33RD EUROPEAN VETERINARY DENTAL FORUM

7-9 MAY 2026 PORTO PORTUGAL

BOOK OF PROCEEDINGS

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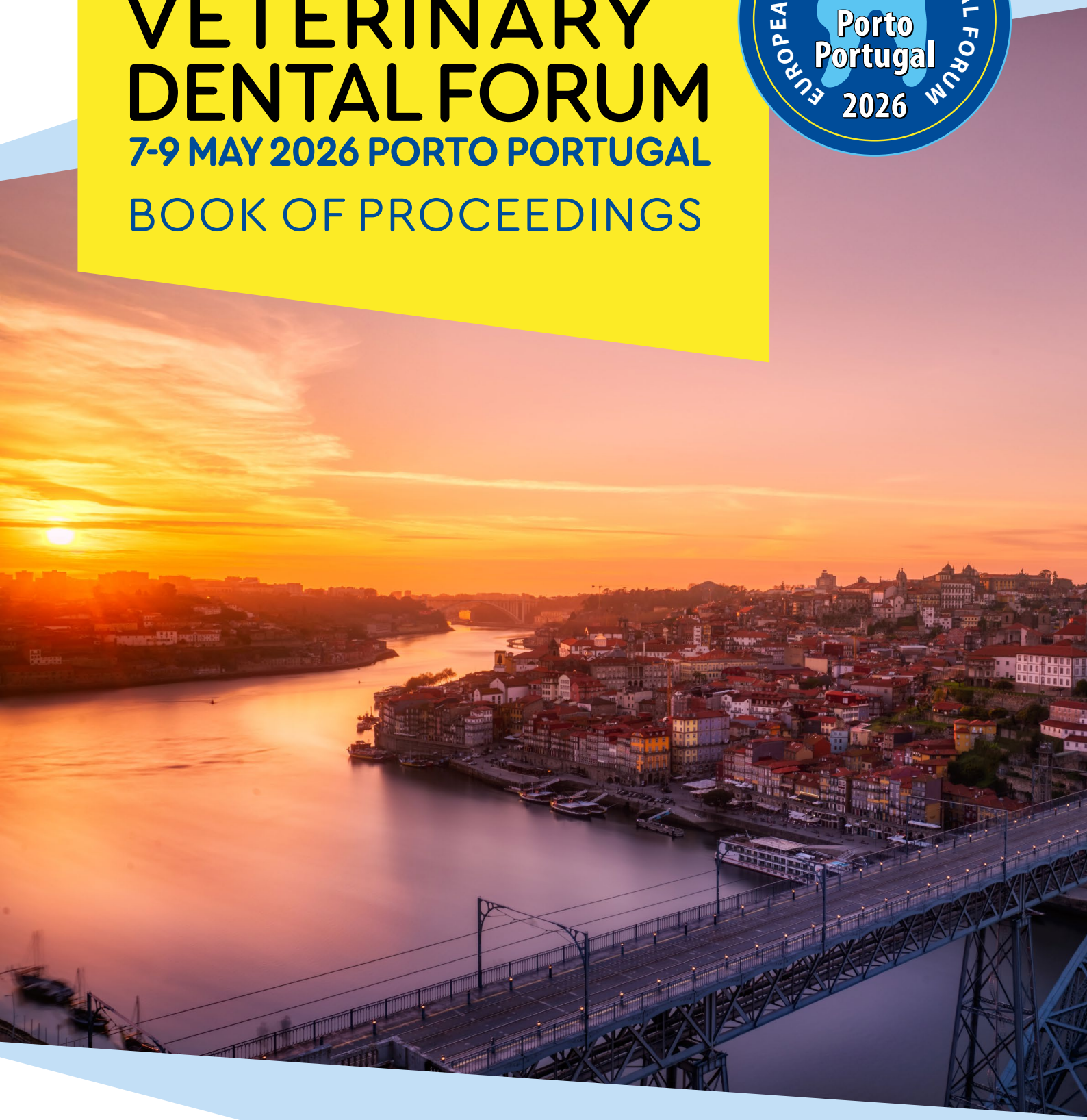

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Dental care in overweight and obese dogs

More than 80% of dogs over three years of age are affected by periodontal disease.

It can lead to painful abscesses and tooth loss, and it is linked to complications such as heart, liver and kidney conditions.[1] Despite this, periodontal disease is often overlooked by dog owners.[2]

At the same time, more than half of dogs are overweight or obese[3] and subsequently in need of a calorie-restricted diet. To reduce the risk of overfeeding, owners may not consider incorporating dental chews into their dogs' daily oral care routine.

As such, the availability of low-calorie dental chews is paramount to help maintain oral health in overweight and obese dogs.

Dental chews can play an important role in supporting a dog's oral health by providing a convenient way for owners to care for their dog's teeth and by helping to reduce plaque and tartar build-up.

Because as we know, if left alone, plaque and tartar can lead to periodontal disease.[REF]

KEYNOTE LECTURE

From Lab to Clinic and Beyond: Animal Models as the Cornerstone for Translational Advances in Endodontics and Veterinary Dentistry

Prof. Paulo J. Palma, DDS, PhD, University of Coimbra

Prof. Paulo J. Palma is an Assistant Professor at the University of Coimbra and Subdirector of the Centre for Research and Innovation in Oral Sciences (CIROS). Recognized as a "World's Top 2% Scientist," he was recently elected Vice-President of the Pulp Biology & Regeneration Group of the International Association for Dental Research (IADR). His research is dedicated to pioneering novel biomaterials and regenerative strategies in Endodontics. He translates laboratory findings into clinical practice, actively leading projects and serving as an expert for EXPAMED of the European Medicines Agency. An accomplished editor and reviewer for leading journals, Prof. Palma seamlessly integrates his cutting-edge research with a dedicated clinical practice in Endodontics.

This keynote addresses the pivotal role of animal models in translational endodontic research. Drawing on Prof. Palma's extensive experience with in vivo studies on pulp regeneration, the presentation demonstrates how these models are indispensable for the development and validation of novel biomaterials and regenerative therapies for human clinical practice.
The discussion expands to illustrate how such advanced innovations are subsequently adapted to elevate the standard of care in veterinary dentistry. Finally, the talk argues that this relationship is fundamentally bidirectional: clinical challenges encountered in veterinary practice offer valuable insights that can redirect and refine fundamental research questions. By advocating for an integrated, collaborative vision, the presentation shows how progress in both disciplines feeds mutual advancement-ultimately benefiting the oral health of all patients.

SMALL ANIMAL DENTISTRY

CORE

SPEAKERS

Michael Balke
Dr. Michael Balke earned his Bachelor of Science in Biology and Doctor of Veterinary Medicine from the University of Missouri. Following graduation, he practiced as a small animal veterinarian in St. Louis, Missouri, where he developed a strong clinical interest in veterinary dentistry. In 2012, Dr. Balke joined Arizona Veterinary Dental Specialists and completed a rigorous residency in veterinary dentistry. He subsequently achieved board certification as a Diplomate of the American Veterinary Dental College (AVDC). In 2025, Dr. Balke further advanced his expertise by completing a fellowship in advanced oral and maxillofacial surgery, earning the distinction of AVDC Fellow in Oral and Maxillofacial Surgery (F-OMFS). Dr. Balke's professional interests include all things dental with a particular focus on complex oncological surgery as well oral and maxillofacial reconstruction. He is dedicated to advancing the field of veterinary dentistry through both clinical excellence and professional engagement. He maintains active membership in several professional organizations, including the Foundation of Veterinary Dentistry (FVD), the American Veterinary Medical Association (AVMA), the Veterinary Society of Surgical Oncology (VSSO), AO North America, and the Arizona Veterinary Medical Association (AZVMA). In addition, Dr. Balke is a frequent lecturer on veterinary dental and surgical topics at local, national, and international conferences. Committed to education and professional development, Dr. Balke currently serves on the Residency Program Administration Committee of the American Veterinary Dental College. He has previously contributed to the College as a member of both the Training and Support Committee and the Examination Committee. He also serves as Chair of the Phoenix Zoo Animal Health Committee, supporting the advancement of veterinary care in zoological medicine. Dr. Balke is the Medical Director of Arizona Veterinary Dental Specialists at the Gilbert location, where he provides advanced specialty care to patients while supporting the growth and mentorship of the veterinary community.

Péter Bogár
Dr. Péter Bogár graduated in 2016 from the University of Veterinary Medicine in Budapest, following in his father's footsteps. He started his veterinary career in Hungary. In 2016, he moved to England, where he worked as a general practitioner in various practices. Péter gained his General Practitioner Certificate in 2021 through ISVPS and his Postgraduate Certificate in Small Animal Dentistry and Oral Surgery from Harper Adams University in 2022. He is currently a dentistry resident at Eastcott Veterinary Referrals in Swindon, England.

Janny Evenhuis
Dr. Janny Evenhuis is currently an Assistant Professor of Veterinary Dentistry and Oral Surgery at PennVet. Originally from Cleveland, Ohio, Dr. Evenhuis attended Case Western Reserve University for her undergraduate education. She then obtained her veterinary degree from University of California-Davis in 2020. After a general rotating internship at Colorado State University, she returned to UC Davis for residency and achieved diplomate status with the American Veterinary Dental College in 2024. She then completed a fellowship in oral and maxillofacial surgery at UC Davis in 2025.

SPEAKERS

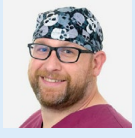
Heidi Lobprise
Dr. Lobprise is a 1983 Texas A & M graduate. She became board certified in dentistry in 1993. After 10 years in industry, she returned to dental specialty practice in 2014 and has since 'semi-retired' to Kerrville, Texas, taking cases at Cibolo Creek Veterinary Hospital in Boerne outside of San Antonio. She is the author/co-author of three dental texts, edited one senior care text, has written many chapters and articles and has lectured internationally.

Ira Luskin
Dr. Luskin is actively involved with Small Animal Dentistry and Oral Surgery since his residency time in Vienna Austria. He is a Diplomate of both the American and European Veterinary Dental Colleges. He is the founder of the Animal Dental Centers of, Maryland and Pennsylvania. These are fours referral facilities that service the Mid-Atlantic States. In January 2000, he established the first private post-graduate training facility for veterinary dentistry in the United States. The Animal Dental Training Center of Maryland, in the last 25 years has offered over 500 courses to 7000 student.

Ivan Nikolaevich Makarov
DVM, PhD, Makarov Ivan. Head of the Department of Veterinary Dentistry and Maxillofacial Surgery, as well as Head of the Jungle Veterinary Clinics, Moscow. Member of EVDS, teacher at the clinic-based training center and at the VGAUniversity, lecturer at Russian and international congresses.

Ana Nemec
Ana graduated as a DVM from the University of Ljubljana, Slovenia in 2004. She was later awarded her PhD in Biomedicine at the University of Ljubljana, and completed her 3-year residency training in Dentistry and Oral Surgery at the University of California-Davis, USA. Ana became a Diplomate of American and European Veterinary Dental Colleges in 2013 and has been appointed as an Assistant Professor at the Veterinary Faculty, University of Ljubljana. Ana is an active member of several organizations, and author of research and professional papers.

Brook Niemiec
Dr. Niemiec is a 1994 graduate of the University of California, Davis. He is a Diplomate of the American and European Veterinary Dental College as well as a Fellow in the Academy of Veterinary Dentistry. He is Chief of Staff of Veterinary Dental Specialties and Oral Surgery with 16 practices. He runs the veterinary dental training center as well as the premier telemedicine site vetdentalrad.com.



Andrew Perry
Andrew Perry is a Diplomate of the European Veterinary Dental College, and has just completed his final term as Secretary. Andrew qualified from Liverpool University and, following 9 years as a general practitioner in South London, began a residency travelling between Vancouver and Swindon. Gaining his diploma in 2018, Andrew became the Head of the Dentistry, Oral and Maxillofacial Surgery department at Eastcott Referrals in 2019. He's particularly fond of teeth, oral surgery and indoctrinating the willing in all things dentistry!

Elizabeth Schilling
Dr Schilling obtained her DVM from UC Davis. She limited her equine practice to dentistry and then expanded her dental studies and practice to all species. She taught at WesternU College of Veterinary Medicine for 10 years before returning to clinical practice and currently works in both equine and small animal dental practice.

Christopher Snyder
Chris Snyder, Diplomate of the American and European Veterinary Dental Colleges, is Clinical Professor, Associate Dean for Clinical Affairs, and Hospital Director at the University of Wisconsin–Madison SVM. A Founding Fellow in AVDC Oral and Maxillofacial Surgery, he has authored articles, textbook chapters, and lectured worldwide. His passions include mentoring residents and advancing veterinary dental education, with academic interests in maxillofacial trauma, reconstruction, and oral surgery.

Mark M. Smith
Dr. Mark M. Smith is a Diplomate of the American College of Veterinary Surgeons and the American Veterinary Dental College, and a Founding Fellow in Oral and Maxillofacial Surgery for both Colleges. He was professor of surgery and dentistry at VA Tech from 1988–2004. Dr. Smith is the recipient of numerous awards and is co-author of Atlas of Approaches for General Surgery of the Dog and Cat. He is Editor Emeritus of the Journal of Veterinary Dentistry.

Kevin S. Stepaniuk
Kevin S. Stepaniuk, B.Sc., DVM, FAVD, DAVDC is a Diplomate of the American Veterinary Dental College and is Co-owner of Pet Dental Specialists. He is a previous faculty member and section chief of Veterinary Dentistry and Oral Surgery at the University of Minnesota, lecturer at Oklahoma State University and Oregon State University College of Veterinary Medicine. He is past-Executive Board member and treasurer of the AVDC, appeals committee, job analysis leader, ad hoc committee chairs, and past-president of the AVDS. Dr. Stepaniuk works clinically full-time and provides continuing education.

Elias Wolfs
Dr. Elias Wolfs received his DVM degree from Ghent University, Belgium in 2018. After graduating, he completed a small animal new graduate program for CVS, UK prior to starting a residency in dentistry and oral surgery at the University of California, Davis, USA in 2020. He is currently an assistant professor and fellow candidate in oral and maxillofacial surgery at the University of Wisconsin, Madison. His special interests include general oral surgery, maxillofacial trauma, and oncologic surgery with an emphasis on potential reconstruction.

SMALL ANIMAL DENTISTRY | CORE

Embryological development of the tooth... It's important (honestly!)
Andrew Perry

Embryology can sometimes be perceived as somewhat opaque. In my experience this stemmed from my time in the first year of university. Perhaps it was that I couldn't perceive the benefit of the fundamental knowledge my professors were struggling to convey or it could have been that the lectures were immediately after lunch, I guess we'll never know! As a general practitioner I never really thought too much about embryology. On beginning my development to specialism I soon realised that that fundamental knowledge was actually pretty useful. As a specialist I am often presented with cases where the diagnosis may be in shadow. It is these cases I now find myself returning to first principles to begin to navigate the puzzle and hopefully find proverbial illumination. Embryology is unquestionably a fundamental pillar of any advanced practitioners knowledge. This lecture will seek to refresh memories regarding the embryologic development of the tooth. If you're not sure who Malassez and Serres are, or you think Hertwig might be a character from "the prisoner of Azkaban" this lecture might just be for you. With a focus on clinical relevance we'll explore the (honestly) fascinating development of the tooth from initiation, via bud, cap and bell all the way to maturation. Once finished, the tooth germ will hold no fear for you (hopefully), and you will be able to boldly proclaim that that deciduous tooth is molarised but not a molar!

Embryology and developmental anatomy of congenital cleft palate formation in dogs
Péter Bogár

Cleft palate is one of the most common developmental malformations in dogs. It is an abnormal communication between the oral and nasal cavities due to the failure of fusion of the processes, bones and soft tissues responsible for forming the palate (Peralta *et al.*. 2018). Early diagnosis is essential and usually straightforward during a physical examination following birth (Evans and de Lahunta, 2020). Congenital oral and facial defects may manifest due to genetic and non-genetic factors in any dog breed, with a higher prevalence in some pure breeds and brachycephalic dogs. As facial and palatal development is complex and timely, this requires an orchestrated process. Depending on the timing of influencing factors, a primary and/or a secondary cleft palate may occur, which can manifest on its own or in combination (cleft lip, cleft palate, cleft lip and palate (Carlton and McGavin, 2016). The **primary palate** develops from the fusion of the medial nasal processes and the maxillary processes during embryonic development, forming the upper lip, alveolar crest and incisive bone (Kelly & Bardach, 2012). The **secondary palate** is formed by the midline fusion of the palatine processes originating from the maxillary processes. Fusion with the nasal septum (dorsally), palatine bones (caudally), and primary palate (rostrally) ensures complete separation of the oral and nasal cavities. Intramembranous ossification occurs in all but the caudal part of the secondary palate, which becomes the soft palate (Carlton and McGavin, 2016).
Primary cleft palates usually have limited clinical consequences, and surgical repair is often elective in the absence of clinical signs. In contrast, **secondary clefts** due to the large oro-nasal communication predispose affected puppies to malnutrition, aspiration pneumonia, and early mortality without supportive care and eventual surgery, typically after adult teeth eruption and before eight months of age. Understanding the embryological process of palate formation provides important context for the clinical differences between cleft types. It helps decision-making and setting client expectations regarding potential outcomes, as well as guiding treatment.

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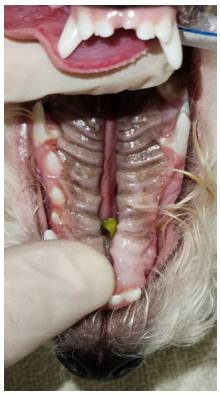
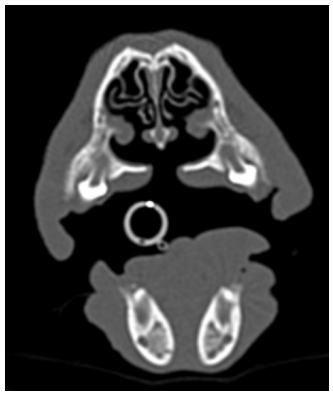
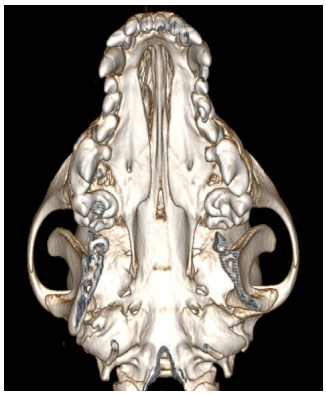

Vascular anatomy for the oral surgeon
Andrew Perry

This lecture is focused toward those beginning their journey in oral surgery. Surgery has the potential to be highly stressful, often associated with the unplanned presence of blood in the surgical field! A clear understanding of the vascular anatomy can provide confidence to the clinician and mitigate unwanted blood loss. The lecture will explore the course of the vessels of the head from their origin, the common carotid, with specific focus on vessels with clinical importance, such as the angularis oris. This lecture will also consider methods of haemostasis and what to do if the worst happens.

Clinical cases on anatomy, complications, flaps
Andrew Perry

This presentation focuses on the clinical relevance of anatomy through selected cases, highlighting common complications and principles of flap reconstruction. It emphasizes the importance of anatomical precision in surgical planning and outcome optimization.

SMALL ANIMAL DENTISTRY | CORE

Alternative Intubation Techniques For Oromaxillofacial Surgery In Dogs And Cats

Elias Wolfs, *DVM, DAVDC, MRCVS*

Advanced oromaxillofacial surgeries in dogs and cats present unique challenges in anesthetizing the patient, particularly regarding airway management and intubation. Traditional (routine, orthograde, or normograde) endotracheal intubation techniques may not always be feasible or optimal due to anatomical constraints and limiting surgical access. In such cases, alternative intubation techniques have emerged as valuable alternatives, offering improved access, reduced risk of complications, and enhanced surgical outcomes.

The first aim in maxillofacial trauma repair is to restore the pre-trauma occlusion, allowing patients to comfortably resume masticatory functions(1). Routine intubation typically impairs the evaluation of occlusion intra-operatively. In addition, temporary maxillomandibular fixation (MMF) has become the standard of care when patients undergo open reduction and internal fixation (ORIF) for trauma that resulted in a malocclusion[1]. In addition, temporary MMF allows the surgeon to proceed with ORIF without the need to intermittently assess occlusion. A normograde intubation followed by a pharyngotomy or transmylohyoid intubation overcomes these challenges that exist with temporary MMF and bypasses the oral cavity optimizing surgical outcome[2,3]. The decision to use a transmylohyoid over a pharyngotomy intubation is operator preference. The latter has a more hostile surgical work environment due to the close proximity of the maxillary and linguofacial veins, external carotid artery, vagosymphatetic trunk, and the recurrent laryngeal nerve. These techniques can also be used for patients that undergo reconstruction of the mandible after oncologic surgery with a staged or immediate reconstruction. In these reconstructive cases, as well as patients that have bilateral mandibular fractures a pharyngotomy intubation may be preferred as the transmylohyoid intubation technique may limit the surgical field.

On the contrary, pathologies that result in a restricted range of motion of the TMJ possess a different set of challenges when normograde intubation is not feasible. Restricted range of motion of the TMJ could be the result of pathologies directly related to the TMJ such as TMJ ankylosis or pseudoankylosis. Other differentials include oral foreign body, retrobulbar disease, neoplasia, zygomatic sialocele, and masticatory muscle myositis (MMM). Masticatory muscle myositis, an immune mediated condition that attacks type 2M muscle fibers, is known to cause inflammation of the masticatory muscles in the acute stage and atrophy with fibrosis of these muscles in the chronic stage, both of which result in reduced range of motion or in severe cases even total inability to open the mouth. For these patients an endoscopy guided intubation or retrograde intubation may circumvent these difficulties[4,5].

Lastly, a temporary tracheostomy should be reserved for patients where all other options have been exhausted due to the significant morbidity and relatively high complication rate associated with this technique[6,7].

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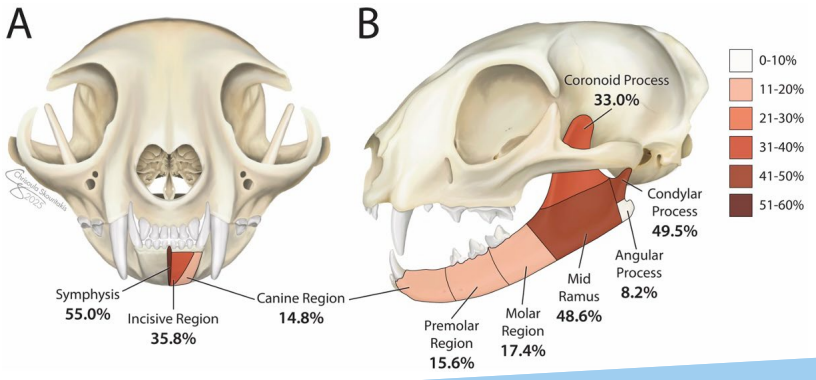
Clinical and diagnostic imaging outcomes of mandibular fracture management in 109 cats

Janny Evenhuis[1], Anna Vincek[1], Stephanie Goldschmidt[2], Maria Soltero-Rivera[2], Mindy Nguyen[1], Boaz Arzi[2]

1 *School of Veterinary Medicine, William R. Pritchard Veterinary Medical Teaching Hospital, University of California, Davis, Davis, CA, United States*
2 *Department of Surgical and Radiological Sciences, University of California, Davis, Davis, CA, United States*

Abstract

A retrospective study was performed on a population of 109 cats that were presented for evaluation and treatment of mandibular trauma. Medical records and diagnostic imaging were reviewed to determine mandibular fracture location, morphology, and treatment. Follow-up data were obtained from repeat clinical examination and diagnostic imaging. The most commonly injured anatomical locations were the mandibular symphysis (55.0%), the condylar process of the mandible (49.5%) and mid ramus (48.6%). More severe pre-operative fracture displacement was associated with a poor healing outcome in the mid ramus and coronoid process regions. The group of cats treated with open reduction and internal fixation (ORIF) had a significantly higher percentage of cats showing adequate healing (P = 0.0247) compared to the group of cats treated with maxillomandibular fixation (MMF). Cats treated with ORIF also had lower prevalence of persistent malocclusion (9.1%) when compared to cats treated with MMF (53.9%) (P = 0.0138, respectively). Placement of an esophageal feeding tube did not have a statistically significant impact on weight change in patients post-operatively (P = 0.0973). Patient survival was high at 94.5% indicating that cats that are treated for mandibular injuries have a good to excellent prognosis.



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Non-Invasive Repair Methods for Oral Fractures in Dogs

Mark Smith

Surgical techniques for mandibular fracture repair should provide for fracture stability, however rigid internal fixation may not be necessary since the mandible is a non-weightbearing bone. Further, application of internal fixation techniques may disrupt vascular supply to bony fragments which has already been compromised secondary to the traumatic event. Non-invasive osteosynthesis can provide for occlusal maintenance and bone healing while maintaining optimal oral and dental health. Strength in bending was determined for interdental apparatuses applied to canine cadaver hemimandibles osteotomized between the mandibular third and fourth premolar teeth.The bending strength of stainless steel wire applied using a Stout loop interdental wire technique and Erich arch bar anchored to teeth using individual interdental wires was increased by acrylic reinforcement. Although acrylic does not adhere well to metal, it conforms to crown shape and interdigitates with gross metal architecture and deformation (wire twists). The ability of non-invasive methods to provide mandibular fracture stabilization in dogs while avoiding iatrogenic complications inherent with other more conventional fixation methods makes them particularly desirable.The low cost of materials, relative ease of application, and frequency of mandibular/maxillary fracture in dogs contribute to their potential uses in veterinary medicine. In fact, there use is an economically viable alternative to muzzle coaptation since the outcome with these techniques is more likely to restore occlusion while avoiding the potential complications associated with tape muzzles. Interdental wire fixation methods for human maxillofacial fracture stabilization include Ivy loop, Stout loop, Risdon, and Essig wiring techniques. Application techniques and outcomes for these non-invasive techniques will be presented including complications associated with coronally applied devices.

Management of Acute Oral Trauma of Hard and Soft Tissue

Ira Luskin, *Diplomate, AVDC*
Animal Dental Training Center Towson Maryland U.S.A

Initial Assessment and Patient Stabilization
Maxillo-facial injuries resulting in either blunt or sharp trauma can result in both soft and hard tissue damage. The clinician's first assessment must evaluate the patient for life-threatening conditions. Hemorrhage, both internal and external, must be controlled. Any injuries to the airway and damage to the lung tissue must be evaluated and treated. Often concussive forces of the head lead to neurogenic shock. This needs to be rigorously treated with steroids mannitol and volume replacement. Any open fractures of the extremities must be initially prepped and cleaned and conservatively bandaged and splinted until the animal is stable. Antibiotics are immediately started and any blood volume loss needs to be corrected. Patient stabilization is the primary initial concern.
Signs of maxillo-facial injuries are initially assessed by observing the pet. Facial symmetry must be evaluated from the front and side of the animal. Any compression fractures of the temporal bone need to be compared with any abnormal neurological findings. Head tilting to one side could indicate ipsilateral vestibular damage, a ruptured tympanic membrane, or a fracture of the mandibular condyle-temporal fossa. Lateral displacement of the mandible or inability to close the lower jaw can be visualized. An animal often presents with this, and in addition, it copiously salivates. The presence of epistaxis and scleral hemorrhage might indicate trauma to the underlying facial bones. Often shearing injuries can avulse the soft tissue from the underlying bone. Injuries to the lips, muzzle, and nose are very common. If the animal permits, a further inspection of the oral cavity should be carried out. Fractured or avulsed teeth need to be carefully identified. Open pulp exposure will lead to

contamination and infection with eventual tooth devitalization. At times, the fractured crowns might appear normal however on palpation, they are mobile. The fractured portion of the crown is being held only by gingival tissue. Obvious mobile segments of teeth can indicate a fracture of the underlying supporting alveolar bone. Often lacerations of the associated soft tissue are visible. The tongue or inside buccal mucosa often are traumatized by the teeth. At times the crowns can break off and lodge within the soft tissue wound. The buccal mucosa should be assessed for evidence of ecchymosis, perforation, or full-thickness tissue damage.

Treatment of Oral Trauma

Once the animal is stable, anesthesia is induced. Any open oral wounds should be lavaged and the soft tissue sutured with absorbable simple interrupted sutures. This author favors a 5–0 Poliglecaprone with 13–15mm reverse cutting needle. Monofilament is preferred over polyfilament absorbable sutures due to reduced tissue drag. Fractured teeth that have open pulp chambers depending on the tooth importance (the canines and upper and lower carnassial teeth being the most important), should be either extracted or receive a vital pulpectomy. The latter treatment should be considered in animals less than 5 years old with freshly exposed pulp chambers of more important teeth. Pulpectomies should also be considered when the tooth in question is in close association with a mandibular fracture and an extraction of the affected tooth would leave a space void and difficulty in jaw stabilization. The procedure involves removing 5 mm of the contaminated coronal pulp and covering the freshly excised tissue with MTA powder which is tissue-compatible and is a cement. This is then restored with a glass ionomer and a composite material. The so-treated tooth should be reevaluated radiographically in 6 –months to determine the tooth's vitality.

Radiographic Evaluation and Management of Luxations and Fractures

Skull radiographs, Cone Beam CT in conjunction with intraoral dental films need to be taken. If there is any suspicion of traumatic malocclusion, the TMJ bilaterally should be imaged. The more common TMJ luxations are of the dorsal cranial position. On clinical evaluation, the lower jaw moves laterally to the contralateral side. If it is a caudal ventral luxation the jaw will lateralize to the ipsilaterally affected TMJ. The latter is often caused by cranial-caudal trauma to the mandible. Often the fossa is fractured as the condyle is driven caudally.

Fractures of the vertical mandibular ramus are often at the juncture to the horizontal ramus since the more dorsal portion or coronoid is protected by the maxillary zygoma. The bone is extremely thin at this site and a fracture is difficult to stabilize with internal fixation. Stabilization of caudal fractures and reduced TMJ luxations are either done with a tape muzzle, Interarcade fixation with buttons or by fusing the canine teeth. The teeth are first acid-etched, rinsed, and dried. A bonding agent is then applied and light-cured. The teeth are fused in a partially opened position with a composite resin. The opening is just enough to allow the tongue to pass through it, therefore allowing the animal to lap soft food. Initially, the client is instructed to help syringe food into the patient's mouth for the first week. Alternatively, an esophagostomy tube can be placed at the time of surgery. The primary concern of the oral surgeon is to reestablish occlusion of the upper and lower jaws if there is any traumatic displacement. First aligning the teeth will allow the proper alignment of the underlying fractured bones which are attached to the teeth. Fractures of the upper jaw pose specific problems of stabilization since the palatal and maxillary bones are thin and incapable of holding screws and plates. Any facial deviations caused by their fracture must be stabilized by utilizing a combination of interosseous or interdental wiring techniques and acrylic splinting. The splint can be kept in place by directly bonding it to the pre-etched teeth similar to above. It can also be kept in place by priorly placing interdental wires and then covering them with acrylic. Significant trauma to the dorsal naso-maxillary bones with disruption of the turbinates can lead to subcutaneous emphysema.

This rarely requires intervention since spontaneous resolution occurs post-operative to the fracture repair

Fractures of the mandible lend themselves to acrylic and wire stabilization. Although plates and screws can be used in edentulous areas when the teeth are present an increased risk of perforating the roots and creating chronic draining tracts exists. Often when tooth roots are within the fracture site it becomes necessary to extract the tooth in part or totally. A partially hemisected tooth followed by a vital pulpectomy can serve as an abutment tooth for purposes of an acrylic splint retention and stabilization. It also allows for a functional tooth after the oral trauma has healed.

Symphyseal fractures are commonly dealt with by a full cerclage wire behind the canine teeth. Usually, the wires are placed through an eighteen gauge needle which enters through the submandibular skin below the canines and exits at the muco- gingival line on the distal aspect of the canine. This loops over the symphysis and reenters into the needle tip which has been passed again from the ventral mandible up through the muco-gingival line on the distal aspect of the other lower canine. The wire ends are then twisted on each other until the symphysis is stable. Additionally, an acrylic splint can be bonded between the canines for additional stabilization. Any lip avulsions in association with Symphyseal fractures can usually be dealt with by reattachment of the lip by sling sutures passed around the incisal teeth and anchoring the lip to the underlying bone. If the incisor teeth have been fractured then predrilling the rostral mandible with a #2 round bur will allow a suture or wire to tack down the lip to the bone. Often in addition to the soft tissue avulsion the underlying incisal bone and teeth are fractured away from the symphysis. In this case, a rostral mandibulectomy can be performed. The bone and teeth are excised off of the soft tissue and the gingiva is attached with simple interrupted sutures to the remaining mandible.

Avulsions of the teeth usually occur more frequently in the rostral canines and can either be partial or complete. The apex of the tooth is displaced and alveolar bone is often fractured. Mobility of the tooth requires radiographs to determine if there is a root fracture concomitant to the fractured alveolar bone. Usually, the radiographs show a disparity of periodontal space width from one tooth side to the other when a luxation is present. The sequella of a damaged apical blood supply is pulpal necrosis in the mature tooth. The immature tooth due to an open apex and a greater tendency to recover may only develop a partial pulp necrosis limited to the coronal aspect. This may lead later to internal changes of the tooth so further radiographic assessment should be recommended. Luxated teeth are digitally reduced to a normal position. A wire/acrylic splint should be placed around the affected tooth and stabilized to the contralateral side during the initial alveolar fracture healing. The splint should not interfere with the animal's opening and jaw closing. The procedure of splint placement is as follows: Apply a "figure 8" 24 gauge wire around the reduced canine and the contralateral canine. Suture any soft tissue lacerations. Cleanse the crown after the tooth has been reduced. The tooth surfaces that will receive the acrylic are acid etched with 40% phosphoric acid gel for 1 minute followed by rinsing with water. On drying, this will leave a frosted appearance to the enamel. Acrylic is applied circumferentially around the reduced tooth and the contralateral anchorage tooth which is connected by an acrylic bridge formed across the palatal mucosa if it is a maxillary canine injury. A cold-curing acrylic without significant exothermia should be used for splinting (Pro-temp Garant-ESPE or Maxitemp Schein). The animal is sent home with a curved-tip syringe and a dilute 1:100 chlorhexidine flush (1 cc of Nolvasan with 8 ounces of water). Normally the splint is removed in 4 weeks and the non-vital tooth is root canalled at this time. Devitalization of the affected tissue is not uncommon as a complication of maxillofacial injuries. In the case of the bone having been separated from its blood supply, a bone sequestrum may occur. If a bone

sequestrum forms it needs to be excised to bleeding tissue. Non-healing draining tracts usually indicate deeper-lying necrotic tissue. Dehiscence of suture lines can also occur due to tissue that has initially undergone trauma and subsequently devitalizes. Often repeat surgeries 7–14 days later are required after the non-vital tissue demarcates. In young animals, distortion of the facial growth plates can occur due to premature traumatic closure. Adult tooth buds can be malpositioned and erupt in ectopic areas of the mouth due to the traumatic insult.

Oral trauma surgery should abide by the following principles: All lacerated soft tissue should be closed when possible over bone and not a void. The muco-gingival pedicle flaps necessary for this closure should be carefully harvested with a good underlying blood supply. Care should be given to prevent any rough handling of the tissue edges. Any potentially compromised tissue should be excised. Tension along the suture line can be prevented by harvesting excess donor tissue. This is undermined and mobilized. If the traumatized palatal mucosa is the recipient site for the pedicle flap, the epithelium should be scarified to allow for proper attachment to it. This scarification can be accomplished by using a rough diamond bur in a high-speed handpiece. Young animals with jaw fractures should be treated with as minimally invasive procedures as possible. This is because the non-erupted adult teeth and the poorly mineralized bone are not appropriately treated with orthopedic hardware. Using tape muzzles and tincture of time with close radiographic follow-up can give excellent results. If a fracture is poorly reduced, any maloccluding teeth need to be prevented from destabilizing the fracture healing. The traumatic malocclusion caused by teeth hitting other teeth or into soft tissue creates movement which prolongs the healing. If not corrected, this can lead to a non-union fracture. To prevent this from occurring, the insulting teeth are either extracted or the crown reduced. The latter treated teeth then receive a vital pulpectomy/pulp capping. This technique is especially useful when treating the maloccluding canine teeth whereby extracting them would be considerably more invasive.

Management of Dentoalveolar Trauma: Classification and Clinical Decision-Making

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Dentoalveolar trauma is a common finding in small animal dentistry. Knowing when and how to treat can be confusing. This lecture will cover the classifications of dentoalveolar injuries secondary to trauma, necessary diagnostics, the body's response to these injuries and treatment options.

Using the WSAVA Dental Guidelines to improve your practice

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Many veterinarians have not heard of the World Small Animal Veterinary Association; much less know they are members. However, the vast majority of veterinarians worldwide are members. The WSAVA is an association of associations, counting over 200,000 members and 100 associations. Therefore, you likely are a member of this excellent group and have access to all of the educational and promotional material on the website and any CE provided.
The WSAVA will launch global dental guidelines next month. This work is a culmination of 2 years of writing and research. The committee includes not only Diplomates of the American and/or European

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Veterinary Dental Colleges from 5 continents but also specialists in anesthesia and analgesia as well as nutrition. Finally, there are two animal welfare advocates providing input.

This document is tiered by the socioeconomic position of various countries, to improve the minimum standards of care in a realistic fashion while still promoting best practice. The authors have strived to create a document that is not only available world-wide for free, but also written in a very accessible way.

The guideless document contains sections on oral pathology, anesthesia and pain management, and the universities role in improving oral and dental education. Further is a section on the importance of and how to perform a complete oral exam, which includes instructions on the use of a free on line charting system. Step by step instructions with full color images detail the basics of dental prophylaxis, dental radiology and extraction. Minimal equipment recommendations are made for the various areas as well as a thorough review on dental homecare. While non-anesthesia dentistry is discouraged throughout the text, it's inappropriateness is the subject of its own section. Finally, the animal welfare impact of untreated dental disease is introduced.

This lecture will cover the many uses for this document in general practice, and how practitioners can make the best use of them. It is important to note that this document recommends "best practice" in the various areas and therefore is of most value to clinics who strive to provide the ideal care. By quoting the recommendations, these clinics can separate them from clinics who perform lower quality care.

The sections on oral pathology provide current diagnostic and treatment recommendations for common oral pathology. The text is supported by numerous full color pictures as well as dental radiographs. Since this is available on line for free, it can facilitate client communication. This will improve dental compliance, thus improving patient care and practice income.

The oral exam section provides instructions for a thorough oral exam while arming practitioners with a free basic on line charting system. This system also allows print outs which further improve client communication.

The techniques sections equate to "mini-textbooks" which due to their online availability, are always at hand for review. While current literature is available in tier 3 countries, for tier 1 and 2 they provide a critical resource.

The anesthesia & analgesia section contains instructions and recommendations for pre-anesthesia testing, drugs, and monitoring. This is the latest information and is a valuable resource for the practitioner. Further, this section details the most current level of safety, which should further increase compliance

The numerous mentions of the inappropriateness of NAD will greatly aid practices in decreasing this wholly ineffective practice. The arguments against this procedure are presented in not only the dental prophylaxis section, but also in the anesthesia and welfare areas. This combination, together with a listing of all the professional associations who oppose it will aid in client discussions.

Finally, but perhaps most importantly, is the section on the welfare aspect of untreated dental disease in small animal medicine. This well referenced section, penned by non-dentists, highlights the plight that our pets face on a daily basis when dealing with untreated dental conditions. By using the term "animal welfare concern" we can improve the acceptance of recommendations on a personal as well as association level. Together we can strive to improve oral care for pets worldwide.

Oronasal Fistula Repair – Don't Make It Difficult!

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Introduction

An oronasal fistula (ONF) is a communication between the oral and nasal cavity. An oroantral fistula is communication with the oral cavity and the maxillary recess. The epithelial surfaces of the nasal and oral cavity communicate via the fistula. The nasal cavity is normally separated from the oral cavity by the incisive, maxilla, and palatine bones and overlying mucosa as well as the soft palate tissues caudally. In the caudal region of the canine nasal cavity a maxillary recess is present and communication of the distal root of the third premolar, 4th premolar, and molar result in an oroantral fistula. Causes of ONF include periodontal disease, trauma, traumatic malocclusion (i.e., linguoversed mandibular canine teeth), electrocution, cleft palates, neoplasia, severe eosinophilic granulomas, and surgical dehiscence secondary too inappropriate, or lack of, closure of surgical extraction sites, and/or maxillofacial surgery. Commonly, and for the purpose of the following discussion, oronasal fistulas secondary to severe periodontal disease, and particularly, loss of the maxillary canine teeth will be discussed.

Commonly the loss of the maxillary canine teeth and/or periodontal disease associated with the maxillary canine teeth in small breed dogs' result in oronasal fistulas or inapparent oronasal fistulas, respectively. The palatal aspects of the maxillary canine teeth are separated from the nasal cavity by several millimeters of bone depending on the size of the patient. Intrabony pockets (vertical bone loss) on the palatal aspects of teeth 104 and 204 provide a good environment for periodontal pathogens to proliferate with resulting loss of periodontium. The teeth may, or may not, be mobile and it is not uncommon to have normal or slightly increased to moderate buccal periodontal probing measurements with very large probing depths palatally. Occasionally, a trickle of blood may be seen exiting from the ipsilateral nares when the probing depths are measured palatally, confirming an ONF. Occasionally, the periodontal probe is inhibited from reaching true probing depths by large accumulations of subgingival calculus and inflammatory tissue.

Oral stratified keratinized squamous epithelium and the nasal stratified cuboidal to non-ciliated pseudostratified columnar and ciliated pseudostratified columnar epithelium line the maxillary and nasal sides of the defect, respectively. An ONF allows connection of these epithelialized surfaces thereby oral bacteria, food, fluid, debris, etc. communicate with the nasal epithelium. The nasal cavity is not designed to withstand the insults of products from the oral cavity, acute and chronic inflammatory rhinitis, infection, and morbidity results. Clinical signs may include chronic nasal discharge (serous, mucopurulent, and/or epistaxis). Sneezing may or may not be present. Oronasal fistulas may be obvious upon clinical examination or may be a pinpoint lesion that requires anesthesia and a thorough oral exam to identify.

ONF Repair Techniques

There are various techniques to repair defects between the oral and nasal cavity. Repair techniques for oronasal fistula and cleft palate defects have been reported and include single buccal mucoperiosteal sliding flap, palatal inverted and buccal sliding flaps, palatal and labial buccal pedicle flaps, split U-flap, rotational palatal flaps, auricular cartilage grafts, laminar bone membranes, advancement flaps, and obturators. Advanced surgical techniques for complicated cleft palates (acquire or congenital) are discussed elsewhere. For oronasal defects secondary to periodontal disease of teeth 104 and 204 a single buccal mucoperiosteal flap is adequate for primary repair.

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It is the author's experience that the majority of oronasal fistulas secondary to periodontal disease in the maxillary teeth can be easily closed with a single buccal mucoperiosteal flap if surgical principles are followed. With very large defects or failures, an inverted double palatal and buccal sliding flap may be utilized to close the defect. With 25+ years of dentistry and oral surgery experience a single buccal mucoperiosteal flap has all that has been required, in my hands, for repair of maxillary canine tooth oronasal fistula defects secondary to periodontal disease even with previous failed referring veterinarian repairs.

Surgical Principles for Successful Flap Repair

1. The surgical flap should be larger than the defect to be repaired (1.5–2.0 times the width of the bone defect)
2. Suture lines should be planned to be placed over bone
3. The epithelial margins of the defect must be debrided
4. Denude palatal epithelium along margins
5. There must be no tension on the flap
6. The sutures should be placed 2 mm apart with 2 mm bites of tissue
7. 25-Polyglecaprone is used as the appropriate suture material
8. Gentle tissue handling
9. Appropriate home care instructions
10. Client and patient compliance

Single Buccal Full Thickness Mucoperiosteal Flap

The keys to surgical success, whether closing a defect or following extraction of a canine tooth with an oronasal fistula include, a large broad-based full thickness (soft tissue and mucoperiosteum) mucoperiosteal flap maintaining blood supply, absolutely no tension, suture lines placed over bone, and simple interrupted sutures placed 2 mm apart with adequate 2–3 mm "bites" into healthy palatal tissue and mucoperiosteal flap tissue. The periodontal flap also creates visibility of the underlying bone and root surface by surgically separating gingiva or mucosa from the underlying tissues. Visualization of the bone defect into the nasal cavity is necessary to debride any necrotic bone margins, remove the inflammatory tissue, infected material, and remove the communicating epithelium. The goal of surgical intervention is to provide an epithelial surface on the nasal and oral sides of the flap. Nasal epithelial cells will migrate over the nasal side of the flap during the healing process.

The dorsal and ventral labial arteries and the angular artery provide vascularization to the buccal mucosa and preservation of blood supply is important. Long, narrow, skinny flaps may have inadequate blood supply and lead to necrosis of a portion of the flap with subsequent failure.

The epithelial margins of the flap are removed with a sharp #15 scalpel blade, La Grange scissors, Goldman Fox Scissors, etc. Following elevation of the mucoperiosteal flap, the author likes to further "freshen the margins" of the palatal mucosa with a medium diamond bur to ensure removal of all the epithelial tissues and perform on osteoplasty on any irregular, rough bone margins. Fresh vascularized margins will allow first intention healing to occur following apposition and suturing.

The mucoperiosteal flap is elevated using a periosteal elevator directed toward the bone and moving in an apical direction. Care is taken not to perforate the mucosa, which will diminish the success of the procedure. Perforated flaps leave mucoperiosteal defects and suture lines over bone defects and not over underlying bone greatly increasing chance of flap failure.

Closure of the mucoperiosteal flap without tension and harvesting a large broad-based flap with appropriate releasing incisions are requirements. Additionally, releasing the oral mucosa and connective tissue from the periosteum with a careful scalpel incision or blunt surgical scissor dissection allows the flap to be released and easily moved to cover the defect without tension.

A broad based mucoperiosteal flap can be created to cover an oral nasal fistula from a maxillary canine tooth by incising from distal aspect of 103/203 to distal 105/205 (being certain to return

gingiva around 105/205 with the flap closure if those teeth are present) or equivalent, depending on the presence and absence of adjacent teeth. Alternatively, a distal divergent incision can be created leaving gingiva with teeth 105/205. Following release of the flap, removal of epithelialized tissue margins, and osteoplasty of the bone defects, the flaps are initially apposed and sutured at the vertical release corner margins to the palatal mucosa. After the flap is anchored, the fresh margins of the palatal mucosa and free margin of the mucoperiosteal flap are sutured. Finally, the vertical releasing incisions are sutured in apposition. The simple interrupted sutures are placed approximately 2–3 mm apart and no less than 2–3 mm from the incision. Suture choices for surgical flap closure include poliglecaprone-25, polyglactin 910. Polydioxanone is NOT an appropriate suture for the oral cavity due to its long degradation time and potential to cause foreign body reactions. Chromic gut is NOT an appropriate suture as it is degraded too quickly.

Inverted Palatal Mucosal Flap with Buccal Mucoperiosteal Flap (Double-Flap Technique)
The author never has had to utilize this technique in clinical practice over 25+ years. With this technique, an immediate epithelial surface adjacent to the nasal cavity is created. A full thickness palatal flap is created by incising the palatal mucosa parallel to the mesial and distal margins of the defect near or past the midline of the palate. Hemorrhage is anticipated from the vascular palatal mucosa and the major palatine arteries and its terminal branches. The palatal artery may need to be ligated and digital pressure applied to the region to temporarily control bleeding. The palatal mucosa, adjacent to the defect, acts as a hinge as the palatal flap is inverted to cover the oronasal defect. A second flap as described previously (single buccal mucoperiosteal flap) is created and sutured over the inverted palatal flap. The palatal defect is allowed to heal by second intention. A potential troublesome consequence with this technique is exposure of the nasopalatine foramen. Therefore, the flap may need to be made split thickness in that location. Additional more complicated palatal surgery would then be necessary to close the defect created by the surgeon. This can be prevented with knowledge of anatomy and using a split-thickness flap, if necessary.

Additional Techniques
There are publications demonstrating the use of inverted palatal mucosal flap with buccal mucoperiosteal flap (Double-Flap Technique), autogenous auricular cartilage to cover the defect and support the mucoperiosteal flap. This requires a second surgical site, sterility, and may result in disfigurement of the patient's ear. The use of Ossiflex™ membrane or other types have been reported to be used in a similar fashion. Essentially these autogenous and allogenic materials are used to support a single buccal mucoperiosteal flap. Nevertheless, If the flap is not created correctly, the surgical site will still fail! The author has never had to utilize those additional materials.

Post-Operative Recommendations
1. Soft food only for 10–14 days
2. No chews or toys for 10–14 days
3. +/– 0.12% chlorhexidine gluconate rinses every 12 hours for 10–14 days, if tolerated.
4. Minimal client handling of the flap and lip
5. Leash control when outside to urinate and defecate to prevent foreign objects being picked up in mouth for 10–14 days.
6. Elizabethan collar to prevent patient from rubbing or pawing at the incision, if indicated. Very often not used with my surgical cases.
7. Post-operative pain medication (NSAIDS, Gabapentin, etc. as indicated based on underlying metabolic/systemic disease and concurrent medications)
8. Antibiotics, if indicated, for 5–7 days.
9. Written discharges to ensure client compliance
10. Recheck in 14–28 days

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Ensuring aseptic standards in veterinary dentistry: key considerations and future directions

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Recent research has revealed a high level of microbial contamination in dental units, coupled with limited implementation of disinfection protocols. These findings identified the pressing need to establish clear guidelines regarding acceptable microbial levels in water derived from dental units used in small animal dentistry, as well as standardized approaches to disinfection.

However, ensuring asepsis in veterinary dental procedures extends beyond the management of dental unit water systems. Critical considerations also include adequate preparation of both the patient and surgical personnel, maintenance of the surgical environment and equipment beyond dental units, and sterilization of critical surgical instruments and materials.

Adherence to aseptic principles not only safeguards patient health but also reduces the need to use antimicrobials. Moreover, integrating additional preventive measures, such as attention to ergonomics, minimizes the risk of occupational diseases among veterinary staff.

This lecture will examine these critical components, identify gaps in the current evidence base concerning veterinary dentistry, and propose general recommendations for both routine clinical practice and future research.

Mandibular Fracture Subsequent to Canine Tooth extraction in Cats: minimizing risks and maximizing success

Elizabeth Schilling

Abstract:
Canine tooth extraction is a procedure that is commonly performed in cats, but one that is fraught with potential complications. Among those complications are morbidity associated with prolonged anaesthesia, local tissue trauma, wound dehiscence, hemorrhage, nerve damage, loss of jaw structure and mandibular fracture. Risk factors for jaw fracture include tooth resorption and ankylosis, excessive alveoplasty, and improper extraction technique. Fractures typically occur through the alveolus but can also involve the mandibular symphysis. Proper case selection based on diagnostic imaging is important in preventing mandibular fractures during extraction, as is appropriate extraction technique. Mandibular fracture repair options include soft fixation with a muzzle, mandibular cerclage wiring, internal fixation, acrylic splinting.

Learning Objectives
Attendees will be able to:
1. review mandibular and dentoalveolar anatomy in the cat
2. understand the mechanism and common configuration of iatrogenic jaw fracture associated with canine tooth extraction in the cat
3. consider extraction techniques to make mandibular canine extraction easier, while decreasing the risk of iatrogenic complications
4. evaluate extraction-related mandibular fracture and
5. implement effective repair techniques

Extraction Complications – Oops, I did it again!
Abstract title: Common Complications: Dental Extractions

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Introduction
When extractions go well, there is a sense of satisfaction with removing a source of chronic infection, inflammation and pain from our patients. But with a lack of formal training, less than adequate equipment and time constraints, complications and frustration are far too common. Here are some common issues that can arise to complications with dental extractions, and how to overcome them.

Not enough time
This may not seem like a direct complication, but when we get rushed and can't be patient with elevation, that is when a lot of complications can arise. Our dental patients often have more advanced disease that becomes apparent once radiographs are taken, potentially requiring more anesthetic time than expected. Multiply this by the number of procedures you have scheduled, and it can become a nightmare. Solution: consider recommending 'staged procedures': get the general cleaning, probing and radiographs completed for accurate evaluation, extract the 'easy' ones, and plan to perform the oral surgery to extract the more complicated teeth at a later time. Prepare your clients ahead of time for this possibility, particularly in those smaller, older dogs that will likely have hidden problems. Not only does this avoid excessively long procedures, it gives you and your staff options to avoid having to rush. Sometimes the soft tissues and even bone will appear healthier 2–4 weeks later, and you can give a price break on induction. Also -during oral examinations, try to estimate the extent of disease, and assign a 'degree of difficulty' for the anticipated procedure.
This is not the stage of periodontal disease, but how difficult you feel the procedure may be and how much time it might take. On a scale from 1–3 'points', then determine how many points total you want to handle in a day. If that total is 7 and you already have two patients with level 3 – only take one more 'simple' procedure, level 1.

Incorrect or dull instruments
Without the correct instruments that are sharpened regularly, extractions will be challenging. Sharpened tips are needed, as they are to be advanced into the periodontal ligament (PDL) in between tooth and bone, and that is not a wide space. Dull or thick instruments will never fit into the PDL space for optimal elevation forces. Straighter edge 'luxators' are helpful to 'start' opening up the PDL (1.3, 1.8) or to help elevator flatter surfaces of larger teeth such as canines. Winged elevators come in multiple sizes, and the size of the winged tip should fit the curve of the root, not too big, not too small. Solution: put together multiple extraction packs with appropriately sized instruments have have sharpness evaluated after each use! There are different methods of sharpening, some on YouTube. Have a few extra elevators available if you make some dull during a procedure, or even sharpen during the procedure.

More flap
Inadequate flap creation will limit your access to section multi-rooted teeth or expose enough of a canine tooth to remove sufficient alveolar bone. It is also important to incise the periosteum on the underside of the flap (especially on maxillary canines) to release the tension in order to close it adequately.

Incorrect sectioning
Having a decent flap to identify the furcation of a multi-rooted tooth is the first step.

In many teeth, especially mandibular first molars and maxillary fourth premolars, it is optimal to remove a triangular piece of the crown to allow more direct access to each root. In the maxillary fourth premolars, this will also allow you to visualize the distal aspect of the furcation between the two mesial roots. Just sectioning over the crown of the palatal root will not section the tooth correctly, and starting elevation will just break the crown at this stage. Even if the tooth appears mobile, still section a multi-rooted tooth, especially the maxillary molars. As soon as you think you can just 'wiggle' it out, those thin, crooked roots will break off. Section the palatal root away from the two buccal roots, then separate between the two buccal roots. Occasionally there will be a 'ribbon' root with a 'sheet' of root formed along the length and between two roots; with no furcation, so watch out for those. Also watch out for a third root on a typical two-rooted tooth (premolars)

Incorrect evaluation of remaining attachment
The presence of a deep pocket, notably at the mesial aspect of a mandibular canine, may seem to indicate the need for extraction. However, you need to fully evaluate the extent of healthy alveolar bone and PDL around the root of the tooth. A deep 'pocket' may be present if the tooth is under-erupted, or if bone loss at the adjacent incisor has contributed to the probing depth. Determine if removal of the incisor and possible redundant gingival tissue at the site may allow you to leave the canine while lowering the gingival height around it, minimizing the pocket.

Assessment of periodontal ligament space
It is critical to evaluate the presence of the periodontal ligament prior to extraction. If the PDL is visible and there are no apparent root abnormalities (resorption, lack of PDL, ankylosis of root), then it is likely that you will be able to 'fatigue' the ligament for elevation. Excessive forces on a tooth with resorption or ankylosis will likely result in a root fracture; you might need to take out more alveolar bone to have a successful extraction.

Compromised bone
What's worse that hearing that tooth crack? – hearing the jaw break! Always remember to offer the option of a referral if you feel the conditions at an extraction site may be beyond your comfort level; the owner can always decline, but note that in your records in case there is a problem. Here are a few problem spots:
Mandibular symphysis: with any mandibular incisor or canine extraction, always check for mandibular symphysis mobility first; it is often present in cats and small dogs and this may be their 'normal'. If it is no worse after extraction, there is no need to stabilize it. If there has been a fracture, then circumferential wiring can stabilize it. Mandibular canines: even with a stable symphysis, the alveolar bone can be thin on the lingual aspect, even with large dogs. Really evaluate the radiographs for the integrity of the PDL; use a buccal-caudal-lingual approach and plenty of patience. Use the sharpened 'luxators' on the flat surfaces and winged elevator following the root distally on its dorsal surface. Cup the jaw with the opposite hand.
Mandibular first molar: Extensive bone loss of this tooth is a common reason for extraction, and a common cause of pathologic (and iatrogenic) mandibular fractures. Complete bone loss at the distal root allows for easy elevation of it after sectioning the tooth, but the mesial root is usually solid. Shave off a bit of the crown to allow for elevator placement between it and the fourth premolars. Use the flat elevators on the buccal and lingual aspects. Remove cancellous bone from the distal aspect of the mesial root – there is often an indentation that prevents rotation.
Oronasal fistulas: An ONF (or OAF – oroantral fistula further caudal) may already be present and the reason for extraction, particularly of maxillary canines. Excessive elevation forces at the palatal aspect of the tooth, or rotation of the apex into the nasal can cause or exacerbate an ONF that is already

present. Concentrating elevation effort at the mesial, distal and even buccal aspects can help elevate the tooth enough for removal. If an ONF occurs or is present, the most important aspect is having a wide-based mucoperiosteal flap so incision lines are place over bone, not the defect. The palatal edge must be freshened and released the flap by incising the periosteal fibers is critical.

Broken root tips
Once you have broken off the root tip, now you need to retrieve it without pushing it into the nasal cavity or mandibular canal. If there was apical bone loss to begin with, this complication becomes much more likely! In the maxilla, removing buccal bone to expose the entire root tip will often allow you to retrieve it without incident. In the mandibular, buccal bone can be removed on a larger patient, but too much bone loss can be detrimental to a small dog or cat. Instead, remove more of the cancellous bone in between the root spaces and try to preserve the cortical bone plates buccally and lingually. With a small round or cross-cut fissure bur, create a ditch around the root or remove the bone in the interdental space and try to elevate the tip with small elevators or root tip picks.

Root tips into mandibular canal or nasal regions
Excessive apical force can cause that root tip to drop into the mandibular canal or push up into the nasal cavity or sinuses. Since the tip is obviously loose, this is the best time to try to retrieve it; waiting 2 weeks or sending it for referral will complicate matters as fibrous tissue will grow around the piece. Expand the opening it fell through, similar to how you removed bone for getting to the root tip above. Take care not to injure the mandibular neurovascular bundle as you try to retrieve the root. Grasping for it is often like bobbing for apples, and it might move farther away. Sometimes making the opening larger and then flushing saline into the opening may be enough to dislodge the tip though the opening. Occasionally tips can be flushed rostrally or distally when in the nasal passages.

Damage to soft tissues: salivary ducts, sublingual swelling, air, tongue
Never forget the surrounding tissue when using a highspeed, air compression unit. Not only can the bur damage soft tissues, but pulverizing teeth and directing the spray or air can cause swelling and air emboli. Use a tongue depressor when sectioning mandibular teeth and lip retractors for better visualization. Now that you will be sharpening your instruments, be very cautious with any forward movement – hold the instrument so the tip just barely passes your fingertip. A small 'ooops' may scrape a little tissue; a big 'oops' can penetrate the infraorbital canal near the upper fourth premolar, the eye above the molars and there has even been a case of a brain abscess post extraction trauma.

Deciduous extractions
Deciduous extractions take the concepts of careful extraction to a higher level, as underlying permanent tooth buds can easily be damaged with incorrect forces. Again, the correct equipment (1.3 elevators) are essential and elevation forces should be avoided in areas where tooth buds are close (lingual aspect of mandibular canines), mesial aspect of maxillary canines). Retrieving broken roots with a single incision over the root is usually successful. Informing the owner that even with careful elevation, some changes to the enamel of the permanent tooth may occur, so monitor closely.

Dehiscence or non-healing extraction site
Adequate flap formation and release should minimize the chance of dehiscence, though with tension against the ONF flap with every breath, a small persistent opening is always possible. Full dehiscence of any site is less common, so make sure the patient is not self-traumatizing the site. A truly non-healing extraction site is concerning, and a biopsy should be considered to rule out an underlying neoplastic cause.

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Pyogenic granuloma or other trauma from remaining teeth
In cats, extraction of the mandibular first molars can allow the sharp tips of the maxillary fourth premolars to contact the mandibular mucosa and cause chronic inflammation in the form of a pyogenic granuloma. Extraction of a feline canine can also result in chronic contact trauma. Gentle blunting (odontoplasty with bonding) of opposing teeth should be considered in these cases.

Summary
"Stuff" will happen with extractions – to all of us. Knowing how to minimize the changes and how to manage the problems when they occur benefits our patients.

How the microbiome of the oral cavity changes in dogs and cats during an inflammatory process

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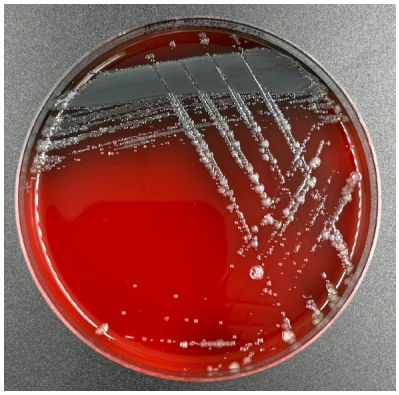
To understand the causes and nature of pathological processes (pathogenesis) it is important to research the microbiome of the oral cavity with an emphasis on the connection between the composition of the microflora, fluctuations in the Ph of saliva and the severity of the inflammatory process, which in turn gives an opportunity to provide effective treatment at various stages of a disease. Also, it helps to improve methods of oral cavity hygiene. We conducted a study of the microbiome of the oral cavity in dogs and cats together with A.A. Smorodintsev Scientific Research Institute of Influenza of the Ministry of Health of the Russian Federation (abbreviated name: Research Institute of Influenza) and the veterinary laboratory POISK (Saint Petersburg). Animals were arranged in 3 groups: clinically healthy (no inflammation or calculus), patients with gingivitis, minor stomatitis and calculus, and patients with severe inflammation (periodontitis) of the oral cavity. Additionally, dental X-ray examination was performed for some animals. In parallel, changes in saliva pH were monitored in these patients.



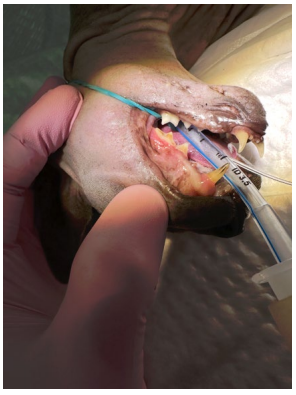
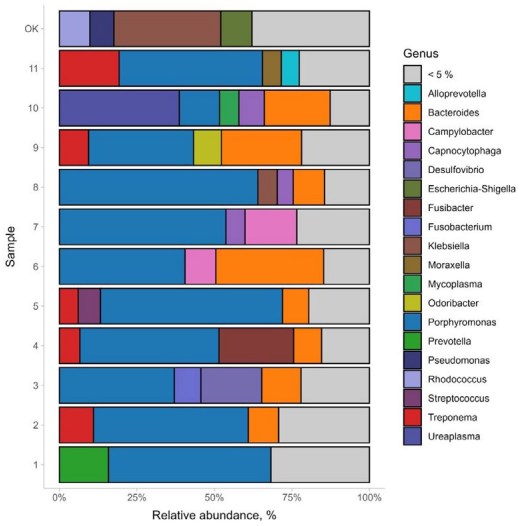


Photo 1. Different bacterial cultures are represented on blood agar from a lingual swab of a cat, female, 9 y.o.

The study has revealed limitations of traditional culture methods, which predominantly detect aerobic and fast-growing microorganisms, ignoring strict anaerobes and uncultivated species. MALDI-TOF mass spectrometry (Autof MS 1000) has demonstrated high accuracy and speed of identification of microorganisms, however, difficulties remain in differentiating normobiota, contaminants and pathogens, especially in conditions of polymicrobial associations. Based on the data obtained, it is proposed to introduce molecular genetic methods, including 16S rRNA gene sequencing and full-genome sequencing (WGS), for a comprehensive analysis of the microbiome, including uncultivated and anaerobic species, as well as the ability to detect not only bacteria, but also their resistance and virulence genes. These approaches will improve the accuracy of diagnosis and the validity of prescribing antibacterial therapy, overcoming the limitations of classical cultural studies.



Practical Periodontal Treatment
What to do and when

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Introduction

The extent of periodontal disease you might encounter in patients can vary from patient to patient and even from tooth to tooth in the same patient. From minimal inflammation and no attachment loss in Stage 1 Periodontal Disease to the beginnings of attachment loss (up to 25%) in Stage 2, then deeper pockets (up to 50% attachment loss in Stage 3) and even compromised teeth (greater than 50% loss) in Stage 4, you must be able to tailor the treatment to the problem. Beyond the dental cleaning, being able to provide advanced periodontal management for your patients is not only good medicine, but good business. By adding simple instruments, materials and skills to your dental armamentarium, you can identify and treat those teeth that may have been extracted in the past.

Therapy goals

When looking at periodontal disease, therapy is determined by a number of factors, such as the stage of the disease, the involved tooth, the client's commitment and the desired outcome. There are several goals to set, including removal of all debris or biofilm (plaque, calculus), keeping the maximum amount of attached gingiva, minimizing attachment loss and minimizing the pocket depth. 1 Certainly, all foreign material, from bacteria to desquamated cells must be removed from the tooth surfaces and pockets in order to attain healing. Since the attached gingiva is the first line of defense against bacteria, a minimum of 2–3 mm is necessary to protect underlying tissues, as the looser alveolar mucosa doesn't afford that protection. The inability to halt attachment loss will eventually lead to tooth loss. Minimizing pocket depth is related to attachment loss, but is a more specific parameter, because pocket depth in itself directly affects the ability for effective home care and maintenance, and deeper pockets can harbor more virulent strains of bacteria. There are even times where excessive gingiva will be removed to decrease pocket depth (hyperplastic gingiva) or the gingiva will be sutured further down the root (apically repositioned flap) for the same effect.

Attachment loss without pocket formation occurs when gingival tissue and bone is lost at the same time, exposing the roots and even furcation areas. The ability to take intraoral radiographs is essential, in order to determine the extent and characteristics of bone loss. With recession of gingiva and bone across several roots and/or teeth, a horizontal bone loss pattern will often result in exposed roots. With a deeper osseous loss down one root surface, an infrabony pocket may result from the vertical bone loss, and specific therapy may be needed to address that specific defect. These deeper pockets are more difficult to treat and maintain, and anaerobic infections may persist.

Attachment Loss – Treatment Decisions
In evaluating teeth at either end of the spectrum – minimal disease with stage 1 or 2 teeth, or extensive stage 4 disease – the decision process is pretty straight forward. With stage 3 periodontal disease affected teeth – there is more of a challenge to decide whether to extract or try to save. The extent and type of attachment loss is a part of the decision process, as is the consideration of the relative importance of the tooth itself. Major teeth (canines, carnassials) will often be considered for advanced procedures, and adjacent, smaller teeth that are contributing to the infection should be considered for extraction, as their removal will allow better access to the strategic tooth. By extracting the middle tooth in the middle of three rotated, crowded premolars can often enhance the health of the remaining two teeth.

If the attachment loss results in root exposure with minimal pocket formation, professional cleaning and home care may be easier. Any involvement of the furcation puts the tooth at higher risk, due to challenges of continued care. If a pocket is present, it should be thoroughly evaluated: how deep is it? is it suprabony or infrabony?

Patient health status is also evaluated: patients with systemic disease would like benefit more from extraction with the immediate removal of the infection, and a decreased anesthetic time. Clients also are involved in the decision: advanced periodontal therapy requires excellent home care and more frequent professional visits.

Advanced Periodontal Therapy

Moderate Pocket Depths
With suprabony pockets (soft tissue only) of up to 5 mm in depth, evaluate not only the pocket, but the amount of attached gingiva left. If there is 7mm of attached gingiva due to inflammation or gingival enlargement, a simple gingivectomy/plasty can immediately reduce the pocket depth to a more manageable level. A 12-fluted bur on a high-speed hand-piece is extremely helpful with minor trimming. If there is minimal gingival enlargement and only 2–3 mm of attached gingiva, then closed root planing and placement of a perioceutic can provide excellent care for the defect.

Root planing/ subgingival cleaning
This is by far the most important aspect of periodontal therapy. If the debris is not thoroughly removed from the pocket depths, the disease will remain and intensify. The rounded tip of the curette, and it's rounded back, makes it ideal for subgingival therapy, as opposed to the sharp tip and back of a hand scaler. Certain ultrasonic scalers are modified for subgingival treatments, but most are not. If root surfaces are exposed, or if the pocket depth is less than five mm, closed root planing and subgingival curettage may be performed. Using a curette subgingivally with overlapping strokes in horizontal, vertical and oblique directions, root planing removes calculus, debris and necrotic cementum to provide a clean, smooth surface. Root planning that is too aggressive can damage the root, so take some care. The curette can also be angled slightly to engage the gingival surface for removal of diseased or microorganism-infiltrated tissues, but again, not too aggressively. When pocket depth exceeds 5 mm, or other pathology exists, more invasive procedures are warranted.

Perioceutic therapy
In moderate pockets of up to 5 mm in depth (and generally deeper than 2 mm), once the area is debrided, placement of a local perioceutic medicaments can be considered. The combination of the cleaning and therapy can often help reduce the pocket depth in moderate situations. A gel containing doxycycline hyclate can not only provide a direct antibacterial affect against any remaining bacteria, but the anticollagenase activity can help "rejuvenate" the soft tissue of the pocket. A clindamycin gel may also be considered. A hyaluronic acid gel is now available in the US as well.

Surgical Periodontal Therapy
Many standard pieces of equipment and supplies can be used, including scalpel blades (15C works well), scissors (sharp/sharp for gingival remodeling), and sutures (usually absorbable, from 3–0 to 5–0). It is important to have other equipment as well for unique oral situations, including periodontal curettes for scaling root surfaces and periosteal elevators (Molt No. 2 or No.4) for elevating gingival flaps. For minor gingivectomy/gingivoplasty, a 12-fluted bur on a high-speed hand-piece can be helpful

When pocket depths exceed 5 mm but remain above the level of the bone, a simple envelope flap allows access and improved visibility for open curettage and root planing. That deep of a pocket will usually lead to a consideration of extraction, unless the tooth is a strategic one (canine tooth, carnassial tooth). Exposing the area with a gingival flap (scalpel blade inserted into the sulcus, sometimes with a releasing incision, and elevation with a periosteal elevator) allows thorough evaluation and debridement. The flap can then be sutured back into place, or to a position further apical on the root, more directly over the bone, to reduce the pocket depth.

If the pocket extends down between the root and alveolar bone (infrabony defect) inadequate therapy can lead to even further attachment loss and even tooth loss. Just cleaning the area will often lead to the soft tissues (gingival epithelium, gingival connective tissue) growing back into the defect faster than the more important supportive tissues of the periodontium (alveolar bone, periodontal ligament). Placing bone graft material and barrier membranes can actually help exclude the soft tissue and allow bone to grow back into the defect (guided tissue regeneration).

If an adjacent, smaller tooth is involved in the area of attachment loss, its extraction is sometimes the best way to get access to the larger, more strategic tooth's surfaces. The releasing incision is made away from the tooth being treated, allowing a complete attached gingival coverage of the treated site. Extraction of the middle of three crowded teeth also allows better exposure and treatment of the remaining teeth.

Regenerative Therapy
There are several indications for practical application of regenerative periodontal therapy. Vertical bone loss at the distal root of the mandibular first molar, at the palatal or mesial aspect of the maxillary canines, and mesial or lingual intrabony pockets of the mandibular canines can all be effectively treated to fill in the osseous defects. If there is no apical involvement, oronasal fistulation, and adequate exposure can be afforded (extract adjacent teeth, flaps), complete debridement of the defect with placement of a variety of materials, including placement of membranes, can help save these critical teeth and even strengthen the associated mandible or avoid fistulation.

The site for attempted GTR needs a biocompatible root surface, presence of healthy precursor cells (osseous 'walls'), exclusion of surface tissues and stabilization of the wound and clot. The morphology of the pocket (walls and angle of defect) and access to the defect are factors in selection and prognosis. A 4-wall or cup defect may provide the most osseous surface area but will be challenging

to debride; a wide defect may provide better access but will have a broader expanse to repopulate. Once a deep infrabony pocket is cleaned, typically the soft tissues (gingival epithelium, gingival connective tissue) will grow back into the defect faster than the more important supportive tissues of the periodontium (alveolar bone, periodontal ligament). By placing a barrier between the instrumented root surface and the gingival flap, it can act as a deterrent to exclude the gingival epithelium or gingival connective tissue from populating the root structure. This barrier then provides an area for the progenitor cells of the periodontal ligament and/or alveolar bone to have free access for migration.

Bulk materials in the form of bone graft material can be used alone but can be maximized with a barrier membrane. An osteoconductive material provides a scaffold that can 'promote' (Consil) the cellular attachment, proliferation and migration, often with substances that enhance osseous response. Alloplasts (synthetic material) are incorporated into the bone while products with demineralized freeze-dried bone (DFDB – Osteoallograft) can be resorbed quickly. An osteointegrative material can take a product with DFDB and go one step further, using BMP (bone morphogenic proteins) to allow a direct structural and functional connection with living bone. Osteoinductive products are biological materials with growth factor or graft material that helps lead the differentiation of mesenchymal stem cells into osteoblasts. Products that stimulate osteogenesis from any tissue or cell capable of differentiation can aide in the development, growth or repair of bone.

The origins of materials also play a part, with autogenous bone from the same individual being harvested from intraoral or other sites providing a variable osteoinductive response. Allogenic bone from the same species is often a DFDB product and likely provides osteoconductive and possibly osteoinductive impact. Xenografts have been developed with bone from different species, but are not significantly better than open root planing and home care in human studies. Alloplasts are biosynthetic materials than only provide osteoconductivity as a scaffold and may be considered more for a bone fill.

A new gelatin-based tissue scaffolding (ReGum Vet®) utilizing a proprietary Cell-Foam™ technology, with injectable and solid forms (cones and small sheets). It fills and supports the defect, providing a framework for tissue repair. It is resorbed and replaced with the tissue during the healing process. Cases have shown bone fill and there are options for using it in furcation defects. The hyaluronic acid gel may also be considered (PerioVive®)

Barrier membranes on their own can inhibit rapid epithelial growth but can sometime result in a long junctional epithelium, so are often used in conjunction with bulk materials (see above). The earliest membranes were synthetic and non-resorbable, requiring removable and are used now primarily for guided bone regeneration. Resorbable, biodegradable and some natural membrane (Ossiflex – DFDB) materials are more frequently used, from vicryl based materials to those using collagen, and even made chair-side with perioceutic gels (Doxirobe).

Biological products are now frequently used in conjunction with barriers (bulk and membrane) to enhance the regeneration of tissues. Growth factors such as BMP (bone morphogenic protein) with osteogenic proteins can help induce mesenchymal progenitor cells to become osteoblasts. Autologous platelets and pellets provide platelet-derived growth factors that can be added to autologous bone graft to help increase the quality of bone regeneration, especially in larger defects with lower osteogenic potential. Even enamel matrix derivatives (EMD) from porcine tooth protein help promote fibroblasts that can result in new cementum, PDL and bone, similar to GTR with membranes, but with unpredictability among batches.

Two sites that are most commonly selected for GTR involve the distal root of the mandibular first molar (often with extraction of the second molar for exposure) and the palatal aspect of the maxillary canine, before the defect results in an oronasal fistula. An essential key to such a procedure is adequate exposure and debridement of the area. A gingival flap is necessary to allow for thorough curettage of all material in the infrabony pocket in between the tooth and root, including the removal of any granulation tissue. Once healthy bone and tooth surfaces are clean, the bone graft material is packed into the defect, the membrane placed, and the gingival closed over it. Post operatively vigorous home care and plaque control are essential.

Specific Conditions

Mandibular Canines and Incisors
The mandibular incisors are frequently affected by periodontal disease and bone loss, especially in smaller dogs. It is tempting just to wiggle out a loose tooth, and that will remove the primary source of the disease, but leaving the involved, less healthy soft tissues can continue to impact adjacent teeth, especially the mandibular canines. The bone loss between the mandibular third incisor and canine can result in a persistent deep soft tissue pocket (with some intrabony extension) once the incisor is gone. A deep soft tissue pocket may also be present around the mandibular canine if the tooth is not fully erupted, as gingiva cannot attach to the enamel that is still below the gum line. Persistent pockets here can predispose the canines to additional periodontal disease with anaerobic plaque bacteria present.

In order to minimize these pockets, the soft tissue linings often have to been excised, and the level of the gingival margin may have to be moved further apically down the tooth. A wedge excision of the tissue from the mesial margin of the canine (the surface closest to the midline of the symphysis) helps remove the excess and granulomatous tissue, and can minimize the pocket depth if the height is reduced (if sufficient attached gingiva remains). With partially erupted teeth, the wedge incision may not be enough: the attached gingiva may have to be elevated past the muco-gingival junction to release the flap at the level of the looser alveolar mucosa. This way the flap can be repositioned further apically on the tooth and secured with sutures, revealing more of the crown and decreasing the pocket depth. In other teeth, trimming the gingiva or securing the margin further apically will actually expose more root surface, but root exposure is simpler to keep clean that a root within a pocket.

Mandibular First Molar
Any attachment (bone) loss at the mandibular first molar deserves attention. Advancement of bone loss at this tooth is one of the most common reasons for pathological fracture of the mandible. Bone loss at the mandibular fourth premolar or second molar, particularly if vertical bone loss has started at the first molar, is sufficient reason to extract the smaller tooth to provide access to treat the first molar more effectively. For best periodontal treatment, a releasing flap is made at the furthest margin of the adjacent tooth to be extracted, with the gingiva elevated to facilitate extraction, and thus exposure of the affected root of the first molar. Any pocket lining or granulation tissue in the region should be removed, and the area scaled until healthy root and bone is exposed. If there is an intrabony pocket around the first molar, a bone graft material can be placed, as well as in the alveolus of the extracted tooth. At the very least, the disease tissue should be removed, the root cleaned thoroughly, and the gingiva sutured closed around the first molar.

Maxillary Premolars
In smaller dogs and brachycephalic breeds, maxillary premolars can often be crowded, sometimes with significant rotation that stack them up on each other. The lack of healthy bone in between these teeth predisposes them to additional periodontal attachment loss, and it can be challenging to keep them healthy. While some propose prophylactic extraction of any rotated and crowded maxillary premolars, in most patients, regular examination and cleaning can alert the practitioner to those that may require extraction. Often, the 'middle' tooth in a series of three teeth can be extracted to improve the condition of the two adjacent teeth. Special attention should be paid to the maxillary third premolar, for if the distal root is crowded between the two mesial roots of the fourth premolar, the third premolar may need to be sacrificed.

As a strategic tooth, it is often worth it to provide additional effort to preserve the health of the maxillary fourth premolar. In smaller dogs, it is critical to evaluate the status of the periodontal tissues around the palatal root. It is often so small, that a 3–4 mm pocket with bone loss can completely envelope the root, compromising the entire root. In fact, an infraorbital swelling in a small dog with an intact (not fractured) fourth premolar should lead a close examination of the palatal root.

Maxillary canines

Periodontal bone loss at the palatal aspect of maxillary canines can lead to oronasal fistulae, once a deep pocket extends past the level of the palatal bone. Once formed, the fistula is nearly impossible to correct, so extraction is necessary. Chronic fistulation can be challenging to close, as every breath puts tension on the sutured flap. Prevention of fistulation is critical, so careful evaluation of the palatal (and mesiopalatal aspect) of the maxillary canine is important. If a moderate pocket is formed, closed root planning and a perioceutic may help stop the progression. If an intrabony pocket has formed, there may an opportunity to provide advanced periodontal treatment for guided tissue regeneration to build back the lost bone before the fistula is formed.

Faster, Longer, Better- Regional Anesthetic Secrets for Comfortable Patients

Christopher Snyder, *DVM, DAVDC, DEVDC*

Regional anesthesia and pain management are fundamentally important skills to successfully leverage for the benefit of our dentistry and oral surgery patients. Despite these patients being under general anesthesia while undergoing procedures, there are inherent benefits to utilizing techniques that will allow for the reduction of inhalant anesthesia, improve recovery and improve the patient's comfort at the time of discharge. Anatomy of the face and mouth is complex. There are many locations and combination of locations where local anesthetics can be administered which will result in regional anesthesia.

Regional anesthesia can offer many benefits by reducing the animal's response to painful stimuli during the procedure as well as provide postoperative analgesia. Primarily speaking, benzodiazapines, phenothiazines and general anesthetics have no primary analgesic activity. These medications alter the state of consciousness and abolish the perception of pain. Peripheral sensitization, or a reduction in the threshold necessary for stimulus transduction occurs due to the effects of tissue injury and inflammation. Inflammatory mediators including prostaglandin E2, bradykinin, neurotrophic factors (NGF) and the activation of mast cells contribute to peripheral sensitization. These inflammatory mediators lower the activation threshold and increase the amount of Na+ flowing across the channel. Once general anesthetic medications are metabolized, the patient is vulnerable to the sensation of pain. In recent years, significant advancements have developed aiding our ability to assess pain in cats. Evaluating facial expression in these patients not only help us identify painful patients prior to treatment but also to assess response to treatment and post-operative efforts for analgesia.

Local anesthetics work by inhibiting transmission through their effects on Na+ channels. By preventing depolarization and propagation of neural signals to the brain, pain can be effectively blocked. While local blocks reduce the amount of perceived pain and amount of required general anesthesia and associated unwanted side effects, the patient's comfort can be improved. Effective local blocks are not a replacement for safe, effective general anesthesia. The addition of local blocks to the anesthesia and analgesia protocol will provide the benefits of polypharmacy which can be recognized as threefold. These drugs: (1) prevent peripheral and central sensitization, (2) reduce the adverse effects associated with larger doses of medication and (3) provide better postoperative pain management to smooth out the recovery of the patient.

Studies measuring minimum alveolar concentration have shown that administration of local anesthetics reduce the amount of inhalant necessary to keep 50% of patients asleep during a given stimulus. The use of local anesthetics preventing the propagation of nerve impulses may be beneficial on its own but may be further improved through the addition of opioids or alpha-2 agonists administered locally.

When given as a local anesthetic, the lidocaine family of drugs provides a variety of options with different onsets of action and different durations of action. Doses should not exceed 5mg/kg in dogs and 2mg/kg in cats. Lidocaine is commonly used in human regional and local anesthesia because a quick onset and short duration of action is desirable. Compliance with human patients for taking oral medications is quite good and return to function (frequently the workplace) is important. In canine and feline dentistry, bupivacaine is a popular medication used off label because of its longer duration of action. Depending on placement the duration of action may be 6 to 10 hours. Recent study information suggests that duration of action may vary by individual dog, but that bupivacaine may last 1–3 days in some patients. Time to onset of action is longer with bupivacaine than lidocaine, some texts referring to a 20-minute period necessary before the nerve impulses are effectively blocked. Lidocaine is labeled for veterinary use while bupivacaine is not. The most common concentration of bupivacaine is 0.5% (5mg/mL) while lidocaine is 2% (20mg/mL). Mixing these drugs should be discouraged until substantiated research is preformed determining that the drug remains active and what the concentration of active drug is. A recent publication demonstrated that mixing lidocaine and bupivacaine worked longer than lidocaine alone. That study's results with bupivacaine mixed with lidocaine demonstrated a shorter duration of action than a study using bupivacaine alone. This begs the question whether mixing the two drugs results in a reduction in the prolonged effect of bupivacaine alone?

Key Clinical Diagnostic Points
Using the techniques covered in this presentation, it has been the experience of the author that small dosages are sufficient to achieve the desired result of local blockade. Using the techniques discussed, the entire mouth can be anesthetized through the administration of local anesthetic in only four locations.

Bupivacaine
0.1–0.15mL per site (cat or small dog)
0.2mL per site (medium dog)
0.3mL per site (large dog)
The various blocking locations are listed below.

Infraorbital Block
Location: immediately within the infraorbital canal above the distal roomy of PM3

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What it blocks: maxillary incisors, canine tooth, premolars 1–2, +/– PM3, buccal mucosa, ipsilateral lip, ipsilateral soft tissue of that side of the face.
What it won't block: palatal mucosa, PM4 (commonly extracted), may not completely anesthetize for extraction of the central incisors due to crossover innervation.

Caudal Maxillary Block
Location: advance the needle parallel with the hard palate trough the infraorbital canal and as far casually as to the last molar tooth.
What it blocks: all the maxillary teeth in that quadrant, ipsilateral lip, ipsilateral hard/soft palatal mucosa, ipsilateral soft tissues on that side of the face.
What it won't block: may not completely anesthetize the central incisors.

Middle Mental Block
Location: ventral to the mesial root of the 2nd premolar (dog) or labial frenulum (cat). Enter through the mesial aspect of the labial frenulum and place the needle against periosteum half the height of the mandible and centered over the tip of mesial root of the second premolar.
What it blocks: ipsilateral lip and rostral soft tissues, incisors? and canine tooth?
What it won't block: Questionable coverage for the ipsilateral mandibular incisors and canine tooth (probably due to diffusion into the mandibular canal).

Caudal Mandibular Block (Inferior Alveolar Block)
Location: two main approaches
1. Intraoral: half the distance between the angular process and the mucosa immediately caudal to the third molar (dog) or only molar (cat) (lingual side of the mandible).
2. Extraoral: palpate the ventral notch of the mandible, half the distance of the length of the notch, place needle perpendicular to the notch and immediately on the lingual surface, advance needle ½ to 1 cm.

What it blocks: all ipsilateral mandibular teeth, rostral mandibular soft tissues
What it won't block: questionable coverage for caudal mandibular soft tissues, if applied correctly, should not risk anesthetizing the tissues of the tongue.

Note: It has been shown that intraoral administration of the caudal mandibular block is more accurate than the extraoral approach- this may be useful in helping to reduce the risk of inadvertent blocking of the sensory innervation to the tongue. Once the needle has been placed, it is important to aspirate, and re-aspirate, while rotating the needle 90o along its long axis to ensure the injection is not given intravascular. Medication should be administered with the needle being placed on periosteum for the middle mental, and caudal mandibular blocks. Even if the bevel is not directly over the nerve, by being deposited on periosteum, the local will cover more surface area and increase the chance that the nerve will be coated. Once the local has been administered, the needle should be withdrawn and digital pressure should be placed for 1 minute to provide adequate time to prevent hematoma formation.

There is reasonable expectation that the addition of opioids to a local block may improve postoperative analgesia long after the effects of the sodium channel blockade wear off. In a study performed in dogs comparing bupivacaine versus bupivacaine + buprenorphine (30mcg) it was shown that 3 of 8 dogs with the combination demonstrated analgesia 72-hours post administration while 2 of 8 dogs experienced analgesia 5 days following administration. It has been well established that mu receptors exist in the peripheral nervous system and are up-regulated when exposed to chronic noxious stimulation. Dentistry patients undergoing procedures for acute injuries, such as tooth fracture, are less likely to demonstrate the benefits of opioids in their local blocks as compared to cats with stomatitis or tooth resorption. Chronic conditions may make some drugs work better or

last longer. There are several situations where long-term desensitization of a surgery site may be undesirable. Patients suffering from an oronasal fistula already have a loss of bone and a communication between the oral and nasal cavities. Repairing these defects and having the surgery site be completely numb may result in the animal becoming preoccupied with feeling the sutures on their tongue and subsequently tongue thrusting through the surgery site up into their nasal cavity. Similar potential situations exist with maxillectomy patients. It is this author's experience and recommendation that using short acting local anesthetics like lidocaine followed by aggressive post-operative pain management will result in a comfortable patient after surgery with decreased risk of tongue thrusting. Procedures involving the tongue should never receive local block administration because these patients will be at very high risk of self-trauma and risk "chewing their tongue off." Use of large volumes when performing local blocks has also been anecdotally reported in resulting in this form of self-mutilation. Sticking with the small volumes and accurate placement afford good results with decreased risk.

Whenever there is potential for the local block needle to traverse through an area of possible tumor, the local block should not be performed. Seeding tumor cells through the infraorbital canal may extremely complicate treatment options available for a maxillary tumor. Using a 25-gauge 1 inch to 27 gauge 1.5-inch needle helps reduce possible nerve injury.

Complications

Complications with local anesthetic blocks have been reported in the literature. Paresthesia, altered sensation and motor changes are occasionally reported anecdotally from practitioners. It is unclear as to where the origin of nerve injury associated with local anesthesia comes from. While histologic nerve changes associated with local anesthetic administration are reported in veterinary patients (Correspondence: J Anthony), true clinical significance should be considered since similar blocks have been performed in humans for decades with a low incidence of true complications. Peripheral nerve paresthesia is a rare complication reported in humans. One human dental textbook reports an occurrence of 1 case in 1 million injections. Peripheral nerve paresthesia and subsequent self-mutilation of the veterinary patients' tongue has been only anecdotally reported. The technique for proper needle placement for local anesthetic placement is different than it is for venipuncture. After initial needle penetration, the needle should be guided into position for local administration. When these needles are guided through foramen (as in the infraorbital or caudal maxillary blocks) the needle should be advanced slowly and in most situations the needle bevel with help to displace the neurovascular bundle as the bevel is advanced. Nerves penetrated by needle placement can have variable effects- from no change to permanent sensory or motor dysfunction.

There is a school of thought that nerve injury associated with local blocks may not be directly related to physical damage by needle placement. Peripheral nerve ischemia associated with the addition of epinephrine to a local block may also be associated with nerve injury. The addition of epinephrine to long-acting local blocks has therefore been recommended against for that very reason. Beyond the delayed absorption of local anesthetics by the vasoconstriction associated with epinephrine, it has been shown that this catecholamine has some alpha-2 agonist analgesic activity.

The use of small doses in regional anesthesia and aspiration immediately after needle placement can help avoid inadvertent intravascular injection. The most common complications with intravascular injections of local anesthetics include seizures and cardiac toxicity. Bupivacaine has a high affinity for cardiac sodium channels and can cause brady-dysrhythmias as well as ventricular tachycardia and ventricular fibrillation in humans.

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The complications of inadvertent anesthesia of the tongue and iatrogenic globe penetration with the needle while performing the maxillary nerve block should both be effectively prevented by close attention to careful needle placement. Iatrogenic perforation of the globe by a needle during local anesthetic placement has a high mortality rate to the eye.

Conclusions

Effective local blocks are not a replacement for safe, effective general anesthesia or multimodal postoperative pain management. Use of local anesthetic agents helps to reduce the amount of inhalant general anesthesia required to keep a veterinary patient anesthetized. The unwanted, most frequently seen complications associated with general anesthesia in veterinary patients who are anesthetized for any reason are hypotension, cardiac dysrhythmias, hypercapnia and hypoxemia. Multimodal analgesia anesthesia can help reduce these unwanted side effects by reducing the amount of gas required to keep the patient anesthetized.

Recommended Reading

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INTERMEDIATE/ ADVANCED

SPEAKERS

Scott Alexander
No biography has been provided.

José C. Almansa Ruiz

Lead Clinician of the Dentistry and Maxillofacial Surgery Department at Bristol Vet Specialists. José graduated from the Universidad Complutense de Madrid in 2008. He is a diploma holder of the EVDC since 2021. José has a keen interest in TMJ pathology, oncological surgery and reconstruction, as well as wildlife dentistry. He has presented at numerous national and international congresses as well as published in peer-reviewed journals.

Michael Balke

Dr. Michael Balke earned his Bachelor of Science in Biology and Doctor of Veterinary Medicine from the University of Missouri. Following graduation, he practiced as a small animal veterinarian in St. Louis, Missouri, where he developed a strong clinical interest in veterinary dentistry. In 2012, Dr. Balke joined Arizona Veterinary Dental Specialists and completed a rigorous residency in veterinary dentistry. He subsequently achieved board certification as a Diplomate of the American Veterinary Dental College (AVDC). In 2025, Dr. Balke further advanced his expertise by completing a fellowship in advanced oral and maxillofacial surgery, earning the distinction of AVDC Fellow in Oral and Maxillofacial Surgery (F-OMFS). Dr. Balke's professional interests include all things dental with a particular focus on complex oncological surgery as well oral and maxillofacial reconstruction. He is dedicated to advancing the field of veterinary dentistry through both clinical excellence and professional engagement. He maintains active membership in several professional organizations, including the Foundation of Veterinary Dentistry (FVD), the American Veterinary Medical Association (AVMA), the Veterinary Society of Surgical Oncology (VSSO), AO North America, and the Arizona Veterinary Medical Association (AZVMA). In addition, Dr. Balke is a frequent lecturer on veterinary dental and surgical topics at local, national, and international conferences. Committed to education and professional development, Dr. Balke currently serves on the Residency Program Administration Committee of the American Veterinary Dental College. He has previously contributed to the College as a member of both the Training and Support Committee and the Examination Committee. He also serves as Chair of the Phoenix Zoo Animal Health Committee, supporting the advancement of veterinary care in zoological medicine. Dr. Balke is the Medical Director of Arizona Veterinary Dental Specialists at the Gilbert location, where he provides advanced specialty care to patients while supporting the growth and mentorship of the veterinary community.

Nicolas Girard

Diplomate of the National Veterinary School of Toulouse, he practiced small animal medicine and surgery for ten years before specializing in veterinary dentistry and oral and maxillofacial surgery. He completed a four-year residency in Paris with Dr. Hennet and became a Diplomate of the European Veterinary Dental College. Former President of the French National Dental Group and current Chair of the EVDC Examination Committee, he is actively involved in veterinary education across France and Europe. His research focuses on periodontal disease, tooth resorption, endodontics, bone regeneration, and CBCT applications in dentistry and OMFS. He is Board Associate and Head of the Dental and OMFS Service at AzurVet Referral Center.

SPEAKERS

Stephanie Goldschmidt
Dr. Goldschmidt is a passionate educator in the fields of general dentistry and oral oncology and is an assistant tenure track professor in dentistry and oral surgery at the University of California, Davis. Previously, she was a clinical assistant professor at the University of Minnesota. She is currently undergoing fellowship training in both oral medicine and oromaxillofacial surgery. Her subspecialty clinical and research area is oral oncology; specifically, she is focused on improving treatment paradigms with the use of theragnostic agents. Her current projects include using fluorescence imaging to evaluate intraoperative surgical margins and lymph node status in canine oral tumors.

Barden Greenfield
Barden Greenfield is a 1985 graduate of Mississippi State University College of Veterinary Medicine. He became a Diplomate of the American Veterinary Dental College (AVDC) after completing a non-conforming dental residency in 2010. He has a dental referral specialty practice (Your Pet Dentist) in Nashville, Tennessee. Dr. Greenfield previously served on the AVDC board for multiple years and was President of the College from 2016–2018. He is currently a Board Member of the Foundation for Veterinary Dentistry serving as President. He was the recipient of the prestigious AVDC Peter Emily

Mihai Guzu
Mihai graduated from the Faculty of Veterinary Medicine at the University of Liège in 2013 and completed a rotating internship in Small Animal Medicine and Surgery at the National Veterinary School of Alfort in 2014. After three years in general practice, during which he also earned degrees in Microsurgery and Head and Neck Surgical Oncology at the University of Paris, he joined ADVETIA Small Animal Hospital in 2017 for a full-time residency in Dentistry, Oral and Maxillofacial Surgery. He became a Diplomate of the European Veterinary Dental College (EVDC) in 2021. His work focuses exclusively on Dentistry, Oral and Maxillofacial Surgery. He is currently pursuing a degree in Maxillofacial and Reconstructive Surgery at the University of Lorraine and regularly lectures nationally and internationally on maxillofacial conditions.

Kirsten Hailstone
Dr. Kirsten Hailstone is a Board Certified Veterinary Dentist, holding the prestigious diploma from The American Veterinary Dental College. She is a director and owner at Adelaide Veterinary Dentistry and Oromaxillofacial Services (AVDOS) where she works alongside a surgical registrar with the ECVS. At AVDOS Surgery and Dentistry seamlessly combine to provide thoughtful solutions for complex issues related to companion animal oral and facial diseases and malocclusions.

Brian Hewitt
Brian Hewitt graduated from the University of Florida Veterinary College in 1990, and has been practicing in Las Vegas, Nevada since that time. He started pursuing advanced dentistry in 2001 and became board certified in veterinary dentistry in 2018. In 2023, Dr. Hewitt opened Animal Dental Specialists of Nevada, in Las Vegas. Dr. Hewitt frequently lectures and is also the president of the Peter Emily International Veterinary Dental Foundation. PEIVDF is a nonprofit organization that provides free dental services to wild animal sanctuaries.

Lucy Holcombe

Dr. Lucy Holcombe is a Research Manager at the Waltham Petcare Science Institute, the global fundamental research centre for Mars Petcare. She leads the Oral Health research programme, focusing on improving oral health in dogs and cats. Lucy earned her PhD in molecular microbiology and genetics and initially worked in academia researching microbial disease conditions. She joined Waltham in 2011 to focus on oral health research in companion animals. Since 2015, she has been leading a team of scientists investigating biomarker-based questions related to pet health. Her oral health research has been shared through over 20 peer-reviewed publications with insights additionally supporting Mars Petcare to develop new product claims and practical tools.

Jessica Johnson

Dr. Johnson graduated from Texas A&M College of Veterinary Medicine in 2008. She spent ~10 years as a small animal general practitioner in day practice, EC and relief. Following her passion for dentistry, she pursued a residency, becoming a Board Certified Veterinary Dentist in 2022. In 2024, she helped open Veterinary Dentistry & Oral Surgery of North Texas. She's developed multiple RACE-approved wet lab designed to teach new DVM graduates how to perform flaps, blocks, and extractions. She serves as the residency director at her clinic and on the Training & Support Committee for the AVDC.

Daehyun Kwon

Daehyun Kwon, DVM (1999), has practiced veterinary dentistry and oral surgery since 2007 and currently serves as Director of MAY Veterinary Dental Hospital and Vice President of the Korean Veterinary Dental Society. With 18 years of clinical experience in dentistry, he has authored seven first-author SCI papers in the past four years on topics including canine and feline endodontics, orthodontics, periodontal pathogens, and extraction causes. He will earn his PhD in February 2026 with a dissertation on subgingival bacteria as diagnostic biomarkers for periodontal disease in dogs and cats.

Jennifer Mathis

Dr. Mathis is a board-certified veterinary dentist from Des Moines, Iowa. With over 20 years of initial experience in general practice, she has also become a certified veterinary pain practitioner and medical acupuncturist through the IVAPM. Dr. Mathis is passionate about treating the mouth to prevent and treat pain. In 2024, she was named WVC's Laboratory Speaker of the Year. She also provides RACE lectures at Vet CE You'll Use.com.

Annabel McFadzean

Annabel graduated from the Royal Veterinary College in 2010 and then completed a rotating internship at the Queen Mother Hospital for Animals. She subsequently worked in primary care practice whilst achieving a postgraduate certificate in small animal surgery. Annabel started a 3-year full time residency in Dentistry and Oral Surgery at Eastcott Veterinary Referrals in 2020. She became a Diplomate of the European Veterinary Dental College in 2024, and is an RCVS Recognised Specialist and EBVS® European Specialist in Veterinary Dentistry. Annabel joined Cave Veterinary Specialists in 2023 to lead and develop the new Dentistry and Oral Surgery department. She has a special interest in maxillofacial surgery – particularly oncological surgery.

SPEAKERS

Santiago Peralta
Santiago Peralta obtained his degree in veterinary medicine from Universidad de La Salle in Bogota, Colombia. He worked in private practice for six years before completing a residency in veterinary dentistry and oral surgery at the University of California – Davis. He then joined the faculty at Cornell University where he currently serves as an Associate Professor. He is a Diplomate of the American Veterinary Dental College and a Founding Fellow of Oral and Maxillofacial Surgery.

Mirko Radice
Since 2002, he has been working as an instructor and lecturer in SCIVAC dentistry courses. He has served as scientific coordinator and is currently director of the SCIVAC dentistry programs. He has held the positions of vice president and president of SIODOCOV. He is currently head of the odonto-stomatology department at DENTALVET-ANIMALIA and is responsible for the development programs of the ANIMALIA group in the field of dentistry.

Erin P Ribka
Dr. Ribka is a 2002 graduate from the University of Wisconsin School of Veterinary Medicine. Shortly after graduation, she moved to New Orleans to begin her career, marry Paul and start their family. After ten years working in small animal practice and primate medicine, in 2012 she began formal training in small animal dentistry, working with Dr. Brook Niemiec, a Diplomate of both the American and European Colleges of Veterinary Dentistry. Together they opened Louisiana's first veterinary clinic devoted exclusively to veterinary dentistry. She has been a diplomate of the AVDC since 2022.

Philippe Roux
Philippe Roux (1964) graduated from the Faculty of Veterinary Medicine of the University of Bern, Switzerland 1990. Since 2005, diplomate of the EVDC and since 2010, working exclusively as a veterinary dentist in a small animal clinic in Lausanne, switzerland. Topics of interest: tooth resorption, endodontic and maxillo-fascial surgery

Alice Sievers
Alice Sievers is a Diplomate of the American Veterinary Dental College. She has worked in mixed and small animal practice, emergency medicine, and referral practice, and is a co-Founder of Pet Dental Specialists in Vancouver, Washington. She supports education as a residency supervisor and as a visiting clinical instructor at Oregon State University College of Veterinary Medicine, providing dental and oral health education to all third-year students.

The Inflammation Game: Decoding Feline Oral Inflammation

Alice Sievers

Diagnosis of inflammatory diseases in the oral cavity of cats, and veterinary patients in general, can be complicated by the fact that there is a limit to the creativity of the oral tissues in their response to inflammatory disease. Not surprisingly, these inflammatory conditions create pain and discomfort for our veterinary patients and many of them suffer in silence due to the potentially subtle changes in their behaviors that may be missed by their caregivers and veterinary providers. It is important to look at oral lesions in cats with a critical eye and work to obtain the most accurate diagnosis possible. Diagnostic follow-through is critical. Inflammatory and malignant lesions can overlap in their clinical appearance and care must be taken to avoid assumption and mis-identification. Inflammatory lesions may represent more of the lesions seen in our patients than previously recognized, and a diagnosis of a malignant lesion can have serious implications for the care a patient may be provided, impacting the length and quality of their life. While there are many inflammatory oral conditions that can be seen in our feline patients, this presentation is focused on those commonly referred to specialty practice and those commonly seen in general veterinary practice. In this presentation we will review pattern recognition to narrow the differential list based on clinical findings which can help facilitate discussion with clients to develop a diagnostic plan to guide therapeutic planning.

Review of the dynamic role of the oral microbiome in health and disease

Corrin Wallis and **Lucy Holcombe**
WALTHAM Petcare Science Institute, Waltham-on-the-Wolds, Melton Mowbray, LE14 4RT

The oral microbiome, the community of microorganisms (bacteria, fungi, viruses and archaea) residing in the mouth, plays a vital role in health. Distinct microbial profiles exist due to the unique biological properties of the various habitats which are constantly bathed in saliva. Under healthy conditions, the oral microbiome has a favourable commensal association with its environment. However, the build-up of dental plaque can trigger host-mediated inflammation leading to conditions such as gingivitis and periodontitis. Oral infection has been linked to systemic diseases and microbes are postulated to contribute via spread of infection due to transient bacteraemia, circulation of microbial toxins or systemic inflammation from an immune response.

Advances in sequencing and bioinformatics capabilities have led to numerous studies describing bacterial and fungal associations with periodontal health or disease. Crucially, several publications have indicated a lack of similarity (< 20%) between the microbial communities in dogs and cats with those in the human oral cavity. This knowledge creates new opportunities for tailored species-specific diagnostic and health monitoring solutions for cats and dogs. The main technological approaches deployed include sequencing of the entire bacterial community, quantification of individual species and measurement of bacterial biproducts. High throughput sequencing provides a comprehensive profile of the entire microbial community, but is resource-intensive, requires bioinformatics expertise and has a lengthy turnaround time. Quantification of individual species (e.g. qPCR) is cheap, fast and routinely used for diagnostics but can result in false negatives as some pets may not have the bacterial biomarker being screened for. Detection of bacterial biproducts involves measuring bacterial activity (e.g., volatile sulphur compound production or protease activity) and is rapid, cheap and applicable to point-of-care use. However, byproduct levels can fluctuate due to host and environmental factors and can lack specificity so may need to be combined with other measures.

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Diet composition may impact the oral microbiome by providing a food source that enriches for certain bacterial species. For example, westernised human diets have led to an increase in acid-producing bacteria within the oral cavity which is likely the reason for the high prevalence of dental caries observed. In dogs and cats, the influence of diet is less well understood, however, molecular screening tools have shown that dry diets shift the bacterial population towards those associated with healthy gingiva and vice versa for wet diets. Dental chews have also been demonstrated to modulate the oral microbiome, increasing the relative abundance of taxa associated with oral health and decreasing the abundance of those associated with periodontal disease.

The oral microbiome plays a critical role in maintaining overall health. Advances in molecular methods and bioinformatics have significantly enhanced our understanding of the distinct microbial communities in the oral cavities of dogs and cats, enabling more precise and rapid diagnostic and monitoring tools. Oral care interventions have been shown to modulate the oral microbiome towards a healthier profile. Continued research integrating microbial profiling with clinical outcomes is required to optimise strategies for improving oral and systemic health in pets.

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Immune Related Inflammatory Oral Disease In The Dog

Barden Greenfield, *DVM, Dipl. AVDC*
Your Pet Dentist of Nashville

Introduction
Immune related inflammatory disease in the oral cavity provides the clinician a diagnostic and treatment challenge. A tooth fracture is such and periodontal disease can be identified via Stages (1–4) with both probing and radiographic identification. However, immune oral pathology can mimic many processes. This lecture will review some of those processes and how to both identify and treat those conditions. I will be referencing three major pieces of literature (Frontiers in Veterinary Science, a lecture by Cindy Bell at the 2024 Veterinary Dental Forum and a recent article in JoVD regarding treatment of Canine Contact Ulcerative Stomatitis by Jamie Anderson)

Choosing an oral pathologist...and dermatologist
This is paramount. One must choose a pathologist that can help direct you clinically but a proper identification is necessary. Therefore, I HIGHLY RECOMMEND you take clinical images of the pathology and submit those along with intraoral radiographs when applicable with your sample. Historically, few pathologists are oral 'specialists' so please check with your laboratory and ask who within that group can read and help identify pathology. In addition, consulting a local boarded dermatologist will be helpful as they see many mucosal diseases.

Classification of inflammation
1. Plaque-associated contact mucositis and gingivitis
Oral mucositis (to also include ulcerations) can be a direct response to existing periodontal disease. Oral bacteria trigger a biological response of a variety of cells within the body such as interleukins (IL), mast cells, macrophages, osteoclasts. Therefore, plaque is the causative agent. This may occur with bacterial related to exposed necrotic bone and exposed roots in areas of gingival recession. Calculus can also lead to ulceration via a direct contact to the gingival mucosa (which occurs frequently in the caudal maxillary cheek teeth) as well. There could still be concurrent disease so in

some case such cases where inflammation is more localized or proliferative, submission for pathology will help rule out neoplasia. A significant differentiation among these categories is with this condition, dermatological signs are not present. Histologically, they are generally lymphoplasmacytic, superficial and erosive.

Treatment is based on true identification of this condition but selective oral surgical extractions of affected teeth/area, followed by aggressive home care and repeated anesthetic dental assessment (supragingival/subgingival cleaning and polishing) every 3–6 months is warranted.

Doxycycline as a subantibacterial, anti-inflammatory agent at 2.0 mg/kg daily; fatty acid supplementation; daily brushing or usage of an enzymatic toothpaste along with water additive. (VOHC-approved) The usage of systemic antibiotics at normal dosages is contraindicated as well as the usage of corticosteroid therapy.

2. Canine Contact Ulcerative Stomatitis (CCUS)
CCUS is a clinical diagnosis, not a histopathological one, therefore, it is impossible to distinguish this from the above and can overlap with autoimmune diseases. Therefore, clinical presentation is paramount. Differential diagnoses for CCUS include autoimmune conditions such as pemphigus vulgaris, bullous pemphigoid, erythema multiforme, and lupus erythematosus, along with epitheliotropic T-cell lymphoma and uremic stomatitis.

Canine chronic ulcerative stomatitis (CCUS) is a spontaneously occurring, painful, and often debilitating condition of the oral cavity, with a suspected immune-mediated component. Ropey saliva with a fetid odor emanating from the mouth occurs. These pets are extremely painful to the touch and may experience weight loss, irritability and depression. This condition is seen with severe mucosal ulcerations related to contact to the tooth cusp and plaque formation that has occurred. Lesions may also occur on the lateral aspects of the tongue, mucocutaneous lesions of the lips, and glossopalatine folds of the palate. Breed association may be Maltese Terrier, Cavalier King Charles Spaniel, Labrador Retriever, Greyhound, and terrier breeds.

In some cases, medical management along with aggressive home care does help. A recent study used Cyclosporine and Metronidazole after oral care performed and periodontally compromised teeth were removed. Cyclosporine is an effective immunosuppressive agent that inhibits T-cell function, therefore inhibiting cell-mediated immunity.

Medical Management
Doxycycline 2.0–5.0 mg/kg daily; Niacinamide 250–500 mg po bid; Fatty acid supplementation; +/– pentoxifylline DOSAGE. Study Plan: Cyclosporine 5.0 mg/kg orally once daily (1 hr prior to or 2 hrs post meal) for 8 days. Cyclosporine assays were run on day 8 (pre pill and 2 hr post trough). Then added day 9 metronidazole @ 15–20 mg/kg orally once daily for 21 days. Frequency of cyclosporine was reduced in successful cases to every other day or twice weekly.

3. Pemphigus vulgaris (PV), mucous membrane pemphigoid (MMP), Cytotoxic mucositis (EM, SJSA, TEN)
Pemphigus vulgaris is rare in dogs but is the most likely type to occur in the oral cavity. It is considered life threatening due to the loss of the epithelial barrier. Previous studies show 90% of dogs had oral lesions, and with 6%, the oral cavity was the only cavity involved. (Frontier). Areas of involvement are the areas of keratinized oral mucosa including hard palate, gingiva and dorsal tongue. Dogs experience oral pain with hypersalivation, lip smacking and halitosis.

Lesions are flaccid vesicles and bullae, ulcerations and erosions. Many times the vesicles have already ruptured so you do not see them on oral exam. Histopathologically, one notices suprabasilar clefting with only a single layer of rounded basal cells and acantholysis. Therefore, histopathology alone may confirm a diagnosis. (Frontiers/Bell)

Mucous Membrane Pemphigoid
This is the most common AISBD (autoimmune subepidermal blistering disease) that occurs in 48% of cases of that category. German Shepherd dogs are highly represented. Interestingly, symmetrical lesions (vesicles and erosions on mucous membranes and mcj occurred in 90% of patients in a particular study. Oral sites are gingiva, hard and soft palate and tongue. The nasal planum can be the second most common site. Histological findings are large subepidermal clefts lacking inflammatory cells at the margin of the ulcer.

Treatment
Corticosteroids (prednisone, prednisolone) or immunomodulating drugs (doxycycline and niacinamide).

Erythema multiforme (EM)
Erythema multiforme encompasses a variety of clinical presentations that include Stevens Johnson Syndrome (SJS) and toxic epidermal necrolysis (TEN). TEN is identified as the most severe form. These are cytotoxic diseases that cause epithelial cell injury. Histopath is characterized by a distinctive pattern of interface inflammation with keratinocytes necrosis. Causes or most likely a 'trigger' may include chemotherapeutic agents, medication, bacterial / virus or an exposure to a toxin.

These dogs are quite ill with fever a common theme. CBC abnormalities are leukocytosis and neutrophilia; hypergammaglobulinemia may occur along with other biochemical abnormalities. Clinically, skin and mucosal lesions are typically macular erythema that progress to blisters/ulcers with exudation (Frontiers). Nikolsky's sign (epidermis sloughs with minimal pressure)

Treatment
Removal of the causative agent (if found). Changing diet to a novel protein or hydrolyzed protein diet may be beneficial. Medical management may include one or more of the following: corticosteroids, azathioprine, cyclosporine, pentoxifylline. Niacinamide (vitamin B) and doxycycline have been used for synergistic immunomodulatory effects.

Immune Mediated Connective Tissue Diseases
Lupus erythematosus (LE) and Wegener's Granulomatosis are in this category. With regard to LE, various forms can mimic paraneoplastic neoplastic syndromes, multicutaneous pyoderma, CCUS and plaque-associated mucositis. (Bell) These lesions, however, may mimic neoplasia due to the proliferative nature. (I can attest to this in many instances)
Areas involved may be rostral labial mucosa, buccal mucosa, and sublingual mucosa. Tooth mobility (bone invasion) has been seen in many instances, giving the clinical appearance of an aggressive malignant neoplasia. The surface epithelium is usually smooth and non-lobulated, which may help differentiate this from neoplasia. Histologically, diffuse inflammatory disease that includes a missed leukocyte population of macrophages, plasma cells, lymphocytes and neutrophils.

Wegener's Granulomatosis may be multifocal and one distinguishing characteristic seen clinically is dark red or purple lesions. Alveolar bone loss is common with gingiva being swollen. Histological differentiation from LE may be the added presence of eosinophils with the possibility of multinucleated giant cells.

Treatment
Corticosteroid therapy

Conclusion
Immune-related oral diseases do occur in the canine and can be difficult to diagnosis and or find the causative agent. Proper biopsy techniques should be used and submission to an oral pathologist that has a knowledge of this category of disease. Images should be submitted to the pathologist when providing samples, and intraoral radiography should be performed to evaluate for bone loss.

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Puppy Mandibular Diseases (Compare and contrast)

Jennifer Mathis

Mandibular conditions in puppies present unique diagnostic and therapeutic challenges, particularly in large breeds during rapid skeletal growth. Several proliferative or inflammatory diseases can mimic each other clinically and radiographically, making recognition and differentiation essential for prognosis and treatment.

Mandibular Periostitis Ossificans (MPO)
MPO has been documented in immature large breed dogs between 3–5 months of age, including Labradors, Great Danes, and Great Pyrenees. Clinical presentation involves unilateral mandibular swelling, firm ventrally and fluctuant intraorally. Histopathology reveals necrotic bone, sterile fluid, fibrin, immature granulation tissue, and vascular proliferation with acute inflammation. Most cases involve male dogs, with left-sided swelling in 80%. The proposed mechanism parallels human periostitis ossificans: odontogenic infection elevates the periosteum, which responds by laying down new bone. Repeated cycles periosteal elevation produce the classic "onion-skin" radiographic appearance. Over time, the layers consolidate, and normal bone remodeling may occur. These lesions are often self-limiting, though some enlargement may persist.

Craniomandibular Osteopathy (CMO)
CMO, colloquially known as "lion jaw" or "Westie jaw," is a developmental orthopedic disease of terrier breeds aged 3–8 months. Clinical signs include pain on opening the mouth, palpation discomfort, bilateral firm mandibular swellings, reduced jaw motion, excessive salivation, and intermittent fever. Atrophy of the masticatory muscles may develop. Radiographically, CMO shows spiculated, mineralized hyperostotic cortical bone, usually bilaterally. Histology demonstrates exuberant new bone formation. While self-limiting, supportive care-nutritional support, fluids, analgesia, and corticosteroids-may be required. Relapses are common if treatment stops prematurely, and in some cases, progress to malnutrition due to the inability to open the mouth.

A genetic basis is implicated, particularly involving the SLC7A2 gene, a glucose-phosphate transporter in osteoclasts. In West Highland White Terriers, 36% were carriers, highlighting incomplete penetrance and variable expression.

Idiopathic Canine Juvenile Cranial Hyperostosis (ICH)
ICH affects dogs 3–8 months of age across multiple breeds, including Boston Terriers, Pit Bulls, Dobermans, Great Danes, and others . Predilection sites vary but often include the parietal and occipital bones, tympanic bullae, mandibular rami, and temporomandibular joints. This condition is non-neoplastic, with proliferative periosteal thickening. The etiology remains unclear but may involve trauma or inflammation.

Hypertrophic Osteodystrophy (HOD)
HOD (the CMO of the long bones) primarily affects large breed puppies aged 2–6 months. It presents with painful, usually bilateral swelling of the metaphyses, often accompanied by fever. The disease is self-limiting but may recur, and nutritional support and analgesia are essential.

Hypertrophic Osteopathy (HO)
Though less common in puppies, HO manifests as distal periosteal new bone proliferation, usually secondary to thoracic disease. Proposed mechanisms include vagal stimulation from pulmonary pathology, altered vascular dynamics, or systemic hormonal influences. Puppy mandibular diseases range from self-limiting developmental conditions to proliferative inflammatory diseases, including MPO. Accurate diagnosis requires the integration of a patient's history, clinical examination, imaging, and, in some cases, histopathology. Awareness of breed predispositions and genetic influences is critical. While many conditions resolve spontaneously, supportive care and careful monitoring are essential to minimize pain, prevent malnutrition, and preserve mandibular function.

Grafting the future: Saving More Teeth in Practice

Jennifer Mathis, *DVM, CVPP, DAVDC*

Periodontal disease is staged based on the amount of bone loss surrounding a tooth root. Should one root of a multirooted tooth have more bone loss than the other, the PD classification is based on the worst root. It's also essential to note that attachment loss (AL) rarely equates to periodontal pocket depth (PP). Any root exposure (RE) and/or gingival enlargement (GE) should be noted. In cases of root exposure, PP+RE = AL. For a video on the differences between curettes and scalers and their placement into the gingival sulcus, visit: https://tooth.vet/wvc-perio.
Keeping owner compliance and patient comorbidities in mind, along with tooth size variation, one can simplify PP measurements to guide treatment:
- PP depths 1–4 mm should receive closed root planing
- PP depths ≥5 mm are best served by open flap debridement surgery for an average patient (5 mm may be normal in large breeds, while 3 mm may be problematic in small teeth/breeds).

One reason to consider open root planing, which usually extends into some form of flap and oral surgery, is that despite meticulous closed cleaning, residual plaque and calculus are still found at depths greater than 5 mm. In other cases, practitioners may rely on perioceutic medication under the false impression that antimicrobials alone resolve disease. The advantages to open flap treatments include:
- Direct root cleaning with visualization
- Resection of diseased pocket lining and soft tissue treatment
- Primary intention healing
- Evaluation and treatment of bony defects if present
- Minimal alveolar bone resorption during healing

In pockets with vertical bone loss, common on palatal aspects of maxillary canines, intrabony defects provide potential for regenerative procedures. Guided tissue regeneration (GTR) removes irritants (calculus, bacteria, granulation tissue, debris) to encourage PDL, bone, and cementum by excluding gingival tissues with a barrier. Many barriers and graft products exist, with new options entering the veterinary market each year. Familiarity with their properties and sources aids in product selection. Available products are listed at https://tooth.vet/wvc-perio
Grafts vary in source and features. The most basic feature is osteopromotive: promoting new bone. They may also have osteoconductive surfaces whose topography permits and encourages cellular attachment and migration. Both osteopromotive and osteoconductive surfaces act as scaffolds. Materials are often augmented to be osteoinductive, containing growth factors that induce stem cells. Osteogenic materials contain living mesenchymal cells capable of forming bone (from the patient's marrow). Almost all graft materials do not function as barriers/ membranes. Recall that a barrier is required for GTR to prevent soft tissue in-growth.

Emdogain: A Magical Periodontal Regeneration Agent or an Overrated Solution?

Daehyun Kwon

In recent veterinary dentistry, the concept of "saving natural teeth" has gained increasing attention. A 2025 study reported that periodontal disease is the primary cause of tooth extraction (82.05%) in small- to medium-sized dogs in Korea. Periodontal disease progresses from gingivitis, which is reversible, to periodontitis, which is irreversible and characterized by the destruction of normal periodontal structures. The concept of "saving natural teeth" includes guided tissue regeneration (GTR), a surgical approach that aims to restore these damaged tissues to a normal or near-normal state. Recently, Emdogain has been introduced as a biomaterial capable of simplifying conventional GTR procedures-traditionally involving bone grafts and barrier membranes-while potentially maximizing periodontal regeneration. This lecture will provide an in-depth analysis of Emdogain's concept, application techniques, limitations, and anticipated clinical outcomes. Emdogain is a porcine enamel matrix derivative extracted from developing premolars and molars of pigs less than six months old, with amelogenin comprising approximately 90% of its composition. Amelogenin exhibits high morphological conservation across mammalian evolution and can promote the formation of periodontal ligament, cementum, and alveolar bone through mechanisms similar to those involved in root development. Clinical application involves thorough root planing to debride the root surface, conditioning with 24% EDTA (PrefGel) to remove the smear layer, and applying Emdogain to the dried root surface.However, Emdogain is not universally effective for all periodontal defects. Cases where favorable outcomes are unlikely include: (1) teeth with significant mobility, (2) periodontal pockets involving furcation exposure, and (3) sites with horizontal bone loss. Furthermore, Emdogain application must be performed with surgical access; its use following simple closed root planing is not recommended. Human studies on Emdogain report varying conclusions, but consistently highlight its ability to accelerate early wound healing, stimulate gingival fibroblast proliferation, and promote partial regeneration of keratinized gingiva. Nonetheless, the sole use of Emdogain in periodontal pockets with extensive defects remains controversial, and its limitations are evident.

This lecture will review the biological mechanisms of Emdogain, detail its surgical application protocol, and discuss clinical case selection criteria. By understanding its mode of action and boundaries, veterinary practitioners can develop case-specific strategies for successful periodontal regeneration.

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The Changing Face of Training: The Role of the Non-Cadaveric Model

Kirsten Hailstone

Teaching surgical skills has long been a part of the veterinary training space. There is no illusion as to the benefit of repetitive deliberate practice, with feedback, in improving technical skill sets Non-cadaveric surgical training has many methods and already uses virtual reality, 3D printing, plastic models, and advanced simulations to teach surgical skills. 3D printing has less limitations than the use of cadavers. Beyond the ethical considerations there are many benefits to adopting the use of truly anatomical 3D printed modelling. As degrees around the world become internationally recognised it continues to stand out that the day 1 competency in dentistry remains well below the standard of public expectation across the world. According to the AVMA in 2024 in the USA 59.8 million households owned a dog and 42.2 million households owned a cat. According to FEDIAF in Europe in 2025 108 million cats were owned and 89.6million dogs. In Australia the statistics per household are slightly above those in the USA with 5.1million owned dogs and over 5 million pet cats.

Current statistics show the approximate incidence of periodontal disease in dogs to be 85% of dogs over 2 years of age and 75% of cats over 3 years of age. This without doubt makes periodontal disease the most ubiquitous disease of dogs and cats. Post graduate training in this area is on an exponential growth track because of the deficiencies in the day one competencies around the world. This has been limited by physical access and expert tutor numbers.
The way forward must be to increase the access to standardised training. Given the current numbers of AVDC and EVDC diplomats there are approximately 456 thousand pet owning households being serviced per diplomat across USA, Europe, Australia and New Zealand.
There is no doubt that this is a busy training space and it's only going to get busier.

3D-Printed Models
Anatomically correct customizable and realistic models of specific anatomy will enable ground up training in areas where day one competencies are poor. The benefits are lengthy.

Benefits of Non-Cadaveric Training
- Patient Safety
- Accessibility and Cost-Effectiveness
- Standardized and Objective Feedback:
- Repetitive Practice
- Reduced Demands on Supervision increasing accessibility
- Fidelity and Realism

Use of Augmented Reality and Virtual Reality in Veterinary Dental Radiology

Mirko Radice

The purpose of this work was to develop a system that enables the acquisition of skills in the use of intraoral radiographic systems and methodologies through virtual reality (VR) and augmented reality (AR). Learning dental radiology techniques requires a multidisciplinary approach combining a solid theoretical foundation, practical skills, and technological sensitivity. To overcome these challenges, it is essential to integrate innovative teaching tools such as virtual and augmented reality simulations. The integration of AR and VR in dental radiology represents one of the most promising technological innovations of recent years, with a significant impact on diagnosis, planning, treatment, and education. VR creates immersive three-dimensional environments, ideal for detailed analysis of complex radiological data and simulation of radiographic techniques.

It is widely used in dental education, offering realistic models for learning surgical techniques and improving understanding of anatomical and pathological structures. VR headsets and specific software allow clinicians to explore diagnostic images in 3D space, enhancing personalized treatment planning and fostering interdisciplinary collaboration.

Despite numerous advantages, large-scale adoption of AR and VR in dental radiology is still limited by challenges such as high equipment costs, the need for advanced staff training, and integration into existing clinical and diagnostic workflows. Further technological advancements and greater economic accessibility could overcome these barriers, making AR and VR indispensable tools for improving the quality of dental care. With this objective, we developed a system based on VR and AR that allows simulation of intraoral radiographic imaging.

Students can perform radiographs by wearing specific headsets, enabling them to virtually position radiographic plates inside the patient's oral cavity and place the X-ray device accordingly. The resulting virtual radiograph can then be compared with standardized images obtained at precise angles, allowing immediate feedback on whether the positioning was correct or errors occurred. In a recently published study, the average time required for students to feel comfortable with this technology was 60 minutes, demonstrating its ease of use and rapid learning curve. The virtually unlimited repeatability of the process, without radiation exposure, accelerates and enhances the acquisition of the skills required to produce high-quality images in a shorter time. As shown in Shanahan's study 95% of students identified repeatability as the main advantage of simulation, allowing them to practice until fully satisfied with the results. Up to now, practical labs represented the only way to learn radiographic techniques, with high costs, the use of cadavers, and significant radiation safety issues. All these problems have been completely overcome by this methodology.

Financial Impact of Providing New Veterinary Graduates with Veterinary Dental Education

Jessica Johnson *DVM, DAVDC.*
Veterinary Dental Educator for Mission Pet Health

It is generally agreed that by graduation, new veterinarians should have acquired the needed knowledge and skills to meet both client demands and professional expectations. However, studies have shown that dental education is lacking in veterinary colleges. A 2017 article surveyed North American veterinary schools, achieving an 86% response rate. Among those schools, more than 50% of the colleges provided less than 5 hours of veterinary dental education.
In 2025, the American veterinary corporation Southern Veterinary Partners (SVP) launched a program for new graduates, titled Dental Fundamentals, which is offered to new graduates in their first two years of practice. A Diplomate of the AVDC designed this course. This is a 2-day wet lab offering 15 RACE-approved hours of CE that teaches equipment and instruments, how to create a flap, extraction techniques, a brief discussion on dental radiographs, and local blocks in canine cadavers. The goal is to fill the gap in veterinary dental education as the new graduates enter clinical practice. SVP wanted to determine if the return on investment was financially beneficial to the company; therefore, the company employed a data analyst to review multiple data points. Currently, the company has a robust dataset on the production of new graduates in their first few years of practice. Accounting for several variables, that data is being compared to the new graduates who have participated in a 2-day wet lab. Additionally, the data for each attendee, both before and after the lab, is being evaluated.

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Dental Fundamentals is a new course, launched in 2025. Before this course, SVP had developed a CE course called Dental Principles. This is a 21-hour RACE-approved CE course on veterinary dentistry offered to veterinarians at any part of their career. We learned that participating in this course increased dental production by ~$6,000 per veterinarian. We also learned that there were predictable trends in production following the course that warrant further investigation. Through discussion with the participating veterinarians, we have also identified common roadblocks, outside of education, that limit further growth and likely production as well. In 2025, Southern Veterinary Partners merged with Mission Veterinary Partners to become Mission Pet Health. The leadership of this new company remains committed to veterinary dental education. By 2026, we should have robust data on the financial impact of providing 2 days of veterinary dental education to new graduates. This presentation will present the data collected so far.

Surgical margin determination for oral tumors and management of the lymph node for oral tumors

Stephanie Goldschmidt

The presentation will focus on determining appropriate surgical margins in the treatment of oral tumors, highlighting their critical role in achieving optimal oncologic outcomes, ensuring adequate local disease control, and minimizing the risk of recurrence. In addition, it will address the evaluation and management of cervical lymph nodes in patients with oral tumors, with particular emphasis on accurate assessment of nodal involvement and the selection of the most appropriate therapeutic approach to improve prognosis and overall treatment success.

Advantages of piezoelectric instrumentation and (targeted) neoadjuvant therapies

Santiago Peralta

The presentation will focus on the advantages of piezoelectric instrumentation in oral and maxillofacial surgery, emphasizing its precision, selective cutting properties, reduced trauma to surrounding soft tissues, and potential benefits in promoting improved healing and postoperative outcomes. It will also focus on the role of (targeted) neoadjuvant therapies in the management of oral tumors, highlighting their potential to reduce tumor burden prior to surgery, improve resectability, and contribute to more favorable oncologic and functional results.

A modified full-thickness labial/buccal rotational flap reconstruction technique following bilateral rostral maxillectomy and nasal planectomy for resection of maxillary tumors: Technique and results in three dogs

José C. Almansa Ruiz

Objective
To describe a naso-facial reconstruction technique following bilateral rostral maxillectomy and its functional and cosmetic outcomes.

Animals
Three dogs

Study design
Clinical case series.

Methods
Three dogs were presented with a right rostral maxillary mass. Preoperative biopsy and staging revealed a biologically high-grade and histologically low-grade fibrosarcoma (Hi-Lo FSA) in two dogs and a papillary squamous cell carcinoma in one dog. A combined nasal planectomy and radical bilateral rostral maxillectomy was performed, sparing the labial/buccal mucocutaneous flaps bilaterally. Surgery resulted in asymmetry of the width of the flaps; the narrower flap was rotated medially to reconstruct the lip and create an oral vestibule. The wider flap was rotated medially to cover the remaining dorsolateral opening of the nasal conchae. The flaps overlapped in a parallel manner, discretely concealing the nasal passages and separating them from the oral cavity. Haemorrhage occurred in all dogs, with one dog requiring a blood transfusion postoperatively.

Results
Oral Hi-Lo FSA with tumour-free margins was confirmed in two dogs, and a papillary squamous cell carcinoma with tumour-free margins in the last dog. All dogs recovered uneventfully within 4 weeks. Owners reported being very satisfied with the functional (return to normal exercise/activities and uncompromised respiration) and cosmetic outcomes. Based on the owners' telephone follow-up, no tumour recurrence was noted at 36 (Dog 1), 24 (Dog 2), and 6 (Dog 3) months postoperatively.

Conclusion
The full-thickness bilateral labial/buccal rotational flaps were used successfully to reconstruct the rostral maxilla, external nose and facial defects involving the nasal cavity. The technique resulted in acceptable functional and cosmetic outcomes and can be considered for naso-facial reconstruction in selected cases.

Orbitozygomaticomaxillary Excision With Exenteration In A 4 Month Old Dog To Treat Pscc With Two Year Follow Up

Michael Balke, *DVM, DAVDC, F-OMFS*

This lecture will be a case discussion of a young dog with a diagnosis of papillary squamous cell carcinoma on the left caudal maxilla. The process of the surgical planning and treatment will be discussed in detail. Post operative recovery and two year follow up including computed tomographic evaluation will also be presented.

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Panel Discussion: Advancing Oral and Maxillofacial Oncologic Surgery

Stephanie Goldschmidt, Santiago Peralta, Mihai Guzu, Annabel McFadzean

The session will be structured as an **interactive expert discussion**, focused on exchanging professional opinions, clinical experiences, and contemporary approaches in advancing oral and maxillofacial oncologic surgery. The panel will bring together specialists in oral and maxillofacial surgery, head and neck oncology, reconstructive surgery, and related disciplines to provide diverse perspectives on current challenges and future directions in the field. The discussion will emphasize critical evaluation of current standards, sharing of clinical insights, and collaborative dialogue aimed at shaping future strategies in oral and maxillofacial oncologic care. Special attention will be given to inter-institutional collaboration, research opportunities, and the integration of innovation into clinical practice.

Single-Access Endodontic Treatment of the Maxillary Carnassial Tooth in Dogs: A Conservative Technique Based on Clinical Experience and Modern Materials

Philippe Roux, *Dr DVM, Dipl EVDC*

Introduction

The maxillary fourth premolar (P4), commonly referred to as the carnassial tooth, is recognized as the most frequently fractured tooth in dogs. Dental fractures are relatively common in the canine population, with prevalence estimates ranging from 20–27% depending on the cohort studied[1,2]. Among fractured teeth, the maxillary P4 is consistently reported as the most affected, often accounting for nearly one third of cases[3]. Its strategic role in mastication, combined with the high occlusal forces it bears, makes this tooth particularly vulnerable to traumatic injury and subsequent complications. A major concern in veterinary dentistry is the delayed detection of such fractures. Uncomplicated crown fractures (UCFs), in which the pulp is not obviously exposed, can remain unnoticed for extended periods. Without timely intervention, these lesions may progress to pulpal necrosis, pulpitis, or secondary endodontic infection, ultimately resulting in periapical pathology. Goodman *et al.*. reported that 24.3% of maxillary P4 UCFs already had radiographically detectable endodontic lesions at diagnosis[4]. Traditionally, the presence of periapical abscesses or osteolysis has been considered an indication for extraction. However, recent studies suggest that conservative endodontic therapy may remain a viable alternative even in such cases. Kwon *et al.*. demonstrated that although preoperative periapical lesions reduced the probability of complete radiographic healing, only 4.16% of teeth with periapical lucencies were ultimately classified as failures after endodontic therapy, highlighting the potential for tooth preservation in selected cases[5].

When radiographic evidence of periapical disease is absent, endodontic therapy represents the most appropriate treatment option, preserving the tooth while maintaining function and structural integrity. Retention of the P4 preserves occlusal function, maintains the scissor-like carnassial mechanism, and prevents the anatomical and biomechanical changes associated with tooth loss. Current guidelines, including the WSAVA Global Dental Guidelines, emphasize the importance of thorough clinical and radiographic evaluation to distinguish between teeth requiring extraction and those suitable for endodontic management[6]. Despite these advantages, endodontic treatment of the maxillary P4 remains technically demanding. The tooth's complex anatomy, including three roots-mesiobuccal, distobuccal, and palatal-presents challenges for canal location, debridement, and obturation.

Anatomy and Morphological Considerations of the Maxillary Fourth Premolar

The maxillary fourth premolar is a large, three-rooted tooth located immediately caudal to the third premolar and rostral to the first molar. Its elongated, robust crown reflects its primary shearing function. The occlusal surface exhibits a prominent **paracone cusp**, the principal shearing cusp, accompanied by smaller **metacone** and **protocone** cusps. Together, these create a scissor-like occlusion with the mandibular first molar, enabling the carnassial function[10].

The root system consists of three distinct roots: mesiobuccal, distobuccal, and palatal. The distal root is typically the broadest, contributing significantly to the tooth's resistance to occlusal forces. The palatal root is often the longest when measured from the cemento-enamel junction to the anatomical apex, though this varies with methodology. The mesiobuccal root is smaller, but all three roots combined provide strong alveolar anchorage[11,12]. Each root contains a canal, and micro-CT studies have demonstrated pronounced curvatures, especially in the mesiopalatal canal, where coronal angulations may exceed 150°, complicating instrumentation[10]. Access to the palatal canal is further limited by the tooth's deep maxillary position and surrounding soft tissues[10]). Morphology is also influenced by breed, size, and age. Larger dogs often have proportionally broader roots and pulp chambers, while smaller breeds have narrower, more tapered canals[10,11]. Age-related deposition of secondary dentin progressively narrows the pulp chamber, increasing the technical difficulty of instrumentation. In geriatric patients, calcification may obscure canal entrances radiographically[13].

Radiographically, the P4's three roots are generally visible, though superimposition can obscure structures. Careful selection of oblique views is required for accurate interpretation, particularly when assessing periapical pathology, resorption, or root fractures[14]. Certain zones of fragility are consistently observed. The paracone cusp is the largest and most functionally prominent buccal cusp, and because of its size and role in shearing, it is frequently involved in crown fractures. When fractured, the natural fault line often extends toward the pulp chamber, increasing the risk of pulpal exposure or infection. Unfortunately, this pathological opening is not aligned with any of the three root canals, requiring additional preparation to fully access all canals.

Traditional Approaches and Their Limitations

Historically, veterinary endodontic treatment of the maxillary P4 has adapted techniques from human dentistry. The tooth's three roots, sharp canal curvatures, and narrow diameters, however, limit the effectiveness of conventional methods.

Multi-access approaches

Clinicians have traditionally created multiple coronal access points to reach the mesiobuccal, distobuccal, and palatal canals. Separate vestibular and palatal openings are often needed, particularly when the palatal canal is obscured or at an unfavorable angle. While this improves visualization, it comes at the cost of considerable enamel and dentin removal. The resulting weakening of the crown increases susceptibility to post-treatment fractures of both crown and root[7].

Coronal enlargement and structural weakening

Coronal enlargement facilitates straight-line access, a principle borrowed from human dentistry. In the maxillary P4, however, aggressive coronal shaping risks undermining the paracone cusp and thinning buccal root walls. Experimental studies confirm that large or multiple access preparations measurably reduce fracture resistance[7,8,9], an important consideration given the high functional loads on canine carnassial teeth.

Instrumentation challenges

Traditional stainless steel hand files are limited in addressing sharp curvatures, increasing the risk of ledging, canal transportation, or perforation. Achieving complete debridement of the apical third is difficult, particularly in ovoid canals[12].

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Radiographic limitations
Standard intraoral radiographs provide only 2D views, with overlapping buccal and palatal roots obscuring canal trajectories[14]. Missed canals are a recognized cause of endodontic failure. Advanced imaging, such as CBCT, improves 3D anatomical understanding but is not yet widely available in routine veterinary practice.

Clinical outcomes
Although traditional techniques can resolve infection and maintain function, structural weakening compromises long-term prognosis. Vertical root fractures, secondary crown fractures, and restorative failure are more likely after multiple or extensive access preparations. These complications highlight the tension between adequate access for thorough therapy and preservation of tooth structure.

Development of the Conservative Single-Access Technique
The single-access technique was developed to balance thorough canal debridement with preservation of crown and root structure.

Conceptual Basis
The cornerstone of this method is a single vestibular access aligned with the natural fracture line at the tip of the paracone cusp. This fracture line is refined into a functional access cavity, permitting negotiation of all three canals using flexible NiTi instruments. Secondary coronal perforations are avoided, preserving dentin that would otherwise be lost.

Access Design
The cavity is initiated on the paracone cusp using a small round diamond bur (ISO 10) to penetrate the pulp chamber. Refinement with a fine tapered diamond bur establishes a triangular outline aligned with the tooth's longitudinal axis, allowing straight-line access distally toward the distal root and mesially toward the two mesial roots. To improve visualization of the palatal canal, the mesial portion of the access is extended triangularly in the sagittal plane. Enlargement is limited to what is necessary for unobstructed instrumentation.

Instrumentation Strategy
Flexible NiTi rotary files are used to negotiate curved canals. Modern adaptive systems adjust cutting action to canal morphology, enhancing cleaning while minimizing dentin removal. Irrigation protocols with sodium hypochlorite and EDTA complement mechanical debridement.

Advantages
- **Minimized tissue removal:** Single-point access reduces coronal dentin loss.
- **Cusp preservation:** Natural fracture line integration spares sound tissue.
- **Improved fracture resistance:** Limited dentin removal preserves structural integrity.
- **Efficient canal management:** Flexible instruments navigate complex curvatures without multiple entries.
- **Practicality in compromised crowns:** Pre-existing fractures are utilized rather than enlarged.

Challenges
- Success depends on precise anatomical knowledge and skilled instrumentation.
- The palatal canal remains the most challenging to access.
- Clinicians must adapt to a smaller, precision-driven access approach.

Conclusion and Future Perspectives
Managing endodontic disease in the canine maxillary P4 is challenging due to its complex anatomy, high functional demands, and frequent fractures. Traditional multi-access techniques, while effective, compromise structural integrity.

The single-access conservative technique offers a practical alternative, leveraging natural fracture lines, flexible instrumentation, and modern irrigation to preserve tooth structure while achieving thorough canal therapy. Preservation of coronal and radicular integrity is critical for long-term function under physiologic loads. Prospective clinical studies comparing single- versus multi-access approaches are needed to quantify differences in fracture incidence, treatment outcomes, and restoration survival. Advanced imaging (CBCT, micro-CT) and evolving instrumentation will likely expand the feasibility of conservative strategies. Adoption within the veterinary dental community will require training programs emphasizing magnification, modern irrigation, and precision instrumentation. In conclusion, single-access endodontics for the canine maxillary P4 represents a significant advancement, balancing biological objectives with biomechanical preservation to extend the functional lifespan of one of the most critical teeth in the canine mouth.

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CBCT Evaluation of an Ultrasonic-Assisted Root Canal Protocol in Canine Teeth: A 57-Case Series (2012–2024)

Nicolas Girard DV, *DipEVDC*

Introduction

Root canal therapy (RCT) has become a standard and conservative alternative to extraction in dogs, allowing preservation of strategic teeth. The success of RCT depends on effective canal disinfection and a dense, three-dimensional obturation. In human dentistry, ultrasonic activation has been shown to improve irrigant penetration and obturation homogeneity, but this technique has not previously been evaluated in veterinary patients.

Objectives

This study aimed to describe and assess the outcome of a standardized endodontic protocol that combines passive ultrasonic irrigation (PUI) with ultrasonic-assisted thermoplasticised obturation in canine teeth, using cone-beam computed tomography (CBCT) for postoperative evaluation. To our knowledge, this is the first veterinary study to incorporate ultrasonic activation into both cleaning and obturation phases of endodontic treatment.

Materials and Methods

Medical records and CBCT scans from 47 dogs (53 canine teeth) treated at AzurVet (2012–2024) were reviewed. All teeth had complicated crown fractures diagnosed as irreversible pulpitis or pulp necrosis. Root canal preparation followed standard veterinary endodontic guidelines. Irrigation was performed with 3% NaOCl activated ultrasonically in three 10-second cycles, followed by 17% EDTA. Obturation used ultrasonic spreaders and pluggers for lateral and vertical thermocompaction of gutta-percha cones coated with zinc oxide eugenol sealer. Outcomes were classified on follow-up CBCT (3–24 months) as success, NEF, or failure according to ESE criteria.

Results

Overall, 87% of treated teeth were classified as successful, 4% NEF, and 9 % as failures. When pulp status was considered, all irreversible pulpitis cases healed completely (100%), while necrotic pulpitis cases achieved 75% success, 6% NEF and 16% Failure. The use of ultrasonic irrigation appeared to improve cleaning of the apical delta, while ultrasonic obturation produced a denser and more homogeneous fill compared to conventional cold lateral condensation. The technique was well tolerated, and no adverse heat effects were recorded.

Conclusion

Ultrasonic-assisted root canal therapy combining PUI and thermoplasticised ultrasonic obturation provided predictable clinical and radiographic success, particularly in early pulpitis cases. This protocol enhances canal debridement and sealing quality in long, narrow canine roots and may shorten operator time. To our knowledge, this is the first report describing ultrasonic cleaning and obturation as an integrated approach in veterinary endodontics. Further prospective studies are warranted to confirm long-term benefits and to refine clinical application in complex endodontic cases.

Apicoectomy indications and procedure

Brian Hewitt, *DVM, DAVDC*

There are multiple treatment options for difficult to treat endodontically compromised teeth or for teeth with failed endodontic treatment. Apicoectomy (surgical root canal) is an effective treatment in these cases. The appropriate treatment for some failed endodontic procedures is retreatment. Treatment options for a tooth with a diseased apex may include treatment with MTA, extraction, or apicoectomy. Some compromised teeth with no apical disease may require close monitoring only. Factors in the decision making process include the radiographic appearance of the tooth, health of the apex, and previous treatments. When apicoectomy is the chosen treatment, the procedure requires specific equipment due to the small area of access to the apex. MTA or other bioceramic materials are the preferred apical fill products. Performing a successful apicoectomy procedure requires accurate location of the apex, removal of an adequate amount of the apex, appropriate cleaning, adequate apical fill, and appropriate closure. Case presentations will be provided.

Dentin Bonding- It is not for every one!

Alice Sievers

Dentin bonding is the commonly used term for the application of unfilled or partially-filled restorative materials to exposed dentin and enamel surfaces to seal or close damaged or exposed enamel and dentin tissue. The use of adhesives has many applications in veterinary dentistry, both as part of composite resin application and as a "stand-alone" therapeutic option. In this presentation we will be focusing on the use of resin adhesives used to treat uncomplicated crown fracture or acutely exposed dentin tissue. To understand when to use dentin sealants, it is also important to understand when not to use them. This requires a discussion of anatomy and the dentin-pulp complex as well as a discussion of product choices.
The term bonded sealant is used loosely in dentistry and can be confusing if taken literally. Hours can be spent on the discussion of the various types of products available to use for this purpose. These products are micromechanically interlocked into the dentin and enamel with resin tags that interlock into the prepared demineralized dentin collagen fibril mesh, creating a dentin-resin hybrid layer. They can be used alone to seal the tooth surface or to bond or adhere composite resins or other materials to the tooth. The typical products used can be resins, glass ionomers, or pit and fissure sealants. They can be unfilled or filled.

Products used as bonded sealants need to be chosen based on multiple factors and I would posit that one size fits all may not be applicable in our veterinary patients. Many of our products are designed for human usage, occlusal forces, and oral environment. Our veterinary patients (primarily dogs) have a different oral environment, different occlusal forces, dietary substrates, more densely packed and ovoid dentin tubules, and thinner enamel.
There is no consensus on when to apply a dentin adhesive to "seal" uncomplicated crown fractures and enamel fractures. There are multiple factors that should be considered when making this decision and, in some areas, the research is limited or inconclusive for treatment of uncomplicated crown fractures and defects. As part of the dentin-pulp response to injury, the odontoblasts can create regenerative dentin or the mesenchymal cells in the pulp tissue can differentiate and replace lost odontoblasts to make reparative dentin. If sufficient barrier is created and reversible pulpitis is present, the tooth can survive if the source of irritation or trauma is removed. The preparation for and placement of a bonded sealant may disrupt or destroy the barriers put in place by the tooth.

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Intraoral imaging is required and should be considered in conjunction with a complete periodontal examination. If radiographic findings of endodontic disease or pulp exposure is present, the tooth is not an appropriate candidate for restorative treatment, endodontic therapy or extraction should be applied. If the tooth has advanced or terminal periodontal disease that is present and cannot be managed or addressed sufficiently, extraction should be applied.

A review of application and use principles will be included.

Prosthodontic Crowns for Canine Teeth: Why I Recommend Them and an Introduction to Feather Margin Preparation

Erin Ribka, Scott Alexander

***This is a brand new presentation that is in development and is as yet incomplete. It includes a review of indications for crown therapy in dogs (and cats), recommended materials, as well as presentation and discussion of the feather margin (or knife edge) techniques for tooth preparation. It references and builds on the information included in: Success of Feather Margin Preparation for Full Metal Prosthodontic Crowns in the Canine Teeth in 84 Pet and Working Dogs (2005–2017) J Vet Dent. 2022 Mar;39(1):34–40.*

Crown therapy has become a widely accepted treatment option for teeth in canine patients. Indications for prosthodontic crown therapy include teeth that have been worn through attrition or abrasion, or fractured, as well as the teeth of working dogs, or dogs with behavioral predispositions to excessive or potentially damaging use of their teeth (for example, habitual cage chewers, or highly reactive or anxious individuals). Working dogs, particularly those used in bite work, are frequent candidates for prosthodontic crown therapy. Affected teeth may or may not have been previously treated by root canal therapy.

Fractured teeth are frequently encountered issue in small animal practice. Little data is available on the prevalence of traumatic dentoalveolar injuries (TDI), (which includes luxation as well as other dental injuries), in dogs and cats. Reportedly, 26.2% of dogs and cats have at least one TDI, and crown fractures constitute four-fifths of all TDI in dogs and cats. In addition to tooth fracture, abrasive damage, behavioral characteristics, training and/or work-related causes may also be indications for prosthodontic crown treatment. A prosthodontic crown is a cemented extra-coronal restoration that covers the entire surface of the clinical crown. Crowns are indicated to protect and strengthen weakened teeth, and to restore function.

There are three types of margin commonly used in veterinary crown preparation: bevel, chamfer, and 90 degree (shoulder). In our practice, we aim to routinely use a 'feather' or 'knife edge' margin technique rather than the more commonly employed and widely accepted 'chamfer' margin for preparation of canine teeth in both dogs and cats. Personal preference (eg. bur choice) plays a significant role in crown preparation, but in general, a chamfer margin is created by first using a round diamond bur around the circumference of the tooth just above the gingival margin, cutting into the enamel to a depth of 0.5–1.0 mm. The primary characteristic of the chamfer margin is the rounded internal line angle created with the round diamond bur as described above. Shoulder margins, or 90 degree margins, are recommended for porcelain fused to metal (PFM) restorations, and may be created with a flat-end cylinder diamond bur. The axial portions of the tooth are then removed to the depth of the margin and shaped to create a smooth preparation, with no unsupported enamel nor undercuts.

Any margin angle other than 90 degrees is considered a bevel. The feather margin is a bevel margin of greater than 70 degrees. Anecdotally, feather preparations are faster and easier to perform, take impressions of, and finish, and because less tooth structure is removed in this preparation the remaining tooth is stronger and more resistant to fracture.

Crown preparation should remove as little enamel and/or dentin as is necessary, allowing space for a prosthodontic crown to fit without contacting other teeth, and eliminating enamel undercuts. Enamel in dogs is inconsistent, varying from 0.1–0.6 mm across a tooth, and the cervical bulge is an area of tooth thickening, not thicker enamel.

When performing feather margin crown preparations, it is not uncommon for the entire preparation to remain within the enamel layer, retaining even greater amounts of tooth structure than preparations extending into the dentin layer. In canine teeth, it is most vital to remove sufficient tooth structure for the prosthetic crown in occlusal areas (the mesial aspect of the maxillary canine teeth, and the mesial and distal aspects of the mandibular canines) to avoid contact between the metal crown and opposing canines and incisors. In non-occlusal areas of the canines, there is generally enough space to allow for minimal enamel removal, even though it may result in a metal crown slightly thicker or larger in these areas than the original, anatomic tooth. Without question, each patient must be thoroughly evaluated for bite, tooth spacing, and any preexisting malocclusion, and canine teeth prepared for prosthetic crowns that will comfortably accommodate an individual animal's anatomy. A study published in 2022 showed that feather preparation is as least as successful as the chamfer margin preparation most commonly taught and performed in veterinary prosthodontics.

Typical failures for prosthodontic crown procedures in veterinary patients include fracture apical to the crown, and bond failure, and occur in teeth prepared with chamfer and shoulder margins as well as feather or knife margins. Failure by wearing through a metal crown is extremely rare or unreported.

As veterinary dentistry matures and gains recognition in the pet-owning population, prosthodontic crown therapy will also continue to grow. Our ability to successfully apply proper planning and treatment must grow as well. Much work has been done in recent years to improve the quality and quantity of evidence-based research available on the subject.

The feather preparation is the most conservative of all margin preparation techniques, and may remain completely within enamel layers, without extending into dentin; it is therefore possible that significant surface area is retained. Additionally, by not exposing dentinal layers, it may be presumed that the prepared tooth is less sensitive, leading to less patient discomfort while awaiting crown manufacture and cementation.

SMALL ANIMAL DENTISTRY

A COMPARATIVE LENS INTO TMJ DISORDERS

SPEAKERS

Boaz Arzi
Dr. Boaz Arzi is a Professor and Chief of Dentistry and Oral surgery at UC Davis School of Veterinary Medicine. Dr. Arzi completed the residency-training program in Dentistry and Oral surgery at the School of Veterinary Medicine, UC Davis and two years fellowship in the Department of Biomedical Engineering at UC Davis. He is a Diplomate of the AVDC and the EVDC. Dr. Arzi is also a Founding Fellow of the AVDC in OMFS. Dr. Arzi's clinical and research focus is on oral maxillofacial reconstruction and regenerative solutions in dogs and cats.he is an affiliate member of ASTMJS.

Eric Granquist
Associate Professor of Clinical Oral and Maxillofacial Surgery / Pharmacology
University of Pennsylvania Center for Temporomandibular Joint Disorders

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Management of Temporomandibular Joint Fractures in Dogs and Cats

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Professor, University of California Davis, Davis CA
Eric Granquist

Fractures involving the temporomandibular joint (TMJ) require a detailed understanding of the joint's structure–function relationship to guide diagnosis and treatment. TMJ fractures may affect the condylar process and mandibular head and/or the mandibular fossa of the temporal bone. Among TMJ disorders, fractures represent the second most frequent condition in dogs and the most common TMJ disorder in cats. Recent evidence demonstrates that in immature dogs, rostral mandibular trauma is significantly associated with fractures involving the articular surface of the TMJ. The degree of fracture displacement is influenced not only by the magnitude and direction of traumatic forces, but also by the surrounding soft tissues and regional anatomy.
Management of TMJ fractures is complex and must consider multiple patient- and injury-specific factors, including age, dentition status, degree of fracture displacement, involvement of the articular surface, concurrent maxillofacial injuries, and occlusion.
Advanced diagnostic imaging plays a central role in treatment planning and surgical decision-making. Computed tomography (CT) and cone beam CT (CBCT) are the preferred modalities for accurate identification of TMJ anatomy, fracture morphology, and spatial relationships. Conventional CT is recommended in cases with suspected neurologic involvement, whereas CBCT is appropriate when neurologic and extensive soft tissue injuries are not present.
A descriptive classification system based on anatomical topography of the condylar process-including the condylar base, neck, and head-assists in standardizing diagnosis and guiding therapy. An adapted version of the AO craniomaxillofacial (CMF) classification system has been modified for use in dogs and cats. Condylar process fractures are defined as fractures extending caudal to the mandibular notch, whereas mandibular head fractures directly involve the articular surface. Fracture complexity is categorized by the degree of fragmentation (none, minor, or major), and displacement is graded according to vertical apposition of fracture segments (complete, partial, or absent contact). In cases with multiple fractures, classification is assigned based on the most severe lesion.
Treatment strategies for TMJ fractures are broadly categorized into closed (conservative or minimally invasive) and open (surgical) approaches. Closed treatment is the most commonly employed strategy and is adequate in the majority of cases.
Conservative management does not involve opening the joint and may include muzzle therapy or rigid or elastic maxillomandibular fixation. Elastic therapy is often preferred, as it may reduce the risk of fibrosis or ankylosis, preserve joint homeostasis, and facilitate vascular supply to the healing tissues. In immature patients, the TMJ demonstrates substantial regenerative capacity, with bone healing typically occurring within two to three weeks. Active physical therapy should be gradually introduced after an initial healing period.
Open reduction and internal fixation (ORIF) of TMJ fractures remains uncommon in veterinary medicine due to the complex anatomy and small size of the involved structures. However, open treatment is indicated in cases of severely displaced fractures that impair mandibular opening or closure, fractures involving the mandibular fossa, displacement of the condylar process into the auditory canal or other critical structures, or severely fragmented injuries with a high risk for ankylosis or functional limitation.
In all cases, management of TMJ fractures should be planned within the broader context of concurrent maxillofacial trauma, with treatment goals focused on rapid return to function, restoration of pre-traumatic occlusion, preservation of range of motion, and maintenance of normal masticatory function.

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Diagnosis and management of TMJ arthritis in dogs

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Eric Granquist

Arthritides of the temporomandibular joint (TMJ) present significant diagnostic and therapeutic challenges. Degenerative joint disease (DJD) of the TMJ is generally classified as a low-inflammatory condition, whereas septic arthritis represents a high-inflammatory process; these entities exhibit distinct biological behavior, clinical presentation, and management requirements. Septic TMJ arthritis is typically associated with marked pain, periauricular swelling, erythema, and impaired mandibular opening, often necessitating urgent intervention. In contrast, degenerative TMJ disease is frequently subclinical, with clinical signs such as discomfort or mild-to-moderate pain occurring in approximately 25% of affected patients. Accurate diagnosis and treatment planning for TMJ arthritides require advanced diagnostic imaging, including computed tomography (CT), cone beam CT (CBCT), and/or magnetic resonance imaging (MRI). This lecture will review the current diagnostic and therapeutic approaches to TMJ arthritides in dogs and cats and introduce emerging technologies, including TMJ arthroscopy and positron emission tomography/computed tomography (PET/CT).

Degenerative TMJ Disease (TMJ Osteoarthritis)
A definitive diagnosis of TMJ osteoarthritis (TMJ-OA) requires correlation of clinical findings with CT-based imaging. Although TMJ-OA is the most common TMJ disorder, it frequently coexists with other TMJ pathologies. Once isolated TMJ-OA is diagnosed, treatment is directed toward pain control and restoration of joint function. Medical management typically includes non-steroidal anti-inflammatory drugs administered for 2–4 weeks, with or without adjunctive opioid analgesia. Temporary "jaw rest" is recommended during this period by avoiding activities associated with excessive mandibular loading. Controlled physical therapy, consisting of guided mandibular opening and closing exercises, is encouraged to maintain joint mobility and prevent stiffness. Dietary modification to soft food is recommended for the initial days, followed by a gradual return to normal mastication. Surgical intervention, such as condylectomy, is reserved for severe, refractory cases characterized by uncontrolled pain or established ankylosis.

Septic Arthritis of the TMJ
Septic arthritis of the TMJ may develop through hematogenous dissemination or by direct extension of infection into the joint. Unlike TMJ-OA, septic TMJ arthritis is a high-inflammatory condition with rapid progression and significant clinical consequences. Disease development depends on pathogen-related factors (bacterial, fungal, or parasitic virulence) as well as host-related immune responses. Clinically, affected dogs commonly exhibit moderate-to-severe periauricular pain, pain on mandibular motion, regional swelling, erythema, and, in some cases, purulent discharge.

Diagnostic Imaging
While physical examination may raise suspicion for septic TMJ arthritis, advanced imaging is required to establish a diagnosis, guide treatment decisions, and aid prognostication. Contrast-enhanced CT is most commonly employed; CBCT may be used in selected cases, and MRI is indicated when soft-tissue or intracapsular pathology is suspected. Conventional skull or dental radiographs are insufficient for assessment of TMJ arthritides.

Cytology and Histopathology

Whenever feasible, arthrocentesis or exploratory arthrotomy should be performed to obtain samples for cytology, histopathology, and culture with antimicrobial sensitivity testing. Initiation of targeted antimicrobial therapy based on culture results is strongly associated with improved clinical outcomes.

Surgical Management

Surgical exploration is performed via a lateral approach to access both the dorsal and ventral compartments of the TMJ. Following identification of the joint capsule, a horizontal capsulotomy is performed to expose the joint. The articular disc is carefully mobilized from its dorsal and ventral attachments, permitting inspection of both compartments. Foreign material, if present, is removed, and representative tissue samples are collected prior to initiation of systemic antimicrobial therapy. Each compartment is then lavaged with sterile isotonic saline via indwelling catheters before routine three-layer closure of the surgical site.

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Advanced diagnostic Imaging of the TMJ in dogs and cats

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Introduction

Disorders of the temporomandibular joint (TMJ) in dogs are under-recognized and often misdiagnosed due to complex anatomy, variable clinical presentation, and limitations of conventional imaging. TMJ pathology may involve osseous, cartilaginous, synovial, and periarticular soft-tissue structures, frequently in combination. Accurate diagnosis is essential, as treatment decisions and prognosis differ substantially between degenerative, inflammatory, infectious, traumatic, and proliferative TMJ conditions. Computed tomography (CT) and cone beam CT (CBCT) have become the imaging modalities of choice for evaluation of the oromaxillofacial region in dogs and cats, providing high-resolution assessment of osseous structures.

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However, CT is inherently limited to structural imaging and offers little insight into metabolic activity, synovial inflammation, or early cartilage disease. Magnetic resonance imaging (MRI) is superior for soft-tissue and intra-articular evaluation but remains limited in availability and spatial resolution for small joint imaging in veterinary patients. Recent advances in functional imaging, specifically positron emission tomography (PET) combined with CT, as well as minimally invasive TMJ arthroscopy, offer new opportunities for earlier detection, refined characterization, and improved understanding of TMJ disease.

Computed Tomography and Cone Beam CT
CT and CBCT remain the cornerstone of TMJ imaging in dogs. These modalities provide excellent visualization of the mandibular head, condylar process, mandibular fossa, and surrounding osseous structures. CT is particularly valuable for identifying fractures, osteoarthritis, ankylosis, and osseous remodeling. However, CT findings often lag behind clinical disease, particularly in early inflammatory or degenerative conditions, and do not reliably reflect disease activity.

Magnetic Resonance Imaging
MRI allows assessment of soft tissue structures, including the articular disc, synovium, joint effusion, and periarticular muscles. MRI is especially useful in cases of suspected internal derangement (in people), septic arthritis, or myopathic pain syndromes. Despite its advantages, MRI is not routinely available in many veterinary settings and may be limited by motion artifacts and spatial resolution when evaluating small TMJ structures.

TMJ Arthroscopy
TMJ arthroscopy, as developed and described in veterinary patients, provides direct visualization of the synovial cavity, articular cartilage, disc attachments, and inflammatory changes not detectable on imaging alone. Arthroscopy allows for real-time assessment of synovitis, cartilage fibrillation, intra-articular adhesions, and early degenerative disease. In addition to its diagnostic value, TMJ arthroscopy permits targeted interventions such as lavage, synovial biopsy, adhesiolysis, and guided therapeutic injections. Arthroscopy has been shown to enhance diagnostic accuracy, refine prognostication, and guide decision-making in complex TMJ disorders, particularly when imaging findings are equivocal or discordant with clinical signs.

Dual-Tracer PET-CT in Oromaxillofacial and TMJ Disease
Positron emission tomography is most used in veterinary medicine for oncologic staging; however, PET imaging is not specific for neoplasia and can identify areas of increased metabolic and osteoblastic activity associated with inflammation and infection. Combining PET with CT enables precise anatomical localization of metabolically active disease.

Clinical Implications and Future Directions
Advanced imaging and arthroscopy are reshaping the diagnostic paradigm for TMJ disorders in dogs. Integration of CT, MRI, TMJ arthroscopy, and functional imaging such as PET-CT allows for comprehensive structural and metabolic assessment of the joint and surrounding tissues. These modalities facilitate earlier diagnosis, improved disease characterization, and more targeted therapeutic strategies. Future work will focus on refining imaging protocols, validating outcome-based indications for PET-CT, and expanding the clinical application of TMJ arthroscopy. Collectively, these technologies advance the standard of care for veterinary patients with TMJ disease and strengthen translational parallels with human TMJ diagnostics.

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Towards alloplastic temporomandibular joint replacement in dogs and cats

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Trauma and ankylosis of the temporomandibular joint (TMJ) in dogs and cats can result in progressive and debilitating limitation of mandibular motion. Affected patients may lose the ability to open the mouth sufficiently for drinking, food prehension, grooming, thermoregulation, and vocalization, leading to severe reductions in quality of life.
Traditional salvage procedures, such as TMJ gap arthroplasty, aim to remove ankylotic tissue and restore mandibular opening; however, these techniques may be complicated by progressive mandibular drift and recurrence of ankylosis.
In human medicine, alloplastic temporomandibular joint replacement (TMJR) has become the standard of care for end-stage TMJ disease and ankylosis, significantly improving function, nutrition, speech, and social interaction. Building on these principles, our group developed the first species-specific alloplastic TMJ replacement system for dogs and cats. The prosthesis is designed to restore mandibular stability, permit physiologic range of motion, and enable functional recovery.

This presentation reviews current data and ongoing research validating the biomechanical and kinematic performance of TMJR components under ex vivo conditions that replicate clinically relevant loading scenarios. Additionally, the pathway toward clinical translation of veterinary TMJR is discussed.

Refefence
Arzi B, Weed M, Garcia TC, Goldschmidt SL, Marcellin-Little DJ. Kinematic performance of a novel temporomandibular joint replacement prosthesis under bite-force conditions in dogs and cats. Am J Vet Res. 2024;85(7).

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EXOTICS

SPEAKERS

Jamie A. Berning
Dr. Jamie Berning is a board-certified veterinary dentist under the AVDC and the owner of Veterinary Dentistry and Oral Surgery of Ohio. She is passionate about all aspects of dentistry and particularly enjoys endodontics, oral surgery, comparative dentistry, and diagnostic imaging using cone-beam CT. Dr. Berning enjoys teaching veterinarians, students, technicians, and staff. She is a consultant for multiple zoos and serves as the director of education and outreach for the Dental Coalition for Conservation.

Alexandra Biácsi
Dr. Alexandra Biácsi is a dedicated veterinarian with over 10 years of experience specializing in exotic, zoo, and wildlife medicine. She graduated in 2014 at the University of Veterinary Medicine Budapest, Hungary. She currently serves as the head veterinarian at Sosto Zoo in Nyíregyháza, Hungary, where she manages the zoo's veterinary operations, including preventive care, surgery, epidemic control, and veterinary team leadership. Dr. Biácsi has completed a Hungarian national specialisation in exotic animal medicine since 2018 and is currently a PhD student at the University of Veterinary Medicine Budapest, where her topic is Infectious diseases of exotic animals. She gained international experience, including at the University of Veterinary Medicine Vienna, and on the field in Vietnam, Thailand and Africa.

Edward Taylor Earley
Ed Earley started at Michigan State University for his undergraduate and veterinary medicine studies. He received a Dairy Science degree in 1983 and a Doctor of Veterinary Medicine degree in 1985. In 2014 he became a Diplomate with the American Veterinary Dental College for Equine and recently in 2022 he became a Diplomate with the American Veterinary Dental College for all species and small animal. Currently, he is an Associate Clinical Professor at Cornell University working in the department of large animal dentistry and oral surgery

Loic Legendre
After running a mobile referral practice in British Columbia for several years, Dr. Legendre now works at West Coast Veterinary Dental Services Ltd., a dental referral center where two other boarded dentists and two residents also work. He has published several articles in Canadian Vet Journal, J Vet Dentistry, Compendium of CE for the Veterinarian and chapters in veterinary books such as "Oral and Maxillofacial Surgery in Dogs and Cats", BSAVA manual, and Veterinary Clinics of North America, to name a few. He enjoys teaching both for universities and at conferences around the world.

Romain Pizzi
Dr Romain Pizzi is a Royal College of Veterinary Surgeons Recognised Specialist in Zoo & Wildlife Medicine, and the world's leading expert in wildlife surgery. He has travelled the globe pioneering many world-first operations in endangered wild animals. He has operated on everything from elephants to tarantulas, across the world from Ethiopia to Indonesia.

Olga Tretter
Dr. Olga Tretter graduated from the University of Veterinary Medicine, Budapest, in 2010. After several years of work in England, she returned to Hungary and began focusing on small animal dentistry. Since 2020, she has dedicated her practice exclusively to small animal dental procedures, oral, and maxillofacial surgeries. She is an alternative resident of the European Veterinary Dental College (EVDC). Dr. Tretter is deeply passionate about her clinical work, teaching, collaboration with colleagues, and advancing the field of small animal dentistry in Hungary.

SMALL ANIMAL DENTISTRY | EXOTICS

Challenges and Solutions for Harmonizing Dental and Anaesthesia Teamwork in the Zoo Setting: Our Experiences During a Series of Dental Procedures Performed on Large Felids

Olga Tretter[1], Alexandra Biácsi[2]
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[2] *Nyíregyházi Állatpark/ Sosto Zoo, Nyíregyháza, Hungary*

Dental disease in large captive felids presents significant clinical and logistical challenges, particularly within the zoo setting where dedicated dental facilities are rarely available. Over a three-year period (2022–2025), we collaborated as a dental and anaesthesia team to manage seven dental procedures in species including the White Tiger (Panthera tigris), Sumatran Tiger (Panthera tigris sumatrae), North Chinese Leopard (Panthera pardus japonensis), and Jaguar (Panthera onca). Due to the absence of a purpose-built dental theatre, procedures were performed in three different zoo locations, requiring the transportation of equipment and establishment of temporary dental workspaces. Preoperative planning relied on clinical reports, photographs, and radiographs provided by zoo staff, though definitive treatment plans often required substantial revision following intraoperative examination. Time pressure, restricted working space, and the inherent risks of anaesthesia in wild animals necessitated strict adherence to protocols ensuring safety and radiation protection. Success depended on meticulous preparation, efficient equipment setup, and-most critically-continuous, transparent communication between dental and anaesthesia teams. Coordination extended from preliminary planning through intraoperative management to post-procedure debriefing, with precise scheduling essential to balance anaesthetic duration and procedural requirements. Our experiences underscore that interdisciplinary collaboration is central to achieving optimal outcomes in zoological dentistry. By sharing expertise and fostering a framework of mutual learning, veterinary professionals can address the unique challenges of providing advanced dental care to large felids in the zoo setting. This presentation summarizes the challenges encountered and the experiences gained in organizing and performing complex dental procedures on large felids under zoo conditions.

Treating the weird, the wild, and the wonderful – an ethical minefield?

Romain Pizzi, *BVSc MSc PhD DZooMed DipECZM MACVS(Surg) FRES FRSB FRGS FRCVS*

The lecture explores a facet of the ethical considerations of provision of general treatment to wild and zoo animals exploring the ethhical differences between health care provision in domesticated and pet animals and in zoo and wild animals.

Apexification in a Mandibular Canine Tooth of a Hyena Following Failed Endodontic Therapy

Jamie Berning, *DVM, DAVDC*
Veterinary Dentistry & Oral Surgery of Ohio

Endodontic therapy in nondomestic species presents unique diagnostic and therapeutic challenges, particularly when prior unsuccessful treatment has compromised tooth and periapical health. This case report describes the management of a mandibular canine tooth in a spotted hyena (Crocuta crocuta) that had previously undergone unsuccessful endodontic therapy performed outside the reporting institution. Clinical examination and diagnostic imaging revealed an open apex with associated periapical lucency, consistent with persistent endodontic pathology. Apexification was elected as the treatment approach, utilizing mineral trioxide aggregate (MTA) to achieve an apical barrier and promote periapical healing.

The procedure was completed without complication, and follow-up evaluations demonstrated satisfactory clinical and radiographic outcomes, including resolution of the periapical lucency. This case highlights the applicability of MTA apexification techniques in nondomestic carnivores and underscores the value of appropriate endodontic retreatment strategies in preserving strategically important teeth.

Porcine Dentistry: Imaging and surgical management of the chronically infected tusk

Edward Earley, *DVM, Dipl. AVDC-Eq, Dipl. AVDC-NSS/SA.*

Introduction

Oral endoscopy, dental radiography and computed tomography are necessary imaging modalities for diagnosis, management and follow-up of a chronically infected tusk. Apicoectomy may be an option for surgical management of chronically infected tusk.

Dental imaging – oral endoscopy

The porcine oral examination is best accomplished with a hoist system and soft strap placed just behind the maxillary canines/tusks. Oral endoscopy gives excellent visualization of individual tooth structure and soft tissue attachment. The porcine molars have a double row of "rounded" cusps while the premolars have a "sharper" single row of cusps. The difference in the cusp anatomy suggests that the function of the porcine premolars is more for tearing/shredding of food material while the molars appear to have more of a grinding function. Premolars and molars may be affected by a chronic infected tusk due to extension of the disease into the mandible. Oral cutaneous fistulas may also develop due to severe chronic infection.

Dental imaging – radiographic technique

Maxillary arcade: Extra-oral radiographic technique of the maxillary premolars and molars is achieved by placing the screen/sensor next to the arcade to be imaged and placing the generator along the opposite side at ~45 degrees. Positioning for the left maxillary arcade is achieved by placing the sensor vertically along the left side and the generator on the right side at ~45 degrees (above horizontal). The mouth may be held open with a strap and hoist. The "opened mouth" will reduce the amount of dental arcade superimposition. Mandibular arcade: Extra-oral radiographic technique of the mandibular premolars and molars is achieved using a bisecting angle technique. The screen/sensor is placed along the ventral aspect of the mandible(s) and the generator is placed on the side to be imaged at ~60 degrees (above horizontal). Positioning for the left mandibular arcade is achieved by placing the sensor flat along the ventral aspect of the mandible and the generator is directed from the left side with a slightly steep angle of ~ 60 degrees. The mouth is may also be held in an open position with a small "rolled" towel to help minimize dental arcade overlap. Rostral maxillae and mandible(s): Intra-oral radiographic technique of the rostral maxilla and mandible(s). The screen/sensor is placed within the mouth facing up (maxilla) or down (mandible) and the generator is directed dorsal to ventral for the maxilla and ventral to dorsal for the mandible(s). For the best placement of the sensor, a corner of the screen is placed centrally into the oral cavity to allow more caudal placement between the commissures of the lips. This technique will allow intra-oral imaging of the incisors and canines/tusks.

Dental imaging – computed tomography

With radiographic superimposition of dental, sinus, maxilla and mandible anatomy; three-dimensional evaluation of the skull is often indicated for an accurate diagnosis of dental pathology. The clinical

crown of the mandibular tusk is present in the rostral mouth just behind the third incisor. The reserve crown courses through the mandible below the premolars and molars and then at the second or third molar the reserve crown diverges in a buccal direction to the radicular root. The radicular root is encapsulated with bone that is prominent just rostral to the masseter muscle. Using CT imaging, the anatomical features of the mandibular tusk will be discussed.

Surgical management – apicoectomy
If an apical infection of a tusk is isolated to the radicular aspect of the tooth, an apicoectomy may be considered. A case discussion will be presented showing an apical infection of the left mandibular tusk in a male castrate 10-year-old mixed breed pig. With CT imaging of the coronal reserve crown of the same tooth, there is good periodontal attachment. Additionally, there is no endodontic disease (or pulp horn) evident. In the same CT image, a supernumerary tusk on the right side is noted. The radicular root is developing along the medial aspect of the mandible. A surgical approach to the apical aspect of the mandibular tusk is a rostral curvilinear "C" flap. Once the flap is elevated, buccal bone is removed with a high-speed surgical drill to expose the apical aspect of the tusk. Heavy purulent discharge from the abscess is noted as the buccal bone is removed. The apical portion of the tusk is sectioned in a coronal direction until normal reserve crown and attachment are noted. No pulp horn is evident at the level of final resection of the reserve crown. A Penrose drain is placed, and the flap is closed in three layers; periosteum/deep submucosa, submucosa, subcuticular/skin.

Porcine Dentistry: Management of mandibular osteomyelitis secondary to tusk infection

Edward Earley, *DVM, Dipl. AVDC-Eq, Dipl. AVDC-NSS/SA*

Chronic osteomyelitis secondary to an infected tusk can be very destructive as it spreads through the mandible and surrounding soft tissue structures. The extension of the disease can lead to complete loss of mandibular structure and bone. The infection may cause severe periodontal disease of the overlying premolars and molars. The disease and bone loss may become so devastating that permanent oral cutaneous fistulas develop. The disease may also spread into the medial cortex of the mandible creating complete bone loss leaving only a fibrous capsule of the mandible with a draining cutaneous fistula. A combination of xenograft and platelet rich fibrin shows great potential for management of the destructive osteomyelitis commonly associated with a chronically infected tusk.

Bone graft/Xenograft
There are several types of xenograft material commercially available. Most sources use bone from cattle and process it so that it can be used in other species (including humans).

Platelet Rich Fibrin (Leukocyte Rich)
Platelet Rich Fibrin (PRF) can be produced as a liquid or solid form. The solid form is most commonly used in cases with osteomyelitis. There are two types of solid form that may be created based on centrifuge speed (rpm), force (g) and time (min). The original form (L PRF) is collected in glass blood tubes. The centrifuge is set at 708 g, 2700 rpm for 12 min. The current solid form used in human maxilla facial surgery is the A-PRF which is made by collecting blood in plastic tubes and setting the centrifuge at 1500 rpm, with a "g" force of 208 for 14 minutes. This form of PRF has the highest proportion of leukocytes which is helpful when placed in an infected environment. Recently an injectable or liquid version of PRF (I PRF) has been developed. It is created by setting the centrifuge at 60 g, 3300 rpm for 2 min. When the fibrin clot is compressed to remove the liquid, a membrane remains that can be used as a matrix barrier. This barrier slows invading epithelial cells and has a slow release of growth factors to enhance osteoblast activity.

Tusks Removal in a Two-Year-Old Walrus (Odobenus Rosmarus)

Loïc Legendre, *DVM, Diplomate AVDC, Diplomate EVDC, AVDC-ZWD*

Abstract

A young walrus was presented because of a chronic abscess involving the left maxillary canine tooth, also known as the left tusk. Oral exam showed that both tusks were severely worn. To control the infection and to prevent further ones from occurring, decision was made to extract both at the same time. Equipment was collected, an anesthesiologist was contacted and the surgery was set. Two techniques were planned but after trial and error, we ended up drilling the tusks out using the same approach used with elephants.

Introduction

A two-year-old male walrus, kept in an aquarium facility was diagnosed with a chronic facial swelling associated with apical infection of the left tusk. Oral exam revealed that both tusks were worn down close to the gums. Purulent material had been seen around the base of the left tusk. Plan was made to extract both tusks to fix the present condition and to prevent a repeat on the remaining tusk.

Planning

Because of the short clinical crown remaining, loosening the tusk using an electric hammer and an axle puller was impossible. The other possible techniques would be 1) luxation of the reserve crown by cutting the periodontal ligament with sharp chisels as far apically as possible and then rotating the tusk using a large wrench or 2) drilling the inside of the tusk with progressively enlarging drill bits until only thin walls of the tusk remain. These are then split with a chisel and the shards/segments are then removed with pliers. The apical area is curetted clean. The first technique was used for a few minutes until it became apparent that it would take much too long to achieve results. We then switched to the second technique and removed the tusk in a timely manner. Once the apical areas were curetted clean, the alveoli were obturated with chlorhexidine soaked seton drains. These fell in the first 24 hours. The surgical openings continued to granulate in slowly over several days and healed uneventfully.

Discussion

In any of those cases, one must spend most of his energy carefully planning for all eventualities. Having multiple plans ready it the only feasible way to approach these patients with minimal stress.

SMALL ANIMAL DENTISTRY

ABSTRACTS

SPEAKERS

Boaz Arzi
Dr. Boaz Arzi is a Professor and Chief of Dentistry and Oral surgery at UC Davis School of Veterinary Medicine. Dr. Arzi completed the residency-training program in Dentistry and Oral surgery at the School of Veterinary Medicine, UC Davis and two years fellowship in the Department of Biomedical Engineering at UC Davis. He is a Diplomate of the AVDC and the EVDC. Dr. Arzi is also a Founding Fellow of the AVDC in OMFS. Dr. Arzi's clinical and research focus is on oral maxillofacial reconstruction and regenerative solutions in dogs and cats.he is an affiliate member of ASTMJS.

Michael Balke
Dr. Michael Balke earned his Bachelor of Science in Biology and Doctor of Veterinary Medicine from the University of Missouri. Following graduation, he practiced as a small animal veterinarian in St. Louis, Missouri, where he developed a strong clinical interest in veterinary dentistry. In 2012, Dr. Balke joined Arizona Veterinary Dental Specialists and completed a rigorous residency in veterinary dentistry. He subsequently achieved board certification as a Diplomate of the American Veterinary Dental College (AVDC). In 2025, Dr. Balke further advanced his expertise by completing a fellowship in advanced oral and maxillofacial surgery, earning the distinction of AVDC Fellow in Oral and Maxillofacial Surgery (F-OMFS). Dr. Balke's professional interests include all things dental with a particular focus on complex oncological surgery as well oral and maxillofacial reconstruction. He is dedicated to advancing the field of veterinary dentistry through both clinical excellence and professional engagement. He maintains active membership in several professional organizations, including the Foundation of Veterinary Dentistry (FVD), the American Veterinary Medical Association (AVMA), the Veterinary Society of Surgical Oncology (VSSO), AO North America, and the Arizona Veterinary Medical Association (AZVMA). In addition, Dr. Balke is a frequent lecturer on veterinary dental and surgical topics at local, national, and international conferences. Committed to education and professional development, Dr. Balke currently serves on the Residency Program Administration Committee of the American Veterinary Dental College. He has previously contributed to the College as a member of both the Training and Support Committee and the Examination Committee. He also serves as Chair of the Phoenix Zoo Animal Health Committee, supporting the advancement of veterinary care in zoological medicine. Dr. Balke is the Medical Director of Arizona Veterinary Dental Specialists at the Gilbert location, where he provides advanced specialty care to patients while supporting the growth and mentorship of the veterinary community.

Péter Bogár
Dr. Péter Bogár graduated in 2016 from the University of Veterinary Medicine in Budapest, following in his father's footsteps. He started his veterinary career in Hungary. In 2016, he moved to England, where he worked as a general practitioner in various practices. Péter gained his General Practitioner Certificate in 2021 through ISVPS and his Postgraduate Certificate in Small Animal Dentistry and Oral Surgery from Harper Adams University in 2022. He is currently a dentistry resident at Eastcott Veterinary Referrals in Swindon, England.

SPEAKERS

H.E.Booij-Vrieling
Henriëtte Booij-Vrieling (1974) graduated from the Academic Centre for Dentistry Amsterdam (ACTA), Amsterdam in 1998 and has been working as a human dentist ever since. In 2004 she graduated as a veterinarian at the faculty of veterinary medicine (Utrecht University). She finished her PhD project on Tooth Resorption in cats in 2010 and is combining human dental clinical work, veterinary dental work and teaching. In 2018 she became a diplomate of the European Veterinary Dental College. Henriëtte has been part of the board of the EVDS from 2016–2025.

Maria Valentina Carrozzo
Dr. Maria Valentina Carrozzo graduated cum laude from the University of Perugia in 2007. She spent five years working in private veterinary practices in Italy before pursuing an international academic career in anaesthesia, holding clinical associate positions at institutions including Maisons-Alfort in Paris and the University of Liège. She subsequently completed an ECVAA residency at the University of Saskatchewan, alongside a Master's degree, and became a Diplomate of the European College of Veterinary Anaesthesia and Analgesia (ECVAA) in 2022. Following her residency, she returned to the UK, where she worked in several referral hospitals before joining Dental Vets in February 2023. Dr. Carrozzo has a strong interest in advancing pain recognition and management, with a particular focus on improving analgesia for veterinary dentistry patients.

Perrine Catelain
Perrine Catelain graduated from the Université Libre de Liège (Belgium) in 2016. She worked in general practice in the UK for six years before returning to her native country, France. In January 2024, she began a residency in veterinary dentistry under the supervision of Philippe Hennet.

Crina Iulia Dragu
Crina graduated in 2013 from the Freie Universität Berlin and spent 8 years in general practice, earning a certificate in acupuncture and pain management, before embarking on a dentistry residency and training at The Ralph Veterinary Referral Hospital (Marlow, UK), ADVETIA (Paris, France) and Dentovet (Geneva and Lausanne, Switzerland). She is passionate about animal welfare, patient safety and veterinary human factors.

Janny Evenhuis
Dr. Janny Evenhuis is currently an Assistant Professor of Veterinary Dentistry and Oral Surgery at PennVet. Originally from Cleveland, Ohio, Dr. Evenhuis attended Case Western Reserve University for her undergraduate education. She then obtained her veterinary degree from University of California-Davis in 2020. After a general rotating internship at Colorado State University, she returned to UC Davis for residency and achieved diplomate status with the American Veterinary Dental College in 2024. She then completed a fellowship in oral and maxillofacial surgery at UC Davis in 2025.

Jerzy Gawor

Dr Jerzy Paweł Gawor (1966) graduated in April 1992. He received his PhD in 1996. Since January 2009 Fellow Academy of Veterinary Dentistry. In 2015 successfully completed requirements and became Diplomate of the American Veterinary Dental College (AVDC) and European Veterinary Dental College (EVDC). On 2023 Dr Gawor was elected for the Vice President position in Executive Board of the World Small Animal Veterinary Association. At present Dr Gawor provides dental teaching services in European School of Advanced Veterinary Studies in Europe and Asia.

Martin Hamilton

Martin Hamilton graduated from the Royal (Dick) School of Veterinary Studies, Edinburgh, Scotland, in 2016. After spending several years in general practice in both the United Kingdom and Canada, he elected to pursue a residency in veterinary dentistry and oral surgery in Ottawa in 2020. Following completion of his residency, Dr. Hamilton moved to Guelph, Ontario, to join the team at Hale Veterinary Clinic. He became a diplomate of the American Veterinary Dental College in 2024, and a diplomate of the European Veterinary Dental College in 2025.

Colin Harvey

Emeritus Professor of Surgery and Dentistry, School of Veterinary Medicine, University of Pennsylvania. Owner Colin Harvey LLC Veterinary Dental Consulting Service. Founding Diplomate AVDC, EVDC. Past President and Executive Secretary, AVDC. Director of the Veterinary Oral Health Council, 1997–2018.

Suzanna Hatunen

Suzanna Hatunen is a Board Certified Veterinary Dentist™ and Diplomate of the America Veterinary Dental College. She has worked at Veterinary Dental Services since 2021, in Massachusetts, USA. She completed her Bachelor of Veterinary Medicine at the University of Sydney (Australia) in 2017. She then completed a Shelter Medicine and Surgery Internship at the Royal Society for the Prevention of Cruelty to Animals (RSPCA) in 2018, followed by a small animal rotating internship at the University of Sydney, School of Veterinary Medicine in 2019.

Daniëlle Kirbus-Beekman

Daniëlle Kirbus-Beekman, DVM. Graduated as a veterinarian at the faculty of veterinary medicine at the Utrecht University in the Netherlands in 2016. In the following years she enrolled in several courses in the Netherlands as well as abroad (ESAVS). She is an EVDC resident since the beginning of 2025.

Santiago Peralta

Santiago Peralta obtained his degree in veterinary medicine from Universidad de La Salle in Bogota, Colombia. He worked in private practice for six years before completing a residency in veterinary dentistry and oral surgery at the University of California – Davis. He then joined the faculty at Cornell University where he currently serves as an Associate Professor. He is a Diplomate of the American Veterinary Dental College and a Founding Fellow of Oral and Maxillofacial Surgery.

SPEAKERS

Karla Raquel de Sousa Pinto
Karla Pinto (1978) graduated in Veterinary Medicine from the Federal University of Goiás (UFG), Brazil, in 2000. A member of the Portuguese Veterinary Order (OMV) since 2003, she works in the Greater Lisbon area, focusing on veterinary acupuncture and pain management. She served as president of the Portuguese Association of Veterinary Medical Acupuncture (APAMV) from 2021 to 2024. Currently, she is pursuing a PhD in Veterinary Sciences at the University of Trás-os-Montes e Alto Douro (UTAD).

Laura Šakarnytė
Laura Šakarnytė is the Head Veterinarian at Gyvūnų odontologijos centras in Vilnius, Lithuania, and a PhD student at the Lithuanian University of Health Sciences. With over five years of clinical experience in veterinary dentistry, she holds a GPAdvCert in Veterinary Dentistry and Oral Surgery, and her work focuses on advancing oral health care in companion animals through both clinical practice and academic research.

Luka Šparaš
Luka Šparaš graduated from the Faculty of Veterinary Medicine, University of Ljubljana, in December 2020. After graduation, he completed a one-year small animal rotating internship at Tierklinik Hofheim in Germany. He also took part in various ERASMUS exchange programs and externships, gaining additional international experience. Currently, he is a third-year alternative pathway resident of EVDC under the mentorship of Assist. Prof. dr. Ana Nemec, and works at the Small Animal Clinic of the Faculty of Veterinary Medicine in Ljubljana.

Sigbjørn Hesthammer Storli
Sigbjørn graduated from Justus Liebig University Giessen in 1990. He worked at Lørenskog Dyreklinikk from 1996 to 2013, focusing on small animal soft tissue and orthopedic surgery, as well as dentistry. From 2009, he dedicated his practice exclusively to dentistry and oral surgery. He completed a specialty internship (2013–2014) at the Dentistry & Oral Surgery Service at the Ryan Veterinary Teaching Hospital. Afterward, he returned to Evidensia Lørenskog Dyreklinikk as a referral clinician in veterinary dentistry and oral surgery until 2018. In 2017, he became an EBVS European Veterinary Specialist in Veterinary Dentistry, and in 2018 he founded Dyretannklinikken, Norway's first referral clinic dedicated to veterinary dentistry and oral surgery. His main interests are oncologic surgery and orthodontics, and he lectures internationally while publishing scientific articles and textbook chapters.

Paul Theuns
Paul Theuns, DAVDC DEVDC EBVS DVM. Graduated in 1987, he owns and operates a private dentistry practice in Leusden, The Netherlands. He also runs the dentistry service in a specialty hospital in Wageningen, The Netherlands. Dr Theuns is also chief of staff of the veterinary specialty hospital.

Ingrid Tundo
Ingrid Tundo is a European Specialist in Veterinary Dentistry and Head of Maxillofacial Surgery at DentalVets in Scotland. She is the only EVDC Diplomate based in Scotland. After graduating from the University of Milan in 2014, she moved to the UK for a residency in dentistry and oral surgery, becoming a Diplomate in 2021. Formerly a senior lecturer at the University of Edinburgh, she has authored several scientific publications. Outside work, she enjoys surfing, snowboarding, and spending time with her cat Miso and whippet Bagel.

Comparison of Two Techniques for the Removal of Displaced Root Fragments from the Mandibular Canal in Canine Cadavers

Michael Balke, *DVM, DAVDC, F-OMFS*

Tooth extraction is the most common oral surgical procedure performed in human and veterinary dentistry. One possible complication during extraction is root fragment displacement into adjacent anatomical spaces. Root fragment displacement into adjacent anatomical spaces can lead to serious side effects including pain and infection, therefore displaced fragments should be removed when possible. Root fragment removal techniques from the mandibular canal have not been studied in veterinary or human dentistry. A reported complication of dental implant placement in humans is displacement into the mandibular canal, and techniques have been developed to remove these displaced implants. This lecture compares two techniques to remove displaced root fragments from the mandibular canal in canine cadavers based on previously published methods to remove displaced dental implants from the mandibular canal in humans.

A novel technique to retrieve displaced toot roots from the mandibular canal and extraction of impacted canine teeth in dog using piezoelectric osteotomy (surgery)

Sigbjørn Hesthammer Storli

Abstract

Impacted canine teeth and displaced tooth roots present significant surgical challenges in small animal dentistry, particularly when located in close proximity to the mandibular canal. Conventional extraction techniques risk iatrogenic trauma to critical neurovascular structures, postoperative complications, and prolonged recovery. Piezoelectric surgery has emerged as a minimally invasive alternative for bone management, offering precision cutting with reduced risk to adjacent soft tissues.

This presentation describes a novel technique for the retrieval of displaced tooth roots within the mandibular canal and for the surgical extraction of impacted canine teeth in dogs using piezoelectric osteotomy. The procedure was developed to improve surgical control, minimize collateral damage, and enhance patient outcomes.

In cases of displaced tooth roots, intraoral radiography and cone beam computed tomography (CBCT) were employed to localize the fragment within the mandibular canal. A targeted osteotomy was then performed using a piezoelectric surgical unit, enabling selective bone removal while preserving neurovascular integrity. For impacted canine teeth, piezoelectric osteotomy was applied to create a conservative bony window that allowed atraumatic access to the crown and root. The precise micrometric cutting action reduced intraoperative hemorrhage, improved visualization, and facilitated controlled luxation and removal.

Clinical results demonstrated that piezoelectric surgery significantly reduced surgical morbidity compared with conventional rotary instruments. Postoperative complications such as mandibular fracture, hemorrhage, or persistent neurological deficits were not observed. Patients exhibited rapid recovery, with minimal postoperative swelling and pain, likely attributable to the reduced mechanical and thermal trauma associated with ultrasonic cutting. This technique represents a refinement of veterinary oral surgical practice, providing a safe and effective method for managing two of the most technically demanding procedures in canine dentistry. Beyond immediate clinical benefits, the use of piezoelectric osteotomy may also reduce the need for aggressive bone removal and thus contribute to preservation of mandibular structural integrity.

The presentation will detail surgical protocols, instrumentation, and case outcomes, supported by clinical imaging and video documentation. Emphasis will be placed on indications, stepwise technique, and management of intraoperative challenges. The potential applications of piezoelectric osteotomy in other advanced oral surgical procedures will also be discussed. In conclusion, piezoelectric surgery offers a valuable adjunct in veterinary dentistry, enabling controlled retrieval of displaced tooth roots and successful extraction of impacted canine teeth with minimal complications. Adoption of this technique may significantly advance the standards of care in small animal oral surgery.

Early Experience Using Dual 18F-NaF/18F-FDG PET/CT as a Diagnosis Tool for Pain of Unknown Origin in the Oral and Maxillofacial Region of Dogs

Boaz Arzi, Lauren E Ayne, Mathieu Spriet

Short abstract
Pain of unknown origin in the oral and maxillofacial region is a common clinical problem in veterinary medicine. The differential diagnosis list is extensive and may include periodontal disease, endodontal disease, neoplasia, skeletal abnormalities and trauma, just to name a few.
Positron emission tomography (PET) is most used for oncologic imaging in dogs, however PET is not specific for neoplastic disease. Computed tomography is regarded as the modality of choice for oromaxillofacial imaging in small animals, but only provides structural imaging. The goal of this study was to assess whether the addition of dual tracer PET, using both 18F-Fluorodeoxyglucose (18F-FDG) and 18F-Sodium Fluoride (18F-NaF) to CT would be pertinent for oromaxillofacial imaging in dogs. Eight dogs presenting for assessment of oromaxillofacial pain were prospectively included in this study. Dual tracer PET and CT were performed under a single anesthetic episode using a PET-CT scanner with an extended axial field of view (480 mm). The main abnormalities identified included bilateral TMJ arthritis and coronoid process inflammation, a periapical lesion on the maxillary molar tooth, a deep lingual abscess, pterygoid myopathy and marked inflammation of the oropharynx. Injecting 18F-FDG first was identified as the preferred order, as the presence of marked 18F-NaF uptake in the alveolar bone tends to mask more subtle gingival 18F-FDG uptake. PET was pertinent at clearly identifying margins of inflamed areas and regional variation for assessment of periodontal disease. We conclude that dual tracer PET-CT is suitable as a pertinent imaging modality for advanced characterization of oromaxillofacial disease.

Prevalence of incidental dental disease in rabbits undergoing CT scan for non-dentistry presentations: a retrospective study

Crina Iulia Dragu

Background
Dental disease is common in domestic rabbits and often subclinical. Recent prevalence studies relying on visual or otoscopic examination suggest rates around 15%, but these methods may underestimate disease burden. Computed tomography (CT) provides superior detection of early and occult dental pathology, yet systematic data on incidental findings in rabbits are lacking.

Objectives
To determine the prevalence of incidental dental pathology detected by CT in rabbits undergoing imaging for non-dental conditions, and to assess whether normal visual clinical examinations reliably exclude dental disease.

Methods
Clinical records and head CT scans of rabbits referred to a specialist hospital over a 2-year period were reviewed. Inclusion required CT performed without prior suspicion of dental disease. CT studies were assessed for malocclusion, tooth abnormalities, periapical changes, and bony lesions.

Results
Data collection is ongoing. We hypothesise that a substantial proportion of rabbits will demonstrate CT evidence of dental disease despite unremarkable visual oral examinations.

Conclusion
This study is expected to provide the first CT-based prevalence estimate of incidental dental pathology in rabbits, highlighting the diagnostic limitations of visual examination and informing future screening recommendations.

Analysis of the relation between shedding incisor teeth and the age of pups among different dog breeds

H.E. Booij-Vrieling

Authors
H.E.Booij-Vrieling (DDS, DVM, PhD, Dipl EVDC. Dept Clinical Sciences, FVM-UU), H.Fieten (DVM, PhD, Dipl ECVIM, MSc genetic epidemiology. Dept Clinical Sciences, FVM-UU), H.Vernooij (MSc, Dept Population Health Sciences, FVM-UU).

Objective
The aim of the project was to investigate whether the shedding of the incisor teeth can be used as an evidence based tool to estimate the age of a puppy.

Animals
Owners of puppies with a known and reliable birthdate were asked to send twice a week a frontal viewed picture of their dogs teeth and measure weekly the weight.

Procedures
Data collection started at the age of 10 weeks until the dog has shed all 12 incisor teeth. Dogs were arranged according to the breed and assigned to a weight category.

Results
For the analysis complete data of 629 pups was used. More than one hundred different breeds participated. The shedding process follows a fixed pattern: starts with the mesial-, followed by the middle and ends with the lateral incisors. This is similar for the maxilla and the mandible. Dogs from breeds with higher weights (> 15 kg) start shedding at the mean age of 108 days (15.4 weeks). Dogs with very low weights (< 5kg) start about 4 weeks later, at a mean age of 137 days (19.6 weeks). Median time frames for shedding incisor teeth do not differ between smaller and larger breeds (21–25 days), but individual variation is more prevalent in the lower weight categories.

Conclusions
Starting points and time frames for shedding incisor teeth differ between weight categories. The indicated time in most literature (12–15 weeks) needs to be reviewed.

The current dataset can be used to predict the age of a puppy based on the shedded teeth and to compare the estimate with the age registered in the dog's passport to detect inconsistencies.

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No conflict of interest

Long term outcome of refractory cases of feline chronic gingivostomatitis treated with oromucosal application of recombinant feline interferon omega (rFeIFN-ω), preliminary results of a retrospective study from 2010 to 2024

Perrine Catelain, Philippe Hennet

Feline chronic gingivostomatitis (FCGS) is an immune-mediated debilitating chronic oral mucosal inflammatory disease in cats. Partial to full-mouth dental extractions remain the treatment of choice, improving quality of life in 60–70% of cases. Refractory cases showing little to no improvement following dental extractions may benefit from immunomodulatory therapy. Oromucosal recombinant feline interferon omega (rFeIFN-ω), cyclosporine, and mesenchymal stem cells have been studied and demonstrated clinical effectiveness. A study has reported the outcome of oromucosal rFeIFN-ω in 39 refractory cases.

This study aimed to assess whether previously reported response rates to oromucosal rFeIFN-ω (~45%) could be reproduced in a larger retrospective cohort of cats with refractory FCGS.
We reviewed the medical record of 162 cats diagnosed with refractory FCGS and treated with oromucosal rFeIFN-ω at our referral hospital between 2010 and 2024. They presented persistent clinical signs and oral lesions after extractions impairing quality of life, with dental radiographs confirming the absence of root remnants. Of the 162 cases identified, 94 were excluded due to deviation from protocol, use of forbidden treatments, or loss to follow-up before 3 months, resulting in a final cohort of 72 cats.
Collected data included age at treatment initiation, viral status (FCV, FHV, FeLV/FIV), pre-treatment bloodwork, and prior therapies. Clinical parameters such as pain-related signs, activity level, body weight, and diet changes potentially linked to oral discomfort were assessed at three time points: at the start and end of treatment, and during post-treatment follow-up. In addition, lesion characteristics – including type, anatomical location, and inflammation scores – were systematically evaluated at the same three time points to document the progression or resolution of the disease. A coding system developed for this study will be used to enhance the assessment of overall clinical outcome and support consistent inclusion or lesion characteristics in the statistical analysis.

Clinical remission was observed in 42% (30/72) of cats with complete outcome data, within 1 to 12 months. Among cats achieving remission, median treatment duration was 3.5 months, mean 4.0 months (range: 1–12). Thirteen cats were followed after the end of rFeIFN-ω treatment for 1 month to 4 years; one showed clinical relapse after one year.
These findings suggest that oromucosal rFeIFN-ω induces remission in a substantial proportion of refractory FCGS cases, with outcomes consistent with prior reports. Among this population, 50% achieved remission within 3.5 months. Ongoing statistical analysis will further assess the significance and predictive value of these outcomes.

Quantitative Light-Induced Fluorescence objective scoring system for plaque and calculus in dental trials in dogs

Colin Harvey, Elbert Waller, Laurie Serfilippi

Abstract title: Developments in Use of QLF-ED for Dental Scoring Trials in Dogs

Quantitative Light-induced Fluorescence – Extent & Density (QLF-ED) is a dental plaque and calculus objective scoring system designed to be used in VOHC® Seal of Acceptance trials. Images are taken with a custom-made digital auto-focus camera equipped with both blue light and white light rings (QRayCam Pro). The images are then fed into a proprietary QLF software program (C4 – Inspektor Research Systems, NL) for analysis. Teeth to be scored are digitally contoured, then each 10×10 pixel square on the buccal crown surface of targeted teeth is analyzed for presence of and density of red fluorescence in the blue light image. The result is reported as the percentage of the crown covered by variable thickness plaque or calculus relative to maximum full-crown coverage.To validate the use of QLF-ED, trials have been run where typical subjective scoring systems (e.g. Modified Logan -Boyce [ML-B] plaque score or Warrick-Gorrel [W-G] calculus score) and QLF images were both scored. The first data were from a dose-response trial; the correlation coefficient 'r' values comparing the disclosed subjective and disclosed QLF plaque and calculus scores indicated moderate or strong correlation; these data were based on dogs 21 days after scaling, which is shorter than the minimum required 28 days in VOHC® trials. Recently, additional data were obtained from dogs 30 days following scaling. Some of the teeth were completely covered by plaque, which results in QLF reporting a zero score, rather than 100%. In a previous report of scoring extent of disclosed plaque in dogs by QLF, this zero/100% problem was addressed by exporting the image to PhotoShop to add a white reference spot, then importing the image back into C4. As a result of recent C4 QLF-ED programming work, a one-mouse click reference spot system corrects the zero reports for fully plaque-covered teeth.

QLF-ED is expected to provide a more accurate assessment of plaque and calculus than subjective scores or the simple extent-only plaque QLF score previously described (Wallis *et al.*, 2016), because it combines extent of coverage with fluorescence density (indicative of thickness) on multiple individual sites. The ML-B and W-G scores rely on subjective human eye assessment of coverage on a 0–4 scale and of thickness on a 1–3 scale, with the thickest area being recorded for that tooth. VOHC® trial requirements include scoring of teeth stained by disclosing solution – scoring undisclosed calculus requires brushing or rubbing away superficial plaque, which would prevent scoring disclosed calculus. The effect of application of disclosing solution on QLF scores has yet to be fully explored. Does it artificially distort the fluorescence score by augmentation or by creating 'noise'? If so, scoring undisclosed teeth by QLF would be indicated. To date, while some teeth have been QLF scored for plaque before the disclosing solution is applied, no QLF data have been obtained on undisclosed calculus. Undisclosed plaque in some dogs has been scored, and results will be discussed.

SMALL ANIMAL DENTISTRY | ABSTRACTS

Effect of a buried knot in the healing process of dental extraction sites: a prospective study in cats

Klim Emilia Barbara[1], Mestrinho Lisa Alexandra[2], Gawor Jerzy Paweł[3]

Presenting author
JP Gawor Klinika Weterynaryjna Arka, Kraków, Poland

Abstract
Objectives: This study aimed to evaluate the effect of the buried-knot suture technique on gingival wound healing in cats undergoing dental extractions. We hypothesised that a simple buried-knot interrupted suture would provide a healing advantage at the extraction sites.

Methods
A prospective, randomised, split-mouth design was used, involving 40 cats sequentially included in the study. Each side of the mouth was sutured using simple interrupted sutures, with and without a buried knot. Healing was assessed at 2, 4 and 6 weeks postoperatively through visual inspection of the maxillary sites. Indicators of wound healing, such as swelling, bleeding on inspection, redness of the wound margins, dehiscence, ulceration, exudate, halitosis, pain on palpation, presence of necrotic tissue, flap instability, suture loosening and entrapment of food debris or foreign bodies were recorded.

Results
Although both sutures showed similar mechanical behaviour as assessed through flap stability, dehiscence, suture loosening and the presence of necrotic tissue, the buried-know technique was significantly associated with reduced inflammatory signs, including less swelling, bleeding on inspection, redness of wound margins, ulceration, exudate, halitosis and pain.

Conclusions
The findings suggest that simple interrupted sutures with a buried knot provide a healing advantage in gingival wound closure following dental extractions in cats.

Periodontal attachment surface area in dogs

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Abstract
Periodontal diseases are the most common problem seen in dogs. Prevention and appropriate management of these conditions has a critical importance for patient welfare and protecting the patient from their potential systemic impact. The systemic impact of periodontal pathologies occurs due to the significant inflammatory and immune mediated processes induced by the infection. The chronic inflammation of the periodontal tissues allows for the direct infiltration of microorganisms and their toxic byproducts into the vascular system. The degree of systemic effect may be associated with the surface area of periodontal attachment.

The purpose of this study was to assess the periodontal attachment surface area (in mm2) in dogs in relation to their various sizes and head types. In addition, we aim to compare this to the average human being. 14 dogs of different sizes, bodyweight, and head types were assessed by cone beam computer tomography (CBCT) and the scans were digitally analyzed to calculate the periodontal attachment surface. The results underwent statistical assessment and relation with body surface and facial index (ratio between facial width and facial length) were evaluated.
The surface area of periodontal attachment was significantly correlated with body surface area. The smaller the dog the higher the periodonta surface in in relation to body surface size In brachycephalic dogs the periodontal attachment surface is relatively smaller that in similar size mesocephalic and dolichophallic breeds. dogs.

The use of bio-absorbable regenerative matrix and the preliminary results of a study looking into the use of the new micro version of the bio-absorbable regenerative matrix in periodontitis in dogs

Paul Theuns, Daniëlle Kirbus-Beekman

Periodontitis is a common condition in dogs. If left untreated, periodontitis leads to the destruction of the periodontal ligament, alveolar bone loss and eventual tooth loss. Apart from the local implications, it has been linked to systemic effects, including cardiac health. Early diagnosis of periodontitis and an appropriate therapeutic intervention can halt the progression and when possible, regenerate lost periodontal tissues. When the periodontitis is in an mild to moderate stage, a COHAT and closed root planing can be performed to remove deep deposits of plaque and inflammatory tissue. This can allow the periodontium to heal and reduce the attachment loss of the tooth.

Bio-Absorbable Regenerative Matrix
Bio-absorbable regenerative matrix has been applied in clinical veterinary practice for several years and has shown promising results in periodontal therapy. This lecture will provide a comprehensive overview of the bio-absorbable regenerative matrix, including its composition, mechanism of action, and the current body of research supporting its use. Practical examples of its application in the management of periodontitis in dogs will also be presented, highlighting clinical outcomes and case considerations. Additionally, demonstration of the step-by-step technique for proper placement of the matrix will be demonstrated, including surgical preparation, handling, and positioning to optimize tissue regeneration and healing. This lecture aims to combine both the scientific evidence and practical guidance necessary for effectively integrating the bio-absorbable regenerative matrix into veterinary periodontal treatment protocols.
Furthermore, preliminary findings from the research study into a new micro bio-absorbable regenerative matrix will be presented. This current, ongoing study looks into the new micro product that is developed specifically for the shallower pocket depths (4–6mm). The study compares pocket depth and alveolar bone height in teeth treated with closed root planing vs closed root planing with the new micro implant material. The first preliminary results will be discussed.

SMALL ANIMAL DENTISTRY | ABSTRACTS

Autologous Conditioned Serum (ACS) as Adjunctive Therapy for Post-Extraction Wound Healing in Dogs

Laura Šakarnytė, Indrė Matsuzaki, Julien Troillet, Modestas Ružauskas

This retrospective study investigated the therapeutic potential of autologous conditioned serum (ACS) as an adjunctive therapy to improve periodontal wound healing after 109, 209 tooth extraction in dogs. Tooth extraction is a common procedure in veterinary dentistry practice with reported complications such as wound dehiscence, delayed healing, alveolar osteitis, and infection. ACS, derived from the patient's own blood, exhibits biologic activity that offers promising potential as an adjunctive therapy to accelerate tissue repair processes. Serum contains biological active components like growth factors and cytokines, that promote cellular activation, angiogenesis, and regeneration.

Data from 20 dogs that received adjunctive ACS treatment were compared to data from 20 dogs that received standard of care. ACS was applied locally to the extraction site via soaked collagen sponges before surgical closure. Pre-and postoperative dental radiography was conducted for all cases. All dogs received caudal maxillary regional block, and were sedated with the same protocol. All surgical sites were closed with 5–0 Poliglecaprone 25. Following the procedure meloxicam was applied orally for 5 days. No antibiotics were administered.
Healing outcomes were assessed retrospectively using the Early Wound Healing Score (EHS) system applied during follow-up examinations on days 3, 7, and 14 post-extractions. Animals with recorded aggression or other behavioral issues were excluded. Analysis revealed that dogs treated with ACS exhibited a significantly improved healing process compared to controls. By day 3, the ACS group showed a 71% increase of EHS from baseline compared to a 47% increase in the control group ($p = 0.011$, $d = 0.79$). By day 7, the ACS group's EHS reached 91% while the control group's EHS was 78% ($p = 0.046$, $d = 0.81$). By day 14, no significant differences between EHS scores were identified. Notably, these improvements were consistent across subgroups, regardless of the dog's age, weight, breed, feeding type, tooth position or reason for extraction.

Our findings support the hypothesis that autologous conditioned serum facilitates early wound stabilization, resolves inflammation, and accelerates soft tissue regeneration after tooth extraction, eliminating the risk of complications. ACS may represent a valuable addition to minimally invasive regenerative medicine strategies in veterinary dentistry.

Incidence of wound healing complications after tooth extractions in dogs

Luka Šparaš*, Ana Nemec
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Tooth extractions are commonly performed in adult dogs, mostly due to advanced periodontal and/or endodontic disease. Generally, extraction site in dogs is clinically healed within 2–4 weeks. Dehiscence following exodontia is the most common complication in dogs, leading to delayed wound healing and possibly alveolar osteitis. However, there is a surprising lack of detailed literature in veterinary dentistry exploring extraction wound healing complications. The aims of this prospective study are to evaluate the incidence of wound healing complications associated with extraction site(s) following permanent tooth extractions in healthy dogs and to investigate potential contributing factors.

Materials and methods
Client-owned dogs scheduled for dental extractions due to different reasons are being included in the study. Dogs with underlying diseases and/or undergoing treatments, that could contribute to healing complications, are excluded from the study. All procedures are performed as clinically indicated following contemporary surgical principles, including routine preoperative local nerve blocks. No antibiotics nor antiseptics are used perioperatively. All dogs recieve analgesia as clinically indicated with an in-person clinical re-check scheduled in 10 days after the extraction(s).

Results
A preliminary cohort of 68 dogs was evaluated at this point. In total, 416 teeth were extracted, most commonly due to advanced periodontal disease (79,6%). 173 teeth were removed via closed extraction, while 243 required surgical extraction, corresponding to 150 extraction sites with created mucoperiosteal flaps and varying amount of ostectomy. Wound dehiscence and wound healing complications following tooth extraction were observed in 25% (17/68) of dogs and at 5.3% extraction sites (17/323). Apart one site (closed extraction), all complications were related to sites where ostectomy was performed. Complications were the most common following extractions due to complicated crown fractures (35.3% of the sites with complications) and complicated crown–root fractures (29.4% of the sites with complication). Although periodontal disease was the leading overall indication for extraction, it accounted for only 17.6% of sites in which dehiscence developed. Dehiscence occurred most frequently at canine teeth extraction sites (29.4%), followed by maxillary fourth premolar teeth sites (23.5%). Dehiscence/wound healing complications were reported as early as five days post-extraction, but all sites healed without surgical intervention within 2–4 weeks. Analgesia with an NSAID was prolonged in 4 dogs with dehiscence and a course of an antibiotic was prescribed in 3 of these dogs.

Conclusion
Current findings from this study suggest that wound dehiscence is a relatively frequent complication, particularly associated with the extraction of large periodontally healthy teeth. Conservative approach with medical (mostly pain) management is a viable option in most dogs to address dehiscence/wound healing complications of extraction sites.

References
Available upon request.

Biomechanical evaluation of two plating systems for fixation of mandibular condylar process fractures in dogs demonstrates sustainability under bite forces

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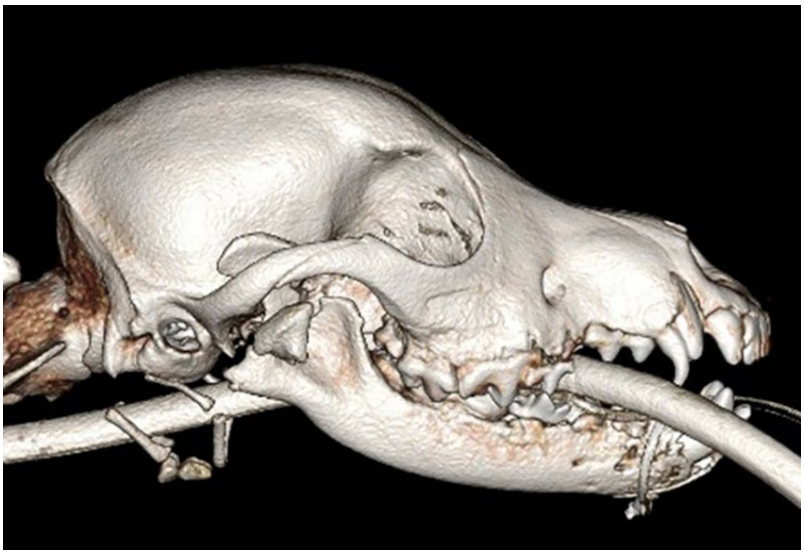
Objective
To determine the biomechanical strength of two different condylar titanium plating systems (trapezoid and lambda condylar plates) in medium to large breed dogs for repair of mandibular condylar fractures under physiologic bite forces

SMALL ANIMAL DENTISTRY | ABSTRACTS

Methods
Using a block study design, twelve medium- to large-breed adult dog cadaver heads were used to simulate a mandibular condylar process fracture. The selected implant was applied to simulated fracture, and the cadavers were loaded in a single-load-to failure test simulating the direction of force of the masseter, temporalis, and medial and lateral pterygoid muscles.

Results
All implants failed at simulated bite forces greater than 600N. The mean force to failure was 1006.5 N (344.7) for the lambda plates and 847.8 N (78.0) for the trapezoid plates. There was no statistically significant difference in mean force to failure when comparing the different types of plates. Some degree of screw pull-out occurred in 50% of specimens tested with the trapezoid plates. There was no significant difference in mode of failure between the two groups. The most common mechanism of failure was breakage of the loading apparatus.
Conclusions
Both condylar lambda plates and trapezoid plates are able to sustain expected physiologic bite forces in domestic dogs after implantation. There is no significant difference in the force to failure for either type of implant.

Clinical Relevance
Based on biomechanical testing, both lambda condylar plates and trapezoid plates are suitable for open reduction and internal fixation of mandibular condylar process fractures in medium to large-breed dogs.



Vital Pulpotomy in Cats: A Retrospective, Multicenter Study – Preliminary Findings

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Objective
To assess the success rate, and the factors which may affect outcome, of vital pulpotomy in cats.

Design
A retrospective, multicentered study

Methods & Materials
Medical records were collated from several referral practices located in North America and reviewed, noting patient signalment, presenting complaint, materials used, and any intra-operative complications. Radiographs from the time of initial treatment, and those from the last available follow-up were evaluated. Treatment outcomes were categorised as successful, no evidence of failure (NEF), or failure according to the endodontic outcome guidelines established by the European Society of Endodontology.

Results (Preliminary)
At the time of writing, treatment was classified as either successful or no evidence of failure in all teeth (100%), with no teeth exhibiting any evidence of failure (0%) radiographically.

Conclusions
Vital pulpotomy in cats appears to have a high success rate when utilising either mineral trioxide aggregate or bioceramic material as a direct pulp capping agent. Vital pulpotomy is a suitable treatment for pulp exposure during crown reduction, and in cases of recent fracture, in the canine teeth of cats. Further studies, ideally prospective in nature, with a larger sample size, and long-term follow-up are required.

Vital Pulp Therapy in Cats: A Case Series and Clinical Outcomes

Ingrid Tundo

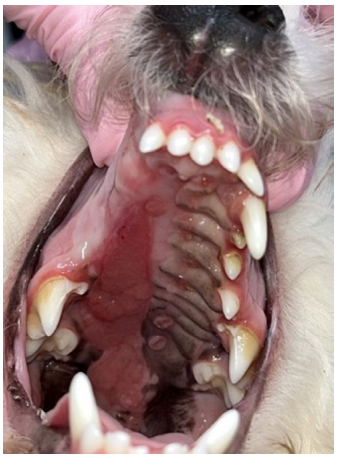
Vital pulp therapy (VPT) is an established treatment in human and canine dentistry, but evidence in feline patients remains limited. At DentalVets, we have collected and reviewed a case series of nearly 20 cats treated with VPT for complicated crown fractures and other pulp exposures. Each case was managed using a standardised protocol, and follow-up periods range from 4 months to over 2 years. This presentation will share the preliminary results of an ongoing retrospective study, focusing on clinical and radiographic outcomes, treatment indications, materials used, and long-term tooth vitality. Cases include both young and adult cats, and follow-up data have been collected through routine rechecks and dental imaging. The goal of this work is to assess the viability and predictability of VPT in feline patients and to help define its role in feline dentistry. This presentation will be of particular interest to general practitioners, residents, and specialists seeking evidence-based approaches to preserving pulp vitality in cats.

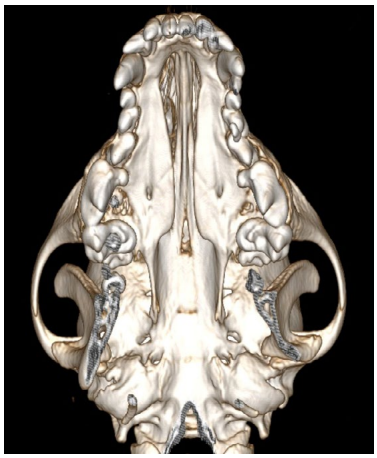
SMALL ANIMAL DENTISTRY | ABSTRACTS

Outcomes of congenital secondary cleft palate repair using the overlapping flap technique with or without prior selective tooth extraction in dogs

Péter Bogár

Congenital secondary cleft palate is a common developmental abnormality affecting various dog breeds. Due to the large oro-nasal communication, affected puppies are prone to malnutrition, aspiration pneumonia, and early mortality without supportive care and eventual surgery. Computed tomography (CT) is an invaluable tool in orofacial cleft diagnosis, which helps to evaluate the extent of the fissure and any potential co-morbidities that may affect the skull. Selective tooth extractions, performed typically 6–8 weeks before definitive surgical repair of secondary cleft palate, can enhance the available soft tissues, thereby increasing the chances of a successful defect closure. The overlapping flap technique is one of the surgical methods described for closure of secondary cleft palates in dogs, used especially in cases of wide defects, providing a robust closure.
The lecture will discuss the results of a retrospective case series assessing the outcomes of congenital secondary cleft palate repair and cleft morphology (based on clinical photographs and CT scan images) in ten client-owned dogs using the overlapping flap technique with or without prior selective tooth extractions, treated between 2015 and 2025 at Easctott Veterinary Referrals.





Defining the somatic mutational spectrum of canine oral squamous cell carcinoma

Arly Camila Armas Jimenez, William Katt, Shawna Cook, Michael Byron, Jacquelyn Evans, Santiago Peralta

Oral squamous cell carcinoma (OSCC) is the most common oral malignancy of epithelial origin in dogs, representing ~6% of all cancers in this species. Current standard of care consists of wide-margin surgical excision in eligible patients according to stage of disease. Although long-term remission can be achieved, surgery is invasive and results in varying degrees of dysfunction. We have previously shown that the MAPK pathway is hyperactivated in canine OSCC, and that oral administration of the small-molecule inhibitor trametinib can significantly reduce local tumor burden in some patients and represents a clinically applicable neoadjuvant strategy. However, not all tumors are sensitive to trametinib, and the response appears to be at least partially dependent on the presence of specific underlying somatic variants including the well-known MAPK pathway-activating BRAF V595E mutation. These observations suggest that tumors that carry wild-type BRAF alleles likely harbor oncogenic mutations in genes that dysregulate other pathways not inhibited by trametinib, or that confer tumor cells the ability to evade MAPK-pathway inhibition. However, the mutational landscape of OSCC has not been thoroughly investigated, and it remains unknown whether other

somatic mutations underlie the apparent oncogenic signaling heterogeneity. In this study, we investigated the somatic mutational landscape of canine OSCC by performing high-coverage whole-genome sequencing of OSCC tumor tissues compared with matched blood-derived germline DNA from 15 dogs known to be sensitive (n=6) or resistant (n=9) to trametinib. Results confirmed the presence of BRAF V595E alleles in most responders, and showed that canine OSCC is genetically heterogeneous, that non-responder dogs have a higher somatic mutational burden compared to responders, and that somatic mutations predicted to have a deleterious effect are relatively common in genes such as TP53, CDH10, HRAS, and FAT2, among others. A larger cohort tied to clinical outcomes, complemented with transcriptional and functional data, will help identify other molecular vulnerabilities and ways to more robustly stratify dogs considered potential candidates for targeted interventions.

Cannabinoid Receptors Cb1, Cb2 And Orphan Receptor Gpr55 In Canine Amelanotic Oral Melanomas: A Spontaneous Model To Explore Translational Targets In Immuno-Oncology

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Introduction

Cannabinoid receptors 1 (CB1R) and 2 (CB2R) are integral components of the endocannabinoid system and play key roles in modulating immune responses and tumor progression. The orphan receptor GPR55, sometimes referred to as a "third cannabinoid receptor," has been increasingly implicated in oncogenesis, being associated with pro-proliferative and pro-metastatic signaling. Canine oral melanomas, particularly the amelanotic subtype, are highly aggressive and share biological similarities with human mucosal melanomas, making them valuable spontaneous models for translational research.

Aims

To assess the immunohistochemical expression of CB1R, CB2R, and GPR55 in canine amelanotic oral melanomas.

Methodology

Twenty samples of canine oral amelanotic melanomas were analyzed. Indirect immunohistochemistry was performed using anti-CB1R (Origen®), anti-CB2R (Abcam®), and anti-GPR55 (Abcam®) antibodies, diluted 1:100, 1:200, and 1:200, respectively. Mucosa epithelium served as internal positive controls. Receptor expression in neoplastic cells was semi-quantitatively scored on a scale from 0 (negative) to 3 (strong) by three independent blinded observers.

Results

CB1R expression was absent or minimal (<10% of tumor cells) in 62% of cases. CB2R exhibited moderate and diffuse expression (score 2) in all samples. GPR55 is positive in normal epidermis, which served as an internal positive control. All samples were positive to this marker. In most amelanotic

neoplasms, moderate positivity (grade II) was observed, and in some cases the nuclear membrane is also positive, with the same intensity. Melanocytes with melanin, scattered throughout the dermis and epidermis, are intensely (grade III) marked. All controls were positive.

Conclusions
The minimal CB1R expression and the consistent presence of CB2R and GPR55 suggest preferential involvement of CB2R and GPR55 in the biology of amelanotic melanomas. While functional associations with proliferation or metastatic behavior cannot be established from these results alone, the observed expression patterns support the need for further studies addressing their role in tumor aggressiveness, immune modulation, and metastatic potential. These findings suggest CB2R and GPR55 as promising candidates for future investigation as biomarkers and therapeutic targets in melanoma comparative oncology.

Medication Related Osteonecrosis of the Jaw (MRONJ) in Cats

Suzanna Hatunen

Medication Related Osteonecrosis of the Jaw (MRONJ), also referred to as Antiresorptive Agent Related Osteonecrosis of the Jaw (ARONJ) and formerly known as Bisphosphonate Related Osteonecrosis of the Jaw (BRONJ), is a rare but intractable disease in humans linked with long term use of potent antiresorptive medications, such as bisphosphonates (BP) and denosumab, and angiogenesis inhibitors. The American Association of Oral and Maxillofacial Surgeons (AAOMS) has preferred the term "medication related osteonecrosis of the jaw" (MRONJ) to include other antiresorptive and antiangiogenic drugs that have also resulted in necrosis of the mandible, maxilla or both. This talk will discuss salient aspects of medication related osteonecrosis of the jaws in cats, specifically bisphosphonate related osteonecrosis of the jaw. Though more commonly published in human literature, this presentation is rare in cats.

Referring to recently published study of 20 cats with MRONJ, learning objectives of this lecture include discussing MRONJ in cats (and humans) and how this disease is thought to occur, and then highlighting presenting concerns, clinical findings, risk factors, diagnoses, interventions, outcomes (including adverse events), and follow-up that can aid in improved prognosis for cats with MRONJ. Given the limited literature in veterinary patients, discussion about MRONJ in humans will be included, where relevant.

The aforementioned case series revealed that cats with feline idiopathic hypercalcemia treated with bisphosphonates (alendronate) may be at a risk for development of MRONJ, a serious oral condition with significant morbidity. Prior dental extraction sites in patients concurrently treated with bisphosphonate medications were often associated with MRONJ lesions. Therefore, any needed dental surgery should be performed prior to the use of bisphosphonates where possible. Diagnosis of MRONJ was made by a correlation of diagnostic findings and patient history. No single diagnostic, or combination was pathognomonic for lesion diagnosis. As well, there were no statistically significant associations between patient variables assessed and the overall patient outcome.

Given the serious morbidity of this disease, and its rarity in the literature, the hope is that this talk will bring light to MRONJ diagnosis and treatments in cats, to ensure appropriate monitoring, client discussion, diligent follow-up and rapid diagnosis and treatment, if a lesion is to ensue.

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Brief Bio (Submitting and presenting author):
Suzanna Hatunen is a Board Certified Veterinary Dentist™ and Diplomate of the America Veterinary Dental College. She has worked at Veterinary Dental Services since 2021, in Massachusetts, USA. She completed her Bachelor of Veterinary Medicine at the University of Sydney (Australia) in 2017. She then completed a Shelter Medicine and Surgery Internship at the Royal Society for the Prevention of Cruelty to Animals (RSPCA) in 2018, followed by a small animal rotating internship at the University of Sydney, School of Veterinary Medicine in 2019. She is currently undertaking the Thomas P. Sollecito One-Health Oral Medicine Fellowship, through the University of Pennsylvania Dental School.

Self Inflicted Lingual Trauma Secondary To Inferior Alveolar Nerve Block In Dogs A Multicententric Case Series

Maria Valentina Carrozzo, *DVM MVetSc MRCVS Dipl. ECVAA EBVS® RCVS®*[1]
Elliot Pye *DVM MRCV*[2]
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Introduction

Locoregional anaesthesia techniques (LA) have become integral part in managing pain associated with dental interventions. Inferior alveolar nerve (IAN) is one of the branch of the mandibular division of the trigeminal nerve (CN V). Blocks of the IAN (IANb) are generally effective, but their success hinges on precise technique, anatomical knowledge, and appropriate anaesthetic volume. Incorrect landmark identification, volume related complication (VRC) and mechanical complication (haematoma, tissue swelling, local nerve damage) have been reported sporadically[1–3]. Data on incidence, management and outcome of IANb related complications in clinical practice remain limited[4,5]. In this retrospective, descriptive, multicentric study we present a pattern of complications occurred after IANb.

Material and Methods

Data were collected retrospectively from the digital archives of 7 institutions over the course of 4 years period (2019–2022). Age, breed, weight, sex, drug, dose, approach and location of IANb were registered (Table A). LA used were selected based on surgeon preference, procedure and desired length of postoperative analgesia. IANb was performed using either intra or extraoral approach by 7 different operators. Volume administered followed standard protocols from established reference[6]. Location of the lingual trauma and mitigating interventions were recorded. Lesions were scored as mild, moderate and severe subjectively and categorically. Follow up was present for all except one case.

Results
13 dogs reported complication postoperatively. Mean patient age was 5.5 years, and mean body weight was 20.6 kg. Procedures performed included extraction, root canal treatment, mandibulectomy, and gingivectomy. 2/13 (15%) dogs received combination of Bupivacaine 0.5% and Lidocaine 2%. 9/13 (69.2%) dogs received bupivacaine as a sole agent, 2/13 (15%) dogs received combination of bupivacaine 0.5% and buprenorphine. IANb was performed bilaterally in all dog except one. Of the 13 dogs with reported lingual auto-inflicted self trauma, 8 received intraoral IANb and 5 IANb via extraoral approach. The self-trauma occurred in a variable time after the extubation. Duration of chewing episodes was limited in all apart for 1 dog where it lasted for 3 days post-procedure. Mitigation strategies for lingual self-trauma included: sedation or re-anaesthesia and suturing, muzzling, titrated analgesia and antibiotic treatment. Follow-up data was available for all except 2 dogs. Most dogs reported complete healing of the lingual lesions within 3 months and normal eating behaviour.

Discussion
Current recommendation for LA dosing is typically linked to body weight. This series describes a pattern of complications across multiple practices. It cannot establish causality (retrospective, uncontrolled, subjective scoring) therefore it does not allow calculation of complication incidence/ risk after IANb.

Conclusion
In this study we describe lingual auto-inflicted self-trauma as complication following IANb. Our results suggest that, albeit rare, is a possible event, mostly noticed in the immediate recovery. Breed, operator, or procedure are likely to play a role, while correct technique and volume are paramount as suggested by the previous literature[4,5]. Interventions to mitigate the trauma are effective and prognosis is generally good.

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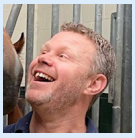
CRUZ HOUSE

EQUINE DENTISTRY

SPEAKERS



Tim Barnett
Tim graduated from Edinburgh University in 2005 and began his career working at a small animal and equine practice in East Yorkshire. He joined Rossdales in February of 2007, initially as an orthopaedics assistant and then a hospital and diagnostic centre intern. He began a surgical residency at Edinburgh in 2010, co-supervised with Rossdales, gaining his Cert AVP and DipECVS in 2013 and his DipEVDC-Eq in 2017. Tim currently works in the surgical team at Rossdales were his particular interest is soft tissues surgery, in particular upper airway, dental and sinus cases.

Astrid Bienert-Zeit
Astrid qualified from the University of Hannover and worked in different departments of their Equine Clinic becoming an Equine Specialist. Finding her main interest in dentistry and sinus surgery, she became one of the first diplomates of the European Veterinary Dental College (EVDC Equine) and wrote her Habilitation thesis on the topic of equine sinus diagnostic imaging and diseases. Astrid has recently become head of the dental department of the Equine Clinic Burg Müggenhausen. Besides the clinical work, her main activities are teaching veterinary students and the post-graduate training of veterinarians. Outside of work her major interests are riding and bicycling.

Wouter Demey
Wouter Demey graduated as a veterinarian in 2008 from University of Ghent, Belgium and focuses only on equine dentistry in his veterinary work. In 2018, he built his own state of the art clinic fully dedicated to equine dentistry. Wouter Demey provides a full range of modern dental services and is actively involved in education (co-creator of the SIR staging system and publication on intraligamentary anesthesia, several lectures at congresses like EVDF or NCED over the years), research, and professional development, having minimal invasive techniques and animal welfare at heart.

Jonathon Dixon
Jonathon Dixon is an RCVS and EBVS European Specialist in Large Animal Veterinary Diagnostic Imaging (DipECVDI) who works at Rainbow Equine Hospital in the North of England (Yorkshire) where he is a clinical director and leads the diagnostic imaging services for the hospital. He had previously undertaken a large animal diagnostic imaging residency at the Royal Veterinary College, UK, and obtained his diploma in 2017. He has particular interests in the use of standing and anaesthetized computed tomography for the equine head and neck and has published multiple peer-reviewed manuscripts relating to these topics.

Paddy Dixon
Prof. PM Dixon graduated from University College Dublin and later obtained a PhD on equine respiratory disease from The University of Edinburgh. He held positions as lecturer, senior lecturer, reader and Professor of Equine Surgery at the University of Edinburgh. His main clinical and research interests focused on equine dental disorders and head and neck surgery. He retired in 2021 but continues to work as a consultant and remains active in academic writing. Together with more than 60 postgraduate students, he has published extensively, with over 250 refereed papers and more than 7,000 citations, in addition to authoring book chapters and books. He is a European Specialist in Equine Dentistry and a Royal College of Veterinary Surgeons Specialist in Equine Soft Tissue Surgery. Over four decades, his research group has been internationally recognized for its leading contributions to equine respiratory and dental research, as highlighted in editorials in major veterinary journals.

SPEAKERS

Edward Taylor Earley
Ed Earley started at Michigan State University for his undergraduate and veterinary medicine studies. He received a Dairy Science degree in 1983 and a Doctor of Veterinary Medicine degree in 1985. In 2014 he became a Diplomate with the American Veterinary Dental College for Equine and recently in 2022 he became a Diplomate with the American Veterinary Dental College for all species and small animal. Currently, he is an Associate Clinical Professor at Cornell University working in the department of large animal dentistry and oral surgery

Bettina Hartl
Bettina Hartl graduated from the Vetmeduni Vienna, Austria in 2006. Following her graduation, she completed an equine internship at Dierenkliniek de Bosdreef, Belgium. From 2009 to 2010, she worked at the equine clinic Pferdeklinik Parsdorf in Germany, after which she worked in a mixed veterinary practice. Between 2012 and 2015, she worked at the dentistry station at the Vetmeduni Vienna. After a maternity leave, she joined the Institute of Anatomy at the same university, where she is involved in teaching and conducting research on equine dental biomechanics and the equine hyoid apparatus.

Ákos Tibor Hevesi
Akos Tibor Hevesi (1972) graduated from the University of Veterinary Medicine of Budapest in 1997. He had spent 1 year internship at the equine hospital of the uni. He established his equine clinic in 1999 which is focusing on dentistry, head surgery, general surgeries, orthopaedics, internal medicine, reproduction. He completed his PhD in 2005 based on MRI study of enchondral ossification abnormalities of the navicular bone in foals and the habilitation in 2012. Next to the special focus of equine dentistry he is doing general surgical activities at his clinic in Hungary.

Travis Henry
Dr. Henry graduated from veterinary school at Michigan State University in 1993. Shortly after graduation, he established a full-service equine clinic that expanded to an eight-doctor practice, which he subsequently sold in 2003 to commence his current practice dedicated solely to dentistry. He completed a residency in Dentistry and Oral Surgery at UC Davis in 2014. Following the residency, he achieved board certification with the American Veterinary Dental College (AVDC) in 2015 for the non-species-specific certification and earned the equine certification in 2016. He currently serves as the National Specialty Director of Dentistry for Thrive Pet Healthcare. His clinical practice is confined to equine oral surgery within the Ocala, Florida, and Scottsdale, Arizona, markets.

Matthias Jehle
Veterinary surgeon Matthias Jehle studied veterinary medicine at the University of Veterinary Medicine Vienna from 2011 to 2017. After three years as an university assistant at the University Clinic for Horses, he led the equine dental department there from 2020 to 2022. Since December 2022, he has been working as a senior at the equine dental station in Gessertshausen.

Carla Manso

Graduate in veterinary medicine in the Complutense University in Madrid . Working exclusively in equine dentistry since 1995 . Postgraduated studies in veterinary dentistry and maxilofacial surgery U.C.M. in 2005. European diplomate in equine dentistry since 2015. Member at large EVDF (European Veterinary dental Foundation), honorary president SEOVE (Spanish Society of veterinary dentistry) . Teaching lectures and courses in Spain and other countries since 1996, also teaching in different Universities.

John Mark O'leary

I graduated from the University of Glasgow in Veterinary Medicine (2004), completed an MSc in equine veterinary dentistry from the University of Edinburgh (2012), while completing his specialist training in large animal surgery from the European College of Veterinary Surgeons (2015). John Mark also completed specialist training in equine veterinary dentistry from the European College of Veterinary Dentistry (2019). He has worked as an Assistant Professor in Large Animal Surgery at University College Dublin Veterinary Teaching Hospital since 2016. John Mark is currently enrolled as an Irish Clinical Academic Training fellow at Dublin Dental University Hospital where he is doing a PhD on the molecular pathways of pulpitis, so better diagnostics and therapies can be developed. I will be comparing the inflammatory and mineralisation pathways and markers of healthy and inflamed pulp cells from human brachydont and equine hypsodont teeth through transcriptomic and proteomic analysis. I hope to determine if there are translational differences between species and types of teeth.

Frank Schellenberger

1995 graduated fom Leipzig University
1995- 1999 working at a private equine clinic in all fields of equine medicine
since 1999 own mobile equine dentistry practice providing a complete dental care for horses from routine dentistry to advanced dental surgeries
2008 foundation of pegasos4D- developing and manufacturing of innovative instruments for oral tooth extracion and dental treatment in horses
2009–2010 President of IGFP
since 2010 organising workshops in equine dentistry
since 2011 working as an external specialist for equine dentistry for other equine clinics in Germany and Switzerland

Elizabeth Schilling

Dr Schilling obtained her DVM from UC Davis. She limited her equine practice to dentistry and then expanded her dental studies and practice to all species. She taught at WesternU College of Veterinary Medicine for 10 years before returning to clinical practice and currently works in both equine and small animal dental practice.

David Seymour

David is currently enrolled in an EVDC equine dental residency which is being supervised by Henry Tremaine. David is based in the UK and he splits clinical time between Western Counties Equine Hospital in Devon and B&W Equine Hospital in Gloucestershire.

SPEAKERS

Hubert Simhofer
Hubert Simhofer graduated from the University of Veterinary Medicine in Vienna in 1992. Following a two-year period in a private equine clinic near Vienna, he completed his doctoral thesis in 1996 and returned to the University as an assistant at the Clinic for Surgery where he specialised in Equine Dentistry and Maxillofacial Surgery. In 2013 he became a specialist of the newly formed equine branches of the American and European Dental Colleges. From 2015 to 2020 Hubert Simhofer was associate professor for Equine Surgery in Vienna. In 2020 he left University and founded a private practice in which he is currently working.

Amelia Sidwell
Amelia graduated from the University of Veterinary Medicine, Budapest in 2016. She subsequently returned to the UK, spending two years in mixed practice before transitioning into equine-only practice, further developing her interests in surgery and dentistry. In 2022, Amelia embarked on an EVDC residency in equine dentistry with the University of Nottingham and Pool House Equine Hospital. Amelia is also a post-graduate researcher investigating the behavioural indicators of oral and maxillofacial pain in horses

Manfred Stoll
Dec. 1990 Veterinary Medicine (DVM) at University of Veterinary Medicine Giessen
Dec. 1991 private practice (general equine)
2001 private Equine clinic with focus on dentistry
2005–2007 Developing a new extraction procedure: (Transbuccal Screw extraction acc. to Stoll)
2007 AAEP Convention Orlando, Presentation: "How to perform a buccal approach for different dental procedures" including the Transbuccal Screw Extraction acc. to Stoll
2010 Coauthor in the Textbook, Equine dentistry: "Vogt, Lehrbuch der Zahnheilkunde beim Pferd"
2010 Horse dental practitioner acc. IGFP (International Association for improvement of the masticatory system of the horse)
2012 Specialist Veterinarian (LTK Hessen) Equine Dentistry
2014 Teaching facility (LTK Hessen) Equine Dentistry
2016 Diplomate EVDC (equine)
2018 Fellow member NCED – Nordic College of Equine Dentistry
Main Tasks: Endodontic and restorative dental therapy,

Henry Tremaine
Henry Tremaine graduated from the Royal Veterinary College in 1989, and after a spell practice undertook a residency in equine soft-tissue surgery and dentistry at the R(D) SVS where he attained an MPhil and Cert ES(Soft tissue). He subsequently worked at Ohio State University, was on the faculty at the Universities of Edinburgh and Bristol and gained his Diploma of the ECVS, and EVDC, and FHEA. He moved to a multi-centre private practice in 2017. His research activities include equine upper respiratory tract disease and dentistry, and in addition his clinical interests also extend to wound management, and laparoscopic surgery. He is an RCVS and European specialist in equine surgery, a Fellow of the RCVS and has published and lectured widely internationally and in the UK. He was a de facto member of the Equine subspecialty, and was admitted to the College in 2013. He is widely published din the field of Equine dentistry and lectures internationally. He now works in a multi-specialist Equine hospital in the West of England, UK.

Patricia Trummer-Schug

Patricia Trummer-Schug (born 1996) graduated from the University of Veterinary Medicine Vienna in 2021. Following her graduation, she completed a rotating internship at the Equine Clinic of the University of Veterinary Medicine Vienna from 2021 to 2022. She subsequently held a junior surgical position in equine dentistry at the Center for Equine Health and Research. Since 2022, she has combined fundamental research on early-stage osteoarthritis as part of her doctoral thesis with clinical work in equine dentistry at the university clinic.

Neill Townsend

Neil qualified from Bristol University in 2004 and after a brief period in mixed practice embarked on an equine only career starting with an Equine internship at Liverpool University and surgical residency at the University of Edinburgh. He re-joined Liverpool University in 2010 as a surgery clinician, setting up an advanced dentistry service including standing CT. During this time, he gained European Diplomas in both Equine Surgery and Veterinary Dentistry (Equine). He became a Fellow of the RCVS in 2023 and a Fellow of the Nordic College of Equine Dentistry in 2025. He joined private practice in 2015 where he provided both an in-house and peripatetic advanced dentistry and surgery service. He set up his own peripatetic advanced dentistry and surgery consultancy service in May 2023. He is interested in all aspects of equine surgery and advanced dentistry and lectures nationally and internationally on these subjects.

Denis Verwilghen

Prof. Denis Verwilghen is Clinical Director at Goulburn Valley Equine Hospital in Australia and Professor at the University of Melbourne. A Diplomate of both ECVS and EVDC (Equine), he is a leading expert in equine dentistry with clinical focus on dental and sinus surgery. He is actively involved in postgraduate education and clinical research in this field.

EQUINE DENTISTRY

Use of CT in the identification of equine cheek tooth disease

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RCVS & EBVS® European Specialist in Large Animal Veterinary Diagnostic Imaging
Clinical Director, Rainbow Equine Hospital
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Use of CT in the identification of equine cheek tooth disease

The equine skull presents one of the most challenging anatomical regions within equine diagnostic imaging. The hypsodont equine cheek teeth, elongated reserve crowns, structural complexity of the infundibulae and pulp systems, and the spatial relationship between maxillary cheek teeth and the paranasal sinuses render conventional two-dimensional radiography limited, even in experienced hands. Planar radiography is confounded by the superimposition of osseous and dental structures, restricting a clinician to a limited number of orthogonal planes, and this lacks the contrast resolution necessary to characterise subtle endodontic, periodontal, and alveolar pathology with confidence (Tietje *et al.*., Equine Vet J 1996;28:98–105; Townsend *et al.*., Equine Vet J 2011;43:170–178). Computed tomography (CT) has addressed these fundamental shortcomings and is currently considered the gold standard imaging modality for the investigation of dental disease.

Technical Principles and Acquisition Parameters

CT generates cross-sectional (tomographic) images through differential x-ray attenuation of tissues, reconstructed computationally with each pixel assigned an attenuation value in Hounsfield Units (HU). In this scale, pure water is designated 0 HU, air −1,000 HU, and cortical bone ≥1,000 HU, with the density of most soft tissues falling between 10 and 100 HU.

Multiplanar reformatting or reconstructions (MPR) of the topographic data in transverse, sagittal, and dorsal planes, together with three-dimensional volume-rendered reconstruction, enables comprehensive spatial evaluation of each tooth, the periodontium, adjacent alveolar bone, and the overlying (maxillary teeth) paranasal sinus compartments (Manso-Díaz *et al.., Equine Vet Educ* 2015;27:97–106). The varying densities (HU) of dental tissues – cementum, enamel, and dentine – and the lamina dura of the alveolus can then be differentiated, provided an appropriate algorithm and window width / level is utilised. A thin-slice (0.5 to 1.25 mm), bone window width and level setting is required for the interrogation of dental and osseous structures. However, evaluation in a soft tissue algorithm and window width / level is essential to characterise changes in the adjacent soft tissues, with an increased slice thickness often helpful (often around 2.5mm). In addition to facilitating visual tissue differentiation, HU values provide an objective measurement of region-of-interest (ROI) densities, allowing improved differentiation of 'tissue composition'. Cementum, dentine, and bone exhibit overlapping attenuation ranges, of approximately 550–2,000 HU, but are distinguishable from pulp (−400 to +500 HU) and enamel (>2,500 HU), permitting identification of mineralised tissue deposition and structural defects. Post-contrast imaging is sometimes utilised for equine skull imaging. However, in practice, this is rarely necessary for dental disease assessment. This can be undertaken via intravenous injection or local instillation of iodine-based contrast media (i.e., iohexol) into fistulous tracts to improve differentiation of soft tissue alterations. Likewise, use of thin malleable metal probes can also be utilised for such cases to demonstrate thin or small tracts which could otherwise be challenging to follow.

Standing CT and Cone-Beam CT

The development of standing CT platforms, in which the deeply sedated horse is positioned on a surface suspended by compressed-air skates and passed through a stationary gantry, broadened clinical access to this modality by eliminating the requirement for general anaesthesia. Avoiding general anaesthesia makes standing CT a low-risk procedure, and more recently, a sliding gantry system has also been developed. Sedation is required to minimise patient movement, though with

care not to over-sedate and induce "wobble", which will degrade image quality and introduce motion artefact. Recently, cone-beam CT (CBCT) technology – employing a cone-shaped x-ray beam directed at a flat-panel detector – has been developed for the equine head. This has significant technical limitations in standing live horses, due to inherent low-power x-ray output and the susceptibility of volumetric acquisitions to be plagued with artefacts. Nevertheless, some literature does suggest that a radiological diagnosis or the exclusion of structural changes was achievable in 97% of cases. One prospective comparison study in 11 cadaver heads using a 64-slice MDCT scanner and a CBCT unit identified dental abnormalities in 122/468 teeth (26.1%) and 105/468 (22.4%) respectively, with near-perfect overall agreement (κ = 0.90). Agreement was κ = 0.95 for clinical crown abnormalities and κ = 0.93 for infundibular abnormalities, potentially suggesting CBCT as an alternative to MDCT for dental assessment (in cadavers), with a strong caveat that CBCT image quality is inferior to MDCT for soft tissue structure assessment.

Computed tomography V radiography

Multiple studies have established the significantly greater sensitivity of CT compared with conventional radiography in equine dental disease assessment. In one study comparing CT and radiography in 32 horses with dental disease, CT demonstrated a sensitivity of 100% and specificity of 96% for the diagnosis of dental disease. Pulpar and apical / periapical changes, highly indicative of maxillary cheek tooth apical infection, were present in all 32 examined teeth on CT but in only 17/32 teeth (53%) radiographically; with gross pulpar or apical abnormalities and histological periapical changes confirmed in 31/32 (97%) of extracted teeth on pathological examination (Liuti *et al..*, *Equine Vet J* 2018;50:41–47). These findings have also been supported by earlier work.

CT features of an abnormal cheek tooth

The diseased equine tooth on CT can be systematically categorised according to the anatomical segment(s) affected.

Endodontic (Pulp) Changes

CT can detect more subtle pulpar changes than radiography, including pulp horn irregularities, increased pulp volume with a heterogeneous internal density, and – most pathognomonic of infection - gas-attenuation within the pulp horns / common pulp chambers. This may also extend to gas presence within the adjacent periapical periodontal tissues, where negative HU values are consistent with gas; attributed to by-products of bacteria such as anaerobes within a necrotic pulp. In a cadaveric study of 30 abnormal cheek teeth, intra-pulpar gas was detected by CT in 19/28 (67.9%) apically infected teeth, alveolar bone 'sclerosis' in 20/28 (71.4%) and apical tooth root clubbing in 20/28, whilst periapical 'halo' formation was identified in 4/28 cases. The source of pulp gas may be bacterial activity, or in the context of infundibular caries-related or traumatic crown fractures / defects, may represent ingress of air from the oral cavity or infundibular cavities (Liuti *et al..*, Front Vet Sci 2018;4:236).

Apical / Periapical Changes

CT features of apical infection include widening of the periodontal space, loss or irregularity of the lamina dura, thickening / remodelling of the alveolar bone surrounding the apices, with or without osteolysis, blunting of the tooth roots (clubbing), periapical gas and root fragmentation. In some cases, periapical cementum deposition is also identified. A study of 49 horses by Bühler *et al..* (*Equine Vet J* 2014;46:468–473) established that combined CT changes of the pulp, root, lamina dura, periapical bone, and periodontal space, in conjunction with the presence of a dental fracture, were reliable features to diagnose apical infection. A non-detectable lamina dura as an isolated finding

should be interpreted with caution, as it was also identified as a solitary change in 76% of tooth roots from horses without clinical signs of dental disease, possibly reflecting the inherently thin nature of the structure and resolution limitations. Periapical sclerosis, clubbing of one or two roots, the degree of apical clubbing, and periapical halo formation demonstrated high sensitivities for apical infection (73–90%), though with only moderate specificity (61–63%); multivariable analysis identified severity of periapical sclerosis and extensive periapical halo formation as CT features most strongly associated with periapical infection.

Infundibular Disease
Infundibular changes are present with a high frequency in horses on CT examination and can be seen often in asymptomatic horses. A normal infundibulum appears on CT as a hypodense, linear, central structure; infundibula may contain gas in cemental defects that must not be mistaken for an infected pulp (different anatomic location). CT features of infundibular caries include hypoattenuation of the cementum, destruction of the infundibular enamel, and filling of the infundibular cavity with gas; the most advanced stage is characterised by linear hypoattenuation with a bulbous configuration at the apical extent segment. CT allows more thorough evaluation of the extent of infundibular lesions than radiography, particularly when restorative treatment is being considered; only 10% of infundibulae were found to be entirely "normal" on CT. The term infundibular hypoplasia has been proposed given that caries is invariably associated with occlusal exposure of developmental cemental hypoplasia.

Dental Fractures
A periapical infection grading system using HU measurement of endodontic, apical, and periapical regions has been applied to sagittal cheek tooth fractures; in 81 teeth from 49 horses. Apical/periapical infection was identified in 100% of midline sagittal fractures, 73% of buccal fractures, and 96% of fractures involving the infundibulae, with midline sagittal fractures significantly associated with secondary sinusitis (OR 5.92; 95% CI 1.67–20.83; p = 0.006), demonstrating the value of pre-operative CT in fracture cases.

Periodontal Disease
CT changes in periodontal disease range from focal, early findings (widening of the hypodense periodontal space beyond 1 mm), and focal lamina dura defects – to extensive food and gas pocketing with destruction of alveolar bone. In more advanced disease, marked widening of the periodontal space and thickening of the overlying alveolar bone are seen, with pockets of periapical gas with / without extension of soft tissue – food material or gas attenuation into the paranasal sinuses. Large defects can also lead to presence of oronasal or oromaxillary sinus fistulae.

Developmental and Neoplastic Abnormalities
CT is of considerable value in characterising odontogenic tumours – which, although rare, appear more frequently in equids than in other species CBCT-guided surgery has been described for removal of ectopic teeth, enabling real-time intraoperative navigation and minimally invasive approaches (Klopfenstein Bregger *et al.*., ECVS Proceedings 2023).

Conclusions
CT – particularly standing MDCT and, potentially in the future, CBCT – has transformed the diagnostic evaluation of equine dental disease by enabling high-resolution, three-dimensional, quantitative characterisation of the tooth, periodontium, alveolar bone, and paranasal sinuses without structural superimposition. HU-based characterisation, and capacity to detect intrapulpar gas / subtle periapical change enable diagnostic accuracy substantially exceeding conventional radiography.

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When and how to use CT – the dentists perspective

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Abstract title: The role of CT in Equine dentistry

Computed Tomography (CT) imaging offers more diagnostic information than traditional two-dimensional systems. This enables imaging of greater anatomical detail, with a wide range of tissue attenuation and has the potential to eliminate the confusion that results from superimposition of surrounding structures. Currently at B&W Equine clinic is used for both standing horses, and anaesthetised animals such as foals or horses with neurological signs requiring a cervical myelogram. Patients undergo a CT examination of the head, performed with the horse under carefully monitored standing sedation with an aquisition time of 30–45s. The majority of horses accept the diagnostic procedure extremely well, although like all procedures performed in a conscious horse's, the horse's temperament and safety concerns ultimately dictate the feasibility. CT performed in the conscious sedated clinical patient is very helpful to diagnose many lesions localised to the head and cranial part of the neck depending on the conformation of the horse.

EQUINE DENTISTRY

Indications for Computed tomographic exams of the head are widespread. At our hospital these include investigation of: Horses with head trauma, including mandibular injuries and fractures; Suspected apical dental disease involving the reserve crown or apical areas and Dental fractures; Oral tumours; Paranasal sinus diseases including neoplasia, cysts, PEH, sinus empyema; Periocular lesions; Middle ear disease and Temporomandibular disease; Pharyngeal and Guttural pouch disease and cervical neurological disease.
In vitro studies have demonstrated the ability to produce high resolution three-dimensional imagery pf the nternal equine dental structures[1, 2]. In Ex vivo studies CT, has demonstrated sensitivity for detailed appraisal of occlusal secondary dentinal thickness[3], indundibular restoration[4, 5]. Clinical studies have confirmed the sensitivity for identification of dental alveololitis[6] pulpar disease and dental sinusitis[7, 8]; sinus disease[9, 10] and dental fracture[11], and it has been shown to be more sensitive than radiography[12].
Both helical and cone beam systems have been demonstrated to be diagnostic[13] but the resolution of helical systems is preferred diagnostically currently.
In many cases CT assists in determination of extent of periodontal disease, the significance of dental fractures, the presence of supernumerary dentition and appraisal of relation of dysplastic and/or fractured teeth to the surrounding structures. Localisation of disease to an individual root or pulp can assist greatly with treatment planning and outcome prediction. CT should be considered essential for determination of the extent of space occupying lesions such as Progressive Ethmoid Haematoma (PEH)[14], brain abscess[15], and neoplasia. Neoplasia involving the maxilla and mandible are often associated with teeth and CT this enables three-dimensional imaging that will inform the prognosis before undertaking ambitious surgical techniques.
Treatment planning for surgical procedures involving the head, such as sinus exploration eg for sinus cysts or mandibular fracture repair, is greatly enhanced with the benefit of 3d CT images.
Like all diagnostic imaging modalities, there are limitations with CT. Horses that are severely ataxic or with acute neurological disease can tolerate the mobility of the air plinth poorly, resulting in excessive movement and non-diagnostic image or excessive anxiety in the patient.
Cervical vertebral lesions of the mid- to caudal cervical vertebra only fit in the baryatric coils, and can require general anaesthesia. However, most horses can be managed effectively to enable a diagnostic examination of the head while standing, and in our clinic the costs of the imaging are usually offset by a more precise approach to treatment with improved outcome predictions.

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CT dental case interpretation and case management examples

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Abstract title: Computed tomography of the horse's head with a special focus on dental structures – significance in the multimodal diagnostic concept

High-resolution computed tomography (CT) is currently considered the most sensitive imaging technique for three-dimensional representation of complex pathologies of the equine head. In particular, the anatomical features of hypsodont teeth with pronounced reserve crowns, multiple pulp horns and the close topographical relationship to the paranasal sinuses often lead to diagnostic limitations due to superimposition in conventional X-rays. CT enables a superimposition-free, high-resolution assessment of dentoalveolar and sinonasal structures.
At the same time, it is important to emphasise that CT alone does not usually allow a definitive diagnosis to be made. Rather, it only reveals its maximum diagnostic value in the context of a structured, multimodal examination process. A careful medical history, including documentation of the course of the disease, previous treatments and clinical symptoms (e.g. unilateral nasal discharge, feeding problems, pain response), forms the basis for a targeted interpretation of the images. Clinical general and specific examinations – including inspection, palpation, intraoral examination, probing and percussion – provide essential information on the location and relevance of possible lesions. Endoscopic procedures also allow direct assessment of the nasal passages, the ethmoid region and the sinus drainage pathways, and provide functional information that often cannot be obtained, or at least not as well, with static computed tomographic imaging. Ultrasound can also be used to assess superficial bone changes and soft tissue reactions, or to assist with puncture-based diagnostics.In the case-based context presented, CT was shown to have high sensitivity, particularly in the detection of subtle periapical osteolysis, neoplastic processes or alveolar destruction. It allows for the precise identification of pathological processes and a differentiated analysis of the paranasal sinuses. Nevertheless, the interpretation of the findings requires critical correlation with clinical and endoscopic results in order to distinguish incidental findings from

clinically relevant lesions.
The CT data sets are therefore not an isolated endpoint, but an integral part of an overall diagnostic concept, allowing precise therapy planning and realistic prognosis assessment. In summary, the case studies underscore the importance of CT in the modern management of complex equine head disorders, but equally emphasise the need for a structured, multimodal diagnostic approach to avoid overinterpretation and unnecessary interventions.

Imaging for endodontics

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The complex and highly variable anatomy of the equine endodontic system, particularly in cheek teeth, represents a major diagnostic challenge in equine dentistry. Multiple pulp horns, age-related morphological changes, and secondary dentin deposition complicate both the assessment of endodontic status and the planning of appropriate therapeutic interventions. Advanced imaging techniques have significantly improved the understanding of equine dental anatomy. Micro-computed tomography (micro-CT) provides highly detailed three-dimensional insights into pulp morphology and interconnections and is therefore an invaluable tool in research. In clinical settings, however, evaluation of pulp vitality is of particular importance for treatment decision-making. Magnetic resonance imaging (MRI) has been demonstrated to provide the most reliable information on pulp vitality (Gerlach *et al.*., 2013). Nevertheless, due to limited availability, high costs, and logistical constraints, both micro-CT and MRI are rarely applicable in routine equine practice. Consequently, clinicians must rely on more accessible imaging modalities. Following thorough clinical and oroscopic examination, radiography and computed tomography (CT) represent the cornerstone of endodontic diagnostics in horses. CT allows for detailed three-dimensional assessment of dental structures and is particularly useful for identifying apical infections, pulpar changes, and associated sinus involvement. Despite these advantages, CT is typically not available intraoperatively. Conventional radiography therefore remains indispensable during endodontic procedures. It provides essential real-time guidance for instrumentation and allows the detection of communications between the endodontic system and surrounding structures, such as fistulae or paranasal sinuses.Radiographic contrast studies further enhance diagnostic capabilities by visualizing these communications. Barium sulfate-containing contrast media are commonly used to delineate pathways between the pulp system and adjacent cavities. Accurate endodontic instrumentation relies heavily on radiographic control. Due to the inherent limitations of two-dimensional imaging, multiple projections at different angles are often required to precisely determine the position and depth of instruments, such as endodontic files, and to avoid procedural errors.

Take-home messages

- The anatomical complexity of the equine endodontic system necessitates a multimodal imaging approach.
- Micro-CT and MRI provide superior anatomical and functional information but are currently limited to research or selected clinical cases.
- CT is the most informative clinical imaging modality for diagnosing endodontic pathology, particularly in relation to apical disease and sinus involvement.
- Conventional radiography remains the key tool for intraoperative guidance and endodontic instrumentation. (Image1)
- Contrast radiography is a valuable adjunct for identifying communications with fistulae and adjacent cavities. (Image 2)
- Multiple radiographic projections are essential to compensate for the limitations of two-dimensional imaging and to ensure accurate instrument placement.

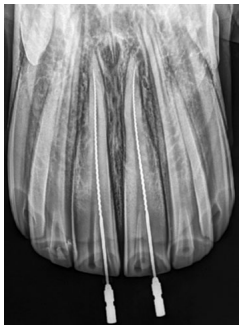

Image 1: Radiographic control of file positioning

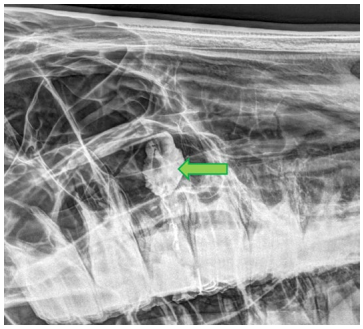

Image 2: Contrast study confirm communication of 209 (Pulphorn 1) with rostral maxillary sinus

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Can pre-operative CT help predict impending surgical challenges or aid in complication management afterwards: a radiologists perspective

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Dental disease represents a diagnostically and surgically challenging domain in equine practice, with cheek teeth lesions, particularly apical infections, diastemata, and peripheral cementum hypoplasia – accounting for a substantial proportion of referral caseloads in equine hospitals (Dixon & Dacre, 2005, *Equine Veterinary Journal*, 37(6), 476–487). Historically, diagnosis was based on oral examination / oroscopic evaluation, planar radiography, and endoscopic assessment of the paranasal sinuses, yet the complexity of equine dental anatomy and its intimate anatomical relationships with the paranasal sinuses and nasal passages have in many cases limited accurate preoperative assessment using these modalities alone (Townsend *et al.*., 2011, Veterinary Radiology & Ultrasound, 52(1), 94–100). The progressive increased availability and utility of computed tomography (CT), particularly standing, in equine practice has fundamentally transformed skull imaging, offering submillimetric cross-sectional resolution with multiplanar and 3D reconstructive capability, enabling clinicians to characterise pathology, and guide therapeutic decision-making

with a precision unachievable by conventional imaging (Henninger *et al.*., 2003, *Veterinary Radiology & Ultrasound*, 44(1), 57–65). As we learn more about the appearance of disease, and follow these cases through treatment, we may learn more regarding the risk factors for surgical treatment failure or where complication risks may lie.

The roots of the caudal maxillary cheek teeth, particularly Triadan 09–11, may protrude into or be entirely enveloped by sinus mucosa, rendering apical pathology in these teeth highly likely to produce secondary sinusitis (Barakzai & Dixon, 2011, *Veterinary Clinics of North America: Equine Practice*, 27(1), 123–137). Conventional radiography, even in optimal conditions, is limited by superimposition of overlying structures, distortion, and the restrictions in ones ability to assess surrounding osseous and soft tissue involvement (Cvindrich *et al.*., 2014, Equine Veterinary Education, 26(2), 95–102). Standing CT eliminates these limitations by generating isotropic volumetric datasets that allow retrospective reconstruction in any plane, with modern multidetector CT systems routinely achieving voxel (3D pixels) resolutions around 0.5, sufficient to resolve subtle dental / periodontal architecture, identify early periapical hypodensities, and subtle endodontic changes (Veraa *et al.*., 2009, *Equine Veterinary Journal*, 41(5), 436–441).

Preoperative Prediction of Surgical Complexity

The primary surgical approach to equine cheek tooth extraction has historically involved the oral extraction technique, yet repulsion via trephination, lateral buccotomy, or sinusotomy-assisted approaches are sometimes necessary when anatomical complexity, pathological extent or structural failure precludes oral extraction (Schumacher *et al.*., 2000, *Veterinary Surgery*, 29(3), 215–225). CT provides detailed characterisation of root morphology, including the presence of cemental hyperplasia, ankylosis, divergent or convergent root configurations, and root curvature - each of which constitutes an independent predictor of extraction difficulty and intraoperative fracture risk (Liuti *et al.*., 2018, *Veterinary Radiology & Ultrasound*, 59(6), 661–670). Liuti and colleagues, in a retrospective analysis of 58 equine cheek tooth extraction cases, demonstrated that CT-identified cemental hyperplasia and root divergence were significantly associated with intraoperative tooth fracture ($p < 0.01$), a complication with implications including potential for retained root fragments, unresolving sinusitis, and prolonged recovery (Liuti *et al.*., 2018, *Veterinary Radiology & Ultrasound*, 59(6), 661–670). This finding support the use of preoperative CT not just for identification of an infected cheek tooth but, with appropriate time to assess the findings, potentially as a surgical planning instrument to manage operative risk. A study from Townsend *et al.*. (2011) demonstrated that CT accurately predicted sinus involvement in 94% of maxillary cheek tooth apical infections compared with 61% accuracy for radiography, a difference with direct treatment success implications. Unrecognised sinus involvement may result in inadequate drainage, persistent empyema, and thus perceived surgical failure (Townsend *et al.*., 2011, *Veterinary Radiology & Ultrasound*, 52(1), 94–100). Furthermore, CT characterisation of the degree of any present (pre-surgical) osteolysis, presence of abnormal mineralisation, extent of sinus compartment involvement, and involvement of the infraorbital canal allows a surgeon to anticipate the need for concurrent sinus surgery, the extent of sinonasal lavage required, and whether additional procedures are indicated – features which can alter the complexity and duration of surgery (Barakzai & Dixon, 2011, *Veterinary Clinics of North America: Equine Practice*, 27(1), 123–137). A paper from Dubois, Dixon, and Witte (2019, *JAVMA*), evaluated clinical and CT findings in horses and ponies undergoing intraoral cheek tooth extraction and to assess which features were associated with the outcome of the procedure. The study included 74 horses and 7 ponies, all operated on by board-certified veterinary surgeons at one centre (RVC). Eighty-nine cheek teeth were included (80 maxillary and 9 mandibular). Sixty of 89 (67%) cheek teeth were extracted successfully; 70% of maxillary and only 44% of mandibular cheek teeth.
The key finding was that cheek teeth with known clinical crown fractures were statistically less likely to be successfully extracted with simple oral extraction techniques, while other individual

CT configuration factors – including dimension, type, Triadan number, form of apical / periapical change, infundibulum alterations, and root position – did not have an impact on the successful dental extraction rate. Overall, only the presence of a simple fracture (*versus no fracture*) was associated with outcome on multivariable regression analysis; the odds of successful intraoral extraction were significantly lower when this was present.
In mandibular cheek tooth disease, CT also offers benefit. The mandibular canal – housing the inferior alveolar / mandibular nerve and vascular structures – runs in immediate proximity to the apices of the mandibular cheek teeth, particularly the Triadan 09–11, and its proximity to the planned surgical corridor can be a determinant of risk of damage to these structures (Henninger *et al*.., 2003, *Veterinary Radiology & Ultrasound*, 44(1), 57–65). CT also allows precise preoperative measurements, such as the distance between the tooth apices and the mandibular canal, identification of canal displacement by expansile pathological lesions, and characterisation of mandibular cortical bone integrity. These features can provide information permitting a tailored approach minimising the risk of iatrogenic nerve injury, facial hypoaesthesia, or mandibular fracture (Tremaine & Dixon, 2001, *Equine Veterinary Journal*, 33(5), 453–462). Chronic periapical infections, trauma, peripheral odontogenic cysts and alveolar periostitis – identifiable on CT with greater sensitivity than on radiography – may substantially alter mandibular cortical architecture and necessitate modified surgical planning; CT-guided appreciation of this remodelling enables the surgeon to anticipate the need for altered surgical technique, client risk management / informed consent, or need for postoperative mandibular support (Dixon & Dacre, 2005, *Equine Veterinary Journa*l, 37(6), 476–487).

CT Following Complication occurrence
The occurrence of retained root fragments following equine cheek tooth extraction is a recognised and potentially significant complication, with reported rates ranging from 8% to 27% depending on surgical technique (Schumacher *et al*.., 2000, Veterinary Surgery, 29(3), 215–225). Retained fragments can act as sequestra, perpetuating alveolar osteomyelitis, persistent / recurrent sinusitis, or oromaxillary sinus fistula development, and accurate localisation is a prerequisite for effective intervention. Radiography in the postoperative period is frequently confounded by gas within the alveolus, and the inherent superimposition limitations described; CT simply provides unambiguous three-dimensional localisation of fragment position, size, and surrounding socket changes, informing whether a conservative approach, or further surgery may be required (Veraa *et al*.., 2009, *Equine Veterinary Journal*, 41(5), 436–441). Veraa and colleagues documented a series in which CT localised retained root fragments in 11 postoperative cases, compared with successful localisation in only 6/11 via radiography, and CT additionally identified concurrent sinus septum necrosis in 4 cases; this being a finding that altered patient management (Veraa *et al*.., 2009, *Equine Veterinary Journal*, 41(5), 436–441).
Persistent or recurrent sinusitis following dental extraction represents an indication for postoperative CT. This is increasingly valuable in the face of greater focus on appropriate use of antimicrobial therapies in veterinary medicine. Recurrent or persistent sinusitis in the post-extraction case may arise from retained roots, failure of an oro-antral defect to seal, development of fungal sinusitis, or another manifestation of uncharacterised but concurrent pathology (Barakzai & Dixon, 2011, *Veterinary Clinics of North America: Equine Practice*, 27(1), 123–137). CT can aid in differentiation between these aetiologies by characterising any present fluid "density" and distribution, identifying gas-fluid interfaces, mucosal thickening, detecting mycotic plaques (though with limited specificity), and assessing sinus wall and septum integrity. Sinoscopy / conventional endoscopy cannot reliably replicate the extent of visualisation for example within in the deeper (i.e., sphenopalatine) sinus compartments (Cindrich *et al*.., 2014, *Equine Veterinary Education*, 26(2), 95–102). This differentiation is important: progressive lavage and systemic

antimicrobial therapy often is adequate for bacterial sinusitis with appropriate drainage, whereas fungal sinusitis may require more specific topical treatment(s) or debridement. Unrecognised concurrent pathology may necessitate further extraction or sequestrectomy (Dixon & Dacre, 2005, *Equine Veterinary Journal*, 37(6), 476–487).
Osteomyelitis of the maxilla or mandible following failed or complicated dental surgery presents a further scenario in which CT augments patient and owner management. Delineation of extent of bony involvement, demarcation between normal and abnormal / necrotic bone, and the proximity of the infection to adjacent tooth roots are additive in managing the nature of debridement required; three-dimensional reconstructions permit virtual planning of surgery, allowing surgeons to define resection margins and reduce the risk of inadequate debridement or inadvertent injury to adjacent structures (Henninger *et al.*., 2003, *Veterinary Radiology & Ultrasound*, 44(1), 57–65).

Conclusion
Evidence supports CT as the imaging modality of choice for surgical planning in equine cheek tooth disease, additionally having capabilities to potentially predict extraction difficulty, quantifying risk, and guiding treatment approaches in a manner superior to radiography. Equally, its role in post-complication management – through precise localisation of retained material, iatrogenic trauma, characterisation of sinonasal sequelae, or delineation of osteomyelitis, renders it indispensable. The primary constraints remain cost, and potentially geographic availability; however, in many cases persistent (unsuccessful) interventions in complications post-operatively can cumulatively become of great expense to a client. As such, a larger up-front cost expenditure may be justifiable to rapidly guide a successful resolution. Standing CT systems mean that the risks posed to patients are minimal, and acquisition times are short; often in line with that used for a typical dental series of radiographs.

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Radiographic identification and description of the equine middle conchal sinus (mcs): implications for diagnosing mcs sinusitis

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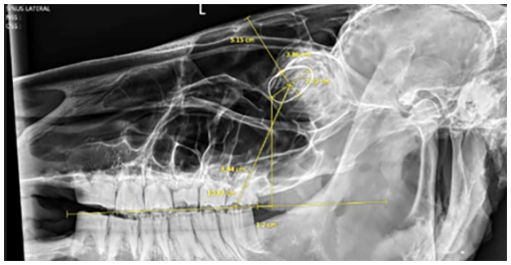
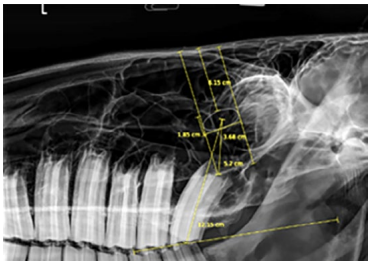
Introduction
The middle conchal sinus (MCS), also termed the ethmoidal sinus, remains one of the least understood equine paranasal compartments. Despite recognition of its involvement in sinonasal disease, it remains underdiagnosed in absence of CT due to limited anatomical understanding and challenges with radiographic visualization.

Materials and Methods
Three equine cadaver heads representing different age groups underwent standard radiographic projections before and after sagittal sectioning and placement of wire markers outlining the MCS. Radiographs were evaluated to identify and describe consistent anatomical landmarks. A clinical case of MCS sinusitis confirmed by CT was used for comparative assessment.

Results
The MCS was not identifiable on pre-dissection radiographs. Post-sectioning images revealed consistent latero-lateral radiographic landmarks, notably its ovoid shape superimposed with the ethmoid turbinates and located dorsal to the third maxillary molar (111/211). Oblique projections allowed side differentiation. On dorsoventral projections, the MCS was consistently superimposed with the middle nasal meatus and the rostral margin of the ethmoid turbinates, allowing tentative localization in all specimens. The clinical case demonstrated pathology at the predicted MCS site, correlating with cadaveric observations.

Relevance to Clinical Practice
This study provides a reproducible radiographic reference for localising the MCS using widely available imaging techniques. Improved awareness of its location and presentation on radiographs will aid clinicians in diagnosing sinus disease involving this compartment, especially when CT is unavailable. This work also highlights the need to reassess the role of the MCS in persistent or atypical sinusitis.





EQUINE DENTISTRY

Intraoral X-Rays Of The Maxillary Region, As An Aid To The Determination Of Age In Purebred Spanish Young Horses (Pre)

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Introduction

In horses, it is difficult to determine their exact age by dentition in the period between the eruption of the third deciduous incisors (6–9 months) and the eruption of the first permanent incisors (30 months)1,2.

Objective

To show that intraoral radiographs of the incisors can more accurately determine the age in these periods, if we study both the formation of dental germs and their radiographic evolution.

Material and methods

Intraoral radiographs were performed of the incisors of the maxillary region of 101 Purebred Spanish Horses (PRE) (51 males and 50 females), all of known ages and ranging from 178 days (5.9 months) to 1001 days (33.3 months). The studies were performed with portable radiology equipment and processed with DR. All of them underwent an intraoral x-ray of the maxillary region3,4, exposure factors were ranging from 45–60 kVp and 2–3 mAs.

Results and discussion

Based on the radiographic findings considered as reference, the following groups have been established:

1. Group 1: corresponding to specimens, between 178 and 213 days, in which only deciduous incisor teeth are present.
2. Group 2: specimens between 179 and 285 days, in which the dental germs of teeth 101 and 201 appear, but without content inside.
3. Group 3: specimens between 265 and 548 days with the dental germs of 101 and 201 with non-erupted crowns with a conical shape, but without infundibulum.
4. Group 4: specimens between 440 and 608 days with the germs of 101 and 201 in which the poorly developed infundibulum is visible. The dental germs of 102 and 202 are also visible (Figure).
5. Group 5: specimens between 613 and 855 days in which the infundibules of 101 and 201 are closed and the dental germs of 102 and 202 contain unerupted crowns.
6. Group 6: specimens between 758 and 925 days in which 101 and 201 have not yet erupted and 102 and 202 present an infundibulum with greater or lesser development, but without closure.
7. Group 7: specimens between 925 and 1001 days, with 101 and 201 erupted, 102 and 202 with closed infundibules and germs from the 3rd incisors with enamel appear.

The description of the radiographic evolution of teeth is similar to those previously provided by the authors5, although in our study we establish its relationship with age.

Conclusion

The study of dental germs in the PRE-horse helps to better determine the age between 12 and 30 months.

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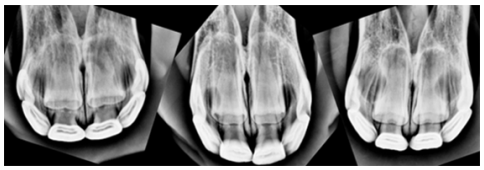

Figure: Group 4.

Owner informed consent in equine dentistry

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Informed consent in equine dentistry should serve three fundamental objectives: ensuring patient safety, providing legal security for practitioners, and establishing a robust trust-based partnership with the owner. Regulatory approaches differ internationally not only in veterinary medicine[1,2] but also in human medicine. Regarding timing, human medicine typically requires a minimum 24-hour interval between consent discussion and intervention; veterinary standards similarly recommend advance consultation where feasible, though emergency situations permit immediate treatment. The literature on owner informed consent in veterinary medicine is naturally less extensive than its human medicine counterpart. Publications address ethical frameworks[3,4], legal considerations4, practical implementation challenges[5–7] and communication dynamics[8–10]. The unique relationship in veterinary medicine-involving veterinarian, animal patient, and owner-creates distinct challenges for informed consent. A central challenge lies in balancing adequate risk disclosure with client reassurance, while following national legislation and good practice. Overly detailed enumeration of rare complications may induce unnecessary anxiety, potentially deterring owners from pursuing medically indicated treatments. Conversely, insufficient disclosure exposes practitioners to liability and compromises client autonomy. Optimal practice therefore demands tailored communication that conveys material risks proportionate to severity and likelihood, whilst maintaining therapeutic alliance and supporting informed decision-making without undue alarm. Key themes emerging from the literature include the tension between owner autonomy and animal welfare[3,4,11], the importance of readable and comprehensible consent materials[6,7] the central role of communication in effective consent processes[8–10], and the need for continued development of best practices, particularly in research contexts [12,13]

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Mortality and Morbidity rounds and follow up in my practice – why?

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Key Take-Home Messages

- ***M&M in equine dentistry is a marker of professional maturity, not just a safety tool.***
  Embedding structured review and follow-up reflects a commitment to evolving standards, refining practice, and continuously improving outcomes-moving the discipline toward true clinical excellence.
- ***M&M without follow-up is theatre, not clinical governance.***
  Discussion alone does not improve outcomes-only structured action, ownership, and re-evaluation close the loop.
- ***Complications are signals of system performance, not individual failure.***
  At specialist level, outcomes reflect the interaction of decision-making, workflow, communication, and environment-not a single pair of hands.
- ***Trends matter more than cases.***
  Individual events may mislead; analysing patterns over time (infection rates, anaesthetic events, treatment failures) is where real improvement happens.
- ***Psychological safety is a clinical tool.***
  Without a culture that allows open discussion across all team members, the most critical information never surfaces-and improvement stalls.

Morbidity and Mortality (M&M) rounds are widely recognised in human healthcare as a cornerstone of clinical governance and patient safety. In veterinary practice-and particularly within specialist equine dentistry-their implementation often remains inconsistent, variably structured, or limited to retrospective case discussion without meaningful follow-up.
Yet, it is precisely at specialist level, where case complexity, expectations, and risks are highest, that structured reflection becomes most critical.
In my practice, M&M rounds have evolved beyond a forum for case discussion into an integrated system of continuous quality improvement. The rationale is simple: adverse outcomes are inevitable in complex clinical environments, but failure to analyse, translate, and follow up on these events represents a missed opportunity to improve both patient care and team performance.
Rather than focusing on isolated "errors," M&M rounds are used to systematically examine deviations from expected outcomes, including morbidity, mortality, and near-miss events.
These are rarely attributable to a single individual or decision. Instead, they reflect the interaction of clinical reasoning, technical execution, communication, workflow design, equipment, and organisational structure. At a specialist level, recognising and interrogating this complexity is essential. A defining feature of effective M&M processes in practice is not the discussion itself, but what follows. Structured follow-up transforms reflection into action. This includes implementation of targeted changes-ranging from protocol adjustments and equipment choices to communication pathways and team training-as well as the monitoring of outcomes over time. Without this longitudinal component, M&M risks becoming an intellectual exercise rather than a driver of real-world improvement. Equally important is the shift from case-based reflection to population-level insight. Reviewing trends across defined time periods-such as complication rates, surgical site infections, anaesthetic events, or diagnostic delays-allows identification of patterns that may otherwise remain invisible. This data-driven perspective strengthens clinical governance and supports more objective decision-making within the practice.

Cultural aspects remain fundamental. Effective M&M rounds require psychological safety, multidisciplinary participation, and a shared commitment to transparency and learning. In a specialist environment, where hierarchies and expertise levels may be pronounced, maintaining this culture is both more challenging and more important. The goal is not to assign blame, but to understand systems and improve them. This presentation explores how M&M rounds are practically implemented and sustained within a specialist equine practice, with a particular focus on follow-up mechanisms and measurable impact. It addresses not only the "how," but critically the "why": why structured reflection must be embedded into routine clinical workflows, why follow-up determines success, and why specialist practice has both the responsibility and the opportunity to lead in this domain. Ultimately, M&M rounds-when coupled with robust follow-up-shift practice from reactive problem-solving toward proactive system improvement, supporting better outcomes for patients, stronger teams, and more resilient clinical environments.

Will it be easy or hard to extract

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Exodontia in equine patients is optimally performed intraorally. Research has demonstrated that preserving the bony alveolus throughout both the extraction process and subsequent healing phase significantly minimizes complications. The feasibility and complexity of oral extraction are influenced by several factors, which must be carefully evaluated during planning.

In this presentation, we will address these critical considerations and strategies for achieving successful extraction outcomes.

Endodontic Status
The initial step in assessment involves evaluating the tooth's endodontic status within the oral cavity to determine its viability. Non-vital teeth with significant decay present increased challenges during extraction. If all pulp chambers are open or exposed, there is a heightened risk of crown failure or separation during manipulation. Additionally, assessing the extent of root resorption and blunting is essential, as these factors can markedly impact the ability to remove the tooth effectively.

Periodontal Status
Periodontal evaluation is integral in determining tooth mobility relative to the bony alveolus. Periodontitis leads to bone loss presenting as either vertical loss (with pocket formation) or horizontal generalized loss along the buccal and lingual aspects. A widened periodontal ligament typically indicates inflammation and may facilitate extraction. Conversely, teeth with a narrow or nearly absent periodontal ligament complicated by endodontic disease frequently present significant extraction challenges.

Anatomical Findings
It is crucial to account for anatomical variations of the tooth. Abnormal rotation or morphology may necessitate advanced techniques such as sectioning or coronectomy. Furthermore, anatomical anomalies may coexist with additional dental conditions; supernumerary and impacted teeth are examples addressed under anatomical findings.

Conclusion
Comprehensive examination of the oral cavity, supplemented by appropriate imaging, is necessary to establish an accurate diagnosis. The resulting treatment plan should integrate both diagnostic findings and consideration of the tooth's eruption pathway and extraction biomechanics. Thorough evaluation and planning are vital for maximizing extraction success and minimizing complications.

Retrieving or leaving fragments?

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The complete removal of dental fragments during or after tooth extraction in horses is often the aim in clinical practice but is not strictly necessary in all cases. The aim of this article is to formulate an evidence-based and practice-oriented basis for decision-making regarding the indication for or against the removal of dental fragments, based on current literature and personal experience. Retained tooth fragments, particularly apical root remnants, represent a significant risk factor for postoperative complications. Gergeleit and Bienert-Zeit (2020) demonstrated that alveolar sequestrations can result from this and usually require surgical intervention. Pathophysiologically, fragments act as foreign bodies and bacterial reservoirs, which promotes chronic inflammation, fistula formation and delayed wound healing. The clinical relevance is supported by the case report from Clarysse *et al.*. (2025), in which persistent sinusitis and an oronasal fistula could only be resolved following the complete removal of remaining fragments.

Modern extraction techniques therefore explicitly aim for complete removal in order to minimise complications (Leps *et al.*. 2024). At the same time, Biermann *et al.* (2025) point out that, particularly in geriatric horses, the increased fragility of the teeth raises the risk of intraoperative fractures and necessitates a careful risk-benefit assessment regarding their removal. Not all tooth fragments necessarily require removal. Small, "sterile and inactive" fragments may, under certain circumstances, be left in the alveolus provided there are no clinical symptoms or progressive radiographic changes. In such cases, a controlled, conservative approach is justified, particularly if the surgical risk would be increased. Regardless of the chosen strategy, comprehensive documentation and the mandatory provision of information to the owner and the referring veterinarian regarding any remaining tooth fragments are essential. Only in this way can adequate follow-up care, including clinical and imaging follow-up checks, be ensured and the risk of delayed complications be identified at an early stage. In summary, the decision to remove fragments should be made on an individual and risk-based basis. Whilst infected or clinically active fragments should be removed consistently, a watch-and-wait approach may be justifiable in asymptomatic cases, provided that transparent communication and close follow-up are ensured.

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Anticipating and managment of post extraction complications

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Abstract title: Anticipating and Managing Post-Extraction Complications in Equine Exodontia
Equine exodontia, particularly when performed using intraoral techniques, typically has a low rate of complications. However, as with all surgical procedures, complications are an inherent risk. Preventing complications starts with a comprehensive understanding of equine oral anatomy, followed by a thorough diagnostic workup, and a treatment plan tailored to the specific dental pathology necessitating the extraction.

Challenges in Equine Oral Surgery and Wound Management

The equine oral cavity presents unique challenges for extraction procedures. The small oral opening and long oral cavity make access difficult, requiring the careful use of long, sharp instruments in a sedated horse with potential for tongue movement and chewing. While extraction sites are often sutured in other species, this is generally not feasible for equine cheek teeth due to limited access and minimal mucosal tissue for closure. Although mucogingival flaps can facilitate closure for incisor and canine extractions, these sites have a high incidence of dehiscence in horses. This is primarily due to the tension created by the horse's lip movement during prehension, and irritation from coarse feed material easily entrapped in the sutures.

Despite these challenges, the equine oral cavity possesses an excellent blood supply, promoting rapid granulation tissue formation and healing. The main rationale for suturing incisor and canine extractions is to protect the blood clot, which is vital for releasing healing factors into the alveolus.

Alveolar Management and Packing
For cheek teeth extractions, the primary goal is to protect the blood clot from food material invasion. The ideal packing material is one that biodegrades, allowing the alveolus to quickly fill with granulation tissue. While no single substance is perfect, the choice of packing material requires careful consideration. Since a robust blood supply is crucial for alveolar healing, it should be assessed *before* surgery. Diagnostic imaging can reveal factors like sclerotic bone, significant soft tissue swelling, or a jaw fracture, all of which suggest potential blood supply disruption. Post-extraction, signs like lack of readily apparent hemorrhage or discolored bone also indicate that normal healing may be compromised. If the bony alveolus is incomplete, the blood clot may not be maintained, and healing factors will not be released effectively. In these cases non-dissolvable or slow-wearing packing materials (e.g., dental impression material, gauze and other plastic like materials) are used, and when used, they must be changed frequently and shortened to allow granulation tissue to fill the alveolus rapidly. Once granulated, the environment is resistant to infection.

Complete alveoli should not be packed with rigid materials, such as polymethyl methacrylate or impression materials. These substances hinder full alveolar filling because they only allow granulation tissue to develop up to the level of the packing material. To achieve complete alveolar filling with a rigid non absorbable material, the packing material must be changed repeatedly and gradually shortened over a period of several weeks. In cases where the alveolus is not complete and communicates with a sinus or a draining tract to the epidermis, a material that sets up rigidly and cannot be misshaped is essential to prevent it from being exuded into the sinus or tract. This happens due to the fact that there is no blood clot for the material to sit on. One should consider placing the material and letting it set up and then removing immediately and trimming the alveolar plug material so that it does not protrude into the sinus or tract. If the material is placed so that it protrudes into the draining tract or sinus it will act as a nidus and have deleterious effects on healing.

Antibiotic Therapy
The use of antibiotics is often debated. They are most critical in the early healing phase before granulation tissue is established. Once the alveolus is fully covered with granulation tissue, antibiotics are less often needed. However, certain situations, such as traumatic cases, immunocompromised patients, or those with a history of chronic antibiotic use, may necessitate longer treatment times. The use of antibiotics in chronic cases should be based on culture and sensitivity results.

Conclusion
Most oral extractions with a complete bony alveolus and a normal blood supply will heal uneventfully, regardless of the packing material or diet. The key to successful management is identifying factors that could contribute to a lack of clot formation, epithelization, or sequestra formation, which mandates frequent rechecks. It is crucial to discuss these potential issues with the owner during treatment planning so they are prepared for the need for intensive follow-up care in complicated cases.

The horse has not been eating since dental treatment. Causes, possible consequences, therapeutic options, and forensics

Frank Schellenberger

There are many possible causes for this problem. The same applies to the possible consequences. These vary from harmless-the problem resolves itself-to a worst-case scenario with a subsequent hospital stay and five-figure costs for the necessary follow-up treatment. The therapeutic spectrum is equally variable.
The causes and consequences can be divided into different categories

1. Latrogenic trauma
2. Absolute and relative 'intensive' changes to the natural tooth shape with a 2° loss of function = over-floating, and its effects.
3. Unfortunate chain of circumstances – no specific cause can be verified

Group 1 largely consists of manual errors, some of which are individual and some of which are caused by a certain systemic error resulting from the instrumental equipment. There is no age-specific occurrence here. 1.5. is a problem that, according to osteopaths' reports, occurs much more frequently than is commonly assumed. There are no valid figures on this topic to date. However, it seems obvious to note here that the less I have to open the horses mouth while working, the lower the risk of problems with the temporomandibular joint structures. There are a number of ways to counteract this. Therapeutically, the range extends from spontaneous healing or short-term temporary use of NSAIDs to costly follow-up treatments with computed tomography and complex surgical intervention.

Group 2 primarily consists of 2° functional disorders resulting from absolute and/or relative overfloating. Young horses are only affected by this problem in exceptional cases. This makes it all the more difficult to predict the effects of the method, because ageing horses (>15 years) increasingly lose their reserve capacity. Another problem is local subclinical and clinically significant pre-existing damage in ageing horses. This group of patients can react promptly and violently to further functional limitations. The interesting thing about this group is that they demonstrating the possible effects of our treatment and at the same time they can inspire us to think about fundamental issues. The therapy for these cases is very individual and simple NSAID administration is rarely successful. Here, too, very cost-intensive follow-up treatments may be necessary.

In summary, we should be aware that a significant proportion of 'routine dental treatment', is performed on clinically healthy horses. Here, more than anywhere else, the rule primum non nocere applies.

However, complications that arise can also help us to rethink and improve our working methods in the long term. However, this only happens if we deal with them appropriately. Last but not least, the algorithm of 'evidence collection' is also important, as it is not only of interest to science but also relevant to possible forensics.

EQUINE DENTISTRY

Behavioural indicators of oral pain in horses: Towards the development of an equine dental ethogram

Amelia Sidwell

Dental disease is highly prevalent in horses, yet frequently remains undetected until advanced pathology is present. While overt clinical signs such as nasal discharge or facial swelling may occur, more subtle behavioural changes often go unnoticed. This study investigated behavioural indicators of dental pain, with the aim of developing an ethogram to support diagnosis, monitoring, and welfare assessment in equine dentistry.

Horses with confirmed dental pathology on sedated oroscopic examination were compared with controls free from oral disease. Overnight video surveillance was employed to capture both eating and general behaviours in undisturbed horses, while parallel caretaker observations provided insight into which behaviours were readily identified.

Pilot work identified candidate behaviours – such as yawning, atypical jaw movements, altered head position, and changes in eating behaviour – that may serve as reliable indicators of discomfort. Based on these pilot observations, an a priori power calculation determined that a minimum of nine horses per control group was required to detect meaningful differences (balanced one-way ANOVA, k = 3, Cohen's f = 0.64, α = 0.05, power = 0.8). This confirmed the feasibility of the study design and ensured robust statistical comparisons. The study aimed to identify distinct behavioural differences between horses with and without dental disease, some of which were not consistently recognised by caretakers. These findings will be presented at the conference. By refining pain recognition and enhancing clinical decision-making, this work has the potential to improve both early diagnosis and welfare outcomes in equine dental practice.

Non-erupted supernumeric incisor as a cause of headshaking (case report)

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Introduction
Headshaking in horses is a commonly encountered syndrome, recognized by spontaneous and often repetitive uncontrolled movements of the head and neck, which can occur intermittently or persistently (Newton, 2005; Madigan & Bell, 2001). The majority of horses presenting with signs of headshaking are diagnosed with trigeminal-mediated headshaking (Pickles *et al.*., 2014). Other causes can be local diseases such as dental problems, periapical dental osteitis, rhinitis, intranasal masses, and sinusitis (Pickles at al. 2014; Newton *et al.*. 2000; Gilsenan *et al.*. 2014) infraorbital canal changes (Edwards *et al.*. 2019). We couldn't find publication considering supernumeric tooth induced headshaking. Our objective is to present a successfully treated headshaking caused by a non-erupted supernumeric and other misaligned incisors. Materials and methods: A 12 years old dutch warmblood showing spontaneous, intermittent and repetitive vertical/horizontal movements of the head and neck during exercise. Priorly the horse had detailed physical and edoscopic

examination at different clinics. Nose cover was used by the owner without satisfactory result. Former examinations diagnosed misaligned, mispositioned, malformed 102–103 and a remnant 503. At our clinic x-ray of the incisors and transverse CT images of the head were acquired on a standing sedated horse from the occipital region until the incisors. The images revealed a non-erupted supernumerary incisor positioned deeply within the right incisive bone, thinning and bulging out the dorsal compacta of the bone at the alar fold region. The right sided infraorbital nerve block caused mild improvement. The CT did not reveal any other changes in the rest of the head that could correlate to the actual headshaking condition. Based on the results we decided to extract the 503 remnant, the 102–103 and the supernumeric incisor. The surgery was performend on a standing sedated (0,01 mg/bwkg Detomidin-hydroclorid and 0,01 – 0,02 mg/bwkg butorphanol) horse using infraorbital nerve block and local lidocaine infiltration. For packing platelet rich plasma covered with calcium/sodium alginate were used and changed 2–4 days intervalls until the granulation level made the packing unnecessary. For oral hygiene 0,2% chlorhexidine was used twice daily. NSAID and combinated penicillin were administerd in the first 5 days following extraction. Results: 2,5 months after the operation the horse could start working again without any signs of headshaking. Conclusions: In the horse, clinical signs attributed to supernumerary incisor teeth are rarely noted and therefore treatment is not sought (Baker 1991; Dixon *et al.*.1999b; Baker 1999). Although we could not prove 100% our final diagnosis but the negative results of the complex examinations focusing on the frequent causes of the headshaking turned us towards the pathological conformity of the incisors including the supernumerary one.

Equine Case Report: Zygomatic Arch Resection and Coronoidectomy in a 2-year-old Thoroughbred filly

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A 2-year-old Thoroughbred filly presented for a facial deformity that occurred from a traumatic injury as a foal. A Computed Tomography examination revealed that the coronoid process of the right vertical ramus (mandible) fused with the zygomatic arch creating a pseudoankylosis. The boney callus limited the horse's mobility of the jaw and her ability to prehend food, graze and masticate. Additionally, a severe skull asymmetry was present which created a "shearing" malocclusion involving the left maxillary and mandibular 2nd and 3rd deciduous premolars.

The horse was placed under general anesthesia. An initial vertical incision was created over the zygomatic arch in alignment with median aspect of the long axis of the coronoid process. Once the zygomatic arch was isolated a sagittal saw was used to create a 2.5 cm segment of the arch directly over the coronoid process. A Hall's surgical drill with an oval carbide bur was then used to create an osteotomy of the segment and section through the callus down to the coronoid. The segment and callus were removed to expose the coronoid process. Once isolated a 3.5 cm long section of the coronoid process was sectioned using the surgery drill with a long bur and guarded shank. Care was taken to leave a thin rim of bone along the medial aspect of the coronoid to avoid trauma to soft tissue, vascular and nerve structures. Using gentle pressure with an osteotome the final portion of the coronoid was severed. An additional incision was created just dorsal to the coronoid process. A Periosteal elevator was used along the axial and lateral aspect of the sectioned coronoid process to remove soft tissue attachments so that the segment could be elevated and removed through the dorsal incision. Both incisions were closed and increased mobility of the jaw was noted.

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A dental speculum was placed. The left maxillary and mandibular deciduous 2nd and 3rd premolars (606, 607, 706 and 707) were extracted due to severe malocclusion. Slight odontoplasty was performed on the left maxillary and mandibular deciduous 4th premolars and permanent 1st molars (608, 708, 209 and 309).

A one-month follow-up surgical and oral examination was performed. Both surgery sites had healed. The range of jaw motion improved, and the dental speculum could be opened an additional ~20 mm. The left maxillary and mandibular permanent 2nd and 3rd premolars were partially erupting.

A Review of Nasal Cavity Disorders Associated with Equine Sinus Disease

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Introduction
In recent years, it has become increasingly recognized that many cases of equine sinus disease are accompanied by nasal cavity disorders. Together, they can be more accurately referred to as sinonasal disorders.

Nasal conchal bulla disorders
Sinus-associated nasal disorders include empyema or distortion of the ventral and dorsal nasal conchal bullae. These anatomical structures have often been neglected in the equine literature. Nasal conchal bulla changes are observed in more than 50% of horses with sinus disease, particularly in cases with purulent sinusitis, such as primary and dental sinusitis. Whilst computed tomography imaging (CT) is the most reliable method for detecting such changes, financial and practical limitations often restrict its use. These conchal bulla changes can usually be endoscopically identified in the lateral aspect of the middle meatus as a swollen, rounded structure, possibly fistulated. A smaller (typically less than 10 mm diameter) flexible endoscope is best for this examination. With appropriate training, nasal conchal bulla changes can also be recognized on lateral-oblique head radiographs. Anatomical, endoscopic, and diagnostic imaging examples of normal and diseased nasal conchal bullae will be presented, and their treatment discussed.

Sinonasal fistulation
Another common concurrent sinus and nasal disorder is spontaneous sino-nasal fistulation, which mainly occurs between the lateral aspect of the middle meatus and the rostral or rostro-medial aspects of the ventral conchal sinus. When identified, this fistula can sometimes be used as a portal to lavage the sinuses. However, direct endoscopic access to the rostral maxillary sinus from this portal may be difficult in young horses.

Inspissated Exudate and Sequestra in the Middle Meatus
In many cases of sinusitis (44% in a recent large study), the middle meatus, particularly its lateral aspect, develops an accumulation of inspissated exudate, and/or sequestered nasal conchal or nasal bulla bone, sometimes with overlying secondary, dark fungal plaques. These lesions are best detected using a small endoscope as described above, which can actually be more sensitive than.

CT imaging in identifying these lesions
In some cases, visualization of the middle meatus may be obstructed by large amounts of exudate present at this site. Vigorous flushing of this area transendoscopically, using high volumes of lukewarm water or 1% saline solution using a diastema pump, can remove exudate and allow clearer visualization of the remaining area. Most such exudate can be lavaged into the nasopharynx or common nasal passages, as described earlier. Firmer areas of inspissated exudate can be "flicked"

down into the nasal passages by flexing the endoscope tip, where they may be swallowed or snorted out of the nostrils. Irregular pieces of the thin, lacelike bone can be transendoscopically grasped with biopsy forceps and retracted back through the middle meatus and then nostrils or pushed into the common nasal meatus if too large. Examples of these middle meatus lesions will be presented.

Triadan 06 and 07 Infections and Sinus Disease
Because their apices normally lie outside the sinuses, apical infections of Triadan 06 and Triadan 07 cheek teeth do not directly cause equine sinus disease. However, infections of these teeth may be present along with apical infections of adjacent Triadan 07 and 08 teeth, particularly of the 08, and so be associated with sinusitis. There are also documented instances where apical infection of the Triadan 07 teeth led directly to sinusitis, and some examples will be presented.

Sino-Nasal Fistulation and Sinus Disease
The formation of an oro-nasal fistula following the extraction of Triadan 06 or Triadan 07 teeth allows food material to enter the nasal cavity. This will lead to foreign body rhinitis, which can become severe in some horses and can subsequently result in ipsilateral sinusitis.

Equine Paranasal Sinus Pathobiology

Hubert Simhofer

Equine paranasal sinus disease is a complex clinical challenge, primarily due to the intricate anatomy and their proximity to critical dental and neurological structures. Understanding the etiopathogenesis is essential for effective clinical management. Current scientific literature classifies these disorders into primary and secondary categories2, each with distinct pathophysiological pathways.

Anatomy and Mucosal Physiology
The equine paranasal sinuses consist of the rostral and caudal groups of sinuses, which are separated by a bony septum1,2. The rostral sinus compartment comprises the rostral maxillary and ventral conchal sinuses. It drains via the rostral sinonasal canal. The caudal sinus compartment comprises the caudal maxillary, conchofrontal, and sphenopalatine sinuses and drains via the caudal sinonasal canal. The nasomaxillary aperture (Apertura nasomaxillaris) is located in the middle nasal meatus, this slit-like opening leads into a common sinonasal canal which bifurcates into the rostral and caudal sinonasal canals.

Mucosal Characteristics and Defense
The sinuses are lined with pseudostratified columnar ciliated epithelium and mucus-producing goblet cells. Under normal conditions, mucociliary clearance is the primary defense mechanism, with cilia beating in a coordinated fashion toward the drainage ostia into the nasal cavity. Histological studies show that the nasomaxillary aperture, the critical drainage point, has a significantly thicker mucosa (~820 µm) compared to the general sinus mucosa (~75 µm) and contains five times more goblet cells3. This makes the aperture highly prone to obstructive swelling during inflammation.

Age-Related Changes: In younger horses (under 5 years), the maxillary sinuses are largely occupied by the massive reserve crowns of the cheek teeth. As the horse ages, these teeth erupt and shorten, leading to a progressive increase in sinus volume and a decrease in mucosal thickness.

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Common Pathological Processes
Sinus disease is primarily classified into two categories based on its origin.

1. ***Primary sinusitis:*** Often follows an upper respiratory tract infection. Viral or bacterial (e.g.,Streptococcus equi) insults cause mucosal edema and hypersecretion. If the swelling obstructs the narrow nasomaxillary opening, trapped exudate can become inspissated (thickened), leading to chronic, non-resolving infection.
2. ***Secondary sinusitis:*** The most frequent cause is dental disease (60–80% of cases), specifically periapical infections of the distal maxillary cheek teeth. Bacteria penetrate the thin alveolar bone to inoculate the sinus, often causing malodorous empyema due to anaerobic organisms.

Space-occupying lesions
Non-infectious pathologies also significantly alter sinus function: Paranasal sinus cysts: Benign, fluid-filled cavities that grow progressively, exerting pressure that may thin or distort facial bones can compromise the infraorbital nerve and nasolacrimal duct.

Progressive ethmoid hematomas (PEH): Locally destructive, non-neoplastic hemorrhagic polyps. They typically arise from the ethmoid labyrinth and expand into the sinuses, causing intermittent, low-grade epistaxis.

Neoplasia: Neoplastic sinus disease is rare with squamous cell carcinoma being the most frequently diagnosed malignant tumor in the paranasal sinuses. These are aggressive, invading bone and causing secondary bacterial infections due to tissue necrosis.

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Differentiating varying sinus pathologies on advanced imaging

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Differentiating varying sinus pathologies on advanced imaging (CT)
The equine paranasal sinuses represent one of the most anatomically complex regions of our equine patients. The sinuses accommodate multiple causes of disease, including that secondary to cheek teeth infection, benign and malignant space-occupying intra-sinus masses, trauma, oromaxillary sinus fistulae, and mycotic infections, and in the absence of any identifiable underlying cause, the remainder are by default: primary sinusitis. Accurate differentiation of these conditions has implications for surgical planning, prognosis, and patient welfare. Conventional radiography has historically formed the basis of imaging in equine sinus disease, yet its utility is fundamentally constrained by the superimposition inherent to the complex craniofacial architecture.

The use of computed tomography (CT) has had a positive impact on the diagnosis of equine sinonasal disorders, allowing detailed imaging in multiple planes without the presence of overlapping structures. This review evaluates the CT characteristics of primary sinusitis, dental secondary sinusitis, mycotic sinusitis, paranasal sinus cysts, progressive ethmoid hematoma (PEH), sinonasal neoplasia, and traumatic sinus injury, with the emerging veterinary literature supporting CT as the imaging modality of choice.

Primary and Secondary Sinusitis

Primary sinusitis, meaning sinus inflammation in the absence of identifiable additional cause, and secondary bacterial sinusitis arising from dental, primary fungal, traumatic, or mass-associated aetiologies, share overlapping CT appearances though with distinguishing features when evaluated systematically. In primary or dental sinusitis, soft tissue attenuating to fluid material, with decreased volume of air is present within the sinus, associated with exudate caused by bacterial infection and adjacent mucosal thickening / oedema. The relevance of CT over radiography is demonstrated by a 97% (CT) sensitivity, facilitating the diagnosis of periapical infections that could lead to secondary sinusitis. In contrast, radiography has demonstrated sensitivities of 76–80% in clinical populations (Townsend *et al.*., 2011). Compartment involvement on CT has been widely characterised. The rostral, and more dependent sinus compartments are most commonly involved, with the rostral maxillary sinus affected in 284 of 300 horses (94.7%) and the ventral conchal sinus in 87% of cases. The caudal maxillary sinus (65.3%), dorsal conchal sinus (52.7%), frontal sinus (26%), ethmoidal (or middle conchal) sinus (32%), and sphenopalatine sinus (28.7%) were less commonly affected. Furthermore, there was involvement or deformity of the ipsilateral nasal conchal bullae in 56% of horses with paranasal sinus disorders. This information, limited in assessment on radiography, guides surgical approach selection and underpins the superior nature of CT in equine sinusitis evaluation.

Fungal sinusitis is much less common, with suspicions raised in cases of significant osteolysis / bony thickening, and in cases with plaque like lesions which are infraorbital canal – centric in location.

Dental (secondary) Sinusitis

Secondary sinusitis is more common than primary sinusitis in horses, and of the causes of secondary sinusitis, dental-associated sinusitis is the most frequent, resulting from a breach of the alveolar bone overlying the maxillary cheek teeth (Triadan 08–11). CT findings associated with dental disease and secondary (dental) sinusitis include; hypoattenuation of the cementum, enamel loss / defects, infundibular changes when severe, gas within the roots or fragmentation of the root in combination with swelling / thickening of the adjacent sinus lining. Critically, CT features of sinusitis in this context include thickening of the respiratory epithelium in the rostral maxillary sinus. In some cases the facial crest or maxillary bone more generally is involved, characterised by 'endosteal' sclerosis, thickening, periosteitis, and / or deformation leading to facial swelling in chronic infections. Identification of the specific offending tooth guides surgical treatment, and CT images allow the most detailed and rapid assessment of the cheek teeth. Henninger *et al.*. (2003), in a retrospective evaluation of 18 Warmblood horses with chronic sinusitis, demonstrated that the first molar (09) was the most frequently affected maxillary cheek tooth, a finding sometimes obscured on radiographs by fluid presence within the sinus. Both related to diastemata presence, in some cases of trauma, and in cases post-extraction with complications, oromaxillary sinus fistulae can be present, and can lead to chronic – persistent – recurrent sinusitis, with or without feed material present in the sinus compartments. The CT features (Hargreaves & Dixon. 2018) are known to be extremely variable, however evaluating sockets carefully if complications are suspected can be vital, as some alveolar bone defects in particular, can be small. Additionally, some may not be visible on oroscopic examination if the alveolus is filled with granulation tissue.

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Sinus Cysts
Paranasal sinus cysts represent a differential for space-occupying – expansile intra-sinus lesions and carry a favourable prognosis compared to neoplasia. Their CT differentiation from other mass lesions was documented by Ostrowska *et al.*. (2020), in a series of eight histopathologically confirmed cystic cases. A discrete hyperattenuating 'wall-like' structure was detected in the periphery of the sinus lesion in non-contrast images in 7 of 8 horses, with a similar 'wall-like' structure detected in only 3 of 10 horses with other sinus diseases; in these latter cases, two also had hyperattenuating regions within the contents of the lesion. The detection of this peripheral hyperattenuating capsule therefore represents a potentially useful feature on plain CT assessment. Interestingly considering the content differences at gross assessment, no significant difference in attenuation (HU) values was found when comparing the fluid or soft tissue content of paranasal sinus cysts (mean 28.9 ± SD 9.2 HU) with other sinus diseases when progressive ethmoid hematomas (PEH) were excluded (30.4 ± 12.9 HU), indicating that measurement of attenuation values of the internal contents alone is not reliable in identifying paranasal sinus cysts. However, in the authors view they often have somewhat characteristic appearances. Additional CT features include displacement of adjacent osseous structures and septal deviation (mass effect) without aggressive bone destruction. CT allows better evaluation of the lesion extent with respect to adjacent bones, the nasal septum, and paranasal sinuses than radiography. Some horses will have secondary effects on the nasolacrimal ducts and infraorbital canals. In rare cases, cysts may attain sufficient size to cause neurological compromise, as illustrated by a reported case of a sinus cyst extending into the cranium and compressing the optic chiasm (Frontiers in Veterinary Science, 2022).

Progressive Ethmoid Hematoma (PEH)
Progressive ethmoid hematoma are a locally expansile, non-neoplastic angiomatous masses of uncertain aetiology, arising from the mucosa of the ethmoid turbinates or paranasal sinus linings, characterised by recurrent epistaxis and slow mass growth. Intra-nasal portions of PEH are readily diagnosed on nasal endoscopy, however intra-sinus PEH require imaging or sinoscopy for diagnosis. CT allows differentiation between fluid and a PEH and facilitates diagnosis of lesions of the ethmoidal or sphenopalatine sinuses, even when small, contributing to surgical planning. A characteristic CT appearance, though not pathognomonic, is described: a mixed, hyperattenuating (*mean 101HU, SD 37.4HU*), "swirling" pattern without severe bony destruction suggests an ethmoid hematoma is highly likely. Some regional skull bone deformation due to expansion is often seen. This mixed internal attenuation pattern reflects the layered haemorrhagic contents of varying 'age' within the lesion through expansion over time. Textor *et al.*. (2012) reported CT findings in 16 horses with PEH, noting that lesions involving the sphenopalatine sinus posed the greatest imaging challenge due to limited endoscopic access and anatomical complexity.

Sinonasal Neoplasia
Sinonasal neoplasia in the horse is thankfully uncommon but associated with a poor to grave prognosis owing to locally aggressive behaviour and the advanced state of disease typically present by the time of an initial diagnosis. Several tumour types of the nasal cavity and paranasal sinuses have been described, with the most common being squamous cell carcinoma (SCC), followed by neuroendocrine tumours, carcinoma, myxosarcoma, adenocarcinoma, and hemangiosarcoma. Cissell *et al.*. (2012), examined CT features specifically in a case series of equine sinonasal neoplasia, documenting the appearance of malignant tumours as poorly

marginated, heterogeneously attenuating (soft tissue) masses with variable osteolysis of adjacent osseous structures, including potential disruption of the cribriform plate. Contrast-enhanced CT can in such cases add further value: in neoplastic lesions, heterogeneous peripheral enhancement may be evident, reflecting neovascularity, in contrast to the largely non-enhancing fluid content of cystic lesions or the minimally enhancing central regions of PEH. Neoplasia of the sinus system in horses is rare, with tumours originating from the oral cavity, osseous or odontogenic structures extending into the sinuses being more common than tumours originating within the sinuses themselves. Despite CT's clear superiority to radiography in characterising lesions, definitive diagnosis invariably requires histopathological confirmation, and the imaging differentiation of PEH from neoplasia remains imperfect.

Traumatic Injuries

Trauma, commonly resulting from kick injuries or blunt craniofacial trauma, presents a distinct CT diagnostic context where the modality's capabilities are particularly informative. Often, fracture presence can be identified on radiography, however very typically the extent and complexity are underestimated compared to subsequent CT findings. The most common bones involved in skull fractures are the maxilla, nasal, and frontal bones, and sometimes the periorbital structures; secondary intrasinus haemorrhage / sinusitis was present in 10 of 13 horses with skull fractures in one study, with the rostral maxillary, caudal maxillary sinus, and ventral conchal sinus being the most affected. In the early stages haemorrhage can be potentially differentiated from sinusitis due to high HU presence in blood. CT allows for precise characterisation of fracture configuration, displacement, and involvement of adjacent structures including the orbit, nasolacrimal duct, and infraorbital canal – information critical to both any form of management. In the context of chronic traumatic sinusitis, CT is additionally capable of identifying sequestrum formation, periosteal reaction, and the presence of bone fragment displacement into the sinus compartments – findings that limit the ability to achieve resolution with medical management alone.

Conclusions

CT has established itself as the gold-standard imaging modality for equine paranasal sinus disease, especially considering the limited availability of MRI for the equine skull, and limitations associated with this modality. The identification of a peripheral hyperattenuating capsule favours a sinus cyst; a mixed internally heterogeneous, swirling hyperattenuating mass without aggressive osteolysis is most consistent with PEH; poorly marginated, heterogeneous masses with cribriform plate destruction raise strong concerns for neoplasia; and fluid attenuation sinus opacification with periapical gas or root fragmentation likely reflects dental (secondary) sinusitis. Traumatic pathologies are best evaluated using CT bone algorithms and window width / level settings to delineate fracture / lesion extent and/or sequestrum presence. While histopathological confirmation remains mandatory for definitive diagnosis of mass lesions, CT-guided pattern recognition provides clinically actionable diagnostic probability that directly shapes surgical approach, client counselling, and prognostic accuracy in this demanding clinical domain. In the absence of a clear inciting cause, with sinus compartments filled with fluid – exudative material, a primary sinusitis would be the likely diagnosis of exclusion (bacterial > fungal).

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Optimizing surgical approaches to the sinuses

Hubert Simhofer

Advancements in veterinary anesthesia have shifted many sinus surgeries from general anesthesia to the standing, sedated horse. Standing surgery significantly reduces intraoperative hemorrhage - a major challenge in equine head surgery – and avoids the risks associated with recovery from general anesthesia. Regional anesthesia is achieved through nerve blocks (maxillary, mandibular, infraorbital and mental) combined with local infiltration of the surgical site.

1. Trephination

Trephination involves creating a small circular opening (typically 1.- 2 cm) into the sinus bone. This is often the first step for sinuscopy, allowing a rigid – or flexible endoscope to be inserted for direct visualization and biopsy1,2. Trephination sites are specific to the targeted sinus:
Conchofrontal sinus: Medial to the bony orbit
Caudal maxillary sinus: Rostral and ventral to the orbit
Rostral maxillary sinus: Dorsal to the facial crest
While excellent for (endoscopic) diagnosis and lavage, trephination offers limited room for debriding inspissated (thickened) pus or removing large masses.

2. Osteoplastic bone flaps

For complex cases requiring extensive access, a bone flap is the gold standard. A three-sided incision is made through the skin and periosteum, and the bone is cut (often using an oscillating saw or osteotome) while remaining attached to a "hinge" of soft tissue or periosteum[1].
Frontonasal bone flap: This provides the widest access to the conchofrontal sinus, the ethmoid turbinates, and the frontomaxillary opening. It is the preferred choice for treating ethmoid hematomas and cysts.
Maxillary bone flap: Centered over the facial crest, this flap allows access to the rostral and caudal maxillary sinuses. It is frequently used for dental-related sinusitis (e.g., tooth root infections) or removing large tumors.

3. Minimally invasive sinus surgery

Modern techniques focus on creating larger drainage pathways with minimal external trauma. This includes the use of laser surgery via sinuscopes to fenestrate internal septa or the enlargement of the nasomaxillary opening using electrosurgical instruments[2] to facilitate natural clearance of exudate.

Intraoperative Considerations and Drainage

The primary goal of sinus surgery is often the restoration of drainage. If the natural ostium is blocked, surgeons may perform a transnasal conchotomy or create a "sino-nasal window." This involves breaking through the thin bone of the ventral conchal sinus into the nasal meatus, allowing gravity to assist in flushing out debris postoperatively.

Postoperative Care and Complications

Postoperative management usually involves sinus lavage with sterile saline via a temporary indwelling catheter. Complications occur in approximately 25% of cases and include:

Suture periostitis: Bony swelling at the flap edges
Sequestrum formation: Small pieces of bone that lose blood supply and become infected
Chronic drainage: Often due to undetected necrotic bone or incomplete removal of dental fragments

In conclusion, surgical access to the equine sinuses has evolved from aggressive "open" procedures to more targeted, standing interventions. The choice between trephination and a bone flap depends entirely on whether the objective is simple visualization or the removal of obstructive tissue1.

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Transnasal Sinus Endoscopy (TSE)- Technique and Landmarks

Hubert Simhofer

Endoscopy of the equine paranasal sinuses via small trephination portals or through accidental or surgically created fenestrations of the nasal conchae has been described[1,2] Transnasal sinus endoscopy via the nasomaxillary aperture (TSE) has been developed by Nowak. Scientific publications concerning this technique are still sparse[3,4].

Materials and Methods

Flexible video- or fiber endoscopes of 3–6 mm diameter are required.
TSE is usually performed in standing, sedated horses. Lidocaine gel should be topically applied prior to endoscope insertion.

Examination technique and anatomical landmarks

The rostral and caudal sinus compartments and the recesses of the dorsal and ventral concha can be examined.

1. Recess of the ventral concha and ventral conchal bulla

The endoscope is inserted 5–6 cm into the middle nasal meatus and directed caudo-laterally along the dorsal and lateral aspect of the ventral concha. It is then guided into the space between the dorsal aspect of the ventral concha and the medial wall of the maxillary bone. Bending the tip of the endoscope in ventral and medial direction, it can be guided into the recess.

2. Recess of the dorsal concha and dorsal conchal bulla

The recess of the dorsal concha can be accessed with small endoscopes (< 5 mm) via the middle nasal meatus, about 5–7 cm caudal to the nostrils in dorsal direction.

3. Nasomaxillary aperture, rostral and caudal sinonasal canals

The nasomaxillary aperture is an approximately 3–5 cm long, slit-like part of the middle nasal meatus, located approximately 20–25 cm caudal to the nostrils between the ridge of the ventral concha and the base of the dorsal concha. Caudally, it bifurcates into the latero-ventrally oriented rostral sinonasal canal and the caudo-dorsally orientated caudal sinonasal canal.

4. Rostral sinus compartment

The rostral sinonasal canal is located laterally, between the ventral conchal lamella and the medial wall of the maxilla. In sinusitis-affected horses with a widened rostral sinonasal canal, the endoscope can be directed latero- ventrally through the canal to visualize the rostral maxillary sinus. Visualization of the infraorbital canal and the ventral conchal sinus via the concho-maxillary aperture is only possible in a small number of horses.

5. Caudal sinus compartment
Inserting the endoscope along the dorsal crest of the ventral concha in caudo-dorsal direction, the tip of the endoscope can be directed through the sickle-shaped caudal sinonasal canal. Having passed the caudal sinonasal canal, the ethmoid is clearly visible looking caudo-medially. The large fronto-maxillary aperture, conchofrontal sinus, caudal maxillary sinus, infraorbital canal and the opening into the sphenopalatine sinus can be visualized.

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Flushing the Sinus – what with?

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Abstract title: Equine sinus lavage: current clinical practices and translational insights from human medicine

Take-home messages
- ***Equine sinus lavage practices are highly variable***, with no clear standardisation in fluid choice, sequence, or use of additives across clinicians.
- ***The primary therapeutic effect of lavage is mechanical***, with volume and frequency likely more influential than the specific solution used.
- ***Use of antiseptics is inconsistent and often not standardised***, raising concerns about cytotoxicity, impaired mucociliary function, and unintended microbial selection.
- ***Human sinonasal research highlights the importance of solution composition*** (tonicity, pH, ionic balance), suggesting a clear opportunity to improve and standardise equine lavage protocols.

Background
Sinus lavage (sinus flushing) has long been a cornerstone in the management of equine sinus disease, particularly in cases of dental sinusitis, primary sinusitis, and post-surgical care. Despite its widespread use, there is currently ***no consensus on optimal lavage protocols*** in equine practice and the performed practices do not seem to have substantial medical evidence
Clinical approaches vary substantially in terms of:
- irrigation solutions used
- sequence of flushing (initial vs terminal lavage)
- use and concentration of additives (e.g. antiseptics)
- volume, frequency, and delivery methods

In contrast, human medicine-particularly in chronic rhinosinusitis (CRS)-has progressively refined sinonasal irrigation strategies based on ***mucosal physiology, antimicrobial balance, and patient outcomes.***

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This study aimed to:
1. Characterise current sinus lavage practices among equine clinicians
2. Identify areas of variability and inconsistency
3. Compare these findings with established principles from human sinonasal irrigation

Materials and Methods
An anonymous, cross-sectional survey was distributed to equine clinicians and specialists.
The questionnaire explored:
- irrigation solutions and sequences
- use and rationale of additives
- lavage volume, frequency, and duration
- catheter use and management
- variation between primary and secondary sinusitis

Descriptive statistics were used to summarise practice patterns.

Results
A total of ***92 complete responses*** were analysed.

Marked variability in irrigation solutions
A wide range of primary irrigation solutions was reported, including:
- isotonic saline
- balanced electrolyte solutions (e.g. Hartmann's)
- tap water (with or without pre-boiling)
- sequential combinations of these

A significant proportion of respondents reported ***multi-stage lavage protocols***, typically involving an initial mechanical flush followed by a secondary solution.

Extensive variation in additive use
The use of additives (e.g. povidone-iodine, antibiotics, other agents) showed considerable heterogeneity:
- Additives were frequently used ***only in terminal lavage phases***, rather than throughout the procedure
- Concentration was often ***not standardised***, with many respondents relying on subjective estimates (e.g. "a splash" or visual dilution)
- Clear protocols or defined concentrations were uncommon

Volume and frequency: predominantly empirical
Lavage strategies were largely guided by clinical judgement rather than defined protocols:
- Large variability in volume and frequency
- Decision-making was primarily influenced by case severity, response to treatment, and practical constraints

Catheter use and management
A broad range of catheter types and management strategies were reported, reflecting ***practical adaptation rather than standardisation.***

Discussion
This study highlights ***substantial heterogeneity in equine sinus lavage practices***, particularly regarding irrigation composition and additive use.

Mechanical vs chemical effects
Findings suggest that lavage in equine practice is primarily considered a ***mechanical intervention***, relying on volume and repetition to remove debris and infectious material.
This aligns with human data, where:
• l***arge-volume, low-pressure irrigation*** is preferred
• mechanical clearance is a key therapeutic mechanism

Additives: potential benefits and risks
The widespread but inconsistent use of antiseptics such as povidone-iodine raises important considerations:
• Antiseptic efficacy depends on ***concentration and contact time***, both of which are difficult to control in lavage settings
• High concentrations may be ***cytotoxic***, impairing epithelial integrity and mucociliary clearance
• Subtherapeutic concentrations may contribute to ***selective pressure on microbial populations***
Human studies demonstrate that ***low-concentration PVP-I (≈0.08%)*** can improve outcomes in refractory CRS without impairing mucosal function. However, the non-standardised concentrations reported in this study suggest that equine protocols may frequently fall outside this therapeutic window.

Importance of solution composition
Human sinonasal irrigation research emphasises that lavage solutions should consider:
• ***Tonicity***
• ***pH buffering***
• ***ionic composition***
Balanced solutions (e.g. Ringer's) have been associated with improved outcomes compared to normal saline, likely due to better preservation of epithelial function. Hypertonic solutions may improve mucociliary clearance but are associated with increased irritation at higher concentrations (>3%). These principles are ***largely absent from current equine practice***, where solution selection is often pragmatic rather than physiologically driven.

Emerging adjuncts
Novel additives such as ***xylitol*** and ***manuka honey*** have demonstrated antimicrobial and anti-biofilm properties in human medicine, with improved culture negativity in some settings. Their role in equine sinus disease remains unexplored but represents a potential area for future investigation.

Safety considerations
The use of non-sterile water remains a concern. In human medicine, unsterile irrigation has been associated with severe complications including ***amoebic meningoencephalitis***. Comparable risks, including bacterial complications, have been reported in equine sinus surgery.

Conclusion
Equine sinus lavage practices are characterised by ***significant variability and limited standardisation***, particularly in relation to irrigation solutions and additive use. Comparison with human sinonasal irrigation highlights several key areas for improvement:
• consideration of ***solution composition (tonicity, pH, ions)***
• cautious and standardised use of ***antiseptics***
• recognition of lavage as primarily a ***mechanical intervention***
• need for ***evidence-based protocols***

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This study provides a foundation for future work aimed at developing ***guidelines and consensus-driven approaches*** to equine sinus lavage. At GVEH, the aim is to prepare a lavage solution that supports mucosal function while maintaining mechanical cleaning efficiency. Based on human literature composition data the solution is designed to be:
- ***Slightly hypertonic*** (approximately 1.5–3%) to support mucociliary clearance
- ***Buffered to a neutral to slightly alkaline pH*** (around pH 7–7.5) using sodium bicarbonate
- ***Balanced in composition*** to minimise irritation of the sinus epithelium

In practical terms, this is achieved by:
- Mixing ***salt and sodium bicarbonate*** (baking soda) in a 2:1 ratio
- Adding approximately ***5.5 g of this mixture per 500 mL of water*** (scaled accordingly for larger volumes)
- Adjusting bicarbonate content as needed to achieve a near-neutral pH

In addition, ***xylitol (5% w/v)*** is included as a potential adjunct due to its antibacterial and anti-biofilm properties. Tap water is used as the base fluid, with attention to cleanliness and preparation standards and is pre-boiled before mixing.

Transnasal Sinus Endoscopy in Equine Sinonasal Disease: A Retrospective Clinical Evaluation

Wouter Demey, *DVM*

Background
Transnasal sinus endoscopy (TSE), together with derived techniques such as transnasal endoscopic sinus lavage (TESL) and transnasal endoscopic sinus surgery (TESS), represents a non- to minimally invasive approach for the investigation and treatment of the equine paranasal sinuses and adjacent nasal structures. Despite its potential, this technique is not yet widely adopted in equine sinonasal imaging and surgery. The increasing availability of small diameter high-quality (single-use) videoscopes is likely to further improve its accessibility.

Objectives
To evaluate the feasibility, advantages, and limitations of transnasal sinus endoscopy in the diagnosis and treatment of equine sinonasal disease.

Materials and Methods
A retrospective evaluation was performed on 55 cases presenting with unilateral nasal discharge (including primary and dental-related sinusitis, excluding cysts and neoplasia), which were managed using transnasal techniques.

Results
Transnasal sinus endoscopy proved clinically feasible in the majority of cases, with only a limited number requiring surgical conversion such as trephination (n=4) and sinus flap surgery (n=1), with 2 documented failures (n=2). Analysis of treatment frequency per case demonstrated a median of approximately 3 interventions, with most cases managed within 2 to 4 treatment sessions. However, a subset of cases required substantially more repeated interventions, reflecting increased disease chronicity, anatomical complexity, and limitations in access.

Discussion
The technique is inherently constrained by the complex anatomy of the equine sinonasal system, particularly the narrow nasomaxillary apertures. Access to the rostral maxillary sinus and ventral conchal sinus (the anatomically distinct "rostral system") remains especially challenging.

However, advances in endoscopic technology, combined with appropriate case selection and pre-treatment, have significantly improved procedural success. Pathological remodelling and the formation of additional drainage pathways may facilitate transnasal access to otherwise difficult-to-reach regions. In addition, structures such as the dorsal and ventral conchal bullae, although not strictly part of the sinus system, are frequently involved in chronic disease and may become accessible via a transnasal approach in selected cases. While transnasal approaches may require multiple treatment sessions and can be more time-consuming than traditional surgical techniques, their minimally invasive nature and repeatability under standing sedation make them particularly valuable for selected cases, follow-up treatments, and as an adjunct to surgical approaches.

Conclusions

Transnasal sinus endoscopy represents a valuable minimally invasive diagnostic and therapeutic tool in the management of equine sinonasal disease. Its ability to provide direct visualisation of sinonasal structures allows improved localisation and characterisation of pathology, including differentiation of secretions, identification of necrotic tissue and sequestra, and assessment of mucosal changes. Although anatomical constraints limit access to certain compartments, particularly within the rostral sinus system, transnasal sinus endoscopy offers clear advantages in selected cases and complements conventional diagnostic modalities such as radiography and computed tomography. While it does not replace trephination or sinus flap surgery, it expands the diagnostic and therapeutic toolbox within a multimodal approach and allows a staged, less invasive approach in a substantial proportion of cases.

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Treatment of a horse with chronic empyema of the dorsal conchal bulla using a minimally invasive, extra-nasal surgical approach guided by computed tomography

David Seymour

Summary

The nasal conchal bullae (NCB) were historically considered relatively innocuous structures, but recent publications have highlighted their potential as sources of both primary or secondary infection in horses presenting with persistent unilateral nasal discharge. While the radiographic morphology and landmarks of the NCB have been extensively described, computed tomography (CT) remains the most sensitive modality for diagnosing NCB empyema. Standard sinoscopic treatments for sinusitis potentially bypass these structures, possibly leading to treatment failure. Surgical treatment of the conchal bullae aims to establish drainage and to remove any inspissated exudate or devitalised tissue. This is most commonly achieved via a trans-nasal endoscopic approach. Transcutaneous extra-nasal techniques based on pre-established anatomical landmarks have also been described in equine cadavers. This report describes diagnosis and surgical planning assisted by CT, followed by a minimally invasive, extra-nasal osteotomy in a case where anatomy precluded a trans-nasal approach. The procedure allowed fenestration of the dorsal conchal bulla (DCB), transendoscopic removal of inspissated material, and placement of an indwelling Foley catheter to facilitate postoperative lavage. The horse recovered uneventfully, and long-term follow-up indicated sustained resolution of clinical signs.

Diode Laser Fenestration of the Dorsal Concha for Developmental Sinonasal Obstruction in a One-year-old Miniature Shetland Pony: A Case Report

Patricia Trummer-Schug

Introduction

Chronic nasal discharge in equids often results from dental disease, infections or anatomical abnormalities. Miniature horses and ponies are particularly predisposed to upper respiratory issues due to their small skulls and disproportionately large teeth. Retained juvenile cranial features may contribute to impaired sinus drainage and recurrent sinusitis. While sino-nasal anatomical abnormalities are rarely described in horses, some reports suggest a developmental origin in young animals with possible breed predisposition. This case illustrates the diagnostic value of computer tomography (CT) and the therapeutic application of diode laser fenestration in managing sino-nasal obstruction.

Case Description

A one-year-old miniature Shetland pony filly presented with an eight-week history of unilateral, nasal discharge unresponsive to prior antimicrobial therapy. Endoscopy on the right side revealed yellow, mucous discharge, a displaced dorsal concha overlapping a hypoplastic ventral concha and malformed sino-nasal drainage anatomy. CT imaging confirmed significant anatomical abnormalities of the right nasal passage including an enlarged dorsal concha, a hypoplastic ventral concha and a deviated nasal septum with right-sided sinus enlargement.

Treatment and Outcome
Initial conservative management with meloxicam and doxycycline proved ineffective. Due to the presence of an anatomical obstruction, diode laser fenestration of the dorsal concha was performed under standing sedation. Using an 810 nm diode laser (15 W, 600 J), a 3 cm drainage window was created to establish communication between the sinus system and the nasal passage.
This facilitated effective evacuation of purulent material and allowed for transnasal lavage. Postoperative endoscopy on days 2 and 5 confirmed patency of the fenestration and a marked reduction in mucosal inflammation. The filly showed clinical improvement and was discharged six days postoperatively without the need for additional treatment. At a two-month follow-up she remained free of clinical signs of sinusitis and was reported by the owner to be significantly more energetic.

Conclusion
This case highlights the utility of advanced imaging for diagnosing developmental sino-nasal abnormalities in miniature equids. Diode laser fenestration of the dorsal concha provided a minimally invasive, effective solution for re-establishing sinus drainage and resolving sinusitis. It offers a viable therapeutic alternative in young miniature horses or ponies whose skull anatomy limits traditional approaches.

Bio
Patricia Trummer-Schug (born 1996) graduated from the University of Veterinary Medicine Vienna in 2021. Following her graduation, she completed a rotating internship at the Equine Clinic of the University of Veterinary Medicine Vienna from 2021 to 2022. She subsequently held a junior surgical position in equine dentistry at the Center for Equine Health and Research. Since 2022, she has combined fundamental research on early-stage osteoarthritis as part of her doctoral thesis with clinical work in equine dentistry at the university clinic.

Use of an axial pattern rotational flap to repair a non-healing head wound in a horse
Dehiscence is a concerning complication for any surgical wound. Surgical repair over the equine sinus can be complicated by many factors including lack of bone support, skin tension, or unresolved sinus infection. Chronic wounds are challenging to repair for the above reasons as well as the presence of fibrosis or scar tissue adjacent to the wound. In this case report, an axial pattern rotational flap and a transpositional flap were used to repair a chronic non-healing wound in a horse.

Learning Objectives
Attendees will be able to:
1. explain reasons for failure of surgical repair
2. describe different types of skin flaps
3. apply an axial pattern flap for repair of a sinus wound in a horse

The history of odontoplasty and what evidence is avialable for current practice

Neil Townsend, *MSc BVSc Cert ES (Soft Tissue) DipECVS DipEVDC (Equine) FNCED FRCVS*

Equine odontoplasty-commonly known as tooth rasping or "floating"-has a long and complex history rooted in the broader development of equine dentistry. Archaeological and textual evidence suggests that dental intervention in horses dates back at least 3,000 years, making it one of the oldest forms of veterinary care.

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The earliest direct evidence comes from Bronze Age Mongolia (c. 1150 BCE), where horse skulls show deliberate modification of teeth, including the cutting of abnormal incisors. These early procedures were likely experimental and performed with stone tools, indicating a practical attempt to improve feeding efficiency and behaviour. This demonstrates a clear link between equine dental care and the development of horsemanship and warfare.
The practice of rasping sharp enamel points-central to modern odontoplasty-likely developed gradually alongside domestication and changes in feeding and management. Horses possess hypsodont teeth that erupt continuously, leading to uneven wear and the formation of sharp edges that can injure soft tissues. Historical accounts from the 19th and early 20th centuries indicate that practitioners focused heavily on these enamel points, often using hand rasps to smooth them. This period marks the emergence of rasping as a routine procedure, although it was often performed by horsemen rather than trained veterinarians.
In the modern era, odontoplasty has become the most commonly performed procedure in equine dentistry, aimed at restoring proper occlusion and preventing pain or dysfunction. Despite its widespread use, the scientific evidence supporting routine rasping remains limited.
One of the first areas investigated was the direct effect of rasping on dental tissues. A key study used scanning electron microscopy to compare rasp types and found that all methods caused damage to dentine and enamel, including disruption of odontoblast processes and surface gouging. Motorised tools produced smoother surfaces but also removed more tissue, raising concerns about over-aggressive reduction. These findings challenged the assumption that rasping is entirely benign and suggested potential long-term consequences for tooth vitality.

More recent work has focused on how odontoplasty interacts with normal dental physiology. Reviews emphasise that irregularities such as enamel points and ridges are part of the horse's natural grinding system and contribute to efficient mastication. Excessive smoothing may therefore reduce chewing efficiency rather than improve it. Histological studies of equine teeth also show a continuous capacity for dentine production, suggesting teeth are adapted to gradual wear, but potentially vulnerable to excessive artificial reduction.
Newer research has examined iatrogenic risks associated with dental procedures, including rasping. A 2024 study measuring forces during odontoplasty found that use of mouth speculum can generate high loads on incisors (up to several thousand newtons), with potential for injury. Other studies have investigated heat production during overgrowth reduction and the potential to cause heat necrosis of the pulp tissue, reinforcing the need for caution.

Despite its widespread use, there is limited high-quality evidence proving routine rasping improves health or performance. Much of the support comes from clinical experience (e.g., reducing oral ulceration from sharp enamel points), rather than controlled trials.

Linking occlusal dynamics to orodental pathologies in the equine stomatognathic system

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The biomechanical integrity of the stomatognathic system is closely linked to occlusal dynamics. Variations in incisor and cheek tooth occlusion parameters may not only reflect underlying orodental pathologies but also serve as potential indicators for grading their severity and biomechanical impact. By exploring these relationships, occlusion metrics could be utilized as a diagnostic tool to assess orodental health and guide risk stratification in clinical evaluations.

The aim of this retrospective study was to investigate the causal association between the global severity of orodental pathologies and occlusion parameters of the incisors and cheek teeth in horses. Dental examination records from 605 horses treated by a single equine veterinary dentist were evaluated. Static and dynamic clinical orthodontic parameters–including horizontal over-/underbite (also termed overjet/underjet, OJ/UJ), incisor midline deviation in neutral cheek tooth position (OC), lateral excursion to separation (LETS), as well as transverse (TA) and sagittal (SA) incisor occlusal angles–were measured before and after incisor treatment. Horses were categorized into three groups based on a global severity score of their orodental pathologies: Group 1 (no pathologies), Group 2 (mild to moderate), and Group 3 (severe). Group 3 included horses with either multiple concurrent pathologies resulting in high cumulative scores or at least one pathology classified as severe. The data were statistically analysed linking global severity scores and orthodontic parameters.

Horses that had never received any dental treatment showed a significantly higher total severity score. Pathologies occurred more frequently and at higher severity in the lower jaw quadrants, while overall no laterality was observed. Comparing groups, the age of horses increased with increasing severity classes. The presence and severity of an OJ was positively associated with the degree of orodental pathologies. Only younger horses with low total scores showed slight OJ reductions after dental prophylaxis. However, prophylaxis is likely to have only a minor immediate influence on the relative rostrocaudal jaw mobility overall. UJ was absent in group 1 and observed in <1.4% of horses in other groups, with UJ increasing with higher total pathology scores. Horses in group 3 exhibited slightly greater OC measures, but there was no strong overall association with the severity or side of orodental pathologies. LETS was 1.2 times higher pre-treatment but differed significantly between sides, with left cheek tooth arcades contacting later. No clear association was found between LETS magnitude and pathology scores or laterality. 80% of horses exhibited a TA diagonal malocclusion 3 (DGL3) and 10% a DGL4 pre-treatment. TA measurements did not relate to side differences in global pathology scores, but severe pathologies more often led to a higher amplitude of the diagonal malocclusion. Most horses (86%) showed a SA plane running above the temporomandibular joint level with minimal age dependency and consistent values across groups.

This study shows that the severity of orodental pathologies can globally affect occlusion parameters. Measuring these parameters is essential for biomechanical assessment of mastication. Further research is needed to clarify links between specific occlusion metrics and particular pathologies.

Panel Discussion -Odontoplasty in Equine Dentistry: Indication, Technique, and Limits

Paddy Dixon – Travis Henry – Neil Townsend

Odontoplasty remains one of the most frequently performed procedures in equine dentistry, yet its purpose, scope, and limitations are often debated. This panel brings together leading experts - Paddy Dixon, Travis Henry, and Neil Townsend – to critically explore contemporary approaches to odontoplasty within a diagnostic-driven framework. The discussion will move beyond routine "floating" to examine odontoplasty as a targeted, indication-based intervention. Key topics will include the relationship between occlusion and pathology, decision-making grounded in thorough oral examination (including oroscopy), and the biological consequences of excessive or inappropriate dental reduction. The panel will address how much is enough-and when it becomes too much-highlighting the balance between functional correction and iatrogenic harm. Technical considerations will also be explored, including instrument selection, thermal injury prevention, and the role of staged treatments in managing complex cases.

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Particular emphasis will be placed on integrating odontoplasty into a broader treatment plan rather than viewing it as a standalone procedure. Ultimately, this session aims to challenge traditional paradigms and encourage a shift towards precision dentistry-where odontoplasty is not routine, but a deliberate, evidence-informed component of maintaining long-term dental health and performance in the horse.

Use of an axial pattern rotational flap to repair a non-healing head wound in a horse

Elizabeth Schilling

Dehiscence is a concerning complication for any surgical wound. Surgical repair over the equine sinus can be complicated by many factors including lack of bone support, skin tension, or unresolved sinus infection. Chronic wounds are challenging to repair for the above reasons as well as the presence of fibrosis or scar tissue adjacent to the wound. In this case report, an axial pattern rotational flap and a transpositional flap were used to repair a chronic non-healing wound in a horse.

Learning Objectives
Attendees will be able to:
1. explain reasons for failure of surgical repair
2. describe different types of skin flaps
3. apply an axial pattern flap for repair of a sinus wound in a horse

Non-dental oral pathology in horses

Padraic Dixon, *MVB, PhD, FRCVS, Diploma EVDC (Equine)*
RCVS Specialist in Equine Surgery (Soft Tissue), European Specialist in Equine Dentistry

Oral tumours are a significant cause of oral pathology that are discussed in another presentation in this session." Recognition and management of oral and dental neoplasia"

Trauma
Aspects of trauma are also discussed in an accompanying presentation "Dealing with oral trauma" by Tim Barnett

External trauma more commonly affects the incisor region and less commonly the mandibular and especially the maxillary regions. Incisor damage often includes damage to the supporting bones and less commonly fractures of the incisors and intra-oral radiographs are optimal for imaging. If there is pulpar exposure of the incisors, even suspect (i.e., indirect) pulpar exposure then endodontic restoration is indicated. Repair of detected incisor area bone fractures are indicated, and many such repairs are very straightforward procedures. Lacerations of the lips are obvious and should be sutured, in 3 layers if full thickness lacerations are present. Mandibular fractures may cause endodontic infection, especially in younger horses that may cause mandibular swelling and discharge, and so be mistaken for a primary apical infection. Radiography is indicated and depending on the type of fracture present, the use of an oral speculum should be performed with care.

Bitting and tack trauma are more common than external trauma and can be caused by use of excessive force on the bit by inexperienced riders, such as using the bit to punish the horse, by using constant bit pressure, or use of the bit to balance the rider. Bitting damage can also be caused by experienced riders who do not care whether they cause oral injury, if they achieve their competition goals. Very narrow bits and damaged bits can cause bitting injuries when using normal forces. Bitting lesions often involve the dorsal aspect of the mandibles, variably causing

ulceration to periostitis, sequestration or even osteomyelitis ("polo pony mouth"). Bits can also damage loose buccal soft tissue, the inner commissures of the lips and occasionally the tongue. Bit damage can also cause high wear on the lower Triadan 06s (first cheek tooth) and even cause deep periodontal disease and apical infection of these teeth. Tight nosebands can put focal pressure on the cheeks opposite the buccal aspect of the rostral maxillary cheek teeth, and some equestrian bodies have new guidelines on noseband tightness as well as disciplinary procedures if horses have blood in their mouth following competition. Severe iatrogenic dental trauma can be caused by the unvalidated procedures of "incisor reduction" and "bit seating" that may cause pulpar and thus dental death. Severe tongue damage can occur after falls with a bit in place, also from a riderless horse treading on its reins, neglect of "tongue ties" and from a horse eating too soon after mandibular (with inadvertent lingual) nerve blocks.

Foreign bodies
Typically, these are short pieces of ingested wire that become embedded in the tongue (often at its base), in the oral mucosa at the side of the tongue or in the oropharynx. The clinical signs are usually due to secondary infection/abscessation that often causes soft tissue swelling and marked oral pain. Horses may become distressed, inappetent and may drool saliva. It may be difficult to open the horse's mouth for examination, even following sedation. Intra-oral palpation may reveal swollen and firmer areas on the tongue or oral mucosa, that are often painful on pressure even in sedated horses. Sometimes, a piece of wire can be felt or seen protruding from the soft tissues. These can be grasped with long forceps and removed. If such painful swellings are detected without any protruding wire, then radiography is indicated to assess the possible presence of metallic foreign bodies. These pieces of wire may have caused abscessation and then become displaced. If metallic foreign bodies are present, identification of their exact site and then their surgical removal, can be difficult, and may involve multiple drainage may also be needed.

Dealing with oral trauma

Timothy Barnett *BSc(Hons) BVM&S MSc CertAVP DipECVS DipEVDC-Eq MRCVS*
Rossdales Equine Hospital & Diagnostic Centre, Newmarket, UK

Oral trauma encompasses a number of injuries, including fractured teeth and surrounding bones, as well injury to the soft tissues of the mouth. In this talk we will focus on the soft tissues of the mouth, however the reader should be reminded that these injuries can all occur at the same time and any case with pain or bleeding emanating from the oral cavity should undergo a comprehensive wider examination to ensure there is no evidence of concomitant injuries. Common sites of oral trauma include the lips, the lip commissures, the tongue, pharynx, salivary ducts and glands, the hard and soft palate, the palatine artery and the cheeks. Falls, catching the lips and nostrils on external objects, bits and tack, as well as iatrogenic and idiopathic injuries can all be implicated as sources of trauma. In addition, conditions altering the usual mastication of the horse may also result in inadvertent trauma to the buccal mucosa.

The lips, and lip commissures particularly, are prone to damage from the bit and trauma from objects in the patient's environment. In addition, the rostral aspect of the 06 teeth, either due to sharp overgrowths and altered dynamics due to overzealous rostral profiling can also cause damage to the lip commissures and the adjacent buccal mucosa. Presenting signs will depend on the nature and duration of the injury and range from fresh bleeding wounds, ulcers and chronic scar tissue. It may be that the patient presents with resentment to ridden work with a bit or, less frequently, problems grazing or prehending food. Clinical signs can also include inappetence, halitosis, ptyalism and pyrexia.

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Superficial to partial thickness wounds will often heal spontaneously and quickly by secondary intention, especially once any inciting cause is removed. In these cases, lavage of the oral cavity, to reduce any contamination, may expediate the healing. In particularly painful cases, analgesia may be indicated. Any full thickness injuries at this site are invariably always contaminated, and the stability of any repair is limited, and are often unsuccessful as a result. However, attempts at repair should be considered to improve the functional and cosmetic outcome in these patients. Any surgical repair needs meticulous apposition of the individual epithelial, muscular and mucosal layers involved, following thorough cleaning and debridement of the contaminated tissues. Use of hydrosurgical equipment for debridement may be of benefit in these cases. If extensive contusion is present then delayed primary closure may be indicated.
Standing surgery can be considered, but a more successful outcome is likely obtained when completed under general anaesthesia. Once debrided and clean the skin and oral mucosa should be undermined (1–1.5cm) on each side, which will help to reduce the movement on the suture line. Vertical mattress sutures with quills (0–1 non-absorbable) are advised in most cases, from extra oral through the lip musculature.
The intraoral mucous membrane can then be closed with simple continuous or interrupted sutures (2–0 monofilament absorbable). The skin margins are then apposed with simple interrupted or, in locations with tension still present, vertical mattress sutures (2–0 monofilament non-absorbable). A vertical mattress suture of the same material should be placed at the mucocutaneous junction. In addition, an additional vertical mattress suture place rostral to the lip commissure may provide extra stability.
Tongue lacerations can have very similar clinical signs to lip and cheek lacerations, but in some cases the haemorrhage can be profuse, and a tourniquet at the base of the tongue may be indicated. Sharp enamel overgrowths can be implicated, but in severe, acute cases they are usually caused by direct trauma to the tongue from tack (e.g. a bit or tongue tie) or inappropriate restraint. Oral examination with a speculum, light and usually heavy sedation is necessary. In some cases diazepam can be useful at reducing movements of the tongue for a short period of time to allow a more detailed examination.
Superficial tongue wounds will usually heal with second intention healing in a short space of time. More severe wounds may be candidates for repair, as the rostral tongue is important in both the prehension of food and ridden contact, so as much as possible should be conserved. As a general rule – if 25% or more of the cross-sectional area of the tongue remains attached and vital then an attempt to repair should be made. The neurovascular structures are in the ventral aspect, and if unsure, intravenous fluorescein can be used to assess perfusion of tissues. Any non-vital tissues should be removed and wounds edges thoroughly debrided. Once again, hydrosurgery can be useful. Vertical mattress sutures are initially placed in the exposed deep muscles, but delaying the tying until all sutures are placed (0 to 1 absorbable monofilament). Additional buried rows of sutures (2–0 to 0 absorbable monofilament) are placed to reduce the dead space. The initial vertical mattress sutures can then be tied. The mucosa is then closed with simple interrupted or continuous sutures.
Glossectomy can also be considered in cases in which the rostral tongue is not viable; this will help control haemorrhage, reduce pain as well hasten healing of the wound. Debridement is the first step, and consideration should be given for removing a wedge of muscle tissue to aid in apposition of the mucosal margins. The muscle edges are closed followed by the mucosal edges (simple interrupted absorbable monofilament). Foreign bodies are also a source of oral trauma, and a challenge to diagnose. The clinical signs are similar to other causes of oral trauma, and require systematic and careful oral examination and palpation to identify the foreign body directly, or more commonly ulceration and soft tissues swellings associated with the foreign bodies.
Radiography may be useful with radiodense foreign bodies, but is greatly retarded in the head by superimposition. Computed tomography (CT) can eliminate the effect if superimposition and is useful in identifying radiodense and some organic bodies that would not usually be identified with conventional radiography.

Ultrasonography, using a 5–10MHz rectal scanner for example, can be useful in cases with suspicion of foreign bodies in the tongue, cheeks or the masticatory muscles. Nasopharyngeal endoscopy is also warranted in most cases, to ensure foreign bodies are not located there and/or a cause of trauma to this region too. Removal of the foreign body is dictated by the individual lesions, but careful avoidance of neurovascular and ductal tissues is essential to ensure good healing with minimal complications.

Non Dental causes of Dysmastication in the Horse

John Mark O'leary, *Irish Clinical Academic Fellow University College Dublin / Trinity College Dublin / Dublin Dental University Hospital.*

Normal ingestion of food involves the co-ordinated movements of prehension, mastication and swallowing (deglutition) involving the voluntary prepharyngeal and involuntary pharyngeal and oesophageal phases[1]. Normal chewing involves proper function of the masticatory muscles and their innervation, temporomandibular joint and oral dental structures. Mild forms of dysmastication or difficulty in chewing may present with a slow masticatory cycle or reduced masticatory force during the normal triphasic chewing cycle (open, close and sliding) or with more severe signs such as quidding / spitting out semi-chewed food, reluctance or inability to move the lower jaw, halitosis and inappetence [1–3]. There is considerable overlap with the clinical signs of dysmastication and prepharyngeal dysphagia (difficulty transferring of food from the oral cavity to the pharynx) which include dropping food or water from the mouth, reluctance to chew, ptyalism and abnormalities in prehension. Cases with dysphagia at the level of the pharyngeal and oesophageal anatomical regions typically present with an extended neck position, pain or swelling in the throatlatch region, anorexia, inappetence, nasal discharge containing saliva, water or food material or a cough associated with aspiration pneumonia[1,2].

Dysmastication and dysphagia can be divided into four types: painful, muscular, neurological and obstructive. Painful and obstructive causes interfere with the mechanism of prehension, bolus formation and transfer to the pharynx region[4–12]. Muscular and neurological causes impede prehension by affecting the motor function of the lingual and buccal musculature, restricted or impaired movement of the muscles of mastication, with restricted ability to open the mouth (trismus) [13–14]. Sensory loss to the lips, buccal mucous membranes, tongue, pharynx or larynx can cause dysphagia. Neurological causes may arise from the forebrain, brainstem or peripheral nerves that control prehension (Vm, Vs, VII, XII), transfer of food bolus to the pharynx (Vs and XII) and swallowing (IX and X)[1, 2, 15]. Specific questions relating to vaccination history, diet, involvement of other systems such as respiratory signs (nasal discharge, coughing) and progression of the presenting signs (weight loss and degree of quidding or inappetence and behaviour changes) are important details to help identify the cause of dysmastication. A general clinical and neurological examination including cranial nerve functions will help determine if there is evidence of a systemic disease distant to the oral cavity. External palpation of the salivary glands, the masticatory muscles, cheek folds, bony contour of the skull region, in particular the temporomandibular joints, the base of the ears and regional lymph nodes can identify focal areas of swelling, crepitus or fistulous tracts which may induce a painful evasive response. Initial assessment of the oral cavity including visual assessment of the incisor mucogingival health, the incisor bite plane and the ability to open the mouth and move the mandible and assess the position and mobility of the tongue are important steps before sedating the patient and placing a mouth speculum.

Further assessment of the skull, oral cavity, pharynx and larynx can be performed using imaging modalities; oroscopy, rhinoscopy, ultrasonography, radiography, computed tomography, magnetic resonance imaging and histology of biopsies. Secondary dental changes such as increases in obliquity to the occlusal plane of the incisors (slant mouth) and cheek teeth (shear mouth) may occur due to a chronic painful or restricted masticatory cycle.

EQUINE DENTISTRY

Differential Diagnosis for Dysmastication & Dysphagia in the Horse:

Painful	Muscular	Obstructive	Neurological
Dental related	Masseter myositis	Retropharyngeal mass / abscess	Guttoral Pouch mycosis / empymea
Mandibular Trauma	Nutritional myopathy	Guttoral pouch empyema / tympany	Retropharyngeal mass / abscess
Glossitis	Rectus Capitus Ventralis rupture	Neoplasia	Petrous temporal bone fracture
Stomatitis	Hyperkalemic periodic paralysis	Sialithiasis	Tetanus
Sialodenitis	Polysaccharide storage disease	Oesophageal choke	Botulism
Retrophayngeal Mass / Abscess		Cleft Palate	Equine protozoal myeloencephalitis
Temporohyoid Osteopathy		Chaonal atresia	Toxin absorption
Temporomandibular Osteoarthropathy		Pharyngeal mass / cyst	Pharnygitis / Laryngitis
		Dorsal displacement of the soft palate	Hepatoencephalopathy
			Intracranial mass
			Meningitis

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Recognition and managment of oral and dental neoplasia

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RCVS Specialist in Equine Surgery (Soft Tissue), European Specialist in Equine Dentistry

Introduction

The terms *Mass, Growth and Tumour* simply describe an abnormal localised tissue growth. Most equine growths, for example, polyps, gingival hyperplasia and cysts are non-neoplastic, as they do not have autonomous (independent) growth (Bienert-Zeit *et al.* 2022). The cells of true neoplasms independently grow and divide more than they should and do not die when they should, e.g., by programmed cell death such as (apoptosis) and malignant tumours show aggressive behaviour. There is very limited factual data on the prevalence of equine oral neoplasia, but the literature indicates that neoplasia is less common in horses than other species, and that less than 1.1% of all equine neoplasms are reported to develop directly in the mouth. In contrast to other sites in the body, the majority of reported equine oral neoplasms are malignant, mainly squamous cell carcinomas, and also adenocarcinomas, undifferentiated carcinomas, ameloblastic carcinomas and fibrosarcomas. Oral tumours can of course develop from any tissue in the oral cavity, including connective tissue, muscles, nerves and blood vessels. Only a small number of benign neoplasms such as cementoblastoma, fibroma and osteoma have been reported, as compared to oral tumours in small animals. [16]

If the growth has been detected by the owner, such as growth of the incisor region or those that cause external facial swelling, its duration and progression can then be evaluated. Information on whether the growth is affecting horse's prehension, mastication, work performance, or quality of life can also be assessed. As well as a general clinical examination, and examination of the maxillary and mandibular areas for swellings or painful areas, a detailed intra-oral examination is next performed, to assess the nature and size of the lesion, and the possible presence of additional lesions. If the lesions appear to involve the mandibular bone or the nasal or maxillary areas, radiographs are indicated and whenever possible, computed tomography of the head should be obtained. A most important part of the investigation is obtaining a biopsy of the mass, that should be a deep sample, avoiding necrotic areas and preferably including some of the transition zone that has normal tissue. Due to the rarity of equine oral neoplasms, it is helpful if the histology can be read by an experienced equine pathologist. Calcified growths often need surgically-obtained biopsies and then long delays for decalcification and histological processing. It is often more pragmatic to initially perform a complete excision of the calcified mass.

Clinical signs with many oral tumours; include: Ptyalism (excessive salivation), Halitosis, Quidding, Dysphagia, Anorexia, Weight loss, facial swellings and bitting/performance problems.

Squamous Cell Carcinoma is the most commonly reported malignant neoplasm of the equine oral cavity or pharynx. They can arise on mucosal surfaces including the gingiva, tongue, hard or soft palate. They have a high malignancy and usually cause local invasion and bone destruction. Infection by *Equus caballus* papillomavirus type 2 (EcPV2) has been implicated as a contributing factor in oral SCC development, similar to HPV-related human cancers. Less common mucosal tumours in horses are adenocarcinomas and undifferentiated (poorly differentiated) carcinomas. SCCs are red, irregular fleshy growths, that may have necrotic areas and inevitably grow fast, and cause marked local destruction and swellings. Clinical signs include ptyalism, breath malodour, Quidding, Dysphagia (difficulty eating), Weight loss, Unilateral nasal discharge (due to sinonasal invasion), nasal obstruction and facial swellingif extension into sinuses occurs. Less common epithelial oral tumours include adenocarcinomas and undifferentiated (poorly differentiated) carcinomas. Unless detected and treated early, the prognosis is very poor.

EQUINE DENTISTRY

Ameloblastomas/Ameloblastic Carcinomas. Ameloblastomas and their malignant variant, ameloblastic carcinomas are dental tumours but are a non-calcified epithelial tumour that arise adjacent to teeth, especially incisors from the epithelial precursors of enamel. They cause localised often rounded, radiolucent growths that cause variable local tooth and bone resorption, depending on their duration and malignancy. Surgical excision of early cases is usually successful.

Fibrosarcoma are a malignant mesenchymal tumour arising from subgingival connective tissue. They are less common than SCC and are often more firm and fleshy with a lower predisposition for local or metastatic invasion. Fibrosarcomas are a malignant mesenchymal tumour arising from the subgingival connective tissue. They are less common than SCC and clinically are often more firm and fleshy than SCC that can be soft and necrotic due to their rapid growth. Fibrosarcomas appear to have a lower predisposition for local or metastatic invasion than SCC. They have been recorded to respond to local excision and intralesional therapy.

Equine juvenile mandibular ossifying fibroma. In contrast to most other oral swellings, these very firm swellings that develop on the incisor areas of very young horses can be considered pathognomonic. They are benign but if not treated can enlarge quickly and cause resorption of the adjacent bones and teeth and at that stage, may require resection of the rostral mandible or of the premaxilla.

Calcified dental tumours. These include compound and complex odontomas, and cementoblastomas/cementomas (to be differentiated from reactive nodular hypercementosis – "cement pearls"), osteomas, osteosarcomas. These all need radiography or CT imaging for evaluation and imaging may show large homogenous calcified rounded masses possibly osteomas or cementomas or well differentiated dental structures such as a compound odontoma or a less structured dental appearance such as complex odontoma. These lesions need surgical removal that may involve extensive maxillary sinus or mandibular bone surgery. If associated teeth need to extracted, there is increased risk of post-operative oro-maxilalry fistula formation.

Reading

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PONTE LUIZ I

INTERACTIVE SESSION

SPEAKERS

Ingrid Tundo
Ingrid Tundo is a European Specialist in Veterinary Dentistry and Head of Maxillofacial Surgery at DentalVets in Scotland. She is the only EVDC Diplomate based in Scotland. After graduating from the University of Milan in 2014, she moved to the UK for a residency in dentistry and oral surgery, becoming a Diplomate in 2021. Formerly a senior lecturer at the University of Edinburgh, she has authored several scientific publications. Outside work, she enjoys surfing, snowboarding, and spending time with her cat Miso and whippet Bagel.

INTERACTIVE SESSION

Interactive Dental Imaging: Interpreting Dental Radiographs and Cone Beam CT in Small Animals

Ingrid Tundo, *DVM, Dipl. EVDC.*

Proposed Format
Interactive Session – 2 hours
I would like to present two-hour interactive session that will guide participants through the interpretation of dental radiographs and cone beam CT (CBCT) images in small animal patients. The session is designed to be practical, case-based, and engaging, offering attendees the opportunity to actively participate in clinical problem-solving.

In the first part of the session, we will focus on dental radiography. Participants will be presented with a range of radiographic cases and challenged to identify key findings, formulate differentials, and discuss potential treatment plans. Emphasis will be placed on developing a systematic and reproducible approach to radiograph interpretation.

After a short break, the second part of the session will introduce CBCT-based scenarios. Using real clinical cases, we will explore the added diagnostic value of 3D imaging in complex or ambiguous presentations. Participants will be encouraged to engage with the images, offer interpretations, and consider how CBCT findings influence clinical decision-making.

Throughout the session, the audience will be actively involved in image reading, group discussion, and interactive diagnosis-solving, making this an ideal learning experience for those looking to enhance their diagnostic confidence in dental imaging.

Learning Objectives
To improve the interpretation of dental radiographs in dogs and cats
To introduce a systematic approach to reading CBCT images
To enhance clinical reasoning through case-based discussions
To build confidence in using imaging findings for diagnosis and treatment planning.

Target Audience
General practitioners, veterinary students, and residents with a basic to intermediate level of experience in veterinary dentistry and imaging.

POSTERS

SPEAKERS

Carolina Silva
Carolina Silva works as a veterinary surgeon at the Covilhã Veterinary Hospital, having completed her Integrated Master's Degree in Veterinary Medicine in 2020 and her PhD in Veterinary Sciences in 2025, both from the University of Trás-os-Montes and Alto Douro. She is the author and co-author of several scientific articles and has completed an intensive course in dentistry through Improve International.

Sergio Minei
The Dr. Minei graduated in 2018 with honours at the the University of Bari. In 2019 he worked as general practitioner in UK before undergoing a Rotating Internship at Eastcott Referrals completed in 2020. From 2021 to 2024 he underwent a full time Residency in dentistry and oral surgery, under the supervision of Margherita Gracis in northern Italy. From April to August 2024 he worked at Dental Vets in Edinburgh as dentist, oral and maxillofacial surgeon. Since the 2025 he works as freelance dentist, oral and maxillofacial surgeon in Italy.

Se Eun Kim
Dr. Se Eun Kim is a Clinical Professor in the Department of Veterinary Clinical Sciences (Dentistry) at Seoul National University. She earned her DVM and PhD from Seoul National University, where she also completed residency training in veterinary dentistry. Her primary interests include periodontal disease, tooth surface loss (TSL), tooth resorption (TR), and the development of therapeutic agents for dental disorders in companion animals. She has published widely in international journals and currently serves as Chair of the Academic Committee of the Korean Veterinary Dental Society.

Agstina Algorta
Agustina Algorta obtained her Veterinary Science degree (2015) and a Master's in Animal Health (2019) from Universidad de la República (Uruguay), and completed a postgraduate program in Veterinary Dentistry in São Paulo, Brazil (2020). She works at the Dentistry Service and teaches in the Immunology and Immunotherapy Unit at Universidad de la República, while pursuing a PhD in stem cell therapy for feline oral diseases. Her main research interests include veterinary dentistry and regenerative therapies. She has presented at international conferences and co-authored publications in these fields

Jamie Annette Berning
Dr. Jamie Berning is a board-certified veterinary dentist under the AVDC and the owner of Veterinary Dentistry and Oral Surgery of Ohio. She is passionate about all aspects of dentistry and particularly enjoys endodontics, oral surgery, comparative dentistry, and diagnostic imaging using cone-beam CT. Dr. Berning enjoys teaching veterinarians, students, technicians, and staff. She is a consultant for multiple zoos and serves as the director of education and outreach for the Dental Coalition for Conservation.

Crina Iulia Dragu
Crina graduated in 2013 from the Freie Universität Berlin and spent 8 years in general practice, earning a certificate in acupuncture and pain management, before embarking on a dentistry residency and training at The Ralph Veterinary Referral Hospital (Marlow, UK), ADVETIA (Paris, France) and Dentovet (Geneva and Lausanne, Switzerland).
She is passionate about animal welfare, patient safety and veterinary human factors.

David Clarke
Dr David E. Clarke – Diplomate/Past-President AVDC; Director, Foundation Veterinary Dentistry; Editor-in-Chief, Journal of Veterinary Dentistry; Chairman, WSAVA Dental Committee; Veterinary Dentist, Taronga Zoos; 13 publications.

Senni Vesterinen
Senni Vesterinen graduated as a veterinarian from University of Helsinki in 2018 and started focusing on small animal dentistry after that. She did her EVDC residency in Finland in private clinic Anident in 2022–2024.

Juan Eguren
Juan Eguren obtained his Veterinary Science degree from Universidad de la República (Uruguay), where he teaches at the Small Animal Surgery and Clinical Unit. He is currently pursuing postgraduate studies focused on platelet-derived products in veterinary dentistry. His main interests include veterinary dentistry and anesthesiology, as well as regenerative therapies. He has participated in conferences and co-authored scientific publications in veterinary dentistry.

Paula Halast
Piia Paula Hallast is a veterinarian with a special interest in small animal dentistry. She is currently working at Männimäe Small Animal Clinic in Viljandi, Estonia.

Kuehwan Choe
Kuehwan Choe earned his DVM in 2014 and has since been practicing exclusively in veterinary dentistry at Taeil Animal Dental Clinic, with a primary focus on feline dentistry. He currently serves as an academic board member of the Korean Veterinary Dental Society and is expected to complete his Master's degree at Chonnam National University, College of Veterinary Medicine, in March 2026. His research interest lies in feline chronic gingivostomatitis, and he plans to present his research findings.

Gyumin Kim
Gyumin Kim entered the College of Veterinary Medicine at Jeonbuk National University in 2005 and received his PhD degree in 2025. Since 2013, he has been serving as Director of Dentistry at Jidongbeom Animal Ophthalmic and Dental Hospital, specializing in veterinary dentistry and oral surgery. He is currently the Director of Academic Affairs at the Korean Veterinary Dental Society. His research focuses on endodontics, and he has published several first-author papers in this field.

Kayoko Kuroda
Dr Kayoko Kuroda graduated from the University of Queensland (Australia) with a Bachelor of Veterinary Science in 2006 and has worked in small animal general practices in Queensland. In 2018, she obtained Membership in ANZCVS Small Animal Dentistry and Oral Surgery. Kayoko currently serves as a consultant in small animal dentistry at SASH Sunshine Coast, Mobile Pet Dentistry, and a Brisbane general practice. She has been actively involved in veterinary dentistry education, delivering lectures and workshops across Australia and internationally, including at the University of Sydney CVE.

SPEAKERS

Tomáš Fichtel
Born in 1969 in Brno, CZ. Graduated from the University of Veterinary Sciences Brno in 1994. In 1996, he has returned to the University as an academic surgeon. In the year 2005 he finished Ph.D. thesis in veterinary dentistry. Currently he is a senior lecturer in the University. His research and teaching tasks include tutoring of postgraduate students (2 completed) and graduate students (9 completed). In 2023 he started his residency with EVDC. He is the author or co-author of 105 scientific articles and has managed or co-managed 4 research projects so far. He is the co-holder of 2 patents.

Magdalena Wilczek
Magdalena graduated in 2017 from the University of Life Sciences in Lublin, Poland. She moved to the UK shortly after and worked in a variety of veterinary practices across Southern England. Since the beginning of her career she has had a strong interest in small animal dentistry and took part in numerous courses and conferences. Magdalena joined Rowe Referrals in January 2024 as the Dentistry Clinician. In 2025 she became resident in Veterinary Dentistry and Oral Surgery to further expand her skills and widen the services provided.

Ewa Chronowska
Ewa Chronowska graduated from University of Life Sciences in Lublin, Poland in 2007. After years of continuing education and running her own practice she started residency EVDC program in 2024 with dr Gawor as her mentor. Active member of PSAVA.

Olga Tretter
Dr. Tretter graduated from the Veterinary University of Budapest in 2010. She worked in the United Kingdom for several years and after moving back to Hungary she focused on small animal dentistry in her work. Since 2020, she exclusively performs small animal dental procedures, oral and maxillofacial surgeries. She is an alternative resident of the EVDC (European Veterinary Dental College). She is very passionate about her clinical work, teaching, cooperation with Colleagues and improving small animal dentistry in Hungary.

Francesco Paesano
Italian veterinary surgeon expert in dentistry and oral and maxillofacial surgery for companion animals, with extensive clinical experience in Italy, the UAE, and Europe. He is an expert in piezoelectric techniques and heads the Dentistry and Maxillofacial Surgery service at several facilities in Tuscany. Holding a GPCert(SADen&OS), he treats dogs, cats, exotic pets, and wildlife. He has authored peer-reviewed publications and lectured at international conferences, including the EVDF and ICARE. He also directs advanced postgraduate courses about Dentistry and Piezosurgery across Europe.

Yves Debosschere
Graduated from the university of Ghent in 1992 and worked in a mixed practice (equine and small animals) for almost 10 years. After completing the ESAVS Dentistry courses, dentistry became a passion which resulted in the admission to start a residency in veterinary dentistry in 2016. Since more than 5 years he is responsible for the dental and orofacial surgery at the AniCura referral centre Hond en Kat in Deinze (Belgium) and coordinates the dental continuing education for AniCura in Belgium.

POSTERS

Diagnostic value of haematological ratios at different stages of canine periodontal disease

Carolina Silva [1,2], Ana Carolina Abrantes [1,2], Ana Carolina Fontes [1,2], Isabel Dias [1,2,7], Rosário Domingues [3,4], Francisco Peixoto [5,6], Carlos Viegas [1,2,8]

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[7] *CITAB-Center for the Research and Technology of Agro-Environmental and Biological Sciences, University of Trás-os-Montes e Alto Douro (UTAD), 5000–801 Vila Real, Portugal*
[8] *CIVG-Vasco da Gama Research Center, University School Vasco da Gama (EUVG), Campus Universitário, Av. José R. Sousa Fernandes, Lordemão, 3020–210 Coimbra, Portugal*

Periodontal disease (PD) is one of the most prevalent clinical conditions in dogs, representing a considerable concern in veterinary practice, not only because of its local effect, but also because of its significant systemic impact, which is reflected by its association with other comorbidities such as endocarditis, hepatitis, and chronic kidney disease. Haematological ratios (HR), easily obtained from complete blood counts (CBC), have emerged as promising indicators of systemic inflammation in both human and veterinary medicine. These HR integrate the interaction of different cell lines and provide a more comprehensive view of the inflammatory response compared to isolated counts of the various cell lines. However, their role in canine PD has not yet been widely investigated, and to date there are no studies evaluating their potential as inflammatory biomarkers at different stages of canine PD and in a single dog breed.
Therefore, the objective of this retrospective study was to assess the clinical significance of five HR – neutrophil/lymphocyte ratio (NLR), platelet/lymphocyte ratio (PLR), mean platelet volume/platelet count ratio (MPV/PLT), monocyte/lymphocyte ratio (MLR), and platelet/neutrophil ratio (PNR) – in 80 Portuguese Podengo dogs. The animals were classified according to their PD status: clinically healthy (n = 24), gingivitis (n = 26) and periodontitis (n = 30).

The analysis revealed statistically significant differences in three of the five ratios. NLR was lower in dogs with periodontitis compared to the healthy and gingivitis groups, reflecting the increased role of lymphocytes in the chronic phase of the disease, characteristic of an adaptive immune response. The PLR was significantly reduced in both gingivitis and periodontitis compared to controls, which once again reflects the lymphocyte predominance that occurs with disease progression. The PNR was lower in gingivitis than in healthy dogs, a result that may be a direct consequence of the increase in the number of neutrophils characteristic of acute inflammatory responses. In contrast, MPV/PLT and MLR showed no significant differences between groups, rendering them unsuitable as inflammatory biomarkers of canine PD.

Analysis of the receiver operating characteristic (ROC) curve indicated weak discriminatory power for all indices, with areas under the curve (AUC) between 0.5 and 0.7. Nevertheless, PNR performed best in distinguishing between gingivitis and healthy individuals (AUC = 0.692). However, this weak discriminatory power makes it impossible to use these HR exclusively for diagnosing the different stages of canine PD, and their application should be complemented with a detailed stomatological-dental examination.

In conclusion, this study demonstrates that PD induces measurable systemic changes in HR, particularly NLR, PLR, and PNR. Although their diagnostic accuracy is limited, these indices are simple, inexpensive, and non-invasive tools that can complement clinical evaluation and dental examination. In the future, studies involving larger samples and substaging periodontitis should be developed in order to understand the possible evolution that these HR may present following periodontal treatment.

Treatment of mandibular ramus osteomyelitis associated with Pseudomonas and limiting mandibular extension in a 6 month old cat

Sergio Minei

It is the first case report of a mandibular ramus osteomyelitis in a 6 month old cat, associated with pre-operative extra articular TMJ partial ankylosis, ROM and mandibular extension reduction (2cm). The surgery was performed removing the ramus in total via a zygomatic approach and preserving the TMJ. Culture and sensitivity evidentiated that the osteomyelitis (histologically confirmed) was due to Pseudomonas, that was treated with dedicated fluoroquinolones. Immediate pain relief and normal ROM of the TMJ and mandibular extension (4.5cm) was achieved in the immediate post-op, with the cat normally eating in few hours. CT in the immediate post-op showed successful removal of the infected bone as planned. Today I had finally the chance to perform a 2 months post operative CT, that evidentiated nearly complete regrowth of a normal mandibular ramus, and optimal clinical status of the cat at 8 months, in absence of complications. A new TC is due in 6 months. It is the first case report of such type of osteomyelitis in a cat, and it is the first time Pseudomonas is isolated as etiological cause for such osteomyelitis in the maxillofacial district of a cat. A complete and more appropriate abstract will be sent to Dr. Ana Rejec in few days, as agreed.

Experimental and Clinical Evidence of Medication-Associated Dental Erosion in Dogs

Se Eun Kim*, Jin hee Bae
Department of Veterinary Clinical Sciences, College of Veterinary Medicine and Research Institute for Veterinary Science, Seoul National University, Seoul, Republic of Korea

Dental erosion refers to the loss of the outmost crown surface due to acquired factors. In humans, it most frequently occurs with acidic exposure, which weaken the teeth, increased sensitivity, and may lead to fracture in severe cases. However, as saliva generally acts as a buffer, not all individuals exposed to acidic foods or agents develop erosion. There have been few reports of dental erosion in dogs. This presentation aimed to report medications that may cause dental erosion in dogs.
A 10-year-old castrated male Chihuahua presented with progressive reduction in the size of the left maxillary third incisor and canine over two months. Based on the medical history, acidic oral medication (clopidogrel) mixed with honey as a delivery vehicle was suspected as the cause.
To evaluate whether the medication directly caused dental erosion, teeth extracted from another dog due to periodontal disease were immersed in a mixture of honey and clopidogrel for three weeks. Field emission scanning electron microscopy (FE-SEM) revealed a roughened enamel surface, while energy-dispersive X-ray spectroscopy (EDS) showed a reduction in the Ca/C ratio compared to control tooth.

To further investigate, another experiment was conducted using anti-asthma drugs, which have been reported to reduce the hardness of dental hard tissue due to low pH. Teeth extracted due to periodontitis were sectioned and divided into three groups: salbutamol, budesonide and

control. The enamel surfaces of tooth fragment were treated daily for two weeks according to group assignment. FE-SEM revealed marked surface erosion in the salbutamol-treated group, an EDS showed a significant reduction in the Ca/C ratio compared to the control group.

These studies suggeste that prolonged exposure of tooth surfaces to acidic medications can cause clinically relevant dental erosion in dogs. Monitoring for dental erosion should be considered when administering low-pH oral or Inhaled drugs in dogs. Further research is warranted to develop preventive and therapeutic interventions that can minimize the unfavorable dental effects associated with these pharmacological agents.

Evaluation of the Efficacy of Ascophyllum nodosum Supplementation in Dogs with Periodontal Disease

Algorta, A[1,2]; Glausiuss, MN[1]; Eguren, JM[1,3]; Turini, G[1]

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In small animal practice, periodontal disease (PD) is among the most prevalent conditions. By the age of two, 80% of dogs and 70% of cats already present some degree of PD. Early diagnosis and treatment, as well as the implementation of preventive strategies, are critical in this disease. Toothbrushing remains the gold standard method for achieving good oral health. However, certain products haveñ proven effective in preventing plaque accumulation. The seaweed Ascophyllum nodosum (AN) has gained worldwide interest as a passive method for oral hygiene in humans. Its use in dogs and cats has demonstrated a reduction in the rate of oral health deterioration, quantitatively assessed through plaque and calculus indices. It has also shown effects in preventing plaque formation and inhibiting calculus development. This study evaluated the efficacy of AN ProDen® supplementation in dogs with PD, being the first research on this product in canines in Montevideo, where ProDen PlaqueOff® powder (Swedencare), based on AN ProDen® and endorsed by the V.O.H.C., is commercially available. The objective was to determine the impact of ProDen PlaqueOff® on PD management, analyzing its effect on dental calculus, plaque, and gingivitis, as well as on selected blood parameters of treated animals. Twelve neutered dogs (males and females) from an animal shelter, age range from 1 to 6 years and diagnosed with grade 1 or 2 PD, were selected. All dogs were fed the same diet and kept under controlled conditions. Dogs were divided into two groups: one treated group receiving ProDen PlaqueOff® for 120 consecutive days, and one untreated control group. The teeth evaluated were: 104, 204, 304, 404, 108, 208, 309 and 409. Calculus, plaque and gingivial indices adapted from Löe and Silness were registered monthly for 4 months. Blood samples were collected from the treated group at days 0 and 120. The treated group had a mean age of 3.4 ± 1 years and a mean weight of 19.8 ± 6 kg, while the control group had a mean age of 3.5 ± 1 years and a mean weight of 19.5 ± 7 kg. Findings indicated significant improvement in calculus ($p < 0,0001$), gingivitis ($p < 0,0001$) and plaque ($p = 0,0244$) indices in the treated group. Changes were observed in blood parameters including calcium ($p = 0,003$) and creatinine ($p = 0,05$), with a tendency ($p = 0,09$) toward variation in thyroxine (T4L) and aspartate aminotransferase (AST) levels, although all values remained within physiological ranges. In summary, ProDen PlaqueOff® supplementation proved effective in managing PD in dogs, highlighting its potential as a therapeutic adjunct. The results of this study support the inclusion of ProDen PlaqueOff® as a valuable tool in periodontal therapy.

Malocclusions in Exotic Species: A Case Series in a Kangaroo, Cougar, and Otter

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Malocclusions are well documented in domestic companion animals, yet reports in exotic and nondomestic species remain sparse. This case series describes the diagnosis and management of three unique malocclusion presentations in an Eastern grey kangaroo (Macropus giganteus), a Cougar (Puma concolor), and an Asian small-clawed otter (Aonyx cinereus). Each case highlights a different classification of malocclusion, associated pathology, and tailored treatment approach. The first case involved a kangaroo with a class IV asymmetric malocclusion resulting from developmental trauma. The abnormal occlusion caused repeated palatal trauma, necessitating both diagnostic imaging and corrective intervention to reduce pain and improve oral function. The second case, a cougar, presented with a class I malocclusion characterized by palatoversion of the maxillary fourth premolar teeth. This abnormal tooth positioning contributed to occlusal trauma and soft tissue contact lesions on the mandibular mucosa. Treatment considerations focused on preserving function while preventing progressive tissue damage. The third case involved an otter with a class III malocclusion and associated traumatic soft tissue injuries. Malpositioning of the dentition led to chronic lip trauma, soft tissue damage, and lip entrapment. Management required both endodontic intervention to restore comfort and normal oral mechanics. These cases underscore the importance of recognizing species-specific variations in occlusion and adapting treatment strategies beyond those commonly applied in small animal practice. By presenting a spectrum of malocclusion types across three diverse species, this case series emphasizes the need for careful clinical evaluation, creative problem-solving, and individualized treatment planning when managing oral health in exotic animals.

Treatment of oral problems in a rescue dog with persistent myoclonus caused by previous infection with canine distemper virus

Crina Iulia Dragu

This case report describes the treatment of oral problems in a dog with persistent repetitive myoclonus caused by previous infection with canine distemper virus. Maxilla and mandible had undergone extensive remodelling; a number of teeth were missing or previously extracted. Remaining teeth were malpositioned and some were fractured, extensive oronasal fistulae were present bilaterally and the oral mucosa had chronic self-induced trauma. As myoclonus continued during general anaesthesia the patient required a neuromuscular block to facilitate oral surgery. Soft tissue healing was complicated by the myoclonus; the patient required staged treatment and revision surgery of oronasal fistula repair. The patient was also assessed by an internal medicine and neurology team and underwent blood tests and cytology, radiography and computed tomography of the head and thorax to determine suitability of dental treatment. The goal of involved oral surgery was to achieve as much comfort as possible, as the combination of continuing orthognathic forces and presence of fistulae and mucosal lesions caused problems with persistent pain and adequate nutrition.

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Optimization of canine platelet-rich fibrin for clinical application in veterinary dentistry

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Introduction
Autologous platelet concentrates have become valuable tools in regenerative medicine due to their capacity to release growth factors at supraphysiological concentrations and to stimulate tissue healing (Miron *et al.*., 2019; Fujioka, 2020). Among them, platelet-rich fibrin (PRF) is considered a second-generation autologous biomaterial, obtained through centrifugation of whole blood without anticoagulants. PRF generates a three-dimensional fibrin matrix that acts as a biodegradable scaffold, harboring platelets and leukocytes, and supporting angiogenesis and tissue regeneration
(Soares *et al.*., 2020; Graciani *et al.*., 2023). In human dentistry, PRF has been successfully used for periodontal defects and regenerative procedures (Fujioka-Kobayashi *et al.*., 2017; Miron *et al.*., 2019). In veterinary medicine, particularly in veterinary dentistry, its application remains poorly standardized (Soares *et al.*., 2020). Technical parameters such as g-force, centrifugation time, and rotor type have been shown to directly influence clot characteristics (Miron *et al.*., 2023). Recently, Farshidfar *et al.*. (2025) demonstrated that horizontal centrifugation results in a more homogeneous cellular distribution and greater release of growth factors compared to fixed-angle rotors. In dogs, Caterino *et al.*. (2022) standardized production protocols for L-PRF, confirming that methodology significantly impacts macroscopic and histological properties. The hypothesis of this study is that centrifugation force modifies the physical and histological characteristics of canine PRF, allowing the identification of an optimal protocol for application in veterinary dentistry.

Methodology
Blood samples were collected from four clinically healthy dogs (>15 kg) in plastic tubes without anticoagulants. Samples were centrifuged immediately for 8 minutes at 200 g, 300 g, 400 g, and 500 g using a Thermo Electron Corporation IEC CL30R centrifuge, equipped with a horizontal rotor (90°) and set at 18 °C. Clot mass was measured, and morphometric analysis was performed using ImageJ software. Histological processing: clots were fixed in 10% formalin and processed using routine techniques. Representative slides were selected and digitized with a Motic Easy Scan One® slide scanner. Image analysis: digitized preparations were evaluated using Motic DS Assistant® (VM V1 Viewer 2.0). Each clot was divided into three zones (apical, middle, basal) and nine quadrants per zone. A total of 27 standardized areas of 50,000 µm² were analyzed per clot (figure 1). Cell counting: cellular remnants were defined as ~5 µm eosinophilic spheroidal structures. Counting was performed with ImageJ (Cell Counter), by three independent observers, blinded and in triplicate, with averaged results. Statistical analysis: normality was assessed by the Shapiro-Wilk test. A two-way ANOVA with Tukey's post hoc test was performed, considering g-force and clot zone as factors.

Results

Leukocytes were occasionally identified in only three PRF clots, while absent in the remaining samples. Cellular remnants, defined as spheroidal eosinophilic structures of approximately 5 µm in diameter, were consistently observed across all clots. Descriptive statistics revealed no significant effect of clot region ($p > 0.05$), indicating a relatively uniform distribution of remnants along the PRF structure. Two-way ANOVA demonstrated a significant main effect of centrifugation force on cellular remnant counts ($F = 6.41$, $p = 0.003$), whereas neither clot region nor the interaction between force and region were significant. Post hoc Tukey's test confirmed that clots obtained at 200 g contained significantly more remnants than those produced at 500 g ($p = 0.0017$), and that 400 g also yielded higher counts compared to 500 g ($p < 0.05$). A trend for increased remnants at 300 g versus 500 g was observed, although this contrast did not reach statistical significance after correction. No differences were found between 200 g and 300 g or between 300 g and 400 g (figure 2). Overall, centrifugation at 200–300 g produced clots with the highest and most consistent cellular content, together with favorable macroscopic features (length, consistency, weight), supporting their application as optimal protocols for canine PRF preparation in veterinary dentistry.

Discussion

Our findings support the "low-speed centrifugation concept", which proposes that lower centrifugal forces better preserve cellular components and may enhance growth factor release (Miron *et al.*., 2020). The higher abundance of cellular remnants at 200 g, and to a lesser extent at 300–400 g, reinforces this hypothesis. Conversely, 500 g markedly reduced cellular content, suggesting that higher forces may impair the biological potential of PRF. Recent literature highlights the importance of rotor design: horizontal centrifugation generates more homogeneous and functional clots compared to fixed-angle systems (Miron *et al.*., 2023; Farshidfar *et al.*., 2025). In veterinary medicine, Caterino *et al.*. (2022) emphasized the need to standardize protocols in dogs to ensure reproducible and clinically useful PRF. In this context, our data indicate that centrifugation at 200 g for 8 minutes provides an optimal balance of physical and histological characteristics.
The non-significant trend observed at 300 g versus 500 g suggests that additional replicates might confirm a broader effective range (200–300 g), further supporting its clinical translation in veterinary dentistry.

Conclusions

Centrifugation at 200–300 g for 8 minutes represents an optimal range for canine PRF preparation, producing clots with favorable macroscopic properties and a uniform distribution of cellular remnants. These characteristics support its potential clinical application in veterinary dentistry, particularly for regenerative procedures. Future studies should assess the biological activity and clinical performance of PRF obtained under these conditions to validate its use and contribute to the standardization of regenerative techniques in veterinary practice.

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Tooth resorption in cats and dogs – awareness among Estonian veterinarians (2025)

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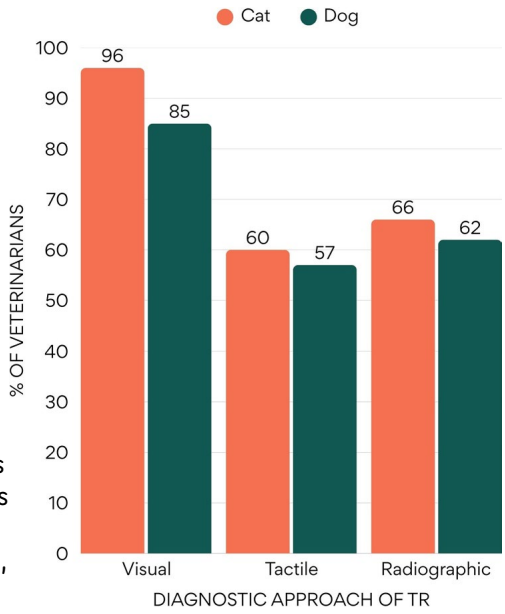
Master's thesis: "Tooth resorption in cats and dogs – awareness among Estonian veterinarians" (2025)

Resorptive lesions represent one of the most common and clinically significant oral diseases in cats, and they are increasingly recognised in dogs as well. They are painful, progressive, and often diagnosed late, which makes early detection and awareness crucial for animal welfare. The aim of this study was to investigate how general practitioners and veterinarians performing oral procedures under general anaesthesia perceive resorptive lesions and which diagnostic methods they apply in practice. A cross-sectional survey was conducted between November 2024 and February 2025. The online questionnaire consisted of 19 items, of which nine targeted general practitioners and ten targeted veterinarians performing oral procedures under anaesthesia. A total of 99 responses were collected and analysed using descriptive statistics. The results showed that awareness of resorptive lesions was higher for cats than for dogs, while knowledge regarding other species remained inconsistent. In routine clinical examination, 90.8% of respondents reported that they actively checked for signs of resorptive lesions, whereas 9.2% did not. In addition, 53.5% of respondents reported that they perform oral procedures under general anaesthesia.

Diagnostic methods were dominated by visual examination. During comprehensive oral health assessments, 96% of veterinarians used visual inspection in cats and 85% in dogs. Tactile probing was applied by 60% in cats and 57% in dogs, and intraoral radiography was used by 66% in cats and 62% in dogs. Although both tactile and radiographic techniques are considered essential for detecting early and subgingival lesions, their use was reported substantially less frequently than visual inspection, indicating that many cases may remain undiagnosed until advanced stages.

Respondents identified conferences, professional training courses, and colleagues as their most important sources of information on resorptive lesions (79% and 74%, respectively). Textbooks and scientific articles were mentioned less often (60% and 64%), with association websites cited the least, highlighting veterinarians' reliance on continuing education, expert-led events, and peer interactions to stay updated These findings underline a clear gap between best-practice recommendations and the methods currently most used in daily clinical settings. Visual inspection alone, while quick and widely applicable, cannot reliably detect early lesions. Underutilisation of tactile probing and radiography contributes to the risk of late or missed diagnoses. Improving awareness and diagnostic practices requires close collaboration between general practitioners and dental specialists. Specialists can play a key role by sharing guidelines, offering structured continuing education, and supporting timely referrals.



In conclusion, Estonian veterinarians demonstrate good overall awareness of resorptive lesions, particularly in cats, but daily practice is inconsistent and heavily dependent on visual examination. Strengthening collaboration with specialists and ensuring the dissemination of evidence-based diagnostic standards through professional training and conferences are essential steps toward earlier diagnosis, better treatment outcomes, and improved animal welfare.

Clinical success of Enamel Matrix Derivative for treating ginigival recession of mandibular teeth (Dehiscence-Type Defects) in 16 teeth of cats

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Background

The molars of felines are essential for mastication. Gingival recession in these teeth may arise from malocclusion or periodontal disease. Chronic gingival recession and root exposure can lead to heightened root sensitivity, deposition of plaque and calculus on the root surface, and inflammatory reactions.

Objective

The coronally positioned flap (CPF) is a frequently employed method in humans for repositioning retracted gingiva to its original location. This study assessed the potential of CPF as a therapy to enhance root surface coverage to within the normal range in feline mandibular molars exhibiting gingival recession.

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Methods
Sixteen mandibular premolars or molars displaying Class II or III gingival recession were addressed using conservative surgical techniques. Open flap debridement (OFD) and CPF were performed in conjunction with enamel matrix derivative (EMD) to augment periodontal regeneration. The cases were reassessed 1 to 3 years postoperatively, and treatment success was determined by the extent of complete or partial root covering achieved.

Results
The vertical bone defect ratio (VBDR), evaluated through dental radiographic examination, improved from 0.24 ± 0.07 preoperatively to 0.16 ± 0.08 postoperatively. Of the 16 treated teeth, 14 had significant improvement, while 2 showed no change. The mean clinical attachment level (CAL) improved from 2.22 mm ± 0.25 preoperatively to 0.7 mm ± 0.43 postoperatively. Out of the 16 treated teeth, 15 exhibited a successful improvement in clinical attachment level (CAL). According to the entire success criteria, 13 out of 16 cases (81.3%) met the objective success benchmark without complications.

Conclusions
Periodontal surgery in felines has historically been underused for many reasons. However, progress in veterinary medicine and the development of superior regenerative materials are driving increased attempts to explore innovative therapeutic options. CPF with EMD achieved complete or partial root coverage on premolars or molars. This study aspires to facilitate the development of a more advantageous eating environment for cats with retracted teeth by conservative approaches in the future.

Keyword
Gingival recession, Coronally positioned flap, Emdogain, Open flap debridement, Open root planning, Periodontitis

Incidence of Vertical Crown Fracture in Root Canal–Treated Canine Teeth of Cats: 0.04-Taper versus Taperless NiTi Files

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Abstract
Endodontic treatment of feline canine teeth is essential for preserving function and preventing tooth loss. The use of tapered nickel–titanium (NiTi) files used during canal preparation can remove substantial amounts of dentin and make thereby compromising the structural integrity of the crown and increasing susceptibility to vertical crown fracture (VCF). This study aimed to compare the incidence of VCF between feline canine teeth prepared with 0.04-taper NiTi files (ProTaperTM) and taperless files (LightSpeedTM LSXTM). Fifty fractured canine teeth from 50 cats underwent

root canal treatment using NiTi file systems and were classified into two groups according to the instrument system used: 0.04-taper (n = 27) and taperless (n = 23). All canals were obturated with mineral trioxide aggregate (MTA) and a single gutta-percha cone. Data from postoperative clinical and radiological follow-up examinations were used to identify VCF for comparison between groups. Firth logistic regression analysis was applied to evaluate the association between the presence of taper in the instrument system and VCF incidence. VCF occurred in six of 50 teeth, all in the 0.04-taper group, while no fractures were observed in the taperless group. This difference was statistically significant ($p < 0.05$) with the 0.04-taper files associated with a twelvefold higher likelihood of VCF compared with taperless files (odds ratio = 12.09). These findings indicate that the use of 0.04-taper instruments significantly increased the risk of VCF compared with taperless files. Considering the thin crown structure of feline canines, taperless files that allow more conservative preparation can be considered as a safer clinical option.

Clinical and Histopathological Effects of Intramucosal Mesenchymal Stromal Cells in Feline Chronic Gingivostomatitis

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Abstract

The recommended treatment for feline chronic gingivostomatitis (FCGS) is tooth extraction to reduce pain and inflammation. The use of intravenous feline adipose tissue derived MSC (fAT MSC) as immunomodulators has been reported in refractory cases with favorable outcomes. However, intravenous administration may be associated with adverse events and pulmonary cell trapping. This study assessed the clinical and histologic effects of fAT MSC administered intramucosally in cats with FCGS undergoing tooth extraction. For this purpose, two groups were studied: (1) control, treated with premolar and molar extraction (PME) (n=10), and (2) treated with PME plus a single intramucosal dose of 10 million fAT MSC at the time of surgery (n=10). Cats were tested for FIV antibodies and FeLV antigen. Monthly clinical follow up was performed using the Stomatitis Disease Activity Index (SDAI) scoring system, together with hematological and biochemical analyses. Caudal oral mucosa biopsies were collected at days 0 and 30 for histopathological evaluation of the inflammatory infiltrate by classification using the scoring system for severity of microscopical inflammatory change. The study population had a mean age of 7.5 years, with 67% males and 33% females; 20% tested positive for FIV and 25% for FeLV. Lifestyle distribution was mixed in 62%, indoor in 24%, and outdoor in 14%, with 95% cohabiting with other cats. Among the 20 cats included in the study, a decrease in SDAI scores was observed at day 15, 30, 90, 120 and 180. At day 30, 75% of the cats demonstrated clinical improvement, and when analyzed by group, improvement was observed in 60% of the treated cats and 89% of the controls.

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Treated group had a mean SDAI of 15.1±6.8 at day 0 and 9.2±3.3 at day 30 (p=0.001), while the control group scored 13.5±3.7 at day 0 and 6.9±3.0 at day 30 (p=0.01). Interestingly, by day 90 the overall rate of improvement reached 83%, with 90% in the treated group and 75% in the control group. The most frequent hematological alterations were anemia, eosinophilia, lymphopenia, and monocytosis, while biochemical changes included hyperglobulinemia, increased total protein, and hypoalbuminemia. Hematocrit and hemoglobin increased significantly at days 15 and 60 post treatment (p=0.0003 and p=0.003, respectively) in treated cats compared with controls. Oral mucosa biopsies stained with H&E were analyzed in 9 cats (4 controls and 5 treated) at days 0 and 30. A decrease in inflammation and a correlation between histological score and SDAI were observed. At day 0, the median inflammatory severity score was 3 in both groups while at day 30, the treated group scored 2 versus 1.5 in controls. In conclusion, both treated and control groups showed clinical improvement in most cases, accompanied by a reduction in inflammatory infiltrates in the caudal oral mucosa. Notably, the treated group exhibited an increase in hematocrit and hemoglobin values compared with controls. No adverse reactions were observed during o after intramucosal administration of fAT MSCs. These findings suggest potential systemic effects of intramucosal administration of fAT MSCs in combination with PME, supporting further research with larger cohorts.

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Permanent Mandibular Canine Tooth Extraction Technique in Dogs: A Hybrid Approach to Assist Extraction and Minimise the Complications

Kayoko Kuroda *(BVSc, MANZCVS Small Animal Dentistry and Oral Surgery)*

Submission: Lecture, Category: Continuing Education or Case Discussion, Time: 15 minutes lecture

Abstract

The extraction of the permanent mandibular canine tooth in dogs presents unique surgical challenges due to its anatomic constraints and limited access. Inappropriate extraction technique may result in perioperative and postoperative complications, including rostral mandibular fractures, trauma to adjacent structures, including the mandibular first premolar and 3rd incisor tooth, and wound dehiscence, which is often exacerbated by the surrounding anatomy. While several extraction techniques have been described in the literature, this presentation introduces the "hybrid approach technique", which combines both labial and lingual surgical access with coronal sectioning to overcome anatomical limitations and facilitate controlled extractions.

The technique involves the creation of mucoperiosteal flaps on both labial and lingual aspects of the mandibular canine tooth. The removal of some labial bone is performed at the labial alveolar plate and interdental crestal bone between the distal aspect of the canine and the mesial aspect of the first premolar tooth. A deep lingual groove (or gutter) is created along the lingual aspect of the mandibular canine tooth, at the location of the periodontal ligament space to accommodate luxators and winged elevators. Coronal sectioning is performed to remove the curvature of the crown at approximately three-quarters of the crown from the cusp, with or without a shallow groove over the dentine at the mesial and distal aspect of the tooth, to assist in forceps placement. This triple-access strategy enhances visibility, improves instrument placement and may result in reduced risk of iatrogenic trauma.

A modified closure technique has been previously described, which anchors the lingual bony plate to the mentalis muscle using pilot holes for primary-layer sutures, followed by simple interrupted closure of the overlaying labial and lingual mucogingival flaps. This approach counters the constant tension exerted by the mentalis muscle at the labial frenulum, which is activated by everyday oral activities such as grooming, mastication, and drinking. By reducing muscle tension and gravitational stress, this technique should reduce the likelihood of wound breakdown, a common postoperative complication associated with permanent mandibular canine tooth extraction. This hybrid method offers a practical and reproducible solution for general practitioners seeking to refine their extraction techniques and improve surgical outcomes.

Comparison of the Effects of Doxycycline and Amoxicillin-Clavulanate on the Healing of Periodontal Pockets in Dogs

Tomáš Fichtel, Tereza Jeřábková

Abstract

The aim of this study was to compare the healing of periodontal pockets treated with curettage following systemic administration of doxycycline or amoxicillin-clavulanate.

A total of 24 periodontal pockets in 10 clinical canine patients (8–12 kg) were evaluated regardless of sex or age. Inclusion criteria were good cooperation of both patient and owner. In each dog, periodontitis stage PD 2–3 was radiographically diagnosed on one canine tooth (104/204/304/404). The depth of the periodontal pocket was measured, and the deepest value and its location were recorded. All patients underwent standard periodontal treatment including closed subgingival root planing and curettage (RP/C) using a Gracey 7/8 curette. Dogs were randomly divided into two groups of five (12 pockets per group). Both groups received antibiotics for 7 days post-treatment. Group 1 received doxycycline (10 mg/kg once daily p.o.), Group 2 amoxicillin-clavulanate (20 mg/kg twice daily p.o.). Thirty days after treatment, follow-up examinations and repeated measurements were performed at the same sites. Statistical analysis showed significant improvement within both groups: paired t-test Group 1 (doxycycline), $\alpha = 0.000119$; Group 2 (amoxicillin-clavulanate), $\alpha = 0.00145$. The Mann-Whitney U test revealed no significant difference between groups before treatment ($p = 0.44$; mean depth 4.08 mm in Group 1 vs. 4.0 mm in Group 2). However, a significant difference was observed 4 weeks after therapy ($p < 0.05$): mean pocket depth 1.66 mm in Group 1 vs. 2.58 mm in Group 2.

Conclusion

Systemic doxycycline administration significantly enhances healing of periodontal pockets in dogs compared with amoxicillin-clavulanate. The study was conducted as part of student training at the University of Veterinary Sciences Brno.

Clinical and radiographic assessment of teeth treated with odontoplasty

Magdalena Wilczek, Jerzy Gawor, Daria Ziemann, Ewa Chronowska

Preliminary results

Feline patients with traumatic malocclusion of premolar and molar teeth can be treated by corrective, interceptive treatment as well as the use of the odontoplasty procedure. Odontoplasty aims to reduce height and/or change the shape of the dental crown to alleviate occurring occlusal conflict resulting in trauma. This procedure preserves dentition, reduces the general anaesthesia time and is less invasive for the patient compared to tooth extraction. During this procedure a part of coronal enamel and dentin is removed and subsequently the dentinal bonding procedure is performed to seal the exposed dentinal tubules. Presented study is evaluating the long term results of odontoplasty treatment with particular attention being paid to the tooth status and functionality, occlusal relations and the radiographic appearance of hard dental tissues, endodontic system and the surrounding periodontium. This retrospective study includes cats which had received odontoplasty procedure and were subsequently presented for a clinical and radiographic reassessment in varied time distances (between four to fifty eight months based on the data collected until present). All feline patients included in the study received thorough clinical and radiographic assessment (including intraoral radiographs and/or three-dimensional imaging –

cone beam computed tomography). Preliminary results indicate the importance of this procedure in terms of long-term solution for the occlusal conflict alleviation and demonstrate that the majority of observed teeth did not show neither radiographic nor clinical signs of complications and/or pathologies within hard dental tissues, endodontic system and periodontal tissues.

Use of acupuncture as an adjunctive treatment in feline chronic gingivostomatitis: A prospective, randomised, double blind, controlled trial

Crina Iulia Dragu

Objective

To improve the well-being of cats suffering from chronic feline gingivostomatitis by determining the effectiveness of acupuncture in improving their quality of life (particularly in terms of pain levels, inflammation, appetite, grooming habits, and weight).

Background

Chronic feline gingivostomatitis is an inflammatory disease of the oral mucosa, affecting up to 26% of domestic cats. The complete etiology is not yet fully understood, although it is known to be a multifactorial disease, often associated with feline calicivirus. and multi-cat environments. Therapy is based on surgical extractions (total or subtotal/canine and incisor sparing, depending on the extent of rostral mucosal inflammation and other patient and client factors). Previous studies indicate that 60 to 80% of cats show significant improvement or resolution of clinical signs after dental extractions, within weeks to a few months post-surgery. The degree of improvement can range from complete remission to a substantial reduction in symptoms. Throughout the postoperative period, pain management is a crucial aspect of patient well-being, as this disease is associated with very high levels of pain, and the treatment itself involves acute (surgical) pain on top of the pre-existing chronic pain. In our clinical experience in dentistry and chronic pain management, we have encountered patients who, despite appropriate surgical treatment and seemingly adequate pharmacological pain management, did not eat sufficiently, resisted handling, and showed signs of ongoing pain. In these cases, a few acupuncture sessions proved effective in addressing these issues (normalisation of behaviour and physical condition, weight gain, acceptance of oral examination). In human medicine, acupuncture is used as part of treatments for chronic pain, mental health/well-being, and various disorders affecting the neurological, digestive, and immune systems. In veterinary medicine and specifically for the treatment of feline chronic gingivostomatitis, there is only anecdotal evidence and limited empirical data. The use of acupuncture may be of particular interest as an adjunct or alternative to administration of multiple medications over prolonged periods, which may prove difficult in cats. To extend a general recommendation to integrate acupuncture into the standard protocol for managing feline chronic gingivostomatitis, we need rigorous and systematic studies to demonstrate a direct link between acupuncture and improvements in chronic pain, quality of life, appetite, etc. in these patients.

Methods

26 cats were randomly assigned to a standard treatment group (total extractions and post operative pain management) and an acupuncture group (receiving total extractions, post operative pain management and 4 weekly acupuncture sessions). The cats were followed for a period of 8 weeks, with weekly examinations in the first 4 weeks. Clients submitted a client specific outcome measures questionnaire to assess quality of life prior to treatment and at the end of the study. Acute pain was assessed at each recheck exam using the Feline Grimace Scale.

Results
This trial is still ongoing at the time of the abstract submission

Conclusion
This trial is still ongoing at the time of the abstract submission

Importance of on-site PCR diagnostics in the management of feline oral inflammatory diseases

Ewa Chronowska, Jerzy Paweł Gawor

Feline inflammatory oral diseases are complex and painful conditions frequently associated with the presence of pathogens typical for upper respiratory tract infections. Accurate detection of these agents is essential for guided treatment and monitoring therapeutic response. In this study, we evaluated an in-clinic PCR assay targeting Feline Calicivirus, Feline Herpesvirus, Mycoplasma felis, Chlamydia felis and Bordetella bronchiseptica in cats diagnosed with inflammatory oral diseases. Initially, we compared the sensitivity and reproducibility of the in-clinic system with results obtained from a licensed external laboratory. Subsequently, we performed pre-treatment and, when positive, follow-up post-treatment testing to assess infection dynamics. While PCR itself is an established method, the availability of reliable on-site diagnostics significantly reduced turnaround time compared to conventional laboratory submission. This facilitated earlier clinical decisions, timely therapeutic interventions, and more effective management of affected patients. Our findings support the use of in-clinic PCR as a practical and efficient diagnostic approach in daily veterinary practice.

Root canal treatment of four canine teeth in a white tiger, with long-term follow-up: a clinical case presentation with an overview of the current literature

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Iceboy, a 13-year-old white tiger was presented with multiple tooth fractures, including complicated crown-root fractures (with pulp exposure) in all four canine teeth. Diagnostic workup included full-mouth radiography, dental charting and probing. The patient was operated on by a dental team of four (including two european specialists in veterinary dentistry) in Sóstó Zoo (Nyíregyháza, Hungary). Anaesthesia team was provided by the zoo. All canine teeth were treated by root canal treatment including a combination of hand-filing and motorized techniques in a single anaesthetic episode. Simultaneous treatment of ipsilateral canine teeth in lateral recumbency was performed to reduce anaesthesia time.15 months later a follow-up procedure was performed, during which all previously treated teeth were radiographically rechecked and were considered successful. This presentation highlights the challenges of performing complex dental procedures in a zoo environment and reviews the current literature on endodontic treatment of large felids.

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Introduction
Dr. Tretter graduated from the Veterinary University of Budapest in 2010. She worked in England for several years and after moving back to Hungary she focused on small animal dentistry in her work. Since 2020, she exclusively performs small animal dental procedures, oral and maxillofacial surgeries. She is an alternative resident of the EVDC (European Veterinary Dental College). She is very passionate about her clinical work, teaching, cooperation with Colleagues and improving small animal dentistry in Hungary.

Extraoral Dental Extractions with Piezoelectric Technique for the Treatment of Odontogenic Abscesses in Rabbits: Technical Description, Clinical Rationale, and Postoperative Management

Francesco Paesano

Odontogenic abscesses represent one of the most frequent and challenging conditions in pet rabbits, with a clinical course often complicated by osteomyelitis and osteonecrosis. The unique dental physiology of lagomorphs, characterized by continuously growing teeth and delicate craniofacial bone architecture, makes surgical management particularly complex. Traditional approaches using rotary instruments or manual luxators require the application of significant force, which increases the risk of iatrogenic mandibular or maxillary fractures, thermal necrosis of bone margins, and delayed healing. Piezoelectric surgery offers a minimally invasive and highly selective alternative. This technology relies on ultrasonic microvibrations that cut only mineralized tissues such as bone and teeth, while sparing soft tissues. The cavitation effect generated during irrigation produces antibacterial action, reduces intraoperative bleeding through microcoagulation, and maintains a clear surgical field. These properties allow atraumatic osteotomies and osteoplasties, precise dental extractions without force, and preservation of vascularized bone margins, thereby reducing postoperative pain and accelerating tissue regeneration.

A clinical parallel can be drawn from human oral surgery, where piezoelectric devices have become indispensable in the treatment of mandibular osteonecrosis. In advanced cases of odontogenic abscesses in rabbits, where osteomyelitis and osteonecrosis are also present, this analogy supports the use of piezoelectric surgery as a preferred tool. The ability to selectively remove infected and necrotic bone while preserving viable structures makes it an excellent option for complex or recurrent cases that otherwise carry a poor prognosis. The described technique involves extraoral access to the affected region, atraumatic bone removal with dedicated piezoelectric inserts, and extraction of diseased teeth without forceful manipulation. Intraoral suturing prevents orocutaneous fistula formation, while marsupialization facilitates drainage and granulation.

A key adjunct to surgical treatment is ultrasonic wound debridement (UWD), performed with the same piezoelectric unit by switching to specific programs and inserts. UWD applies low-frequency ultrasonic oscillations that selectively emulsify necrotic tissue while preserving granulation tissue and stimulating angiogenesis. Cavitation phenomena further enhance antibacterial activity by disrupting bacterial biofilm and promoting the release of growth factors. In the postoperative management of abscess cavities, UWD accelerates healing, reduces the number of required anesthetic events, and is often well tolerated without pharmacological restraint. Clinical application in rabbits has shown reduced recurrence rates, improved wound hygiene, and faster resolution compared with conventional mechanical debridement. By combining extraoral piezoelectric extractions with postoperative UWD, a comprehensive and minimally invasive treatment protocol can be achieved. This dual application of the same technology ensures continuity of care: precise surgical removal of infected dental and bony structures, followed by targeted and atraumatic management of residual infection. In conclusion, piezoelectric extraoral dental extraction

represents a safe and effective method for managing odontogenic abscesses in rabbits, while ultrasonic wound debridement provides a powerful adjunctive therapy to optimize postoperative recovery. Together, these approaches mirror the successful integration of piezoelectric surgery in human oral and maxillofacial medicine, highlighting its role as an indispensable tool in the treatment of osteomyelitis and osteonecrosis secondary to advanced dental disease in rabbits.

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Are You Going to Remove What (and Where)?! Application of Coronal Sectioning for Feline and Canine Extractions

Kayoko Kuroda *(BVSc, MANZCVS Small Animal Dentistry and Oral Surgery)*
Proposed presentation time: 15 minutes, Submission: lecture, Category: Case Discussion

Abstract
Exodontia is a common yet technically demanding procedure in small animal dentistry due to anatomical constraints and proximity to vital structures. Coronal sectioning is a strategic technique that facilitates safer and more controlled extractions, particularly in anatomically complex cases. This presentation examines the clinical indications, risks, and applications of coronal sectioning in feline and canine patients, aiming to enhance surgical access, reduce iatrogenic trauma, and broaden the clinician's procedural repertoire through case-based insights.

Contents of the Presentation
Exodontia (tooth extraction) is undoubtedly one of the most frequently performed oral surgical procedures in small animal practice. Despite clinicians encountering the necessity for this procedure in many clinical settings, exodontia can be technically challenging due to the anatomical structures and their location: tooth roots are often fragile, may have a longer crown-to-root ratio, and apices may have some malformation, such as dilaceration, which can complicate removal. The oral cavity itself is typically small, with limited visualisation. The apical third of the roots often lies in very close proximity to other important anatomical structures, including the mandibular canals, infraorbital canal, infraorbital foramen and middle mental foramen.

Some teeth requiring extractions may have very little to no interdental space between them and the adjacent teeth. These anatomical nuances increase the risks of iatrogenic trauma and perioperative surgical morbidity. There are several terms for "cutting the crown" in dentistry, including coronectomy, odonectomy, and crown amputation. Coronectomy, also known as partial odonectomy, is a process that involves extracting the crown of a vital tooth with the purpose of intentional root retention. "Coronal sectioning" is typically performed on multi-rooted teeth to create a separate segment, thereby facilitating the extractions of individual roots. It can also be performed on single-rooted teeth, including the permanent canine tooth and the deciduous canine tooth, to facilitate:

1. Improving visualisation of the surgical field, particularly in anatomically constrained areas for instrumentation.
2. Enhanced access and anchorage for hand instrumentation, aiding better control of hand instruments during extraction.
3. Reduced perioperative surgical and iatrogenic complications.

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Despite its advantages, the performance of crown sectioning during tooth extraction carries some risks, including the potential for inadvertent damage to the adjacent tooth structure. It may also weaken the remaining tooth structure, which may lead to tooth or root fractures. This presentation explores the indications, contraindications and clinical reasoning behind coronal sectioning in feline and canine patients for the purpose of exodontia. Through the presentation of case examples and information regarding the assessment of tooth structures, it is hoped that the strategic applications of the coronal sectioning technique may expand the clinicians' armamentarium in canine and feline dental extraction techniques and assist in reducing the potential perioperative surgical morbidity and trauma to the patient.

Traumatic Zygomatico-Ramal Ankylosis in a Caucasian Shepherd Dog: Diagnosis, Surgical Management, and Functional Outcome

Yves Debosschere

Objectives
To present a clinical case of traumatic zygomatico-ramal ankylosis in a dog, highlighting diagnostic pitfalls, the role of advanced imaging, surgical treatment, and functional recovery.

Case History
"Leo," a 3-year-old male Caucasian Shepherd Dog rescued as a stray in Turkey, had suffered from chronic trismus for over two years. He required hours to eat small amounts of food and was only able to drink by immersing his muzzle in water and sucking. Previous treatments-including corticosteroids for a presumed diagnosis of masticatory myositis, antibiotics, and NSAIDs-were unsuccessful. A primary left-sided entropion was diagnosed and surgically corrected in Turkey during the same period, but recurred and remained present at referral.

Methods
Clinical examination confirmed inability to open the mouth, making intraoral evaluation impossible. Multi-detector CT (MDCT) revealed an osseous bridge between the zygomatic arch and the mandibular ramus. A lateral surgical approach was undertaken, and the ankylotic mass was removed using piezosurgery. Postoperative management included tracheostomy-based anaesthesia, multimodal analgesia, professional physiotherapy, and structured home care.

Results
Immediate restoration of mandibular mobility was achieved, with the dog regaining normal eating and drinking behaviour. No recurrence of ankylosis was noted on follow-up.

Conclusions
Zygomatico-ramal ankylosis is a rare but surgically treatable cause of canine trismus. CT is superior to radiography for accurate diagnosis and preoperative planning. Combined surgical and physiotherapeutic management can restore full function and dramatically improve quality of life.

Introduction
Trismus, or the inability to open the mouth, is an uncommon but functionally devastating condition in dogs. It compromises essential functions such as eating, drinking, thermoregulation, and oral grooming, and it can significantly reduce quality of life. A wide range of underlying conditions may lead to trismus, including inflammatory, neoplastic, infectious, neuromuscular, and traumatic causes. Distinguishing among these requires careful clinical assessment, appropriate imaging, and a high index of suspicion for rarer entities such as extra-articular ankylosis. The present report describes a case of traumatic zygomatico-ramal ankylosis in a young Caucasian Shepherd Dog.

To our knowledge, this presentation is exceptionally rare. The case emphasises the importance of advanced imaging, surgical precision, and structured postoperative rehabilitation.

Differential Diagnoses for Trismus in Dogs
- Masticatory myositis
- emporomandibular joint (TMJ) ankylosis
- TMJ osteoarthritis
- Craniomandibular osteopathy
- Zygomatic arch and/or coronoid process fracture
- Tetanus
- Abscess or cyst
- Neoplasia
- Ear disease
- Ocular disease (retrobulbar lesion)
- Retropharyngeal abscess

In Leo's case, initial misdiagnosis as masticatory myositis delayed appropriate treatment. Corticosteroid therapy failed, underlining the importance of ruling out extra-articular ankylosis.

Case History
Leo, a 3-year-old intact male Caucasian Shepherd Dog, had been rescued as a stray in Turkey. His condition had been progressive since the presumed traumatic event two years earlier. The owners reported that he could only ingest food by pushing individual kibbles between his teeth, taking hours to finish a meal. Drinking was achieved by immersing his muzzle and sucking water, rather than lapping. Veterinary care abroad included radiography, corticosteroid therapy, antibiotics, and NSAIDs. None resulted in clinical improvement. At the same time, a primary entropion of the left eye was diagnosed and surgically corrected in Turkey, but the condition recurred and remained present at the time of referral. The dog was subsequently referred to our service after relocation to Belgium.

Diagnostic Work-up
Clinical Examination
On admission, Leo exhibited complete inability to open his mouth. This prevented direct intraoral examination or assessment of occlusion. Palpation revealed no overt pain, but functional evaluation was impossible. The severity of the restriction underscored the need for advanced imaging. Routine haematology and serology were within normal limits, and no cardiac abnormalities were detected. Ophthalmological evaluation confirmed a persistent left-sided primary entropion, which had already been surgically corrected in Turkey at the time of the presumed diagnosis of masticatory myositis, but without lasting success.

Imaging
Conventional radiographs obtained in Turkey had been inconclusive. The limitations of radiography are well recognised: superimposition of complex craniofacial structures reduces sensitivity for detecting ankylotic lesions. Computed tomography (CT) was therefore performed using a multi-detector CT (MDCT) scanner. The advantages of CT over radiography include:
- Elimination of superimposition, enabling 3D reconstruction.
- Precise evaluation of fracture or fragment orientation.
- Clear delineation of ankylotic masses and adjacent structures.

In comparative studies, CT detects approximately 1.6 times more traumatic injuries in dogs and twice as many in cats than radiography. This reinforces its role as the diagnostic modality of choice for

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maxillofacial ankylosis. In Leo's case, MDCT revealed a dense osseous bridge between the right zygomatic arch and the ascending ramus of the mandible, confirming the diagnosis of extra-articular zygomatico-ramal ankylosis.

Preoperative Planning and 3D Printing
CT data can be converted into three-dimensional (3D) printed models to aid preoperative planning. Such models provide tactile and visual reference for surgeons, allow simulation of surgical access, and are a powerful communication tool with owners. In this case, the MDCT scan was primarily used digitally, but 3D printing remains a valuable adjunct in complex craniofacial surgery.

Owner Discussion
Prior to surgery, the findings, prognosis, and potential complications-including recurrence, intraoperative haemorrhage, and nerve injury-were discussed extensively with the owners.
The importance of intensive postoperative physiotherapy was emphasised.

Anaesthetic Management
Airway management posed a major challenge in this case due to the complete inability to open the mouth. Standard orotracheal intubation was not possible. Fibre-optic guided intubation, occasionally described in veterinary anaesthesia, was considered; however, the severity of the trismus precluded its use in this patient. General anaesthesia was therefore induced with propofol. A temporary tracheostomy was then performed, and a 9.5 mm endotracheal tube was inserted directly through the stoma to secure the airway ("tracheostomal intubation"). Anaesthesia was maintained with inhalant agents delivered via the tracheostomy tube. Analgesia was provided intraoperatively by means of a continuous intravenous fentanyl–lidocaine–ketamine (FLK) infusion, ensuring stable and balanced pain management. Cardiovascular and respiratory parameters were continuously monitored throughout the procedure. The tracheostomy was closed at the end of surgery without complications.

Surgical Procedure
A skin incision was made over the left zygomatic arch. The overlying fascia and fibrotic tissue were bluntly dissected, and the surgical field was maintained under optimal exposure with a Lone Star Retractor. To improve access, the caudal segment of the zygomatic arch was resected. The fibrotic callus tissue, secondary to an old fracture, was carefully separated and excised. This provided full exposure of the ankylotic mass adjoining the mandibular ramus. The bony bridge, together with the surrounding fibrotic tissue, was removed using a piezotome, which allowed precise and selective resection of mineralised structures while sparing adjacent soft tissues. The operative site was copiously irrigated. Closure was carried out in layers: the fascia was sutured with PDS 3–0, the subcutaneous tissue with Monocryl Plus 4–0, and the skin with Ethilon 3–0. The tracheostomy was closed at the end of the procedure by placing simple interrupted sutures in the tracheal rings (PDS 3–0), continuous closure of the sternohyoideus (PDS 3–0), followed by continuous subcutaneous closure and intradermal skin sutures with Monocryl 4–0. A pressure bandage was applied.

Postoperative Management and Physiotherapy
Postoperative care included multimodal analgesia, anti-inflammatory medication, and prophylactic antibiotics. At the end of surgery, the continuous FLK infusion was discontinued and the patient was transitioned to methadone for systemic analgesia. The FLK infusion remained available for re-initiation if pain control proved insufficient. Upon recovery from anaesthesia, Leo was already able to open his mouth to approximately 6 cm. Once fully awake, he immediately demonstrated vigorous mandibular function by chewing through his intravenous line – a somewhat inconvenient but reassuring sign that his ability to bite had not been lost.

The dog was discharged with the following home-care regimen:

- Meloxicam oral suspension (Meloxoral), administered once daily at the weight-adjusted dose (40 kg), for ten days, starting the morning after discharge. Owners were instructed never to administer the drug on an empty stomach and to discontinue immediately if vomiting, diarrhoea, or melena occurred.
- Amoxicillin–clavulanic acid (Clavaseptin 500 mg), one tablet twice daily for ten days.
- Wound care: daily inspection for discharge, erythema, or swelling. A protective collar was to be worn at all times to prevent licking or scratching. Special attention was drawn to the cervical tracheostomy site. The external bandage could be removed after three days or sooner if it detached spontaneously.
- Dietary management: unrestricted access to food, with soft pâté recommended in small, frequent portions to encourage licking and mandibular movement.
- Follow-up examination scheduled one week postoperatively.
- Ocular care: the left eye remained visual but was irritated by inward rolling of the lower eyelid. The entropion was confirmed as primary but was thought to be exacerbated by deeper positioning of the globe following surgery. Potential complications included ulcerative keratitis and reduced vision. The owner was advised to plan a blepharoplasty of the left lower eyelid once postoperative swelling had fully resolved, ideally after several weeks. In the interim, the eye was to be protected with frequent application of lubricating gel. Should ulcerative keratitis or excessive irritation occur, earlier surgical correction was recommended.
- Physiotherapy: professional physiotherapy sessions were initiated and supervised by a certified veterinary physiotherapist. The programme included both passive and active mouth-opening exercises, gradually increasing in intensity, and owner involvement was encouraged to maintain continuity at home.

Results

Leo regained the ability to open his mouth to a normal functional range. Immediately postoperatively, mandibular excursion measured 6 cm. He was able to eat dry food without assistance and resumed normal drinking behaviour. At follow-up seven weeks later, coinciding with surgical correction of the left-sided entropion (blepharoplasty), Leo's maximum mouth opening had further improved to 9 cm. No recurrence of ankylosis was observed, and overall quality of life was considered excellent.

Discussion

This case demonstrates the diagnostic pitfalls of chronic trismus in dogs. Initial treatment for presumed masticatory myositis delayed correct intervention, a reminder that absence of clinical improvement with corticosteroids should prompt reconsideration of the diagnosis. CT proved indispensable, revealing an osseous bridge hidden by superimposition in radiographs. Literature supports CT's superiority, detecting up to 1.6× more injuries in dogs and 2× more in cats compared to radiography. 3D printing, while not utilised here, represents a powerful adjunct for planning and client communication. Surgical management using piezosurgery allowed precise removal of the ankylotic mass with minimal collateral trauma. The Lone Star Retractor facilitated atraumatic soft tissue handling and excellent exposure of the surgical site. Postoperative recovery underscored the crucial role of professional physiotherapy in maintaining function and preventing recurrence. While owner-led exercises are important, the structured involvement of a veterinary physiotherapist provided tailored therapy, progressive adaptation, and improved compliance, likely enhancing long-term outcome. Extra-articular ankylosis between the zygomatic arch and mandibular ramus is exceedingly rare, but recognition and surgical intervention can restore normal function and quality of life.

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Conclusion
Zygomatico-ramal ankylosis should be included in the differential diagnosis of chronic trismus in dogs, especially those with a history of trauma. CT is the diagnostic modality of choice, offering superior lesion characterisation. Surgical removal with piezosurgery, combined with professional physiotherapy and structured home care, can result in complete functional recovery.

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Clinical application of autologous platelet-rich fibrin (PRF) in the treatment of naturally occurring periodontal disease in dogs: preliminary split-mouth results
Juan Eguren

Staged surgical management of a dentigerous cyst in a captive white-faced saki (Pithecia pithecia): marsupialisation and extraction with piezoelectric bone surgery
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A Multimodal Investigation of a Pink Discoloured Canine Tooth in a Jaguar (Panthera onca): A Clinical, Computed Tomographic, Microstructural, Ultrastructural, and Computer-aided-design/Computer-aided-manufacturing (CAD/CAM) Prosthodontic Reconstruction Study
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Radiopaque mandibular lesions in three dogs
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The Inclined Plane – An Investigation Into The Mechanism Of Movement In The Application For Congenital And Trauma Induced Malocclusions. 3 Case Studies & Literature Review
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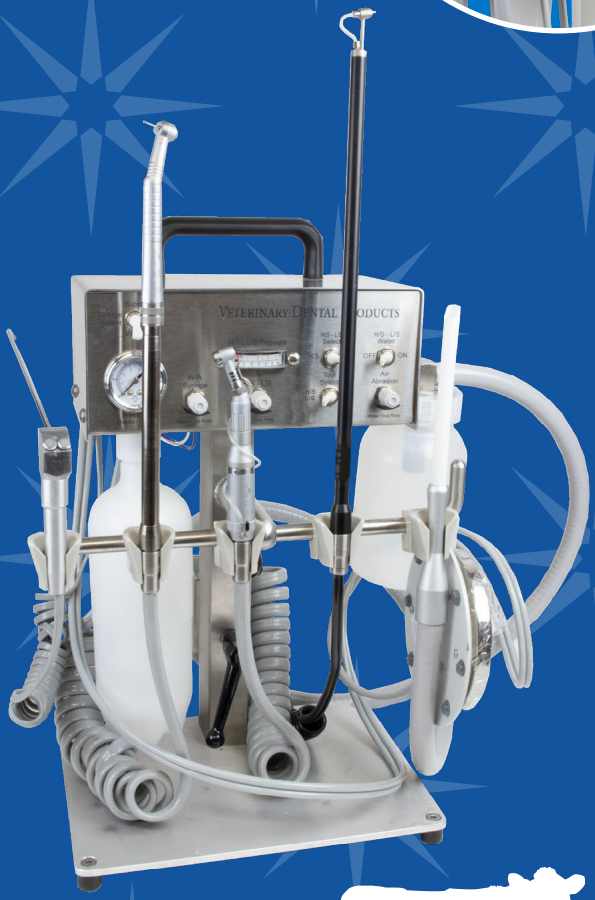

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