18th European Congress of Veterinary Dentistry

September 10th-12th 2009, Zurich, Switzerland

Welcome to Zurich!
Why take the risk of high sodium levels?

Hill’s™ Prescription Diet™ Feline t/d™ has great taste and unbeatable efficacy, without the risk. Proven.

Hill’s™ Vets’ No.1 Choice™
Find out more, visit www.HillsPet.com
18th European Congress of Veterinary Dentistry

September 10th-12th 2009, Zurich, Switzerland

The ECVD local organising committee (Philippe Roux, Gottfried Morgenegg, Daniel Koch), the EVDS board and all the participants would like to thank the sponsors of the 18th European Congress of Veterinary Dentistry for their financial support, their help and assistance that helped us to make this meeting a success.

Diamond sponsor of the EVDS:

![Hill's](image)

Main sponsors of the EVDS:

![Pedigree](image)

Special thanks to Mars that supported the translation during the Congress.
EUROPEAN VETERINARY DENTAL SOCIETY
Executive Board

President:
Jerzy Gawor
ul.Chlopska 2a
30-806 Kraków - Poland
Phone/FAX: +48 12 6588365
E-mail: jgawor@pp.com.pl or president@evds.org

President Elect:
Jan Schreyer
Ahornstraße 42
09112 Chemnitz – Germany
Phone: +49 (0) 371/304973 Fax: +49 (0) 371/3674574
E-mail: Dr.Schreyer@fuer-mein-tier.de or presidentelect@evds.org

Secretary:
Ines Ott
Brueker-Grimm-Str. 3
63450 Hanau, Germany
Phone : +49 (0) 6181 22492 Fax : +49 (0) 6181 257176
Email : Dr.Ines.Ott@Tierarztpraxis-Hanau.de or secretary@evds.org

Treasurer (and Past president):
Paul Cooper
The Veterinary Surgery - 309 The Ridge
Hastings, East Sussex, TN34 2RA, UK
Phone: +44 1424 751595
Fax: +44 1424 756378
E-mail: pcooper@vetdent.plus.com or treasurer@evds.org

Immediate Past President:
Olivier Gauthier
Unité de Chirurgie-Anesthésie – Ecole nationale vétérinaire de Nantes
Atlanpole La Chantrerie
BP 40706 – 44307 Nantes cedex 3 – France
Phone +33 2 40 68 78 09 (76 72) Fax +33 2 40 68 77 73
E-mail gauthier@vet-nantes.fr or pastpresident@evds.org

EVDS web site : http://www.evds.info
We thank all the local sponsors of the ECVD Zurich 2009 for their support!
<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Speaker</th>
<th>Type</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thursday 10th SEPTEMBER</td>
<td>EVDC Training Sessions: wetlabs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.30am - 5.00pm</td>
<td>EVDC Training sessions meeting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.00 - 7.00pm</td>
<td>EVDC Training sessions meeting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.00pm</td>
<td>Welcome Reception</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friday 11th SEPTEMBER</td>
<td>Stream 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.00am - 9.10am</td>
<td>Opening of the congress</td>
<td>Jerzy Gawor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.10am - 9.35am</td>
<td>Validation of Use of Sub-sets of teeth for the TMSPosterior Scoring System in dogs</td>
<td>Colin E. Harvey</td>
<td>Periodontology</td>
<td>USA</td>
</tr>
<tr>
<td>9.35am - 9.55am</td>
<td>Field Safety and Efficacy of Conventional in the Treatment of Naturally occurring Periodontal Disease in dogs</td>
<td>Henry Giboin</td>
<td>Periodontology</td>
<td>UK</td>
</tr>
<tr>
<td>9.55am - 10.20am</td>
<td>VALIDATION OF THE USE OF HALIMETER® IN DOGS</td>
<td>Philippe Houet</td>
<td>Periodontology</td>
<td>France</td>
</tr>
<tr>
<td>10.20am - 10.30am</td>
<td>Coffee Break</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.30am - 11.15am</td>
<td>EFFECT OF TOOTH BRUSHING AND CHEW DISTRIBUTION ON HALITOSIS IN DOGS</td>
<td>Claire Mariani</td>
<td>Periodontology</td>
<td>France</td>
</tr>
<tr>
<td>11.15am - 11.35am</td>
<td>Total Mouth Periodontal Score System in Cats</td>
<td>Colin E. Harvey</td>
<td>Periodontology</td>
<td>USA</td>
</tr>
<tr>
<td>11.35am - 11.55am</td>
<td>TREATMENT BY PREMAXILLECTOMY OF MAXILLARYOSTEOMYELITIS IN TWO SCOTTISH TERRIERS SUFFERING FROM CHRONIC ULCERATIVE PARADENTAL STOMATITIS</td>
<td>Florian Boutolle</td>
<td>Periodontology</td>
<td>France</td>
</tr>
<tr>
<td>11.55am - 12.40pm</td>
<td>Feline Caudal Stomatitis: extraction and then what else?</td>
<td>Philippe Houet</td>
<td>EVDC interactive session</td>
<td>France</td>
</tr>
<tr>
<td>12.40pm - 1.40pm</td>
<td>Lunch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.40pm - 2.40pm</td>
<td>Digital Volume Tomography</td>
<td>Dirk Schulz</td>
<td>KEYSINE Lecture</td>
<td>Germany</td>
</tr>
<tr>
<td>2.40pm - 3.10pm</td>
<td>RADICAL TONGUE RESSECTION IN CATS AND DOGS</td>
<td>Alexander M. Reitter</td>
<td>Surgery</td>
<td>USA</td>
</tr>
<tr>
<td>3.10pm - 3.30pm</td>
<td>Meet the EVDC Tea Break</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.40pm - 3.50pm</td>
<td>A critical review of endodontic filling material and adjuncts</td>
<td>Brock A. Neumeier</td>
<td>Endodontic</td>
<td>USA</td>
</tr>
<tr>
<td>4.00pm - 5.00pm</td>
<td>Comparative Endodontics, Small Animal, Hicivores, and Basics</td>
<td>Peter Emery</td>
<td>Endodontic</td>
<td>USA</td>
</tr>
<tr>
<td>4.40pm - 4.50pm</td>
<td>Endodontics and Prosthodontics of a Chilled Kiwi</td>
<td>Barron Hall</td>
<td>Endodontic</td>
<td>USA</td>
</tr>
<tr>
<td>5.00pm - 5.20pm</td>
<td>Oral and dental conditions in captive animals in two privately owned facilities</td>
<td>Cedric Tutt</td>
<td>Pathology</td>
<td>South Africa</td>
</tr>
<tr>
<td>7.30pm</td>
<td>Gala Dinner</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saturday 12th SEPTEMBER</td>
<td>Stream 2 Equine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.00am - 9.20am</td>
<td>Equine dentistry: an overview</td>
<td>Alessandro De Simoi</td>
<td>Equine</td>
<td>Italy</td>
</tr>
<tr>
<td>9.20am - 9.45am</td>
<td>How I do crown preps</td>
<td>Barron Hall</td>
<td>Restorative</td>
<td>USA</td>
</tr>
<tr>
<td>9.45am - 10.30am</td>
<td>To crown or not to crown, that is the Q…?</td>
<td>Frank Verstraete and Chris Visser</td>
<td>EVDC Interactive session</td>
<td>USA</td>
</tr>
<tr>
<td>10.30am - 11.00am</td>
<td>Coffee Break</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.00am - 11.25am</td>
<td>Surgical Root Canal Treatment in Fowl</td>
<td>Chris J. Ixler</td>
<td>Endodontic</td>
<td>USA</td>
</tr>
<tr>
<td>11.25am - 12.00pm</td>
<td>Technical aspects of accessory dental restorative and grinders and the introduction of a new anterior diamond grinders for treating occlusal of small mammals</td>
<td>Stefan Gabriel</td>
<td>Small mammals</td>
<td>Germany</td>
</tr>
<tr>
<td>Time</td>
<td>Session</td>
<td>Speaker</td>
<td>Location</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-------------------------------</td>
<td>--------------</td>
<td></td>
</tr>
<tr>
<td>12.05-12.20pm</td>
<td>Dental eruption chronology in degus (Octodon degu) – a preliminary study</td>
<td>Vladimír Jekl</td>
<td>Czech Republic</td>
<td></td>
</tr>
<tr>
<td>12.20-12.30pm</td>
<td>Lunch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.20-1.40pm</td>
<td>The Science and Art of Oral Surgery – palatal defects and tumors</td>
<td>Ira Loktin, Dale Kressin</td>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>1.40-1.50pm</td>
<td>Complicated acquired palatal defect in a cat</td>
<td>Gerhard Riehmeier</td>
<td>Austria</td>
<td></td>
</tr>
<tr>
<td>1.50-2.00pm</td>
<td>Tea Break</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.00-2.10pm</td>
<td>Practical review of clinical decision-making and treatment options</td>
<td>Helena Kusmi-Vuittovaara</td>
<td>Finland</td>
<td></td>
</tr>
<tr>
<td>2.10-2.40pm</td>
<td>Prevalence of occluded abnormalities in dogs</td>
<td>Igor Capik</td>
<td>Slovak Republic</td>
<td></td>
</tr>
<tr>
<td>2.40-3.00pm</td>
<td>Screen, elastic, wire, loops, magnets and inclined planes in power sources in veterinary orthodontics</td>
<td>Gerhard Staudacher</td>
<td>Germany</td>
<td></td>
</tr>
<tr>
<td>3.00-4.00pm</td>
<td>Closure of the congress</td>
<td>EVDS Board and local organizing committee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.00-7.00pm</td>
<td>EVDS AGM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.00-9.25am</td>
<td>DENTAL RADIOLOGY TECHNIQUES</td>
<td>Brook A. Niemiec</td>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>9.25-9.50am</td>
<td>Dental Radiograph Interpretation</td>
<td>Brook A. Niemiec</td>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>9.50-10.10am</td>
<td>Radiographic Evaluation of Feline Tooth Resorption</td>
<td>Dan Cao</td>
<td>Switzerland</td>
<td></td>
</tr>
<tr>
<td>10.10-10.30am</td>
<td>Missing and Supernumerary Teeth</td>
<td>Stefan Grundmann</td>
<td>Switzerland</td>
<td></td>
</tr>
<tr>
<td>12.20-12.30pm</td>
<td>Lunch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.20-12.40pm</td>
<td>An Improved Extraction Technique</td>
<td>Cecilia Garrett</td>
<td>UK</td>
<td></td>
</tr>
<tr>
<td>1.20-1.30pm</td>
<td>Bone graft material</td>
<td>Barbara Mosimic</td>
<td>Germany</td>
<td></td>
</tr>
<tr>
<td>2.10-2.40pm</td>
<td>Surgical removal of cystic submandibular gland tumors</td>
<td>Leen Verhaert</td>
<td>Belgium</td>
<td></td>
</tr>
<tr>
<td>2.40-2.50pm</td>
<td>Surgical removal of cystic submandibular gland tumor</td>
<td>Ayako Okuda</td>
<td>Japan</td>
<td></td>
</tr>
<tr>
<td>2.50-3.00pm</td>
<td>Surgical removal of cystic submandibular gland tumor</td>
<td>Ayako Okuda</td>
<td>Japan</td>
<td></td>
</tr>
<tr>
<td>3.00-3.20pm</td>
<td>Surgical removal of cystic submandibular gland tumor</td>
<td>Ayako Okuda</td>
<td>Japan</td>
<td></td>
</tr>
<tr>
<td>3.20-3.40pm</td>
<td>Surgical removal of cystic submandibular gland tumor</td>
<td>Ayako Okuda</td>
<td>Japan</td>
<td></td>
</tr>
<tr>
<td>3.40-3.50pm</td>
<td>Surgical removal of a Red panda</td>
<td>Barron Hall</td>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>3.50-3.55pm</td>
<td>Surgical removal of a Red panda</td>
<td>Barron Hall</td>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>5.30-6.00pm</td>
<td>Closure of the congress</td>
<td>EVDS Board and local organizing committee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.45-6.00pm</td>
<td>Secondary Hyperparathyroidism in 4 dogs</td>
<td>Leen Verhaert</td>
<td>Belgium</td>
<td></td>
</tr>
<tr>
<td>5.55-6.00pm</td>
<td>Periodontal therapy</td>
<td>Brook A. Nimestic</td>
<td>USA</td>
<td></td>
</tr>
<tr>
<td>6.05-7.00pm</td>
<td>Treatment of a Facial Abscess of Dental Origin in Ferret</td>
<td>Jesús Maria Fernández Sánchez</td>
<td>Spain</td>
<td></td>
</tr>
<tr>
<td>6.00-7.00pm</td>
<td>EVDS AGM</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Poster Presentations:**

1. **TREATMENT OF A FACIAL ABScess OF DENTAL ORIGIN IN Ferret**
   - Jesús Maria Fernández Sánchez
   - Periodontology
   - Spain

2. **Tissue Interactions in Tissue in Dogs: Clinical Diagnosis and Therapy**
   - Tomislav Štucl, Michaela Chichilniska, Michaela Urbína
   - Pathology
   - Czech Republic

3. **Prevalence of Periodontal Disease in Domestic Sled Dogs**
   - Mohamed Shokry
   - Pathology
   - Egypt

4. **parasitism – more than a point of pain in veterinary**
   - Carlos Alberto Antunes Viegas
   - Pathology
   - Portugal

5. **DEVELOPMENT OF PHARMACEUTICAL WAYS FOR PERIODONTAL DISEASE IN VETERINARY**
   - Prado, A.M.B.; Isaka, L.J.E.; Nishimoto, T.; Ramos, C.M.G
   - Pathology
   - Brazil
VALIDATION OF USE OF SUB-SETS OF TEETH FOR THE TMPS PERIODONTAL SCORING SYSTEM IN DOGS

Colin E. Harvey, BVSc, FRCVS, Dip ACVS, Dip AVDC, Dip EVDC

A Total Mouth Periodontal Score (TMPS) system using weighted contributions of specific teeth based on gingival circumference (for gingivitis scores) and root surface area (for periodontal attachment loss for periodontitis) was recently reported in dogs. Use of the TMPS spreadsheet results in a validated and repeatable single gingivitis or attachment loss score representative of the extent of periodontal disease present at the time of examination. The full TMPS system measures each root site separately, and thus is time-consuming.

TMPS scores from a full set of measurements from 34 dogs were used to determine whether sub-sets of teeth can be reliably used to generate TMPS gingivitis and periodontitis scores. Using correlation coefficient and Bland-Altman analyses, correlation of several sub-sets of teeth with the full mouth data set was analyzed.

Scoring only the maxillary third incisor, canine, third premolar, fourth premolar, first molar and mandibular canine, third premolar, fourth premolar and first molar teeth (9 teeth, 15 root sites) was sufficiently closely correlated with the full-mouth data to validate use of this sub-set for studies using TMPS weighted scores in dogs.

Reference:

Colin Harvey is Professor of Surgery and Dentistry in the Department of Clinical Studies, School of Veterinary Medicine, University of Pennsylvania.
FIELD SAFETY AND EFFICACY OF CONVENIA™ IN THE TREATMENT OF NATURALLY OCCURRING PERIODONTAL DISEASE IN DOGS

H. Giboin, J. Civil, and M. R. Stegemann
Pfizer Animal Health, Research & Development, Sandwich, United Kingdom

Cefovecin (Convenia™) has been approved in Europe for the treatment of bacterial skin and urinary tract infections in both dogs and cats. A multicenter field safety and efficacy study was conducted according to VICH-GCP to support the registration of a periodontal claim in dogs in 20 veterinary practices located in France and Belgium. A total of 308 adult dogs exhibiting signs of periodontal disease were assessed for inclusion. Out of those, 299 dogs were randomised (enrolled and treated) in a 1:1 ratio to one of two treatments: either cefovecin (8 mg/kg subcutaneously, Convenia™) and placebo capsules (orally once daily for at least 10 days) (T01; 150 dogs) or clindamycin (11 mg/kg orally once daily for at least 10 days, Antirobe™ capsules) and subcutaneous placebo injection (T02; 149 dogs).

Day 0 was defined as the day of administration of the injection. Prior to inclusion on day 0, the dogs were anaesthetised; a bacteriological sample taken and their oral cavity assessed. For a dog to be included in the study, it had to have at least one tooth site bleeding on probing, and a pocket of at least 4.0 mm depth or a gingival recession of at least 1.0 mm (both measured with a pressure sensitive probe; Florida Probe, Florida Probe Corporation, Gainesville, Florida). All dogs enrolled in the study underwent full dental cleaning, including supragingival and subgingival scaling, polishing, and tooth extraction as appropriate, before treatment. Dogs received the antimicrobial treatment after these procedures. Two additional visits were scheduled on day 14 and day 42. Both visits included a clinical observation with scoring of Halitosis and General Oral Health on a Visual Analogue Scale. Day 42 also repeated activities conducted on day 0, with an anaesthesia and a complete assessment of the oral cavity. A dog was considered to have completed the study at the end of the procedures on day 42. Out of the 299 dogs randomised to treatment, 297 completed the study; and of those, 291 were evaluable for the efficacy analyses.
There were no reports of abnormal injection sites observed following the administration of Convenia or placebo injection. On rare occasion, abnormal faeces, vomitus and lethargy were observed in both treatment groups.

Tooth sites bleeding on probing was chosen as the primary efficacy endpoint (Harvey and others 2008). The objective of the study was to demonstrate non-inferiority of cefovecin when compared with clindamycin for the primary efficacy endpoint. A tooth site was considered to be bleeding on probing if it scored greater than 1 on a Gingival Bleeding Index ranging from 0 to 3. Table 1 illustrates the number of sites bleeding on day 0 and 42 in T01 and T02, for both the ‘per protocol’ and the ‘intent to treat’ population. In both statistical analyses, cefovecin was shown to be non inferior when compared with clindamycin.

**Table 1: Summary of percentage of sites bleeding on probing before and after treatment, on day 0 and day 42.**

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Treatment</th>
<th>Number of dogs</th>
<th>Mean day 0</th>
<th>LS Mean day 42</th>
<th>Number of dogs</th>
<th>Mean day 0</th>
<th>LS Mean day 42</th>
<th>Difference day 42 [95% CI]</th>
<th>Non Inferiority demonstrated?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cefovecin (T01)</td>
<td></td>
<td></td>
<td></td>
<td>clindamycin (T02)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per Protocol</td>
<td></td>
<td>148</td>
<td>54.3%</td>
<td>20.3%</td>
<td>143</td>
<td>53.1%</td>
<td>17.4%</td>
<td>2.91% [-0.65 to 6.48]</td>
<td>YES (&lt;10%)</td>
</tr>
<tr>
<td>Intent To Treat</td>
<td></td>
<td>149</td>
<td>54.5%</td>
<td>20.5%</td>
<td>148</td>
<td>52.7%</td>
<td>17.4%</td>
<td>3.16% [-0.35 to 6.67]</td>
<td>YES (&lt;10%)</td>
</tr>
</tbody>
</table>

Secondary efficacy endpoints included Pocket Depth on day 42, Total Mouth Periodontal Score Gingivitis (TMPS-G) and Periodontitis (TMPS-P) on day 42, presence of a Pathogen on day 42, and Halitosis and General Oral Health on days 14 and 42.

Statistical analyses for changes in Pocket Depth, TMPS-G, TMPS-P, Halitosis and General Oral Health showed no statistically significant difference between cefovecin- and clindamycin-treated dogs, at the 5% significance level. Mean scores in both treatment groups for all parameters indicated a clear clinical improvement after treatment.

*Porphyromonas gulae* and *Prevotella intermedia* were cultured and identified from samples taken on day 0 and 42 (Hennet and Harvey 1991). Cefovecin-treated dogs were less likely to have *Porphyromonas gulae* or *Prevotella intermedia* isolated on day 42 compared with clindamycin-treated dogs. This difference was statistically significant for *Porphyromonas gulae* ($p<0.0001$), but not statistically significant for *Prevotella intermedia* ($p=0.25$).
The Minimum Inhibitory Concentrations (MICs) of cefovecin and clindamycin were determined against 272 Porphyromonas gulae strains and 29 Prevotella intermedia strains isolated from pre-treatment samples (Table 2). MIC determinations were performed using agar dilution MIC methodology (supplemented Brucella Blood agar) in accordance with CLSI guidelines M31-A3 and M11-A8.

Table 2: Summary of activity of cefovecin and clindamycin against periodontopathogen strains isolated before antimicrobial treatment.

<table>
<thead>
<tr>
<th>Bacterial Species (number of strains)</th>
<th>Cefovecin MIC (µg/ml)</th>
<th>Clindamycin MIC (µg/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MIC range</td>
<td>MIC₅₀</td>
</tr>
<tr>
<td>Porphyromonas gulae (272)</td>
<td>≤ 0.008 to 1</td>
<td>0.031</td>
</tr>
<tr>
<td>Prevotella intermedia (29)</td>
<td>≤ 0.008 to 4</td>
<td>0.125</td>
</tr>
</tbody>
</table>

The MIC₉₀ values of cefovecin for the pathogens Porphyromonas gulae and Prevotella intermedia are 0.06 and 1.0 µg/mL, respectively. The pharmacokinetic and -dynamic index “time above MIC” using both plasma and transudate suggests that a dose of 8 mg/kg bw will be effective (Stegemann and others 2006).

Results of the study demonstrated cefovecin administered at a single dose of 8 mg/kg b.w. to be safe and efficacious in the treatment of naturally occurring periodontal disease in dogs presented as veterinary patients. The efficacy resulting from a single administration of cefovecin demonstrated to be statistically non inferior to daily oral treatment of clindamycin (Antirobe™) administered for 10 to 14 days in the treatment of infections of the gingival and periodontal tissues when administered as an adjunct treatment to mechanical or surgical periodontal therapy.

References

VALIDATION OF THE USE OF HALIMETER® IN DOGS

Hennet P.**, Douhain J.*, Servet E.*, Mariani C.*, Biourge V.*
*Royal Canin Research Center, Aimargues, France.
**Clinique Vétérinaire ADVETIA, Paris.
Contact author: emariani@royal-canin.fr

Introduction
Oral diseases have been identified as the most frequently diagnosed clinical conditions in dogs, especially in small dogs\(^1\). Halitosis or bad breath is most of the time the first sign of oral diseases, observed by animal owners. Surprisingly, very little data are available around halitosis in dogs. The aims of the study were (i) to validate a methodology to measure Volatile Sulfur Compounds (VSC), the main gases responsible for bad breath, using the Halimeter® and (ii) to investigate the effect of age and size on halitosis in dogs.

Materials and methods
A total of 76 kennel healthy female dogs, varying in age (mean: 5.4±3.8yrs, range: 0.5 to 14yrs), body weight (mean: 15.4±12.3kg, range: 1.6 to 65kg), and representing 25 different breeds, were included. Dogs were not, or moderately, affected by oral diseases (based on visual examination on calculus deposit and gingivitis) and had not received regular dental care over the 6 months prior to the study. All dogs had been fed premium dry-expanded foods all their life. The Halimeter® (RH-17-K digital, Interscan, Chatsworth, Canada) was used to measure the VSCs. Two types of measures were performed as described by Hennet et al\(^2\): the Intra-Oral measure (IO) evaluated the VSC level in the central oral cavity, and the Tooth Surface measure (TS), evaluated the VSC level on the upper carnassial. Repeatability, reproducibility, effects of the time of the day, age and size were studied in 4 different studies. Results are expressed as a mean ± SEM.

Study 1 repeatability
One operator performed 2 series of 10 consecutive IO and TS-VSC measures on 20 dogs (5.9±2.9yrs; 18.4±15.5kg). The mean ± SEM were 78±4ppb and 328±18ppb for CSV-IO and TS respectively. The Coefficients of Variation (CV) averages (of each series) were 21% and 24% for TS and IO, respectively. The first measure of each series was lower than the 9 others (-12%). By averaging the following 5 consecutive measures, it enabled to be within the 20% Confident Interval range around the VSC mean of the 10 measures. Based on this study, we concluded that after discarding one reading, the average of the five following readings gives a repeatable VSC measurement.
Study 2 Reproducibility

Pairs of operators performed 2 series of 10 consecutive IO and TS-VSC measures on 11 dogs (5.6±2.9yrs; 13.2±9.9kg). For the first pair of operators, results were 111±10ppb and 114±13ppb for VSC-IO; 364±23ppb and 325±23ppb for VSC-TS. For the second pair results were 80±7ppb and 51±4ppb for VSC-IO; 340±40ppb and 350±31ppb for VSC-TS. A 2 factor-ANOVA (dog, operator) was used to study the “inter-operator agreement” for each pair for both IO and TS methods. No significant “operator effect” was found on any of the 2 pairs and for both methods (p=0.24 and 0.78 for IO; p=0.58 and 0.93 for TS).

Study 3 Influence of the time of the day and the day on the measure

The time of the day effect was studied by measuring the VSCs on 4 dogs over 1 day (4 measures: 7:00am; meal at 8:00am; 9:00am, 3:00pm; meal at 4:00pm; 5:00pm). The VSC levels increased significantly (p<0.05) between 9:00am and 3:00pm (35±14 to 92±14ppb and 26±6 to 51±13ppb, for TS and IO respectively, two-factor ANOVA, dog, hour).

The day effect was studied by measuring the VSCs on 10 dogs over 6 non-consecutive days. For each dog, all measurements were performed at the same time of the day. No effect of day was detected (p=0.27 and 0.23, for IO and TS respectively two-factor ANOVA dog, day).

Study 4 Influence of age and size of dogs on halitosis

VSC measures were performed on the 76 dogs taking into account the results of the 3 previous studies. To take into account the effect of the time of the day, measurements were performed between 10:30am and 3:30pm, on dogs for which age and size were randomly distributed. For analyses, dog were divided in 3 size categories (small <12kg, medium <25kg and large >25kg), and 4 ages categories (0-3, 3-6, 6-9, >9yrs).

Regarding the age effect, VSC-IO levels increased significantly up to 9 years and then remained stable ([0-3yrs]: 35±6ppb; [3-6yrs]: 64±18ppb; [6-9yrs] and >9yrs: 85±10ppb).

Concerning the size effect, VSC-IO levels in small dogs were significantly higher (whatever the age category) compared to medium and large dogs (mean 73±8ppb versus 52±15ppb and 59±8ppb, respectively). More interestingly, in small dogs, VSC-IO levels rapidly reached a high-value-steady phase, 39±6ppb for [0-3yrs] and then stable and around 107±12ppb for [>3yrs] (significant increase, p<0.05). In medium dogs, VSC-IO levels significantly increased over time ([0-3yrs]: 13±6ppb,] 3-6yrs]: 37±9ppb,] 6-9yrs]: 54±14ppb and [>9yrs]: 94±63ppb).
In the 76 dogs, a significant correlation (p<0.001) was found between VSC-IO readings and the olfactory human assessment using a “bad breath” scale (grade 1: no smell, 2: mild smell, 3: strong smell).

**Conclusion**

VSC assessment using the Halimeter® is repeatable and reproducible. This method is well-tolerated by dogs and can be performed easily by different scorers after a short training. VSC readings are correlated with the subjective nose perception of the oral malodor. We recommend to remove the first measure and to take into account the average of the 5 following readings. In a protocol, VSC evaluation has always to be performed at the same hour of the day for a dog. This study confirms that halitosis increases with age. As expected, small dogs are affected earlier in life and more than medium and large dogs. This user-friendly methodology should help to progress in the understanding of halitosis, a common consequence of dental diseases in dogs.

EFFECT OF TOOTH-BRUSHING AND CHEW DISTRIBUTION ON HALITOSIS IN DOGS

Mariani C.*, Douhain J.*, Servet E.*, Hennet P.**, Biourge V. *

*Royal Canin Research Center, Aimargues, France.
** Clinique Vétérinaire ADVETIA, Paris.
Contact author: cmariani@royal-canin.fr

Introduction

Dental scaling-polishing, followed by a tooth-brushing on a regular basis, is known to be the most efficient way to limit the extent of dental plaque and associated diseases. But, little data are available on the effect of tooth-brushing on halitosis in dogs, whereas halitosis is the first symptom perceptible by dog owners. In veterinary dentistry, tooth brushing alternatives have been studied because of the difficulty for many dog owners to brush their dog’s teeth. Therefore, the aim of the study was to investigate the effect of two treatments on halitosis in dogs: a specific tooth-brushing treatment and an oral hygiene chew¹ distribution.

Materials and methods

Two groups of healthy adult female dogs were included in the study: 10 in the tooth-brushing group (8.0±4.4yrs, 13.2±7.3kg, 5 small-breed and 5 medium-breed dogs) and 10 in the chew group (6.4±2.3yrs, 9.9±2.6kg, small-breed dogs). Dogs were moderately affected by periodontal diseases (based on visual examination on calculus deposit and gingivitis) and had not received regular dental care over the 6 months prior to the study. All dogs were fed with the same premium dry-expanded foods.

The tooth-brushing treatment consisted of brushing only the left side of the jaw, with water, during 2min, using a soft tooth-brush, 3 times per week. This allowed comparing the unbrushed right side versus the brushed left side, each dog being its own control.

The other treatment consisted of distributing one chew/dog/day (2hrs after the morning meal) over six weeks. The chew has been specifically designed to fit small-dog oral biometry, with an adapted shape, size and texture. It has been developed to encourage chewing, a mechanical effect associated with less plaque and calculus formation.
Volatile Sulfur Compounds (VSC), the main markers of halitosis, were measured using the Halimeter® (RH-17-K digital, Interscan, Chatsworth, Canada). For the brushing group, Tooth Surface measurements (VSC-TS) made on the upper carnassial were performed on both sides of the jaw. For the chew group, two types of measures were performed: Tooth Surface measure (VSC-TS) and Intra Oral measure (VSC-IO) made in the central oral cavity. The measurement was repeated 6 times, the first value was discarded and the following 5 values averaged. Each VSC measurement was associated with an olfactive evaluation using a scale (1=no halitosis, 2=mild halitosis, 3=strong halitosis). All measurements were performed by the same operator.

At the start of the study, VSC measurements was taken daily over a week. Measures were averaged to constitute the baseline value for each dog before treatments. Then, the 2 groups of dogs started their treatments (Day 1). For the Brushing group, measurements started 8 days after the beginning of the treatment. VSC-TS were recorded weekly over 4 weeks, always on the same day of the week and the dogs were tested in the same order. No tooth-brushing was performed on days of measurements. Measurements were also conducted 3 weeks after the end of the brushing treatment to investigate the return of halitosis. For the Chew group, measurements started 5 days after the beginning of the treatment. VSC-TS and -IO values were recorded weekly over 6 weeks, on the same day of the week and dogs were tested in the same order. Chews were not distributed on the days of measurement. Results are expressed as a mean ± SEM.

**Results**

In the tooth-brushing group, baseline VSC-TS values were 216±35ppb and 221±29ppb, for the unbrushed and brushed sides respectively. During tooth-brushing treatment, the unbrushed side was associated with steady VSC-TS values (217±15ppb), which did not differ significantly from baseline throughout the study. The brushed side was associated with significantly lower VSC-TS values compared to the unbrushed side as soon as Day 8 (178±36ppb for the brushed side, -30%, p=0.01). The VSC-TS values on the brushed side continued to decrease throughout the study, became significantly lower than baseline at day 15 (117±31ppb, -47%, p<0.05) and stabilised around 104±17ppb at day 22. Three weeks after the end of the brushing, no significant difference could be detected between VSC values of brushed and unbrushed sides and between the brushed side and the baseline.
For the chew group, baseline values were 89±16ppb and 277±65ppb for CSV-IO and CSV-TS respectively, and 2.5±0.1 for the olfactive score. As soon as day 5, dogs showed significantly less VSC-TS compared to baseline (165±49ppb, -40%, p<0.05). VSC-TS values remained significantly lower throughout the treatment at around 152±18ppb. VSC-IO decreased gradually during treatment and reached 66±11ppb (-26% reduction, p=0.16) after 6 weeks. The olfactive score also gradually decreased during treatment and reached 1.4±0.2 (slight halitosis) at 6 weeks.

Conclusion
On dogs without recent scaling-polishing procedure, the tooth-brushing treatment and the chew distribution were both effective in reducing and maintaining lower VSCs compared to baseline. This confirms that tooth-brushing and chew distribution are efficient in limiting the extent of bacterial accumulation on tooth surface. When the brushing treatment was stopped, VSC levels returned to baseline within 3 weeks. To conclude, the chew appears an efficient easy-to-use alternative to tooth-brushing to limit the extent of halitosis and dental deposits in dogs.

1: Royal Canin, Veterinary diet, Oral Bar small dog 20, Aimargues, France.
TOTAL MOUTH PERIODONTAL SCORE SYSTEM IN CATS

Colin E. Harvey, BVSc, FRCVS, DipACVS, DipAVDC, Dip EVDC

A Total Mouth Periodontal Score (TMPS) system using weighted contributions of specific teeth based on gingival circumference (for gingivitis scores) and root surface area (for periodontal attachment loss for periodontitis) was recently reported in dogs. Use of the TMPS spreadsheet results in a validated and repeatable single gingivitis or attachment loss score representative of the extent of periodontal disease present at the time of examination. This presentation will report the results of the TMPS measurement system applied to cats, based on digital image measurements of teeth from several cat cadavers with intact dentition. The spreadsheet utilizing the weighting system will be demonstrated.

Reference:

Colin Harvey is Professor of Surgery and Dentistry in the Department of Clinical Studies, School of Veterinary Medicine, University of Pennsylvania.
TREATMENT BY PREMAXILLECTOMY OF MAXILLARY OSTEOMYELITIS IN TWO SCOTTISH TERRIER DOGS SUFFERING FROM CHRONIC ULCERATIVE PARADENTAL STOMATITIS

Florian BOUTOILLE (DMV, resident EVDC)
Philippe HENNET (DMV, dipl.AVDC, dipl.EVDC)
Clinique Vétérinaire ADVETIA, Paris, France

Chronic Ulcerative Paradental Stomatitis (CUPS) is a well known, ill-defined and severely painful condition in dogs. A family predisposition has been identified in Maltese Terrier though no specific etiology could be found (Carter, 1989; Harvey, 1989). The condition has been identified in various other breeds, it is characterized by diffuse ulcerative and sometimes ulcero-necrotic lesions of the oral mucosa facing the largest tooth crown surfaces (mostly corner incisors, canine teeth, carnassial teeth). These lesions have been named contact or kissing ulcers. Though some muco-cutaneous autoimmune diseases may present with oral lesions, most cases of CUPS do not show the clinical or histological characteristics of autoimmune diseases and are rather considered to be the consequence of a rupture in oral ecology due to inappropriate local immune system function.

CLINICAL PRESENTATION

History
Two dogs, Scottish Terrier, males, 10 and 14 years-old, were referred for refractory CUPS based on the persistence of severe and painful diffuse ulcerative lesions of the oral mucosa which had not responded to various antibiotic and anti-inflammatory drugs as well as to conventional dental scaling. The duration of disease at the time of presentation was respectively 10 and 18 months. Both dogs had been treated with glucocorticoid drugs, one at 3 mg/kg/day for 8 months.

Clinical examination
The two dogs presented with dysorexia, severe pain and severe halitosis. Mandibular lymph nodes were bilaterally enlarged. The dog previously treated with 3mg/kg/day corticoid drugs showed physical appearance of Cushing syndrome. The examination of oral cavity of each dog showed periodontitis on molar and premolar teeth especially on maxillary and mandibular carnassial teeth.
Ulcero-necrotic lesions on the vestibular buccal mucosa facing the crowns of carnassial and canine teeth and severe osteomyelitis and necrosis of the premaxillary bone around the maxillary incisors teeth were noticed.

**Laboratory results**

Biopsies of ulcero-necrotic lesions were performed. The histological reports indicated lichenoid lesions of chronic stomatitis with plasma cells infiltrate suggestive of an immune mediated process related to the persistence of a highly immunogenic pathogenic agent. Blood chemistry and routine hematology were performed, the abnormalities were an increase of alanine amino transferase for one dog and of phosphatases alkaline for both dogs.

**Treatment and outcome**

The dogs were anesthetized and thorough oral and periodontal examinations, including taking intra oral radiographs, were performed. All teeth facing ulcero-necrotic areas and presenting loss of supporting tissues were extracted after elevation of a mucoperiosteal flap. Alveolar ostectomy/osteoplasty was followed flap suturing. Area of bone necrosis surrounding maxillary incisors teeth was eliminated by resection of premaxillary bone until maxillary canine teeth which were extracted, closure of the rostral defect was performed with a double labial flap technique. Remained teeth were scaled supragingivally and subgingivally with ultrasonic tips, then polished with an aeropolishing system. Daily or twice daily dental home care with a chlorhexidine gel and very soft bristle tooth brush was recommended. Recheck was performed 3 weeks after surgery, dogs’ condition were clearly improved and sites of premaxillectomy and extractions were perfectly healed, but ulcerative lesions on buccal mucosa were noticed facing remaining maxillary premolar teeth for one dog and mandibular canine teeth for the other one. These teeth were extracted and three weeks later the dogs were presented with total clinical cure.

**DISCUSSION**

The diagnosis of CUPS as an immune dysfunction of the local defence system which favours mucosal bacterial-induced lesions must rule out other causes of oral ulcerative lesions in dogs: metabolic disorders, autoimmune disorders, physical or chemical trauma, neoplasia and iatrogenic lesions. The rational of treatment is to achieve a very low dental plaque level as improving immune function is not feasible. CUPS is a very frustrating condition resulting in severe oral pain and subsequent anorexia. Conservative treatment is often unrewarding as subsequent daily oral hygiene, which is essential, is difficult in most cases.
Aggressive treatment with dental extractions is successful in achieving suppression of dental plaque, which permits tissue healing. Concomitant antibiotic treatment helps reducing the bacterial load. Once improved, maintaining low bacterial plaque level through dental hygiene is essential.

In addition to an individual predisposition, long term corticosteroid treatment might have been responsible for the severity of the disease. In such cases, large resection of the bone necrotic area is mandatory and must be followed by rostral reconstruction using a double labial flap technique.

**CONCLUSION**

Precise evaluation of dogs suffering from CUPS is essential and this local immune dysfunction must be differentiate to mucocutaneous auto-immune disease. Inappropriate use of corticosteroids might be detrimental. Aggressive treatment with dental extractions followed by dental home care results in clinical cure.
EVDC Interactive Session

Feline Caudal Stomatitis: Extraction and then what else?
Philippe HENNET, DMV, Dipl. AVDC, Dipl. EVDC

Background
1. Should we identify Feline Caudal Stomatitis (FCS) as a specific condition as part of the Feline Chronic Gingivo-Stomatitis (FCGS) complex?
2. Do we agree that it a multifactorial disease
3. Do specific bacteria or virus play a role?

Extraction as the primary treatment?
1. What can we expect from medical treatment alone prior to extraction?
2. Do we agree that extractions play a significant role in the treatment?
3. What kind of results can we expect?
4. Does it really need to be full-mouth extraction?

Treatments beyond extractions
1. What do we want to control: pain, infection, inflammation, immune system?
2. Can we act on immune defenses?
3. What has been proposed/tried?
   a. Corticosteroids
   b. Non Steroids Antiinflammatory
   c. Specific antibiotics (Azithromycin ?)
   d. Interferon (systemic, local, transmucosal)
   e. Ciclosporine
   f. Lactoferrine and/or Thalidomide
   g. CO2 Laser
   h. Radiation Therapy
   i. Immunomodulators
   j. Any thing else?

We might still have more questions than answers, the intent of this lecture is only to review what has been done, what is believed and what is scientifically known.
**DIGITAL VOLUME TOMOGRAPHY - CONE-BEAM CT (CBCT)**

Dr. Dirk SCHULZE

CBCT is a rather old techniques while its use can be dated back two decades ago. Primarily it was used as a planning tool for radiation treatment. In 1997 the first dental machine was brought to the market and the first paper about CBCT in dentistry was published. Times change and so did CBCT image quality. Spatial resolution and contrast were not similar to general CT in the early beginning. But in the recent 3 years one could observe a dramatic improvement in both. CBCT is now able to provide isotropic voxels with a minimal edge length of around 80µm. It is still a high-contrast imaging modality which means that especially greater differences in absorption (air vs bone) can be visualized very well. What kind of consequences can be drawn for the user? CBCT is capable to depict any important hard-tissue anatomical landmark in dentistry and it’s pathologic relatives. CBCT delivers liberate planes for all kind of views one can imagine because it is a slice imaging technology. And moreover acquisition and reconstruction time consumes just a couple of minutes.

This presentation shall give a technical overview, deliver numerous imaging examples and discuss the possibilities in veterinary dentistry. Moreover you receive information about legal and technical prerequisites, radiation exposure and financial considerations. Finally an example for an intraoperative solution will be shown.
RADICAL TONGUE RESECTION IN CATS AND DOGS

Alexander M. Reiter, Dipl. Tzt., Dr. med. vet., Dipl. AVDC, EVDC

The most common malignant tumor of the tongue in cats and dogs is squamous cell carcinoma (Figure 1). Metastasis to lymph nodes and distant sites is common and more rapid in the dog compared to the cat. The dorsum and sides of the body of the tongue are usually involved in the dog. In the cat, the tumor is often located in the sublingual area, from where it can invade the root of the tongue. Other lingual malignancies include malignant melanoma, fibrosarcoma and rhabdomyosarcoma.

Malignant lesions can be resected with good results if the tumor is confined to the rostral or – due to the more ventral location of supplying arteries – the dorsocaudal portions of the tongue. Clamping the tongue caudal to the resection site with non-crushing intestinal forceps will provide effective intraoperative hemostasis. A stab incision through the lingual frenulum and blunt dissection of sublingual tissues will allow the blades of the forceps to engage around the tongue (Figure 2). Transected salivary gland ducts are ligated.

Maintenance of swallowing function is a primary concern when resecting a large portion of the tongue. Malignant lesions located deep in the root of the tongue or causing the tongue to be tied down to the intermandibular tissues are likely not amenable to complete resection without loss of function of remaining tongue tissue. Loss of up to one third of the body of the tongue may not necessarily be associated with clinical signs. Greater amounts of tongue loss require the animal to learn ‘sucking’ water from a deeper bucket and tossing bolused food to the oropharynx (Figure 3).
Feeding tubes aid in providing nutrition and fluid intake during the immediate postoperative period. Cats may be unable to groom effectively after major tongue resection. Adding a new cat may be helpful in that it may socialize with the disabled cat.

Figure 1: Photographs of the ventral and dorsal tongue surfaces of a dog with lingual squamous cell carcinoma (asterisks).

Figure 2: Photographs obtained intraoperatively, demonstrating clamping of the tongue with non-crushing
intestinal forceps through a window in the lingual frenulum about 3 cm caudal to the tumor (arrow), partial resection, and suturing.
A CRITICAL REVIEW OF ENDODONTIC FILLING MATERIALS AND METHODS

Brook A. Niemiec, DVM
Diplomate AVDC, Fellow AVD
San Diego, CA

Sealer Cements:
Zinc oxide eugenol: This is the classic sealer cement. It has been in use since and the efficacy of all other sealers is compared to it. It is very inexpensive and has a long shelf life. It sets up fairly slowly and is fairly easy to remove if the obturation is poorly performed if recapitulation is necessary. It comes in a combination of zinc oxide powder and eugenol solution. Zinc oxide is antimicrobial and when used in combination with resins, it has been shown to be cytoprotective. However, eugenol is consistently released over time and is an irritant as well as cytotoxic. Finally, it has been shown that ZOE cements will dissolve over time, resulting in an 11% loss over a 180 day period in 1 study. This loss of volume may create microleakage and endodontic failure.

Calcium Hydroxide: This is a highly basic product made into a sealer cement. The high pH of CaOH makes it an excellent antibacterial agent, however much of this effect is lost when the cement is created. The antibacterial effect relies on the CaOH being dissolved, which occurs, this leaving voids. This loss of volume may create microleakage and endodontic failure. In addition, these sealers result in a chronic inflammatory reaction. Calcium hydroxide sealers have been shown to be superior to glass ionomer and ZOE sealers in some leakage studies. However, in other studies, it was shown to be inferior to glass ionomer cements. The seminal endodontic text does not recommend these sealers at this time. This being said, there is an unpublished clinical study from Europe using only CaOH paste fills will good results. This author finds that these cements (in particular sealaplex) are less irritating to the tissues than resin based sealers. In addition, any extruded cement will resorb over time allowing for superior rechecks. These two findings in combination with the antibacterial effects is why this author uses these cements in cases of chronic periapical abscessation, especially in immature canals when extrusion beyond the apex is expected.
**Epoxy resins:** These are relatively new products for obturation and have excellent clinical results. They have excellent handling characteristics and are some of the least toxic of all cements (especially after 24 hours). They set up relatively slowly and therefore can be removed if obturation is not perfect. Epoxy resins have been proven to be highly effective in leakage studies. In addition, one resin product showed to have the best bond strength to dentin and gutta percha. In fact, most studies show that this is the most effective sealer cement.

**Glass ionomer:** Working length is fairly short and removal is difficult to impossible. One positive aspect of glass ionomer cements is that when extruded periapically they are only slightly inflammatory. These products have not been shown to create a good seal in leakage studies. Additionally, at least one glass ionomer product has been shown to be insufficiently radiopaque.

**Medicated:** These are old school products usually containing formaldehyde. This was added to sterilize and mummify the canals. This addition has not been shown to improve success rates and has been shown to be highly inflammatory in numerous studies both in vitro and vivo. Furthermore, osteomyelitis and irreversible neurotoxicity (resulting in paresthesia) have resulted from overextension of these materials. Finally, the formaldehyde is potentially carcinogenic. These are not recommended.

**MTA:** Studies have been performed to test if MTA is an acceptable material for root end fillings. This has not been shown to be effective at this point. However, it has demonstrated good efficacy in creating a “stop” for diseased or immature apices.

**Gutta percha application: Single Cone:** This method requires precise shaping of the canal to accept the gutta percha point perfectly. It will not place any lateral pressure on the sealer cement (or very little) and therefore will not likely get effective fill of canals. Additionally, it has been shown to have the highest leakage of any method of obturation. For this reason, this has not been a recommended form of therapy. In fact, it is not even mentioned in the most recent issue of *Pathways of the pulp*. However, one study at least, showed that lateral condensation was no better in controlling coronal leakage. In addition, an additional study found that condensation methods may remove sealer from canal wall and result in inferior seal. Furthermore, this author has had great success with this technique. Preliminary results of a clinical study of the success rates of single cone obturation in dogs and cats have shown the technique to have over a 98% success rate.
The high rate of success is likely due to several factors; however primary in this is the fact that the technique includes using a point which is slightly larger than the canal so that prior to plugging it stops approximately 1-2 mm short of the apex (see light speed below). In this way, the apical portion of the canal is very tightly filled. Additionally, the operator is immensely experienced and has been performing obturations in the same manner for over 10 years. Next, resin based sealers have been utilized, which have been shown to be highly effective (see above). Finally, the obturation in all cases is radiographically excellent to perfect, thus decreasing the chance of future infection. **Lateral Condensation:** This is the current standard in human endodontics where by all the other methods are tested. This consists of placing a master cone which closely approximates the size of the canal, after which the point is forced laterally with a “spreader” and another “accessory” point placed. This is continued until the canal cannot accept further points. This method will force sealer cement into the dentinal tubules and the rebound should more densely fill the canal. This was shown to be as effective as thermoplasticized gutta percha. **Softened Gutta Percha:** These techniques utilize gutta percha which has been plasticized by some method. It is then compacted into the prepared canal (s) which theoretically allows a more complete fill, especially into canal irregularities and apical delti. These methods employ a minimal amount of sealer cement to ensure the maximum amount of gutta percha. The one negative to these methods is that some shrinkage will occur during hardening, the amount dependant on the softening method. In addition, there is a risk of root fracture as well as an increase in apical extrusion of obturation material. Plasticized gutta percha has been shown to be superior to lateral condensation in filling canal irregularities and in some cases superior apical sealing, but with poorer radiographic fills. However, other studies show that there is no improvement in the apical sealing ability between heated gutta percha and lateral condensation techniques. **Resin Based obturation:** These are relatively new materials that are designed to work with the resin based cements. The bond chemically to the resin cements and are reported to strengthen the teeth. In addition, studies suggest that these products may have superior sealing ability with decreased inflammation. These products may well become the standard in endodontics in the near future.

**Importance of the coronal seal:** We have heard for a long time that the coronal seal is very important for the success of root canal therapy. While this may be important in human dentistry, it is not as important as apical seal. In fact, this author has not found that the loss of coronal seal has a negative effect on the long term root canal success.
This has been further supported by a study in human dentistry where the degree of apical periodontitis may create a bias which creates a link between coronal restoration and periapical disease.

**Conclusion:** There are numerous studies in the literature comparing different sealer cements as well as obturation methods. These studies typically are either radiographic, dye leakage, or occasionally bacterial leakage. The important point is that there are almost no studies which compare these modalities in a clinical setting. I.E. what is the success rate in actual patients, which is the most important criteria. This is unfortunate in that radiographic and leakage studies may not correlate well with clinical results. Additionally, there is typically little correlation between studies with regards to which technique/material is superior. With one study reporting that one method is superior and another study “proving” the exact opposite. This makes deciding on the “best” method/materials for obturation difficult. This is likely why so many options exist.

One constant in endodontics is that the cleaner the canal and the more complete the obturation, the greater the success rate. Therefore, these studies may be highly prejudiced by operator skill. This means that if the researcher is very good at lateral condensation and then attempts to compare it to vertical condensation which he is just starting to perform, the results will likely show the former to be superior to the latter. This is glaringly true in the case of lightspeed and simple fill where the ease of the procedure leads to superior fills in the hands of a novice. The difference would be much less to none in the hands of an experienced veterinary dentist.

The point is almost all materials and methods are effective when performed properly. Therefore, practitioners are recommended to find what they are comfortable with, gives them a very high rate of success (i.e near 100%), and stick with it. If anything is REALLY proven to be superior, we will ALL hear about it.
COMPARATIVE ENDODONTICS: SMALL ANIMAL, HERBIVORE, AND EXOTICS

Peter Emily, DDS, Hon. AVDC
Colorado State University School of Veterinary Medicine

Overview
Comparative Endodontics as we know it is the comparative pathology diagnosis, instrumentation, and varied treatment modalities of those species that have an endodontic system. The objectives are the same - the elimination of pathology and the restoration of function. These objectives are all that the species have in common. The procedures can follow similar lines in most cases, but can vary greatly in treatment approaches and medicaments. Vital pulpotomy are rarely performed in many species.
Veterinary endodontics must deal with all species. This lecture will describe and compare three species and their treatment choices. These may involve macro or micro endodontics. Conventional and or surgical:

1. Herbivores
2. Carnivores
3. Primates

Etiology of Pulpal Pathology
Inflammatory process is the complex vascular, lymphatic, and pulpal reaction to inflammation and infection. Pulpal pathology is most commonly the result of trauma, attrition, caries, dental resorption, anachoresis, or of iatrogenic etiology.

Herbivore Endodontics
Unfortunately, most cases of equine endodontics are often misdiagnosed. Pathology usually becomes advanced before treatment. Treatment is generally extraction for lack of knowledge of endodontic therapy. Access to the endodontic system in premolars and molar teeth is retrograde. Some incisors can be accessed from a conventional incisal access.

Premolars and molar endodontics in most equines and other herbivores is from a surgical or retrograde approach. Apical access often is best achieved by following the fistulas draining tract of the premolar or molar involved.
Access can also be made intra-orally at the base of the tooth in question. The difficulty arises in accessing the right tooth. Equine teeth slant slightly to the distal, often presenting difficulty with alignment. An intra oral x-ray with a probe, root canal file, or an explorer placed at the suspected apex, or a gutta percha point placed into a draining fistula, when radiographed will help to locate the access point. The canal or canals are prepared from apical to occlusal with conventional root canal files, for a minimum of ten millimeters. The canals are obturated with one of three cements: IBM, Super EBA, or one of the Portland Cement preparations. Silver amalgam, as used in the past, is contra indicated due to a poor apical seal, and poor retentive properties.

Other Herbivores, such as llamas and alpacas often present other problems and treatment modalities. There is a wide variation in endodontic systems and root morphology. Preoperative radiographic diagnosis for these variations is essential. Although it may be a rather false impression, the posterior dentition seems morphologically mixed in some herbivores - that is, Hippsodont and Brachydont dentition in the same quadrant, as seen in alpacas.

Anachoresis

Anachoretic pulpitis by definition is the haematogenous spread of infection to endodontically compromised teeth. The condition is reversible in cases of hyperemia or mild pulpitis. Advanced serious or suppurative pulpitis results in pulpal death. This is one of the most common causes of pulpal pathology in equines and other large herbivorous.

Carnivore Endodontics

The primary concern with most carnivore endodontics is instrumentation. Large carnivores, such as lions and tigers present root length of 8 to 9 centimeters from gingiva to apex. Most carnivores have closed apices as seen in domestic Canids.

Long endodontic files of 120 mm are essential for lions, tigers, bears, etc. Gutta percha of these lengths are not available. However, a master cone of the proper length can be fashioned by heat fusing two Gutta Percha points together – pointed end to butt end. The lengthened master Gutta Percha cone is then placed to length after placement of the root canal sealer. Then lateral condensation technique can be used to complete obturation.

Large diameter canals seen in non-vital young teeth can be obturated by fabricating a master cone from bulk Gutta Percha, such as temporary stopping. The mast cone is fabricated by heat warming a temporary stopping stick and rolling it between two glass slabs with slight pressure at one end to form a tapered cone.
The Gutta Percha is then placed in to the canal for proper fit. If it is too large, the cone can be reheated and reshaped in the same manner. This process is repeated until the Gutta Percha cone is placed to the apex with slight tug back. Another obturation technique utilizes softened Gutta Percha in small amounts, quickly place and condensed apically with long pluggers made from orthopedic pins of various diameters. Exotic specific long pluggers and spreaders are currently available from Cislak/Zoll Dental.

**Primate Endodontics**
Primate dentition is similar to humans - primate teeth have open apices. Therefore after access, a primary endodontic file is placed to the estimated apex, radiographed, and adjusted for length. The file tip should be one-half millimeter from the radiographic apex. All subsequent files of canal preparation are then inserted to the measured length. After preparation, a master cone is placed before cementation and again radiographed for proper length, adjusted if necessary and then cemented to place.

**Small Animal Endodontics**
Treatment of endodontic problems can be somewhat routine in species with dentition similar to those found in domestic animals. Early detection of endodontic disease in Canidae, Hyaenidae, and small Felids, (Acinonyx, Lynx Rufus and canadensis, Ocelot, and Serval) are treated with endodontic techniques similar to those performed on domestic Canids and Felids.

**Conclusion**
Endodontic treatment becomes increasingly involved in advanced lesions where endodontic and radicular morphology is unknown. Also, large species, where repeated inductions are dangerous to the animal’s surgical survival, present additional problems. Endodontic therapy must ensure a successful result with a one induction. Therefore, endodontic therapy generally is both conventional and surgical to ensure as successful a result as possible.
All masticatory function must be considered for the various species before final access closure. Endodontic disease comprises sixty to seventy percent of all zoo dentistry. Zoo animals are very susceptible to endodontic problems. Many of the larger species are very oral expressive. Their dentition is compromised through bites on steel bars, rocks, and other enclosure objects resulting in coronal fractures. This syndrome is exacerbated by the smaller enclosures that produce the highly nervous cage-pacing animals.
Endodontically involved teeth usually go undetected until facial swelling, oral bleeding, or draining fistulous tracts become clinically evident. Familiarization with the multiple differences in the endodontic system of the various species is essential; many will need endodontic therapy at some time. These differences not only present in tooth size, but in external, apical, and endodontic morphology.
ENDODONTIC AND PROSTHODONTICS OF A CLOUDED LEOPARD

Dr. Barron P. Hall

The oral examination of a 14+ year old, intact male captive clouded leopard revealed distal attrition and complicated crown fractures (CCF) of all four canine teeth (#104, #204, #304, #404). There was a fracture of #104 near the gingival margin. Most of the crown remained for #204 and #304, while nearly three quarters of the crown of #404 was fractured.

Intraoral digital images were taken and revealed an irregular apex of #104, due to the chronicity of the fracture of #104. A periapical radiolucency was seen at the maxillary right central incisor (#101).

A 25:75 mixture of Lidicaine HCl and marcaine was combined and 1cc of the mixture was injected bilaterally at the infraorbital and middle mental foraminae. A surgical extraction of #104 was elected due to the irregular apex. The other three canine teeth were selected for standard endodontic procedures with crown preps for #204 and #304. Access to the root canal was made just coronal to the gingival margin using a #1 and #2 round ball bur for #204 and #304, while #404 was accessed through the fracture.

Hedstrom files (50mm) with RC Prep were manually used to widen the coronal access, and then fully instrument the pulp cavity. Saline, NaOCl, EDTA, and hydrogen peroxide were alternately used to aid in the cleaning, debridement, and instrumentation. The working length was 45mm. A #120 Hedstrom file was able attain working length in all teeth. The root canals were well irrigated and then dried using course paper points. AH Plus, a root canal sealant, was placed in the root canal using a #80 Hedstrom file. Cold parallax gutta percha points “buttered” with AH Plus were placed then vertically and horizontally compacted to complete the obturation. Digital images confirmed this. Excess AH Plus was removed with an ultrasonic scaler. 40% Phosphoric acid was placed on each crown for 45 seconds, and then manually removed with cotton tipped swabs and gauze. Any remaining phosphoric acid was rinsed away with the 3-way air/water syringe. A bonding agent, BondOne, was placed on with a small disposable brush in multiple layers. After sitting for 30 seconds, the first layer was thinned using the air/water syringe. A second coat was applied in the same manner, thinned, then cured with a light curing handpiece. A third coat was applied and thinned.
Flow It, a light cured flowable composite, was placed into the pulp chamber and cured. A medium grit diamond bur was used on a water-cooled, high-speed handpiece to smooth the edges of the composite. Two more layers of the bonding agent were applied and light cured. A final radiograph was taken to confirm obturation and restoration.

A course diamond bur had been used to remove undercuts and prepare #204 and #304 crowns for impressions. Vinylpolysoloxane area specific impressions were made of both teeth.

These impressions were sent to the lab where titanium crowns were cast.

About three weeks after the initial procedure the two crowns were cemented on. The extraction site had healed well. Before intubating the crowns were placed on and the patient was placed in full occlusion. There was no interference, so the patient was intubated and placed on isoflurane anesthesia. Each crown was scaled with an ultrasonic scaler, and then polished with a flour pumice. Each tooth was gently dried using the 3-way air/water syringe. BondOne was placed over the crown using a small disposable brush in multiple layers. The first one was thinned with the 3-way air/water syringe, while both the second and third layers were placed and each one was light cured. A thin layer of the crown cement was placed in each crown, and then they were placed on their respective teeth and firmly held in place for five minutes. Excess was cleaned from the crown margins.
ORAL AND DENTAL CONDITIONS IN CAPTIVE ANIMALS IN TWO PRIVATELY OWNED FACILITIES

Cedric Tutt BVSc (Hons), MMedVet (Med), Dip EVDC

Captive animals are inevitably fed a diet that is different from the diet they would consume in their natural environments. This may affect oral and dental disease.

Captive animals may also injure themselves in their area of confinement and these injuries may present as oral and or dental disease. In two cases discussed here the dental injury had occurred numerous years prior to presentation for treatment. In some animals there were enamel defects of unknown origin affecting one or numerous teeth. One palatal fistula adjacent to the upper carnassial tooth was found in a cheetah. Three of the animals examined required root canal therapy.

At one facility the large cats are anaesthetised annually and routine oral examination and dental scale and polish procedures are performed by a registered veterinary nurse. Any abnormalities of conditions requiring further treatment are scheduled for examination and treatment by a veterinary dentist.

This paper will discuss the oral and dental findings and treatment in an African lioness rescued from a circus in Europe, a tabby spotted Bengal tigress also rescued from an European circus, a captive bred “albino” tigress, 6 captive bred cheetahs, a Jaguar and an Arabian wolf.
EQUINE DENTISTRY: AN OVERVIEW

Alessandro De Simoi

Dental disorders are a common problem in horses. Horses have hypsodont anelodont teeth that erupt at a constant rate of about 2-3 mm/year. The occlusal wear and the range of lateral chewing action is influenced by the type of the diet provided. Free ranging horses chew for a longer period in comparison to confined horses. This result in a normal “physiological” teeth wear rate that prevents overgrowth of the incisors and of the cheek teeth. On the other side, horses on concentrate diets have a limited jaw excursion and the reduced time dedicated to chewing eventually leads to wear abnormalities as well as to malocclusion. Because of the anatomic condition (hypsodont anelodont teeth), domestication have a tremendous impact on dental wear/eruption balance and this is the main reason why horses have so many dental problems that must be early recognized and appropriately treated before the development of permanent damages to the dentition take place.

Dental abnormalities that go undetected for a long period of time often require advanced therapeutic treatments.

The deciduous dentition is represented by the dental formula: $2(dI^3/3\,\,dC^0/0\,\,dP^3/3)= 24$

The dental formula for permanent teeth in adult horses is: $2\,i^{13/3}, C^{1/1}, P^{3-4/3}, M^{3/3})= 40$ or 42.

Dental disorders may be associated with several symptoms and most of them will be evident only in the advanced disease. Horses affected from dental diseases may show weight loss, abnormal chewing behaviour, quidding riding/bitting problems etc.

A thorough oro-dental examination is mandatory to detect subtle pathology. Horse’s mouth is a long, dark and dangerous tunnel, and therefore to perform a detailed examination the horse must be kept still, the mouth must be held open and well illuminated.

For the safety of the operators and of the horse, chemical restraint is strongly recommended. A full mouth speculum weights more or less 2.5 kg and can be a formidable weapon without sedation. A combination of sedative (i.e. acepromazine, xylazine, detomidine, opioids) and local anaesthetic can provide proper chemical restraint. After sedation, the lateral and cranio-caudal mandibular excursions are evaluated, the horse’s mouth is rinsed with water to remove food debris, the speculum is then installed and the oral cavity inspected.
All findings must be recorded in a dental chart. Some common abnormalities (i.e. sharp enamel points, ramps, hooks, waves, protuberant teeth, caps, wolf teeth), can be addressed during this first examination-treatment session. Other disorders (dental decay and endodontic pathology, periodontal disease etc) requiring more involved diagnostic and operative procedures such as extractions, restoration, endodontic therapy, orthodontic treatment can be planned in a second session. It is not infrequent to find out severe dental abnormalities during routine dental examination.

References

EQUINE ORAL PATHOLOGY- A DIVERSE SURVEY

James Anthony

Dental abnormalities in horses can lead to weight loss, poor performance, pain, behavioral abnormalities and illness. Despite this, the occurrence and type of dental disease in horse populations is infrequently reported in veterinary medicine. The purpose of this cross-sectional survey of horses presented for slaughter at a processing plant in Western Canada was to measure the prevalence of equine oral abnormalities, examine associations between the most common abnormalities, and look at the relationship between the age of horse and types of abnormalities observed. The horses used in this research consisted of a variety of ages, breeds, body conditions, and origins.

Horses ranged in age from 18 months to 30 years. The most common oral pathologies included sharp edges, buccal abrasions, calculus, lingual ulcers, gingival recession, periodontal pockets, ramps and waves. Several types of pathology were strongly associated with other dental disorders. The prevalence of periodontal pockets, gingival recession and waves was highest in older horses.
A Practical Approach to Sedation and Pain Management in the Equine Dental Patient

Elizabeth F Schilling DVM
College of Veterinary Medicine, Western University of Health Sciences, Pomona, CA

What is pain?
It has become widely accepted in both human and small animal medicine that proper pain management is an essential part of patient care. The American Animal Hospital Association (AAHA) adopted pain management guideline in 2007 which the equine practitioner would do well to examine. From the 2007 AAHA Guidelines for Pain Management:

> All tissue injury, including that from elective surgery, may cause pain. Pain-induced stress responses, mediated by the endocrine system, are one of the negative consequences of pain. Increased cortisol, catecholamines, and inflammatory mediators cause tachycardia, vasoconstriction, decreased gastrointestinal motility, delayed healing, and sleep deprivation. In addition, trauma causes unseen changes in the central nervous system. Inadequate pain prevention or management can lead to magnification of pain perception and a prolonged pain state…

From the International Society for the Study of Pain, pain is defined as:

> An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage. Note: The inability to communicate verbally does not negate the possibility that an individual is experiencing pain and is in need of appropriate pain-relieving treatment. Pain is always subjective.... Biologists recognize that those stimuli which cause pain are liable to damage tissue. Accordingly, pain is that experience we associate with actual or potential tissue damage.

How do we identify pain?
Pain scales have been used extensively in human medicine, and are usually determined by the patient choosing a number or point on a scale which best correlates to the pain that patient is experiencing. Veterinary patients cannot verbally answer our questions about their pain level, nor point to a visual pain scale. This does not mean that they are not experiencing pain or discomfort, nor does it mean that we cannot address their pain.
Neuroanatomic pathways in animals are analogous to those in people, so procedures which are known to elicit pain in people can logically be assumed to cause pain in veterinary patients as well. Where on the pain scale is it? Pritchett et al described a behaviour-based pain scale for use in horses following celiotomy \textsuperscript{iii}, in which they correlated behavioural indicators of pain with elevated plasma cortisol and heart rate. Behaviours studied included locomotion and position in stall as well as interactions with caregivers. While the behaviours noted do not necessarily relate to equine dentistry, it is noteworthy that there is in fact a range of quantifiable pain-related behaviours in horses, and thus we can assume that horses experience pain.

**Do we cause pain in dentistry?**

In dental procedures, there is always the possibility of producing pain, be it mild discomfort, or moderate to severe pain. While most routine dental procedures in horses are thought to elicit only discomfort, and not severe pain, discomfort is part of the pain scale, albeit the low end of the scale. Potential sources of pain include dentin, pulp, bone, or oral soft tissue. In addition, myofascial or joint pain may arise, due simply to the manipulation required to access the oral cavity in the horse.

**Pain pathways**

The neuroanatomic pathways have been well-elucidated in both humans and animals\textsuperscript{iv,v}. Pain relating to the teeth and oral cavity involves branches of the mandibular and maxillary nerves, which are branches of the trigeminal nerve. Pain impulses travel to the sensory nucleus of the trigeminal nerve in the brainstem, from which there are multiple steps in the pain pathway at which analgesia can be effected:

- **Transduction** – pain impulse may initiate with mechanical, chemical, or thermal stimulus. Trigeminal Specialised nerve endings, or nociceptors in the tissues initiate pain signals. Nociceptive nerve fibres are comprised of slow-conducting unmyelinated C fibres or fast-conducting myelinated A-\(\delta\) fibres. C fibres are associated with “slower” pain, with more of a dull, aching, or burning quality. A-\(\delta\) fibres are associated with “faster” pain, with an acute sharp, stabbing, or throbbing quality\textsuperscript{vi, vii, viii}. Pulp has more C than A-\(\delta\) fibres\textsuperscript{ix}.

Drugs which can affect transduction include local anesthetics (administered as local (submocosal, supraperiosteal) or regional nerve blocks), NSAIDs, and opioids.

- **Transmission** – the nociceptive signal is transmitted by the nociceptive neuron to projection neurons in the brainstem.
Drugs which can affect Transmission include local anesthetics and Alpha-2 agonists

**Modulation** – occurs in the nucleus of the spinal tract of the trigeminal nerve, in the sensory nucleus of the trigeminal nerve in the medullary dorsal horn. This area of brainstem is continuous with, and analogous in function to, the dorsal horn of the spinal cord. Modulation may involve either amplification or diminishment of the pain signal. There are many neurotransmitters involved in modulation of nociception in the dorsal horns of the medulla and the spinal cord. They include glutamate, substance P, calcitonin gene-related peptide (CGRP), $\gamma$-aminobutyric acid (GABA), N-methyl-D-aspartate (NMDA), and nitric oxide (NO). Both excitatory and inhibitory receptors are involved.

Drugs which can affect modulation include locoal anesthetics, Alpha-2 agonists, NSAIDs, opioids, and NMDA receptor antagonists

**Projection** - projection neurons in the trigeminothalamic and thalamocortical tracts relay the nociceptive signal to the cortex. The reticular activating system of the brainstem relays information to the thalamus, from which information is then relayed to the cortex, where **Perception** occurs.

Drugs which can affect perception include Alpha-2 agonists, opioids, and general anesthetics.

**A Practical approach – multi-modal analgesia & sedation**

Safety and comfort should be the first concerns in approaching a patient for any dental procedure, whether routine or major. A safe and quiet work space is essential. Considerations of the horse’s temperament and level of training or handling are factors in planning a treatment protocol. A horse that is either more nervous or is less habituated to handling would be a candidate for a larger pre-med dose of a tranquiliser. A thorough physical exam should be performed on all patients prior to administration of any medications. This exam gives the practitioner time to assess the horse’s response to being handled, as well as to discover potential complicating disease factors. Fever or severe heart block may be an indicator of underlying disease which warrants investigation, and may alter the sedation protocol or treatment plan. Baseline lab work (CBC, Chemistry panel) is indicated in any geriatric or debilitated horse. If significant oral pain is either present before the procedure (incisor disease, fracture, apical abscess, severe periodontal disease) or anticipated (extraction, prolonged procedure, significant odontoplasty) then greater pre-procedural analgesic doses (or greater variety of multi-modal analgesia) or local nerve blocks may be indicated.
Analgesia

Multi-modal or balanced analgesia describes the approach of utilizing a variety of analgesic agents, usually with differing mechanisms of action, with the goal of optimizing analgesia while minimizing potential adverse effects\textsuperscript{xii}. By using several different agents with actions along different aspects of the pain pathway, lower doses of each can generally be employed. Effective pre-emptive and peri-operative analgesia are more effective at reducing post-op pain than is “playing catch-up” with pain once it is present\textsuperscript{xiii}.

Sedation/Analgesia Plan:

This author’s approach to sedation for the dental patient is described. The patient is examined in as quiet an area as possible (in the patient’s own stall if possible, or in a barn after several minutes to acclimate). The minimum data gathered on a physical examination are body temperature, heart rate/rhythm and presence/absence of murmurs, mucous membrane colour, capillary refill time, respiratory rate, auscultation of lung fields, and borborygmi, including auscultation for sounds of sand in the ventral abdomen. Any abnormal findings are discussed with the client prior to proceeding. The patient is then administered pre-operative doses of analgesics and tranquillisers. Depending on the situation, these may include: Flunixin, ketoprofen, butorphanol, acepromazine, xylazine, or romifidine. The patient is given a minimum of ten minutes, but preferably twenty, before proceeding. During this time equipment is set up, the client is counseled, or the previous patient’s work is completed. If multiple patients are to be worked on in one facility, the first patient may be examined and pre-medicated, then the rest of the patients examined and equipment set up. Each successive patient’s pre-medication is administered when roughly twenty minutes remain in the procedure for the preceding horse. Twenty minutes after pre-medication, the patient’s level of anxiety or tractability are assessed. At this time the mouth is rinsed, and lateral excursion measurements are taken. Depending on how well this is tolerated, the tranquilliser is administered. The author has found a good approach to be administration of a low dose of an $\alpha$-2 agonist (typically 40$\mu$g/kg of romifidine). Three to five minutes is allowed to pass, then the speculum is placed, and oral examination is performed. If this is all well-tolerated then we proceed with the procedure. In this practice, a combination of hand and motorized dental instruments are employed. If the instruments are not well-tolerated, the speculum is closed, the patient is allowed to rest for a moment or two, and a second dose of tranquilliser is administered. In many cases this amount equals the initial dose, but in many cases it may be less.
If the patient has responded much more violently than anticipated, then detomidine will likely be selected rather than romifidine, and additional butorphanol may be added. If the patient continues to react, sources of pain are investigated and nerve blocks, readjustment of the speculum, or readjustment of treatment protocol may be performed. Since instituting this protocol, the majority of routine dental procedures are accomplished with dosages of Romifidine ranging from 0.04-0.1 mg/kg, and even most “difficult” horses are dosed with less than 0.025 mg/kg detomidine.

For more difficult, lengthy, or advanced procedures, local and regional nerve blocks are an essential and effective tool. Blockage of pain transduction can allow the procedure to be performed with a much lower level of sedation. Alternatively, a continuous rate infusion (CRI) of a combination of analgesics and tranquilisers (typically detomidine and butorphanol) can be employed.

Many practitioners have favorite “recipes” or “cocktails” for sedation for dentistry. These have been arrived at through trial and error, which are certainly valuable teachers. Most of the time, these work adequately. However, not all horses respond alike, and use of a “cookbook” approach increases the chance for adverse events. In order to achieve optimal analgesia and sedation with minimal adverse or untoward effects, it is imperative to view each patient as an individual, and to treat accordingly.

Multimodal sedation (phenothiazine, α-2 agonist, opioid) combined with multimodal analgesia (opioid, α-2, NSAID) provides for an excellent and safe sedation experience for the equine dental patient, client and practitioner. The ability to provide greater comfort for our patients and success for our procedures will increase as new information is uncovered concerning new analgesics, and those pioneered in other species.

Further Reading:
Gaynor J, Muir W, Handbook of Veterinary Pain Management, St Louis, Mosby, 2009
REVIEW OF SOME EXTRAORDINARY EQUINE DENTAL CASES

Dr. Peter STELZER

The first patient is a three year old mare, which showed significantly problems in accepting a bit. The owner reported about headshaking, refusing the bit and obviously pain. After taking radiographs, CT and endoscopy we found several tooth related fragments in the maxillary and frontal sinus. The maxillary and frontal sinus were opened using a trephine under general anesthesia and most of the parts could be removed. However general anesthesia in horses is limited by time. So the procedure had to be repeated three times to find all parts and remove. The complete recovery of the horse took six months because of the massive surgical trauma.

Secondly we present two cases of fistulae which have their opening very close to the entrance of the ear. Clinically we find every day approximately 2-5 ml of secretion coming out of the fistula. Depending on the length and diameter of the fistula. The inside of the fistula is usually covered with a mucose membrane and the ground is sometimes filled with small teeth. The surgical preparation and removal of the complete fistula with a length of at least 15 cm and 2 to 3 cm in diameter showed no teeth. The radiographs which have been taken prior to surgery were not able to make conclusions about the presence of teeth. These small teeth are occasionally not dense enough for radiographic determination.

The second case shows a real big tooth coming out of the horses skull almost in the middle of the temporal muscle. It has been completely removed and the horse recovered very fast after surgery.

Part three of the presentation shows many cases of multiple lacerations of the oral mucose membranes. The vision of the simple oral pathology shows a lot of problems which can be solved by floating teeth. However dental problems in equine species are able to cause severe health problems.
THE ROLE OF LAY DENTISTS IN EQUINE AND SMALL ANIMAL DENTISTRY

Dr. Peter FAHRENKRUG, Dr.med.vet., Dr.med.dent, FAVD, Dipl., EVDC
Fahrenkrugvetdent@t-online.de
www.Fahrenkrugvetdent.de

Equine:

Education and training rg. Equine dental care had been neglected in the veterinary profession for decades, worldwide. From the end of the 1700s, when veterinary schools opened and trained veterinarians took over the equine care business from healers, farriers and stable-masters untill the end of WW II all major dental procedures were in the responsibility of veterinarians.

With the decreasing number of horses (mechanisation of agriculture) in the 20th century the veterinarians focussed on meat animal care and small animals. Routine jobs like floating teeth became unpopular and was estimated “unacademic” work.

Consequently farriers, smiths and other lay people took over and began to establish a structured business in routine equine dental care.

Since many complex cases cannot be treated properly in unsedated horses, the therapy often was insufficient. Although it is acknowledged, that esp. well-trained and experienced lay dentists can do a good job on less complicated or routine cases, the use of narcotic drugs is limited to licensed veterinarians.

Lay dentists are not prepared for emergency cases such as ruptured blood vessels or other incidents – neither surgically or rg. Fluid and pharmacological therapy, which is life threatening for the patient. Furthermore many lay dentists are not properly insured and the horse owner risks a severe financial damage if for whatever reason a horse gets killed or injured in a procedure executed by a lay dentist.

Veterinarians can handle all these circumstances properly. The veterinary schools do in most cases not teach the knowledge and art of equine dental care properly. So it is in the own responsibility and interest of the veterinarian to learn and practice the dental procedures, the handling and diagnosis.

Nevertheless: A good lay dentist can be a better option than a bad untrained vet!
In an ideal situation, the experienced Lay dentist works in an equine clinic as assistant of the Veterinarian, where he does all the routine floating, but has the vet in the background for sedation, critical care or accident management plus for more complicated procedures such as extractions- but this is not the real world: the typical Lay dentist is self-employed and visits “his” patients on a regular basis.

Unfortunately, lay-dentists have developed a certain “philosophy”, which they communicate to their clients. Their standard often avoids sedation, since this would require the assistance of a licensed vet and would double the costs for the treatment, or- if given by the lay dentist illegally himself, bears the risk of prosecution and punishment. So they tell the owners, that sedation is dangerous, costly, unnecessary and only administered by vets for financial reasons. This is naturally a simple and transparent lie.

The truth is that the sedations are a very safe way today to ensure a safe, proper treatment with the best options for a complete exam and treatment in a wide open mouth without greater risks for horse and Vet. In the old days, horses had to be restrained by cruel measures such as twitches, these days are gone. Often in uncooperative horses, the treatment had to be stopped prematurely before a full completion of the necessary measures could be achieved (“compromise”) which is an awkward situation.

All these complications can safely be avoided today with standard medical restraint.

From the animal welfare point of view, dental treatment in horses without sedation is malpractice, since panicking, behavioural changes, pain and various accidental risks for patient, Vet and keepers etc. can only be avoided by sedation. Not sedating the patient is definitely not a sign of good care and gentle treatment!

This is probably the strongest argument, why in many european countries the legislation is changing these days and there are several federal states in Canada and USA already today strictly prohibiting dental care through lay dentists.

The national legal regulations are very different from country to country, so it will not be possible to come to a generally acceptable solution rg the role of the lay dentist in the near future, but there is development, discussion and progress in that matter today.

In some countries there is a high percentage of unemployed or underemployed veterinarians. Equine Dentistry offers excellent chances for job opportunities to these vets. So there is financial pressure to gain back neglected parts of the equine medical field from other service people like equine dentists.

The same is true in the small animal field, where “healers”, “therapeuts” and other non-academic people care for diseased animals.
SMALL ANIMALS:
“Periodontal care” is a modern trend for groomers.
Schools for Grooming offer courses to students to train with them the use of ultrasound Perio-
cleaning devices. Naturally without sedation, a coronal detertrage is performed without proper
diagnosis, without additional medical treatment and without scaling or cleaning periodontal
pockets or root surfaces, no final polishing is performed.
This totally inadequate and incomplete treatment is only for cosmetics. It masks the real
amount of pathology and disease and does not help the patient.
The German Veterinary Dental Society (DGT, Deutsche Gesellschaft für Tierzahnheilkunde)
together with the Animal Wellfare Veterinary Association has recently published an official
statement to inform the public, Animal wellfare Organizations and the authorities about this
critical situation.
AMIKACIN-IMPREGNATED PMMA FOR TREATMENT OF APICAL CHEEK TOOTH INFECTION

Wilke, M. and Roux, P.
Department of Clinical Veterinary Medicine, Vetsuisse Faculty, Berne, Switzerland

Aims: Apical infections of cheek teeth show poor response to systemic antibiotic treatment due to difficulties in eliminating local persistence of infection. Surgical debridement including apicoectomy and endodontic treatment does not completely overcome this problem. We describe our clinical observations and outcome after use of amikacin-impregnated polymethylacrylate-methylmethacrylate (PMMA) bone cement as an aid to treat apical root infections in cheek teeth after minimal apicoectomy and retrograde endodontic treatment.

Methods: Horses were presented with a history of an external facial or mandibular swelling, purulent draining tracts and no intraoral abnormalities other than persistent caps. A total of three premolar cheek teeth (Triadan numbers 107, 207, 307) with additional radiographic and/or computer-tomographic signs of apical root infection were treated by apicoectomy and retrograde root canal filling followed by placement of amikacin-impregnated (Amikin® 125 mg/ml, Bristol-Myers Squibb) PMMA bone cement (Palacos® R, Heraeus Medical) around the remaining tooth root. Subcutis and skin were closed over the PMMA using # 3-0 polyglecaprone 25 (Monocryl®, Johnson & Johnson). Systemic treatment consisted of perioperative broad spectrum antibiotics and non-steroidal anti-inflammatory drugs for 5-7 days.

Results: Follow-up consults and telephone interviews with owners after 2, 4 and 5 months respectively revealed no further external drainage or other complications. The amount of antibiotic-impregnated bone cement used was variable, depending on the dead space left after apicoectomy between remaining tooth root and skin. Conclusion and Practical Significance: Use of amikacin-impregnated PMMA bone cement as local antibiotic treatment appears to have no untoward effects and may be a practical way to eliminate dead space and maintain sufficient antibiotic levels to eliminate local infection. Further follow-up may be needed to evaluate long-term effects. Acknowledgements: We thank the Bern Animal Hospital Foundation for financial support in one case.
**Endodontic Treatment of Dens Invaginatus**

Chris Visser, DVM, FAVD, DAVDC, DEVDC
Curt Coffman, DVM, FAVD, DAVDC
Louis Visser, DDS

**Dens Invaginatus** (DE) is a developmental anomaly that is thought to arise as a result of an invagination in the surface of a tooth crown before calcification has occurred. The Dens invaginatus is reported to occur in the mandibular first molar of dogs. This problem in dogs is characterized by an invagination in the furcation area which extends beyond the CEJ. There is a foramen or opening into the lateral periodontal ligament or periradicular tissue.

The invagination allows entry of irritants, such as bacteria, into the area that is separated from the pulpal tissue only by a thin layer of enamel and dentin. Therefore, dens invaginatus predisposes to the development of dental caries, or pulpitis usually leading to pulpal necrosis and development of a periradicular lesion. Because of the bizarre root canal anatomy treatment of teeth with dens invaginatus, especially communicating to the periradicular area is more complicated and ranges from non-surgical root canal treatment, to surgical treatment, or extraction.

An invaginated central mass of hard tissue almost occupying the whole pulpal space can make access to the root canal and debridement of the canal difficult. To be able to completely debride the infected canal and remove the invaginated mass of hard tissue is the key to the success of treatment.
After standard root canal treatment of each canal the invaginated material is cleaned from the pulp chamber. MTA is placed to seal any openings in the furcation area.

Treatment of a tooth with severe dens invaginatus, extending to the apical area and an associated large periradicular lesion, is usually complicated. Non-surgical endodontic treatment should be attempted first. Regardless of the size of the periradicular lesion, surgical treatment is the second option only when the non-surgical endodontic treatment has failed.

After root canal treatment is completed a composite restoration is placed and crown preparation and impressions are performed. Because of the amount of tooth structure removed during the treatment, full crown restoration is necessary to protect the remaining tooth.

Final radiograph and crown restoration.
This presentation is a pictorial on my method of doing crown preparations. I will start by assessing the occlusion to evaluate the space needed for a crown. Crown lengthening, usually Type I, is done to allow for more crown coverage and thereby more cement to hold the crown in place. Odontoplasty using a long, cylindrical to slightly tapered diamond bur is used to eliminate undercuts and reduce the tooth so it will accommodate the crown in full occlusion.

The dental lab needs good area specific impressions and full mouth impressions, so there will be little to no adjustments at the time of the crown cementation.
TO CROWN OR NOT TO CROWN – THE CASE AGAINST

Frank J.M. Verstraete*, DrMedMet, MMedVet, DipAVDC, DipECVS, DipEVDC
Jerrold Tannenbaum**, MA, JD

*Department of Surgical and Radiological Sciences and **Department of Population Health and Reproduction, School of Veterinary Medicine, University of California, Davis, USA

The use of prosthodontic crowns in dogs – especially their routine use following root canal treatment – raises important ethical issues. Crowning, as opposed to providing root canal treatment alone, can create further potential problems for both the patient and client. The patient must undergo additional anesthesia, and the associated inherent risks of this procedure, to place the crown. The patient may also experience additional stress or discomfort. For the client, the major problem is likely to be the significant extra expense of crowning rather than just root canal treatment. These problems can be compounded if a crown is lost and the placement of a second crown is attempted.

In order to determine whether crowning is ethically acceptable, one must consider whether these potential negative aspects are outweighed by the benefits.

When crowning is done for sound medical reasons, it clearly can be an ethical procedure because the prospective benefits can outweigh the potential harms. A prosthetic crown may be medically indicated to prevent further damage to the tooth, for example if a crack is noted in, or if abrasion has weakened, the remaining crown. A prosthetic crown can also restore the gingival contour in case of a superficial crown-root fracture.

It cannot be argued that crowning is always medically necessary to preserve the tooth. Root canal treatment is most commonly completed with a simple restoration of the pulp chamber access opening. Dogs are fully functional with the remaining shorter crown. Root canal treatment weakens the crown structure; however, subsequent fracture following root canal treatment and simple restoration is uncommon with a reported incidence of 5.5%. It is unknown what the incidence of fracture is if a prosthetic crown is used.

It is commonly claimed that fractured canine teeth in working dogs are an indication for crowning. It must be borne in mind however that a crowned tooth does not regain its original strength, that force-distribution on a crowned tooth is different, and that even a working dog can be fully functional with short canine teeth.
There are situations in which the potential harms of crowning are not justified by supposed benefits and in which the procedure is therefore not ethically acceptable. Because of the additional required anesthesia, medically compromised patients should not be given crowns. Other contraindications for crowning techniques include deep crown-root fractures, non-vital teeth without endodontics, questionable endodontic treatment, and abnormal chewing behavior.

It is also not acceptable to place a crown if a dog’s owner wants it for cosmetic reasons. Some owners may truly prefer the appearance of a prosthetic crown to that of the tooth that would remain after root canal treatment. Because a dog’s mouth is usually closed, it may be the case that some owners want a prosthetic crown not so much because it looks better to them but simply because they will always “know” that their dog has a longer tooth, or because they think that a dog without a prosthetic crown is somehow less of a dog. Veterinary associations in a number of countries now condemn as unethical surgical procedures such as ear-trimming and tail-docking in dogs when done for cosmetic reasons. Although these associations have not specifically addressed the issue of prosthetic crowns, it would appear to follow from their positions about other cosmetic surgical procedures that the placing of crowns in dogs solely for cosmetic reasons is also unethical.

One important issue with potential legal as well as ethical implications is whether all veterinary dentists who offer a prosthetic crown are obtaining from clients an informed consent to the procedure. So that clients can decide whether they want to subject their animals to the procedure and whether the economic cost is worth it to them, they should be told about all available options. Some clients may be unsophisticated about dental issues in dogs, and some may assume that because most people who have root canal treatment receive a prosthetic crown so also must dogs. Questions about functionality and medical need should be raised and honestly answered. It is unacceptable for veterinarians to state or to give clients the impression that a prosthetic crown is always a necessary accompaniment to root canal treatment. Even when a crown is medically advisable, it is important that clients know why this is the case and be able to make an informed and truly voluntary decision.

Trainees in EVDC or AVDC training programs may be tempted to place prosthetic crowns to meet the minimum caselog quotas required for credentialing purposes. It can also be asked whether, in light of the fact that crowning is not always (and perhaps not often) an ethical procedure, these quotas should be eliminated or modified.

RESULTS OF 115 FULL-METAL CROWN RESTORATIONS IN DOGS

Curt. R Coffman, DVM, FAVD, DAVDC
Chris J. Visser, DVM, FAVD, DAVDC

Prosthodontic treatment, and particularly crown restoration in veterinary patients has been the subject of general informational articles and veterinary dental texts. These publications have discussed techniques for crown preparation, fabrication, and cementation as well as the general principles of prosthodontic treatment. The authors generally agree that crown restorations are indicated for teeth with loss of coronal structure such as fractured or abraded teeth.\textsuperscript{1-6} In veterinary patients, crown restorations are generally performed on canine and maxillary fourth premolar teeth.\textsuperscript{6} There are a variety of published opinions regarding the indications and success of crown restoration in veterinary patients that may confuse the clinician and lead to less than optimal treatment selections. An extensive amount of information is available in the human dental literature regarding restoration of the endodontically treated tooth. The decisions regarding restorative treatment should be considered as part of the original treatment plan before beginning endodontic treatment for any tooth.\textsuperscript{7} The tooth structure that remains after endodontic treatment has been weakened by previous trauma, fractures, tooth preparation, and endodontic instrumentation. The results of multiple studies are in general agreement that full crown restoration provides the best protection for the underlying tooth and improves the long-term success rate for endodontically treated teeth more than any other aspect of endodontic treatment.\textsuperscript{7,8,9} There are few subjects in human dentistry that have been studied more than the restoration of endodontically treated teeth.\textsuperscript{10}

Conversely, there have been few published studies reporting the success rate of full crown restoration or its effect on endodontic treatment in veterinary patients. However, the few reported results are generally positive in regard to full crown restoration. A study evaluating 41 crowns placed on the canine teeth in 18 working dogs with a median follow-up time of 30-months reported a success rate of 88 % (36/41) for the crown restorations.\textsuperscript{11} In a similar study a success rate of 81% was reported for full cast metal crowns in working dogs.\textsuperscript{12} It is the goal of this report to provide additional information on the success rate of full-metal crown restoration in dogs.
A simple cross-sectional, observational study was designed for canine patients who had previously received full-metal crown restorations and presented for follow-up dental care at our referral veterinary dental practice from July 1, 2006 to July 31, 2007. The crown restorations were originally performed in a standardized manner which has been previously described. All dogs included in the study received complete oral examination, intra-oral radiographs, and professional teeth cleaning under general anesthesia. The crown restorations were deemed successful if they were in place in the mouth at the time of follow-up exam and the restored tooth had no dental, endodontic or periodontal pathology that required subsequent tooth extraction or crown removal. A total of 81 dogs with 115 restorations were sampled with 107 (93%) successful and 8 (7%) unsuccessful results. Of the 115 crowned teeth there were 77 maxillary fourth premolars, 18 maxillary canines, 19 mandibular canines, and one mandibular first molar included in the study population. Success rates for each of these groups were 95%, 94%, 84%, and 100% respectively. The time from cementation to follow-up for the crowns sampled ranged from 5 months to 104 months, with the median follow-up time being 18 months and the mean follow-up 25 months. These results are in general agreement with the previously reported success rates for metal crown restoration of canine teeth in dogs. Additionally, the success rate for maxillary fourth premolars supports the placement of full metal crowns as a viable treatment option in these teeth. Further discussion of study results and ideas for future research will be included in this presentation.

References


SURGICAL ROOT CANAL TREATMENT IN TWO WALLABIES

Chris J. Visser DVM, FAVD, DAVDC, DEVDC
Curt R. Coffman DVM, FAVD, DAVDC
Glenn Brigden, DVM
Louis Visser DDS

Introduction
Within the order, *Diprotodontia* (two teeth) is the family Macropodidae, which means large hind feet. There are 11 accepted genera within the Macropodidae family and the number of species varies from 49 to 95 depending on the source. Wallaby fall into the genus Macropus, also known as "true kangaroo". This genus consists of the three largest kangaroo species, wallaroos, and approximately eight species of wallaby. Wallabies have only two incisor teeth at the front of the lower jaw. These are large and often project forwards as an adaptation to cropping vegetation. There are no lower canines, just a large diastema between the incisors and the cheek teeth. This arrangement is known as diprotodonty (literally translated this means "two first teeth")—hence the ordinal name Diprotodontia.

Wallaby Dentition
Sharp front incisor teeth are for cutting grass, while the flat molars on the sides of the mouth are for chewing. Two incisors on the lower jaw and six incisors on the upper jaw form a continuous cutting edge. The lower jaw is significantly shorter than the upper jaw, and the two incisors extend forward at an angle in line with the mandibular bone. These blade-like lower incisors occlude behind the sharp-crowned upper incisors, not biting directly against them but pressing against a tough pad on the roof of the mouth. This allows for a cropping action very similar to that found in ungulates (1). There is a long gap (diastema) on both the mandible and maxilla between the incisors and the cheek teeth. This diastema permits the tongue to arrange cut grass and shrubbery stems into a package that can be passed backwards for mastication (3). There is a forward movement of the cheek teeth or molars throughout their life. Sequential eruption of the molar teeth and the forward progression of the cheek teeth in the jaw line can be used to estimate age up to about five years, as the last molar does not erupt until that time. The vestigial canine teeth erupt before one year of age are lost between one an two years of age.
The adult dental formula is (2):

I 3/1 C 0/0 P1/1 M4/4  x 2 = 28

There are some reported variations on the number of premolar and molars. This likely is due to the number of cheek teeth present depending on the age of the individual. The molar dentition is in a continually changing state as the molars progress rostrally along the jaw line and are gradually lost as the animal ages. As the premolar is worn down by grinding, it is replaced with a molar from the rear. A young animal may have only the first two molars in use; an animal in mid-life may have all four in use; and an old animal may have only the last one or two in the series, that have progressed to the original front of the tooth row (3). It is very important that enough rough fiber is provided in the diet to wear these molars down, as impaction can occur as the new molars try to migrate in if the previous ones are not lost.

Case report

Two adult Red-necked Wallabies (also known as Bennett’s Wallaby) were referred for dental examination on separate occasions from the Phoenix Zoo. In each instance the keepers had reported changes in eating habits and swelling on the ventral chin. The zoo veterinarian had treated the recurrent swelling and draining tracts in the anterior ventral mandible with antibiotics. Because of the ruminant nature of the gastro-intestinal tract injectable antibiotics had to be used. There was intermittent resolution of the draining tracts with the antibiotic therapy.

Anesthesia was induced and maintained by the zoo veterinarian using Sevoflurane. For each animal the there was obvious abrasion of the tooth structure of the mandibular incisors. Intra-oral digital radiographs indicated periapical disease of one of the incisors in each case. In each case standard root canal treatment was performed using 60mm Hedstroem files and heated gutta percha obturation. The access site on the facial aspect of the incisor was restored with light cured composite. Despite the appearance of an adequate fill on the post treatment radiograph the clinical symptoms did not resolve completely. Antibiotic therapy would resolve the draining tract, but it would reoccur when treatment was halted.

During a second anesthesia surgical root canal treatment and apicoectomy were performed on the incisor tooth through a skin incision on the ventral chin. At this time the animal had been on daily antibiotic therapy. Identifying the apex surgically was challenging as the root extends caudally more than half the distance of the diastema and is covered by a relatively thick layer of mandibular bone.
The surgical approach for the second animal was aided by the presence of a draining tract which could be followed to the apical area. In each case the apex was resected and a root-end filling was placed using mineral trioxide aggregate. For one of the wallabies the apicoectomy was curative. However, the second wallaby required additional surgery to further debride the periapical area. This presentation will highlight the treatment of these cases using dental radiographs and photographs with the goal of providing insight for veterinarians who may be faced with treating similar conditions in this species.

a. Easy Flow Gutta Percha-Obtura II, Obtura Corp, Fenton, MO
b. Filtek Z250, 3M ESPE Dental Products, St. Paul, MN
c. MTA, Tusla/Dentsply Dental, Tulsa, OK

References


INCISOR MALOCCLUSION IN RABBITS

Jekl V., Hauptman K., Knotek Z.

The general incidence rate of oral cavity diseases is highly prominent in small pet mammals (Verstraete 2003). In comparison to various diseases, malocclusion of the cheek teeth is the most commonly diagnosed pathology, especially in herbivorous pet species (Harcourt-Brown 2002). Rabbits and hystricomorph rodents with complete elodont dentition are frequently affected (Crossley 1995, Wiggs and Lobprise 1997, Capello et al. 2005). Incisor malocclusion, incisor fracture and enamel defects (horizontal ridges) are prevalent in clinical practice (Jekl et al. 2008). Incisor pathology could be a result of genetic predisposition, insufficient attrition, trauma, metabolic disorders or secondary crown overgrow due to cheek teeth pathology (Wiggs and Lobprise 1997). Treatment of incisor malocclusion in dogs includes the use of specific orthodontic appliances and materials, including incisal incline planes (Bannon and Baker 2008). The use of such devices is not possible in mammals with elodont dentition, due to their severe deleterious effect. General treatment of incisor malocclusion in pet rabbits implies the incisor extraction or conventional occlusal incisor adjustment (Lennox 2008). This article describes an alternative method of treatment of the incisor malocclusion in five rabbits.

Three females and two males (weight 0.9-2.8 kg, age 8 weeks till 3 years) were included in this study. Clinical examination, blood chemistry and haematology were carried out in all patients. Skull radiography was performed in five standard views (ventrodorsal, lateral, two lateral oblique and rostrocaudal). Oral cavity endoscopy was performed, as previously described by Jekl and Knotek (2007). Early or middle stage incisor malocclusion was diagnosed in all rabbits.
Before surgery, the animals were premedicated with butorphanol (0.4 mg/kg, Torbugesic 10mg/ml, Fort Dodge Animal Health, USA), low dose of medetomidine (0.03 mg/kg, Domitor inj., Pfizer, USA) and ketamine (2 mg/kg, Narketan inj., Vetoquinol S.A., France). Propofol (intravenously to the effect, Propofol 1% Fresenius Kabi, Germany) or isoflurane (via face mask, Isoflurane Rhodia, Torrex Pharma, Austria) was used to maintain the anaesthesia. Incisor crown height and occlusal surface adjustment was carried out by means of a high speed precision dental hand piece and a diamond bur. The occlusal surface of the maxillary incisors was adjusted in accordance with physiologic conditions. The occlusal adjustment of the lower incisors was conducted parallely, just as the occlusal plane of the upper incisors. This “reverse occlusion” worked as the incline plane, resulting in lingual movement of the lower incisors and restoration of the physiological occlusion. This treatment was repeated three to six times in seven days intervals. All patients had been monitored for more than one year post treatment, and incisors display physiological occlusion. Authors also recommend using this method in rodents (Jekl 2009).

References

• Crossley D.A. 1995 Clinical relevant aspects of lagomorph dental anatomy:the rabbit (Oryctolagus cuniculus). Journal of Veterinary Dentistry 12, 137-140
• Harcourt-Brown F. 2002 Textbook of rabbit medicine. Oxford; Reed Educational and Professional Publishing Ltd
• Jekl V., Hauptman K., Knotek Z. 2008 Quantitative and qualitative assessments of intraoral lesions in 180 small herbivorous mammals. Veterinary Record, 162:442-449.
• Verstraete F.M. 2003 Advances in diagnosis and treatment of small exotic mammal dental disease. Seminars in Avian and Exotic Pet Medicine, 12:37-48
TECHNICAL ASPECTS OF ABRASIVE TOOLS (CHAMFERS AND GRINDERS) AND THE INTRODUCTION OF A NEW UNIVERSAL DIAMOND GRINDER FOR TREATING MOLARS OF SMALL MAMMALS

Stefan Gabriel, Meschede, Germany

In practice different burs are used for the correction of elongated or sharp edged cheek teeth in small mammals. A review on physical details of the abrasive techniques and their suitability for use in the oral cavity is given. The author introduces a new developed pear-shaped grinder for the effective but nonhazardous correction of cheek teeth.

Confusion about nomenclature of different abrasive tools and techniques are great in the different languages. Principally, there has to be differentiated between cutting and grinding tools.

Chamfers (German: Fräser, French: fraiseur, Italian: fresa, Spanish: fresa) are rotating cutting tools, either stationary in automatic milling machines or handheld, for example in our dentistry handpiece. Their principle is rotating of blades that cut sharp chips (swarf) from the surface. Rotation in the same direction of feeding (picture 1) and counterdirection techniques (picture 2) are to be differentiated:

1.) rotation in the direction of feeding  2.) rotation against feeding

Chamfers have originally only one direction of cutting and can not be used the other way around. Modern high-tech chamfer heads with cross-cut design may be used in both directions. They are highly abrasive to teeth, but very dangerous to soft tissues!
Principal problems of all cutting techniques are vibration and the production of heat. Besides that, all cutting tools are hazardous because they tend to migrate on the surface whilst cutting and are prone to catch soft tissues easily. Good cutting results are paid by the great production of chips that may mask your view.

Grinders (German: Schleifer, French: rectifieur, Italian: rettificatore, Spanish: afilador) are planning tools with very small particles of diamond or corundum crystals. They can be produced nearly in many different forms, from rubber polishers to globes or cylinder corps. Crystals of different corn are embedded in a matrix of ceramic (3), rubber, plastic (5), or are fixed on the surface of stainless steel tools by electroplating (galvanic)(4).

Three different types of diamond grinders are introduced:

3) ceramic matrix containing diamond crystals
4) diamonds electroplated to
5) diamonds in a matrix of plastic or rubber

Diamond grinders (“burs”) are the ideal tools for dentistry, because they are durable, desinfectable and stay sharp for very long time. They may be produced rather cheaply in all suitable figures (globes, torpedoes, cylinders, etc.) and different graining (from extra fine to coarse). Using diamond grinders it is a great advantage that they produce very low heat (which might damage pulps) and nearly no swarf. Microscopic particles of ablated tooth substances form a smear with the natural moisture in the oral cavity that works as a coolant and provides always good sight.

With a minimum of care diamond tools may be kept sharp nearly forever because of their extreme abrasiveness (with the exception of rubber or plastic tools). It is of special importance to clean and disinfect them after each use. Dried smear will stick like cement and take away the sharpness. It can easily be removed by using a special cleaning stone (“dia-clean”).
In our surgery we use diamond burs and grinders sometimes for years without loss of sharpness. The greatest advantage for use in the oral cavity of small mammals is that grinders do not migrate. So you can even “palpate” the surface of the teeth you work on and feel sharp edges with your rotating tool. It is nearly impossible to catch soft tissues (warning: all kinds of rotating tools like to catch hair, wool, and vibrissae !!!) Controlled work even in the dangerous distal corners of the jaws is safely possible, and different shapes of burs allow quick and effective reduction of crown lengths.

6) work with the pear-shaped grinder  
7) effective length of tool and grip in handpiece head

Our favorite grinder is of pear-shaped figure with a diameter of 6 mm (picture 6). This one gives excellent abrasion due to high velocity at the top at good cooling. The relative large weight of the bur head provides smooth running. The shoulder of this grinder comes parallel to the rows of cheek teeth, and the round head allows safe working even near to the big vessels in the corners of the jaws. An elongated shaft of 65 mm allows sufficient free working length, as the chuck of the handpiece takes away a proper piece of shaft length (picture 7).

A special figure of diamond grinders is the disk. Mounted on a mandrel you can use a diamond disk for cutting and shaping elongated incisors at correct angles of their occlusal planes. Beware of injuring soft tissues and tongue by underlaying with a plastic or wooden spatula and protect your eyes with glasses !

For all works with sharp or rotating tools in the oral cavity of small mammals a relaxing anesthesia, sufficient fixation of the patient’s head, and good support of your working hand is essential – same as in Rottweilers !!
DENTAL ERUPTION CHRONOLOGY IN DEGUS (*Octodon degu*) – A PRELIMINARY STUDY

Jekl V., Hauptman K., Jeklová E., Trnková Š., Knotek Z.

There are many references dealing with dental eruption and exfoliative chronology in carnivorous pet species (Kremenak CR 1967, He et al. 2002, Wiggs and Lobprise 1997). However, very little is known about the dental eruption chronology in small herbivorous mammals with completely elodont dentition. Domesticated rabbits and guinea pigs are the only two herbivorous pet species in which the sequence and chronology of deciduous tooth eruption and exfoliation has been described (Horowitz et al. 1973, Michaeli et al. 1980, Berkovitz 1972). Hystricomorphic pet rodents other than guinea pigs apparently have a monophyodont dentition. However, the chronology of permanent tooth eruption is still unknown. This report presents a preliminary survey about the chronology of permanent cheek teeth eruption in captive degus (*Octodon degu*).

Females born in captivity were maintained under standardised conditions. Food and water were available ad libitum. Five litters of newborn degus (20 animals in total) were included in this study. The oral cavity endoscopic examination was performed in all animals at the age of 24 hours and then in three day intervals till the age of 37 days, which is the recommended time for weaning (Lee 2004). All degus were examined under isoflurane (Isoflurane Rhodia, Torrex Pharma) anaesthesia as described by Jekl and Knotek (2007). For upper dental arcade examination, the animal was placed in a sternal position with its head held horizontally. For lower dental arcade examination, the animal was positioned in dorsal recumbency. Mouth gag (rabbit mouth gag 177304, Eickemeyer) and anatomic forceps were used to open the mouth to gain free entry to the oral cavity.

Rigid endoscope (Hopkins Documentation Forward-Oblique Telescopes 64018 BS, \(\varnothing\) 2.7 mm, 18 cm, Karl Storz) with a xenon light source (Xenon Nova 20131520; Karl Storz) was used for the detailed examination of the oral cavity. All other accompanying procedures have already been described by Jekl and Knotek (2007).

Degus were born with erupted permanent incisors (101,201,301,401), almost erupted permanent maxillary/mandibular fourth premolars (108, 208, 308, and 408) and first molars (109, 209, 309, and 409). At the age of one day, these teeth were still covered by mucosa. However, they were visible via endoscope.
On day four, P4 had already erupted and M1 was still partially covered by mucosa. On day seven, all the first two cheek teeth had completely erupted. On day 16, the first signs of maxillary M2 (110, 210) were detected. Between day 19 and 25, all maxillary and mandibular M2 were completely erupted. Nevertheless, clinical crowns of the mandibular second molars (310, 410) were still not of the same height as those of the mandibular first molars till the age of 34 days. At the age of 37 days, all the clinical crowns of all premolars, as well as first and second molars, had the same size. The third molars were not visible at that age.

Neonate degus are precocious (Lee 2004). Infant degus display typical signs of postnatal development, such as early vocalisation or the opening of the eyes, 3 to 16 days prior to mice and rats of the same age (Bolles and Woods 1964, Scudder et al. 1967, Reynolds and Wright 1979). Nevertheless Reynolds and Wright (1979), Rojas et al. (1982) and Lee (2004) did not specify if the cheek teeth erupt pre- or postnatally, and if degus have a mono- or diphyodont dentition. In the course of this postnatal study, no signs of deciduous teeth were detected. First two upper and lower cheek teeth were visible in degus early postnatally at the age of one day.

All these teeth were still covered by a thin mucosal layer. First two cheek teeth completely erupted one week after the birth. First signs of the eruption of the maxillary M2 were observed on day 16, suggesting that maxillary M2 erupt slightly ahead of the lower by about 1-2 days. At the age of 37 days, all the clinical crowns of all premolars, as well as first and second molars, had the same size.

To the author’s knowledge, this is a first report of the sequence and chronology of permanent teeth eruption in degus (Octodon degu).

Acknowledgement

This study was supported by Czech Science Foundation (GACR 524/08/P564).

References

SCREENING VIKING AGE CATS FOR TOOTH RESORPTIONS

Jens Ruhnau

In an excavation located in Odense, Denmark, 1970, multiple bones of cats and other species were retrieved. In the pit of the excavation, the skulls of cats found, all showed cutmarks on the nose, indicating they were skinned. Also traumatic injuries found on many of the cervical vertebrae, indicates that the cats were killed by means of a trauma to the neck. Presumably the cats were used for fur production, which also explains the high number of cats of varying ages gathered in the pit.

The bones are dated 1070 +/- 100 AD, the late Viking Age. At this time cast were rare, and mostly kept for their fur. Only later, when the number of domestic cats increased, cats were used for catching mice. We did examine the mandibles clinically and by radiography for tooth resorption.

The mandibles of 62 cats were examined. Out of this number, 14 of the cats had bilaterally intact mandibles, whereas 48 cats had only one side of the mandible. Several mandibles were missing in one or more teeth.

Out of the 62 cats, only one had mixed teeth; all others had permanent teeth. Today's cats have mixed teeth at approximately 3-6 months of age.

Out of the 45 canine teeth, the root-end of 21 teeth was open and 24 root-ends were closed. This equals 16 cats with a canine tooth open root-end and 19 cats with a closed root-end of the canine tooth. Assuming that the closure of the mandibular canine root-end occurred at the age of approximately 9 months, our data show that 16 of the cats were younger than 9 months. This means that out of the 62 cats, at least 17 were between 6 and 9 months of age.

The dental age of the remaining 45 cats was roughly estimated on the basis of the X-ray reproduction of the pulp width at the molar roots. Out of these, 28 were described as having a pulp width of less than one millimetre. This is read as 28 of the cats being older cats, estimated to be more than five years old.

In one cat, a half distal root on 309 was observed, which could be interpreted as a TR4c. However, no resorption was identified in the root or the crown, and there were no radiological signs of apical radiolucency. The root, however, was only half its length and was surrounded by normal alveolar bone. Clinically, the tooth was loose in the alveolus and thus showed no signs of ankylosis. There was no clear sign of bone loss due to periodontal disease.
None of the remaining 261 examined teeth showed any signs of TR. The periodontal status evaluated by horizontal and vertical bone loss was not registered in this study. However the overall impression is that the examined mandibles showed none or little periodontal bone loss.

PS.
We are now negotiating with the Zoological Museum of Copenhagen for permission to make a histological investigation of the suspicious tooth. If we are lucky we can present the histological findings in Zürich.
Caries and Erosions

Pr. Adrian Lussi
Department of Operative, Preventive and Pediatric Dentistry, School of Dental Medicine, University of Bern, Switzerland

There are common problems in veterinary and human dentistry such as caries, erosion and also halitosis and endodontology. The lecture will cover these important issues in human dentistry, as the principles are the same in both disciplines.

The onset of caries is characterised by only microscopically visible surface demineralisation on dental hard tissues. Changes of diet and/or oral hygiene habits may stop the progression of a lesion and even allow its remineralisation. The aim of modern dentistry must be a preventive approach rather than invasive repair of the disease. This is only possible if the remaining structural organisation of the attacked tissue will still allow 'restitutio ad integrum' providing early detection and respective preventive measures. Some of today's diagnostic tools are not sensitive enough to detect this early onset of destruction. Therefore, oftentimes demineralisation or stabilisation is not possible any more at the time of detection and restoration is inevitable. This, in turn, is the start of the vicious cycle of destruction.

Erosive tooth wear is becoming increasingly important when considering the long-term health of the dentition. Clinical detection is important once dissolution has started. The clinical appearance is the most important sign for dental professionals to diagnose erosion. The appearance of smooth silky-glazed sometimes dull enamel and grooving on occlusal surfaces are some typical signs of enamel erosion. Adequate preventive measures can only be initiated when the risk factors are known and interactions between them are present.

Halitosis is another condition important in human and veterinary dentistry, so is endodontology. These points will be covered in this lecture.
THE SCIENCE AND ART OF PALATAL SURGERY

Dale J. Kressin DVM, DAVDC
Ira Luskin DVM, DAVDC, EVDC

Categories of palatal lesions
Categorization of palatal lesions can be based on etiology. The acronym “DAMNIT” is used to classify these lesions into developmental or congenital, allergic or autoimmune (feline stomatitis or chronic paradental syndrome), metabolic (such as uremic oral ulcerations), iatrogenic (oronasal and oral antral fistulas secondary to dental extraction) infectious or inflammatory, and traumatic. For this presentation, traumatic palatal injuries are further classified as high or low energy impact injuries and burns.

Incidence of oral trauma and trauma classification
There is limited statistical information regarding the incidence and care of oral trauma in companion animals. A case data search of the previous 5 years at the Animal Emergency Center in Milwaukee, WI, found 129 cases involving head trauma, 37 of those cases involved oral trauma. The most common cause of oral trauma was due to high energy impact injuries including animals hit by automobiles, baseball bats or golf clubs and others suffering from gunshot. Low impact injuries included penetrating foreign bodies and occlusal trauma. Occlusal trauma may be related or unrelated to malocclusion. Oral burns can be from household chemicals, medications or iatrogenic. Fabrication of orthodontic appliances within the oral cavity using the wrong materials or with incorrect technique can be very painful for patients. This is an example of an iatrogenic related palatal burn.

Clinical signs associated with palatal defects and injuries
Patients with palatal defects or injury present with variable clinical signs depending largely on the nature of the lesion(s). Some patients show no clinical signs at all and palatal lesions may be identified during routine oral examinations (cleft palate). Patients may be asymptomatic until they experience respiratory congestion, pneumonia or emergencies associated with aspiration.
Inappetence, dysphagia or food preference changes may be noticed in some patients with chronic conditions. Nasal (epistaxis), Ocular, oral and otic bleeding or discharge may be identified in patients suffering from head trauma. Facial or mucosal bruises (ecchymosis), swellings, lacerations and fistulas may be observed. Patients with high energy palatal impact injuries may present in severe pain, with multiple injuries and potentially with cardiovascular and central nervous system problems (seizures).

**High energy impact injury**

Three high energy impact palatal injury cases are illustrated. A small immature dog was attacked by an adult large breed aggressive dog. The young dog suffered a palatal fracture. This case was used for illustration of suture stabilization and early return to oral function of a patient with a deciduous dentition. A second case was used to illustrate the need for thorough patient assessment, tissue debridement and tension free closure of mucogingival flaps. This particular case was operated a second time to remove bony sequestra, debride devitalized (necrotic) tissue, and to repair the mucogingival dehiscence. A third patient chased a moving automobile, bit the bumper and suffered an incisive bone fracture. The case was managed by suturing the lacerated soft tissues; stabilization of the bony injuries using a wire reinforced composite splint and endodontic therapy to treat devitalized teeth.

**Low energy impact injury**

Foreign body penetration and traumatic palatal malocclusion can result in severe palatal defects. These defects may require minor debridement or major mucosal surgery depending on the extent and duration of the problem.

Palatal burns are illustrated with two clinical cases. One patient was treated with pancreazyme for exocrine pancreatic insufficiency (EPI) and it resulted in a minor palatal burn. Another patient suffered a severe palatal burn secondary to the fabrication of an orthodontic appliance. These cases are managed based on the location and the severity of the injuries.

**Oronasal and oroantral fistula repair**

The mucogingival advancement flap can be used for dental extractions, maxillectomies, to close palatal defects and to repair fistulas that occur between the oral and respiratory tracts. These flaps need to be of adequate size (length, width), be adequately perfused and to be tension free. Case management of a patient with bilateral fistulas will be described in detail. These flaps can be single or two layer.
Congenital Cleft Palate Surgery

Congenital cleft palate is an abnormality which is thought to occur during fetal development whereby the maxillary process with the medial nasal process. The defect can be bilateral (ie involve tissues lying both sides of the midline) or unilateral. The cleft can involve the hard palate, the soft palate or both and may be congenital or acquired. Since it involves certain breeds with much higher frequency (Boston Terriers, Bull Dogs, Abyssinians), a hereditary basis for the disease is suspected. The genetic trait is thought to be multifactorial recessive, polygenic and dominant with partial penetration. Cleft palates can also be induced in the feti of pre partum bitches by high doses of ingested Vitamin A >125,000 units (fish oil or liver supplements) or cortisone usage.

If the animals can be maintained with tube feeding, at 10-12 weeks of age surgery should be undertaken. The basic tenets of surgery should be followed: Minimalize tissue tension by creating flaps that are larger than the defects that they cover. Preserve the blood supply by elevating the mucoperiosteal flaps with the palatine arteries in rotational or advancement pedicle flaps. Do not use Electrosurgery for incisions or hemostasis. Do not suture if possible a flap over bone and always appose freshly incised non-epithelial covered edges. Simple interrupted and horizontal mattress sutures should be used interchangeably to provide for a tight non-gap tissue seal. A synthetic absorbable suture material such as 4-0 polyglactin 910 or polydioxanone with a reverse cutting needle is selected. Care in tissue handling is imperative.

The animal is placed in dorsal recumbency and the maxilla is taped down on the table while the mandible and tongue along with the anesthetic tube is taped up to an anesthetic screen. The method of closure depends on the width of the hard palate cleft. In narrow clefts, releasing incisions along the dental arch and sliding mucoperiosteal flaps bilaterally to the midline where they are sutured should be adequate. If the bony cleft is large a unilateral rotational mucoperiosteal flap is created. This is carried out by incising along the dental arch full thickness incision to the bone to create a rotational hinge flap. The hinge is the untouched tissue on one side of the cleft’s margin. The cut edge is undermined along with the palatal artery and mucoperiosteum. The opposite side of the cleft is incised and partially undermined off of the palatal shelf. The donor flap is than rotated 180 degrees, like a book’s turned page, and tucked under the opposite side of the clefts undermined tissue. So done, the mucoperiosteum of the donor flap is in contact with the mucoperiosteum of the recipient side of the cleft. This is then sutured with the above material and pattern. If the soft palate has a midline cleft, this is closed in two layers.
The soft tissue on either side of the cleft is incised and two layers are created on each side. The naso-pharyngeal layer is apposed and sutured with the knots buried. The oro-pharyngeal layer is then closed usually with a 4-0 polydioxanone simple interrupted layer of sutures. At times it is necessary to provide more tissue by creating releasing incisions on either side of the palatine tonsils.

**Oncologic Surgery**

Neoplastic lesions of the hard palate may originate as primary solitary masses of the palate or secondary metastatic masses from the nasal sinuses. They may stem from the dental laminar epithelium like amelioblastomas and compound and complex odontomas. If they derive from the periodontal ligaments they may be of the epulis type. Fibrosarcomas, melanomas and osteosarcomas derive from the gingiva and bone. Squamous cell carcinoma can involve the gingiva, buccal mucosa, and tonsils.

Most malignant masses are locally aggressive and will invade the underlying bone. Some, like the malignant melanoma and squamous cell carcinoma may metastasize early to the regional lymphnodes whereas the fibrosarcoma rarely spreads to the local lymphnodes. The Amelioblastoma (Acanthomatous Epulis) stemming from the periodontal ligament is locally aggressive but never metastasizes. The form of the masses varies from smooth surfaces seen often in fibrosarcomas and osteosarcomas to a cauliflower ulcerated mass seen in Amelioblastomas and carcinomas although there are huge variations in tumor form.

Grading the tumor is important in the treatment decision. Typing the tumor with an incisional biopsy along with MRI imaging allows the surgeon to evaluate the extent of the mass invasion into the sinuses or ocular cavity and the likelihood of more distant metastasis based on type. Efforts at palliation versus cure depend on the tumor type, extent and localization of the mass. If getting large tumor free margins are impossible, follow-up radiation depends on the neoplasia’s sensitivity to this modality but can offer additional months of quality of life. Squamous cell carcinomas and Amelioblastomas are very sensitive to radiation. Malignant melanomas and fibrosarcomas are very resistant to this treatment modality.

Surgical treatment planning to close the excisional defects and maintain the animal post-operatively in a positive nitrogen balance is extremely important. Using rotational and advancement flaps of the buccal mucosa are the easiest approach to closing large resections. Sensitive tissue handling, flap design incorporating the submucosal tissue and vessel and closure over bone will reduce the frequency of dehiscence.
Reduction or extraction of the ipsilateral lower teeth will reduce the incision stress and subsequent dehiscence due to movement.

At the time of surgery local infiltrative blocks in conjunction with systemic pain management will minimalize post-operative discomfort. Isolation of the major arteries like the infraorbital and palatal and their ligation should be accomplished before the bone is transected. If the turbinates are part of the resection, packing with umbilical cord will reduce the immediate post operative blood loss. This will exit out the nares and then over the next 24-36 hours be slowly removed. The patient should be closely monitored for the first 5-7 days for attempts at pawing at its face, in addition to its ability to eat. An Elizabethan collar should be placed on the animal for the first 10-14 days. Small frequent meal of a soft gruel should be fed. Initially syringe feeding on the side opposite the surgical site should be attempted. In cats, if the maxillectomy will be extensive than an esophagostomy tube should be placed. It is the author’s experience that even with quite extensive reconstructive surgery after neoplastic excisions that the animal’s usually eat the next day.
COMPLICATED ACQUIRED PALATAL DEFECT IN A CAT

Dr. Gerhard Biberauer, DVM

Introduction
Palatal defects may be inherited or acquired. Congenital cleft hard palate is almost always in the midline and usually is associated with a midline soft palate abnormality. The most common cause of acquired palatal defects is the loss of maxillary bone associated with severe periodontal disease or tooth extraction. In dogs but especially in cats (defenestration) trauma is also a very common cause. Closure of these wounds in cats is often very difficult.

Case presentation:
A 5 year-old domestic shorthair cat was referred with a traumatic soft and hard palatal defect with nasal discharge. The referring veterinarian had already tried to suture the defect with not further descript techniques. At the time of presentation no suture was visible and the wound was open about 1 cm in the midline including hard palate, but mostly in the soft palate. The left maxillary canine 204 was fractured.

Therapy:
In general anaesthesia with intubation the cat was thoroughly examined. The defect was closed with the medially repositioned double flap technique described by Harvey CE 1993. The present wound was incised at the edges to create a nasal and an oral part. Then the mucoperiosteum was undermined laterally. On both sides of the palate about 1,5 mm away from P4 a releasing incision was made beginning at the end of P3 continuing about 3 mm in the soft palate. First the nasal (dorsal) flap was sutured with monofil absorbable material (Monosyn 1,5 metric) in a continuous way. Then the two oral (ventral) parts of the flap was closed with the same material with simply interrupted sutures.

At the 10-day follow up visit the cat had some nasal discharge, but well eating. In the distal part of the wound in the soft palate the sutures showed beginning dehiscence.

In the next control visit 2 weeks later the cat was still sneezing. The intraoral examination revealed a small hole of about 3 mm in the soft palate and all sutures were dissolved. After a thorough diagnosis of the situation in anaesthesia the decision for a revision was taken, because there was not only pus coming out of the palatal wound, but also flushing solution was flowing out of the rostral palatal wound.
In this second surgery the rostral palatal wound was closed with a full thickness rotation flap technique. The rotation was made from the right side with an incision 2 mm beside 107/108. A single U-weld suture technique with monofil absorbable material (Monosyn 1,5 metric) was used to get good wound adaptation with some overlaying or the wound edges. The soft palate wound was larger so the technique of an advancement flap was used. The part thickness mucoperiosteal flap was not gained from the caudal part of the soft palate but from the left side right behind the hard palate because the wound was in the longitudinal line. The closure of the wound was also performed in the single U-weld technique with monofil absorbable suture material. The fractured 204 was removed with second surgery. The cat recovered quickly and eats well. At the 2-day post operative control all sutures were in place, but the rostral part of the soft palate wound showed some “white” degeneration signs. At the next control 14 days after second surgery there was no more any nasal discharge, all wound edges healed well and sutures were still in place. At the 3 month control after last surgery the owner reported no more any sneezing and discharge. The two palatal wounds appeared nearly like normal palatal tissues.

Discussion:
The difficulties of closure of older palatal soft and hard palate wounds were also encountered in this case report. The well described medially repositioned double flap technique was performed without difficulties, although wound dehiscence occurred. In the second surgery more simple techniques of rotation flap and advancement flap were used. The single U-weld suture technique is preferred from the author to get tension free well adapted wounds in the oral cavity. In the opinion of the author the single U-weld sutures are less cutting than single interrupted sutures.

Literature:
Harvey CE, Small Animal Dentistry, Mosby, 1993
Gorrel C, Penman S, Emily P, handbook of small animal oral emergencies, Pergamon Press, 1993
PRACTICAL REVIEW OF CLINICAL DECISION MAKING AND TREATMENT OPTIONS FOR
MANDIBULAR DISTOCCLUSION (MAL2)

Helena Kuntsi-Vaattovaara, DVM, DAVDC, DEVDC
Anident Veterinary Clinic, Veikkola, Finland

Introduction
Purpose of the presentation: Help veterinarians to understand the slight but important
differences in each case and choose the best treatment for every case.

- Growth of the skull, maxilla and mandible
- Prevalence
- Genetics

Treatment options
1. Gingivoplasty +/- alveoloplasty
2. Crown extension of mandibular canines for mesio-buccal movement
3. Orthodontics:
   a. Active appliance for distal movement of maxillary canines
   b. Inclined plane bite plate: Composite, metal
   c. Expansion screw
4. Crown reduction and partial coronal pulpectomy of mandibular canines
5. Extractions/interceptive orthodontics

Clinical decision making
1. Trauma to soft tissue and/or teeth, is there need for treatment?
2. Dentition: deciduous/ permanent
   a. Deciduous teeth – is extraction the only way to go?
3. Age of the animal
   a. Are permanent teeth erupted enough?
   b. Is the apex closed? What role does it play?
   c. In younger animals, orthodontics quicker but higher risk
4. Position of canine teeth
   a. Crown reduction: will there still be contact between mandibular and maxillary canines?
   b. Orthodontics:
      i. How much should the mandibular canines move?
      ii. Moving also maxillary canine?
      iii. What about orthodontics “backwards”?

5. Extractions: Which teeth to extract?

6. Crowding
   a. Is there room for the mandibular canine?
   b. Need for extractions?

7. Temperament and use of the animal, homecare

8. Owner commitment
   a. Very important: Orthodontics, vital coronal pulpectomy

9. Financial aspects- short and long run expenses

10. Genetics!

Bibliography
PREVALENCE OF OCCLUSAL ABNORMALITIES IN DOGS.

Igor Capík
Clinic of Small Animals, University of Veterinary Medicine, Košice, Slovak Republic

Orthodontics is defined as the area of dentistry concerned with the supervision, guidance and correction of the growing and mature dentofacial structures, including those conditions that require movement of teeth or correction of malrelationships and malrelationships between and among teeth and facial bones by the application of forces. If the main goal of the treatment is the dental displacement, most commonly a fixed multibracket therapy is used.

The indication for orthodontic treatment is based on an understanding of the accepted normal anatomical variance among the breeds and the sequence of dentinal events that occur in early stages of a pet's life. Timing of orthodontic treatment is an important consideration. In many instances early orthodontic therapy is indicated. On the other hand the tendency of early termination of treatment may result in necessity of retreatment in some cases if early intervention option is chosen.

Guidance of occlusion by the timed extraction of primary teeth (interceptive orthodontics) facilitating eruption of the permanent teeth into a favorable occlusion represents also one of treatment methods. This kind of therapy is indicated if “dental interlock” of frontal milk teeth inhibits the independent growth and development of the bony structures of the jaws. This type of therapy does not stimulate for a maxilo-mandibular growth realignment and is confined to short developmental period of facial growth. Our experiences indicate an interceptive orthodontics also for prevention bucal displacement of maxillary premolars (08), resulting from retention of related milk teeth. This occlusal problem is seen in small breeds of dogs, mainly yorkshire terriers and chihuahuas (Fig. 1a,b). Teeth out of occlusion don’t play full role in self cleaning mechanism and in this way they contribute to oral discomfort and periodontal disease.

This article describes the evaluation of abnormal occlusions diagnosed on the Clinic of Small Animals, University of Veterinary Medicine in Košice, Slovak Republic. Within the last two and a half years 76 abnormal occlusions were diagnosed. Anterior crossbite was the most common malocclusion problem seen in dogs involving 35 cases (46.05%).
As a single orthodontic problem this type of a malocclusion was diagnosed in 24 dogs (68.57 %) and remaining 11 dogs (31.43 %) showed combined abnormal occlusions all of them belonging into the first class (e.g. base narrow canines, rostrally replaced mandibular or maxillary canines) (Fig. 2a-d). Narrow based mandibular canines are the second malocclusion problem in dogs with 17 cases (22.36 %) diagnosed during evaluated period. Base narrow canines as a single problem was diagnosed in 10 dogs (58.82 %) and in other 7 dogs (41.18 %) it was accompanied with other complications (all related to I. class of malocclusion). Rostrally angled maxillary canines were diagnosed as a single problem in one dog (1.31 %). Other rostrally angled maxillary canines accompanied anterior crossbite in 4 dogs and in three dogs base narrow canines. Class II and III malocclusions were diagnosed in 14 dogs (18.42 %). Bullterrier (4) and Chihuahua (3) were breeds the most often seen with this occlusion abnormality. In remaining 9 dogs occlusal problems classified as a polyodontia (3), wry bite (3), crowded incisors (2).

42 dogs (55.26 %) of dogs suffering from occlusal problems belonged to a small breeds, 24 dogs (31.57 %) to medium and 10 dogs (7.6 %) to large breeds of dogs. In treated dogs rubber chain, dental braces and inclined plane were used with satisfactory therapeutic results. Despite the most therapeutic procedures passed with no complications, a few of them showed some unexpected complications leading to lengthening of treatment period.

Fig 1. Bilateral bucal displacement of maxillary premolars (08) resulting from retention of milk teeth.

Fig 2 a-d. Anterior crossbite with rostrally angulated canines before orthodontic treatment (a) and immediately following removing of orthodontic appliance (b)
**Screws, Elastics, Wires, Loops, Magnets and Inclined Planes as Power Sources in Veterinary Orthodontics**

Gerhard Staudacher, Veterinary clinic, Aachen

**Introduction**

Veterinary orthodontics in Germany use preferably screws and inclined planes but only seldom elastics (power chains or latex elastics) as power sources. When you look to human orthodontics you can see that vets give a lot of their potential away. Power sources differ regarding use and forces. Some need more care and service, other resist better the animals attacks. Some need high owner compliance and others do not.

**Properties of different power sources**

**Screws**

Orthodontic screws are available in a lot of variations, formed as expansion or tension screws i.e. to push or to pull. Forces are produced by turning their thread up to 11 millimeters. One whole turn (360°) produces a motion of 0.4 to 0.8 mm. Two holes drilled with an angle of 90° through this thread are used to turn the thread with a small key. The user has to move the thread once a day to once all 4 days for 90° (that is one quarter of a full turn).

Orthodontics use screws to expand or reduce distance between their fixation and one or more teeth or larger parts of a jaw. This motion of 0.2 to 0.4 mm within periodontium induces resorption and bone production by periodontal tissue and therefore moves teeth. Forces produced should not exceed 0.3 N/mm² of root surface. As soon as resorption process has started motion may be produced faster by turning the thread more often, e.g. once a day and even twice a day within jaws of large dogs. In this way an intermittent force is produced turn by turn.

To widen bone sutures you have to produce larger forces (10 – 100 N). An orthodontic screw fixed at the bone of maxillary process or mandibular body using wires, pins or bone screws can produce these forces to widen palate suture or mandibular symphysis.
Power chains and other elastic elements from Latex or rubber
Elastic elements are widely used in human orthodontics. They can be ligated to orthodontic arches, brackets and hooks. Elastic chains even work between jaws.

Power-time-diagrams of elastic elements show a significant decline of tension forces within the first hour. 2 weeks later they are worn out. To prevent destruction of periodontal tissue you can tension-elastics prior to use to 150% of the planned distance. When this elastic is going to be installed within an orthodontic appliance this peak of elastic force is missing. A device for measuring and influencing elastic and other orthodontic forces is shown.

Wires and loops
Wires are used to fix power sources to bones or teeth. Some spring hard or superelastic wires can be used as power sources themselves. For this purpose they may be bent as arches, springs or loops. Some wires have a temperature dependend shape memory effect (elastic recovery). Depending on physical data (material parameters, length, diameter and shape) wires can produce very small forces for a long way as well as large forces within a very short distance. Therefore they are ideal tools to solve a wide variety of orthodontic problems.

Bending loops into a wire increases its malleability decreasing force but increasing distance of action. Ductibility is increased very much. Wires don’t show any symptoms of fatigue. Therefore they work with constant forces over a long time.

Magnets
Since more then 10 years magnets activate temporomandibular joints of children. They don’t need any technical interface between jaws.

Magnetic forces depend on shape and distance of magnetic field. Cylindrical magnets produced from seldom earth metals as neodymium-iron-bor (NdFeB-magnets) produce 360 kJ/m³ compared to 12 kJ/m³ produced by traditional ferrit magnets all of us know. Therefore two NdFeB-magnets of 1,5g weight each can lift 150g for 10 mm. Two zylindrical magnets of 5 g weight each lift 100g for 2 cm. There are no symptoms of fatigue of magnetic field over a period of long time.
To extrude a retained tooth from mandibular bone you can use a very small magnet sticking to
the crown pulled by a large magnet positioned within an orthodontic appliance covering
gingiva. Another example is to use a pair of magnets to activate mandibular growth in Angle-
class 2 malocclusion.

**Inclined planes**

Inclined planes are powered only by muscular forces of the patient. Planes modulate these
forces by redirection. Due to chewing these forces are intermittent and under sensoric control
that's limiting destruction. As dogs breath through their noses their mouth is closed most of
the time. Therefore orthodontic forces are working long enough, in every case for a lot of
hours every day.

Inclined planes therefore can be used to tilt, rotate or sometimes transduce teeth or even
activate jaws. They are able to produce high pressure forces but cannot pull.

**Applications**

This presentation demonstrates different areas of application and orthodontic appliances.
DENTAL RADIOLOGY TECHNIQUES

Brook A. Niemiec, DVM

*Diplomate, American Veterinary Dental College*

*Fellow, Academy of Veterinary Dentistry*

www.vetdentaltraining.com

**Dental Radiograph Units:**
Radiographic exposure is controlled by 3 components: kVp (kilovolt peak), MA (milliamperage), and exposure time. KVP controls the “quality” of the x-ray beam. This is the power of each particular x-ray particle which controls the penetration of the beam through tissues. The quantity of the exposure is controlled by MA and time of exposure. The higher the MA, the more X-rays produced over the time period. Multiply this number by the exposure time and you will get the total number of x-ray units.

Since there is not a significant amount of variation of tissues in oral radiology, the KVP and MA are set constant on dental radiology units. The only variable factor is time. This is measured in seconds or pulses. One pulse is equal to 1/60 of a second. Most standard dental radiology units have a dial or digital control for the exposure and it is set by the operator based on a technique chart. Recently, veterinary products have become available which has a computer that sets the exposure based on the size of the patient, the speed of dental film used, and the particular object tooth. This takes a lot of the guesswork out of the exposure setting.

**Dental Radiographic Film:**
Dental film is non-screen film. This means that it is directly exposed by the x-ray and does not require an intensifying screen. This gives much more detail than standard radiographic film, but requires a higher amount of exposure. It is packaged in its own paper or plastic sleeve, to protect it from light and the oral environment. There are two types of dental film commonly used in dental radiology. These are Ultra-speed “D” and Ektaspeed “E” film. Recently “F” speed film has been introduced which is even faster. The difference is in the size of the silver halide crystals and secondary to this the amount of exposure required. “E” speed requires approximately ½ the amount of radiation for exposure than “D” speed film. This decreases exposure to the patient and staff as well as decreases the wear and tear on the x-ray unit.
There is a slight decrease in resolution with E-speed film owing to the larger crystal size, but according to most experts, the difference is negligible. Therefore, it is recommended in human dentistry to use “E” speed to decrease exposure time. The “E” speed film is more technique sensitive, however, in both the exposure and development of the image. This may be frustrating for the novice, therefore it is generally recommended that practitioners start with “D” speed and advance to “E” speed when they are more comfortable with the settings and positioning. One important point to remember, is that “E” speed and “D” speed have different “safe” lights. “E” speed requires a red filter or safe light whereas “D” speed is amber. If you are unsure of the type of film, you can tell by the color of the back side of the film. “D” speed film has a mint green back, while “E” speed is light purple.

There are several different sizes of dental film available (4, 3, 2, 1, and 0). The most common sizes used in veterinary medicine are 4, 2, and 1. Size 4 (occlusal) film is the largest available, it is used mostly in large breed dogs or when taking whole mouth radiographs. For small dogs and cats and most any single tooth radiograph, size 2 (standard) is commonly used. For the mandibular first and second premolars, and very small cats and puppies size 1 (or 0) (periapical) are used. Another consideration in selecting film size is cost. Size 4 film is about 3 times the cost of size 2. Therefore, if you can use a size 2, it is recommended.

**Digital Dental Radiology:** There are numerous human and veterinary digital systems. These are excellent means of obtaining dental radiographs. The only major problem currently is the lack of a number 4 plate with direct digital systems (sensors). A size 4 plate is available with the PSP system. The major advantages to the direct digital systems are the decrease in radiation exposure, rapidity of the development, and that you can reposition the sensor if the view is not correct the first time.

**Taking a dental radiograph:**

**Step 1: Patient positioning**

Position the patient so that the area of interest is convenient to the radiographic beam. In general this is where the object is “up”. For maxillary teeth, the patient should be in ventral recumbency. For mandibular canines and incisors the pet should be in dorsal recumbency. Finally, for maxillary cheek teeth, the patient should be in lateral recumbency with the affected side up. This being said, in our practice virtually all radiographs are exposed in lateral recumbancy. This takes some getting used to, but decreases the number of times a patient must be rolled.
Step 2: Film Placement within the patient’s mouth

There is an embossed dot on the film. The convex side of this should be placed towards the x-ray beam. In most films, this side is pure white. The opposite or “back” side of the film will usually be colored (purple or green). Place the film in the mouth so that the entire tooth is covered by the radiograph. Remember, the roots of all teeth are very long. This is especially true of canine teeth. Always err on the side of having the film too far in the mouth to ensure you do not cut off the root apices. The film should be placed as near as possible to the object (generally touching the gingiva) to minimize distortion.

Step 3: Positioning the beam head

There are two major techniques for positioning the beam head in veterinary patients. Both of these techniques are used daily in veterinary practice.

Parallel technique: This is where the film is placed parallel to the object being radiographed and perpendicular to the beam. This is how standard (large) films are taken. This gives the most accurate image. Unfortunately this is only useful in the lower cheek teeth in the dog and cat. This is due to the fact that these patients don’t have an arched palate. The film cannot be placed parallel to the tooth roots because of the palate’s interference. Therefore this technique is not always possible.

Bisecting Angle Technique: This is the most common type of dental radiograph taken in veterinary patients. This uses the theory of equilateral triangles to create an image that accurately represents the tooth in question. To utilize this technique, the film is placed as parallel as possible to the tooth root.

Then the angle between the tooth root and film is measured. This angle is cut in half (bisected) and the beam placed perpendicular to this angle. This gives the most accurate representation of the root.

If this angle is incorrect, the radiographic image will be distorted. This is because the x-ray beam will create an image that is longer or shorter than the object imaged. The best way to visualize this is to think of a building and the sun. The building will create a 90 degree (right) angle to the ground. The bisecting angle in this case is 45 degrees to the ground. Early and late in the day, the sun is at an acute angle to the building and casts a long shadow. In radiology this occurs when the angle of the beam to the object is too small and is known as elongation. At some point in the late morning and early afternoon, the sun is at a 45 degree angle to the building, which is the bisecting angle, giving an accurate representation of the building height.
As the sun continues up in the sky, the shadow shortens. This occurs in veterinary radiology when the angle is too great and is known as foreshortening. Finally, at noon, the sun is straight up from the building, which gives no shadow.

The “Simplified Technique” as developed by Dr. Tony Woodward does not utilize direct measurement of any angle, instead relying on approximate angles to create diagnostic images. There are only 3 angles used for all radiographs in this system 20, 45, and 90. Mandibular premolars and molars are exposed at a 90 degree angle, maxillary premolars and molars at a 45 degree angle and incisors and canines at a 20 degree angle.

To initiate any radiograph, place the film in the mouth and set the positioning indication device (PID) perpendicular to the film. For mandibular cheek teeth, this is the correct placement. For the maxillary premolars and molars, rotate the beam to a 45 degree angle. For the incisors and mandibular canines rotate 20 degrees. For the maxillary canines an additional rotation 20 degrees lateral is necessary to avoid superimposition of the first and second premolars.

**Step 4: Setting the exposure**

If you are utilizing the computer controlled system, set the buttons for the species, size of the patient, and tooth to be imaged. If you have correctly set the machine and the image is incorrectly exposed, the easiest way to adjust is to change the $f$ setting. By pressing this button, you will see the numbers go up on both sides.

The one on the left is the $f$ number and the one on the right is the exposure time. If you continue to press the button it will continue to increase the exposure until you reach 9 when it will markedly lower and the $f$ number will go back to 1. If the radiograph is overexposed (too dark) lower the $f$ number by 1. If it is underexposed (too light) increase the number by 1. Continue this process until you have the proper exposure. Generally, the $f$ number will be the same for all radiographs once you have discovered the correct setting. If you are using a machine where you set the exposure manually, you will need to set up a technique chart similar to one for a standard (large) unit.

**Step 5: Exposing the radiograph**

Dental radiograph machines have a hand held switch to expose the radiograph. If it is possible, leave the room prior to exposing the radiograph. If it is not, stand at least 6 feet away at a 90 to 130 degree angle to the primary beam. Once everything is set, press the button. It is important to remember, that these switches are “dead man’s”. 

---

90
This means if you let up during the exposure, it will stop the production of x-ray beams. On a standard unit, this will make a light radiograph, on a computer controlled one it will give an error message and you will need to start over. Make sure you hold the button down until the machine stops beeping.
DENTAL RADIOGRAPH INTERPRETATION

Brook A. Niemiec, DVM

Diplomate, American Veterinary Dental College
Fellow, Academy of Veterinary Dentistry

www.vetdentalrad.com

The first step in radiographic interpretation is determining which teeth have been imaged. This requires not a firm knowledge of oral anatomy as well as the architecture of dental films. The key to properly identifying the imaged teeth is the embossed dot, which is on one corner of the film. When exposing a radiograph, if the film is properly positioned, the convex surface will point towards the radiographic tube head. There is no way to expose a diagnostic radiograph with the film in backwards, due to the lead sheet on the back side of the film. Therefore, when interpreting the film, the embossed dot is facing out of the mouth. First, place the dot towards you (this is done for you on most digital systems. This means you are looking at the teeth as if you are the beam. Next, rotate the film so that the roots are in their natural position (up on maxillary and down on mandibular). Canines and incisors: This orients the film so the right side of the mouth is on the left, and right side is on the left. This is like a VD abdomen. Cheek teeth: Next, ascertain mesial from distal. If the mesial side is on the left side of the film, it is the left side and vice versa for the right.

Periodontal disease

Periodontal bone loss results from the combination of bacterial induced inflammation and host response creating osteoclastic resorption of bone. This resorption will result in crestal bone loss to a level below the cementoenamel junction. This decrease in bone height may also create furcational exposure. Horizontal bone loss is the most common pattern in veterinary patients is horizontal. This appears as generalized bone loss of a similar level across all or part of an arcade. The other pattern is angular (vertical) bone loss. The radiographic appearance of angular bone loss is one area of recession below the surrounding bone. The surrounding bone may be normal or be undergoing horizontal bone loss. Therefore it is common to have a combination of the two types in the same arcade. Bone loss does not become radiographically evident until 30-50% of the mineralization is lost. Therefore, radiographic findings will always underestimate bone loss.
In addition, bone loss on only one surface (i.e. lingual, palatal, or facial) may be hidden by superimposition of bone or tooth. This may result in a non-diagnosed bony pocket. Always interpret radiographs in light of the complete oral examination findings.

**Endodontic disease**

Endodontic disease may be demonstrated radiographically in several ways. An individual tooth may have one, some, or all of the different changes listed below. However, only one need be present to establish a presumptive diagnosis of endodontic disease. Radiographic changes can be broken into two major classifications: 1) changes in the surrounding bone, or 2) changes within the tooth itself.

**Bony changes:** The classic and most obvious finding is periradicular rarefaction. This appears as a radiolucent area surrounding the apex of a root. On rare occasions, this may also be seen mid-root, but these will virtually always be associated with periapical disease. Other, more subtle changes include a widened periodontal ligament, a thickened or discontinuous lamina dura, or even periradicular opacities. It is important to be aware of superimposed lucencies which are artifactual. These structures (i.e. mental foramina) can be imaged over an apex and falsely appear as osseous rarefaction. There are several clues that superimposed lucencies are artifactual. First, superimposed artifacts are typically seen on only one root, whereas it is very rare to find a true periapical lesion on only one root of a multi-rooted tooth. In addition, artifacts tend to be regular in appearance, whereas true periapical lesions are ragged.

If any area is in question, it is best to expose an additional film with a slightly different angle. If a periradicular lucency is still centered over the apex, it is likely real and not an artifact.

**Tooth changes:** The most common change in endodontic disease within the tooth itself is a root canal with a different diameter. As a tooth matures, secondary dentin production will cause a decrease in canal width. When a tooth becomes non-vital, this development stops secondary to the death of the odontoblasts. Consequently, non-vital teeth have wider root canals than the surrounding vital teeth. Conversely, on rare occasions, pulpitis may result in increased dentin production, and create an endodontically diseased tooth with a smaller root canal. This is especially common in teeth that are also periodontally diseased. This could potentially lead to a misdiagnosis of the endodontically diseased tooth as healthy and vice versa with the contralateral tooth. Hence it is important to evaluate the adjacent teeth as well as the contralateral.
Width discrepancy can be compared to any tooth (taking the size of tooth into consideration) but it is most accurate is to compare to the contralateral tooth. Endodontic disease may also be manifested radiographically as internal resorption. This results from osteoclastic activity within the root canal system due to pulpitis. These changes create an irregular, enlarged region within an area of the root canal system. Finally, external root resorption can be seen with endodontic disease. It will appear as a defect of the external surface of the root, generally accompanied by a loss of bone in the area. External resorption most commonly occurs at the apex in companion animals and is quite common in cats with chronic endodontic disease.

**Feline Tooth Resorption (TR’s)**

TRs are the result of odontoclastic destruction of feline teeth, and are classified as either type 1 or type 2. In type 1 there is no replacement by bone, whereas in type 2 there is replacement of the lost root structure by bone.

Type 1 TRs are typically associated with inflammation such as gingivostomatitis or periodontal disease. Thus, they are commonly associated with periodontal bone loss on dental radiographs. The teeth will have normal root density in some areas and a well defined periodontal space. In addition, there is often a definable root canal in the intact part of the tooth. This type will have significant resorption of the teeth and tooth roots that is not replaced by bone.

Type 2 TRs have a radiographic appearance is that of teeth which have a different radiographic density as compared to normal teeth, as they have undergone significant replacement resorption. Findings will include areas with no discernable periodontal ligament space (dentoalveolar ankylosis) or root canal. In the late stages, there will be little to no discernable root structure (ghost roots). In these cases, the lost root structure will be replaced by bone.

The importance of dental radiography in TR cases cannot be overstated. Type 1 lesions typically retain a viable root canal system, and will result in pain and endodontic infection if the roots are not completely extracted. However, the concurrent presence of a normal periodontal ligament makes these extractions routine. With type 2 lesions, there are areas lacking a normal periodontal ligament (ankylosis) which also demonstrate varying degrees of root resorption, which makes extraction by conventional elevation difficult to impossible.
The continued resorption in type 2 teeth is the basis for crown amputation therapy. It is this authors opinion that teeth with an identifiable root canal on dental radiographs MUST be extracted completely, while teeth with no discernable root canal may be treated with crown amputation. If there is any question, always err on the side of complete extraction.

**Neoplasia**

**Benign masses:** Most benign neoplastic growths will have no boney involvement on dental radiographs. If bone involvement does occur with a benign growth it will be expansive, resulting in the bone “pulling away” from the advancing tumor leaving a decalcified soft tissue filled space in the tumor site. Bony margins are usually distinct. Finally, this expansive growth will typically result in tooth movement.

**Cysts:** Cystic structures will appear as a radiolucent area with smooth bony edges. Similar to other benign growths, they grow by expansion and thus displace the other structures (eg teeth). Dentigerous cysts are typically seen as a radiolucent structure centered on the crown of an unerupted tooth.

**Malignant neoplasia:** Malignant oral neoplasms typically invade bone early in the course of disease, resulting in irregular, ragged bone destruction. Initially, the bone will have a mottled “moth eaten” appearance, but radiographs late in the disease course will reveal a complete loss of bone (the teeth will appear to float in space). If the cortex is involved, an irregular periosteal reaction will be seen.

Histopathologic testing is always necessary for accurate diagnosis of oral masses since a variety of benign or malignant tumors appear radiographically similar. In addition, osteomylitis can create the same radiographic findings as malignant tumors. Finally, aggressive tumors will show no bone involvement early in the course of disease. The prudent practitioner will note the type and extent of bony involvement (if any) on the histopathology request form (and may include copies of the radiographs and pictures) to aid the pathologist. It is key to interpret the histopathology result in light of the radiographic findings. A diagnosis of a malignancy without bony involvement should be questioned prior to initiating definitive therapy such as aggressive surgery, radiation therapy, or chemotherapy. Conversely, a benign tumor diagnosis with significant bony reaction should be further investigated prior to assuming that the patient is safe.

Additional diagnostic tests in questionable cases include complete blood panel, urinalysis, bacterial and/or fungal culture, as well as fungal serology.
Conclusion: It is impossible to perform proper dental therapy without dental radiology. Proper exposure technique and interpretation will greatly improve the quality of dental care within the practice. The examples and descriptions in this article provide a quality base for the novice practitioner, however cannot cover all variations of each pathology. The reader is directed to continuing education programs or www.vetdentalrad.com for advice on atypical cases.
**Radiographic Evaluation of Feline Tooth Resorption**

D. Cao, P. Roux, P. Schwalder, M. Doherr

**Objectives**
Feline Tooth Resorptions (Feline TRs), or Feline Odontoclastic Resorptive Lesions (FORLs), are among one of the most common disease of the tooth structure of the domestic cat, with a reported prevalence of 20 to 75 percent [1-4]. The prevalence had highly increased in 1970s to 2000s and it seems now stabilizing [1, 5, 6, 8]. They are characterized by progressive resorptive lesion, with loss of the calcified substance of permanent teeth, resulting from the destructive activity of odontoclasts on the cemental, or external tooth surface[5]. It can lead to pain, gingival inflammation, destruction of the periodontal attachment, and tooth loss [4]. In 2002, DuPont and DeBowes made a radiological classification of TR [7]. There may be two or more different types of dental resorption lesions processes in cats that may be influenced by periodontitis or other specific, yet unknown aetiologies.

The study population consisted in 234 adult cats killed between years 1970 and 1980 in the region of Bern in Switzerland. In this present study, basing on the study of G. DuPont, TRs were investigated with radiographs [7]. Tooth resorptions are described radiographic in form of Type I or Type II based upon the appearance of the periodontal ligament space (PLS) and dental root modification on dental radiology. The differentiation in Types I and II allows different treatment options. The prevalence of TR Type I and II of cats living in the 60s, 70s will be compared with other studies.

**Material and Methods**
The skull collection of the natural history museum of Bern in Switzerland comprised 273 cat’s sculls. The study population consisted in 234 adult cats killed between years 1970 and 1980. Material for charting, including mandibular / maxillary bone and teeth, were first investigated with clinical methods. Then radiography consisted in eight views for each scull then each tooth was separately analysed.

**Results**
Of these 234 skulls, one or more radiographic evidences of TR were identified in 120 cats, 51.3%. The prevalence of TR Type I in the population was 50.9%, 119 cats with one or more TRs of 234 cats, while evident case of TR Type II was only of 1.3% (3 cats with one or more TR Type II of 234 cats).
Females were more affected than males, 63% of females (51 of 81) were positive with TRs and 46% (69/151) for males. Cats with preys in stomach had a prevalence of RL of 53% (31/58), 48% for mixed (16/33) and industrial food (35/73). Molars on mandible were the most affected for this disease, with a prevalence of 15 per cent (137 of 918 molars). TR were present in 13% (300/2320) on premolars, 2 per cent of canines (18/842), 1 per cent of incisives (37/2740). It was found a presence of alveolar bone resorption in 88.8% of teeth with TR Type I. 55 teeth with TR Type I didn’t reveal clearly radiographic or clinical signs of resorption on the alveolar bone.

Conclusion

In this study, Feline Tooth Resorption are common in molars and premolars. The prevalence of the Type I was 50.9% while the Type II only 1.3%. An alveolar bone resorption was present in 88.8% of teeth with TR Type I.

Keywords : Feline Tooth Resorption, Feline Odontoclastic Resorptive Lesions, Cats

References

MISSING AND SUPERNUMERARY TEETH

Stefan Grundmann, Dr. med. vet. ECVS
Vetsuisse Universität Zürich
Tierspital, Winterthurerstr. 260
CH-9057 Zürich

The deficiency of teeth is also called hypodontia. Here, it is either a question of congenitally missing teeth or teeth which have not erupted. Supernumerary teeth occur far less frequently. Here we have to distinguish whether the extra teeth are persistent primary or completely separate teeth.

1. Hypodontia

Congenitally missing teeth can be found especially in brachycephalic dogs and miniature breeds. Most frequently with dogs, it is the P1 and the last molars that are affected. Radiography is required to decide whether a tooth is actually absent or unerupted. Because of the minor functional importance, the missing of P1 is tolerated in many kennel clubs, however, the total number of missing teeth is specified. Where functionally important teeth are not developed, these dogs should be excluded from breeding.

Unerupted teeth can be confirmed with a radiograph and are less frequent. The cause of this can be soft tissue impactions as well as persistent primary teeth. Goal of the treatment is to remove exiting obstructions to enable eruption of the tooth. Unerupted teeth can lead to the development of dentigerous cysts which are easily recognizable on x-rays. Because they destruct bone as they expand treatment involves extraction of the tooth and removal of the secretory lining of the cyst.

2. Supernumerary teeth

Duplication of teeth occur due to complete separate teeth or two crowns sharing one root, which can be observed on a radiograph. Extra teeth are most frequently with incisors and P1. A tooth crowding situation may lead to early onset of periodontal disease. Furthermore additionally developed teeth can cause malocclusions and should be extracted in time to prevent further trauma.
Persistent primary teeth force the permanent teeth to erupt into an abnormal position and may also cause malocclusions. If the permanent crown appears above the gum line, the primary tooth should be gone. Quite often, more than one tooth is affected, sometimes even all incisors especially with small breeds. The development of malocclusions can be prevented if the primary teeth are extracted early. Periodontal disease can also be caused by increased accumulation of dental calculus between the teeth which can lead to damages to the permanent tooth. If the primary tooth root is preserved entirely, an open extraction including buccal osteotomy may be preferred to avoid damage to the adjacent permanent tooth.

We can often observe an aberrance in the number of teeth in dogs. For definite diagnosis a radiographic evaluation is important. The development of typical related diseases such as malocclusions, the formation of cysts or periodontal disease can be avoided if intervened in time. Besides the hence resulting health problems one should also consider the consequences this could have on breeding due to possible heredity.
THE SCIENCE & ART OF FRACTURE REPAIR

Dr. Ira R. Luskin Diplomate, AVDC, EVDC
Dr. Dale J. Kressin Diplomate AVDC

Evaluating Fractures As to Treatment Approach

Older fractures need to be evaluated in terms of the duration of the sustained injury. Is it a fresh fracture or one that has occurred days prior? The fracture might show evidence of bone devitalization or purulence. The blood supply to the area of injury might be disrupted, which would compromise the healing of the fracture. Often ingrowth of granulation tissue would prevent the fracture from being reduced. Depending on the extent of the injury and the severity and devitalization of the bone often rather than try to repair the fracture excision of the dead tissue might be more appropriate.

Signs of more recent fractures are a history that the animal escaped with a recent chronology of injury. Visually a bleeding or a fresh blood clot occupying the area of trauma can be seen. The bone fragments can be easily reduced.

Is there any underlying concomitant disease present? Did either periodontal disease or endodontic disease weaken the bone and precede the fracture. Was there evidence of iatrogenic intervention whereby the fracture occurred when a tooth was extracted? Was there disruption of the clot and or the blood supply to the fracture from injudicious use of force?

The age of the patient is important in oral trauma since the fracture site can cause damage to unerupted teeth in the young animal. These adult tooth buds cans be translocated or their axis of eruption disturbed thereby causing them to undergo either resorption or potential impaction as the animal continues to mature. The bones of these young patient’s are undermineralized and unlikely to hold intraosseous wires. The deciduous teeth are small and making an interdental acrylic splint more difficult to maintain stability. As the animal ages, maintaining stability becomes less of a problem. However if the fracture site includes dental elements these might need to be extracted before final stabilization can be carried out. If the animal is edentulous than interarcade bonding or interdental splinting becomes problematic.
The site of the fracture also plays a role in stabilization. Caudal fractures in general are more difficult to achieve alignment and stabilization. Often open reduction is required in older patients especially if there is distraction of the bone segments due to muscle contraction. More rostral fractures are easier to achieve visual alignment and stabilization. Fractures of the symphysis can be reduced by evaluating the height of the incisors post reduction as a visual aide in prestabilization. The canine teeth when present make stabilization either with wire, or acrylic or both easier.

Loss of tissue, devitalization, severe comminution, and loss of blood supply to the fracture site are all factors which have significant affect on the healing process. Often presence of foreign material in open fractures will delay the healing unless scrupulous debridement of the wound occurs. Whether it is road debris within the soft tissue or gun shot wounds throughout soft and hard tissue, their presence can lead to subsequent infection and fistulization.

**Signs of Injury on Physical exam**

Signs of maxillo-facial injuries are initially assessed by observing the pet. Facial symmetry needs to 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 be a sign of ipsilateral vestibular damage, a ruptured tympanic membrane or 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 presenting with this is, in addition, copiously salivating. The presence of epistaxis, and schleral 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.

**Focus of the repair**

Once the animal is stabile, anesthesia is induced. Any open oral wounds should be lavaged and the soft tissue sutured with absorbable simple interrupted sutures. This author favors either 4-0 gut with a J-1 cutting needle since it hydrolyzes within 10-14 days or Monocryl 5-0 if a Monofilament is preferred.

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.

Skull radiographs in conjunction to intraoral dental films need to be taken. If there is any suspicion of a 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 ipsilateral affected TMJ. The latter is often causes 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 difficult to stabilize with internal fixation. Alignment of the ventral cortices of distracted rostral and caudal segments can be accomplished by a ventral approach to the caudal ramus and a horizontal cerclage wire placement through the ventral cortex. Subsequent stabilization of caudal fractures and maintenance of reduced TMJ luxations are either done with a tape muzzle 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 in 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 a then covering them with the 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 increase risk of perforating the roots and creating chronic draining tracts exist. 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 to 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 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. 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 SCIENCE & ART OF DENTAL EXTRACTION**

Dr. Ira R. Luskin Diplomate AVDC, EVDC  
Dr. Dale J. Kressin Diplomate AVDC

**Indications For Surgery**

There are many conditions that lead to the necessity of having to extract teeth. Dental Fractures that are open or closed with evidence of irreversible pulpitis need definitive treatment. If the owner’s do not want to pursue saving the affected teeth with endodontic therapy than conventional or surgical extraction should be the treatment. Periodontal disease is the number 1 illness in dogs and cats. It has a chronic insidious course and a multifactorial pathogenesis. The disease’s end stage is the disruption of the supporting periodontal structures of the tooth i.e. periodontal ligaments and alveolar bone. The noxious metabolic waste products of the subgingival anaerobic gram negative bacterial flora, which form subsequent to the supragingival plaque and calculus, are the primary etiological agents. As the disease progresses more supporting bone is destroyed and the tooth becomes mobile. Usually radiographic osteopenia of >70 is an indication for extraction on single rooted teeth and where multirooted teeth are being held in place by 1 root only. Antibiotics are started usually 2-3 days in advance, and the personal choice of the author is either Clavamox or Clindamycin. Prior to extraction all teeth should be radiographed to determine root morphology. A dilacerated or curved root will pose greater problems for conventional extraction techniques. Quite often secondary to the disease, the root will ankylose to the bone and will require a surgical approach to remove it. By prior evaluation of the supporting jaw, any severe bone loss could precipitate a jaw fracture and the extraction technique may have to be altered. An example is the lower first molar in the toy breeds quite often have only 1 root that is severely affected by vertical bone loss and mandibular osteopenia. It is far more advisable to section the tooth and remove the affected root and either do a root canal or vital pulpectomy on the well supported root. This not only prevents further bone loss and a subsequent jaw fracture but also allows bone to reform in the empty alveolus and keeps a functional crown and root to chew with.
LPGS (Lymphocytic Plasmacytic Gingivitis Stomatitis) is a condition seen in all cats although there is a breed predilection among the oriental groups and those that are FeLV/FIV positive animals. Although the exact etiology is unclear, the animal has to some degree an exaggerated response to the plaque bacteria on the teeth. Quite often the only modality that offers some help is total extraction of either the buccal cheek teeth or the canines as well. In addition to surgically flapping the gingiva, sectioning and extracting the teeth and roots, quite helpful is lowering the crestal alveolar bone prior to suturing the flaps closed. Total extraction in some cases is curative however in many animals they require periodic use of steroids like methylprednisolone. Removing the teeth greatly improves the disease state in all cases and eliminates the need to use antibiotics later.

Endodontic Disease: Most fractured teeth with pulpal exposures develop periapical abscessation with bone destruction. Very infrequently and usually more often in young animals, will reparative or tertiary dentin form to protect the tooth from infection. Quite often teeth that have been subluxated by “tug of war” or “Frisbee catching” and separated from their blood supply develop a pulpitis. The crown characteristically changes its color to initially pink and then as the blood pigment in the dentin tubules breakdown to form hemosiderin, form a gray color. All these teeth either need to either undergo root canal therapy or be extracted. Depending on whether there is severe bone destruction, and fistulization will depend on the extraction technique.

Malocclusions or the inappropriate eruption of teeth in incorrect positions, can lead to oral trauma. The most common teeth affected are the lower mandibular canines that erupt “base narrow” due to the retention of the deciduous lower canines. This condition causes the lower adult canines to erupt into the hard palate causing a permanent oro-nasal fistula. In treating the young animal with abnormal jaw positions, removing the “baby” teeth of the shorter jaw in what is called “interceptive orthodontics”, eliminates the interlock that could potentially free the forward growth of the shorter jaw. Supernumerary teeth and subsequent crowding cause often malocclusions. Regardless of what the underlying cause might be, extraction sometimes is the most appropriate alternative. Depending on the teeth involved, the approach and technique may alter.

Surgical Extraction Technique:

The basis for any surgical extraction technique is the creation of a buccal mucoperiosteal flap for greater exposure to the surgical area. This flap can be either an “envelope type” construction with 1 vertical releasing incision or of the “advancement type”
which has two vertical releasing incision one cranial the other caudal and diverging from the crown to the apex. The flap is begun using a 15C scalpel blade to create a dotted line pattern by scoring through the attached gingiva with the blade tip the underlying periosteum. These dots are connected by repetitive cuts through the gingiva and periosteum. The flap is then reflected apically (towards the root) by starting at a flap corner with a Periosteal Elevator. Slowly work down and across the flap being careful to keep the instrument at 45 degrees against the underlying tissue. With the other hand, hold a gauze tightly against the intended flap to serve as a stop from tearing if the instrument slips off the jaw. After the flap is elevated to it’s most apical extent, cut through the periosteum horizontally at this level. Do not cut more superficially through the mucosa. This will allow the flap mobilization and prevent tension. The next step in the extraction is to reduce the crestal bone and part of the lateral alveolar bone. In multirooted teeth, using a cross cut fissure bur section the teeth towards the root furcations. If using high-speed handpieces any soft tissue and muzzle hair should be protected. Using a large flat retractor against the flap will prevent it from being sucked into the drill vacuum. In cat teeth or in ankylosed dog teeth, a technique of establishing the periodontal space is done. Using a ¼ round bur in a high-speed handpiece, circumscribe the tooth root. Be sure to use the root as a guide for the drill shaft as you drill apically. This will allow for mobility of the tooth segments. H the extractor be sure to use only two fingers to reduce the force on the individual tooth roots. Always check for root apex smoothness as a sign that you have removed the entire fragment. Use a spoon excavator or a small curette to remove any alveolar granulation tissue. Flush with a 1:100 dilute Nolvasan solution and pack with either ADD granules/Consil or Gel Foam. The closure of the flap should “walk” the tissue from apical to coronal utilizing simple interrupted sutures. This will reduce the tension along the whole flap. Either 4-0 chromic gut, Dexon or PDS placed at 3-5mm intervals usually prevents dehiscence.

Some general principals on flap surgery. 1. The flap design size should require at minimum at least 2 times the size of the defect. 2. The more vascularization and connective tissue the less chance of dehiscence. 3. The major success factor is a tensionless closure. By not closing over dead space but rather tissue that is supported by underlying bone, the healing is greatly aided. 4. Use a coarse diamond on a high speed to abrade the epithelium off of the recipient sites and create a bevel in order to increase the attachment surface area. 5. If necessary crown reduce the opposing occluding teeth in order to take them out of occlusion and prevent the flap from being traumatized. 5. Suture precisely the two bleeding surfaces of the donor to the recipient. Prevent edge inversion.
Complications:

Complications associated with extractions usually occur due to inappropriate technique stemming from either inadequate time to do the procedure, dull instruments that have large handles which remove the tactile sensitivity of the operator or inadequate assessment of the underlying pathology. Root fractures usually are caused by trying to use conventional extraction techniques on an upper 4th premolar or a lower Molar 1. An audible crack is heard or visible detection of partial root fragments that are rough. The treatment should involve reduction of more alveolar bone which affords better visualization and by creating the periodontal space as a “toe hold”. Using a root tip pick, will allow the fragment to be retrieved. Only when the fragment is pushed downward into an already compromised apical alveolus is there the possibility of entering the sinus in the maxilla or the mandibular canal. It is imperative that the surgeon retrieves these infected root fragments. Using a Steiglitz root tip extractor allows the operator to retrieve the fragment with some additional bone reduction.

In cases of severe bone loss excessive force will lead to either bone sequestrums or jaw fractures. Radiographic evaluation prior to extraction will evidence any weak areas or unusually formed roots. Always sectioning the roots and creating the periodontal space, will avoid the necessity to try to “muscle” out the root. The symphysis in carnivores is often the site of either separations or fractures on attempts to extract the lower canines. Since this area is a joint, rigid fixation in separation repair is not desirous!!! If a separation does occur an adequate fixation can be obtained by passing a wire caudal to the canines subcutaneously with a hypodermic needle that originates through a midline ventral symphysis skin incision. The ends of the wire exit ventrally through the incision and are twisted together, shortened and the ends bent up towards the ventral symphysis thereby covering them with skin. Alternatively an acrylic splint bonded between the canines can give stability to this area.

In situations of frank hemorrhage, pressure for 5 minutes will reduce the bleeding. Knowing the anatomy of the area will aid in the location of the vessels. The 4th premolar has 4-7 mm medial to the palatal root the exiting palatal artery. Running between it’s roots dorsally is the infraorbital artery and nerve. Labial and ventral to the mandibular 2nd premolar is the mental artery. In the case of alveoli oozing using Gel Foam and suturing the flap down over the top of it, will usually stop it.
AN IMPROVED EXTRACTION TECHNIQUE

Cecilia Gorrel, BSc, MA, VetMB, DDS, MRCVS, HonFAVD, Dipl EVDC
European and RCVS-recognised Specialist in Veterinary Dentistry
&
Susanne Andersson, Registered Dental Nurse, Registered Veterinary Nurse

In theory tooth extraction is simple; once the gingival attachment of the tooth has been severed, the periodontal fibres are cut and the tooth is lifted out of its socket. In practice in Small Animal Veterinary Dentistry, extraction of teeth is often challenging. Complications, most frequently tooth root fracture but also haemorrhage, neurological damage and jaw fracture often occur. This is in part due to the anatomy of canine and feline teeth, but also due to the lack of availability of suitable instruments.

Tooth extraction requires three types of instrumentation. Firstly, power equipment (high- and/or slow-speed handpieces with suitable burrs) to section multi-rooted teeth into single-root segments and remove alveolar bone. Secondly, a minor surgical kit to raise and replace mucoperiosteal flaps if using an open extraction technique and thirdly a selection of hand instruments (luxators, elevators and forceps) to free the tooth from its periodontal attachment and lift it out of its alveolus. A luxator is a ‘cutting’ tool which is used in an apical direction to transect gingival attachment and periodontal ligament fibres. A luxator should not be rotated as this will damage the fine sharp working edge. An elevator can be used as a ‘cutting’ tool working with it in an apical direction, but it can also be rotated to tear periodontal ligament fibres. An elevator can also be used in a horizontal fashion to elevate teeth out of their sockets. Extraction forceps are designed to make four-point contact with human tooth roots. Due to the differences in anatomy of canine and feline teeth as compared to humans, the extraction forceps do not fit the tooth root and at best a two-point contact is achieved. Moreover, it is impossible to place the forceps as far apically as required. The result of trying to extract canine and feline teeth with extraction forceps designed for human teeth is fracture of the tooth roots. In Veterinary Dentistry, luxators and elevators are the most useful hand instruments and extraction forceps should be used cautiously, if at all.

Extraction should achieve its target, namely removal of a tooth, but also cause minimal trauma to adjacent tissues, thus allowing optimal healing of the created defect. The authors have designed a tool designed to achieve this goal. It is available from Accesia AB, Halmstad, Sweden and is called the ‘Accesia Extraktor’.
The Accesia Extraktor is designed to function as a luxating tool (i.e. cutting action) as well as an elevator. The working end is more convex than either a luxator or an elevator. Both the tip and sides are knife-sharp; yet it is strong enough to allow rotation as well as horizontal application (but not at the tip of the instrument). It is available in four sizes, namely widths of 1.5, 3, 4 and 5 mm. This range of sizes accommodates most teeth. Special attention has been paid to the handle design to give optimum effective use by a range of hand sizes from very small to very large.

The Accesia Extraktor can be used with either a closed or an open extraction technique. It is most effective if used specifically in the way for which it was designed. The extraction technique will be demonstrated in the presentation by the use of video clips. In summary, the crown of the tooth is amputated to allow visibility and application of the instrument to the root surface. The size of tool that best fits the mesial and distal contours of the tooth is selected. The Accesia Extraktor is first used as a scalpel blade to cut the gingival attachment around the whole circumference of the tooth. It is then inserted into the mesial or distal periodontal ligament space working the apical cutting edge of the tool in an apical direction but also sliding buccally and palatally/lingually thus additionally using the knife-sharp edges to cut periodontal ligament fibres laterally. This is repeated mesially and distally until the tooth is so loose that it can be lifted out of its alveolus. In addition, the Accesia Extraktor can be inserted horizontally and used as an elevator. It is important to insert the instrument well into an interproximal space or between tooth root segments before elevating to avoid damaging the tip of the instrument.

The use of this new tool speeds up the process of tooth extraction but more importantly significantly reduces both trauma to adjacent tissue and the risks of complications.
BONE GRAFT MATERIALS

Dr. Barbara Möhnle, Kehl, Germany

Bone graft material can be divided into natural and synthetic material.
The natural material is classified according to the genetic relation between donor and recipient.

**Autogenetic:** Donor and recipient are identic.

**Isogenetic:** Donor and recipient are genetically identic.

**Allogenetic:** Donor and recipient belong to the same species.

**Xenogenetic:** Donor and recipient belong to different species.

The synthetic material is classified into polymere, metal and ceramic. In general this materials are called alloplastic. Furthermore there exist semi-synthetic materials which are phycogenetic or coralgenetic orgin.

Nowadays all these materials are applied in surgery and dental surgery. In order to use them in the correct manner it is absolutely necessary to know the differences of the materials and their different way of reacting in a recipient.

Osteogenesis (active bone building), osteoinduction (materials which stimulate cells to differ to osteoblasts) as well as osteoconduction (means the growth from bone on the top of material or in porous materials) play an important role. Other important details are: availability, simple handling, biocompatibility, low infection risk and stability of the bone defects.

**Autogenetic bone graft material:**
Bone graft may be transplanted with its natural blood circulation. In this case it has got the same qualities as the natural bone.

Another possibility is to engraft the bone without blood circulation. In this case we have to distinguish between transplantation of cortical bone ore spongy bone. Cancellous bone contains more active cells than the cortical area. Being precursors of the osteoblasts they stimulate the building of new bone right after the transplantation. The resorption of the transplantated bone, however, will start after the first vascularisation.

In the cortical bone transplant we find less osteoblasts so that in the beginning the resorption exceeds the growth of the bone.
Another important point is how the bone was gained. If the cancellous bone has to be crunched before transplantation, the number of cells declines, whereas this doesn’t happen with cortical bone.

**Allogeneic bone graft material:**
These bones are of the same species but donor and recipient are different. As this material in its original form causes an immune reaction it has to be treated before it can be used. For this reason it will be freezed, freeze-dried ore freeze-dried and demineralised (DFDBA/M demineralised freze-driedbone allograft or matrix).
Another special bone graft is allograft, autolysis, antigen extracted allogenetic bone (AAA-bone).
This kind of bone graft provokes osteoinduction and osteoconduction but no osteogenesis. Methods of sterilisation have a negative influence on these features. Freezing or freezed-drying doesn’t seem to have an effect on the mechanic resistance of the bone.
In human the application of this kind of bone graft material is very common. Because of its proved efficiency it is used in surgery as well as in dental procedures even if the risk for infection is known.
In veterinary surgery this kind of bone graft is used.

**Xenogeneic bone graft material:**
This bone often descends from pigs or bovine. It is partially prepared in the same way like allogenetic bone. Another possibility of treating the material would be the chemical and physical (thermic) preparation. During thermic treatment the bone transforms into hydroxylapatit which can be divided into two groups: hydroxylapatit generated at temperature below 450°C and over 450°C.
Hydroxyapatite obtained at a lower temperature is more porous (osteoconduction), and the remaining of organic materials leads to osteoinduction.

Hydroxylapatite gained of high temperature shows very little porousness and the resorption and remodelling rate is very low. The high temperature has the effect of creating a kind of ceramic which explains the different characteristics of this material. Such material can be used wherever little or slow reduction is required. (sinus augmentation in human dentistry).

Material of corals represents a very special kind of xenogenetic bone graft material for which just two coral species are used. They have an exoskeleton that is similar to the porous system of bone. After the protein of the coral has been reduced the material is available in form of calcium carbonate (Argonit). Studies have shown that resorption takes only 14 weeks.

In the manufactured form the substance changes to hydroxyapatite. During this remodellation carbonate is exchanged with phosphate under high temperatures. This is the reason for the high degradation stability of this material. In surgery and plastic surgery it is used with good results.

This material is also called semi-synthetical bone graft material.

Surgery also makes use of surrogate materials such as seaweed called semi-synthetical as well. Here fluorhydroxiapatite is extracted from calcium carbonate under pressure and high temperatures. Fluorhydroxiapatite has extremely small pores so that osteoblasts cannot migrate.

Alloplastic bone graft material:

These are materials of pure synthetic origin.

One of the eldest, the “plaster of paris”, is a β-hemihydrate of calcium sulfate (gypsum). These material has neither osteoconductive nor osteoinductive effects. It was used in 19th century surgery.

Calcium phosphate cements (similar to the “plaster of Paris”) are used in surgery for reconstruction. There is few or no conversion or resorption here as well.

Bioactive glass is synthetically fashioned glass ceramic with a very high content of silicon, calcium phosphor and sodium oxide. This quality guarantees the fast formation of a seam of osteoblasts. This has nothing to do with osteoinduction but with a special quality of these glasses. They form a layer which has a high affinity to cells, collagen and protein. Biocative glass is integrated very fast, complete and is resorbed within years.
Synthetic hydroxylapatite has the same features like naturally produced hydroxylapatite under temperatures of 450 °C. Looking at the chemical and crystalline structures, there are differences to naturally made material.

**Tricalciumphosphate (TCP),** is synthesized of calciumphosphate. Depending on sintering temperature two different $\alpha$-TCP and $\beta$-TCP are generated. $\alpha$-TCP arises at temperatures from more than 1,000°C and $\beta$-TCP below 1,000°C. $\beta$-TCP shows a faster resorption-rate than $\alpha$-TCP.

Examinations proved that bone regeneration takes place around and within $\beta$-TCP, thus this material is integrated during resorption. The resorption of this material is linked to the ability of resorption of the bone. This implies a synchronized composition and decomposition, the volume of incorporated material stays equal.

This material is used in surgery, orthopedics and dentistry. Meanwhile there exist various forms, from blocks to granulates.

A comparison with autogenic bone reveals a delay of bone regeneration.

Often the above mentioned materials are mixed with other substances or even among each other.

Thus an optimization of desired capabilities is tried to achieve.

- cortical and spongy bone for stability and covering of defects (spongiosa is resorbed fast)
- bone with alloplastic material (extension of autogenic bone material)
- bone or bone material with bone penetrating antibiotics (e.g. gentamycin)
- bone graft inducting material with growth aiding substances (accelerated healing of defects by osteoinduction)
Further on membrane induced regeneration of bone may be used. Here membranes prevent that missing volume of bone is filled with soft tissue of the surrounding. These membranes may be absorbable or non absorbable. They are widely used in oral surgery. They may also be used with animals. Especially the other factors of pressure and hygiene have to be respected. Newer membranes show a very high stability of shape and could be used.

Literature:
1. Jerosch, Bader, Uhr; Bone ;Stuttgart Thieme 2002
2. Hahn, Klotz, Gruber; Bone reconstruction; Balingen: Spitta 2008
3. Bojrab, Tholen ; small animal oral medicine and surgery; Philadelphia Lea & Ferbiger 1990
4. Brinker, Hohn, Prieur; Manual of internal fixation in small animals; Berlin, Heidelberg; Springer 1984
6. Nolff, Gellrich, Hauschild, Fehr, Bormann, Rohn, Spalthoff, Rücker, Kokemüller; Comparison of two β-tricalcium composit grafts used for reconstruction of mandibular critical size bone defects; VCOT 2/2009(96-102)
CRANIOMANDIBULAR OSTEOPATHY IN DOGS

Leen Verhaert, Dipl. EVDC

Craniomandibular osteopathy (CMO) is an uncommon non-neoplastic proliferative bone disease primarily affecting the bones of the head and occasionally long bones. The lesions are usually bilateral and symmetrical. The disease is self-limiting and occurs in immature dogs. CMO is most often seen in West Highland White, Scottish and other Terriers, but the disease has been documented in other breeds. The aetiology of this syndrome is unknown. An autosomal recessive mode of inheritance is known in West Highland White Terriers, and there may be a hereditary predisposition in Scottish Terriers. Sporadic occurrence in unrelated breeds suggests that aetiologic factors other than genetics must be involved, and factors that have been suggested are viral infection (canine distemper virus) and bacterial infection (*E. coli*). In a report on 12 Irish Setters with canine leucocyte adhesion deficiency, 7 had signs consistent with CMO, suggesting impaired immunity may be a possible factor in some cases of CMO.

Affected dogs are presented for persistent or intermittent pain associated with opening of the mouth and intermittent episodes of fever. Signs that may be seen are depression, drooling and dysphagia. The mandibular thickening is palpable as a firm, painful, usually bilaterally symmetrical swelling. If the angular process of the mandible and the tympanic bulla are involved, jaw movement is diminished. Once skeletal maturity is reached, the abnormal bone growth stops, often regresses and may recede completely.

Diagnosis is based on clinical signs, physical findings, radiography and histopathology. On radiography, dense osseous proliferations projecting from the periosteal surfaces of the affected bones can be seen. In severe cases, the angular process of the mandible may fuse with the tympanic bullae. The histopathological appearance is similar to that of osteitis deformans or Paget’s disease in humans.

Prognosis largely depends on which bones are involved and to what degree. Extensive involvement of the tympanic bullae, or bony fusion of the temporomandibular joint, may warrant euthanasia.
Treatment is aimed at reducing pain and inflammation, and providing nutritional support if needed. When the therapeutic response to non-steroidal anti-inflammatory drugs is poor, corticosteroids may be used. Signs may wax and wane spontaneously, therefore treatment responses are not always easy to assess. Surgical treatment (removal of excess bone) is not useful.

4 cases of CMO will be discussed: 2 West Highland White Terriers, 1 Bull Mastiff and one Newfoundland. The Bull Mastiff had concurrent metaphyseal osteopathy. All were treated with NSAID (one with carprofen, all others with meloxicam), and showed clinical response (reduction of pain) within 2 days, while the bony swelling took several weeks to regress. Interestingly, all female dogs (3) that were affected had serious relapses at the time of the first heat, while the one male dog didn’t show any relapse at any time.

References and further reading


SURGICAL REMOVAL OF ZYGOMATIC SALIVARY GLAND TUMOR OCCUPYING A RETRO-OCULAR SPACE OF 9-YEARS-OLD SHIH-TZU WITHOUT ORBITOTOMY

Ayako Okuda1), Yasuhiro Nakano2), Itaru Mizutani2), Nobuko Minami2), Takeo Minami2)
1) Vettec Dentistry: 3-20-7 2B Higashi-mukojima, Sumida-ku, Tokyo 131-0032, Japan
2) Minami animal hospital: 291-3 Hattori, Iga, Mie, 518-0007, Japan

A 9-year-old Shih-tzu was referred from a local clinician for recent-onset exophthalmos with a fluctuating swelling of caudo-ocular area in the left orbit. Exophthalmos was reduced with antibiotics, but it recurred within 2 months. Clinically the dog had no pain, but discomfort on the left eye with excess epiphora. Causes of exophthalmos in the left orbit should be diagnosed globe or peri-ocular structures. Radiological examination soft tissue mass was found around left retroocular area. Computed tomography imaging confirmed a mass with a large cyst and small cystic structures occupying retroocular space in the left orbit. The cystic structure in the zygomatic gland was measured 2cm in diameter and the whole structure of zygomatic gland showed poorly contrast enhancement. Metastases were not clearly recognized on CT images of regional lymph nodes, lung, and other organs. These diagnostic CT imaging suggested that primary benign or malignant zygomatic salivary gland cyst or tumor with cystic structures. Exophthalmos was caused by the cystic structure. FNA evaluation was resulting mucous-rich fluid with inflammatory cells. The anatomic location suggested the lesion was associated with the zygomatic salivary gland. Tentative diagnosis was a zygomatic mucocele (6).
**Treatment**
Under general anesthesia the incision was started on the zygomatic arch and careful elevations were repeated dorso-medially to approach the zygomatic salivary gland. Prior to surgical removal, contrast radiography was examined by injection through a duct from a zygomatic papilla in the oral cavity to confirm the mass relating with the zygomatic salivary gland. Only few contrast media was flew into the duct because the cystic inner cavity in the zygomatic gland was filled with secreted saliva, but it showed related to the zygomatic salivary gland. Pathology was confirmed in or around the zygomatic salivary gland. Enlarged zygomatic salivary gland was encapsulated just caudal to the globe. Macroscopically a large cystic structure was found in the body of the gland. The whole zygomatic salivary gland was removed with leaving the capsule because it was clearly separated from the body of the gland and tightly attached around the soft tissues. Our tentative diagnosis, cystic mucocele, was not necessarily to remove around tissues extensively. Vigorous lavarge with saline was followed by 4-0 monocryl with p-3 reverse cutting needle. Postoperatively the left eye was returned in the normal position in the orbit as healthy side. No complications and recurrent were observed clinically 12 wks after removal as well as on CT images. Histopathological examination was resulted the mucinous adenocarcinoma with multifocal coaglation of necrosis and cystic formation. The gland was occupied by polymorphic tumor cells with less mitosis consisting irregular glandular, cystic or alveolar structures while no infiltration of orbital tissues and osteolysis were not observed. It suggested that metastasis to local lymph nodes and local recurrent should be concern. This case was at Stage I (T1N0M0) (4).

**Discussion**
Salivary gland pathologies, especially zygomatic salivary glands, were not commonly diagnosed in the veterinary maxilla-facial surgery (7). Spangler and Culbertson (7)pathologically reviewed salivary gland samples, resulting five major pathologies; malignant tumor, sialadenitis, normal gland tissues, sialocele and gland infarction in mostly mandibular glands, rarely parotid glands and non in zygomatic. Several cases of mucocele were reported in zygomatic glands of dogs and cats (1,5,8) and a case of adenocarcinoma was found in a dog (2). Other reports also stated that the salivary gland tumor has rarely been found in the dogs and cats (3,4,7). Hammer et al.(4) reviewed retorospectively 24 dogs and 30 cats with salivary gland tumors.
Distribution of salivary gland tumors in dogs was preferably in parotid, following mandibular and sublingual glands while that in cats was mostly found in madibular, following parotid gland. The tumors were found in 4% of 24 dogs and 3% of 30 cats. Hammer et al.(4) also reported that the most common malignancy was adenocarcinoma and the median survival time was 550 days. Survival time after surgery alone or surgery followed by radiation was longer than surgery and chemotherapy.

The body of zygomatic salivary gland is located caudal of the globe in the orbit and its duct opens at the zygomatic papilla on the buccal membrane just dorsal to gingiva of the maxillary first/second molars. It is one of the large salivary gland of carnivore animals. Enlarged zygomatic gland by developing inflammation, cyst, or neoplasm makes exophthalmos. Exophthalmos is a clinical signs resulting diseases of the eye globe, on mandiblar ramus, or around maxillary molars as well as zygomatic gland. Cystic formation misled us less suspicious developing the tumor inside the zygomatic salivary gland.

Caudo-lateral approach to the zygomatic gland was the first option because of no or less damage of globe and vision (1,2). First incision on the bone of the zygomatic arch following gentle and careful elevation easily and safely approached the zygomatic gland. Considering surgical margin for malignant tumor this approach was less aggressive strategy.

References
LINGUAL NODULES CONTAINING LEISHMANIA IN A DOG - A CASE REPORT

Viegas CA\textsuperscript{1,2}, Requicha JF\textsuperscript{1,2}, Albuquerque CM\textsuperscript{1}, Teigão TM\textsuperscript{2,3}, Sargo T\textsuperscript{1}, Machado J\textsuperscript{1}, Dias MI\textsuperscript{1,2}, Pires MA\textsuperscript{1}, Cardoso L\textsuperscript{1,2}

1 – School of Agricole and Veterinary Sciences, Department of Veterinary Sciences, University of Trás-os-Montes e Alto Douro, P.O. Box 1013, 5001-801 Vila Real, Portugal.

2 – 3B’s Research Group – Biomaterials, Biodegradables and Biomimetics, Department of Polymer Engineering, University of Minho, AvePark, Zona Industrial da Gandra, S. Cláudio do Barco, 4806-909 Caldas das Taipas, Guimarães, Portugal.

3 – Department of Health Sciences, Universidade Católica Portuguesa - Centro Regional das Beiras - Universidade Católica Portuguesa. Estrada da Circunvalação. 3504-505 Viseu, Portugal.

Canine leishmaniosis (CanL) is a parasitic disease caused by protozoa of the genus \textit{Leishmania} and is endemic in the southern European countries. The clinical features of the disease vary and diagnosis may be challenging. Non-healing nodules on the tongue of a 3-year female dog were observed during a follow-up observation at the University of Trás-os-Montes e Alto Douro Veterinary Teaching Hospital (Vila Real, Portugal). The animal had been diagnosed with leishmaniosis two years earlier and received treatment with meglumine antimoniate plus allopurinol. In this moment, serology for antibodies to \textit{Leishmania} gave a low positive result by indirect immunofluorescent antibody test (IFAT), a positive result by direct agglutination test (DAT), and a fine needle aspiration of the lingual nodules showed \textit{Leishmania} amastigotes inside macrophages. Urine was isostenuric (density=1.025) and a mild proteinuria was found. Complete blood count and biochemical analysis revealed a severe neutropenia, a mild thrombocytopenia, moderate alanine aminotranferase (ALT) increase, mild blood urea nitrogen (BUN) increase. Additionally, serum protein electrophoresis showed an increase of alpha-1, beta and gamma globulins. The dog received a new course of meglumine antimoniate (Glucantime\textsuperscript{®}, Merial) (75 mg/kg, SC, q24h) for 30 days plus allopurinol (Zyloric\textsuperscript{®}, Lab. Vitoria) (10 mg/kg, PO, q12h). Only 10 days after the beginning of this therapy, the animal experimented some clinical improvements on the tongue surface. At that moment, the dog had a normal blood and urine analysis; nevertheless, a DAT was repeated and there was also a positive result. In the end of the therapy with meglumine antimoniate, in spite of some clinical improvements, we didn’t observe a complete macroscopic regression of some lingual nodules.
After one month, we performed an incisional biopsy of the persistent nodules in order to conclude if still exist amastigotes inside them, and the result was an inflammatory infiltrate comprising plasmocytes and a few eosinophiles and mastocytes and without *Leishmania* forms. At the same time, we collected a sample of tissue to confirm, by polymerase chain reaction technique, that there is no *Leishmania* DNA inside lesion and the treatment had been effective. Clinical and epidemiological implications are discussed in the light of other similar cases in dogs and humans with lingual processes associated with leishmaniosis.

REFERENCES


Picture legend:

- **Leishmania_1**: Dorsal aspect of the tongue before the therapy.
- **Leishmania_2**: Dorsal aspect of the tongue after 10 days of treatment.
- **Leishmania_3**: Microscopic image of lingual nodule cytology (H&E, obj 100x).
- **Leishmania_4**: Microscopic image of lingual biopsy (H&E, obj 40x).
SECONDARY HYPERPARATHYROIDISM IN 4 DOGS

Leen Verhaert, Dipl. EVDC

Secondary hyperparathyroidism can be either renal or nutritional. The hyperparathyroidism occurs secondary to hypocalcemia, hyperphosphatemia or vitamin D deficiency. Increased PTH secretion attempts at normalizing plasma calcium concentration, therefore in many cases calcium levels are within normal limits.

Renal hyperparathyroidism (RHPTH) is primarily caused by phosphate retention due to chronic renal failure, and consequent hypocalcemia. Increase of circulating PTH maintains normal extracellular calcium concentrations, but leads to renal osteodystrophy. This is first recognized in the maxilla and mandible. Clinical signs of ‘rubber jaw’ are relatively rare, unless RHPTH is chronic and severe, or in young animals when there is a high bone-turnover. Nutritional secondary hyperparathyroidism is quite rare since most animals nowadays are fed nutritionally balanced diets. Generally this condition is seen in young growing animals, fed a diet low in calcium and high in phosphate, even more so with diets low in vitamin D. Radiographically there is a general decrease in bone density, severe cases may show pathological fractures. Most of the time serum calcium levels are within normal limits. Severe swelling of the head from nutritional secondary hyperparathyroidism is generally not reported.

4 cases of secondary hyperparathyroidism with ‘rubber jaw’ will be presented, mainly focusing on clinical signs and radiographic appearance.

Case 1 was a four and a half month old female Bull Mastiff presented as a post mortem case for diagnosis. The dog was thin, with poor body condition, and a massively swollen face. Both upper and lower jaw had a rubbery consistency on firm palpation, and were extremely enlarged. Most of the gingiva of the maxillary arcade was ulcerated. Radiography showed the typical features of Osteodystrophy, with loss of bone density of the maxillary and mandibular bones, and loss of the lamina durae dentis, with the teeth seeming to float in fibrous tissue. Histology of the kidneys showed renal dysplasia.

Case 2 was an 8 year old female Yorkshire Terrier referred for ‘bilateral jaw fracture’ and reluctance to eat. Serum creatinine and BUN were severely elevated. Radiographic examination showed the typical appearance of osteodystrophy, and bilateral mandibular fracture due to loss of cortical bone strength.
Case 3 was a 9 year old female Golden retriever that was referred for bilateral swelling of the jaws. According to the owners, the dog was a bit slow, eating less, and attributed all this to age changes and the jaw swelling. The referring veterinarian was advised to take blood samples prior to referral, which showed severe renal failure. Radiographs were taken under sedation, and showed the typical changes as described in case 1.

Case 4 was a 9 year old intact male Briard, referred to the small animal hospital of Ghent University for depression, reluctance to move or walk, lameness, inappetence, and swelling of the jaws. This dog was fed a home-made diet since he was a puppy. The diet was deficient in vitamin D, and had a reversed Ca/P ratio, leading to hyperparathyroidism. While in most cases of nutritional secondary hyperparathyroidism there is no mention of “rubber jaw”, in this particular case this was the most prominent clinical and radiographic sign. Diagnosis was confirmed by routine bloodwork, radiography of the jaw bones, ultrasound of the parathyroid gland, and PTH and vitamin D assays in the serum.

Special thanks to Adronie Verbrugghe and Dominique Paepe for sharing their findings, perfect work-up, treatment outline and follow up on case 4!
IS THERE ANY UNIFORMITY IN THE MANAGEMENT OF ENDODONTIC DISEASES?

Igor Capík
Clinic of Small Animals
University of Veterinary Medicine
Košice, Slovak Republic

Summary
Management of dental trauma in human medicine is often a team effort involving general dentists, along with one or more of the specialty disciplines. Veterinary dental specialists have to cover not only the endodontic treatment but also therapeutic management of other soft and hard tissue injuries within the facial region. Treatment of traumatic dental injuries is categorized as primary, secondary and tertiary. A primary level of treatment involves urgent care provided soon after an accident including replanting an avulsed tooth, stabilizing luxated teeth or re-attaching a broken tooth fragment.

There are three priority categories for dental trauma based on the effect time has on the outcome.

1/ Acute priority (avulsion, alveolar fracture, extrusive and lateral luxation, and root fractures). These traumas respond most favorably if treated within a few hours. Unfortunately in small animal veterinary medicine many before mentioned traumas remain unnoticed by owners for different period following trauma. Despite this disadvantage, many factors may improve healing potential of dental pulp following traumatic exposure.(developmental stage, degree of pulp concussion, tooth position) Clinical experiences confirm fact that delayed diagnosis

2/ Subacute priority (intrusion, tooth concussion, subluxation and crown fractures with pulp exposures). Treatment several hours after trauma does not appear to affect the outcome of these injuries.

3/ Delayed priority (crown fractures without pulp exposure), which good respond to treatment even after more than a 24-hour. The goal of the urgent care—whether it is acute, subacute or delayed — is to promote wound healing in damaged tissues. In minor injuries, the primary treatment, is often all that is necessary. In major cases of dental trauma, secondary, and possibly tertiary, treatment will be needed.
Secondary level of treatment for traumatic injuries includes:

1. Monitoring and evaluating the condition of the pulp
2. Endodontic therapy in cases where the pulp is not expected to survive or cases in which pulpal disease develops subsequent to primary treatment.
3. Damaged gingival and periodontal tissues that heal unsatisfactorily.
4. Definitive restorations of teeth with crown fractures in which the primary treatment goal was to protect the pulp.

A tertiary level of treatment may take place any time from a few years to many years after a patient has had primary and secondary levels of treatment (dental implants, orthodontic treatment or autotransplantation).

The endodontic consideration in crown fractures is to protect the pulp in young, developing teeth. In fully formed teeth, root canal treatment is recommended. But this is not a rule despite longer time of dental pulp exposure as recommended generally. Dental pulp in maturing teeth shows in some circumstances as high healing potential which in some cases is able to form dentinal bridging spontaneously without previous endodontic treatment. In complicated crown fractures with exposed dental pulp (FX3a) with an immature apex and a vital pulp, the goal of treatment should be to protect the exposed pulp with a material that is biocompatible with pulpal tissues. For years, calcium hydroxide has been the material of choice for vital pulp therapy, and it continues to be used with good success. Recently, a new material, mineral trioxide aggregate (MTA), has been developed for various endodontic situations including pulp protection.

Long term dental pulp exposure in dogs older than 1 ½ years despite generally recommended for conventional root canal therapy may also be treated using vital pulpotomy. Our experiences suggest good prognosis of vital pulpotomies in teeth with the long term dental pulp exposure on terms afforded.

Root fractures are an infrequent occurrence. Horizontal root fractures are frequently mismanaged, resulting in either unnecessary extractions or root canal treatment. Most teeth with root fractures will recover successfully following repositioning of the coronal segment and stabilization for four to six weeks. In some cases, the pulp in a root-fractured tooth becomes necrotic and infected. When that happens, root canal treatment can save the tooth.
The necrotic pulp tissue is usually confined to the coronal part of the tooth and root canal treatment can be confined to the coronal segment only; the apical segment can be left untreated.

Tooth avulsions are more frequent in comparison with root fractures. Their prognosis is dependent on a few factors including the developmental stage, time of treatment, alveolar bone fractures. In dogs older than 2 years good therapeutic results may be achieved also in cases of delayed treatment (more than 12 hours).

Traumatic dental injuries present difficult problems for both patients and veterinary dentist. Appropriate treatment can turn what at first glance looks like a hopeless situation into a very satisfactory outcome for patients. The endodontic specialist plays an important role in the treating patients with traumatic dental injuries.
NON-ODONTOGENIC CYSTS IN MAXILLA FOUND IN TWO SHIH-TZU DOGS

Ayako Okuda1), Mituhiro Irie2), Takuma Miyoshi2), Kazuhiro Sunagawa 3), Yasuhiro Nakano4), Nobuko Minami4) and Takeo Minami4)

1) Vettec Dentistry: 3-20-7 2B Higashi-mukojima, Sumida-ku, Tokyo 131-0032, Japan
2) Irie animal clinic:, 3308 Ikedo, Miki, Kida, Kagawa 761-0701, Japan
3) Sunagawa dogs & cats clinic, 1956-1 Hayashi-machi, Takamatsu 761-0301, Japan
4) Minami animal hospital: 291-3 Hattori, Iga, Mie, 518-0007, Japan

Odontogenic and nonodontogenic cystic structures are often developed in jaw and maxillofacial area. However, the classification of cysts in the area is still controversial in human oral pathology. Dentigerous cyst with impacted tooth, one of odontogenic cysts, is frequently found in dogs, especially brachycephalic breeds. Nonodontogenic cysts consisted so-called fissural cysts and bone cystic structures, are rarely reported in animals as well as in human. Causes of the cystic structures were unknown, but it may have related to unilateral incisive duct or palatal fissure, suggesting that these were more likely developed during maxillofacial development.

Case 1 (2002EVDF presented) : A 7 year-old intact male shih-tzu was brought to the oncology clinic for facial swelling with severe respiratory disturbance. Facial swelling was found by the owner accidentally. He had suffered the respiratory problem for 4 years. No history of severe periodontitis, tooth fracture, impacted tooth, and/or maxillofacial trauma were recorded. Swelling was caused by bloody fluid accumulation on the right maxilla. Once the bloody fluid had been aspirated from the cavity, respiration had been back in normal. Fluid was accumulated within several weeks, caused respiratory disturbance.
Systemic physical exam: The moderate heart murmur on left ventricle was identified with mild enlargement of heart in radiographs. As predonisolone was prescription for seborrheic dermatitis, ALT and ALP in serum was slightly increased. Other systemic disorder was not found at preoperative evaluation.

Oral exam: There were no severe calculus/plaque accumulation and severe inflammation of gingiva. Only severe membranous swelling above from 204 to 209 was observed with fluctuation.

Radiological diagnosis (CT images and dental radiographs): A cystic structure filled with bloody fluid was extended from just caudal to the 103 to the 4th premolar, separated nasal cavity, connected to the right palatal fissure to the nasal septum. A few bone defects were made on the buccal maxillary bone. No impacted teeth or extraction sites were recognized.

Case 2: A two-year old female shih-tzu was referred us as facial swelling on the right. Swelling located on the right of nose was noticed by a groomer. No clinical signs were noticed by the owner.

Systemic physical exam: No pathological abnormalities were found.

Oral exam: Crowding and rotation were observed on the right upper incisors and right and left upper premolars. On palpation there was no hardness like bone around right incisive bone.

Radiological diagnosis (CT images and dental radiographs): The right incisive bone and rostral maxillary bone increased radiological transparency. It seemed that the right palatal fissure extended all direction. The cystic structure occupied almost the rostral nasal cavity. Bone destruction was severe: unilateral incisive bone, rostral maxillary bone, and part of nasal bone. No impacted teeth and extraction sites were recognized.
Treatment
Both cystic structures required surgical removal because of their widely extension with severe bone resorption and respiratory problem. Under general anesthesia gingival incisions were made for the extractions of teeth floating in the cysts, following elevation mucoperiosteum to unveil the cystic structures. Fluid of the cysts was bloody serous. The cystic cavities were lined by the wall on the alveolus bone, mesially next to the nasal cavities. After linings were removed as much as possible, mucoperiosteum flaps were used for closure.

Postoperative prognosis
The dog of Case 1 did show facial swelling without respiratory disturbance for one year of the operation but it was not brought us. Prognosis after that could not be followed. 3mon of postoperative condition of Case 2 was good without clinical signs and recurrent radiographically (CT and dental radiograph) and clinically (palpation).

Histopathological examination
The cystic wall from Case 1 and 2 was dominantly consisted respiratory (ciliated columnar) epithelium with little stratified squamous cell layers.

Discussion
Odontogenic cysts are roughly classified 1) developmental cysts, such as dentigerous (follicular) cysts, odontogenic keratocyst (or primordial cyst), and calcifying odontogenic cyst, and 2) inflammatory cysts, such as periapical cysts and bifurcation cysts (1, 2). Nonodontogenic cysts are also developed in bone of soft tissues caused by 1) developmental origin such as nasopalatine duct cyst, nasolabial cyst, brachial cyst, and others, 2) inflammatory origin such as radicular cyst, residual cyst and so-on, or 3) unknown origin (2,4).

It is difficult to suspect and confirm the origin of these cystic structures because of severe bone destruction. Both cystic structures related to the bordered areas of incisive-maxillary bones with opening palatal fissures to the cystic cavities and cystic walls dominantly were consisted dominantly by respiratory epithelium rather than stratified or simple squamous epithelium. It suggested that these cystic structures were formed during facial development, more likely non-odontogenic cyst.

In veterinary literatures a maxillary bone cyst with unknown origin was reported by Featherstone (3), unrelated to the nasolacrimal duct. However, our case was not related nasolacrimal duct.
References


ROTARY ENDOODONTICS IN A MANDIBULAR CANINE TOOTH OF
A RED PANDA (AILURUS FULGENS)

Dr. Barron P. Hall

Pre-shipment examination of an approximately 7-year-old intact male captive red panda revealed a complicated crown fracture (CCF) of the mandibular left canine tooth (#304). Considering these findings, a comprehensive oral health assessment and treatment (COHAT) was elected before shipment of this animal to another zoological facility.

Examination of the oral cavity revealed normal mature dentition with a CCF of #304 and a missing mandibular right corner incisor (#403). Intraoral digital images revealed normal radiographic anatomy except for a periapical radiolucency of #304 and retained tooth root #403.

Analgesia was achieved with a subcutaneous injection of meloxicam (0.1mg/kg: 0.8mg) and local anesthesia block with Lidocaine HCl injected at the left middle mental foramen.

The retained tooth root of #403 was surgically removed via an envelope flap. The flap was closed using 4-0 Vicryl.

Standard root canal therapy was elected. The coronal opening of the fracture was enlarged using Hedstrom files. A working length (WL) of 22mm was radiographically confirmed, and then a 31mm LightSpeed LSX instrument was used to manually determine the Final LightSpeed to Bind (FLSB). The pulp cavity was filled with EDTA as the FLSB was mechanically advanced rotating in a handpiece to WL. LSX instruments were used to shape the pulp cavity. Between instruments the pulp cavity was flushed, alternating saline, hydrogen peroxide, and 5.4% sodium hypochlorite. Instrumentation was continued using sequentially larger LSX instruments to determine the Final Apical Size (FAS) of #80. The next two sequentially larger instruments than the FAS were each stopped 4mm short of the previous instrument: the #90 instrument was the root canal was recapitulated with the stopped 4mm short of WL and the #100 instrument was stopped 8mm short of WL. The canal was thoroughly irrigated, and then coarse paper points were used to dry the root canal. AH Plus, a root canal sealer, was used and placed within the root canal using a #35 Hedstrom files placed to working length then manually spun counterclockwise.
A lentula spiral paste filler, Group II endodontic instrument, could have been used for this purpose, too. A #80 SimpliFill apical plug (TM) was “buttered” with AH Plus and firmly seated in the most apical extent of the pulp cavity. The handle was rotated counter clockwise 4 times to release the plug from the carrier. A radiograph confirmed the solid apical seal. A #30 parallax gutta percha point was inverted and covered with AH Plus and placed in the pulp cavity. The gutta percha was laterally compacted using manual pluggers and spreaders. Additional gutta percha points were used to complete the obturation. The excess sealer was removed using an ultrasonic scaler. The crown and pulp chamber were etched with 40% Phosphoric acid gel. After 45 seconds the etchant was manually removed, then the remaining remnants were rinsed away with the air/water syringe. BondOne was applied with a small disposable brush in multiple layers. After sitting for 30 seconds, the first layer was thinned using the air/water syringe. A second coat was applied in the same manner, thinned, and then cured with a light curing handpiece. A third coat was applied and thinned. Flow It, a light cured flowable composite, was placed into the pulp chamber and cured. A medium grit diamond bur was used on a water-cooled, high-speed handpiece to smooth the edges of the composite. Two more layers of the bonding agent were applied and light cured. A final radiograph was taken to confirm obturation and restoration.
Nasolacrimal Obstruction Caused by Root Abscess of the Upper Canine in a Cat

James Anthony

A ten year old, castrated male domestic short hair cat was presented to the Small Animal Clinic at the Western College of Veterinary Medicine. The presenting complaint was a chronic left ocular discharge. An ocular exam confirmed epiphora and mucopurulent ocular discharge but there were no apparent reasons for the ocular discharge and nasolacrimal obstruction was suspected. The cat had swelling of the left side of the face, severe periodontal disease and a fractured upper left canine with pulpal exposure. Dacryocystorhinography revealed narrowing of the nasolacrimal duct above the root of the fractured upper left canine and dental radiographs revealed a severe root abscess at the base of the upper left canine. The fractured canine was removed. Subsequently, the ocular discharge and facial swelling resolved. After two years, the epiphora has never reoccurred. This is a noteworthy case because a root abscess resulted in stricture of the nasolacrimal duct, which reveals the importance of an oral examination when dealing with nasolacrimal obstruction.
PERIODONTAL THERAPY

Brook A. Niemiec DVM
Diplomate, American Veterinary Dental College
Fellow, Academy of Veterinary Dentistry
(858) 279-2108
www.dogbeachdentistry.com
www.vetdentalrad.com
www.vetdentaltraining.com

Treatment of periodontal disease is generally a two to four step procedure depending on the stage of the disease. These include a thorough dental prophylaxis, periodontal surgery, homecare, and extraction. The cornerstone of periodontal therapy is a thorough dental prophylaxis. This MUST be performed under general anaesthesia.

Step 1: Pre surgical exam and consultation: This is often a much neglected step of a professional dental prophylaxis. The veterinarian should perform as complete as possible physical and oral exam. The oral examination will identify obvious pathology as well as allow for a preliminary assessment of periodontal status. The veterinarian can then discuss the various disease processes found and the various available treatment options. Based on the physical findings, the practitioner can create a more accurate estimate (both financial and time).

Step 2: Chlorhexadine lavage: The oral cavity is a contaminated area and a dental cleaning is a mildly invasive procedure. For this reason it is recommended to rinse the mouth with a 0.12% solution of chlorhexadine gluconate.

Step 3: Supragingival cleaning. This can be performed via mechanical or hand scaling. The mechanical scalars decrease anaesthetic time and include both sonic and ultrasonic types. The most common type of mechanical scaler in veterinary dentistry today is the ultrasonic scaler which vibrate at approximately 45,000 Hertz. They are very efficient and have an additional benefit of creating an antibacterial effect in the coolant spray (cavitation). They are however can be more damaging to the tooth, and may leave some calculus behind. Thus, it has been recommended that hand scaling be performed after ultrasonic scaling to ensure the complete removal of calculus. Sonic scalers run on compressed air and vibrate at 8-18,000 hertz. They are safer, but slower than sonic scalers and do not offer cavitation.
The area of maximum vibration is 1-3 mm from the tip. Do not use the tip or back of the instrument as these are not effective for calculus removal and can potentially damage the tooth. The instrument is placed on the tooth and LEFT on the tooth for up to 15 seconds. Once the instrument looses contact with the tooth, the scaler can no longer be effective. Run the instrument SLOWLY over the tooth surface in wide sweeping motions to cover every mm$^2$ of every tooth surface.

Hand scaling is performed with a scaler. This is a triangular instrument with e sharp cutting edges and tip. Scalers are designed for SUPRA-gingival use only. The scalers (as well as curettes below) are held with a modified pencil grip. The instrument is gently held at the gnarled or rubberized end with the thumb and index finger TIPS. The middle finger is placed near the terminal end of the shaft and is used to feel for vibrations which signal residual calculus or diseased/rough tooth/root surface. Finally, the ring and pinkie fingers are rested on a stable surface.

Hand instruments are used with a gentle touch and are run over the tooth numerous times in overlapping strokes until the tooth feels smooth.

**Step 4:** Subgingival plaque and calculus scaling: This step is best performed by hand with a curette. A curette has 2 cutting edges and a blunted toe and bottom. In this way, it will not cut through the delicate periodontal attachment as long as excess force is not applied. The proper curette is selected based on its angulation. The lower the number (i.e. 1-2) the less the angle and the further rostral in the mouth the instrument is used. The face of the instrument is placed flat against the surface of the tooth and inserted gently to the base of the sulcus or pocket. Once there, the instrument is rotated so that the shaft is parallel to the long axis of the tooth. This will engage the calculus as well as place the instrument in the proper position for root surface and subgingival debridement. This is repeated with numerous overlapping strokes until the root feels smooth. This is a very technically demanding procedure and the practitioner is directed to continuing education programs to hone their skills.

Traditional ultrasonic scalers should not be used subgingivally due to thermal damage to the gingiva and pulp. This occurs because the water coolant cannot reach the tip of the instrument. However sonic and ultrasonic scalers with specialized periodontal tips have been developed for subgingival use. These are much easier to use and therefore will likely result in superior cleaning in the hands of novices. Like supragingival scaling, it is recommended to perform mechanical scaling first to remove the majority of the plaque and calculus first, and then follow up with hand scaling.
Step 5: Polishing: Scaling (especially mechanical) leaves the tooth surface (and especially the root) rough, which increases plaque attachment. Polishing will smooth the surface of the teeth which will retard plaque attachment. Polishing is typically performed with a prophy cup on a slow-speed hand-piece with a 90 degree angle. The hand-piece should be run at a slow rate and no greater than 3,000 RPM. Ensure that adequate polish is used at all times. Running the prophy cup dry is not only inefficient, it may also overheat the tooth. Just like with scaling, every mm$^2$ of tooth surface should be polished. In addition, slight pressure should be placed down onto the tooth to flare the edges of the prophy cup so as to polish the subgingival areas. One tooth may be polished for a maximum of five seconds at a time to avoid overheating.

Step 6: Sulcal lavage: The cleaning and polishing steps will result in debris such as calculus and prophy paste (some of which is bacteria laden) to accumulate in the gingival sulcus. These substances will allow for continued infection and inflammation. Therefore a gentle lavage of the sulcus is strongly recommended. The lavage is performed with a blunt ended cannula which is placed gently into the sulcus and the solution is injected while slowly moving along the arcades. The typical lavage solution is sterile saline, although some authors favor a 0.12% Chlorhexadine solution.

Step 7: Periodontal probing, oral evaluation, and dental charting: This is a critical, however often poorly performed and underappreciated step. The entire oral cavity must be systematically evaluated using both visual and tactile senses. Careful visual examination should be performed during the periodontal evaluation. The periodontal probe should be inserted at six spots around EVERY tooth to identify periodontal pockets. This is performed by gently inserting the probe into the pocket until it stops and then “walking” the instrument around the tooth. The normal sulcal depth in a dog is 0-3 mm, and a cat is 0-0.5 mm. All abnormal findings must be recorded on the dental chart. Using the modified triadan system will greatly increase efficiency of this step. Dental charts must be of sufficient size to allow for accurate placement of pathology. The minimum size for an acceptable dental chart is 1/3 of a page, however veterinary dentists use full page charts. Samples of these may be downloaded at www.vetdentalrad.com/educationaldownloads.

Step 8: Treatment planning: The practitioner, utilizing all available information (visual, tactile, and radiographic) then decides on appropriate therapy. Additionally, the prudent veterinarian will keep in mind the patient as a whole, the owner’s wishes and willingness to perform homecare, and necessary follow-up. Following the creation of a dental plan for the patient, an estimate is created and the client contacted for consent.
**Home care:** Home care is a very important part of periodontal therapy. A recent study has shown that periodontal pockets are reinfected within 2 weeks of a prophylaxis if homecare is not performed. Therefore, homecare must be discussed with each client following a prophylaxis.

There are two divisions of homecare active and passive. They both can be effective if performed correctly; however, active homecare is still the gold standard in homecare.

Active homecare consists primarily of tooth brushing. There are numerous veterinary toothpastes available. These increase the palatability of the toothbrush, and many add a cleaning aid. Human tooth pastes are not recommended. There are also antimicrobial preparations that can be used in certain cases. Frequency: once a day would be ideal, as this is required to stay ahead of plaque formation, but for most owners this is unrealistic. Three days a week is considered the minimum frequency for patients in good oral health. If the patient has periodontal disease, daily brushing is necessary.

Passive homecare is the other option for minimizing periodontal disease. Since this requires no work by the owner, compliance is more likely. This is important since long term consistency is the most important factor in the effectiveness of dental care. There are currently several diets and treats that decrease tartar and plaque build-up.

All of these products have been shown to decrease plaque and calculus, however, they are most effective on plaque and tartar on the cusp tips not at gingival margin. Supragingival plaque and calculus is in general non-pathogenic. Of the available products, only two have been clinically proven to decrease gingivitis.

The downfall of all passive homecare products is that the patient is not likely to chew with the entire mouth; therefore areas will be missed. Passive homecare is most effective on the carnassial and surrounding teeth, where chewing is concentrated. Active homecare, in contrast, is most effective in controlling plaque and calculus on the incisor and canine teeth, likely due to the ease in accessing these teeth. Therefore, a combination of active and passive homecare is likely ideal.

**Periodontal therapy:** Any pockets greater than normal for the species are pathologic and in need of therapy. It is important to note that this is a separate procedure from the prophylaxis and the practitioner should be charging for this. Periodontal therapy is aimed at removing the infection from the root surface as well as smoothing the diseased root surface. This will allow for reattachment and decrease in pocket depth.
In the canine patient, pockets between 3 and 5 mm which do not have mobility or other issues are best treated with closed root planing and subgingival curettage. This step is performed in a similar manner to subgingival scaling above, with a combination of mechanical and hand scaling.

Pockets greater than 5-mm require direct visualization of the root surface for effective cleaning. If the tooth is not effectively cleaned, the infectious agents remain along with the plaque and calculus. Visualization is best accomplished via periodontal flap procedures. These procedures are very effective in animal patients. If the clients are interested in salvaging the teeth, periodontal surgery can be performed. These are advanced procedures, but can be learned by general practitioners.

The final modality for the therapy of periodontal disease is extraction. While extreme, it is the only true cure. Without a commitment to homecare or routine professional cleanings, advanced periodontal surgery should likely not be attempted. Depending on the stage of periodontal disease, the involved teeth should be extracted.
TREATMENT OF A FACIAL ABSCESS OF DENTAL ORIGIN IN FERRET

Fernández Sánchez, J.M. DVM 1,2. Del Campo Velasco, Marta .DVM 1. Trobo Muñiz, J.I. DVM, DDS, PhD 2. San Roman Ascaso, F. DVM, MD, DDS, PhD, Dipl EVDC 2
1.- Clínica Veterinaria Río Duero SLP. Madrid. Spain.

INTRODUCTION

The ferret (Mustela putorius furo) belongs to the Order Carnivorous, family Mustelidae. The ferrets have 30 teeth decidual and 34 permanent teeth. The dental permanent formula is: 2 (I 3/3, C 1/1, P 3/3, M 1/2). The supernumerary incisor teeth are common in the adult animals.

The facial abscesses of dental origin are relatively frequent in the ferrets, due to the high incident of disease periodontal in this species and specially in ferrets of more than six years old. Another cause of the dental abscesses is due to the wrong practice of "cutting the teeth away" to reduce the damages on having bitten.

CLINICAL CASE

A ferret of 5 year old female who was presenting a soft swelling in the right temporary region compatible with an abscess with drainage of purulent material towards the meatus acusticus externus and ear (Photo 1). In the first oral exploration they do not appreciate signs of disease periodontal, dental fractures, stomatitis or another oral pathology. These absence of signs of oral disease made us think about an otic origin about the abscess well be for some foreign body or some suppurative otitis.

One proceeds to realize a general anesthesia of the patient for a drainage of the abscess, capture of sample for culture and antibiogram and oral definitive exploration.
careful wash is realized with normal saline of the right ear for his visualization with otoscopy no foreign body being observed in the meatus acusticus externus. Later one proceeds to the oral exploration and a severe gingivitis is estimated in the vestibular gingiva to 409 by mobility III (Photo 2).

A periapical intraoral radiography is made and a severe granuloma apical estimates in the tooth 409 in the root mesial, loss of vertical bone, loss of bone in the furca, partial reabsorption of the cervical third of the root mesial and loss of the jaw bone (Photo 3).

![Photo 3](image)

There is realized a drainage of the abscess and extirpation of the whole capsule of the same one, there is sent a sample of the purulent material and of the capsule for his microbiological study. When we do the drainage of the abscess we observe the appearance of bled by the vestibular gingiva to the tooth 409.

We make a block of the alveolar mandibular nerve in his entry for the mandibular canal with bupivacaíne and fulfil the exodontia of the tooth 409, a curettage of the underlying bone and a careful disinfection with clorhexidina to 0,12 %.

In the microbiological analysis Staphylococcus spp was identified and the antibiogram gave sensitively the ampiciline. To 10 days one proceeded postsurgery to remove the stitches (Photo 4) and in the oral exploration it was estimated to good cicatrization. A last review was done to 40 days not having recidiva of the abscess and being the animal in perfect conditions.

![Photo 4](image)

**CONCLUSIONS**

It is very important to do always an oral exploration to the ferrets when they come to a Veterinary Clinic, because the incident of periodontal disease in this species is very high and the abscesses are common in the mandibular region and it are caused by bacteria of the genera Staphylococcus, Streptococcus and Proteus.
CHRONIC ULCERATIVE STOMATITIS IN DOGS - CLINICAL DIAGNOSIS AND THERAPY

Tomáš Fichtel, Michaela Cincibusová, Michal Crha

In the study a total number of 31 dogs were examined. These dogs were diagnosed with an inflammatory disease of mucous membranes in oral cavity and were treated at the Small Animal Teaching Hospital, University of Veterinary and Pharmaceutical Sciences Brno, Czech Republic, during the time between January 2005 and February 2008. All the patients suffered from chronic ulcerative stomatitis unresponsive to a conventional therapy. Before these patients were presented to our clinic they had been repeatedly treated with antibiotics, non-steroidal antiflammatory drugs and local antiseptics (usually chlorhexidine). The clinical signs and history were the same in all the patients. The typical findings were areal lesions on a buccal mucosa that appeared painful with signs of hypersalivation and some bleeding after irritation. The age of the patients ranged between 4 to 14 years. The most common breed was English Cocker Spaniel (17 cases). The other breeds were rarely presented.

<table>
<thead>
<tr>
<th>Breed</th>
<th>Number of dogs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cocker Spaniel</td>
<td>17</td>
</tr>
<tr>
<td>Poodle</td>
<td>5</td>
</tr>
<tr>
<td>Scottish Terrier</td>
<td>2</td>
</tr>
<tr>
<td>Labrador Retriever</td>
<td>1</td>
</tr>
<tr>
<td>Bishon Frise</td>
<td>1</td>
</tr>
<tr>
<td>Brazilian Fila</td>
<td>1</td>
</tr>
<tr>
<td>Akita Inu</td>
<td>1</td>
</tr>
<tr>
<td>Miniature Schnauzer</td>
<td>1</td>
</tr>
<tr>
<td>Dashhound</td>
<td>1</td>
</tr>
<tr>
<td>Crossbreed</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 1: Absolute numbers of dogs of each breed in a studied group.

The biopsy of a changed mucus membranes was performed in all patients and the samples were submitted to histopathology. In addition, a venous blood was taken and submitted to an extended immunological test. The test included a phagocytic activity of leucocytes test, chemiluminisce test with a full blood, immunoglobulines level determination, lymphocytes blastic transformation test out of the isolated mononuclears, antinuclear antibodies test (ANA) in serum, total number and a differential leucocyte count. A standard treatment of the parodont was performed in each patient.
In five cases an autoimmune disease was diagnosed on histopathology, the rest of dogs was diagnosed with an inflammatory disease and lymphosarcoma:

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Number of dogs</th>
<th>Therapy</th>
<th>Success rate (number of dogs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>systemic lupus erythematous</td>
<td>3</td>
<td>immunosupression</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>failed</td>
<td>1</td>
</tr>
<tr>
<td>discoid lupus erythematous</td>
<td>2</td>
<td>immunosupression</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>failed</td>
<td>0</td>
</tr>
<tr>
<td>lymphocytic - plasmacytic stomatitis</td>
<td>6</td>
<td>immunomodulation</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>immunosupression</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>failed</td>
<td>1</td>
</tr>
<tr>
<td>chronic ulcerative inflammation nonspecific</td>
<td>19</td>
<td>immunomodulation</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>failed</td>
<td>7</td>
</tr>
<tr>
<td>lymphoma</td>
<td>1</td>
<td>chemotherapy</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>failed</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 2: The frequency of histopathologic diagnoses and therapeutical success.

ANA test was positive in five cases. Of the five dogs, four was diagnosed with an autoimmune disease and one with a nonspecific inflammation. Out of the patients in which an autoimmune disease was not confirmed, 13 dogs had a decreased activity of the immune system or lower immune cells count. In 13 dogs the immunological parameters were within the normal range with no abnormalities of the immune system detected. The results of the immunological test considerably varied and due to a low number of dogs it was impossible to make statistically significant conclusions. Upon the histopathological and immunological results the protocol consisting of immunosuppressive or immunomodulative therapy was subsequently made.

**The diagnostical recommendations for a clinical practice**

The histopathology is essential for a diagnosis, as in this manner we are able to diagnose specific inflammatory diseases, autoimmune diseases, and neoplastic lesions. The histopathology should be done in every patient with described clinical signs. Immunological test is not as important for a routine diagnostics as histopathology and may be omitted. However, the immunological test may help to clarify the causes of the type of stomatitis.
**Therapeutical protocol:**

Autoimmune disease: immunosuppressive therapy

Introduction - Prednisone (2 – 4 mg/kg BID)

Follow-up - Prednisone – gradually tempered

Maintenance therapy - Prednisone, the other immunosuppressive drugs

Lymphocytic – plasmacytic inflammations: immunomodulators

Systemic enzymatic therapy (Wobenzyn 1 drg./10 kg TID)

Immunostimulation therapy (Zylexis min. 3 applications)

Antiinflammatory therapy (in case of therapeutical failure)

Prednisone (2 – 4 mg/kg BID)

Chronic ulcerative inflammation nonspecific: immunomodulators

Systemic enzymatic therapy (Wobenzyn 1 drg./10 kg TID)

Immunostimulation therapy (Zylexis min. 3 applications)

The described treatments were accompanied by a conventional antimicrobial therapy with amoxicillin-clavulanate in dose of 50 mg/kg/day in each patient.

Fig. 1: lymphocytic – plasmacytic stomatitis

Fig. 2: lymphocytic – plasmacytic stomatitis

Fig. 3: discoid lupus erythematosus

Fig. 4: lymphosarcoma
Prevalence of Periodontal Disease in Default of Dental Hygiene in Dogs

M. Shokry * and L. BenAli**
*Dept. of Surgery, Faculty of Vet. Medicine, Cairo University, Egypt
**Dept. of Surgery, Faculty of Vet. Medicine, El-Fateh University, Libya

The periodontal status of 37 dogs (Griffon 22, German Sheperd 6, Pekingese 6, Mongrel 2, Irish Setter one) with non-teeth health problems was assessed. Periodontal assessment was determined by using the parameters of pocket depth, gingivitis, plaque and calculus accumulation and alveolar bone loss on radiographs. The demonstrated teeth lesions were ranging from gingivitis to destructive periodontitis. The maxillary molars and the mandibular premolars were highly affected. Treatment by supra/subgingival scaling, root planing and curettage combined with maintenance of daily oral hygiene proved very effective for procuring marked resolution of gingivitis and regression of pocket depth in mild cases and useful to lessen and retard the complication in advanced cases.

Introduction
Periodontal disease of dogs is a common problem in veterinary dentistry. Periodontal disease is caused by the accumulation of bacterial plaque with subsequent tissue destruction results from autodegradation induced by the continuing inflammatory response (Harvey et al, 1996; Harvey, 1998). The dog with periodontally involved teeth may be uncomfortable and other organs of the body may be at risk for spread of infection from the affected teeth (DeBows et al, 1996). The development of periodontal disease is facilitated by soft diets (Rawlings et al, 1997). Irrespective of dietary regimen, neglecting of regular dental hygiene did not maintain clinically healthy gingival in dogs (Gorrel and Rawling, 1996). The inflammation of periodontium is progressing from gingivitis to periodontitis and ultimately to loss of teeth (Grove, 1985). Oral malodor or halitosis is a characteristic sign of periodontal disease (Hennet et al, 1998). Since the majority of pet owners’ are usually unaware of their pet’s teeth and their attention is directed to other body health problems, hence the aim of the present study was to elucidate the pattern and distribution of periodontal disease among randomly selected dogs complaining of non-teeth health problems.
Materials and Methods
A total of 37 dogs of different breeds (Griffon 22, Pekegnes 6, G.Shepherd 6, Mongrel 2 and Irish Setter one) of both sexes and age between 5 and 12 years old, were referred to the faculty’s surgery clinic for non-teeth health problems. From the history, all the presented dogs did not provided with any kind of dental hygiene. These dogs were subjected to a thorough periodontal examination under the effect of general anaesthesia. Their periodontal status was assessed using the parameters of gingivitis, plaque and calculus accumulation, pocket depth, furcation involvement and the extent of alveolar bone loss on radiographs using the methods of (Silness and Loe, 1964, Isidor et al, 1984 and Zontine, 1975). The collected data were recorded in the designed flow charts (Figs. 1 & 2). Several methods of treatment were used including teeth scaling and planing (19 cases), gingival curettage (15 cases) and extractions (3 cases).

Results
Generally all the presented dogs showed signs of gingivitis and periodontitis of variable degrees. Excessive plaque and calculus were predominated among the small sized breeds and old dogs which displayed the most periodontal destruction with multiple furcation involvement or even lost teeth (Fig. 1). The pocket depth of most of the small sized dogs exceeded 5mm and 2 mm in large sized dogs. The maxillary premolars and mandibular molars were the most frequently involved teeth in all dogs.
Intraoral radiographs showed different degrees of alveolar bone loss ranging from slight to marked horizontal bone loss involving interradicular and interdental areas (Fig. 2).

Discussion
From the present study, the frequency of periodontal disease was very high in dogs which have not provided with any dental hygiene care. The small sized breeds showed expeditious tendency to develop the destructive form of periodontal disease. These findings in general support with previous observations in Poodles (Hoffmann and Gaengler, 1996) and in Beagles (Page and Schroeder, 1981; Tromp et al, 1986). In the present study, radiography assessment of alveolar bone loss which ranged from slight loss to marked horizontal loss involving interradicular and interdental areas with furcation exposure. These findings are in consistence with those reported by (Smith et al, 1985; Jeffcoat et al, 1991; Hamp et al, 1997; Reddy, 1997). The maxillary molars and mandibular premolars were the most frequently affected teeth. Similar observations were also noted by (Hamp et al, 1997).
Periodontal disease occurs due to accumulation of bacterial plaque and calculus in the gingival sulcus with subsequent destruction of the periodontal tissues from autodegradation induced by the continuing inflammatory response (Gad, 1968; Lindhe et al, 1975; Sorensen et al, 1980; Page and Schroeder, 1981; Harvey et al, 1996). The oral cavity may also serve as a direct reservoir for bacterial contamination and cause disease in other body organs and tissues (DeBowes et al, 1996).

The development of periodontal disease is facilitated by soft diets (Gorrel, 2000). Tooth brushing beside the addition of a dental hygiene chew are necessary for maintenance of periodontal health in dogs (Gorrel and Rawling, 1996). In this study, removal of supragingival plaque and calculus by teeth scaling and root planing combined with chlorhexidine antiseptic mouth wash proved very effective in terms of resolution of halitosis, gingivitis and reduction of pocket depth. Moreover gingival curettage to eliminate granulomatous and inflammatory tissues and deep subgingival calculus proved its feasibility in reducing pocket depth and delay the forthcoming complications. Tooth extractions were carried out to remove loose and hypermobile bad cases with advanced periodontitis. These results are nearly consistent with those reported by (Lindhe and Ericsson, 1978; Tholen, 1982; Grove, 1998).

Conclusions

1. Pet owners’ should give some attention to their pet’s dental hygiene
2. Small sized breeds exhibit expeditious tendency to develop the destructive form of periodontal disease than large sized breeds
3. Early diagnosis and treatment of periodontal lesions reduce the risk of complications.

References on request
Fig. 1
a. A 6 years old female mongrel showing gingivitis
b. A 12 years female Griffon with calculi on the maxillary premolars
c. An 8 years old male Griffon with generalized periodontitis
d. A 12 years old male Griffon with calculi & lost incisors
e. An 11 years old female G.Shepherd with furcation involvement
f. An 8 years old Irish Setter showing gingivitis
g. A 10 years male Griffon with deep pocket (9 mm) at the mesial surface of the 1st maxillary premolar & calculus on 4th premolar
h. A 9 years old female German Shepherd with calculus accumulation on the 1st mandibular molar

Fig. 2
a. Intraoral periapical radiograph of the mandibular premolars showing marked horizontal bone loss & furcation exposure
b. Intraoral periapical radiograph of the mandibular molars showing periapical radiolucency of the 2nd Man.molar & furcation exposure of 1st & 2nd molars
c. Intraoral periapical radiograph of the 2nd man. Molar showing vertical bone & interradicul loss
PINE PROCESSIONARY – MORE THAN A PEST OF PINE TREES

Viegas CA\textsuperscript{1,2}, Albuquerque CM\textsuperscript{1}, Requicha JF\textsuperscript{1,2}, Sousa CM\textsuperscript{1}, Teigão TM\textsuperscript{3}, Dias MI\textsuperscript{1,2}

\begin{itemize}
\item 1 – Department of Veterinary Sciences, University of Trás-os-Montes e Alto Douro (UTAD), P.O. Box 1013, 5001-801 Vila Real, Portugal.
\item 2 – 3B’s Research Group – Biomaterials, Biodegradables and Biomimetics, Department of Polymer Engineering, University of Minho, AvePark, Zona Industrial da Gandra, S. Cláudio do Barco, 4806-909 Caldas das Taipas, Guimarães, Portugal.
\item 3 – Department of Health Sciences, Universidade Católica Portuguesa - Centro Regional das Beiras - Universidade Católica Portuguesa. Estrada da Circunvalação. 3504-505 Viseu, Portugal.
\end{itemize}

The pine processionary moth, \textit{Thaumetopoea pityocampa} (Den. & Schiff.), is one of the major pest affecting pines in Portugal, other Mediterranean countries, Central Europe, the Middle East and North Africa\textsuperscript{1,6,10}. The pine processionary caterpillar (PPC) is the common designation of the caterpillar stage of the referred moth\textsuperscript{11}. This designation comes from the fact that the caterpillars move along the ground in long head-to-tail processions\textsuperscript{3,4}. The PPC is also a serious medical problem, in spite of its toxic and irritative effects to humans and animals\textsuperscript{1,3,4,6,7}. In the most common cases, the exposed human patients present dermatitis, contact urticaria or ocular lesions\textsuperscript{7,11,10}. The PPCs are covered with poisonous hairs of chitinous spines, whose are the responsible for the lesions by a mechanical process (penetration of the hair) and a chemical process (discharge of a toxic substance, namely thaumetopoein)\textsuperscript{3,10,12}. Thaumetopoein is a potent skin irritant and systemic histamine and kinin releaser\textsuperscript{5,7,9}. This toxic protein has a direct effect on mast cells, leading to an IgE-independent degranulation, which explains the urticating properties of PPC\textsuperscript{3,7,10}. Additionally, it was described an allergic hypersensitivity mechanism mediated by IgE to justify violent reactions, such as anaphylaxis, that some individuals present after contact with PPC\textsuperscript{3,7,11,12}.

In the veterinary literature, there are only few reports of exposure to PPC\textsuperscript{3,9}. Seen with a seasonal distribution [in Portugal occur more frequently from February to May\textsuperscript{9} (corresponding to the L5 larval stage, the most poisonous stage)\textsuperscript{3}], can cause serious life-threatening allergic reactions to dogs and cats\textsuperscript{9}. Dogs are especially vulnerable because of their natural curiosity and active exploratory behavior\textsuperscript{9}. 

150
Dogs are attracted to the caterpillars and may sniff or eat them, breathing in or ingesting the hairs, which cause severe reactions to the dog’s mouth and tongue\(^9\). In dogs, clinical signs include lingual, sublingual and submandibular oedema, respiratory distress, labial angioedema, facial pruritus, ptyalism, vomiting, and sometimes ocular signs\(^3,8,9\). The more typical finding is the extensive tongue oedema, cyanosis and in severe cases, necrosis of the tongue, resulting eventually in lost of part or all of the tongue (in 6 to 10 days), which leads to a poor prognosis\(^3,8,9\). The mechanism behind those serious lesions is the accumulation of antigen-antibody complexes forming microthrombus, which occlude the microcirculation of tongue, ultimately leading to necrosis. Some particularly severe cases results in extension of necrotic lesion and loss of labial and mentum tissues\(^8\).

Early recognition of intoxication and immediately treatment are very important for prognosis\(^9\). Treatment of processory caterpillar envenoming is entirely supportive or symptomatic\(^5,9\). An initial and essential step consists of irrigation of exposed tissues to promote removal of urticating larval hairs\(^3,5,8,9\) (oral irrigation must be intensive and prolonged with an isotonic sterile saline solution, nevertheless some clinicians prefer use an aqueous solution of acetic acid (vinager) because its astringent and antimicrobial effects). To control the acute hypersensibility can be used a glucocorticosteroid intravenously (e.g. methylprednisolone sodium succinate)\(^3,9\). Anti-histamines such as promethazine intravenously may be useful to reduce inflammatory reactions, and should be administered until symptoms are resolved\(^3,9\). To try limiting the necrotic lesions in tongue, secondary to thrombosis of microcirculation, it was proposed the intra-lingual administration of heparin\(^9\). Additionally, enteral feeding (e.g. nasogastric feeding tube) can be necessary in the more severe cases\(^3,8,9\). A prolonged antibiotic control of secondary infections is essential; the combination spiramycin/metronidazole is a frequent choice\(^9\). A gastric mucosal protector, such is ranitidine, can be beneficial\(^3\). Finally, because this poisoning in dogs is associated with severe pain is required intensive analgesia\(^3\).

An important fact associated with treatment of this poisoning is the secondary hypersensitivity reaction to attending veterinary staff following contact with exposed animals, which emphasize the importance of take special self-protection measures\(^3,9\).

Most caterpillar exposures can be prevented by simple protective measures taken during peak larval seasons; such is keep dogs away from areas of pine trees reducing the opportunities for dog-caterpillar contacts\(^2,9\). So important is to put in practice phytosanitary measures against this harmful organism.
Chemical and biological control treatments can be applied; such are insect growth inhibitors, formulations of Bacillus thuringiensis, and sex pheromones traps (for monitoring and for mass trapping).\textsuperscript{13}

In conclusion, the pine processionary caterpillar poisoning is a serious and life-threatening problem in dogs and must be recognized by veterinarians and included in the differential diagnoses of unexplained tongue necrosis in dogs in endemic areas.\textsuperscript{3}

In this revision we are able to show such a several clinical cases of stomatological lesions in dogs.

REFERENCES

3 - Bruchim, Y; Ranen, E; Saragusty, J; Aroch, I. Severe tongue necroses associated with pine processionary moth (Thaumetopoea wilkinsoni) ingestion in three dogs. Toxicon 45 (2005) 443-447.
7 - Moneo, I; Vega, JM; Caballero, ML; Vega, J; Alday, E. Isolation and characterization of Tha p 1, a major allergen from the pine processionary caterpillar Thaumetopoea pityocampa. Allergy (2003) 58, 34-37.
9 - Oliveira, P; Arnaldo, PS; Araújo, M; Ginja, M; Sousa, AP; Almeida, O; Colaço, A. Cinco casos clinicos de intoxicação por contacto com a larva Thaumetopoea pityocampa em cães. Revista Portuguesa de Ciências Veterinárias (2003) 98 (547) 151-156.
10 - Vega, JM; Moneo, I; Armentia, A; Fernández, A; Vega, J; Fuente, R; Sánchez, P; Sanchis, ME. Allergy to pine processionary caterpillar (Thaumetopoea pityocampa). Clinical and Experimental Allergy (1999), vol. 29, pp. 1418-1423.
12 - Vega, ML; Vega, J; Vega, JM; Moneo, I; Sanchez, E; Miranda, A. Cutaneous reactions to pine processionary caterpillar (Thaumetopoea pityocampa) in pediatric population. Pediatr Allergy Immunol (2003): 14: 482 - 486.
Picture legends:

- Pine_processionary_1: Pine processionary caterpillar covered with poisonous hairs of chitinous spines.
- Pine_processionary_2: Facial aspect of a dog after processionary caterpillar envenoming. Note the severe initial facial oedema.
- Pine_processionary_3: Tongue necrosis in a dog after oral contact with pine processionary.
- Pine_processionary_4: Severe loss of labial, nasal and facial tissues.
DEVELOPMENT OF PHARMACEUTICAL WAYS FOR PERIODONTAL DISEASE IN VETERINARY

Prado¹,A.M.B.; Isaka²,L.J.E.; Nishimoto³, T.; Ramos,C.M.G;

1 – MV, PhD; TITULAR TEACHER OF VETERINARY ANATOMY IN PONTIFICIA UNIVERSIDADE CATOLICA DO PARANA
2 – STUDENT OF POTIFICIA UNIVERSIDADE CATOLICA DO PARANA
3- PHARMACEUTICS
4- TITULAR TEACHER OF VETERINARY ANESTHESIOLOGY OF PONTIFICIA UNIVERSIDADE CATOLICA DO PARANA, BRAZIL

Introduction

With the development of the market for pet products, many studies have been made to facilitate handling and prevent diseases that cause discomfort to the owner and especially for the animal. (Dębowa ET AL., 1996).

Periodontal disease is an inflammatory process, that can result of a trauma and that affects the tissues support of the tooth and may progress to loss of the same and in several cases can cause systemic diseases (Domingues et al, 1999). The pre-provision is related to age, diet, breed and presence of factors with plaque and / or trauma (HOFFMANN & GAENGLER, 2004). The most common clinical signs of periodontal disease are halitosis, dental calculus, gingival inflammation and bleeding, anorexia, difficulty in chewing, dental mobility, gingival retraction and behavioral changes. In more severe cases, may occur endocarditic, renal failure, disk spondylitis and poly-arthritis due to bacterial migration through blood. (Gioso, 1997, Cox et al., 2003).

Material and methods

This study aimed to evaluate the effectiveness of associations of dental gel with mauve, mauve and propolis, mauve with propolis and allantoin associated with dental prophylaxis. A group of nine dogs were divided in three sub groups of treatment, one with each solution. The dogs were of the routine of the Veterinary Hospital of pets from Catholic University of Paraná and all had periodontal changes. The solutions were prepared in the pharmacy school of the university and had a cost far below the standard treatment using antibiotics. All the dogs were subjected to dental prophylaxis, and the application of solutions made in the postoperative period and followed up weekly for four weeks.

Results

The three groups had very similar results. There was restoration of the gingival epithelium, reduction in gingival hyperplasia, improvement in halitosis, less susceptibility to formation of new plaques.
Conclusion

The study showed the effectiveness, because 100% of cases were successfully in the treatment, showing a simple solution to a so common disease in the veterinary clinic.

Bibliographic References

A dental chew clinically proven to keep dogs' teeth and gums healthier

Periodontal disease – a common problem in dogs.

Anyone working in a veterinary practice will know that dental disease is very common amongst dogs, especially as they age. Periodontal disease is the most frequently occurring clinical condition in dogs with 4 out of 5 of those over the age of 3 showing signs of periodontal disease (Hamp et al., 1984).

Periodontal disease can cause great discomfort and pain in our four legged friends – and can lead to even greater health concerns. Despite the common incidence of periodontal disease, market research across Europe has found that less than 5% of dog owners are aware that their dog has a problem.

Research has shown that owners who have an effective home care routine follow this because of the valuable information and advice they have received from either their vet or vet technician on the risk of periodontal disease for dogs and the effectiveness of different home care routines.

Brushing is best – but owners don’t do it!

Ideally, all owners would brush their dog’s teeth daily, thus preventing the accumulation of plaque and calculus, the springboard for gum disease.

This is a common routine for humans, so it should be no different for dogs. However, we know that, in reality, very few owners are willing or able to do this.

Dog owners need a convenient alternative that’s still effective.

When choosing a dental chew or main meal product, you should look for recommendations set out at the 8th Annual Veterinary Dental Forum about daily interventions.

Whilst no product will completely prevent plaque and calculus build-up, recent developments from Pedigree® are delivering very substantial reductions in the levels of dental deposits.

Chewing Pedigree® DentaStix® everyday has been proven to reduce plaque accumulation by as much as 70% and calculus accumulations by as much as 80%. Furthermore, it is available in different sizes to suit different types of dogs (small, medium and large) and has a low-calorie impact, thus making it suited to daily feeding.

What’s more, because Pedigree® DentaStix® tastes great, your patients’ dogs will think of them as a treat and will come to enjoy having their teeth cleaned.

INDEPENDENT CLINICAL STUDIES HAVE PROVEN THEY WORK.

A number of independent clinical studies that were run according to recommendations set out at the 8th Annual Veterinary Dental Forum have shown Pedigree® DentaStix® to retard the formation of plaque and calculus in dogs to levels that exceed what is observed when feeding dry diet alone (Figure 1).

The studies have shown that, by feeding one Pedigree® DentaStix® per day, levels of plaque are reduced by approximately 30% on average, whilst levels of calculus were reduced by as much as 80%.

<table>
<thead>
<tr>
<th>Dietary Regimen</th>
<th>Plaque Score</th>
<th>Calculus Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Diet</td>
<td>14.47</td>
<td>2.7</td>
</tr>
<tr>
<td>Control Diet with Chow</td>
<td>10.5</td>
<td>1.26</td>
</tr>
<tr>
<td>Average Reduction (%)</td>
<td>28</td>
<td>54</td>
</tr>
<tr>
<td>Highest Reduction (%)</td>
<td>61.3</td>
<td>81.5</td>
</tr>
</tbody>
</table>

Table: Summary of the effect of PEDIGREE® DENTASTIX® on plaque and calculus accumulation relative to a control diet.

Source: University of New England.

So how do Pedigree® DentaStix® chews work?

→ 1. Mechanical action

With its unique X-shape profile, the texture of Pedigree® DentaStix® is designed not only to create the shear forces on the dog’s teeth, which helps to remove plaque, but also to keep the dog chewing for a significant length of time. An added benefit of this sustained chewing is that it stimulates saliva flow, this flow helps to wash away any debris removed from the teeth.

→ 2. Active ingredients

Included within Pedigree® DentaStix® are two active ingredients (sodium tripolyphosphate and zinc sulphate) which have the effect of chelating salivary calcium (Figure 2) as well as slowing down the build-up of calculus by inhibiting further crystal growth by binding to the surfaces of solid calcium phosphates (Figure 3). By this means, plaque is kept softer for longer and so more of it can be removed by the action of the dog chewing Pedigree® DentaStix®.

INDEPENDENT CLINICAL STUDIES HAVE PROVEN THEY WORK.

A number of independent clinical studies that were run according to recommendations set out at the 8th Annual Veterinary Dental Forum have shown Pedigree® DentaStix® to retard the formation of plaque and calculus in dogs to levels that exceed that observed when feeding dry diet alone (Figure 1).

The studies have shown that, by feeding one Pedigree® DentaStix® per day, levels of plaque are reduced by approximately 30% on average, whilst levels of calculus were reduced by as much as 80%.

<table>
<thead>
<tr>
<th>Dietary Regimen</th>
<th>Plaque Score</th>
<th>Calculus Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Diet</td>
<td>14.47</td>
<td>2.7</td>
</tr>
<tr>
<td>Control Diet with Chow</td>
<td>10.5</td>
<td>1.26</td>
</tr>
<tr>
<td>Average Reduction (%)</td>
<td>28</td>
<td>54</td>
</tr>
<tr>
<td>Highest Reduction (%)</td>
<td>61.3</td>
<td>81.5</td>
</tr>
</tbody>
</table>

Table: Summary of the effect of PEDIGREE® DENTASTIX® on plaque and calculus accumulation relative to a control diet.

Source: University of New England.

So how do Pedigree® DentaStix® chews work?

→ 1. Mechanical action

With its unique X-shape profile, the texture of Pedigree® DentaStix® is designed not only to create the shear forces on the dog’s teeth, which helps to remove plaque, but also to keep the dog chewing for a significant length of time. An added benefit of this sustained chewing is that it stimulates saliva flow, this flow helps to wash away any debris removed from the teeth.

→ 2. Active ingredients

Included within Pedigree® DentaStix® are two active ingredients (sodium tripolyphosphate and zinc sulphate) which have the effect of chelating salivary calcium (Figure 2) as well as slowing down the build-up of calculus by inhibiting further crystal growth by binding to the surfaces of solid calcium phosphates (Figure 3). By this means, plaque is kept softer for longer and so more of it can be removed by the action of the dog chewing Pedigree® DentaStix®.