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Welcome to the 21st European Congress of Veterinary Dentistry

Lisbon, Portugal, 2012

- 72 presentations
- 26 scientific sessions
- Speakers from Europe, Africa, North America, Canada and Brazil
- More than 250 participants from around the world
- 17 exhibitors
EVDS Executive board

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Teresa Martins
Dear Colleagues,

The European Veterinary Dental Society (EVDS), the European Veterinary Dental College (EVDC) and the Portuguese Veterinary Dental Society (SPMEDVE) are honoured to organise the 21st European Congress of Veterinary Dentistry. This event is taking place in the beautiful city of Lisbon which offers great historical, cultural and social opportunities to all visitors.

For the first time there will be four parallel streams in order to offer all participants a wide variety of lectures from more basic to advanced subjects.

The European Congress of Veterinary Dentistry is growing every year and becoming an important event not only for veterinary specialists but also for all veterinary surgeons which are interested in veterinary dentistry and want to increase their skills and knowledge in veterinary dentistry.

And last but not least, the European Congress of Veterinary Dentistry is always a good opportunity to meet old friends, make new ones and exchange ideas with colleagues from other countries. The excellent social program will give ample opportunity for this, and help to round off what will undoubtedly be an enjoyable and worthwhile learning experience.

Welcome to Portugal!

Jan Schreyer  
President of the EVDS

Philippe Roux  
President of the EVDC

Lisa Mestrinho  
Chair of the LOC ECVD 2012
EUROPEAN VETERINARY DENTAL SOCIETY
UK registered Charity (registration number 1128783)

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Ahornstraße 42
09112 Chemnitz – Germany
Phone: +49 (0) 371/304973
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President Elect:
Gottfried Morgenegg
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Phone: +41 (0) 44 761 4152 Fax: +41 (0) 44 761 9209
E-mail: presidentelect@evds.org

Secretary:
Ines Ott
Brueder-Grimm-Str. 3
63450 Hanau, Germany
Phone: +49 (0) 6181 22492
Fax: +49 (0) 6181 257176
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Treasurer (and Past president):
Pete Haseler
21 Station Road
Studley, Warwickshire, B80 7HR, UK
Phone: +44 1527 853 304
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Jerzy Gawor
ul.Chlopska 2a
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EVDS website: http://www.evds.info
Webmaster: David Crossley
The Local Organising Committee of the 21st European Congress of Veterinary Dentistry, the Board of the European Veterinary Dental Society, the Board of the European Veterinary Dental College, and all the participants, would like to thank the ECVD sponsors for their financial support, their help and assistance that helped us to make this meeting a success.
>> Local sponsors

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>> Name Badges

Name badges will be required for participation in all sessions and the exhibit hall. You will find your badge included in your conference material received at the meeting registration desk.

>> Lunch and Breaks

Lunches and breaks will be in exhibit hall.

>> Speaker Guidelines

Oral presentations in review category are allocated 50 minutes in total. Speakers are encouraged to talk for 45 minutes, leaving the final few minutes for questions.

Oral presentations in research study and clinical study categories are allocated 25 minutes in total. Speakers are encouraged to talk for 20 minutes, leaving the final few minutes for questions.

Oral presentations in short case reports category are allocated 15 minutes in total. Speakers are encouraged to talk for 10 minutes, leaving the final few minutes for questions.

Plenary speakers are allocated 75 minutes in total.

>> Audio Visual Information

Computer Data Projection is the preferred presentation format. The use of PowerPoint-type presentations is strongly encouraged and the following equipment will be provided in all the meeting rooms:

- Data Projector
- A computer to which your presentation will be uploaded (you will not be able to use your own computer)
- Screen
- Lectern and microphone

If you have any questions, please contact the Congress Secretariat directly on the Tivoli Congress Palace (first floor).
>> Quick Look
Program <<
### Friday, 25th May, 2012

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<td>17.00-20.00</td>
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>> Detailed Program <<
### Friday, 25th May, 2012

#### S1. Keynote Lecture
**Chair:** Carlos Viegas (Portugal)

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<td>New advances on the engineering of different tissues</td>
<td>Rui L. Reis (Portugal)</td>
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#### S2. Restorative Dentistry
**Chair:** Simone Kirby

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#### S3. Rabbits and Rodents
**Chair:** Cedric Tutt (South Africa)

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<td>Explorative investigation of Cone Beam Computed Tomography for maxillofacial imaging of rabbits, rodents and small carnivores</td>
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<td>Measurement of the Clinical Crown Length of the Incisors and the Premolar Teeth in 40 Clinically Healthy Rabbits</td>
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#### S4. Feline Dentistry
**Chair:** Lisa Mestrinho (Portugal)

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<td>Henriette Booij-Vrieling (the Netherlands)</td>
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### S5. Miscellaneous
Chair: Philippe Hennet (France)

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### S6. Endodontics
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### S7. Basic Dentistry
Chair: João Brandão Rodrigues (Portugal)

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### S8. Oncology
Chair: Jens Ruhnau (Denmark)

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### S9. Endodontics
Chair: Patricia Gayan (Portugal)

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S10. **Basic Dentistry**
   Chair: João Brandão Rodrigues (Portugal)

15.35-16.25 O.22 The importance of radiology in dentistry
   Cecilia Gorrel (UK)  p.106
16.25-16.50 O.23 Treatment of tooth fractures
   Barbara Möhnle (Germany)  p.108

Room Norte Júnior

Saturday, 26th May, 2012

S11. **Oral Surgery**
   Chair: Cecilia Gorrel (UK)

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   Alexander Reiter (USA)  p.110
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   Loic Frederic Legendre (Canada)  p.115
10.15-10.40 O.26 Multifocal Palatal fistula repair by autografting buccal mucosa
   Cedric Tutt (South Africa)  p.117

Room Sintra

S12. **Periodontology**
   Chair: Philippe Roux (Switzerland)

09.00-09.25 O.27 Validation of a new method based on an image-analysis system for the
   measurement of dental plaque accumulation in dogs
   Claire Mariani (France)  p.118
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   treatment.
   Thomas Fichtel (Czech Republic)  p.121
09.50-10.40 O.29 Guided tissue regeneration (GTR) utilizing a laminar bone membrane in
   the canine patient
   Kevin S. Stepaniuk (USA)  p.122

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Saturday, 26th May, 2012 (cont.)

**S13. Basic Dentistry**  
Chair: Teresa Teigão (Portugal)

- **09.00-09.50 O.30** Periodontal disease: Pathogenesis, progression, severe local and systemic sequela  
  Brook A. Niemiec (USA)  
  p.126

- **09.50-10.40 O.31** Periodontal surgical techniques for the small animal practitioner  
  Brook A. Niemiec (USA)  
  p.131

**Room Castello Lopes**

**S14. Equine Dentistry**  
Chair: Paddy Dixon (UK)

- **09.00-09.25 O.32** Standing physical and chemical restraint in equine dentistry and oral surgery  
  Alessandro De Simoi (Italy)  
  p.134

- **09.25-10.15 O.33** Radiographic imaging of the equine head  
  Peter Stelzer (Germany)  
  p.135

- **10.15-10.40 O.34** Periodontal disease in equids  
  João Brandão Rodrigues (Portugal)  
  p.136

**Room Avenida**

**S15. Interactive Session**  
Chair: Margherita Gracis (Italy)

- **11.10-12.25 I.1** EVDC Interactive Session on Controversial Issues  
  Alexander Reiter (USA)  
  p.229

**Room Sintra**

**S16. Miscellaneous**  
Chair: Peter Southerden (UK)

- **11.10-11.35 O.35** Preliminary prospective oral pathology prevalence data in dogs presented to the University of Minnesota Veterinary Medical Center  
  Kevin S. Stepaniuk (USA)  
  p.140

- **11.35-12.00 O.36** Oral Pathology Overlooked by Veterinary Students, Interns, and Non-Dentistry Residents, When Compared to Veterinary Dentists After Receiving Veterinary Dental Education  
  James Anthony (Canada)  
  p.141

- **12.00-12.25 O.37** Introduction to four-handed dentistry  
  Camilla Heinze (Denmark)  
  p.142

**Room Norte Júnior**
Saturday, 26th May, 2012 (cont.)

**S17. Basic Dentistry**  
Chair: Teresa Teigão (Portugal)  
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Cecilia Gorrel (UK)  
p.143

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p.145

**S18. Equine Dentistry**  
Chair: Cedric Tutt (South Africa)  
Room Avenida

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Sam Luis Hole (UK)  
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11.35-12.00  O.41 Hypercementosis in geriatric horses  
Jens Arnbjerg (Denmark)  
p.149

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Sam Luis Hole (UK)  
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12.25-12.35  Equine Veterinary Dentistry - thinking out of the box  
Cedric Tutt (South Africa)

**S19. Oncology**  
Chair: Loïc Legendre (Canada)  
Room Sintra

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Leen Verhaert (Belgium)  
p.151

13.50-14.15  O.44 Histologic subtypes of oral nontonsillar squamous cell carcinoma in dogs  
Ana Nemec (Slovenia)  
p.152

Lisa Mestrinho (Portugal)  
p.153

14.40-15.05  O.46 The occurrence and types of tooth resorption in dogs with oral tumors  
Ana Nemec (Slovenia)  
p.156

**S20. Nasal disease related to dental problems**  
Chair: Lisa Milella (UK)  
Room Norte Júnior

13.25-14.15  O.47 Coincidental pathology of nasal cavity and oral structures  
Jerzy Gawor (Poland)  
p.157

14.15-15.05  O.48 Canine lymphoplasmacytic rhinitis associated with dental disease? Kevin S. Stepaniuk (USA)  
p.159
### Management

Chair: João Requicha (Portugal)

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17.00-20.00  ·  Test your knowledge (A simulated theory and case oriented multiple
choice examination)
Presented by Loic Legendre (Canada)
New advances on the engineering of different tissues

Rui L. Reis

1 Director of the 3B’s Research Group – Biomaterials, Biodegradables and Biomimetics, University of Minho, Headquarters of the European Institute of Excellence on Tissue Engineering and Regenerative Medicine, Taipas – Guimarães, Portugal; www.3bs.uminho.pt; Director of the ICVS/3B’S – PT Government Associate Laboratory, Braga/Guimarães, Portugal

Tissue Engineering is a new multidisciplinary area of science that is gaining importance in human health. It is believed that many of the developed strategies will also be used on some areas of veterinary medicine. This keynote lecture will discuss some of the ongoing research and some open clinical opportunities.

The selection of a scaffold material is both a critical and difficult choice that will determine the success of failure of any tissue engineering (TE) strategy. In our research we believe that natural origin polymers are the best choice for many approaches. In addition, we have been developing an all range of processing methodologies to produce adequate scaffolds for different TE applications. Furthermore an adequate cell source should be selected. In many cases efficient cell isolation, expansion and differentiation methodologies should be developed and optimized. In our research we have been using different human cell sources namely: mesenchymal stem cells from bone marrow, mesenchymal stem cells from human adipose tissue, human cells from amniotic fluids and membranes and cells obtained from human umbilical cords. The potential of each type of cells, to be used to develop novel regeneration therapies will be discussed. Their uses and their interactions with different natural origin degradable scaffolds and distinct nano and micro-carriers, and smart release systems, will be described. A great focus will be given to the different sources of stem cells, the isolation of distinct sub-populations, ways of differentiating them, as well as their interactions with different 3D architectures and materials for culturing them. During the all lecture we will try to distinguish what is a fact, a trend and a real clinical open possibility. The use of bioreactors to control cell differentiation, as well as the surface modification of the materials in order to control cell adhesion and proliferation will also be illustrated. The results will be mainly based on our research in the areas of bone, cartilage and osteochondral tissue engineering. Several biomimetic and nanotechnology based strategies to engineer mineralized tissues will be described. We will also pay attention to the role of interfaces and controlled surface characteristics on the performance of different constructs.
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Dental filling materials

Barbara E. Möhnle

There exist various filling materials. From amalgam to composite to ormocere as material for dental restoration.

1. Amalgam

Amalgam is a very durable filling material. During the last years it was discredited. In some countries it is forbidden for health reasons.

Amalgam is an alloy of equal parts silver-tin-copper with liquid quicksilver. Mixing creates a plastic mass. Reaction of quicksilver with particles makes the mass firm within one hour. As particles are very fine the process becomes faster.

During hardening amalgam gains mass. This prevents disruption of marginal adaption (a gap at the edges). A disadvantage is the 50% amount of quicksilver of the finished filling.

2. Silicacement

Silicancements were the first tooth-coloured fillings. Because of their lack of mechanical endurance they could only be used for front teeth. Shrinkage is up to 3.5% of total volume, in addition this material can be washed out. This leads to a gradually loss of filling material at the edge gap (Randspalt) and at the surface. The material is made from aluminiumoxide-fluoride, phosphate, natrium und calcium. Appropriate colouroxides are added, which are burnt to aluminiumsilicaglass. Due to mechanical characters in human medicine silicancements are more and more replaced by glassionomerecements and composites.

3. Glassionomerecements

Glassionomerecements are composed of a watery solution of organic acids and fluorig-containing aluminiumsilicaglasses. Appropriate colouroxides are added. Aluminiumsilicaglass is mixed with phosphoric acid which was reduced by calcium and aluminiumphosphate. Blending of the two components causes a complicated chemical process. At its end the substance is cured.

Per this components also calcium, fluor andapatitfraction of the tooth are integrated. This causes the good attachment to dentin respectively enamel. Shrinkage of up to 4% may occur. Disruptions of marginal adaption (Gaps at the edges) are in some parts unavoidable. Can also cause fissures of the material.

A further disadvantage is the high rate of abrasion. It is not adequate in regions of high force.

Meanwhile glassionomerecements are used in human medicine only as intermediate filling or provisional filling. In pediatrics they are used as substitute for amalgam.

4. Resin composites

Composites are compound materials, based on an organic synthetic matrix and an inorganic filling material. In the beginning filling material were glass particles. These could break out and meanwhile are not used any longer. As alternative stuffs like silica and sili-
caoxide come to use. Depending on size of filling materials, composites are divided in macro-filled resin composites, (particles over 5µm) and microfilled resin composites (particles 0,005-0,05 µm). Macrofilled composites have a hard and rough surface due to the large size of particles. Microfilled composites are more densely packed and have a surface which can easily be polished. Mechanic characteristics (high abrasion, low hardness, greater shrinkage) are clearly worse. Macrofilled and microfilled composites were compound to hybrid resin composites.

These consist approx. with 85 – 90% of macrofilling and with 10-15% of microfilling composites. Hybrid composites (medial particle size 10 µm) are subdivided in composites of fine particle size (Feinpartikelkomposite) (medial particle size < 5 µm), composites of finest particle sizes (Feinstpartikelhybridkomposite) (medial particle size <3 µm) and submicrometer-hybridcomposites (medial particle size <- 1 µm). Resin hybrid composites show a high mechanical endurance which is declared by their composition.

All composites have a tendency to polymerization shrinkage of 1 – 6 %. For prevention of disruption of marginal adaption small cavities and a certain filling technique should be used. Alternating, as small as possible layers, are inserted into the cavity. One single large block shrinks more than many small blocks. In addition a smaller layer can more easily be hardened than a large one, as UV-light can only intrude 2 mm into the composite. In contrast to glassionomerecements composites associate not directly with the tooth, so that a specific attachment between both has to be created. Method is dentine etching technique. Here the surface of the tooth and dentin are etched by phosphoric acid. Into the roughened areas a very thin monomer (adhesive) is applied. The film polymerizes and conjugates with the applied composite. Composites are used in dental medicine at the front teeth but also at the lateral tooth area. Special form of resin composites are composite bondings and composite inlays. Composite bondings are used as alternative to fastening cements. Their advantage: they attach to prepared teeth, to suitable metal and to ceramic surfaces, and they can polymerize with UV-light and autopolymerize. Composite inlays may be directly prepared in the cavity and furthermore be bonded there.

5. Ormocere (organic modified ceramics)

Another development of composites based on monomers with siloxanes and acrylic. By this mixture very variable materials can be created. Ormocere-based fillers are light hardening and in all mechanical features superior to resin composites.

6. Compomere

Mixture of composite and ionomer. They are light hardening and combine abilities of composites (high durability and insensivity, direct adhesion to the hard tooth tissue) with continuous discharge of fluoride of glassionomerecements. Mechanic characteristics are better than those of glassionomerecements, but do not reach those of composites.

7. Dental enamel-dentin adhesives

Actually belong to the filling materials. No useful compound can be generated without these substances between dentin enamel and filling. This applies especially for composites, and a little less for compomeres and least for glassionomerecements. Not only the compound is supported, but also dentin and dental enamel prepared for a good attachment.

There exist different systems:

Separate conditioning of enamel
- Combined conditioning of enamel and dentin
  - Conditioning by phosphoric acid (etch-and-rinse system)
  - Primer adhesive (one-bottle-bond)
  - Primer-adhesive with interlayer application
  - Primer-adhesive with monolayer application
Conditioning with acid monomeres (self conditioning systems)

- Separate application of primer and adhesive
  - Primer for mixing
  - Primer, ready for use
- All-in-one – adhesive
  - For mixing
  - Ready for use

There exist so many bonding systems, that it seems useful to select the system according to the recommendation of the manufacturer of the fillers.

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Literature review of beneficial effects of using MTA

Lisa Milella

Managing pulpal and periradicular disease frequently requires the use of a material that will interface with vital tissues. Unfortunately materials used until recently have always run the risk of causing some irritation to the tissues and propagating chronic inflammation. Ideally a material that was not only biologically acceptable but induced healing and caused regeneration of normal tissue architecture was needed.

Mineral Trioxide Aggregate (MTA) was developed in the early 1990’s and proven to meet many of these requirements. MTA is an endodontic cement composed of several mineral oxides (SiO, K2O, Al2O3, Na2O, Fe2O3, SO3, CaO, Bi2O3, MgO, K2SO4, Na2SO4 and silica to be precise). It has been found to have excellent biocompatibility when it comes in contact with the pulp and periradicular tissues and may not only create an environment conducive to healing, but one that may induce healing. The soluble products released from MTA have been shown to release signalling molecules that are archived within the mineralised dentine matrix and it is hypothesised that these molecules initiate such a favourable healing response. Clinically it should be used when interfacing with vital tissues, be it with the pulp or periradicular tissues. Potential uses include cases of perforation (lateral wall or furcation perforations), for cases of internal resorption, surgical endodontics, vital pulp therapy or apexification.

The hydrophilic powder sets in the presence of moisture over several hours, unlike other cements where a completely dry field is required. After mixing, the pH value is around 10, increasing to 12 within 3 hours. This high alkalinity prevents bacterial growth, but is reported to be biocompatible and non-cytotoxic. Perhaps the best use in veterinary dentistry would be for partial pulpectomy procedures that so far report a relatively high failure rate after 3 years following the standard CaOH dressing. Longitudinal studies in human dentistry show no pulp inflammation following placement of MTA and less chance of pulp necrosis.
RESTORATIVE II LAB—CROWN RESTORATION

The purpose of restoring tooth structure (vital or nonvital pulp) with prosthetic material is to return normal function to the dentition, to prevent further breakdown of remaining tooth structure, and to create a proper aesthetic appearance. The occlusal protection afforded by an overlying cast restoration merits consideration for many endodontically treated teeth. In general, the endodontically treated tooth has been structurally weakened by crown fractures, endodontic access preparation, and canal instrumentation. The endodontically treated tooth has also become more brittle because of changes in microstructure of nonvital dentin. Mineralization and dehydration of the dentinal tubules result in an increasing loss of dentin resiliency. Forces of occlusion and lever forces cause a deformation by flexing. The stress generated may become excessive and lead to fractures of unprotected cusps or coronal fracture in the area of smallest circumference—the cervical area. Creation of the access opening and canal instrumentation further weakens the tooth, and the risk for cuspal or vertical fracture extending down into the roots is magnified. Overlaying the occlusal surface with a casting distributes occlusal forces more favorably to the tooth and improves the long-term prognosis for a functional tooth considerably.

Treatment Planning

Treatment planning requires a systematic plan to assess the structures and associated problems that may challenge treatment success. A close study of existing conditions that have led to the problem is required. It should be determined whether modification in behavior, environment, or a combination of both is required.

In addition, the patient’s occlusion and periodontal health must be taken into consideration. The tooth structure must be evaluated for the ability to sustain a load, its relative qualities, and its aesthetic requirements. A well planned restorative should act not only as a mechanical repair but also as a treatment of local disease and a prophylaxis against local and systemic disease. The treatment plan decision depends on periodontal health, eating habits, the opposing occlusion, aesthetic, prosthetic, and endodontic considerations.

Periodontal Considerations

A critical concern when restoring an endodontically treated tooth is the periodontal attachment apparatus. The ultimate prognosis for a given tooth is dependent on the periodontal status. Periodontal disease should be treated before placement of definitive
restorations. A healthy periodontium provides the best prognosis for the tooth and makes procedures such as marginalization and impression easier and more accurate.

Treatment of teeth that exhibit extensive coronal destruction may require a multidisciplinary approach. With substantial loss of tooth structure, crown lengthening is required to provide adequate isolation for endodontic therapy, reestablish the biologic width, and provide coronal tooth structure to incorporate a ferrule.

The biologic width relates to the amount of tooth structure coronal to the osseous crest to the gingival attachment apparatus. This distance has been established as approximately 1mm for the junctional epithelium and 1mm for the connective tissue attachment.

Endodontic and Prosthetic Considerations During the examination process, attention should be paid to the quality of the endodontic therapy. Before restorative procedures, it is essential that the endodontic treatment be successful. Predictable success in endodontic therapy requires a dense, uniform, three-dimensional obturation of the root canal system to 1.0mm from the radiographic apex of the root or roots.

Designing a restoration for a tooth that has been previously treated endodontically is dependent primarily on the amount of remaining tooth structure. Hock demonstrated that the strength of an endodontically treated tooth is directly related to the bulk of remaining dentin. Based on results of studies, it is evident that care should be taken to preserve as much sound dentin during endodontic therapy and subsequent restorative procedure as possible.

Margin

Margin preparation is defined as the interface between the tooth and the crown. Rules of thumb regarding the margin include:

- It should be easily identifiable on the preparation, working die, and in the casting.
- It should provide adequate bulk to allow for finishing and polishing of the casting.
- It should be placed to allow optimal evaluation of margin integrity.
- It should adapt to the finish line of preparation with minimal opening after the restoration has been luted into place.
- It should have adequate strength to resist deformation during the fabrication process and when placed under occlusal loading.
- It should minimize the number of restorative materials introduced at the cavosurface line angle of the preparation to optimize the periodontal health.
- The relationship of the margin to the gingiva is of major importance. The supragingival margin offers the best approach to prevent adverse effects on the periodontal tissues during the life of the restoration. Crown restorations should be seated 1mm to 2mm above the gingival margin.
- The ferrule has been defined as a circumferential bond of cast metal at the margin of a crown that is placed on solid tooth structure. The encirclement of the tooth provided by the ferrule does act to prevent splitting of the tooth when wedging forces are encountered. As a general rule, a minimum of 3mm of sound tooth structure coronal to the osseous crest is necessary to accommodate the connective tissue attachment, the junctional epithelium, and the margin of the crown.

CONFIGURATIONS

Margin Configuration

Margin configurations can be divided geometrically into three main groupings: (1) bevel, (2) chamfer, and (3) 90 degree forms. The objective of any margin preparation is to provide adequate room for restorative materials at the cavosurface line angle while maintaining the strength of the enamel at the cavosurface line angle. Where two walls meet, a line angle is
formed. At the point where three walls meet, a point angle is produced. The cavosurface angle is the line angle formed between a wall of prepared surface and the unprepared tooth surface. The cavosurface angle is also sometimes termed the preparation margin, especially once the preparation is restored. With regard to restoratives, the restorative margin is the restorative surface that abuts the cavosurface angle or preparation margin. The margin configuration selected should provide adequate bulk at the cavosurface line angle to prevent breakage of the enamel during the fabrication and delivery procedure, creating an open margin. Careful planning and evaluation of the cavosurface line angle formed prevents the development of unsupported enamel rods with the potential for fracture. At the same time, the margin configuration must provide an acceptable closure angle.

Bevel Configuration

A bevel configuration is a shoulder margin that is beveled along the marginal angle. Bevel preparation for all metal restorations begins with developing a 1.0mm horizontal width. A cavosurface line angle of 90 degrees is formed, followed by preparation of the bevel occupying no more than one third of the shoulder width. Several cutting instruments are available with a 45 degree end geometry that simplifies the preparations of this configuration. The primary consideration with all margin finishing is to select an instrument that provides as smooth a cavosurface line angle as possible. The concept of matching diamonds and carbide finishing burs in size and shape is well documented. Because any angle other than a right angle qualifies as a bevel this category contains the most variations. Bevels of 70 degrees or more have been referred to in the literature as a feather edge. The inherent problem with the feather edge design is that it is difficult to identify the cavosurface line angle in the impression or on the working die. This often results in overcontouring of the restoration at the margin. Using a shoulder with the bevel exhibited less distortion. A full cast-metal crown can be designed with bevel configuration because the metal can be very thin at the margin.

Chamfer Configuration

The primary feature of the chamfer configuration is a rounded axiogingival line angle. Rounded line angles have been shown to provide the lowest stress concentrations, which are thought to be most favorable to minimize breakdown of the luting agent. A chamfer margin is often the margin of choice for all ceramic crowns and cast-metal crowns. When prepared correctly, the chamfer approaches the cavosurface line angle with some of the same characteristics of a bevel. A round-ended or torpedo-shaped cutting instrument should be selected that provides 0.5mm of reduction while not using more than the radius at the tip to develop the contours of the chamfer. Caution must be exercised to prevent preparing a trough or lip at the cavosurface line angle. As the tip of the diamond progresses into the tooth structure to the point of exceeding its radius, any increase in the length of the axial wall produces a trough or lip. This creates unsupported enamel that can be fractured easily during the casting try-in and cementation process. Careful examination with an explorer from the axiogingival to cavosurface line angles identifies troughing. When a lip has been created, a carbide bur with a tapered end of 45 degrees can be used to remove the unsupported enamel without altering the chamfer's characteristic rounded axiogingival line angle while maintaining a 45 degree closure angle. Care must be taken not to eliminate the rounded internal line angle that is the primary characteristic of the chamfer, or this procedure will alter the margin configuration, making it into a bevel.

Right-Angle (90 degree) Shoulder Configuration The shoulder design has been advocated because it provides additional reduction at the axiogingival line angle, allowing for more metal to buttress the margin against distortion. The shoulder margin is preferred when selecting a margin configuration that is placed under considerable functional load. Porcelain-fused to metal crowns are best suited for a right-angle shoulder configuration.
Each tooth to be prepared must be evaluated carefully to determine which of the configurations will best meet the triad of biologic, aesthetic, and mechanical factors. Whenever aesthetics is not of primary concern, a metal margin should be used. Chamfer finish line is recommended for preparations not involving porcelain fused to metal restorations. All margins should be on natural tooth structure apical to the tooth core junction. An encircling band of cast metal or ferrule should extend 2mm below the tooth-core junction to protect the tooth from fracture. If a ferrule effect is not created with a well-fitting crown margin on sound tooth structure, the restoration will likely fail.

FINAL RESTORATION

Retention

The axial wall taper should be as close to providing parallelism as possible. Axial wall convergence should be approximately 6 degrees. Reductions should be kept within the enamel if possible because enamel provides the bonding surface with the greatest adhesion properties. Maximizing tooth coverage allows a greater bonding surface. If insufficient tooth structure above the gingival margin is not available, several techniques can be used to lengthen the tooth structure.

Crown lengthening is an alternative method that can be used if fractures extend below the alveolar crest. It facilitates identification of the fracture extent and makes restoration of missing tooth structures more accurate. The canine teeth especially lend themselves to this technique. Crown lengthening can also be done if insufficient tooth structure exists above the gingival margin.

Impressions

The ideal impression material for crown and bridge restorations is polyvinylsiloxane (also called addition reaction silicone). The reasons is that it is more accurate and that it has a medium to long working time, high tear strength, excellent reproduction of detail, very high resistance to deformation and excellent dimensional accuracy, and pouring the impression may be delayed up to 14 days without loss of accuracy. Polyvinylsiloxane is a putty from which to fabricate a custom tray chairside.

Alginate, also known as an irreversible hydrocolloid, is inexpensive, easy to pour, easy to remove and ideal for less accurate stone models. Alginate displaces blood and tissue fluid, is hydrophilic, and pours well with stone. Full-mouth alginate impressions are necessary for accurate casting of crown restorations.

Impression-Taking Technique for Polyvinylsiloxane Material. The two-step overimpression changes a stack tray into a custom tray in the putty-wash technique, which reduces the large dimensional change that occurs when injection materials are used in a full-arch tray.

Take Overimpression. The putty overimpression should be taken with a perforated rigid plastic tray. The use of an adhesive is optional. The putty is mixed and placed only enough in the tray to cover the teeth. Excessive putty puts pressure on the tray’s side walls and increases the chance of distortion. Note that addition-reaction silicone putties should not be mixed with latex gloves nor should glove powder touch them.

The tray should be wiggled in the mouth before the putty has set to create an enlarged overimpression. After the putty has set, the tray is removed from the mouth. All saliva and water are removed from the mouth. After a dry field is achieved, an assistant injects a small amount of wash around the tooth that is being prepared for a crown restoration, as well as a thin coat (1-2mm thick) over all of the teeth to be included in the overimpression. An air syringe can be used to gently blow the impression into the sulcus.

Using Automixers. Before placing the mixing tip on automixing devices, extrude some material from the cartridge to ensure that both sides flow freely and to remove any material that might have set.
Seat the Impression. By applying very light pressure, the filled impression tray is allowed to slowly settle into place, posterior first to keep the excess from extruding down the throat. The lips are slightly pulled so the excess material can gently flow out from underneath the tray passively, with no compression from placement until completely set. If and elastomeric impression is removed before it completely set, it becomes distorted.

Remove the Impression. In a rapid movement down the long axis of the teeth, in one motion, the impression is removed from the mouth.

Inspect the Impression. The margin of the prepared tooth must be entire, and the crown preparation distinct and without defects. If any putty shows through in the preparation area, the impression should be taken again. Exposed set putty creates a pressure spot that rebounds when the impression is removed and results in a too-small casting.

Impression-Taking Technique for Alginate. Clean the Teeth. Teeth that will determine the impression should be clean and free of debris. Excessive saliva and dental calculus should be removed if present. A final rinse and dry should be done immediately before impression is taken.

Select the Tray. The correct size tray should be used to get an exact impression. The tray should fit the animal’s mouth properly, allowing room for all the teeth, without making contact with the impression tray.

Prepare the Material. The amount of alginate needed for the size of the tray is measured. One measure of tepid water is placed into the bowl for each scoop of alginate powder. Note that cold water slows down the set of the alginate and, therefore, increases the working time; and warm water speeds up the set and decreases the working time. All of the water should be added to the alginate at one time.

The water is poured into the premeasured powder and is stirred slowly with the spatula. Once the powder is wet, it is vigorously stirred against the sides of the bowl until no lumps of powder are left in the mixture. This process should be completed in less than 1 minute.

The impression tray is loaded with the alginate, being careful not to create air bubbles or voids; the surface is smoothed, making the alginate level with the sides of the tray.

Insert the Tray. An assistant should hold the jaw level, open the mouth, and retract the animal’s lips. The tray can then slide easily into the patient’s mouth. The tray is seated in the distal portion of the mouth and then in the anterior portion. The tray is held steady until the alginate has set. The alginate sets in approximately 3 to 7 minutes, depending on the type of alginate used. Touching the alginate around the top of the impression tray periodically can help determine when the alginate has set.

Remove the tray. To remove the tray, the front of the tray is gripped, and it is firmly snapped off the teeth while discrepancies are checked for. Once the desired impression is obtained, the stone can be poured immediately. If the stone is not poured immediately, the impression should be wrapped in a dampened paper towel and refrigerated. The alginate is sensitive to air, heat and loss of moisture, so the stone should be poured within 30 minutes.

Let Set. The stone model should be left to set for 2 hours. The alginate is loosened around the edges of the tray, with the stone model and alginate eventually lifted from the tray.

The full-mouth alginate impressions should be poured with a good-quality dental stone or should be kept cool and moist until they are picked up by the lab.

The final impression is a bite registration. This can be done with a sheet of bite-registration wax or with elastic impression material. The mouth, with no obstruction, is closed firmly on the wax or elastic impression material to register how it occludes for future reference.

It is advisable to discuss the patient’s impression materials and choice of crown restoration with the lab.

Crown Restorations System

The ideal restoration does not exist, but if it were theoretically fabricated, it would possess some of the following qualities: conservation of tooth structure, strength,
biocompatibility, aesthetics, low cost, ease and speed of manufacture, and coefficient of thermal expansion similar to enamel.

Types of restorative crown systems include:

- Gold
- White gold
- Gold alloys
- Nickel and chromium-based metal alloys
- Porcelain fused to metal
- Cast Glass Ceramic Dicer (Dentsply International, York, PA) Inceram (Vident, Baldwin Park, CA) Polymer Glass Artglass, (Heraeus Kulzer, Irwin, CA)

The choice of the restorative systems may be based on the practitioner’s skill level. It is difficult to master all the various systems. In veterinary dentistry, prosthetics is evolving continuously. Veterinarians can adopt some of the crown systems from human dentistry to animal dentistry.

Crown Placement

The restoration should be seated and verified for fit, contour, and occlusion. There should be no rocking or movement. Occlusion should be verified to ensure a lack of supraocclusion. When the casting has seated and is acceptable, the next step is a closer evaluation of the margin. Margins are checked tactiley with a sharp explorer, moving it from the casting to the tooth and the tooth to the casting.

Cementation

The tooth surface should be cleaned with a flour of pumice and water to remove debris and plaque that has accumulated since the preparation. The laboratory’s recommendations should be followed as to the types of cement that work best with the types of materials used in the restoration. With animals, it is recommended to use the stronger glass ionomer cements or the newer resin cements, such as Panavia 21 (J. Morita USA, Tustin, CA), C & B Metabond (Parkell, Farmingdale, NY), Infinity (Denmat, Santa Maria, CA), Allbond 2 and Allbond C and B resin (Bisco, Itasca, IL), and Enforce (Dentsply Caulk, Milford, DE).

Summary

Not one post, core, margin, impression material, cement, or final restoration can be used in all clinical situations. This article does not discuss the merits and shortcomings of the numerous restorative concepts and techniques that exist, but rather has concentrated on those that the author believes are valid and applicable today. If one third or more of the anatomic crown remains, or if this is achieved by crown lengthening; however, a crown restoration should definitely be considered.

Veterinary dentistry cannot limit those variables that occur daily in clinical practice. Veterinarians must learn to work with these variables and spend less time trying to find the one that applies to all cases. When the basic concepts of how to retain the various restorative components and how to protect remaining tooth structure are understood, the ability to answer numerous questions that arise during the restorative process is facilitated and results in final restorations that are based on sound design principles.
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One place, one thousand sensations
Explorative Investigation of Cone Beam Computed Tomography for maxillofacial imaging in rabbits, rodents and small carnivores

Bert Van Thielen¹, Olivier Jacqmot², Francis Siguenza³, Bassam Hassan⁴

¹ Centre for Interactive MRI education, 33 rue Philippe Lebon, 80000 Amiens France, cei.irmeurope@free.fr
² MSc, Faculté de la médecine Vétérinaire, Université de Liège, Belgique
³ Sitech, Society of Medical Imaging Technology, France
⁴ PhD, Academic Centre for Dentistry Amsterdam (ACTA), The Netherlands

Introduction

Dental diseases that occur in pet rabbits, rodents, and small carnivores like ferrets are directly related to the different types of dentition present in these species, so dental disease in such kind of animals breed specific [14]. Radiography is in such animals an essential part of a comprehensive oral examination to detect pathology, but the small sizes of rabbits and rodents ant the superposition of dental quadrants make radiographic interpretation difficult that Computed Tomography is even suggested here [14].

Cone Beam Computed Tomography (CBCT) is a new application specific scan technology developed in human medicine (e.g., maxillofacial imaging), which is used increasingly due to its capacity of a reduced radiation dose and its reduced costs and place needed for installation. It’s working completely different from a classical CT. Where a CT is working with a x-ray source which is turning around in a gantry with one or multiple rows of detectors, is a CBCT working with a detector [ CCD (Charged Coupled Device) – or FP (Flat Panel) ] and a x – ray source which are rotating in face of each other and which are making classical 2D – radiographs at different positions in the gantry [4, 12, 13]. All these 2D – radiographs are afterwards reconstructed to a digital volume by mean of a special developed reconstruction algorithme [3].

Cone Beam Computed Tomography (CBCT) has recently been evaluated for its use in veterinary dentistry [6 - 11]. Using a CBCT – device, operating with a FPD – detector, and working with a supine table and an open gantry, has a considerable potential of CBCT for its use in veterinary dentistry that is being suggested [6 - 11]. One of the big advantages in comparison with CT is the presence of application specific reconstruction software for the anatomical region that need to be scanned, which means for exemple that for maxillofacial radiological applications, panoramic and other parabolic curved reconstructions can be made.

The objective of this presentation is to evaluate the feasibility of using a CBCT for to study dental and maxillofacial anatomy of rabbits, rodents and small carnivores.

Material and Methods

CBCT – scan: The heads of 4 rabbits, 2 chincillas, 3 rats and 2 ferrets were amputated and frozen in the 24 hours after death and defrosted 24 hours prior scanning. A CBCT-dental-device for supine patient positioning (NewTom 5G™) was used in order to easily perform positioning of the isolated heads and to be able to perform scans of living animals in...
a later study. The isolated heads were positioned with the ventral side on the scantable. The
operator had the choice between a standard scan mode, a boosted scan mode and a High
Resolution scan mode. The operator had also the choice between a field of view (FOV) of 6 X
6, 8 X 8, 12 X 8, 15 X 12 and 18 X 16 cm. The scan parameters including kV, mA and scan
time, were automatically determined by the scan software for each patient with every
chosen FOV.

Data analysis: Panoramic, in plane logitudinal, Multi Planar Reformatted (MPR), Volume
Rendered (VR) and dental scan reconstructions were made using the scanner software. The
panoramic and in plane longitudinal images were reconstructed by drawing a curve
following the mandibular and maxillar arch for each skull 15 reformatted panoramic
reconstructions were made using a slice thickness of 1, 2 and 3 mm. Image quality was
assessed on the visibility of anatomical structures including teeth, alveolar bone and canals.

Results

Satisfactory image quality was obtained for the reconstructions of all the skulls’ scanned
in this study. Superior detail could be assessed on the images of the rabbits, chincillas and
ferrets. Using the reformatted panoramic reconstructions, an in detail evaluation of the
dental and maxillofacial anatomy was possible. In plane longitudinal reconstructions
Through the Temperomandibular Joints (TMJ’s) were showing in detail assessment of the
osseous structures. The MPR reconstructions were showing in detail assessment of the
sinuses, cochlear and osseous structures of the skull. The dental scan reconstructions were
showing in detail assessment of the bony structure and density in the mandibular and
maxillar bone. All reconstructions were of satisfactory quality, however some informatical
adaptations are still needed before this technology can easily been used in veterinary
dentistry.

Discussion

This study was performed to examine the feasibility of using CBCT technology for
maxillofacial imaging of rabbits, rodents and small carnivores. CBCT is a new imaging
technology, which is recently been evaluated for its use in veterinary dentistry. A first
device with a CCD – detector was evaluated for its use for imaging the skulls of dogs’ and
cats’ [6, 7, 10, 11]. However unsatisfactory to moderate image quality for the skulls of cats’
was obtained in that study [6, 7, 10, 11]. Afterwards, a second CBCT – device with a FPD –
detector was evaluated for its use for imaging the skulls of dogs’, cats’ and ferrets’ [8]. In
that study was even satisfactory detail assessed for the skulls of the ferrets’ [8]. Also the
geometric accuracy for measurements by CBCT – device on dog skulls’ was evaluated as
correct [9]. These different studies have yet suggested the considerable potential of
veterinary dentistry of dogs’ and cats’. Nevertheless are also rabbits, rodents and small
carnivores patients in the veterinary dental practice.

Dental diseases that occur in pet rabbits, rodents, and small carnivores like ferrets are
directly related to the different types of dentition present in these species, so dental disease
in such kind of animals breed specific [14]. Radiography is in such animals an essential part
of a comprehensive oral examination to detect pathology, but the small sizes of rabbits and
rodents ant the superposition of dental quadrants make radiographic interpretation difficult
that CT is even suggested here [14].

An exemple of advanced medical imaging in such cases is the report of Souza et al. [5],
where Micro Computed Tomography was used in the diagnosis of a tooth root abcess in a
Guinea Pig (Cavia porcellus), where molar and premolar overgrowth are typical dental
problems but where tooth root abscesses are not commonly. Even in chinchillas it is been
described that radiography is not sensitive enough to show the subtle pathology associated
with early tooth root elongation, where CT gives a much more accurate picture of the area of
interest [2].
Due to the type of dentition it is been advised to encourage the owners of chinchilla’s a annual or biannual oral examination as a preventative to dental disease [1]. Such oral examination exist of an outside and an inside part, where the outside part is easy to perform with the animal awake, can a complete intraoral examination be challenging in awake patient because of the small size of the chinchilla’s mouth opening, long tongue, and narrow oral cavity. When a anesthetized or sedated procedure is standard in a clinic, suggestion can be made to replace the radiographic exam by an exam on an adapted CBCT device for animal dental care. The advantage of CBCT in this regard could be that with a single scan, volumetric data are sampled which can then be used to reconstructed detail dental panoramic, thin-slice multi planar reformatted (MPR) and 3D volume rendered (VR) views of the skull to better visualise the area to treat.

Conclusion

This study shows the potential that an adapted CBCT could have for studying dental anatomy and pathology of rabbits, rodents and small carnivores.

Such kind of animals are more and more seen by the veterinary dentist, and to have a collection of volumetric data from which multiple reconstructions can be obtained, could be of considerable interest for the treatment of a lot of dental pathologies.

References

Measurement of the clinical crown length of the incisors and the premolar teeth in 40 clinically healthy rabbits

Manfred Schumacher

The clinical crown length of rabbit teeth has not been well documented. Lengths of 'several mm' for mandibular and 'a few mm' for the maxillary teeth being mentioned6, 9. The aim of this study was to determine the clinical crown length of incisors, cheek teeth and the periodontal probing depth (ppd) in young healthy rabbits without clinical signs of dental disease. Two groups of 20 male rabbits were measured, the first in 2007 and the second in 2008/2009. The measurements were taken under general anaesthesia with a periodontal probe. The average crown length of the lower P3 was 3.1 +/- 0.4mm, P4 showed a crown length from 2.6 +/- 0.4mm and the average crown length of the upper P2 was 1.5 +/- 0.4mm. The ppd for the cheek teeth in the upper and lower jaws was very similar (0.5-1.0mm). There was a minor difference in the average crown length of the lower and upper incisors of 0.3 mm (6.4 +/- 0.6mm and 6.1 +/- 0.9mm). The ppd for the incisors showed a clinically relevant difference between the upper and lower jaws. The ppd in the upper Incisor was 2.2 +/- 0.4mm and 5.1 +/- 0.8mm in the lower Incisor. The divergence in tooth length in the individual animals and between the two groups was minimal. Measuring the crown length of the rostral cheek teeth and the incisors is easy to do in the rabbit with a periodontal probe. It should be integrated into the clinical examination. The measurement can be used as a reference when trimming teeth.

References

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Microbial flora of facial abscesses in 30 rabbits—a preliminary study

Vladimir Jekl1, Andrea Minarikova2, Karel Hauptman3, Zdenek Knotek4

1 DVM, Ph.D., Dip. ECZM (Small Mammal)
2 DVM
3 DVM, Ph.D.
4 Univ. Prof., DVM, Ph.D., Dip. ECZM (Herpetology)

Introduction

Dental disease is the most common disease of small herbivorous mammals with completely elodont dentition. In pet rabbits, the most known theories for the cause of this syndrome are lack of food with optimal abrasive properties, lack of chewing and metabolic bone disease due to calcium and vitamin D deficiency. However, when comparing rabbits to guinea pigs and chinchillas, they commonly suffer from odontogenic abscesses (Jekl et al. 2008).

Despite the high incidence of periapical abscesses in pet rabbits, published data on the bacteriology of these infections are lacking. There are only few original publications, mostly related to single case reports or set of 12 rabbits (Harcourt-Brown 2002, Tyrell et al. 2002).

The aim of this study was to describe micro flora of 30 rabbit odontogenic abscesses and recommend optimal therapy for this common condition.

Material and Methods

Thirty rabbits suffering from facial abscesses were included in this study. These animals had been submitted for clinical examination with a history of anorexia, changes in feeding habits, excessive salivation, progressive weight loss and swellings of the face or were referred by practitioners with a diagnosis of facial abscess. All animals were clinically examined and blood haematology, plasma biochemistry and skull radiography were performed in all cases. Computed tomography of the skull was evaluated in 15 rabbits.

After stabilization, all rabbits underwent surgery under general anaesthesia. Affected tissue, including teeth, bone and soft tissues were excised and submitted to microbiological cultivation. The surgical wound was marsupialised and let to heal by secondary intention. The specimens were immediately placed in AMIES transport medium and shipped to the microbiological laboratory. The specimens were inoculated in both aerobic and anaerobic agars. Aerobic and anaerobic organisms were identified with biochemical tests and other standard methods. Aerobic microbes were tested for sensitivity to enrofloxacine, marbofloxacine, T-sulpha, doxycycline, cephalosporin’s, penicillin, amoxycylin-clavulanate and gentamicine. Aerobic microbes were tested for susceptibility to penicillin, amoxycylin-clavulanate and metronidazole.

Results

All rabbits recover uneventfully from all surgeries and healing was appropriate also in all cases. Aerobic microbes were mostly sensitive to flurochinolones and beta-lactams and anaerobes to metronidazole, penicilins and amoxycylin-clavulonate acid. In five rabbits, six
multiresistant microbes (Escherichia coli -2x, Enterobacter cloacae -2x, Proteus vulgaris, Pseudomonas sp., Streptococcus beta-haemol. group G) were found.

Discussion and conclusion

A number of surgical techniques and options have been proposed to treat rabbits including surgical and conservative approach (Harcourt-Brown 2002, Capello 2008). Based on authors of this paper experience, lancing the skin and pus evaluation together with any antibiotic treatment is ineffective. Therefore, surgical approach with excision or extraction of affect soft and hard tissues is the only effective method for the odontogenic abscess treatment. Marsupialization of the surgical wound or use of antibiotic-impregnated PMM beads are the most commonly used techniques (Taylor et al. 2010).

In case of marsupialisation, use of antibiotics seems to be not so important due to growth suppression of anaerobes in the aerobic environment. However, when severe soft tissue inflammation is present, fluoroquinolones in combination with metronidazole or beta-lactam (parenteral administration) antibiotics are recommended. When using AIPMM beads, clindamycine, metronidazole or beta-lactam antibiotic are the first antibiotic choices. Oral administration of beta-lactam drugs, lincosamides, erytromycine, bacitracin, and vancomycin should be avoided, if possible, as they can lead to clostridial enterotoxaemia.

In present clinical study, six multiresistant aerobic bacteria were found. Most of these microbial species, particularly Enterobacter cloacae, are important nosocomial pathogens responsible for various infections, including sepsis, lower respiratory tract infections, skin and soft-tissue infections, urinary tract infections (UTIs), endocarditis, intra-abdominal infections, septic arthritis, osteomyelitis, and ophthalmic infections (Qureshi ZA, et al., 2011). Antibiotic resistance is a global issue that has been aggravated by the recent emergence of multi-resistant bacteria in hospitals, health care establishments, and homes. Appropriate and targeted use of antibiotic is necessary treating any animal. Antibiograms must be interpreted with respect to the different resistance mechanisms and suspected bacterial pathogenicity.

Acknowledgement

This paper was supported by grant project IGA No. 28/2011/FVL.

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Jekl V, et al., 2008, Quantitative and qualitative assessments of intraoral lesions in 180 small herbivorous mammals. Veterinary Record 162:442-449.
Thermal stress of teeth during dental treatment of pet rodents and lagomorphs—do teeth get too hot/overheated

Manfred Schumacher

Elevation of the temperature at the tooth surface during dental treatment of pet rodents and lagomorphs has not been well documented in Veterinary Medicine. The aim of this study was to determine the increase in temperature at the dental surface of rabbits and guinea pigs. Two groups of 6 guinea pigs and 14 pet rabbits were measured. The measurements were taken under general anesthesia during routine trimming of incisors and cheek teeth using a handheld LCD-Thermometer. The surface temperature in the incisors before trimming was 20.0 – 25.0°C and in the cheek teeth 30.0 – 34.5 °C. The increase in temperature at the surface of the incisors during trimming was 1.5 – 4.0 °C without cooling and 0.5 – 2.0 °C with cooling. The increase in temperature at the surface of the cheek teeth during trimming was 1.5 – 5.0 °C without cooling and 0.2 – 2.0 °C with cooling. The risk of damaging the pulp through heat was low using cooling and may be possible without using cooling in our study. Therefore cooling the instruments and the surface of the teeth is recommended.

References:

Periodontal pathogens in cats and their owners

Henriette Booij-Vrieling

1 DVM, DDS, PhD, University of Utrecht, The Netherlands.

Introduction

Periodontal diseases are bacterial infections of the oral cavity. Porphyromonas gingivalis and Tannerella forsythia are established periodontal pathogens, and are the strongest bacterial markers for destructive periodontal disease in humans (1,2). It is well known that periodontal pathogens can be transmitted between family members (3-7).

Periodontal disease is the most common disease in cats and dogs, with a prevalence of 70% and 80%, respectively, in 2-year-old animals (8). Several studies have compared the composition of the oral microflora in animals with those in humans (9,10,11) but not from the perspective of the owner-pet relationship. The aim of the first study was to determine the prevalence of P. gulae, P. gingivalis, and T. forsythia in cats and their owners. Since owners are in close contact with their cats (12,13), we furthermore wanted to determine whether transmission of these periodontal pathogens may have occurred. The second study therefore concentrated on owners with known periodontal disease.

Materials and Methods

Recruitment of dental plaque samples

Cats and their owners were sampled at an international cat show (group 1, healthy group) and at two private veterinary clinics (group 2, patient group). Cats were included in group 1 if there were no visible signs of gingival recession, no visible furcations, no redness/edema, and no hyperplasia with spontaneous bleeding of gingival tissues. Cats in group 2 were selected if one or more of the aforementioned visible signs of periodontal disease were present. Dental plaque samples from cats and their owners were taken and transferred immediately to the laboratory of Oral Microbiology of the Academic Centre for Dentistry Amsterdam (ACTA), the Netherlands, for further processing.

Isolation and detection of P. gulae / P. gingivalis and T. forsythia After sampling, 1.3 mL of the dental plaque samples was stored at -80 °C until real-time polymerase chain reaction (RT-PCR) was performed: two 100-µL samples were used for the culture and isolation procedures. T. forsythia isolates were stored on glass beads (Protect Bacterial Preservers, TSC Ltd. Lancashire, UK) at -80°C until genotyping using Amplified fragment length polymorphism (AFLP) typing. Confirmation of the identification of identical T. forsythia strains from cat and owners was done by sequence analysis.

Statistical analysis

A Mann-Whitney Test (SPSS 15.0 for Windows (SPSS Inc, Chicago, IL)) was used to analyze the differences in the ages of the cats, colony forming units (CFU), and total amounts of P. gulae, P. gingivalis, and T. forsythia between the cats and their owners. Significance was defined as p≤0.05.
Results

In the first study, Porphyromonas and T. forsythia were detected in cats by cell culture and PCR in up to 100% of samples, all typical Porphyromonas-like colonies were tested positive for catalase reactivity. In the cat owners, Porphyromonas spp were also detected in up to 100% when analyzed by cell culture and PCR but were detected in 96% of samples analyzed by PCR. The prevalence of T. forsythia in cat owners by culture was up to 86% and 100% by PCR detection.

The mean total CFU in the plaque samples from cats with periodontal disease was significantly higher than that in the plaque samples from the cats without clinical sign of periodontal disease.

T. forsythia accounted for a greater proportion of the mean number of CFU in cats with than in cats without periodontal disease. Genotyping of T. forsythia isolated from samples from cats with periodontal disease and their owners (six combinations cat/owner) identified six identical isolates of T. forsythia in one cat/owner combination. Sequence analyses of a maximal 502-bp 16S rDNA fragment confirmed the T. forsythia identity of the isolates from the cat and its owner by comparison to known T. forsythia gene sequences from the sequence database of the National Center of Biotechnology Information (NCBI, Bethesda, MD). The T. forsythia isolates that were identical in cat and owner were all catalase positive.

Discussion

The prevalence of P. gulae in cats was 90% in healthy cats and 100% in cats with visible signs of periodontal disease. The much lower prevalence of Porphyromonas spp. in healthy humans might reflect a higher virulence of P. gingivalis in humans relative to the virulence of P. gulae in healthy cats (10,11). P. gulae in cats might be an opportunistic pathogen that could initiate an endogenous infection.

The prevalence of T. forsythia was high in plaque samples from both healthy cats and cats with periodontal disease. Furthermore the relative load of T. forsythia (expressed relative to the mean total CFU) was significantly higher in cats with periodontitis than in cats without periodontal disease, which suggests that T. forsythia is associated with periodontal disease in cats as well as humans since it is known that the relative frequency of T. forsythia is a stronger marker of periodontal disease than the prevalence only (1,14). Identical isolates of T. forsythia have not been described before in pets and their owners. The finding of two identical isolates (based on AFLP typing) suggests that transmission between cat and owner had occurred. Based on the high prevalence of T. forsythia in cats and a positive catalase activity of the identical T. forsythia isolates we hypothesize that transmission from cat to owner is most likely and that cats might be a reservoir for T. forsythia. The transmission of bacteria depends on many factors such as the source of infection, number of microorganisms that are shed, route of infection, genetic factors of the microorganisms, frequency of contact between infected and susceptible individuals, and survival of the microorganism in the environment (5,6). The transmission of oral bacteria is conceivable given the fact that many cat owners allow their pets to eat from their plates, lick their faces, and sleep on their pillows (12).

Conclusions

A larger study with more specific inclusion criteria is needed to establish whether oral pathogens are transmitted from pet cats to their owners. Until then, it would be sensible to bear in mind that cats, and perhaps other pets, might harbor periodontal pathogens.
References

Investigation of effects to topical oral application of esterified fatty acid complex on periodontal disease in cats

James Anthony¹

¹ BSc(Agr), DVM, MRCVS, FAVD, Dip AVDC, Dip EVDC, PAg

Periodontal disease is a very common condition in cats and the disease worsens as time goes on. It can result in loss of dentition and surrounding bone, as well as, pain, oral inflammation, halitosis, and bacteremia. The release of bacteria affects other system organs, as the heart, liver, and kidneys. It is speculated that bacteria from the oral cavity has resulted in septicaemia. Home care, such as brushing the dentition or oral rinses with antiseptic solutions, is often discontinued as it can be difficult to perform in some cats. Topical application of esterified fatty acids in rabbits with periodontal disease has been shown to slow down the progression of this disease and inhibit bone loss. In this study, a group of cats with existing periodontal disease was anesthetized, given a through oral examination and after 6 weeks of treatment with esterified fatty acids applied to their oral cavity every other day the cats were again anesthetized and given another through oral examination. Periodontal scores were significantly decreased after 6 weeks of treatment. This could offer a safe, economical procedure that would be easy for the cats’ care givers to perform at home, with the potential to improve the health and welfare of cats affected by periodontal disease.
Algorithm for feline lymphoplasmacytic stomatitis: what to do next

Katherine E. Queck¹

¹ DVM, Fellow, Academy of Veterinary Dentistry

Feline Lymphoplasmacytic Stomatitis is a difficult and frustrating disease process. It may strike any cat, but in North and South Carolina it frequently occurs in young, feral cats and purebreds. Viral infections, bacterial infections, and poor nutrition predispose individuals to this disorder. Genetic predisposition is probably another key factor in developing this disease process. Once it begins, it is progressive and unrewarding to treat, and the cats are extremely painful. Weight loss, hypersalivation, and vocalization when eating are common signs. Severe halitosis, hiding, and a reluctance to be touched are other common manifestations of the disease. Medications used as a primary treatment for the disorder include antibiotics, non-steroidal and steroidal antiinflammatories, and a variety of nutriceuticals. Most cats are relatively refractory to these treatment methods if done without concomitant surgery. Other causes such as food and environmental allers are often overlooked when considering etiology and pathogenesis. Typical treatment includes routine prophylaxis, partial and full mouth extractions, and frequent use of longterm steroids.

Allergy testing and food trials are indicated prior to treatment with long-acting steroids. Treating these underlying problems frequently delays the need for surgical intervention and makes the cat more comfortable. CO2 laser therapy has been used successfully to eliminate the layers of lymphocytic infiltrates in the caudal pharynx and reduce the inflammation and sensitivity in the oral tissues. Immune modulation with cyclosporine and transdermal steroids can also be useful when these treatments are unsuccessful. Pain control is paramount, so oral buprenorphine, fentanyl patches, and oral meloxicam are incorporated in the regimen. In conclusion, Feline Stomatitis can be successfully treated in most cats with the algorithm presented.
Use of antibiotics in management of patients with oral diseases

Colin Harvey

Every mouth has a rich microbiological flora and contains structures that do not have a vascularized epithelial covering. This combination makes the concept of ‘infection’ in the mouth complex compared with other tissues.

In addition to ‘periodontopathogenic’ organisms, bacteria commonly found in the mouth include organisms considered to be primary pathogens when cultured from other tissues – Staphs and Streps of every type, coliforms, Proteus, Pseudomonas, Pasteurella.

Periodontal disease, caused by periodontopathogens in the dental plaque biofilm, is by far the most common oral infection. As the plaque biofilm matures and gingival inflammation starts to develop, the plaque biochemical environment becomes richer, allowing anaerobic periodontopathogens, including spirochetes, to thrive.

Proving the infectious nature of periodontal disease by applying Koch’s postulates is not possible because of the complexity of the microflora in dental plaque. Periodontopathogens are defined by Socransky’s Postulates:

- Association: The causative agent must be found in active ‘sites’ in higher numbers than in non-active sites.
- Elimination: The elimination of the agent must stop the progression of disease.
- Host response: The cellular or humoral immune response must validate the specific role of the agent in the disease.
- Virulence factors: The agent must possess virulence factors that are relevant for the initiation and progression of the disease.
- Animal models: The pathogenicity of the agent in an animal model must provide conclusive evidence that it can cause periodontitis.

A change from primarily periodontopathogens - predominantly anaerobes of the black-pigmented Bacteroides group (including Porphyromonas and Prevotella spp.) - to a wider variety of organisms, particularly aerobic Staphs and Streps, is considered indicative of reversion from periodontal disease to oral health. However, qualitative and quantitative assessment of the bacteria in direct contact with infected periodontal tissues is challenging, and inconsistent culture results are often found in microbiological studies of periodontal disease.

The ability of an individual animal to resist a given gingival bacterial load varies greatly, depending on immunological competence, differences in protective constituents of oral fluids, and other factors such as age, stress, nutritional status, concurrent infections, distant-organ health status and probably additional factors that are incompletely understood or not yet known.

What is the purpose of an antibacterial drug when an infection is located in a tissue that is always exposed to a rich bacteriological flora? Is re-infection the inevitable result of contamination following antibacterial treatment?

Antibacterial Drug Treatment – Role in Management of Oral Diseases:

In a healthy mouth, the well vascularized oral tissues are adapted to existing in a contaminated environment. Use of an antibiotic drug is indicated in patients with oral
diseases to treat either local infection or to prevent settlement and growth of bacteremic organisms in distant sites in at-risk patients.

Considerations of the patient’s general health aside, patients with contaminated oral sites that are already open for drainage (i.e. periodontal pockets) or that will be open for drainage following a procedure such as scaling or extraction generally do not require antibiotic treatment. Thus, treatment of extensive periodontal disease by a combination of scaling and extraction is, of itself, not an indication for treatment with an antibacterial drug.

Periodontal infection is treated by removing the cause (plaque and calculus) so that the tissues can revert to health; antibiotic administration is an auxiliary treatment.

Indications for Use of Antimicrobial Drug in Patients with Oral Infection:

Treatment of Local Infection

An antibiotic can shift the plaque flora from a pathogenic to a commensal mix. Combining this effect with the mechanical removal of calculus and plaque will enhance the likelihood of stabilization of healthy flora in the healing tissues.

1. Local tissues are severely infected and treatment including retention of teeth would require periodontal surgery that will expose infected bone, or teeth surrounded by severely infected bone are to be extracted. The local tissues will withstand the effects of surgery better and healing will be more rapid if local periodontal infection is controlled at the time of the dental procedure. In this circumstance, antimicrobial treatment is commenced several days prior to surgery and is continued for several days following surgery.

2. When the periodontal infection has progressed to wide-spread osteomyelitis (i.e. is affecting the trabecular bone and outer cortical bone of the involved jaw) and infected bone will be left in place following extraction or deep scaling. Antimicrobial treatment is best started several days prior to the procedure, and continued for several weeks following the dental procedure.

3. When mucosal immunopathy has resulted in oral ulceration that is exacerbated by contact with even small amounts of dental plaque accumulation, such as in ulcerative stomatitis in dogs and possibly stomatitis in cats.

Prevention of Bacteremia

Bacteremia is frequent in patients with gingivitis and active periodontitis, and is rapidly cleared by the reticulo-endothelial system in otherwise healthy patients. However, there is an association between severity of periodontal disease and distant organ abnormalities. Anaerobic culture methods were not used in most studies reporting the prevalence of bacteremia associated with dental treatment; more recent studies have shown that the full range of aerobic and anaerobic bacteria found in local periodontal infection also can cause bacteremia.

Treatment with an antibiotic drug is indicated when the patient’s distant tissues are at risk as a result of bacteremia during a dental procedure.

Examples of indications for prevention of bacteremia:

1. Patients with clinically evident cardiac disease. Although a cause-and-effect relationship between periodontal infection and endocarditis has not been proven, turbulent flow in an abnormally functioning heart may enhance the attachment of bacteremic organisms to the heart valves.

2. Patients with clinically-evident renal or hepatic disease, or with uncontrolled hormonal disorders such as diabetes mellitus or hyperadrenocorticism. When cellular metabolism is depressed by systemic disease, the oral tissues are less able to respond
normally to the trauma of the procedure, and the kidney and liver may be at risk of infection from bacteria that become lodged in sludged blood vessels.

3. Patients with prostheses, such as ocular prosthesis, total hip replacement or cruciate ligament repair using a non-absorbable material, or patients whose spleen has been resected (the spleen is a primary site of the reticulo-endothelial filter that eliminates bacteremia within several minutes in healthy patients).

4. Patients in which a clean surgical procedure will be performed during the same anesthetic episode, such as an older dog with a mammary mass and severe periodontal infection. In this case, continuation of the antimicrobial treatment for several days post-operatively is recommended to ensure that any bacteria trapped in blood clots are exposed to an effective concentration of the antimicrobial drug.

5. Patients with immunopathies or who are undergoing treatment with immune-suppressive drugs, such as cancer chemotherapy or for treatment of severe skin diseases and other severe reactive or auto-immune disorders.

A broad-spectrum bactericidal antibiotic that achieves a high concentration in serum is indicated. Peri-operative treatment is all that is required (single dose orally the morning of the procedure, or IV during induction of anesthesia, repeated every 2-3 hours during prolonged procedures).

Which Antibiotic to Select?

Broad-spectrum or narrow-spectrum? When an antimicrobial drug is administered to treat periodontal infection, it must be effective against the pathogenic organisms likely to be present, and must reach an effective concentration in serum and periodontal pocket fluid. Because of the breadth of the oral flora, and the possibility that bacteria may be pathogenic locally or as a result of bacteremia, a broad-spectrum antibiotic is indicated to ensure effectiveness against local and contaminating pathogens.

Culture and Sensitivity Testing or Not? Because of the microbiological challenges noted previously and the delay in treatment that would result, bacterial culture and susceptibility testing are rarely performed in oral disease patients.

Until recently, there were only three antibiotics have been specifically approved for use in patients with oral infections, amoxicillin-clavulanic acid (Clavamox), clindamycin (Antirobe) and metronidazole-spiramycin (Stomorgyl).

Based on susceptibility testing of gingival samples from a group of patients with gingivitis, the most broadly effective antimicrobial drug currently approved for use in dogs and cats is amoxicillin-clavulanic acid.

For deep-seated, long-standing periodontal bone infections, clindamycin has good activity against oral anaerobes, but has less broad-based aerobic activity compared with amoxicillin-clavulanate. Spiramycin has the advantage that it reaches high concentrations in oral fluids.

Metronidazole by itself is effective against oral anaerobes, but has no aerobic bacterial activity:anecdotally, it is particularly effective for both short-term and long-term/intermittent treatment of ulcerative stomatitis in dogs, though whether the beneficial effect is antibacterial or a poorly understood immunological effect on these immunopathic tissues is not clear.

Recently approved antimicrobial drugs: Pradofloxacin (Veraflex®, Bayer) is a third-generation quinolone antimicrobial drug that has show effectiveness against organisms associated with periodontal disease and as short-term medical treatment of cats with stomatitis.

Cefovecin (Convenia® Pfizer) was initially approved for use in patients with dermatological infections. Recent publications have shown that it is of value in patients with oral infections. The primary advantage of Convenia is that it requires only a single dose to provide 7 days of effective action.
Antimicrobial drugs that do not have approval specifically for management of oral infections: The tetracycline group of antibacterial drugs is now rarely used for peri-operative treatment during dental procedures because of the risk for development of plasmid-derived antibacterial resistance; however, there is renewed interest in the tetracycline group because, even at sub-antimicrobial doses, tetracyclines have an anti-collagenase effect that can protect periodontal tissues against inflammation-induced destruction. Doxycycline is available for local injection into periodontal pockets in an absorbable gel to provide a high concentration locally.

For some specific oral infections (such as actinobacillosis osteomyelitis), treatment with a penicillin/sulfonamide combination for several months is required. Fortunately, such infections are uncommon, and are typically identified only as a result of failure of 'standard' treatment.

Conclusion

A patient under consideration for treatment of oral infection may have no, one or two indications (local disease, distant organ prophylaxis) for use of an antibacterial drug as part of his/her dental treatment.

Each of these indications may have a different recommended treatment period, and the various sub-types of local indication and systemic risk also have different recommended treatment periods. Culture and susceptibility testing will not provide the definitive information needed for selection of the appropriate drug; thus, empirical drug selection is necessary.

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Ethical issues in small animal dentistry

Frank J.M. Verstraete

1 DrMedVet MMedVet DAVDC DECVS DEVDC

The clinical practice of small animal dentistry has evolved considerably over the past 30 years. Many advances have been made in all facets of dentistry. However, clinical advances often raise new ethical questions. Yet, ethical concerns have received very little attention in veterinary dentistry. With increasing clinical prowess (“what can be done”), it is easy to overlook what truly is in the best interest of the patient (“what should be done”). This is mainly applicable to the more advanced procedures, such as prosthetic crowns, implants and the orthodontic correction of malocclusions. A key issue in this matter is the informed consent of the client, which implies that all available treatment options should be discussed. Questions about functionality and medical need should be raised and honestly answered. A confounding factor for trainees in EVDC or AVDC training programs is the temptation to perform advanced procedures that are not necessarily in the patients’ best interests for the purpose of meeting the minimum caselog quotas required for credentialing purposes. Likewise, there is peer-pressure on specialists to perform advanced but not necessarily medically justifiable procedures for fear of not being perceived as “cutting-edge”.

On the other side of the spectrum are entry-level dental procedures that also have ethical implications. Of concern in periodontics is the practice of “anesthesia-free dentistry”, the scaling of teeth by lay staff using manual restraint. Ethical questions associated with dental extractions include whether technicians/nurses should be allowed to perform extractions. Another important question is whether the extraction of teeth for the purpose of addressing aggressive behavior should be condoned.

This presentation will examine the ethical issues associated with common dental treatment options in orthodontics, prosthodontics, periodontics and exodontics.
Pulp Anatomy

Paul Theuns

1 DVM

The root is the part of the tooth that is apical to the neck and crown. It is enclosed by alveolar bone and situated in a bony socket (alveolus). The pulp cavity is the entire intra dental space that the pulp occupies. It consists of a coronal part, called the pulp chamber and an apical part, called the root canal. The most apical part is called the apex. Round the apex there are collagen fibers called the apical group, they radiate from the cementum to the bone, forming the base of the socket. Dogs and cats have an apical delta whereas humans and the non human primates have an apical foramen. The apical delta is a combination of several canals (6-90) or openings, the apical foramen is a single opening, but very often the apical foramen in primates consists of more openings. The length of the apical delta ranges from 1 to 3 mm in 97.7% of the PM4 roots and 80.5% or the M1 roots. The upper limit of the apical delta is 6 mm. The dental pulp communicates with the periapical area through neurovascular soft tissues which traverse the terminal ramifications of the apical delta. In the immature teeth there is a larger area of communication, this is called an open apex. In dog and cat teeth there are apical ramifications, in dogs they are most prevalent in the apical third of the root. Failing of standard endodontic therapy may be related to difficulty in cleaning these contaminated non-apical ramifications[1]. The pulp is a soft tissue that contains blood vessels, sensitive nerves and different types of cells: odontoblasts, fibroblasts, fibrocytes. Blood enters the tooth through arterioles with a diameter of 100μ or less. These vessels pass through the apical delta with the nerve bundles. Smaller vessels may enter the pulp through the lateral or accessory canals. The sensory nerves of the pulp arise from the trigeminal nerve and arrive into the radicular pulp in close association with the arterioles and venules. Before the nerves enter the apical delta they send rami to the periodontal ligament. Single pulpal nerve fibers have been reported to innervate multiple tooth pulps. In addition, it contains collagen fibers, elastic fibers but there are no lymph vessels in the pulp of dogs, therefore they likely have extravascular lymph drainage in their pulp vascular system.

References

Starting out in endodontics can be challenging for the veterinarian with a professional interest in dentistry. The armamentarium required is extensive, expensive and confusing. A sound understanding of both the materials and equipment required can greatly increase the chances of success. Incorrect selection or usage of instruments can lead to complications, which is not only stressful for the practitioner, but also increases the chances of treatment failure, dissatisfaction of the client and discomfort for the patient. The veterinarian must have access to a wide variety of materials and equipment as one protocol will not be appropriate for every tooth in every patient. Endodontic work is technique sensitive, so as well as obtaining the correct equipment for the procedure intended: the veterinarian must also acquire adequate experience and practise in its use. The ultimate goal of endodontics is to salvage teeth and restore form, function and comfort for the patient. The chances of endodontic success are greatly increased by conscientious adherence to the principles of the endodontic triad: namely canal preparation, sterilization and obturation. Failure may occur if any one of these is poorly performed. The practitioner must have means of performing intra-oral dental radiography. Endodontic work must not be performed without radiography.

Canal Preparation · Access

The two main goals of root canal instrumentation are to provide a biological environment conducive to healing (infection control) and to develop a canal shape receptive to sealing. Preparation involves both accessing and then shaping the canal. Access involves creating a straight-line a path to the canal system and ultimately the root apex, as possible. A selection of friction grip (FG) burs on a high-speed handpiece is typically used for this (#2, #4, #6 tungsten carbide round, #330 pear-shaped). Extended shank round burs (Mueller) can be useful as the head of the handpiece is moved away from the tooth. Piezoelectric ultrasonic units also have several indications in endodontics, and specific tips may be used to facilitate canal access. Localization of the canal may be assisted by using a pathfinder file. These have very small working tips (see below) and are also useful for negotiating very narrow canals.

Canal Preparation · Instrumentation

Cleaning and shaping of the canal is then continued with hand or rotary instruments. Hand instruments are the original tools developed for endodontic work and standardization was introduced in the 1960’s. Many file sizes are now defined by their ISO size (International Standards Organization). An ISO 10 file has a working tip diameter of 0.10mm. ISO 15 a working tip of 0.15mm, increasing in 0.05mm increments until ISO 60 and then increasing by 0.10mm until ISO 140 (with a tip diameter of 1.4mm). The initial increase in file size is 50% (10à15) and later 10% (100à110). Other systems provide a consistent 29% increase in file size (ProFile Series 29’). From ISO 15 the files are color coded in the sequence white, yellow, red, blue, green, black, repeating twice, reaching ISO 140 which is black in color. Pathfinder files are the smallest files, with a diameter at the tip of 0.04mm-0.10mm: a K1 file is between a #6 and #8 hand file with a dark brown handle, a K2 is between a #8 and #10 with an orange handle, whilst a #10 file has a purple handle. Taper describes the amount the file diameter increases each mm from the tip to the handle. ISO files
increase in width by 0.02mm per mm of file length, so that a size #25 file would have a
0.27mm diameter 1mm from the tip, 0.29mm diameter 2mm from the tip. Some manufactur-
ers describe the taper as a % (e.g. 0.02 taper= 2%). Once the canal is located, the pulp mate-
rial must be fully extirpated. Barbed broaches are designed to help remove soft pulp tissue
from the pulp cavity. They are produced by making small incisions into the smooth metal shank and then forced open to produce barbs. To avoid instrument fracture (known as in-
strument separation) they must be used with care. The colour coding is similar to other files: Purple= xxxxfine, White= xxxfine, Yellow= xxfine, Red= xfine, Blue= fine, Green= medium, Black= coarse.

K-type (Kerr) files and Reamers

These are made by machining steel wires into 3-sided (triangular) or 4-sided (square/ rhomboid) tapered blanks. The tapered end is then twisted to produce spirals. The number of twists determines whether the blank becomes a file or reamer. K-reamers have 0.1-0.25 spirals/mm. They are used in clockwise turning fashion carrying filings from the depths of canal to the access (reaming). K-files have ≥ 0.25 spirals/mm providing more dentinal wall contact but also making them weaker than reamers. They are used in a quarter-turn clock-
wise and pull mode.

H-File (Hedström File)

A round metal blank is machined to produce a spiral groove (like stacked cones). They are
used in a push-pull filing action. They are not designed to be rotated and are prone to frac-
ture if used in this way. The flutes carry debris from the canal. Both K- and H-type files are produced in human (21, 25 and 30mm) and veterinary lengths (60 and 120mm). Human files are inadequate length for the majority of canine teeth in dogs, requiring a veterinary length file to adequately instrument the apex. Rotary motion is most likely to produce the desired conical apical shape such that K-files are best used for apical preparation. File breakage can occur and H-files are weaker than similarly sized K-files. H-files will fracture if rotational or excessive push-pulling force is used. They are best suited to use in the coronal 2/3 of the ca-
nal. Instruments have been traditionally made with stainless steel, but nickel-titanium (Ni-
Ti) is increasing in popularity due to it being more flexible and less prone to fracture.

Rotary Instrumentation

Gates-Glidden drills and Peeso reemers are engine-driven files occasionally used during canal preparation. Gates-Glidden drills are used in the coronal third of the canal. They are
slightly flexible, but may perforate the canal if used too deeply. Peeso reemers are also used in the enlargement of the canal in its coronal third, but they are not flexible and may perfo-
rate the canal. They are available in different sizes, coded by colors or rings on the Shank.

Many human rotary instrumentation systems for canal shaping and cleaning are availa-
ble, but much fewer in veterinary length (suitable for the majority of canine teeth in medi-
um to large breed dogs). These files are typically made from nickel-titanium (Ni-Ti) and are designed for use in specific low-speed handpieces (2500rpm) but are required to be used at 150-350rpm, indicating the need for a speed-reduction gear. Do not use traditional air driv-
en low-speed handpieces. They allow rapid and efficient canal preparation, but are more costly than hand files to purchase and are technique sensitive. Whichever system is used, it is important to follow the manufacturer’s recommendations on their use, including hand-
piece speed. It is also important to be aware of the files’ sizing system. Whilst many are ISO sized, others are not. The taper must also be known. Many human systems are available, including ProTaper®, ProSystem GT®, LightSpeed LSX®, and Twisted Files®. LightSpeed LSX is a system which has both human (21, 25, 31mm) and veterinary length (60mm) files.
Measuring Aids

It is important to know the working length (WL) of the canal when performing root canal therapy. This can be estimated on a pre-operative radiograph, and measured by introducing a small diameter file until the apical constriction is felt and confirmed radiographically. An endodontic stop, placed on the file shaft and slid down the file until it contacts the tooth margin, allows the length to be measured. Endodontic stops also have either a colored band or notch, which allows orientation of the file, especially important if the file is pre-bent.

Irrigation- Sterilization

Irrigation is required to provide an antibacterial effect, to dissolve necrotic debris, to aid débridement and to remove the smear layer. The smear layer is an ultrafine (1-5µm) layer of organic pulpal and inorganic dentinal debris created by instrumentation of the dentinal walls. The smear layer may be packed into dentinal tubules and contain bacteria, as well as interfere with adhesion of sealers to dentin and tubule penetration of thermoplasticized gutta percha. 5.25% sodium hypochlorite (full strength bleach) is the irrigant of choice but should be used with extreme care. Protection of oral soft tissues is mandatory and prevention of apical extrusion essential. This can be achieved using specific side-exit endodontic needles or specific negative pressure systems (EndoVac®). EDTA products also help removal of the smear layer by chelating inorganic debris (e.g. Glyde®, RC Prep®). The use of specific ultrasonic tips and sonic handpieces (EndoActivator®) can increase the cleaning efficacy of irrigant solutions by cavitation and acoustic streaming. Once the canal is sufficiently instrumented and the master (final) file determined, final irrigation is performed and the canal dried. Absorbent paper points are available for this in corresponding ISO sizes in both human and veterinary length, or as fine, medium and coarse. Dirty or bloody paper points may indicate inadequate cleaning (underinstrumentation) or apical perforation (overinstrumentation).

Obturation

This is the process of completely filling and sealing the cleaned and shaped root canal, providing a hermetic seal against microbial ingress. A list of characteristics has been identified that materials used to fill the canal should possess. A core material + a root canal sealer is the standard combination. Gutta percha (GP) is the most commonly used core material, in combination with a sealer cement which comes close to fulfilling all the criteria. GP is an inelastic natural latex produced from the sap of the tree of the same name. First used in 1847 as a root canal obturation material, GP points or cones were introduced in 1887. GP points consist of 20% GP, 65% Zinc Oxide (bacteriostatic), 10% radioopacifiers, 5% plasticizers, and are available in human and veterinary length, ISO sizes, plus varied taper sizes. It is important to use a GP cone that will match the instrumented canal. GP exists in two forms: the unheated beta phase is solid and compactable. Upon heating, it transforms into the alpha phase which is pliable and flows with pressure. However, the alpha phase will shrink upon setting. GP is still used as the gold standard today, but the search is on for an endodontic material that will supersede it, fulfilling all the criteria for the ideal obturation material. Another less commonly used core material is Resilon, a resin-based material.

Root Canal Sealers

Canal sealers are required to fill the space between the dentinal wall and the GP, voids/irregularities in the root canal, lateral canals, and the space between GP cones in lateral condensation (see below). The properties of an ideal sealer have been outlined, but currently no sealer satisfies all criteria. The practitioner should have several types of sealer available, and understand their indications for use. There are four types of root canal sealer. Zinc Ox-
ide Eugenol (ZnOE) is a simple, but effective sealer with a long history of successful use in veterinary dentistry. It is usually a combination of a liquid (eugenol - extracted from clove oil) and zinc oxide powder (with added substances to provide radio-opacity, eg barium sulphate). Resin Sealers have a long history of use, and do not contain eugenol. Eg AH Plus®. Calcium Hydroxide Sealers were developed for their antimicrobial effect (Eg. Sealapex® a catalyst/base polymeric system). Glass Ionomer Sealers are less commonly used in veterinary dentistry, but have been advocated because of their dentinal bonding properties. There are different methods of sealer placement including paste injection, spiral filling (which uses a lentulo file on a reduction gear low-speed handpiece), file filling and master point coating.

Obturation Techniques

Cold Compaction/Cold Lateral Condensation. After placement of the master cone (the same size as the master file which is the largest file used to WL) a finger spreader is used lateral to the master cone, compacting it, producing space for accessory cones. The process is repeated, excess GP is removed and then a plugger is used to vertically compact the GP. A spreader is a round smooth, tapered instrument with a point, whilst a plugger is flat-ended. Warm Vertical Compaction (Schilder Technique). The master cone is placed and heat is applied with manually heated pluggers/spreaders or the Touch ‘n’ Heat System which allows temperature control and provides heat at the tip of the instrument. This removes coronal segments of GP and softens the remaining cone so that it can be compacted apically. Continuous Wave Compaction. An electric heat carrier (System B/DownPak®) with stainless steel pluggers provides simultaneous heating and compaction of GP. Thermoplastic Injection Technique. The GP is heated outside the tooth and injected into the canal Eg: Obtura® / Ultrafil 3D® / Elements Obturation Unit. Thermolateral condensation. Based on the old McSpadden technique, this technique uses a rotating bladed compactor on a low-speed handpiece. The frictional heat generated from the dentinal walls softens the GP allowing apical and lateral compression by the same instrument. The system can be cost effective, avoiding the need for special heating devices or special GP. Eg. Microseal System.

Carrier-Based GP Techniques

These techniques utilise a carrier/core, which is coated with a ‘plug’ of GP. These carriers may be plastic, and pre-coated with GP (Therafil®) or titanium metal and coated manually by the operator (SuccessFil®). Both these products require the carrier to be resected, leaving it within the canal, and are only available in human length (25mm). The SimpliFill® system deposits the GP plug to within 1-3mm of the prepared length and then the carrier is disengaged from the plug and removed from the canal. This system is available in both human and veterinary (50mm) length. The coronal space can then be filled with warm vertical compaction, or an injectable technique (‘back-filling’).

Gutta-Flow® is a new product combining GP in powder form with a sealer, providing cold GP in a flowable form. It is reported to have excellent biocompatibility, and dimensional stability (with slight expansion rather than shrinkage). This product allows placement of only one master cone, but it does require investment in a triturator to mix the capsules.

Ultrasonics in Endodontics

Many piezoelectric ultrasonic units have the possibility of being used for endodontics. Specific tips are available, allowing their use in a variety of settings, including: access refinement, removal of pulp stones, removal of fractured instruments within the canal, increasing the action of irrigating solutions, and in surgical endodontics during retrograde canal preparation.

Once the obturation is complete, both the fracture and access site must be restored. The
practitioner must have the adequate instruments, materials and knowledge of restorative dentistry to be able to successfully complete the endodontic procedure.

References

References available upon request.

Footnotes

1) Dentsply Tulsa Dental Specialties, Tulsa, Oklahoma, 74135, USA/Dentsply Limited, Building 1, Aviator Park, Addlestone, United Kingdom, KT15 2PG
2) Discus Dental 8550 Higuera Street, Culver City, CA 90232, USA
3) SybronEndo Corporation, 1717 West Collins, Orange, CA, 92867, USA
4) Premier Products Company, 1710 Romano Drive Plymouth Meeting, PA 19462, USA
5) Endo Ingenuity, 3232 N. Rockwell Street, Chicago, Illinois 60618, USA
6) Coltène/Whaledent Inc., 235 Ascot Parkway Cuyahoga Falls, OH 44223
Root canal treatment using lightspeed files

Paul Theuns¹

¹ DVM

Introduction

Lightspeed files follow the root canal and prevent ledging and or zipping. We need to take under consideration that we copied the endodontic procedures from human dentistry books. The anatomy of the root differs from the human teeth. The animal tooth root is difficult to properly get cleaned with the traditional files. Lightspeed files will help to overcome part of these difficulties, they will improve the cleaning and shaping of the canal and will also decrease the time needed to complete the root canal treatment.

Equipment

Light Speed

When using the Light Speed system, the files are introduced manually in the canal continually rotating, with a slow continuous apical movement until the blade binds. After a momentary pause, the blade is advanced to the working length with intermittent pecking motions. The number of pecks (up and down movement) required to reach working length increases as the instrument size increases, because more wall dentin is cut. The instrument that requires 12 or more pecks (12-peck rule) to advance from the point of first binding to the working length is the master apical rotary size (MAR). An instrument one size larger than the MAR then is used to instrument to a length 4 mm short of the working length. Before each file is introduced in the canal, the canal is irrigated with EDTA (ethylenediaminetetraacetic acid). Between each 3rd file size the canal is flushed with NaOCl. Then the coronal part of the canal is enlarged using the step back method. Using the next size rotary file the canal is instrumented to a 4 mm step back from the working length. Continue with stepping back with sequentially larger full size instruments until a size is reached that cannot be easily advanced beyond the coronal third. Finally the MAR is used to recapitulate to the working length. The LightSpeed instruments should be used in a handpiece that rotates at 2500 rpm. LightSpeed instruments are designed with 2 blades that have neutral rake angles. The radial lands keep the instrument centered in the canal while the blunt instrument tip prevents it from cutting or gouging the canal walls. Light-Speed are very flexible which allows them to negotiate and clean curved canals. There is also an option to use them by hand in extreme curves.

Obturation

Obturation can be done with traditional gutta percha or with a simply fill plug.

Sealer

Different sealers can be used. The LightSpeed manufacturer recommends using AH plus
sealer when using gutta-percha plugs. This 2-component sealer is biocompatible and adapts closely to the canal walls. It also provides minimal shrinkage, long-term dimensional stability and outstanding sealing properties. It has a 4-hour working time and sets in eight hours.

However this will increase the financial investment of the equipment considerably.

Conclusion

Veterinarians have to realize that the LightSpeed system allows for the use of longer (50 mm) rotary files for use in the canine teeth. Because rotary files make easier faster and safer access of the canal possible, they are a welcome extension to the dental instruments for the veterinarian practicing endodontics on a regular base.

Literature

3. 19th veterinary dental forum and world veterinary dental congress IX, how to improve the quality and speed of your root canal treatments with LightSpeed rotary instruments, Bob Boyd, pp. 49-51
Oral examination and treatment planning

Cecilia Gorrel

1 BSc, MA, Vet MB, DDS, MRCVS, HonFAVD, DEVDC, European and RCVS-recognised Specialist in Veterinary Dentistry, Veterinary Oral Health Consultancy, 17 Burnt House Lane, Pilley, Hampshire SO41 5QN, UK,

Dentistry encompasses conditions of all structures of the oral cavity, namely teeth (hard tissues and periodontium), oral mucosa, salivary glands etc. Some conditions can be managed successfully in general practice and some need referral to a specialist for treatment. The general practitioner needs to recognize the conditions, be able to perform a full diagnostic workup, realise the clinical significance of the findings and institute treatment (in-house or referral) as required.

Oral conditions and diseases are a diagnostic challenge. Several disease conditions are generally present simultaneously. The great majority of dogs and cats will have gingivitis and or periodontitis as well as other problems. Moreover, clinical signs are rarely specific, i.e. malodour, changing in eating patterns, and dysphagia are indications that there is a problem in the oral cavity, but they are not necessarily specific for a particular disease. Finally, manifestations of disease are often discrete and are often not detected on conscious clinical examination. Even if they are detected on conscious examination, general anaesthesia is required to evaluate the extent of pathology. The importance of a full oral exam under general anaesthesia (definitive examination) cannot be underestimated.

The recommended protocol for definitive examination of the oral cavity (1) involves inspection of the oropharynx, lips, cheeks, oral mucous membranes, hard palate, floor of the mouth, tongue as well as teeth and periodontium. In general veterinary practice examination of the periodontium is often omitted and periodontal disease is missed.

The periodontium of each tooth needs to be assessed to:

1. Identify the presence of periodontal disease (gingivitis and periodontitis);
2. Differentiate between gingivitis (inflammation of the gingiva) and periodontitis (inflammation of the periodontal tissues resulting in loss of attachment and eventually tooth loss);
3. Identify precise location of disease processes;
4. Assess the extent of tissue destruction where there is periodontitis.

The following periodontal indices and criteria should be evaluated for each tooth.

1. Gingivitis and gingival index

   The presence and degree of gingivitis is assessed based on redness, swelling and presence or absence of bleeding on probing of the gingival sulcus. Various indices can be used to give a numerical value to the degree of gingival inflammation present. In the clinical situation, a simple bleeding index is the most useful.

2. Periodontal probing depth (PPD)

   PPD measures the depth of the sulcus. A graduated periodontal probe is gently inserted to the base of the gingival sulcus, i.e. until resistance is felt. The depth from the free gingival margin to the base of the sulcus is measured in mm at several locations around the whole circumference of the tooth. The probe is moved gently horizontally, walking along the floor of the sulcus.
The gingival sulcus is 1-3 mm deep in the dog and 0.5-1 mm in the cat. Measurements in excess of these values usually indicate the presence of periodontitis when the periodontal ligament has been destroyed and alveolar bone resorbed, thus allowing the probe to be inserted to a greater depth. The term used to describe this situation is periodontal pocketing. All sites with periodontal pocketing should be accurately recorded. Gingival inflammation resulting in swelling or hyperplasia of the free gingiva will, of course, also result in measuring sulcus depths in excess of normal values. In these situations, the term pseudo-pocketing is used, as the periodontal ligament and bone are intact (i.e. there is no evidence of periodontitis) and the increase in PPD is due to swelling or hyperplasia of the gingiva.

3. Gingival recession

Gingival recession is the distance (in mm) from the cemento-enamel junction to the free gingival margin. It is also measured using a graduated periodontal probe. At sites with gingival recession, PPD may be within normal values despite loss of alveolar bone due to periodontitis.

4. Furcation involvement

Furcation involvement refers to the situation where the bone between the roots of multirooted teeth is destroyed due to periodontitis. The furcation sites of multirooted teeth should be examined with either a periodontal probe or a curved dental explorer.

5. Tooth Mobility

Assessed using a suitable instrument, e.g. the blunt end of the handle of a dental mirror or probe

Should not be assessed using fingers directly, since the yield of the soft tissues of the fingers will mask the extent of tooth mobility

6. Periodontal/Clinical Attachment Level (PAL/CAL)

Periodontal attachment level records the distance from the cemento-enamel junction (or from a fixed point on the tooth) to the base or apical extension of the pathological pocket. PAL can be measured with a periodontal probe. It can also be calculated, i.e. PPD + gingival recession/PPD – gingival hyperplasia. PAL/CAL is a more accurate assessment of tissue loss in periodontitis than PPD.

The information resulting from the examination (and any treatment performed) needs to be recorded. A basic dental record consists of written notes and a completed dental chart. Additional diagnostic tests and radiographs are included as indicated. A dental chart is a diagrammatic representation of the dentition, where information (findings and treatment) can be entered in a pictorial and/or notational form. It provides a simple way of recording most of your findings and treatments. However, it is only a chart and needs to be supplemented by clinical notes, radiographs, etc. to make a complete dental record.

The definitive oral examination, supplemented by radiographs will give a complete picture of the disease processes present and allow for targeted treatment. Clinical cases will be used to exemplify this approach.

References

Oral Pathology

Brook A. Niemiec

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

Images in this lecture are provided courtesy of Manson publishing and are from: Dental, Oral, and maxillofacial pathology, a color handbook. Niemiec, BA ed.

Oral Anatomy:

The canine has 42 teeth. Of these 8 are considered strategic (4 canines and maxillary and mandibular carnassials (maxillary fourth premolars and mandibular first molars) and 12 aesthetic teeth (incisors). The other teeth are important of course, but these are considered critical.

The feline has 30 teeth. The critical teeth are the same as for the canine. The incisors in this breed are much smaller than the dog and are not generally treated except for extraction.

The important structures of the oral cavity in both species include the teeth, maxillary and mandibular bones, alveolar mucosa, attached gingiva, periodontal ligament, nerves and blood vessels of the teeth.

There are several modes of examination utilized in the oral cavity.

A. Visual

i. Conscious: Depending on the patient, this can be quite limited or fairly detailed. You may be able to diagnose fractured teeth, caries, orthodontic problems, FORL’s, neoplastic masses, and some periodontal disease. However, this should not be relied upon to evaluate for periodontal disease on a continuing basis, especially in small and toy breeds.

ii. Anesthetized: This is the only way to properly evaluate all oral pathology. Only when they are properly anesthetized, can the patient be fully examined. A full oral exam obviously should be done during any dental prophylaxis; however it is also a good idea to examine all anesthetized patients for dental pathology.

B. Periodontal probing: Periodontal probing is critical for evaluating periodontal disease. This is used to ferret out camouflaged periodontal disease. Periodontal probes will improve patient care as well as practice income.

C. Dental Radiology: This is becoming more and more common in veterinary dentistry. The amount of information that will be gained is invaluable. Any dental disease or therapy should be backed up with dental radiology. Help with interpretation is available at www.vetdentalrad.com.

D. Histopathology: Biopsy everything in the mouth that you are concerned about. ANYTHING that is abnormal should be biopsied no matter what your clinical judgement tells you. In my experience, approximately 1% of all benign appearing lesions will actually be neoplastic. This can pertain to lesions you think are nothing or lesions you “know” are bad.
Detailed below are the most common diseases of the oral cavity in dogs and cats, with the exception of periodontal disease which is covered in the next article. This is not an exhaustive list and the reader is directed to texts such as A color handbook of oral pathology for more information.

Malocclusions: An occlusion that is not standard for the breed. It may be purely cosmetic or result in occlusal trauma.

There are several different potential etiologies for orthodontic problems, which are broken into two categories, genetic and non-genetic.

The most common cause of malocclusions is hereditary. This often results from the line breeding of domestic animals (pets) for a certain size or type of head, or other desired characteristics. In addition, malocclusions can result from the mating of parents with dissimilar jaw sizes causing an imbalance of maxilla and mandible. Stockard explained that malocclusions also result from the degree of expression of the achondroplasia gene within a patient. Additional genetic causes include tongue size, lip and cheek tension (or lack thereof), and presence of a cleft palate.

In general, jaw length malocclusions (class II, III, IV) are considered genetic and tooth discrepancies (class I) are considered non-genetic. A notable exception to this is mesioclusion of the maxillary canines seen in Shelties and Persians.

Non-genetic causes of malocclusions include local and systemic influences which may occur before or after birth. Local disturbances include trauma, early or delayed loss of primary teeth, cystic formation, or behavioral issues such as bruxism or abnormal chewing. Systemic disturbances include issues such as severe illness, nutritional disturbances, or endocrine diseases.

These patients often do not show any overt clinical signs other than the jaws or teeth being out of alignment. Depending on the class and severity of the problem, oral trauma may be present and can result in bleeding, oral pain, periodontal disease, traumatic pulpitis, and possibly oronasal fistula.

A jaw length discrepancy will reveal an incorrect alignment of the mandible and maxilla. Other presentations can have normal jaw lengths with a tooth or teeth out of alignment.

Management: Therapy for malocclusions is relative to type and severity of the disease process. Options include:

- No therapy (if purely cosmetic)
- Extraction of the offending tooth or teeth
- Orthodontic correction using appliances
- Coronal amputation and vital pulp therapy

Remember that many orthodontic problems are hereditary and therefore the owner must receive genetic counseling prior to any orthodontic correction procedure. In addition, strictly cosmetic correction is not in the patient’s best interest. The pain associated with orthodontic adjustment, and the numerous anesthetics required, makes orthodontic therapy a disservice to the otherwise healthy patient. The practitioner should obtain a signed consent form for any orthodontic correction case in a non-altered patient.

Deciduous Malocclusions: In some cases, the patient may be genetically programmed for a normal bite and only temporarily maloccluded. In these cases, the alignment problem is typically mild. These temporary malocclusions occur when the maxilla and mandible grow at varying rates during development due to an independent jaw growth surge. In contrast, severe malocclusions within the deciduous dentition should be considered permanent.

In many cases, the deciduous dentition is trapped by a tooth or the soft tissues on the opposite arcade, which interferes with programmed jaw growth and subsequent self correction. This is called an adverse dental interlock.

Clinical Features
These patients most often come from breeders as these clients are likely to perform oral exams on young animals.

Oral exam will reveal that the mandible and maxilla do not rest in the correct occlusion. Any orthodontic presentation is possible; however class II (overshot), III (undershot), and base narrow are the most common presentations (see individual classes for full description of the malocclusions).

Depending on the class of malocclusion (especially class II and base narrow) palatine/gingival/lip/tooth trauma may occur. One major difference between adult and deciduous malocclusions is the anatomy of the teeth involved. The deciduous teeth (especially canines) are much sharper than the corresponding permanent tooth. Therefore, trauma and pain are more intense initially so are more likely to be clinically evident early in the course of disease. This may result in pain or bleeding as the presenting complaint. However, patients will commonly show no outward signs of distress. Occlusal trauma is traumatic and painful, regardless of the lack of clinical signs, therefore expedient therapy is mandated.

Management: If occlusal trauma is present, extraction of the offending deciduous teeth should be performed as quickly as possible to minimize the trauma and relieve the patient’s discomfort.

Even if there is no current occlusal trauma, selective extraction of the deciduous teeth should be performed to remove the adverse dental interlock and allow jaw movement. This is termed interceptive orthodontics.

Deciduous extractions should be performed as soon as the problem is noted (ideally at 4-8 weeks). This will allow the maximum amount of growth as well as relieve pain as expeditiously as possible.

Deciding which teeth to extract can be difficult. Obviously, any tooth that is creating trauma should be extracted. When performing pure interceptive orthodontics, the simple rule is to extract the teeth on the jaw that needs to grow. However, recent texts recommend extracting any deciduous tooth that is or is likely to become a hindrance to movement, while not extracting teeth that may be creating a favorable dental interlock.

Extractions of deciduous dentition are challenging as the roots are proportionally longer and thinner than permanent dentition. Deciduous tooth extraction must be performed very carefully and gently, with a great amount of patience.

Another reason to take great care during deciduous extractions is to avoid damaging the developing permanent tooth. Some veterinary dentists perform surgical extractions for deciduous canines to decrease the possibility of causing iatrogenic damage. However, others (including this author) prefer simple (closed) extractions for the majority of deciduous extraction cases due to decreased surgical time and trauma. Current literature recommends closed extractions in cases with significant root resorption and a surgical approach when the tooth appears intact.

Root fracture is a common occurrence during extraction attempts. If this occurs, every effort should be made to remove the piece(s). A retained root tip may become infected, or more commonly act as a foreign body and create significant inflammation. There are rarely any clinical signs associated with this, but the patient suffers regardless. Complete root tip removal is even more critical in the case of a malocclusion, as the root tip alone is sufficient to deflect the adult tooth from its normal eruptive path. Retained roots are best extracted utilizing a surgical approach.

Dental radiographs should be exposed following extraction, to confirm complete removal of the deciduous tooth as well as document the continued presence and proper condition of the unerupted permanent teeth.

Persistent deciduous teeth: Persistent deciduous teeth are very common, especially in small and toy breed dogs. However, they can occur in any breed as well as cats. They create both orthodontic and periodontal problems if not treated promptly. It used to be believed that the persistent deciduous caused the permanent tooth to become maloccluded. Studies have shown, however, that it is the permanent tooth erupting incorrectly that causes the deciduous to be persistent.
It has been reported that orthodontic problems begin within two weeks of the permanent canines starting to erupt. This is due to the deciduous tooth being in the place that the adult wishes to occupy.

The periodontal issues occur due to a disruption of the normal maturation of the periodontium. When there is a persistent deciduous tooth, one area of the periodontium is not attaching to the permanent, therefore the periodontal attachment in that location will not be normal. It has been reported that the damage begins within 48 hours of the permanent teeth starting to erupt!

Therefore, the adult tooth does not need to be completely erupted for these problems to occur, and they should be extracted as early as possible, do not wait until six months of age to perform the extractions along with neutering. In fact, we recommend that the owners of breeds prone to retain their teeth be instructed to watch for eruption of the permanent teeth and to present the patient for therapy as soon as this occurs.

Supernumary teeth: This occurs when there are extract teeth in the arcade. If there is room for these teeth and they are not causing undue crowding or occlusal trauma, no therapy is necessary. If they result in crowding, selective extractions are recommended to relieve the condition and allow for natural cleaning ability. Some veterinary dentists take this a step further and extract crowded rotated premolars in brachycephalic breeds.

Fractured teeth: The two main types of crown fracture seen in veterinary medicine are complicated and uncomplicated. Both types require therapy; however treatment for each is often different.

The tooth crown is made up of 3 layers. The innermost layer is the pulp chamber (an extension of the root canal). It is filled with blood vessels and nerves that originate from the maxillary or mandibular artery and nerve. The outermost layer is called enamel. It is 97% inorganic material. It has no sensory ability; however it also has no ability to regenerate if lost. Between the pulp chamber and the enamel is dentin. Dentin makes up the majority of tooth structure in mature patients. Dentin is a living structure in that it has the ability to respond to stresses and has sensory ability. This sensory ability is due to the fact that there are dentinal tubules which run at right angles to the root canal system ending at the dentinal-enamel junction (DEJ). There are 45,000 tubules per mm² in coronal dentin. This means that a defect 1 cm in diameter will result in the exposure of 1,000,000 odontoblasts.

The hydrodynamic mechanism of dentin hypersensitivity is the currently accepted explanation for pain associated with dentin exposure. Dentin exposure changes the fluid dynamics within the tubules. This change in fluid velocity is translated into electrical signals by the sensory fibers located within the tubules or subjacent odontoblast layer. These signals result in the sensation of pain (or sensitivity) within the tooth. It is rare for veterinary patients to show this discomfort, but occasionally anorexia will be the presenting complaint. Finally, the exposed dentinal tubules may act as a conduit for bacterial infection of the pulp, thus initiating endodontic disease.

Over time, the tooth will respond to this exposure by laying down a layer of reparative dentin. There is no study that documents the time for an effective layer to be placed in veterinary patients. One human study found that reparative dentin is seldom found prior to 30 days following exposure of dentinal tubules and completion of formation is generally around 130 days. It is not known however, if this layer of reparative dentin is effective in decreasing tooth sensitivity.

All teeth with direct pulp exposure (complicated crown fractures) should be treated with endodontic or exodontic therapy; ignoring them is NOT an option. Prior to tooth necrosis, the viable nerve is excruciatingly painful. Following tooth death, the root canal system will act as a bacterial super-highway creating not only local infection, but also a bacteraemia which has been linked to more serious systemic diseases (see the article on periodontal disease for further information). The owners of these patients will be reluctant to pursue therapy as “It does not seem to bother the dog”. Fractured and/or infected teeth do bother the pet and they will act better following therapy. Veterinary patients are known for being
stoic, and therefore lack of outward signs of oral pain should not be misinterpreted as a benign state. Therefore, you must be a patient advocate and recommend therapy.

Uncomplicated crown fractures are also a very common finding on oral exam, particularly in large breed dogs. These fractures will result in direct dentinal exposure. The exposed dentinal tubules will create significant pain for the patient. The currently accepted means by which this sensitivity is created is via the theory of fluid dynamics. In addition, some of these teeth will become non-vital due to the traumatic incident, pulpal inflammation, or direct pulpal invasion via the dentinal tubules. For these reasons, it is recommended that these teeth be radiographed to ensure vitality. If the teeth are non-vital (evidenced by periapical rarefaction or a widened root canal) endodontic or exodontic therapy is required. If the teeth appear vital, the application of a bonded composite is recommended to decrease sensitivity (please see the article on composite bonding later in the issue for further information).

“Worn teeth” (Abrasion/Attrition): Attrition is tooth loss due to tooth on tooth contact. Abrasion occurs secondary to chewing on foreign objects (tennis balls, rocks, cages, skin/hair). If this occurs rapidly, the pulp chamber may become exposed. In this situation the chamber can be entered and tooth pain/death will occur. Endodontic or exodontic therapy is mandated.

If the wear occurs slowly, the body can lay down a layer of reparative dentin. This will protect the tooth and keep it vital. However, note that this is not effective in maintaining tooth vitality in all cases. Therefore, all worn teeth should be radiographed. If there is evidence of tooth death/widened root canal or periapical rarefaction), endodontic or exodontic therapy is again mandated. If the radiograph is normal, a bonded sealant can be considered.

Intrinsically stained teeth: Endodontic disease is also manifested by intrinsic staining. This can appear as pink, purple, yellow, or grey. A study by Hale showed that only 40% of intrinsically stained teeth had radiographic signs of endodontic disease, however 92.7% are non-vital. Non-vital teeth lose their natural defence ability and are often infected via the bloodstream, which is known as anachorisis. Therefore, do not rely on radiographic appearance to determine vitality; all teeth should be definitively treated via root canal therapy or extraction.

Caries: True bacterial caries are rare in dogs and almost unheard of in cats. They are most common on the occlusal surface of the upper first molars, but can be seen on any tooth. In addition, the most common breed is a German Shepherd dog. Early lesions can mimic wear, and are best diagnosed by tactile feel of the defect with a sharp explorer. If it is sticky, like wax, it is likely a caries lesion. These lesions can progress into the endodontic system resulting in pain and infection (see fracture teeth above). Treatment options are restoration (composite or amalgam) or crown therapy (+/- endodontic therapy); or extraction.

Enamel hypocalcification (hypoplasia): Enamel is a very thin (<1mm) material on the surface of tooth crowns. It is formed and deposited on the dentin by the enamel forming organ which consists of cells called ameloblasts. Enamel is only formed prior to tooth eruption and cannot be naturally repaired after eruption into the mouth.

Hypoplasia/hypocalcification results from disruption of the normal enamel development. Ameloblasts are very sensitive and minor injuries can result in enamel malformation.

The most common acquired cause of enamel hypocalcification of one or several teeth is trauma to the unerupted tooth. This may be due to any external trauma, but is most often associated with the extraction of a deciduous tooth. In traumatic cases, one or several adjacent teeth may be affected. Additional causes of this pattern are infection or inflammation from a deciduous tooth.

A severe systemic infectious or nutritional problem may also result in improper enamel production. In these cases, most or all of the teeth are affected, but only a small part of the
crown, usually a horizontal circumferential strip. Canine distemper was a common cause of this condition in the past.

Finally, enamel hypoplasia may result from a hereditary condition known as amelogenesis imperfecta. This condition is created by a decrease in the amount of enamel matrix applied to the teeth during. In these cases, nearly all teeth are involved on all surfaces.

Areas of enamel hypocalcification will generally appear stained a tan to dark brown (rarely black) color, and may appear pitted and rough. The tooth surface is hard however, as opposed to the soft/sticky surface of a caries lesion. The areas of weakened enamel are easily exfoliated which will expose the underlying dentin, resulting in staining.

Dentin exposure will result in significant discomfort for the patient (see uncomplicated crown fractures above).

The roughness of the teeth will also result in increased plaque and calculus retention, which in turn leads to early onset of periodontal disease.

For all of these reasons, prompt therapy of these teeth is critical to the health of the patient.

Treatment is aimed at removing sensitivity, avoiding endodontic infection by occluding the dentinal tubules, and smoothing the tooth to decrease plaque accumulation. The most efficient and effective way to accomplish these goals is placement of a bonded composite restoration.

If the damage is severe and the client is interested in a permanent correction, crown therapy can be performed. Alternatively, extraction may be performed; however this is not the recommended course of therapy if the root structure is normal with no evidence of endodontic infection.

**Feline Tooth resorption:** TRs are a very common malady. Reports vary as to their incidence, but approximately 60% of cats over 6 years of age have at least one, and those that have one typically have more. These lesions are caused by odontoclasts which are cells that are responsible for the normal remodelling of tooth structure. These cells are activated and do not down regulate, resulting in tooth destruction.

There are currently two recognized forms of resorptive lesions, type 1 and type 2. Clinically, they appear very similar, as dental defects that are first noted at the gingival margin. However, advanced cases will show significant tooth destruction and may appear to be a fractured tooth. The best diagnostic tool for differentiating between types is dental radiology. With type 1 lesions, there is no replacement of the lost root structure by bone, whereas with type 2 there is generally marked replacement of the lost tooth structure.

Type 1 TRs are typically associated with inflammation such asugal stomatitis or periodontal disease. In these cases, it is thought that the soft tissue inflammation has activated the odontoclasts. The inciting cause of class 1 lesions is a cemental defect. Odontoclasts move in and destroy the dentin, leading to secondary enamel loss and a resorption lacuna. The weakened crown will eventually fracture, and in these cases the root canal system stays intact resulting in continued pain and infection for the patient.

Type 2 lesions are generally seen in otherwise healthy mouths; however the lesions will create local gingivitis. The etiology of type 2 TRs remains unproven. The two major current theories are abrasion injuries from eating hard food and excess vitamin D in the diet. Type 2 TRs show histological evidence of simultaneous repair of the defect by osteoblasts at the same time that tooth is being resorbed by odontoclasts.

Historically, restoration was a recommended therapy, however due to the progressive nature of the disease: extraction is now the treatment of choice. Extractions can be very difficult in these cases due to tooth weakening and ankylosis. Additionally, in some cases, there is little to no tooth structure remaining. In cases with significant weakening and or ankylosis, performing the extractions via a surgical approach is recommended to speed the procedure and decrease the incidence of fractured and retained roots (see extraction article).

Recently, crown amputation has been suggested as an acceptable treatment option for advanced type 2 lesions as it results in significantly less trauma and faster healing than complete extraction. This procedure, although widely accepted, is still controversial. Most
veterinary dentists employ this technique, however in widely varying frequency. Veterinary dentists typically employ this treatment option only when there is significant or complete root replacement by bone. Unfortunately, the majority of general practitioners use this technique far too often. Crown amputation should only be performed on teeth with radiographically confirmed advanced type 2 TRs which show no peri- apical or periodontal bone loss. Crown amputation should not be performed on teeth with: type 1 TRs, radiographic or clinical evidence of endodontic or periodontal pathology, inflammation, or infection; or in patients with L/P stomatitis. Those practitioners without dental radiology capability SHOULD NOT perform crown amputation. In these cases, the teeth should either be fully extracted or the patient referred to a facility with dental radiology.

Missing teeth: There are several reasons that teeth may be missing. These reasons include: congenitally missing, previously extracted, fractured (or extracted) with retained roots, or impacted. The first two scenarios do not require therapy, whereas the latter two may necessitate intervention. Therefore, dental radiographs are indicated in all cases of “missing teeth”.

If dental radiographs reveal retained roots and evidence of inflammation or infection (clinical or radiographic), the teeth should be surgically extracted. If they are “quiet”, the owners should be informed and given the option of having the teeth surgically extracted.

Impacted teeth are defined as any tooth that has not erupted by its normal time. This is generally considered to be the time when the surrounding or contralateral teeth have already erupted. The most common cause of impaction is the presence of an overlying structure that interferes with normal eruption. These structures may be bone, soft tissue, or even tooth/teeth that interfere with the normal eruption path. The most common interference is an area of thick and firm gingiva called an operculum.

Impactions occur most commonly in the maxillary cuspid and premolar teeth (especially PM1). They also occur most often in toy and small breeds as well as brachycephalic dogs.

These patients generally have no overt clinical signs other than a missing tooth in a young animal. Alternatively, there may be a persistent deciduous tooth present.

On occasion, an unerupted tooth may lead to the development of a dentigerous cyst. The incidence of this is unknown in veterinary medicine; however pathologic changes were noted in 32.9% of cases in one human study. Consequently, the presenting complaint or oral examination finding may be a swelling in the area of a “missing tooth”.

A dentigerous cyst is a fluid filled structure which develops from the enamel forming organ, of an unerupted tooth. Small dentigerous cysts are generally asymptomatic, and often go undiagnosed without dental radiology. If clinical, these cysts will generally be seen as swellings in the area of a missing tooth in a young patient. Dentigerous cysts can become quite large and disfiguring, requiring major surgical correction.

In addition, these cysts may become infected, resulting in acute swelling and pain. These cases are often misdiagnosed as abscesses. Finally, dentigerous cysts have reportedly undergone neoplastic transformation. Dental radiographs are generally diagnostic, revealing a unilocular radiolucent area that is associated with the crown of an unerupted tooth. An aspirate obtained for fluid analysis and cytology will be supportive of a cyst. Definitive diagnosis can be achieved with histopathologic analysis of the cystic lining.

Prognosis for these lesions is excellent if diagnosis and treatment are achieved relatively early in the disease course.

Surgical removal of the offending tooth and careful debridement of the cystic lining will prove curative. It is important to avoid leaving any of the cystic lining behind, as this could allow the cyst to reform. Early surgical intervention will result in the least invasive surgery possible.

Oral neoplasia

The oral cavity is the fourth most common place to encounter neoplastic growths. The most common oral growths are the epulids (fibromatous and ossifying). These are benign overgrowths of the periodontal ligament (harmatomas). These can grow very large, but are
not aggressive. Acanthomatous Ameiloblastomas (epulids) are locally aggressive. They do not metastasize and are mildly aggressive locally. They respond well to local excision with ½ cm margins and enjoy a 90% control rate with radiation therapy.

Benign tumors are exceedingly rare in cats. By far the most common malignant oral tumor in cats is a squamous cell sarcoma. Fibrosarcomas are a distant second. Both of these tumors are typically seen in older cats, are locally aggressive, and are late to metastasize. The only therapeutic option at this point is early, aggressive surgery (2cm surgical margins).

The above tumors are also seen in dogs. Their behaviour and therapy is similar to cats, however these tumors respond better to radiation therapy in dogs. In dogs, the most common malignant tumor is a melanoma which is typically seen in older dark pigmented dogs. Melanomas are not only locally aggressive; they also metastasizes very early in the course of the disease. A combination of aggressive surgery, radiation therapy, and chemotherapy is the best way to treat this disease process. In addition, a vaccine has been recently released that shows promise as an adjunct therapy for this disease process.

Eosinophillic Granuloma Complex: The true etiology of these conditions is unknown; however a local accumulation of eosinophils is thought to initiate the inflammation and necrosis. The accumulation may result from a local (food) or systemic allergies; although these lesions have been seen in cases where allergic disease has been ruled out. Additional causes include a response to irritation, such as chronic grooming or traumatic malocclusion. There may also be a genetic predisposition.

Indolent Ulcers are the most common oral manifestation, and they will present as brownish-red lesions on the upper lip or around the maxillary canine teeth. Linear granulomas can be single or multiple: the most common sites are the lips, gingiva, palate and tongue. They are generally non-painful, but can become secondarily infected. The typical presentation is a raised, lobulated yellow-pink mass; however, they can also appear ulcerative causing severe damage to the oral mucosa and underlying bone. This may lead to severe periodontal loss, pathologic fractures, or oronasal fistulas.

Histopathology should be performed to confirm the diagnosis. Following confirmation of the diagnosis, a thorough allergy evaluation should be conducted including food trial, flea treatment, +/- allergy testing.

The acute disease process is best treated with systemic corticosteroids; however corticosteroids should NOT be used for long term disease control due to the significant systemic side effects. The typical initial protocol is prednisone 2 mg/kg q 12 hours for 3-4 weeks. Additional options include intralesional triamcinalone (3 mg weekly) or methyl prednisone injections. Antibiotic therapy is required occasionally to induce remission and/or treat secondary infection. There are also cases that appear to respond to antibiotic therapy alone. Therefore, we initially treat mild cases with antibiotics alone and more severe cases with a combination of antibiotics and corticosteroids.

Many cases remain idiopathic, requiring lifelong therapy; options for this include antibiotics and cyclosporine. Fewer side effects may be expected with cyclosporine in comparison to steroids. Cyclosporine is currently not approved in cats and there are reports of opportunistic fungal and fatal protozoal infections associated with its chronic use. Use the lowest effective dose, and perform regular therapeutic levels and routine blood testing.

Caudal Stomatitis: This is another relatively recent disease process in cats that is frustrating us at present. The best description is a severe immune mediated reaction to dental tissues, but we really don’t know. Some feel that this may actually be a group of disease processes that look the same clinically which is why they can be very frustrating to treat.

The history will generally include anorexia, drooling, gagging, and pain during mastication. Physical exam will typically include a thin pet with unkempt fur. The oral exam will reveal severe stomatitis usually over all teeth. The inflammation will most commonly be worse on cheek teeth than canines and incisors. However, faucitis is the key clinical finding. Severe hyperplastic inflammation to the gingiva can result from periodontal disease, however faucitis will not be present.
A pre-operative blood panel will generally show a marked elevation in globulins (Polyclonal gammopathy) and total protein.

Histopathology is recommended but not required. There have been a few cases with the classic look that were created by another pathology (fungal, Pemphigus). In this case full mouth extractions would be ineffective.

Recently bartonella has been implicated as a possible cause of stomatitis. This is due to the high incidence of bartonella in the domestic feline population. Stomatitis is one clinical sign of bartonella infection; however it is not a typical cause. The other major sign is lymphadenopathy. If you see severe lymphadenopathy with stomatitis, consider testing prior to therapy. Most veterinary dentists do not really think that this is the cause of the vast majority of cases. Treatment is zithromax for 21 consecutive days. In multi-cat households the patient must be isolated or all patients treated. The results are questionable at present and therapy is pricey.

Medical Therapy: Most medical therapies will work for a while, however in general resistance will start within a year or less. In addition, most therapies have side effects worse than the disease process in and of itself. In general, medical therapy is very frustrating to the practitioner and client.

Corticosteroids are the mainstay of most medical therapy today. It is generally very effective at first and is relatively inexpensive for the client. In my experience, injectable (depomedrol 10 mg IM) is much more effective than oral preparations in my experience. However, they will typically lose effectiveness after a year or so requiring higher and higher doses at shorter increments. This generally results in significant deleterious effects. About 10% of stomatitis cases we treat are already diabetic!!!

Antibiotics are safer than steroids but much less effective, especially in long term therapy. They are generally disappointing in their success. Metronidazole and clindamycin are the mainstays of therapy; however Clavamox and amoxicillin can be used as well. Metronidazole may be the antibiotic of choice due to its anti-inflammatory effect.

Other immune suppressive such as Imuran, Cytoxan, Gold Salts, Cyclosporine have been used. However, they are all very expensive with numerous adverse side effects (myelosuppression). Cyclosporine is currently the most commonly prescribed immune modulatory drug (other than steroids) for this disease process. However, its chronic use is very expensive and has been implicated in severe fungal and protozoal infections. Starting dose is 5-10 mg/kg. You need to dose for a trough level of about 500 ng/ml on regular basis. In most dentists opinion it is only really effective AFTER teeth are removed. However, it has shown promise in resistant cases.

Laser therapy is not proven at all, most clients and RDVM's are very unhappy with the long term results. It is very expensive and short term relief only.

Surgical Therapy: Extraction is currently the ONLY effective long term treatment for this disease process in cats. In our experience, the sooner this is done, the better that cats do both post-operatively as well as long term.

For extractions to be successful, the teeth must be COMPLETELY removed. Therefore post-operative radiographic confirmation of complete extraction of the tooth roots is recommended. Following the insurance of complete removal of the teeth, perform aveloplasty to remove the periodontal ligament and smooth rough bony edges. This is typically performed do this with a rough diamond bur.

Studies report a 60% success rate when all teeth caudal to the canines are extracted, however our experience has not been as good. However, whole mouth extractions have a success rate of approximately 90-95% for clinical remission. Slight faucitis may remain, but pets are comfortable. In addition, the rare cases that don't completely respond are generally much more responsive to medical therapy.

If there is NO inflammation to the canines or incisors (which is rare), then the owner is given the option of leaving the canines. However, if these are inflamed, all teeth should be extracted.
Oral proliferative lesions in the dog and cat: non-odontogenic oral tumours

Leen Verhaert

INTRODUCTION

Oral tumours represent approximately 5-10% of all tumours in dogs and cats [1, 2, 3, 4]. In dogs a large proportion of proliferations is reactive or benign [5], while in cats the majority of proliferations is a malignancy [3]. The exact nature of any lesion can only be determined by histopathological examination. Biopsy is indicated for all proliferative or other suspicious lesions such as non-healing ulcers.

The mainstay in treatment of oral malignancies is radical surgery whenever possible.

CLINICAL APPROACH

Examination includes a full physical examination, imaging (radiography and more advanced imaging techniques such as CT and MRI), and histopathology of a representative biopsy.

Thoracic radiographs (right lateral, left lateral and dorsoventral or ventrodorsal views) are indicated in all cases of suspected malignancy. Alternatively, if the patient already receives a CT-scan or an MRI, this can be extended to include the neck- and thorax region.

Clinical staging, based on the TNM-classification of the WHO, helps the clinician to evaluate the tumour in a systematic and methodical way, and stage of the tumour is a prognostic indicator: it describes the clinical extent of disease [6]. Patients in stage I and II carry a good prognosis, depending on histological tumour type, and radical surgery is often curative. For stage III patients prognosis is highly dependant on the histological tumour type (stage = extent, histology = degree of malignancy). Stage IV patients carry a bad prognosis.

EPULIS

An epulis is a non specific gingival growth. It is a clinically descriptive term used for tumours and tumour-like masses of the gingiva [7,8].

While half of the epulides are reactive lesions, approximately one out of five epulides is a locally aggressive or neoplastic lesion [8,9]. Therefore, an epulis should always be histopathologically examined.

MALIGNANT MELANOMA (MM)

Malignant melanoma is historically considered the most common oral malignancy in the dog (30-40% of all oral malignancies), though more recent surveys report squamous cell carcinoma as slightly more common [1,2,3,5,10,11]. While most reports suggest a strong predilection for the male (M:F ratio between 2.5 and 4:1), a large review of MM reports no sex predilection [11]. MM typically occurs in older dogs that have some oral pigmentation. Malignant melanoma is uncommon in the cat, but exhibits the same biological behaviour in the cat as in the dog.

The most common locations are the gingiva and labial/buccal mucosa [11].
lesions dental disruption is common and bone invasion is usually seen. MM is a tumour with rapid growth, and usually shows ulceration and/or necrosis at the time of diagnosis. Amelanotic (unpigmented) melanoma often is a diagnostic challenge, and is extremely aggressive.

Prognosis is extremely poor. Surgical excision of very small and early lesions may occasionally be successful, but for larger lesions surgery is no more than palliative, leading to a better quality of life for the patient [5]. Metastasis to the regional lymph nodes and lungs takes place at an early stage in the majority of the patients. A vaccine became available in the USA, which doubled survival times in a clinical trial [12, 13]. Other possible future treatments may include anti-angiogenic therapy [14]. Recently it has been reported that oral MM cells in dogs show over-expression of COX-2, suggesting that COX-2 inhibitors may be useful in the treatment of canine oral MM [15].

SQUAMOUS CELL CARCINOMA (SCC)

SCC is historically considered the second most common oral tumour in the dog (20-30% of cases), though some recent reports show this is currently the most common oral tumour in the dog [1,2,3,10]. In cats it is by far the most common oral malignancy [4,16].

Canine SCC

The most common site for canine SCC is the gingiva. Mean age of affected dogs is 7-9 years, and there is no sex or breed predilection. Papillary SCC, a specific type of SCC, is an uncommon tumour of very young dogs (often less than 6 months of age) [17,18].

The primary mass is often ulcerated. SCC can present as a chronic non-healing ulcer, without proliferation, and may in those cases be misdiagnosed as an infectious process. Dental disruption is common, bone invasion is found in the majority of lesions, and even tooth roots may be resorbed. The incidence of metastasis of gingival SCC to the regional lymph nodes and lungs is generally low but increases with more caudal sites [5, 19, 20]. Lingual SCC shows metastasis more often [21].

Treatment of choice is wide surgical excision. Especially for more rostrally located SCC this is often curative (up to 85% one year survival rate) [5, 20]. SCC is a radiosensitive tumour, but surgical excision gives the best long term prognosis. Often surgery is followed by radiation therapy, especially in larger tumours with a more caudal location. Other treatment options include medical treatment (piroxicam combined with carboplatin) [22] and photodynamic therapy (for lesions not deeper than one centimetre) [23].

Due to the overexpression of COX-2 in canine SCC tumour cells, treatment with COX-2 inhibiting agents may be a useful adjunct to other treatments. Piroxicam has shown to slow down progression in half of the canine patients with oral SCC [24]. Therefore, it may be useful as the sole agent for owners declining other treatment modalities.

SCC of the tongue and tonsils is less common but also much more aggressive than the gingival form. Tonsillar SCC carries a grave prognosis. Metastasis to the regional lymph nodes develops early in the disease, and at the time of diagnosis 90% of patients will show metastatic disease [25]. Often patients are presented for a large mass in the neck region, which is actually the metastatic regional lymph node.

Feline SCC

SCC the most common oral malignancy in cats (60-70% of all oral malignancies) [4,25]. Oral SCC occurs most commonly in older cats, and there is no known breed or sex predilection [16]. The tumour is most often located in the premolar/molar region of the maxilla, premolar region of the mandible and the tongue. SCC infiltrates readily into the bone, and often the extent of bone invasion is much greater than expected from the clinical appearance of the lesion [16]. In the tongue, the lesion may present as a non-healing ulcerative lesion in the frenulum. Often the tumour is not clearly visible, but can be palpated as a firm mass in the ventral body caudal to the frenulum [5].
The high incidence in cats has lead to research about possible causes for SCC in this species. Contact with carcinogens, such as flea-collars, topical tick- and flea treatments may contribute to SCC in cats because of their grooming behaviour [26].

The best treatment option for SCC in the cat is complete surgical excision of early lesions, though even with extensive surgery survival times for SCC are significantly shorter than for fibrosarcoma and osteosarcoma [27]. Maxillary and tongue SCC have a poor prognosis. Median survival time for SCC is one and a half to two months, less than 10% of patients are alive after one year [16,28].

There is currently no good medical treatment available. While there is COX-1 and COX-2 expression in oral SCC in cats, the effect of COX-2 inhibitors is not predictable [29]. Future treatment options may include Epidermal Growth Factor inhibitors, or products such as Zoledronate (a biphosphanate) to slow down growth [30, 31].

Feline SCC is not very radiosensitive. Radiotherapy has been used as palliative treatment when combined with a radiosensitizer, not improving survival but improving quality of life [32].

FIBROSARCOMA

Fibrosarcoma is less common in dogs, but in cats it is the second most common oral tumour [2,4,25]. Fibrosarcoma is most often seen in large breed dogs, with a younger mean age than MM and SCC (approximately 7 years). In smaller animals, fibrosarcoma most often presents at an older age (>8y) [5]. Fibrosarcoma is seen most often in the maxilla. It may occur as a protruberant mass at the dental margins and palate. Fibrosarcoma may also arise from the nasal cartilages, the lateral surface of the maxilla or the palate, as a smooth mass with an intact epithelial covering. CT scan examination is highly advised because on radio-graphs the extent of most lesions will be highly underestimated. The regional lymph nodes are rarely involved but lung metastasis occurs in approximately 20% of the cases [20].

A specific type, ‘histologically low grade and biologically high-grade fibrosarcoma’, occurs in relatively young dogs, with a predisposition for Golden Retrievers [33]. While biopsies suggest a low histological grade (fibroma or well-differentiated fibrosarcoma), this tumour grows invasively and closely resembles the human aggressive fibromatosis.

Surgery of fibrosarcoma may not always lead to cure, and recurrences are seen in more than half of the cases after wide or radical resection. The one year survival rates are at 40-45% with surgery alone [20]. The combination of surgery and radiotherapy gives far better survival rates.

OSTEOSARCOMA

Osteosarcoma of the oral cavity occurs mainly in medium- to large breed dogs, and usually the patient is middle-aged to older (median age approximately 9 years) [34,35].

Osteosarcoma is seen more often in the mandible than in the maxilla [34]. The rate of metastasis is thought to be lower than that of appendicular skeleton osteosarcoma, and survival rates are longer for oral osteosarcoma (depending on the reports between 26 and 60% one year survival overall) [35]. Prognosis worsens with increasing histological grade and elevated alkaline phosphatase levels [36].

Treatment is by radical surgical excision, preferably combined with adjuvant therapy (chemotherapy, radiation, NSAID). Novel therapy with biphosphonates shows promising results, and may lead to palliation (less bone resorption, and less bone pain) and may have a direct anti-tumour action [37,38,39].

OTHER TUMOURS

Many other neoplasms occur in and around the oral cavity. More information on behaviour of the less common tumours is needed, at present there are only anecdotal reports. Any suspect lesion in the oral cavity should be biopsied and histopathologically examined by an interested and experienced pathologist. Long term follow-up needs to be done, and should be
reported.

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Radical mandibular resection in 11 cats

Alexander Reiter¹, John R. Lewis²

¹ Dipl. Tzt., Dr. med. vet., Dipl. AVDC, Dipl. EVDC
² VMD, Fellow AVD, Dipl. AVDC

Objective: To evaluate outcome of cats undergoing extensive mandibulectomy procedures between 1999 and 2009.

Design: Retrospective case series.

Animals: Cats with at least one entire mandible removed or bilateral lower jaw resections performed at or caudal to the mandibular third premolars.

Procedures: Assessment of history, signalment, type, location and extent of tumor, clinical signs, diagnostic imaging findings, laboratory test results, extent of mandibulectomy, associated surgical procedures, and outcome.

Results: Group A included three cats, two of which had unilateral total mandibulectomy and one had total mandibulectomy on one side and rostral mandibulectomy at the level of the third incisor and canine tooth on the other side. Group B included three cats with bilateral partial mandibulectomies at the level of the third premolar, fourth premolar or first molar. Group C included five cats with total mandibulectomy on one side and partial mandibulectomy at the level of the third premolar, fourth premolar or first molar on the other side. Surgical margins were tumor-free in all cases. Feeding tubes were removed 11 to 63 days after surgery. One cat in group A was euthanized 10 days after surgery due to feeding tube placement complications; the other cats were doing well one year after surgery. Cats in group B had follow-ups 3 to 8 weeks after surgery and were doing well. One cat in group C still required hand-feeding 61 days after surgery (lost for follow-up); two cats showed local tumor recurrence 125 days (euthanized 4 weeks later) and 253 days (lost for follow-up) after surgery; one cat died 935 days after surgery due to unrelated cancer, and another passed away 2371 days after surgery due to renal failure.

Conclusion and Clinical Relevance: Unilateral total mandibulectomies and bilateral partial mandibulectomies are well tolerated in cats. Removal of one entire mandible and partial resection of the other mandible at the level of the fourth premolar/first molar may still provide good quality of life.
Obturation of the prepared root canal—a review

Jerzy Gawor1

1 DVM FAVD Klinika Weterynaryjna Arka, Kraków Poland

Obturation is the sealing and filling of the adequately prepared root canal. It is needed to eliminate the routes of leakage form the oral cavity or periapical tissues into root canal system. Properly performed obturation should prevent recolonization of the root canal system with microorganisms, prevent periapical disease and heal periapical disease in teeth with obvious clinical signs. The major contraindication to perform obturation is persistent haemorrhage. When there is bleeding from the apex final obturation should not be considered. Root canal obturation must respect three dimension character of the endodontic system, although the evaluation of filling quality is based on two dimensional radiography. It is clear from the objectives that the most critical area is the apical terminus of the root canal. At the same time quality of the coronal restoration after obturation is raised by some authors as the most important factor for success. Regardless of the obturation method used, homogenous fill of the entire canal ensure the successful outcome of the endodontic treatment. The leakage or unhealthy periodontal tissues are the cause of failure. In modern endodontic treatment the emphasis is placed far more on cleaning and preparing the root canal system than on filling it. This does not mean that root canal obturation is less important, but that the success of endodontic treatment depends on meticulous root canal preparation.

So far over 500 materials and over 100 different obturation techniques had been described. Only the most popular and discussed methods will be noted.

Materials used in obturation are divided into 2 groups: sealers and solid materials.

Root canal sealers:

Ideal sealer: adheres to the dentin and core material, possesses cohesive strength, establishes a hermetic seal, easy to mix and slow setting. It is radiopaque, non irritating the periapical tissue, biocompatible, non carcinogenic, non mutagenic, bacteriostatic, does not react with tissue fluids, resorbs from the periapical area. Furthermore, the ideal sealer has an ample setting time, does not shrink on setting, does not stain the treated tooth. Finally the sealer should be easily removed if recapitulation is necessary. The ideal sealer currently does not exist.

Sealer cements are used to fill the canal irregularities as well as to theoretically occlude the dentinal tubules. In essence, they fill in what gutta percha cannot. Therefore, a good sealer must have good adhesion to dentin as well as the core material (typically gutta percha). Classically, it has been recommended that the minimal amount of cement be utilized and the vast majority of the obturation be gutta percha. This is due to contraction of the cement during setting. Thinner layer of the sealer inserted into treated root canal and its low solubility provide more effective life of material. Numerous studies have compared the sealers. The various sealers exhibit different features among which the most important are: adhesion to dentin and the gutta-percha (resin based sealer has the highest), setting time (longest time has ZnOE), dimensional change (resin based expand the most and the calcium hydroxide shrinks the most).
Zinc oxide eugenol
Calcium Hydroxide
Calcium hydroxide sealers
Epoxy resins, Polymers
Glass ionomer
Medicated
Mineral Trioxide Aggregate
Silicone materials
Chloroperca

Solid materials
Gutta-Percha
Resilon
Resin Coated Gutta-Percha
Silver cones
Titanic and gold cones
Custom cones

Selection of the material and obturation method is made based on the experience of an operator, their preferences, available instruments and materials, as well as the specific anatomy and pathology of the particular presentation. i.e. wide canals in young patients would benefit from thermoplastic injection, whereas the constricted canals in mature patients may be well filled with the standard cold lateral condensation method. Roots with open apexes, roots fractures, or perforations should be filled with MTA. A slow setting sealer cement is generally preferred, which will allow adequate lubrication for accessory point insertion, and accommodate revision and consolidation of the fill if voids are detected on intermediate radiographs.

Obturation techniques:

Preparation of the sealer and solid material Complete three dimensional obturation cannot be achieved with exclusive use of gutta-percha as it does not penetrate into all irregularities in canal and does not have the adhesive features. At the same time paste-only root fillings have a poor reputation in clinical endodontics. The exception is MTA. Therefore currently is recommended to use small amount of the sealer followed by compaction of the solid material.

The last step of root canal preparation is to evaluate fitting of the mastercone in prepared canal (if indicated).

There are several methods of sealant application: paste injection, use of Lentulo filler, file application, and coating the mastercone. All of above methods may leave air voids and are not sufficient as a sole mean of fill and therefore require further obturation steps with a core material. When performing cold gutta-percha obturation techniques a relatively large amount of sealer is used when with plasticised GP methods only the canal walls should be coated with a sealer.

Application of the sealer alone: This is thought to be insufficient for obturation, mostly due to the fact that the traditional sealer cements contracted during setting, resulting in the creation of voids. Because even 1% shrinkage of a material after setting has been recognized as a potentially significant problem in terms of seal and success.

Application of solid material

Cold gutta percha
Single Cone
Lateral Condensation
GuttaFlow
Simplifill
Vertical Condensation

HEATED GUTTA PERCHA:
Warm Lateral compaction
Warm Vertical Compaction
Continuous Wave Compaction technique
Thermoplastic injection
Hybrid systems
Carrier-Based Gutta Percha
Thermo-mechanical (McSpadden)

CHEMOPLASTISIZED GUTTA PERCHA

OTHER TECHNIQUES INFLUENCING OBTURATION QUALITY

Complications Problems that may occur while and after obturation referring to the quality of seal are: underextension, overextension (refer to vertical fill dimensions), underfilling, overfilling (refers to obturation in any dimensions). Underextended canal may be well obturated except the apical area, overextended is when the gutta-percha point extends into periapical ligament area, when the material is extruded into periapical area it is termed overfilled. Canal that has apex well obturated but has voids - is underfilled. Complications related to obturation procedure may also occur when the forces applied to the compaction extends resistance of the treated root. It is quite often that teeth which are to be treated are weakened by long term disease. Particularly in those cases delicate manipulation is required. The worst consequence of too offensive compaction is fracture of the root which inevitable leads to extraction. Inadequately matched lentulo file (too tight) may bind and break while delivering of the sealer. Ideally is to remove the fractured instrument if possible. At this stage it may be considered to leave it on condition the quality of the seal is perfect. Dealing with heated instruments gives numerous opportunity to burn or damage the surrounding tissues. The same concerns to chemicals. Under general anaesthesia patient will not react to any challenging situations. Most of mentioned situations come from malpractice (not following the standards) and lack of experience of the operator. Some of them are possible to improve when diagnosed, some require extraction or surgical endodontics.

Conclusion

Optimal obturation in small veterinary medicine has been discussed since the beginning of veterinary dental publications started. Numerous studies had been performed to evaluate the best obturation for the veterinary patients. Some studies were conducted in relation to specific teeth like canine and recommended a certain method for a certain teeth.

Despite of the increasing number of available obturative methods and materials, still the most popular way of obturation is lateral cold gutta-percha compaction with presence of the sealer.

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Surgical endodontics in small animal patients

Brook A. Niemiec

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

Indications:

Failed standard root canal
– If you feel that you cannot perform a better conventional
– Poor standard root canal therapy is no reason for surgical

Procedural blockage
– Pulp stone
– File separation
– Stenotic canal (try RC prep and watch-winding first!)

Incomplete apex
– Young patient
– Prefer apexogenesis or apexification first

Apical perforation or apical disease/resorption
– Only if severe, these can often do very well with standard root canal therapy

Equipment needs:

There are several critical pieces of equipment that are required to perform this type of therapy. These include: a dental x-ray unit, high speed air driven unit preferably with a pediatric (mini) hand piece, a sterile surgical pack (scalpel, periosteal elevator, needle holder, burs(701, 330, 1/4), and root end filling material (MTA, IRM, amalgam).

Ideally, an ultrasonic root end preparation tool should be available for the root end preparation as it will facilitate the procedure as well as improve the success rate (see discussion below).

There are several models of ultrasonic retrograde preparation tools. All of these are excellent at performing their given task. However, there units can be quite expensive, especially when the relative infrequency of surgical endodontics in veterinary practice. Therefore, there are tips designed for the piezoelectric ultrasonic scalers that exist in most practices. For a very small investment, these can be obtained so that when the need arises, they are available.

Pre-operative testing:

A minimum database should be obtained consisting of a CBC and chemistry panel including thyroid level in older patients as well as a urinalysis. In addition, this author recommends that patients over 6 years of age have 3-view chest radiographs exposed. Finally, a coagulation profile and Crossmatch should be considered.
Since this is a very invasive procedure, IV Fluid therapy, balanced anesthesia, and proper pain control (NSAIDS, Opioids, regional anesthetic) and antibiotic coverage, along with monitoring should be performed in all cases.

Surgical procedure

Approach:

The incision should be placed utilizing your knowledge of dental anatomy and palpating the juga (if possible) to approximate the apex. Make a curved incision to expose the apex by a wide margin avoiding the attached gingiva. The incision should be made full thickness in one deft motion to enhance healing. Following the incision, the mucosa should be elevated full thickness to reveal the bone over the apex. If there is any question as to the location of the apex, the practitioner should consider placing a radiopaque marker over the apex and exposing a radiograph to ensure that the trephination is in the correct position.

Using a dental bur, the bone is carefully removed to expose the apex. This should be done in a paint brush fashion. Once the apex is identified, it is further exposed for the surgical approach. Enough of the root must be exposed to reveal 6-8 mm of the apex plus a little beyond. This bone removal must be done very carefully to avoid damaging the root or entering vital tissues (nose, mandibular canal).

Apicoectomy:

Once the apex is exposed: using a high speed bur (699 normally) resect the apex. It is important to remove a minimum of 4 mm of apex in order to minimize the possibility of lateral or accessory canals. If you are performing the retrograde preparation with a bur, the apicoectomy should be done at a 45 degree angle to help visualization. If utilizing an ultrasonic retropreparation tool the cut should be performed at a 90 degree angle. In fact, the 90 degree angle provides superior seal to the traditional 45 degree angle when ultrasonic units are used to prepare the cavity. The granuloma should be debrided with a curette and a sample submitted to the lab for histopathologic analysis. Following this, the defect is rinsed and packed with cotton pellets to help catch scatter.

Apical preparation:

The apical portion of the root canal system is then prepared to a minimum depth of 3 mm.

This was classically accomplished with a small round bur. The bur is placed into the canal and carefully moved coronally, ensuring that the GP is completely removed. In tight spaces, a slot of matsuri may be necessary to achieve an acceptable fill. For ultrasonic preparation, the reotip is then placed on a moderate setting and gently tapped into the obturative material. The tip is moved in all directions in and out and up and down until the canal is prepared to the selected depth (minimum of 3-mm). It must be noted, that there will be no undercut created during ultrasonic debridement. Therefore any filling material that requires mechanical retention (i.e. amalgam) will require additional bur preparation. The expanding use of MTA makes this a mute point in most operatories.

Retrograde filling:

Following the preparation, an intraoperative radiograph is recommended to ensure complete removal of filling material to an appropriate depth. In addition, it is further recommended to employ a periodontal probe to ensure that the preparation is of sufficient depth. Providing that the radiographic and physical evidence of proper preparation exists, the apical portion of the root canal is filled.
Amalgam, IRM, and EBA have been used historically; however MTA is the current treatment of choice. If there is severe inflammation and seepage, MTA use may be a concern due to the moisture. The selected material is placed with a retrograde filling instrument and packed into the canal to fully and densely fill the canal. The canal should be completely to slightly overfilled with a minimum of splash. If there is any concern of proper fill, a radiograph should be exposed at this time.

Closure:

The cotton pellets are removed and the area thoroughly cleaned and debrided. The defect is packed with an osseopromotive substance and the incision closed normally. If a post-operative radiograph has not been exposed, one should be at this point.

Post-operative Care:

Proper pain medications and antibiotics are prescribed and the clients instructed to feed only soft food for 2 weeks.

Recheck radiographs in six months are critical to ensure success of the procedure.

The case for less surgical trauma, increased root retention, and less aggressive cavity preparation is made by several different factors.

Discussion:

There are numerous reasons that ultrasonically prepared root end fillings are superior to those created with a carbide bur. These are detailed below.

First, the apicoectomy does not need to be performed at a 45 degree angle as access is much easier using these instruments. This decreases the amount of root structure that must be sacrificed in order to restore the root end. In addition, a right angle prep is simpler to perform than a 45 degree angle in this author's hands due to the fact that the depth is easier to gauge. A 90 degree angle has also been shown to decrease microleakage when compared to 45 degree angle preps.

Less apical bone needs to be removed when utilizing ultrasonic reotips. This is due to the 90 degree apicoectomy as well as the fact that there is no need to create room for the head of a high-speed bur beyond the apex of the tooth. This can be of critical importance in some instances where the increased removal may result in the compromise of the mandibular or infraorbital canal and the associated vessels and nerves.

The retroprep is considerably smaller when utilizing ultrasonic reotips than when utilizing a bur. This is due to the ultrasonic tip will more selectively remove the obturative material without indiscriminate removal of critical root structure.

The combination of these three factors results in much less surgical trauma as well as retaining more root structure, thus increasing retentive ability.

Studies have shown that the preparations achieved by ultrasonic preparations are less contaminated compared to bur preparations in several ways.

They have a much decreased smear layer compared to conventional preparation. Smear layer is a big concern in conventional endodontics as it interferes with the bonding ability of the sealant and restorative materials. This concern is of equal or greater importance in surgical endodontics as the restoration is only a few millimeters in depth.

In addition, scanning electron micrograph examination of prepared canals revealed that those prepared with ultrasonic instruments were cleaner than those prepared with burs. This increase in cleanliness is obviously important clinically.

The cavitation produced by ultrasonic instruments is a known antimicrobial method. This has been shown in numerous studies in both the standard endodontic and periodontal disciplines. In fact, the ability of these instruments to “sterilize” plaque is the basis of the perio BUD theory of periodontal therapy (controversial).
Finally, it has been noted that ultrasonic preparation creates deeper and more parallel preparations with increased retentive ability. This results in improved seal at the apical portion.

The combination of a cleaner and more sterile canal with less smear layer results in a superior seal of the retrofilling and therefore a more favorable prognosis. This superior seal has been demonstrated in a controlled experimental study.

Many of these benefits are directly or indirectly responsible for the most important advantage of ultrasonic preparations over traditional bur preps: improved success rates. Studies have shown success rates of 96% (82% complete and 14% partial), 92.4%, and greater than 90% utilizing this method. This is in comparison to the 62% (57% complete and 5% healing), and 82% (71% complete and 11% partial) in those cases treated with burs. The one study that directly compared the two methods reported 85% complete healing in the ultrasonically prepared teeth and a 68% success rate in the group treated with traditional burs. Therefore this technique appears superior to traditional burs. The only concern with this conclusion is that all the rotary treated teeth in these studies will filled with amalgam, where as many of the ultrasonic treated teeth were filled with super EBA which has been shown to be superior to amalgam in other clinical trials. Therefore these studies should be evaluated in this light and we should look to future studies comparing similar root end fillings prior to making the final descion on the preferred method of root end filling.

Finally, there are statistically less perforated cavities in roots treated in this manner as opposed to burs. This is also likely due to the selective removal of obturating material. Reotips also appear to be able to follow the contours of the root surface better than burs. The result of the above will be fewer iatrogenic complications.

One possible negative of these instruments is surgical time. Some studies show that there is increased time involved when treating teeth with ultrasonic tips. Other studies reveal no significant change in time spent. The major negative aspect of ultrasonic tips is that they appear to cause an increase in microcracks in the root end. This is concerning as it may increase leakage and promote failure. However it appears that this damage can be minimized to negated by utilizing a low to moderate as opposed to high power setting.

There is some discussion of the benefits of diamond coated vs smooth stainless steel tips. There is a feeling that the diamond encrusted tips are superior to smooth stainless steel tips. This has not been borne out in the studies to date. Studies show that preparations with smooth tips were cleaner and smoother than diamond encrusted tips. However, a different study reported that diamond coated tips created a superior cavity than smooth tips. These are likely less clinically relevant than the studies which revealed that the dye leakage was similar in the two groups. The one report noted that diamond coated tips appeared to be much more aggressive than smooth tips. This does speed the procedure, however at the risk of iatrogenic damage if not used with care. Therefore, either tip is acceptable, however at this point the limited to no advantage of the diamond coating does not appear to justify the increased cost.
The importance of radiology in dentistry

Cecilia Gorrel1

1 BSc, MA, Vet MB, DDS, MRCVS, HonFAVD, DEVDC, European and RCVS-recognised Specialist in Veterinary Dentistry, Veterinary Oral Health Consultancy, 17 Burnt House Lane, Pilley, Hampshire SO41 5QN, UK.

Radiography is a vital diagnostic tool in veterinary dentistry. Radiographs are required to:

1. Reach a diagnosis
2. Assess extent of pathology
3. Plan optimal treatment
4. Perform certain procedures
5. Assess outcome of treatment performed

General anaesthesia is required for radiography. Ideally, clinical examination and recording should precede the radiographic evaluation. It is also useful to clean the teeth before any radiographs are taken. Dental calculus, because it is radiodense, can obscure pathological lesions on a radiograph.

For a dental radiograph to be diagnostic, it should be an accurate representation of the size and shape of the tooth without superimposition of adjacent structures. Intraoral (film placed inside mouth and X-ray beam directed from outside the mouth through tooth and adjacent structures onto the film) radiographic techniques are therefore required. The two basic techniques (1) are:

1. Parallel technique for the mandibular premolars and molars

   The patient is placed in lateral recumbency (with the side to be radiographed uppermost) Film is placed between the tongue and the teeth and pushed as far down into the sublingual fossa as possible The X-ray beam is then directed from lateral to medial at right angles to the long axis of the tooth.

2. Bisecting angle technique for all other teeth

   The film is positioned at an angle behind the tooth. An imaginary plane is drawn half way between the plane of the film and a plane through the long axis of the tooth, i.e. at the bisecting angle, and the X-ray beam is directed perpendicular to this plane.

Full mouth radiographs describes a series of films where each tooth of the dentition is accurately depicted in at least one view. A full mouth radiographic series of all animals undergoing dental examination provides valuable information, but is not always practically or financially viable. However, it is strongly recommended that all adult cats have full mouth radiographs taken as part of the oral and dental examination. Odontoclastic resorptive lesions are common in cats and clinical examination without radiography will only detect end stage lesions. In cats, it is necessary to take a minimum of 8 views, but 10 views are recommended, to ensure that all teeth are properly visualised. In the case of dogs, full mouth radiographs are encouraged, especially at first examination. If this is not possible (time or financial restrictions) then radiographs are taken where indicated based on the findings dur-
ing the clinical examination. In the event of full mouth radiographs, the size of film and the number of films used will depend upon the breed of dog and the shape of its face.

Equipment and materials for conventional intra-oral radiography:

1. X-ray machine
2. X-ray film
3. Processing facilities
4. Mounts or envelopes for film storage

A dental X-ray machine is preferable to a veterinary X-ray machine. However, most veterinary X-ray machines can be used for dental radiography, but the film-focus distance will need to be adjusted to between 30-50cm.

To allow intra-oral film placement and achieve high definition, dental film should be used. Dental film is single emulsion, non-screen, and is available in three sizes (occlusal, adult periapical and child periapical) and different speeds. The dental film is packed in either a paper or a plastic envelope and the film is flanked by black paper and backed by a thin lead sheet (foil) that reduces scattered radiation.

Automated processors are available for dental film processing, but excellent results can be obtained with the use of a chair-side processor.

In the last five years the major development has been in the introduction of digital dental radiography. The techniques for taking radiographs have not changed. However, the processing using digital is much simpler, cheaper and faster than conventional methods. Given the relative low cost of entry for a digital system and the benefits in terms of speed and ability to manipulate the images via the software I would strongly recommend investing in such a system from the outset. There is a fast payback of the initial investment.

Extra-oral views are not ideal for dental examination mainly due to superimposition of the contra-lateral side, which obscures the image and causes distortion of the image. However, it may be possible to obtain diagnostic radiographs of the maxillary and mandibular premolars and molars using extra-oral film placement, especially in dogs with wide skulls. Some examiners routinely use extra-oral film placement to radiograph the maxillary premolars and molar in the cat. The technique (1) is as follows:

The film is placed on the table and the animal is placed in dorsolateral recumbency with the side to be radiographed closest to the film: the mouth is held wide open using a radiolucent device, e.g. plastic needle cap and the head is tilted so that the maxillary (or mandibular) teeth are almost parallel to the film. The direction of the beam is adjusted according to the bisecting angle technique to reduce image distortion.

Radiographs should be viewed on a viewing box with minimal peripheral light and preferably using magnification. It is recommended to radiograph the contra-lateral structures, to those being evaluated, for comparative purposes. A good knowledge of the radiographic appearance of normal structures of the upper jaw and mandible is imperative to avoid misdiagnosis.

During the presentation clinical cases will be used to highlight normal and abnormal radiographic features and to demonstrate the importance of including radiographs in dentistry. It is in fact impossible to practice dentistry without the use of imaging.

References

Treatment of tooth fractures

Barbara Möhnle
1 DVM

The different types of tooth fractures can be classified according to the localization:

- Fissure of enamel
- Fracture of enamel
- Fracture near the pulp
- Crown fracture with opening of pulp
- Flap fracture without opening of the pulp, up to the gingiva
- Crown root fracture
- Root fracture

Fissures of enamel are often found at dogs canini. Especially dogs which like to carry things and working dogs. These teeth have to be seen very critically as a crown fracture may occur. Such teeth show a weakening which could eventually be treated with enamel boostering measures. Very careful work is essential.

Pure fractures of enamel occur. Here more or less parts of enamel are splintered away from dentin. Can be treated with flowing resin composite. These restorations prevent any further abrasion at this areas. They are not very firm and, depending on localization, have to be reconditioned and checked regularly.

Pulp near fractures are usually crown fractures. Due to the spongy structure of dentin bacteria may enter the pulp via the canaliculi of dentin and cause pulp inflammation. Thus these fractures have to be provided with a filling. Because many filling materials cause inflammation of pulp an intermediate filling with calciumhydroxide as borderline to pulp is important.

Crown fractures with open pulp are often presented. Here time of occurrence is essential. Very fresh fractures can be served with vital amputation. Working clean and sterile is essential.

Pulp is amputated with a sterile drill. Calciumhydroxide or MTA is applied to the remaining pulp, closed with intermediate filling and permanent filling.

These teeth need very regular x-ray monitoring for a fast detection of root canal dieback. Ideally a bridge can be seen underneath the calciumhydroxide, the filling was successful. This means that secondary dentin was created.

In case if there is no bridge visible, filling of the root is advised. The same advise is valid for old fractures: filling of the root at once. Filling of the root may cause complications. A bleeding in the root canal which cannot be stopped should be temporary closed with calciumhydroxide. Some weeks later the final filling can be done.

Flap – fractures at teeth up to the level just under the gingiva can be found at nearly all teeth, but very often at P4 of upper jaw.

This fracture creates a great area of free opened dentin. Affected teeth may be provided with fillings, which maintain frequently bad. Parapulpar pins can be used to fixate the filling. Another possibility is to fabricate a crown or partial crown for this tooth.

Important is to care for those teeth, open lying dentin shows wide caniculi of dentin, through which bacteria can invade the tooth and devitalize the root.

Furthermore a huge amount of tartar is attached. Care has to be taken that the fracture-
line is treated always up to the gingival line. There are various possibilities. The gingiva can be displaced. To reduce the level of gingiva is always the worst solution. Attached gingiva does not regenerate after removal, the defect of gingiva has to be closed with flaps.

Pure fracture of crown root can very often not be saved, the teeth have to be extracted.

If extraction is not avoidable, documentation with x-rays and photographs is advisable. In case of doubt you are able to certify that a pure breed dog has had a certain tooth which could not be kept.

Pure root fractures are very rare. There are reports that the root may heal with secondary dentin.

Very often root resorption can be seen in these areas. These teeth must be checked regularly, arising problems can be realized fast. One of these problems is an infection of the root canal via alveolar gap. The same can happen to sane teeth with parodontitis.

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Non-invasive and invasive jaw fracture repair

Alexander Reiter

1 Dipl. Tzt., Dr. med. vet., Dipl. AVDC, Dipl. EVDC

Introduction

Prior to surgical repair of any damaged hard and soft tissues, the aim of treatment for head trauma should focus on (1) stabilizing the cardiovascular and respiratory systems to obtain optimal blood pressure and oxygenation, and (2) preventing or limiting secondary brain injury such as cerebral edema or ischemia.

Anatomy

The mandible and maxilla differ from the rest of the skeleton in that they contain teeth. Dental roots occupy most of the dorsal two-thirds of the mandibular body. In small-breed dogs and some larger dogs, the tooth roots may reach into the ventral mandibular cortex. The ventral third of the mandible includes the mandibular canal, which contains the mandibular artery and vein and the inferior alveolar nerve.

In the upper jaw, the incisive bone and the maxilla contain all the teeth, and the infraorbital canal (containing the infraorbital artery, vein and nerve) penetrates the maxillary bone in the area of the fourth premolar and molar teeth.

Traumatic Versus Pathologic Jaw Fracture

Traumatic jaw fractures are secondary to automobile trauma, falls, kicks, hits, gunshots, and fights with other animals.

Pathologic jaw fractures are secondary to periodontal disease, oral neoplasia, and metabolic abnormalities (e.g., hyperparathyroidism). While metabolic disease (rubber jaw) may have accounted for a higher number of pathologic jaw fracture in the past, the introduction of well-balanced commercial pet diets now makes the development of nutritional secondary hyperparathyroidism a rare occasion.

Location of Jaw Fractures

Common sites for mandibular fracture in dogs include the region of the mandibular molars (particularly at distal roots of mandibular first molars) and the area immediately distal to the mandibular canines. In cats, the mandibular symphysis (symphyseal separation and perisymphseal fracture) and the condylar process of the ramus are frequently involved. A bilateral rostral mandibular fracture is sometimes seen with trauma that led animals fall and land on their chin.

A common injury of the upper jaw is a unilateral separating fracture of the maxillary process (a fracture across the maxilla at the level of the canine tooth and premolar teeth), so that the anterior portion of the upper jaw is highly mobile. Some cats with head trauma present with traumatic cleft palate or a unilateral separation of the temporal bone from the parietal bone.
Diagnostic Tools

Following stabilization of life-threatening injuries, jaw fractures can be evaluated under sedation or general anesthesia. The mandibular and maxillofacial bones and the temporomandibular joints (TMJs) are palpated both extraorally and intraorally for asymmetry and discontinuity, and the oral cavity is inspected for mucosal lacerations, fractured and displaced teeth, and (submucosal) hemorrhage. Oral and maxillofacial injuries may include tooth fractures, tooth luxations and avulsions, fractures of the mandibular, maxillary, palatal, nasal, frontal, zygomatic, temporal and other bones of the skull, oronasal defects, TMJ dislocations, lip avulsions, and various other soft tissue injuries.

Dental radiographs should always be taken to assess tooth injuries and further define jaw fracture sites. Standard medical radiographs are often an insensitive diagnostic tool in major head trauma patients. Most mandibular and maxillary fractures can be satisfactorily assessed with size 2 and 4 dental radiographic film and intra-oral imaging technique. Dental radiography is quicker (a) in obtaining appropriate and diagnostic views and (b) in producing an image of higher quality and detail, compared to standard medical radiography. The largest dental radiographic film can also be utilized to evaluate injuries to the zygomatic arch, mandibular ramus, TMJ and tympanic bulla in the cat and smaller dog. Standard medical radiography and other imaging techniques should be considered for caudal mandibular and maxillary fractures in medium-sized and larger dogs.

When radiographs do not provide enough detail, computed tomography (CT) and magnetic resonance imaging (MRI) may be necessary. CT is indicated for caudal mandibular and maxillary fractures and TMJ injury that cannot be assessed adequately with dental or standard medical radiography. CT scanning is preferred over MRI for imaging bone and identifying areas of acute hemorrhage or edema. Imaging studies of the intracranial structures should be considered in any patient with moderate to severe head trauma on presentation, failure of improvement, or deterioration of clinical signs.

Mandibular Fractures

Unilateral mandibular fractures may result in the jaw to be deviated toward the side of injury or cause other malocclusion. Bilateral mandibular fractures may result in a dropped-lower-jaw appearance.

An oblique mandibular body fracture, with the fracture line running in a rostroventral direction, is relatively stable, as the masticatory muscle forces will hold the fracture segments in apposition to a large extent (favorable fracture). On the other hand, a mandibular body fracture with the fracture line running in a caudoventral direction is unstable, as the muscular forces will lead to considerable displacement of the fracture segments (unfavorable fracture).

Fractures of the mandibular ramus are relatively stable because the surrounding muscle mass usually prevents gross displacement of the fracture segments. Condylar process fractures may occur after hit-by-car trauma or falling from a height. Although they often heal as pain-free and functional nonunion, comminuted fractures could result in TMJ ankylosis and inability to open the mouth adequately which is a common post-traumatic complication in immature and young adult cats. The prognosis after corrective condylectomy is guarded to poor if the animal is very young, as the cut bony surfaces are inclined to reankylose.

Maxillary Fractures

Fractures of the upper jaw are often multiple. The may remain in alignment, or they may be depressed. Epistaxis, facial swelling (edema), pain, and asymmetry are the usual physical findings, with or without crepitus and subcutaneous emphysema.

Fractures of the incisive, nasal, maxillary, and palatal bones and the bones that form the zygomatic arch (zygomatic and temporal bones) may often not be severely displaced and do not require surgical repair other than suturing of torn soft tissues. The soft tissues that surround the bone fragments provide support, and healing usually proceeds without complica-
tion. When soft tissue attachments are destroyed during overzealous attempts to reduce the fractures, this biologic support is lost. Sometimes, fractures of the temporal bone or a separation of the temporal bone from the parietal bone may go unnoticed in cats with hit-by-car or high-rise trauma. Combined fractures of the zygomatic arch and the mandibular ramus can result in excess callus formation and ankylosic fusion in young animals, resulting in decreased range of TMJ motion.

Severely comminuted, depressed, and grossly unstable upper jaw fractures require surgical intervention. Airway obstruction caused by maxillofacial trauma (displaced bones, swelling, or blood) may be life-threatening in brachycephalic dogs and those that have pre-existing respiratory problems. It is recommended that such animals be placed in an oxygen cage; the nostrils should be cleaned of dried blood and discharge and kept unobstructed.

Teeth in Jaw Fracture Lines

The relationship of teeth to fracture lines must be determined. Jaw fracture stabilization and postoperative occlusion are unfavorably influenced by extraction of structurally intact teeth associated with fracture lines. Instead, these teeth contribute to proper alignment of fracture segments and provide surface areas for anchorage of fracture repair devices. Extraction of a tooth entails further trauma to and weakening of the bone tissue and also presents technical difficulties when the bone fragments are highly mobile. Results of human studies suggest that the complication rate with regard to fracture healing is not necessarily lower following extraction of teeth located in fracture lines, and teeth should be retained unless there is an absolute indication for removal.

Teeth adjacent to fracture lines or considered for anchorage of repair devices should be evaluated for the presence of periodontal and endodontic disease. Healthy teeth can be retained, however, it should be noted that teeth with fracture lines extending along the periodontal ligament towards the root apex have the poorest long-term prognosis. Such teeth should be carefully monitored for any evidence of periodontal or endodontic pathology, and appropriate treatment must be instituted as soon as either is recognized. Severely mobile teeth, teeth with advanced periodontitis or periapical disease, and those that interfere with reduction of the jaw fracture should be extracted, as they may inhibit bone healing. Alternatively, hemisection of the tooth and extraction of the crown-root segment in the fracture line can be performed, and the retained crown-root segment must then be treated endodontically. If crown-root segments with adequate bone support can be retained, they may also aid as anchorage structures for interdental wiring and provide surface areas for intra-oral resin splints.

Patient Preparation

Endotracheal intubation through a pharyngostomy or tracheostomy opening allows intraoperative evaluation of the occlusion, particularly when comminuted fractures are present at several sites of the upper and lower jaw. A temporary tracheostomy may also be useful during postoperative recovery of an animal with airway obstruction. Pre-, intra- and post-operative monitoring of the head trauma patient should emphasize blood pressure, oxygenation and ventilation, and serial neurologic evaluation.

Initially, the mouth is flushed with dilute chlorhexidine solution, and the fracture sites are carefully debrided to remove blood clots, food particles, foreign material and necrotic tissue. Bone fragments that could contribute to the stability of fracture repair should be retained. Soft tissue lacerations are then sutured or be closed after orthopedic repair. Most mandibular and some maxillary fractures are open to the oral cavity, and bacterial contamination is inevitable. Antibiotic therapy may be considered in selected cases to prevent infection.

Maxillomandibular Fixation

Tape muzzles can be used in minimally displaced fractures, in young animals with rapid
bone healing, pathologic mandibular fractures, and as a means of additional support in cases where other fixation techniques did not achieve optimal stabilization. Muzzling can be temporary first-aid treatment when patient stabilization is necessary before surgical intervention. Proper occlusal alignment and stabilization of caudal mandibular fractures, pathologic mandibular body fractures or chronic temporomandibular joint luxation may also be achieved with a bilateral bis-acryl composite bridge that bonds maxillary and mandibular canines together. When fabricating the muzzles and bridges, the mouth is kept open slightly (5 to 10 mm in cats and small dogs and up to 20 mm in larger dogs) to permit the tongue to protrude and allow prehension of water and food.

Circumferential Wiring

This is usually performed for treatment of mandibular symphyseal separation or parasymphyseal fractures, which are common injuries in cats with high-rise or hit-by-car trauma. A stab incision is made at the ventral midline in the chin area. A large needle is inserted between bone and soft tissues of the mandible distal to the canines, through which a wire is passed. The needle is then reinserted on the other side and the oral wire end passed through the needle. The needle is removed, and while the symphysis is stabilized in proper alignment, the wire ends are twisted until the lower jaw is stable. The wire is trimmed and bent caudally, so that the skin covers it. The wire should be removed in 4 weeks. Leaving it in place for longer or overtightening it bears the risk of bone and soft tissue necrosis and exposure of canine tooth roots.

Interdental Wiring and Intraoral Splinting

Interdental wiring should be performed prior to splint application. The Stout multiple loop or modified Risdon wiring techniques make use of the gingiva and dental crowns as anchoring points to stabilize and align fracture segments and to provide additional retention surface for splint materials. Wiring should include at least two teeth of each fracture segment. Intraoral splints made of bis-acryl composite are ideal for the repair of jaw fractures where teeth are present for anchorage of the device. The splint material is applied primarily to the lingual surface of mandibular teeth and the buccal surface of maxillary teeth. The teeth are cleaned and polished with pumice, then dried with an air syringe and acid etched with 40% phosphoric acid gel. Self-curing bis-acryl composite is applied to the teeth via an applicator gun. Once the material has set, the splint is trimmed and polished. The splint is removed by interdental sectioning with a bur and removing the material in segments, using an extraction forceps in a shearing motion. The teeth are then cleaned and polished. Gingival inflammation from splint and wire trauma usually subsides within a few days.

Osseous Wiring

This can be used alone or in combination with interdental wiring and intraoral splint application. After reflection of mucoperiosteal flaps on buccal and lingual bone surfaces, holes are drilled through the mandible no closer than 3 mm to the fracture line, carefully avoiding tooth roots. Two wires are usually used in a triangular configuration where two holes are made in the caudal fracture segment and one (or two) in the rostral segment. Once tightened, the wire ends are bent to lie flat against the bone surface, and the mucoperiosteal flaps are repositioned over the wire ends. In young animals, the wires often become entirely incorporated in the bone and may not need to be removed.

External Skeletal Fixation

This is useful in fractures associated with extensive soft tissue injuries, severe comminution, and edentulous or missing bone segments. At least two Kirschner wires or small Steinmann pins are placed into each fracture segment. Plastic tubing is placed over the external wire/pin ends, and while normal occlusion is maintained with the jaws closed, the tube is
filled with self-curing acrylic or custom tray material. To remove the device, the wires/pins are cut close to the acrylic bar with pin cutters and then pulled from the bone. The wires/pins should only engage in one mandible, not cross the intermandibular space and avoid trauma to tooth roots.

**Bone Plating**

Mini-, intermediate, and microplates allow placement close to the alveolar margin. The screws may be angled to avoid impingement on tooth roots. Specialized equipment is required, and significant soft tissue elevation is necessary for the placement of these plates, which may compromise the blood supply to the fractured bone segments (particularly when advanced periodontitis has already resulted in loss of bone). Proper occlusion is to be maintained, and trauma to tooth roots must be avoided. Return to normal function is rapid, and healing occurs with little or no callus formation.

**Partial Mandibulectomy and Maxillectomy**

Bilateral pathologic mandibular body fractures are a severe complication of advanced periodontal disease in geriatric, small-breed dogs, most commonly occurring in the area of the first mandibular molars or distal to canine teeth following minimal bony stress. Salvage procedures involve extraction of all diseased teeth and partial rostral or central mandibullectomies with bilateral advancement of the lip commissures (commissuroplasty).

**Postoperative Care and Possible Complications**

The occlusion should be assessed and radiographs obtained prior to extubation. Further postoperative management includes control of pain, home oral hygiene (antimicrobials, tooth/splint brushing), restraining devices (Elizabethan collar, muzzles), and a soft food diet for several weeks. Fracture repair devices are removed following radiographic confirmation of fracture healing, usually 3 (young animals) to 6 weeks postoperatively. In general, affected jaws and teeth should be reevaluated in 6 months to determine appropriate healing and whether further dental treatment is required.

Postoperative complications associated with the management of jaw fractures include early loss of fracture devices, malocclusion, wound dehiscence, osteomyelitis, bone sequestration, delayed union, nonunion, oronasal fistula, and various forms of dental abnormalities and facial deformities in the growing animal. Proper surgical technique, adequate pain control, and an Elizabethan collar may prevent the loss of fracture devices.

Treatment options for postoperative malocclusion include immediate removal of the fixation device, followed by proper reduction. Small occlusal discrepancies after device removal can be corrected by odontoplasty; if malocclusion is severe and prevents closure of the mouth, extraction of one or more teeth will be necessary to restore acceptable masticatory function. Although selective extraction of maloccluding teeth can permit the patient to close the mouth in an inadequately reduced jaw fracture, it is considered a significant compromise for poor surgical technique.

Bone fragments impacted into the nasal cavity and diseased teeth in the fracture site could predispose to osteomyelitis and bone sequestration, which may be associated with delayed healing or nonunion. Teeth in jaw fracture lines should be monitored for periodontal and endodontic complications. Severe jaw fractures in puppies can disturb normal skeletal growth and development of the teeth, resulting in facial deformities and dental abnormalities in the growing animal.
Palatal surgery techniques

Loïc Frederic Legendre

Oronasal Fistula. Most often, secondary to a canine tooth extraction. Sometimes it precedes the extraction, being due to severe periodontal disease. Rarely, due to trauma alone.

Single layer repair. It is fairly simple. Flap is harvested from buccal surface and is an advancement flap or a rotational flap. Important points are: debride and freshen the edges carefully and thoroughly. Cut the flap larger than you think you need. Elevate with care. RELEASE THE TENSION. Place sutures every 3 mm. The first surgery has the best chance of being successful. For each successive trial the blood supply to the area is diminished and the healing is hampered. The one layer technique works very well in most cases.

The double layer flap technique is rarely needed (except only for the exam!). It has the advantages of providing 2 layers of repair with epithelium facing both cavities. Its disadvantages are that it is much more invasive and much more extensive. A piece of palate is harvested (interfering with blood supply and exposing the palatal bone). The palatal flap is elevated and flipped over to cover the fistula. A buccal gingivomucosal flap (advancement or rotational) is then harvested to cover the twice larger defect created by the palatal flap. The double layer make the repair more stable (not moving in and out with every breath) and more resistant to desiccation. It is reserved for times when the single layer has failed.

Auricular cartilage flap technique. This technique too has been reserved for failed previous attempts. Nevertheless, it is simple and fast enough that it could be used as the first choice procedure. The area is debrided and the bone defect is measured or even mapped. A longitudinal incision is made on the dorsal surface of the ear pinna. The cartilage is exposed and the skin edges are kept away using a couple of Gelpi retainers. The measured area of cartilage is harvested and placed on saline soaked gauze while the ear incision is closed in a subcuticular manner. The cartilage is transferred to the fistula and sandwiched between the bone and the gingival or palatal layers. Anchor sutures are placed in the corners of the flap. Then the gingival/palatal layers are closed over the cartilage, as much as possible. Full coverage, without tension, is best, but not always achievable.

No matter which technique is used, always tell the owners that more than one procedure may be necessary, always!

Cleft palate repair.

Uncommon surgery as the patients are rarely kept alive. Wait till the patient is as old as possible to perform the surgery. For any technique, dissect gently taking extra care to protect the major blood vessels, make sure the flaps are tension free, and that the apposed edges are freshly cut for better healing. Palate is a tough tissue to elevate and to move. As a result, incomplete closures are common, especially in the rostral palate. The owner should be warned that multiple surgeries may be necessary.

Double overlapping flap technique is better designed for wider defects. It has the advantage of providing 2 layers but it also more complicated, it carries the risk of damaging the blood supply, and it exposes a wide area of palatal bone.

Bilateral palatal release or Langenbeck technique applies to fairly narrow defects. It carries less chance of damage to blood supply, less exposure of palatal bone. It works fairly well in the mid palate area.
Langenbeck with auricular cartilage flap technique is the author favourite. The technique is the same except that the cartilage is sandwiched between the palatal bone and the epithelial layer. The cartilage is anchored and the epithelial layer is slid over and closed. The cartilage increases the stability of the repair and prevents desiccation of the underside of the epithelial layer. Thus it offers much better chance of success. Instead of an auricular cartilage flap, a synthetic membrane may be substituted.

If defect is too wide a third technique is necessary; it consists of extracting all the premolars and molars on one side of the maxilla, letting the area heal, and then coming and elevating palate, gingiva and oral mucosa in one piece and sliding it to cover the defect. Auricular cartilage flap technique. Offers the same advantages than for the ONF repair.

Xenograft. Use of a synthetic or pre-harvested membrane to sandwich between the palatal bone and the soft tissue. Offers similar advantages than the auricular cartilage flap technique without having to harvest the cartilage.

Palatal defects, secondary to trauma or electrocution, situated in the caudal part of the palate, can be repaired by one of a few methods: advancement flap, lateral sliding flap, split palatal U-flap techniques.

Advancement flap. A split layer flap is harvested from the soft palate. It is designed with tension releasing incisions and mobilized. It is then carefully sutured over the defect.

Lateral sliding flap. It can be used in soft palate or caudal hard palate defects. It is similar in technique to the advancement flap.

Split palatal U-flap technique. Best suited for larger, midline, caudal hard palate defects. Major disadvantage is the complex dissection of palatal tissue and the resulting large exposed area of palatal bone.

Palatal defects in the rostral part of the palate are harder to repair (little tissue available, nasopalatine fissures, limited blood supply). If large enough they may be impossible to close and may require an obturator.

The cartilage flap can be combined with any of the above techniques to increase the thick-
Multifocal palatal fistula repair by autografting buccal mucosa

Cedric Tutt¹

¹ BVSc (Hons), MMedVet (Med), Diplomate EVDC

Oro-nasal fistulae are defined as communications between the oral and nasal cavities that are lined by epithelium. Although their edges may be apposed during surgery, healing will not occur unless the epithelial covering is completely removed. ONFs may be congenital or acquired and vary in extent, often involving the hard and soft palates. In traumatic clefts of the palate, there is often tension across the palatine suture and this results in extrinsic suture tension that may lead to dehiscence. This tension may be reduced by placing a figure-of-eight tension band around the gingival aspect of the maxillary canine crowns that will appose the palatine shelves. Dental restorative material or acrylic should be used to keep the wire in place and also protect the tongue where the wire spans the palate.

Punctate ONFs may remain after an attempt at surgical repair of a traumatic palatal cleft and these often cause chronic rhinitis. This presentation will describe the use of buccal core graft transplants to treat persistent punctate ONFs.
Validation of a new method based on an image-analysis system for the measurement of dental plaque accumulation in dogs

Claire Mariani1, Florian Boutoille2, Juliane Calvez3, Vincent Biourge4, Philippe Hennet5

1 DVM PhD Royal Canin France
2 DVM private practice Nantes France
3 PhD Royal Canin France
4 DVM PhD ECVCN ACVN Royal Canin France
5 DVM ACVD ECVD

Accurate assessment of the extent of dental plaque coverage on tooth surfaces is essential in periodontal research. Non-subjective indices are needed to evaluate the amount of plaque accumulating on tooth surfaces when studying the preventive effects of specific dental-oriented diets or chewing devices. In veterinary medicine, the Logan & Boyce plaque index (1994) is commonly used (Gorrel, 1999; Logan et al., 2002). It has been shown that this index was inaccurate and modifications have been suggested to improve precision (Hennet et al., 2006). A gingival plaque contour index was recently described though the measurement of plaque accumulation but still needs validation (Scherl, 2009). In humans, computer-assisted planimetric measurements of dental plaque have been proposed and validated (Smith RN, 2001, Smith RN 2004).

In dogs, an image-analysis system has been developed to obtain plaque surface / crown surface ratio on the basis of standardized pictures of dental arches and showed a good correlation with the manual contouring measurement of the plaque (Boutoille, 2010).

Following this previous study, the purpose of the present study was to validate an image-analysis system for dental plaque coverage assessment in dogs, consisting of 3 steps: taking standardized pictures, manual contouring of the crown surface and image analysis of the disclosed plaque to obtain a dental plaque surface / global crown surface ratio.

1. MATERIAL AND METHODS

1.1 Material

1.1.1 Animals

Repeatability was studied using two Bichons frisés and 3 King Charles Spaniels dogs of 19 months old and reproducibility was studied using 1 Yorkshire Terrier, 1 Bichons frisé and 2 King Charles Spaniels dogs, of 27 months old. Dogs weighted from 2 to 8 kg. They had full dentition, normal occlusion and, at most, mild gingivitis associated with dental plaque and calculus accumulation. The dogs were housed in pairs. Dry expanded diets were distributed (on the basis of 132 kcal/kg\(^{0.73}\)) and water was available ad libitum.

1.1.2 Skull

One bone skull of a Beagle dog was used to evaluate the error on the plaque/tooth ratio due to the standardization of the pictures taking.

1.2. Methods

1.2.1 Methods of plaque disclosing and evaluation of plaque coverage

Dental plaque disclosing
Under general anesthesia, tooth surfaces were rinsed with water and a plaque disclosing solution [FD and C red # 3 (erythrosin)] (Reveal®, Henry Schein, Gillingham, U.K.) was applied on the crown surface of the teeth followed by rinsing and gentle drying.

Image Analysis planimetric measurement:

- Step 1: 12.2 million pixels colour pictures of the maxillary and of the mandibular dental arches of the dogs were taken. The head of each dog was fixed with an immobilisation cushion connected with a vacuum pump after obtaining the horizontality of a circular spirit level placed on the mandibular and maxillary canine teeth and the maxillary fourth premolar tooth. The camera equipped with an annular flash was placed on the top of a black box above the dog head, ensuring standardisations of the light setting and the camera positioning.
- Step 2: Manual contouring of the crown surface was performed using Photoshop® CS4 extended (Adobe Systems Incorporated, San Jose, USA) and a graphic tablet (G-Pen M712®, Genius, Taipei, Taiwan).
- Step 3: Image analysis of disclosed plaque on crown surface was performed using a specific algorithm created with the MATLAB® software (The Mathworks Inc, Natick, USA). Each pixel of the crown surface was identified as disclosed plaque or enamel according to the colour Red Green Blue codes. An interface was also developed to calculate directly the dental plaque surface / global crown surface ratios.

1.2.2 Validation of the method
Repeatability of the method was assessed on 9 teeth (Maxillary I, C, PM3, PM4, M1 and Mandibule C, PM3, PM4, M1) from 5 dogs by the same trained duo of operators on four repetitions of the 3 successive steps of the method.

Reproducibility of the method (3 successive steps) was performed by 2 trained duos of operators on 9 teeth (Maxillary I, C, PM3, PM4, M1 and Mandibule C, PM3, PM4, M1) from 4 dogs, with 3 repetitions (3 successive steps) per duo of operators. A Wilcoxon test was performed for statistical analysis.

1.2.3 Calculation of the error of the method
In order to avoid prolonged anaesthesia for the dog, the calculation of the error of the method was realized on a skull. The dental plaque was simulated with a lead pencil directly on the teeth of the skull.

Pictures were taken depending on the place of the bubble in the circular spirit level, one position in the centre of the mark (reference), two positions spanning on the mark for the rostro-caudal axis and two positions for the dorso-caudal axis. For each position, 3 repetitions of the 3 successive steps of the method were performed.

Manual contouring was used to determine the numbers of pixels of the crown and the simulated plaque on 9 teeth (Maxillary I, C, PM3, PM4, M1 and Mandibule C, PM3, PM4, M1). The ratio was calculated for each position and the error was calculated as the absolute difference (%) with the reference position.

2. RESULTS

2.1 Repeatability and reproducibility evaluations
For the global method, average (±SEM) Coefficient of Variation was 8.38 ± 1.14 % for an average plaque/tooth ratio of 61.8 ± 1.8 %. The complete method of dental plaque coverage assessment is repeatable.

No difference was detected between the two duos of operators for the means of plaque/tooth ratio (p=0.68, Wilcoxon test). Average of ratios was 53.3 ± 3.0 % (median 55.7%) for the duo 1 and 52.7 ± 3.0 % (median 55.2%) for the duo 2. Therefore, the global method is reproducible.
2.2 Error of the method according to the step of pictures taking

The average of plaque/crown ratios for the reference position was $13.4 \pm 2.0 \%$. Compared to the reference ratio, the average of error was $4.50 \pm 1.03 \%$.

3. DISCUSSION

The objective of the present study was the validation of an image-analysis system for dental plaque coverage assessment in dogs. In a previous study (Boutoille, 2010), we showed that the steps 2 and 3 of the plaque image-analysis measurement were repeatable and reproducible and we found a good correlation with plaque manual contouring measurements. The global method with the 3 successive steps needed to be validated.

Firstly, from the results of repeatability and reproducibility evaluation it can be concluded that the whole method was repeatable and reproducible, in small breed dogs, including brachycephalic and mesocephalic dogs.

Secondly, the error of the method needed to be evaluated. As the manual contouring was already known to be repeatable and reproducible (Boutoille, 2010), the step likely to induce an error was the picture taking step, especially the positioning of the dog's head. With a bubble spanning on the mark of the circular spirit level, simulating a few meticulous operator, the error was evaluated at 4.5%, which allows obtaining precise values of the dental plaque coverage.

4. CONCLUSION

We validated a new method for dental plaque coverage assessment in dogs. This method is repeatable, reproducible and precise.

Compared with conventional indexes, this new method helps to quantify the dental plaque coverage giving continuous data and allows an archiving of the pictures. It thereby helps to follow more precisely and accurately the evolution of dental plaque deposition in dogs.

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Microbiological contamination of the workplace during the periodontological treatment

Tomáš Ficht¹, Petr Janalík², Jiří Smola³

¹ MVDr. Ph.D.
² MVDr.
³ prof. MVDr. CSc.

Regular parts of periodontological treatment in the dog are the removal of plaque and tartar, subgingival defects treatment and, when necessary, extractions of teeth. To remove the plaque/tartar, ultrasonic dental scalers are usually used. The tip of this instrument produces due to high oscillation frequency large amount of excessive heat and therefore has to be cooled actively during the entire handling. Because of this, air/water spray spreads nearby and contain bacteria of the patient’s oral cavity.

Blood agar plates (10 cm diameter) were used for the environmental contamination monitoring. These were placed 30 and 90 centimeters both to the left and right side of the patient’s head. 2-3 persons were present in the patient’s surroundings during the handling. The plates were exposed for 30 minutes and then sent to microbiological laboratory for aerobic bacteria cultivation and assessment. Monitoring consisted of three phases at 10 measures.

First phase meant “blank“ exposition of the plate without any patient present. These samples showed the normal aerobic bacterial flora at the workplace. Next two phases meant plate exposition during the periodontological handling in dogs. All of them were dogs with full dentition and weight between 10-20 kg with moderate periodontal disease (PDI II-III) and moderate amount of dental calculus. The aim of this study was to quantify the amount of bacteria spread to the patient’s surroundings and to find out if antimicrobial medication prior to the handling can lower the amount of these bacteria. Therefore the patients in phase two and three differed in the antimicrobial medication. Phase two patients were not premedicated before the handling, whereas the phase three patients were medicated with antibiotics five days prior to the handling. In addition, oral cavity odour intensity was measured using a halimeter prior to the handling in all patients and the data were compared. Qualitative results of microbiological cultivation with particular respect to the difference between phase two and three patients were analysed, too.
Guided tissue regeneration (GTR) utilizing a laminar bone membrane in the canine patient

Kevin S. Stepaniuk

1 DVM, Fellow AVD, Diplomate AVDC

INTRODUCTION

Goals of periodontal therapy include control of the plaque biofilm, prevention of further attachment loss, control and treatment of periodontal pockets (pseudopockets, suprabony pockets, and intrabony pockets) and preparing the tooth surface for re-attachment of healthy periodontal tissues. GTR can be utilized to increase periodontal attachment of strategic teeth. Before GTR should even be considered, understanding periodontal disease pathophysiology, the periodontal cleaning including subgingival scaling, subgingival curettage, and root planing, in addition to open periodontal flaps, must be understood.

Guided tissue regeneration is the new formation of periodontal tissues (cementum, periodontal ligament, and alveolar bone) that had been destroyed from periodontitis. Regeneration, reconstitution of lost tissue, is differentiated from periodontal repair, healing of the periodontal wound/defect by tissue that does not fully restore the normal histological architecture.

GTR involves open periodontal flaps, +/- root surface preparations (e.g., tetracycline, citric acid, EDTA), +/- grafting materials, +/- biological modifiers (e.g., growth factors, cytokines), and periodontal membranes. The following notes are not comprehensive. Instead, the notes will highlight membrane techniques and principles that show promise for common types of periodontal defects in canine veterinary patients.

Intraoral radiographs, in conjunction with general anesthesia, are required for assessment, treatment planning, and treatment execution.

I. PERIODONTAL POCKET HEALING

During healing of periodontal pockets, gingival connective tissue, gingival epithelium, periodontal ligament, and alveolar bone compete to create reattachment to the tooth surface. The gingival connective tissue and epithelium colonize the root surface at the fastest rate and exclude, the other more desirable periodontal tissues, periodontal ligament and bone from the root surface. If soft tissue reattaches to the tooth surface, it is often in the form of long junctional epithelium which is susceptible to breakdown and recurrence of attachment loss.

II. INTRABONY DEFECTS

Intrabony defects are radiographically detected as vertical bone loss. Intrabony defects can be classified based on the number of bony walls facing the root surface (e.g., one, two, three, crater defects). Osseous treatments include 1) osseous resective surgery or 2) osseous additive surgery [i] bone augmentation or ii) GTR. GTR is a procedure attempting to regenerate lost periodontal tissues with the utilization of barrier techniques to exclude gingival connective tissue and epithelium. Three-walled defects, > 4mm, have the best prognosis with GTR.
III. INDICATIONS IN THE CANINE VETERINARY PATIENT – INTRABONY POCKETS

Intrabony pockets can often be identified on the palatal aspect of the maxillary canine teeth, the palatal root of the maxillary 4th premolar, the furcation between the mesial roots of the maxillary 4th premolar, and the mesial and distal aspects of the mandibular 1st molars. Intrabony pockets greater than 5 mm, and not involving oronasal fistulas, are candidates for GTR surgery. Prior to treatment of the mandibular 1st molars and maxillary 4th premolars it is important to determine if a contributing factor is the adjacent premolar or molar teeth. The non-strategic maxillary 3rd premolar, mandibular 4th premolar, or mandibular 2nd molar often require extraction if they are contributing to the periodontal disease or are severely compromised.

A combination of periodontal probing, intraoral radiographs, and open periodontal flap surgery are necessary to assess periodontal pockets. The palatal intrabony pockets of the maxillary canine tooth and mesial roots of the maxillary 4th premolar are often not visible on the 2-dimensional intraoral radiograph. Additionally, the location of the palatal pockets precludes osseous resective surgery due to the location of the hard palate.

Clients who wish to save teeth in their pets are often owners who learned about periodontal disease prevention too late. These clients failed to receive education regarding the importance of annual and semi-annual dental cleanings and home care during wellness examinations. The pets are often young to middle aged pets where periodontal defects were detected at the pets first dental cleaning.

IV. GTR GRAFTING MATERIALS

Bone grafting materials should be safe, biocompatible, non-allergenic, non-toxic, free of disease, accessible, and affordable. Grafting materials include 1) autografts, 2) allografts, 3) xenografts, 4) alloplasts. Allografts include freeze dried bone graft, decalcified freeze dried bone graft (DFDBA), and mineralized bone (same species). DFDBA is considered to be osteoconductive as well as osteoinductive. Alloplasts tend to heal via encapsulation by connective tissue. There is often minimal to no new bone formation. In intrabony defects, grafting materials increase clinical attachment vs. open flap debridement procedures alone. However, grafting materials are not necessarily required for GTR when using an appropriate adapted periodontal membrane.

V. GTR MEMBRANES

Membranes should be biocompatible, exclude unwanted tissue, integrate with tissue, maintain space, maintain barrier, stabilize the clot, and protect newly forming bone. Periodontal membranes are required for GTR procedures. GTR membranes stabilize the clot in the bony defect, prevent apical down growth of the gingival connective tissue and epithelium (exclusion), and control cell/tissue populations.

During wound healing, a fibrin clot forms and links to the root surface. Maintenance of this clot with a GTR membrane allows for new tissue attachment by allowing PDL and bone cells, with regenerative potential, to enter the wound first. If the fibrin clot is disrupted, long junctional epithelium will result. Clot formation and wound stabilization are essential for regeneration.

Membranes can be divided into 1) Synthetic non-resorbable membranes, 2) Synthetic resorbable membranes, and 3) Natural biodegradable membranes.

Synthetic non-resorbable membranes include extended polytetrafluoroethylene (ePTFE) and titanium reinforced ePTFE. An additional anesthetic episode is required to remove the ePTFE membranes in canine patients which increases the cost of the procedure and adds additional anesthetic episodes for the patient. Furthermore, if synthetic non-resorbable membranes are exposed to the oral cavity, infection and failure can result. Synthetic resorbable membranes include polyglactin 910, poly-DL-lactid/poly-L-lactid, and polyglycolid membranes. Natural membranes include collagen and laminar bone membranes.
Absorbable membranes ideally maintain physical integrity for 6-8 weeks post-surgery and gradually resorbed thereafter.

VI. COMPLICATIONS

Membrane exposure is a major complication. Exposed membranes are contaminated by oral bacteria requiring additional medical therapy or removal (particularly if synthetic non-absorbable). Surgical site swelling, bleeding, periodontal flap perforation and membrane exfoliation are potential complications.

VII. RE-ENTRY OF THE GTR SITE

At the recheck in 6 months, the site is evaluated for reattachment via light clinical probing and intraoral radiographs. However, it should be noted this assesses for reattachment [reunion of epithelial and connective tissue (gingival connective tissue, PDL, and/or bone)] and the only true way to confirm successful GTR is surgical re-entry into the site for biopsy and histopathology which is contraindicated and not performed in the clinical patient. With correct patient selection and execution of GTR, the regenerated tissue should predictably be PDL and bone and not the excluded gingival connective tissue and epithelium.

MATERIALS AND METHODS

I. PATIENT SELECTION

1. A recent dental cleaning was performed and active periodontal disease is controlled (e.g., periodontal treatments, extraction of diseased and hopeless teeth) – Generalized active periodontal infection must be treated, controlled, and resolved prior to GTR procedures.
2. The patient is stable for additional anesthetic procedures to perform and recheck the GTR – no major uncontrolled underlying systemic, metabolic, cardiovascular, or endocrine disease.
3. The patient will accept daily home care (brushing) – often the client will need to demonstrate commitment following the initial dental cleaning and prior to the scheduled GTR.
4. The client is willing to brush the teeth daily.
5. The client is willing to follow home care instructions post-surgery.
6. The client is willing to commit both financially and emotionally to the GTR procedure.
7. A motivated client is necessary.

II. GTR STEPS – CANINE PATIENT

A complete periodontal cleaning and assessment is performed in a previous procedure in order to control and treat periodontal disease in the oral cavity. Home care with oral rinses (0.12% chlorhexidine gluconate) and brushing for 2 weeks prior to the procedure are minimally recommended. Often the initial procedure involved surgical extractions so brushing cannot be started until the sites are healed. Therefore, the GTR procedure is often scheduled 4-5 weeks after the initial periodontal cleaning and assessment to allow for tissue healing and then demonstration of brushing and home care.

During the GTR procedure the initial incision is made away from the defect so that the surgical flap closure suture line will not be located over the defect. The mucoperiosteal flap (full-thickness) is elevated 3 mm beyond the defect in all appropriate directions. The tooth is root planed and gingival connective tissue and epithelium are removed from the bone defect with curettes. The membrane is trimmed so that the margins of the membrane extend 2-3 mm beyond the margin of the defect in all directions. Bleeding should be noted in the defect in order to allow progenitor cells to egress from the bone. At this point, grafting materials
are placed if selected for the treatment. The premeasured and precut membrane is adapted to the site and a sling suture is utilized, if necessary, to help secure the membrane. Intimate adaptation of the membrane to the tooth is necessary to exclude gingival tissue down growth. The periodontal flap is closed, polyglactin 910 or poliglecaprone-25 with simple interrupted and/or mattress sutures, as indicated, are used to close the periodontal flap. The patient is prescribed doxycycline, for 10 days, appropriate post-operative NSAIDS (if not contraindicated) for 5-7 days, soft food for 2-3 weeks, 0.12% chlorhexidine gluconate oral rinse (started 48 hours after the surgery until brushing is started – chlorhexidine is contraindicated directly in the periodontal surgery site due to toxicity to the periodontal ligament cells), an office call recheck in 2-3 weeks and 6 weeks is scheduled, 3 weeks post-surgery brushing is started (buccal aspect of the treated canine tooth, maxillary 4th premolar or mandibular first molar but interproximal and palatal brushing is avoided for 8-12 weeks), an anesthetic procedure with gentle probing and intraoral radiographs is scheduled in 6 months from the time of the initial surgery.

Chlorhexidine gluconate 0.12% is contraindicated during the periodontal surgery and should not be used to lavage the surgical site. Additionally, sterile saline, as an irrigant, is much preferred over “city water” used in the dental machines.

RESULTS/CONCLUSION

Preliminary data suggests the absorbable laminar bone membrane with correct periodontal surgery techniques and owner compliance predictably increases radiographic and clinical probing attachment.

REFERENCES

Available upon request.
Periodontal disease: pathogenesis, progression, severe local and systemic sequel

Brook A. Niemiec

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

Images in this lecture are provided courtesy of Manson publishing and are from: Dental, Oral, and maxillofacial pathology, a color handbook. Niemiec, BA ed.

Introduction

Periodontal disease is the number one health problem in small animal patients. By two years of age, 70% of cats and 80% of dogs have some form of periodontal disease. However, there are generally little to no outward clinical signs of the disease process, and therefore, therapy typically comes very late in the disease. Consequently, periodontal disease may also be the most undertreated disease in our patients. Additionally, unchecked periodontal disease has numerous local as well as systemic consequences. Local consequences include: oronasal fistulas, class II peri-endo lesions, pathologic fractures, ocular problems, osteomyelitis, and increased incidence of oral cancer. Systemic diseases which have been linked to periodontal disease include: renal, hepatic, pulmonary, and cardiac diseases; osteoporosis, adverse pregnancy effects, and diabetes mellitus.

Pathogenesis:

Periodontal disease is generally described in two stages, gingivitis and periodontitis. Gingivitis is the initial, reversible stage in which the inflammation is confined to the gingiva. The gingival inflammation is created by plaque bacteria and may be reversed with a thorough dental prophylaxis and consistent homecare. Periodontitis is the later stage of the disease process and is defined as an inflammatory disease of the deeper supporting structures of the tooth (periodontal ligament and alveolar bone) caused by microorganisms. The inflammation results in the progressive destruction of the periodontal tissues, leading to attachment loss. This can be seen as gingival recession, periodontal pocket formation, or both. Mild to moderate periodontal pockets may be reduced or eliminated by proper plaque and calculus removal. However, periodontal bone loss is irreversible (without regenerative surgery). Although bone loss is irreversible, it is possible to arrest its progression. However, it is more difficult to maintain periodontally diseased teeth in comparison to healthy teeth. Additionally, periodontal attachment loss may be present with or without active periodontal inflammation.

Periodontal disease is initiated by oral bacteria which adhere to the teeth in a substance called plaque. Plaque is a biofilm, which is made up almost entirely of oral bacteria, contained in a matrix composed of salivary glycoproteins and extracellular polysaccharides. Calculus (or tartar) is basically plaque which has secondarily become calcified by the minerals in saliva. Plaque and calculus may contain up to 100,000,000,000 bacteria per gram. Bacteria within a biofilm do not act like free living or “planktonic” bacteria; and in fact are 1,000 to 1,500 times more resistant to antibiotics than are planktonic bacteria. Plaque on the tooth surface is known as supragingival plaque. Once it extends under the free gingival margin and into the area known as the gingival sulcus (between the gingiva and the teeth or alveolar bone), it is called subgingival plaque. Supragingival plaque likely
affects the pathogenicity of the subgingival plaque in the early stages of periodontal disease. However, once the periodontal pocket forms, the effect of the supragingival plaque and calculus is minimal. Therefore, control of supragingival plaque alone is ineffective in controlling the progression of periodontal disease.

Initial plaque bacteria consists of predominately non-motile, gram-positive, aerobic facultative rods and cocci. Gingivitis is initiated by an increase in the overall number of bacteria, which is primarily motile gram negative rods and anaerobes. In established periodontal disease, gram negative rods account for approximately 74% of the microbiotic flora. Finally, elevated numbers of spirochetes are found in almost all periodontal pockets, and anaerobic organisms compose 90% of the bacterial species in chronic periodontal disease.

Classically, periodontal disease was thought to be caused by an increase in the overall numbers of bacteria. The non-specific plaque hypothesis was based on the fact that periodontal disease is associated with an increased level of plaque and calculus. It was thought that low levels of plaque bacteria were controlled by the host response. It was further noted that the concentration of bacteria in periodontally diseased sites is twice as high as in healthy sites. However, recent studies point to a few, virulent strains of bacteria as being responsible for the attachment loss seen with periodontal disease. The specific plaque hypothesis is based on the fact that these few species are seen in virtually all cases of chronic periodontal disease. These findings have lead to the development of the “One stage full-mouth disinfection” treatment as well as a vaccine against these organisms. However, the cornerstone of therapy is still meticulous plaque control.

The bacteria in the subgingival plaque secrete toxins as well as metabolic products. Also produced are cytotoxins and bacterial endotoxins which can invade tissues on their own, and in turn cause inflammation to the gingival and periodontal tissues. This inflammation causes damage to the gingival tissues and initially results in gingivitis. Eventually, the inflammation can lead to periodontitis, i.e. the destruction of the attachment between the periodontal tissues and the teeth. In addition to directly stimulating inflammation, the bacterial metabolic byproducts also elicit an inflammatory response from the animal. White blood cells and other inflammatory mediators migrate out of the periodontal soft tissues and into the periodontal space due to increased vascular permeability and increased space between the crevicular epithelial cells. White blood cells fight the infection by phagocytizing bacteria, but may also release enzymes to destroy the bacterial invaders either by design or after their death. When released into the sulcus, these enzymes will cause further inflammation of the delicate gingival and periodontal tissues. In fact, the progression of periodontal disease is determined by the virulence of the bacteria combined with the host response. It is the host response that often damages the periodontal tissues. However, patients with deficient immune systems typically have more severe periodontal disease than those individuals in good health.

Clinical Features:

It is important to be familiar with normal features in order to identify abnormal findings. Normal gingival tissues are coral pink in color (allowing for normal pigmentation), and have a thin, knife-like edge, with a smooth and regular texture. In addition, there should be no demonstrable plaque or calculus on the dentition. Normal sulcal depth in a dog is 0 to 3mm and in a cat is 0 to 0.5mm.
The first clinical sign of gingivitis is erythema of the gingiva. This is followed by edema, gingival bleeding during brushing or after chewing hard/rough toys, and halitosis. Gingivitis is typically associated with calculus on the involved dentition, but is primarily elicited by PLAQUE and thus can be seen in the absence of calculus. Alternatively, widespread supragingival calculus may be present with little to no gingivitis. It is critical to remember that calculus itself is essentially non-pathogenic. Therefore, the degree of gingival inflammation (not the amount of calculus) should be used to judge the need for professional therapy. As gingivitis progresses to periodontitis, the oral inflammatory changes intensify.

The hallmark clinical feature of established periodontitis is attachment loss. In other words, the periodontal attachment to the tooth migrates apically. As periodontitis progresses, alveolar bone is also lost. On oral exam, there are two different presentations of attachment loss. In some cases, the apical migration results in gingival recession while the sulcal depth remains the same. Consequently, tooth roots become exposed and the disease process is easily identified on conscious exam. In other cases, the gingiva remains at the same height while the area of attachment moves apically, thus creating a periodontal pocket. This form is typically diagnosed only under general anesthesia with a periodontal probe. It is important to note that both presentations of attachment loss can occur in the same patient, as well as the same tooth. As attachment loss progresses, alveolar bone loss continues, until tooth exfoliation in most cases. After tooth exfoliation occurs, the area generally returns to an uninfected state, but the bone loss is permanent.

Severe local consequences:

In addition to tooth loss, there are six proven local severe sequela of severe periodontal disease.

The most common of these local consequences is an oral-nasal fistula (ONF). ONFs are typically seen in older, small breed dogs (especially chondrodystrophic breeds); however they can occur in any breed as well as felines. ONFs are created by the progression of periodontal disease up the palatal surface of the maxillary canines however: any maxillary tooth is a candidate. This results in a communication between the oral and nasal cavities, creating an infection (sinusitis). Clinical signs include chronic nasal discharge, sneezing, and occasionally anorexia and halitosis. Definitive diagnosis of an oronasal fistula often requires general anesthesia. The diagnosis is made by introducing a periodontal probe into the periodontal space on the palatal surface of the tooth. Interestingly, this condition can occur even when the remainder of the patient's periodontal tissues is relatively healthy (including other surfaces of the affected tooth). Appropriate treatment of an ONF requires extraction of the tooth and closure of the defect with a mucogingival flap. However, if a deep periodontal pocket is discovered prior to development of a fistula, periodontal surgery with guided tissue regeneration can be performed to save the tooth.

Another potential severe consequence of periodontal disease can be seen in multi-rooted teeth, and is called a class II perio-endo abscess. This occurs when the periodontal loss progresses apically and gains access to the endodontic system, thereby causing endodontic disease via bacterial contamination. The endodontic infection subsequently spreads through the tooth via the common pulp chamber and causes periapical ramifications on the other roots.

This condition is also most common in older small and toy breed dogs, however, this author has personally treated a case in a Labrador Retriever. The most common site for a class II perio-endo lesion to occur in small animal patients is the distal root of the mandibular first molars.

The third potential local consequence of severe periodontal disease is a pathologic fracture. These fractures typically occur in the mandible (especially the area of the canines and first molars), due to chronic periodontal loss, which weakens the bone in affected areas. This condition is again, most commonly seen in small breed dogs, mostly because their teeth (especially the mandibular first molar) are larger in proportion to their jaws as in comparison to large breed dogs. Pathologic fractures occur most commonly as a result of
mild trauma, or during dental extraction procedures. However some dogs have suffered from fractures while simply eating.

Although this is typically considered a disease of older patients, this author has personally treated three cases in dogs less than three years of age.

Pathologic fractures carry a guarded prognosis for several reasons. Adequate healing is difficult to obtain due to lack of remaining bone, low oxygen tension in the area, and difficulty in rigidly fixing the caudal mandible. There are numerous options for fixation, but the use of wires, pins or plates is generally required. Regardless of the method of fixation, the periodontally diseased root (s) MUST be extracted for healing to occur.

Awareness of the risk of pathologic fractures can help the practitioner to avoid problems in at risk patients during dental procedures. If one root of an affected multi-rooted tooth is periodontally healthy, there is an even greater chance of mandibular fracture due to the increased force needed to extract the healthy root. An alternate form of treatment for these cases is to section the tooth, extract the periodontally diseased root, and perform root canal therapy on the periodontally healthy root. In cases where periodontitis involving a mandibular canine or first molar is identified during a routine prophy, it is best to inform the owners of the possibility of a jaw fracture prior to attempting extraction of the offending tooth.

The fourth local consequence of severe periodontal disease results from inflammation close to the orbit which could potentially lead to blindness. The proximity of the tooth root apices of the maxillary molars and fourth premolars, places the delicate optic tissues in jeopardy. In cats (especially brachycephalic), the apices of the maxillary canines lie in this area and can create similar issues.

The fifth local consequence is described in recent studies which have linked chronic periodontal disease to oral cancer. The association in this case is likely due to the chronic inflammatory state that exists with periodontitis.

The final significant local consequence of periodontal disease is chronic osteomyelitis, which is an area of dead, infected bone. Dental disease is the number one cause of oral osteomyelitis. Furthermore, once an area of bone is necrotic, it does not respond effectively to antibiotic therapy. Therefore, definitive therapy generally requires aggressive surgical debridement.

In some cases, the bacterial infection may also result in a septicemia. In one case treated by this author, the patient had white blood cell counts of >50,000 on several occasions, which responded transiently to antibiotics. However, each time the antibiotics were discontinued the infection returned. On clinical presentation, the patient had halitosis, but no obvious dental disease other than a small fistulous tract. A dental radiograph revealed significantly mottled bone in the area, which prompted aggressive surgical debridement of the area of necrotic bone. Histopathology was consistent with osteomyelitis, and after a course of clindamycin, the patient did not relapse.

In another case treated by this author, the patient presented with an entire hemi-mandible which was necrotic secondary to osteomyelitis. In this case, the patient required a complete hemi-mandibulectomy.

Severe systemic manifestations:

Systemic ramifications of periodontal disease are also well documented. The inflammation of the gingiva and periodontal tissues that allows the body’s defenses to attack the invaders also allows these bacteria to gain access to the body. Recent animal studies suggest the possibility that these bacteria negatively affect the kidneys and liver, leading to decrease in function of these vital organs over time. Furthermore, it has also been suggested that these bacteria can become attached to previously damaged heart valves (IE valvular dysplasias) and cause endocarditis, which in turn can result in intermittent infections, and potentially thromboembolic disease. Other studies have linked oral bacteremias to cerebral and myocardial infarctions and other histological changes. Additional human studies have linked periodontal disease to an increased incidence of chronic respiratory disease (COPD) as well as pneumonia. There are many studies that strongly link periodontal disease to an increase in insulin resistance, resulting in poor control of diabetes mellitus as well as increased severity of diabetic complications (wound
healing, microvascular disease). Additionally, it has been shown that diabetes is also a risk factor for periodontal disease. Periodontal disease and diabetes are currently viewed as having a bidirectional interrelationship where one worsens the other.

Finally, it has been proven in animal studies that periodontal disease can elicit an increase in inflammatory lipids as well as an overall lipidemic state. This is described as a state of overall body inflammation leading to chronic disease processes and an abnormal immune response.

While some of these studies are not definitive, we know that periodontal disease is an infectious process and that affected patients must deal with these bacteria on a daily basis, which in turn can lead to a state of chronic disease. Therefore, we must learn to view periodontal disease as not just a dental problem that causes bad breath and tooth loss, but as an initiator of more severe systemic consequences. As one author states, “Periodontal disease is clearly an important and potentially life threatening condition, often underestimated by health professionals and the general public”. Only by thinking in these terms can we fully appreciate the scope of the disease process and discuss the problem with clients so that they can appreciate the depth of the problems their pets face. This information will significantly increase client compliance with homecare and dental prophylaxis, as well as advanced dental procedures.
Periodontal surgical techniques for the small animal practitioner

Brook A. Niemiec

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

Any pocket with depths greater than normal (for the species) are pathologic and in need of therapy. These are present in the vast majority of patients and represent not only an opportunity to improve patient health, but also to increase practice income. A thorough oral exam will elucidate these pockets and allow for proper therapy.

Periodontal therapy/surgery involves removing the infection from the root surface (i.e. plaque, calculus, and granulation tissue), as well as smoothing the diseased root surface. These steps allow for gingival reattachment leading to a decrease in pocket depth.

In dogs, pockets between 3 and 6 mm which are not associated with tooth mobility or other pathology (furcation, root caries) are best treated with closed root planing and subgingival curettage. This step is performed in a similar manner to subgingival scaling described in the basic periodontal therapy lecture, with a combination of mechanical and hand scaling. This should be meticulously performed in order to achieve as clean a tooth as possible to promote healing. Following this, periocular can be administered to improve attachment gain.

Pockets greater than 5 to 6 mm require advanced procedures for effective cleaning, owing to the fact that residual calculus is seen with regularity in pockets greater than 6 mm. In humans this is known as the 5 mm standard. In addition, periodontal surgery is indicated for teeth with even moderate alveolar bone loss, furcation level II and III, and inaccessible areas. Visualization is best accomplished via periodontal flap procedures, which should be offered if the clients are interested in salvaging the teeth. These are advanced procedures, but can be learned by general practitioners.

Periodontal surgery is very effective for treating regaining attachment and salvaging teeth. However, without a commitment to regular periodontal care (consistent homecare and professional cleanings), these surgeries will ultimately fail. This should be communicated to the client prior to performing surgery.

Equipment needs:
All incisions for periodontal surgery are best accomplished with a number 15 or 11 scalpel blade. Other equipment should include a selection of periodontal elevators, several sharp curettes, 7 x 7 tissue forceps, and small needle holders. It is recommended to have all of this as well as a sharpening stone in a sterile pack. Suture should be swedged on a reverse cutting needle and should be absorbable and fine (6-0 to 4-0). Additional materials should include an absorbable barrier membrane and bone grafting particulate (Consil or Bone augmentation).

Surgical Preparation:
All surgery should initiate with a complete dental prophylaxis to decrease oral contamination. Following this, a complete oral exam is performed. Next, a dental radiograph should be exposed of the area to document attachment levels.

Once the surgical site is determined, proper pain management should be instituted and administered, including regional blocks.

The Sulcal incision:
The sulcal incision is created reverse bevel. This means that the blade is angled AWAY from the tooth on approximately a 45 degree angle. This is designed to remove the diseased pocket epithelium. It is a more difficult incision to create, but will make the cleaning as well as suturing easier. Once the reverse bevel incision is performed, the rest of the flap is created.

Flap types:
There are numerous options for flaps, depending on the presentation. The most common flap used in periodontal surgery is a full flap, or one with vertical releasing incisions. This allows for increased exposure, however is somewhat more invasive. The other common flap for periodontal surgery is the envelope flap. This is created along the arcade, without vertical incisions.

Envelope (horizontal) Flap:
The envelope flap is created by first performing the reverse bevel incision along all diseased teeth. Once this is accomplished, the gingiva between the target teeth is incised. The incision should be made in one motion all the way down to the alveolar bone. This will create a full thickness flap. The incision can be carried to adjacent healthy teeth, if necessary for sufficient exposure. Make sure when you are performing this flap to not damage the gingiva.

After the extent of the horizontal flap is created, the flap is elevated from the alveolar bone. It is important to ensure that the entire flap is fully cut prior to attempting release. If there is a small area of attachment, it could result in tearing. Start elevation slowly and if significant resistance is felt, re-incise the area. This is best performed with a sharp periosteal elevator. Carefully release the full thickness flap to expose the root surface and alveolar bone for cleaning and contouring. Following therapy (see below), the flap is replaced (without tension) and sutured interdentally.

Full Flap:
The full flap is once again initiated by performing a reverse bevel incision around the target tooth (teeth). Once accomplished, vertical releasing incisions are created mesial and distal to the area. These incisions should be made very slightly divergent (so that the base is slightly wider than the gingival area) to maintain blood supply. Additionally, the incisions are typically made on line angles of the target teeth or one mesial and distal to the target tooth (teeth). Line angles are theoretic lines where two edges of a tooth meet. In general, the incisions are made on medial and distal line angles. If there is a diastema between the teeth (most notable distal to the canine teeth) an interdental incision may be made. Incisions should never be made mid root as this will damage the periodontal attachment.

After the extent of the flap is created, it is elevated from the alveolar bone. This is best performed with a sharp periosteal elevator. Carefully release the full thickness flap to expose the root surface and alveolar bone for cleaning and contouring. Following therapy (see below), the flap is replaced (without tension) and sutured interdentally. The vertical incisions are closed with simple interrupted sutures placed 2-3 mm apart.

Full flaps can also be sutured at different levels on the tooth. Apical repositioned flaps are utilized to move the gingival height apically, thus decreasing pocket depth. These flaps are most commonly used in the mandibular incisor area. Coronal repositioning flaps are used to move the gingival attachment up the tooth. This is used to move the attachment up the tooth to gain attachment levels. This results in increased attachment, but may also result in increased pocket depth.

Treating the exposed root/bone surface:
The goal of periodontal surgery is to create a smooth and clean tooth surface for reattachment. This is comprised of several steps.

The first and most important step is thorough root planing. This is best performed with a combination of ultrasonic and hand scaling. This author prefers utilizing the ultrasonic scaler on the root surface to remove the vast majority of the plaque and calculus. Following
this, a sharp curette is used to plane the exposed root surface to as smooth as possible a finish.

Following the root planing, the remaining alveolar bone is smoothed to a knife sharp edge. Additionally, the bone should scalloped around the tooth. This can be performed with a bone chisel or a finishing bur.

Next, root conditioning is performed. This step is designed to clean the root surface as well as slightly demineralise it to improve reattachment. There are many products that have been or can be used for this step. Classically it was performed with citric acid, but recently EDTA has been promoted as the best product. Following manufacturers recommendations, it is placed on the exposed root surface and left for the prescribed time. After that, it is rinsed from the surface.

If bone augmentation is indicated, it is mixed according to manufacturer's directions and placed in the defect. There are numerous products available; the practitioner must make their own decision based on cost.

A barrier membrane should be placed over the surgical site, if bone regrowth is desired. In veterinary medicine, absorbable membranes should be utilized. There are several types and manufacturers; this author finds that the vicryl membrane works well. Another option for the barrier membrane is to create one out of Doxirobe. This has the added advantage of the antibiotic and anti-inflammatory properties of the product. To perform this, place a small amount of properly mixed Doxirobe on a glass slab. Thin the product with air and then wet it. Once set, use a scalpel blade to cut out the correctly sized and shaped membrane. Then carefully lift the membrane and suture in place.

Follow-up:
The patient should be prescribed antibiotics and pain management and fed soft food for 2 weeks. At the end of 2 weeks, the patient should be rechecked to ensure that the flap has healed. The owner should be counselled on home care and recheck needs. The patient should be rechecked in six months to determine success or failure of the procedure. This recheck should be performed under general anesthesia and include probing and radiographic monitoring of the surgical site.

Conclusion:
Periodontal disease is the number one diagnosed problem in small animal dentistry. More clients are interested in salvaging these teeth, and periodontal surgery can provide this benefit. By learning these procedures, general practitioners can provide this service under one anesthetic.
Standing physical and chemical restraint in equine dentistry and oral surgery

Alessandro De Simoi

Equine dental and surgical procedures require that the patient is adequately sedated and properly restrained. With the use of modern sedation and analgesic techniques the equine veterinary dentist can provide a full range of dental and oral surgical procedures ranging from routine prophilaxis to more involved techniques such as tooth extractions, sinus surgery and mandibular fractures repair.

In the field, standing chemical restraint remain the backbone of equine general practice. The main goal of sedation techniques is to increase the level of patient cooperation to allow the completion of dental procedures. Even if chemical restraint has become more effective and reliable, still there are situations where a horse may respond in an unpredictable manner that causes injury to himself, the owner, the practitioner, or the practitioner’s assistant. Physical restraint that is safe for both the practitioner and horse becomes more necessary. Using stocks for dental procedures provides standardized conditions of restraint. A huge advantage of using stocks, either a portable stock pulled behind a vehicle, a stocks situated in a customized trailer, or an immovable stock in a hospital, is the greater safety the stocks provides for the practitioner. This lecture focus on the use on a specially built portable stock and the use of constant rate infusion chemical restraint for equine dentistry. Many advanced oral procedures benefit of a constant rate infusion (CRI) protocol. Using an infusion pump or flow control device make fine adjustment of the infusion rate quick and easy.
Radiographic imaging of the equine head

Peter Stelzer

1 Berg Germany

The basic principle of dental and oral radiography of the equine head is to achieve high resolution images, to identify the physiological and pathological structures.

Due to the equine anatomy radiographs of the head and its bone, teeth and soft tissue cannot be taken along the mesiodistal axis.

Therefore certain techniques have to be performed to visualize the target structures.

The incisor teeth e.g. can be shown using the bisecting angle technique and an intraoral film. The mandibular and maxillary diastema requires an oblique as well as a latero-lateral x-ray projection.

However for a general overview of the front part of the equine head a side to side projection is sufficient.

There are more difficult and oblique extra- and intraoral angulated techniques necessary to show premolar- and molar teeth. Especially investigating periapical processes in molar teeth with more than two roots.

This presentation shows the different radiographic techniques with examples. A comparison of the analogue and digital x-ray technique shows the differences between those. Introducing the hemisphere model which represents a new more systematic approach to radiographic imaging of the equine head.
Periodontal disease in equids

João B. Rodrigues¹, Carlos A. Antunes Viegas², Fidel San Roman Ascaso³

1 University of Trás-os-Montes e Alto Douro, IBB - Institute for Biotechnology and Bioengineering, Complutense University of Madrid
2 DVM, MSc, PhD, University of Trás-os-Montes e Alto Douro, ICVS/3B’s Laboratório Associado PT Government Associated Laboratory
3 DVM, MD, DDS, PhD, Dipl. EVDC, Complutense University of Madrid

INTRODUCTION

Periodontal disease (PD) is a general term referring to the altered state of the periodontium. The periodontium consists of gingiva, periodontal ligament (PDL), cementum and alveolar bone (AB)¹. The DP is considered the main cause of premature loss of teeth in adult equids², although it can affect animals of all ages, in different stages.

THE PERIODONTUM IN EQUIDS

The gingiva is the soft tissue that surrounds the teeth and covers the bone. It is divided into two different portions: the marginal (free) gingiva and the attached gingival, that is tightly adhered to the tooth. The gap between the tooth and the marginal gingiva is called the gingival sulcus and in equids, has a physiological depth of less than 5 mm.

The attached gingiva is continuous with the marginal gingiva and in brachydont teeth is attached to the cementoenamel junction. This landmark is used to measure the gingival recession, in case of PD. In equids, the cementoenamel junction does not exist, because the equid hypsodont teeth are completely covered with cementum. A comparison between different teeth appears here as the best way to understand and properly diagnose the presence of gingival recession³.

The gingival connective tissue (rich in collagen and elastin), is formed by three main groups of fibers:

- Gengivodental fibers: bundles of these fibers are connected with the cementum and are responsible for the rigidity necessary to support and shape of the marginal gingiva, especially during chewing movement.
- Circular fibers: the fibers encircle around the tooth, reinforcing the shape of the gingiva around the teeth.
- Transseptal fibers: These fibers are connected to the cementum of two contiguous teeth, supporting the gingival present in the interdental space⁴.

The periodontal ligament (PDL) acts as a "shock absorber", holding the tooth firmly down inside the alveolar bone². The LP is formed by collagen fibers (type I) synthesized by fibroblasts and is continuous with that of gingiva⁵.

The main bundles, called Sharpey’s fibers are organized in a complex way, aligned in different directions and are the responsible to maintain attached the alveolar bone with the cementum of the roots and the reserve crown. The permanent production of collagen allows the continuous remodelling process of the Sharpey’s fibers, thus facilitating the continuous movement of tooth eruption observed in hypsodont teeth and allowing limited regeneration of the PDL¹,⁶.
The equid periodontal ligament has more elastic fibers than the PDL surrounding the brachydont teeth, giving it the necessary flexibility to withstand the force of the chewing movement. The PDL provides nutrients for the remaining constituents of the periodontium.

The alveolar bone supports the teeth and is suffering a constant remodelling process, in order to accommodate the erupting reserve crown inside the alveolus. The alveolar bone supports the teeth and is suffering a constant remodeling process, in order to accommodate the erupting reserve crown inside the alveolus. The inner portion is known as the Lamina dura. The lamina dura is a thin layer of radiodense bone, to which the Sharpey’s fibers of the PDL attach.

The radiographic evaluation of the Lamina Dura is very important to understand if there is some disruption in the anatomical structure, to evaluate the alveolar space and the relationship between the alveolar bone and the tooth.

The cementum is produced by cementoblasts and is one of the four constituents of the tooth. The cementum covers the entire hypsodont tooth, although on the occlusion surface the cementum is wear out just after the contact between the opposite ipsilateral teeth (with the exception of cementum inside the infundibuli of the incisors and maxillary CT). The PDL attaches in this tooth structure.

The subgingival cementum belongs to the periodontium and is considered a living tissue, nourished by the PDL. The supragingival cementum is no longer in contact with the PDL and, therefore, is considered an inert tissue.

GINGIVITIS / PERIODONTITIS

Gingivitis is the inflammation of the gingiva. Periodontitis is the extent of the inflammatory process to the other components of the periodontium.

In order to properly diagnose the presence and stage of PD, it is important to carry out a detailed clinical examination of the oral cavity, evaluating the integrity of the periodontium in each different group of teeth. The use of intra-oral mirror, powerful light source and oral probes assumes special importance here, as well a complete radiographic exam of the affected structures, as mentioned above.

The determination of PD stages will depend on the clinical abnormalities found in the periodontium. The PD in equids is divided into four categories, based on the severity of the lesions:

Stage 1: Local gingivitis with hyperaemia and edema.

Stage 2: Recession of gingival margin between 5 and 10 mm, with formation of small periodontal pockets. Loss of approx. 25% of the gingival attachment, followed by mechanical irritation by food trapped and bacteria.

Stage 3: Periodontitis with loss of gum. Periodontal pockets with more than 1 cm deep. Loss of 25 to 50% of the gingival attachment.

Stage 4: Gross periodontal pocketing (more than 3 cm deep), lysis of alveolar bone, loosening of bone support and teeth. Loss of more than 50% of the gingival attachment.

In the advanced stages of PD it is possible to observe intense halitosis, hypersalivation, oral pain and discomfort, quidding and loss of BSC.

As mentioned earlier, PD can affect animals of all ages. Most studies about PD in equids reported a high prevalence of early stages of PD in young animals (between 2 and 4 years), corresponding to the beginning of the exchange process/eruption of the permanent teeth, leading to the development of gingivitis. It is a self-limiting process that usually disappears when the exchange process ends.

This disappearance of the symptoms in the early stages of PD indicates the reversibility to some extent.
However, PD can be seen in young animals in more severe stages, occurring in these cases a pathological process similar to that described later for adult animals.

The PD is well documented in small animals and it is assumed that the primary cause of development of this pathology is associated with the presence of plaque/calculus. A similar situation can also be observed in equids, mainly involving the lower incisors and canines, leading to the development of gingivitis which is reversible when the dental calculus is correctly eliminated.

The formation of dental calculus in equids is usually associated with systemic disease and significant malocclusion (congenital or acquired) affecting the correct masticatory movement.

Malocclusions are considered the main cause of PD in equids. This pathological situation will be responsible for a non-physiological chewing pattern and dental wear, with the consequent emergence of acquired dental pathology (focal overgrowth, transverse ridges, wave mouth, sheath mouth, etc.).

Among the CT that should align as a functional unit will be formed diastemata, which will allow food impaction in the interdental spaces and the consequent bacterial fermentation process, developing PD (stages 3 and 4), with destruction of the PDL and alveolar bone, resulting in the eventual loss of the teeth.

The development of diastemata is encouraged in those cases whose teeth do not erupt properly (impaction, teeth displacements).

In geriatric animals, diastemata formation occurs, especially when tooth roots are exposed. The root diameter is smaller than the rest of the tooth and thus allows the accumulation of food, facilitating the loss of dental pieces by the process described above.

The natural wear suffered by the occlusal surface of a geriatric equid teeth, will let it very close to the gingiva, increasing the likelihood of trauma during chewing movement.

PERIODONTAL DISEASE TREATMENT

Prevention is the key point in the PD treatment. It is very important to avoid the appearance of pathological situations that may in any way, limit or compromise the normal occlusion and the physiological chewing pattern which can lead to the development of acquired dental and oral pathology.

For that, it is very important to keep a rigorous control of equids mouth, starting from early ages, with regular odontal exams every 6 months to one year.

In the case of animals with PD, the main concern should be to restore the correct occlusion and masticatory movement.

In severe cases, it is very important to:

- Eliminate the food trapped in the periodontal pockets;
- Wash properly the affected area;
- Eliminate de affected tissue;
- Placing a physical barrier (sealant) in periodontal pockets, avoiding the immediate entry of food and allowing the healing of the affected area.
- In cases of PD4 (sometimes PD3), extraction of the affected teeth;
- Administration of AB and NSAIDs.

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Preliminary prospective oral pathology prevalence data in dogs presented to the University of Minnesota Veterinary Medical Center

Kevin S. Stepaniuk1

1 DVM, Fellow AVD, Dipl. AVDC

INTRODUCTION

Periodontal disease, fractured teeth, and other oral diseases were charted and documented in a randomized population of anesthetized dogs. A statistical consultation was obtained during the design of the study in order to determine the number of patients required to statistically evaluate subpopulations of the data set and data within each subset (e.g., age, body weight, skull type, breed, sex).

MATERIALS AND METHODS

Approximately 1,000 canine patients were evaluated by an oral examination and complete periodontal probing while anesthetized or heavily sedated. The study received IACUC approval and individual client-patient consent.

RESULTS

Raw data without statistical evaluation will be presented.

CONCLUSION

Associations will be drawn from the raw data.
Oral pathology overlooked by veterinarian students, interns, and non-dentistry residents, when compared to veterinary dentists after receiving veterinary dental education

James M.G. Anthony¹, Candace Grier-Lowe², Steve Hendrick³, Anthony P. Carr⁴

¹ BSc(Agr), DVM, MRCVS, FAVD, Dip AVDC, Dip EVDC, PAg
² DVM
³ DVM, DVSc
⁴ DR.med.vet, Dip ACVIM

This study was carried out to evaluate the abilities of veterinary students; interns and non-dental residents to identify oral pathology after receiving veterinary dental education, as well as gather some information regarding the prevalence of oral pathology in pet animals. A previous study was conducted with a similar situation where there was no veterinary dental education. Randomly selected routine vaccination cases were evaluated. Final year students first performed a full physical examination on the animal and then an intern and/or resident also performed a full physical examination on the patient prior to vaccination the patient. Once finished, a boarded veterinary dentist and/or a veterinary dental resident (in the third year of a three year residency) performed an oral examination independent of each other and recorded their findings. Medical records were collected and the findings recorded were compared. Oral pathology findings between the veterinary dental resident and the boarded veterinary dentist were in moderate to high agreement based on previous research. A moderate agreement was found with the findings of the students, interns and/or non-dental residents. Oral pathology was common with only 20% of patients considered healthy. The three most common abnormalities detected were periodontal disease (75%), malocclusion (45%), and oligodontia.
Introduction to four-handed dentistry

Camilla Heinze\textsuperscript{1}

\textsuperscript{1} Veterinarian, Dental hygienist.

This lecture is meant as an introduction to four-handed dentistry in veterinary dentistry. Four-handed dentistry is a technique in which the veterinary nurse or assistant works directly with the veterinarian on the procedures being done in the mouth of the patient. The technique reduces fatigue and improves the effectiveness of dental procedures. The goal for four-handed dentistry is to allow the operator and assistant to function as a team in a seated position with maximal efficiency and minimal strain.
Management of traumatic injuries

Cecilia Gorrel¹

¹ BSc, MA, Vet MB, DDS, MRCVS, HonFAVD, DEVDC, European and RCVS-recognised Specialist in Veterinary Dentistry, Veterinary Oral Health Consultancy, 17 Burnt House Lane, Pilley, Hampshire SO41 5QN, UK.

Traumatic injuries to the face are common, often resulting in soft tissue lacerations, tooth fracture, damage to the periodontium and jaw fracture. This presentation will cover management of tooth fracture and injuries to the periodontium. Tooth fracture may affect the crown, the crown and root, or just the root. Injuries to the periodontium may result in subluxation, luxation and avulsion of the tooth.

Tooth fractures are classified as complicated if the fracture line exposes the pulp to the oral environment and as uncomplicated if they do not involve pulpal exposure. Complicated tooth fractures always need treatment as exposed pulp will become inflamed and eventually undergo necrosis, with the inflammation spreading from the pulp to involve the periapical area (1,2,3). The earliest radiographic evidence of periapical pathology is widening of the periodontal ligament space in the apical region. This widening is due to inflammation of the apical periodontal ligament. If untreated, the apical periodontitis progresses to involve the surrounding bone resulting in destruction of the bone, which is replaced by soft tissue. This is evident as an apical rarefaction on a radiograph. The soft tissue may be granulation tissue (periapical granuloma), cyst (periapical or radicular cyst) or abscess (periapical abscess) (2,4). The periapical cyst usually occurs as a sequel to the periapical granuloma (2,3). Periapical cysts enlarge due to the osmotic gradient set up between the lumen of the cyst and tissue fluids in the surrounding connective tissue. An untreated periapical abscess can lead to complications such as osteomyelitis and cellulitis through spread of the infection. A fistulous tract opening on the skin or oral mucosa may develop (2,4).

Pulp and periapical lesions may be entirely asymptomatic or excruciatingly painful. The periapical granuloma and periapical cyst rarely cause severe discomfort but they may undergo exacerbation and develop into a periodontal abscess, which usually is an extremely painful condition. The clinical signs indicative of periapical pathology are often insidious and not noticed by the owner. It is often only after completion of treatment that the owner reports a dramatic improvement in the animal's general demeanour.

Crown fractures are obvious visually. A primary tooth with complicated crown fracture should be extracted to avoid damage to the adjacent developing permanent tooth. A permanent tooth, if unaffected by periodontal disease, can be treated by means of endodontic therapy. If the tooth has periodontitis or the fracture is too extensive, then extraction is the treatment of choice. In fact, with complicated crown fractures extraction is preferable to no treatment at all. Immature permanent teeth are a special consideration in that viable pulp is necessary for apexogenesis (continued root growth and closure of the root apex). Thus, a specific endodontic procedure, namely partial pulpectomy and direct pulp capping, is indicated if the pulp is still vital. Necrotic immature permanent teeth also need endodontic treatment if they are to be maintained. The aim of treatment is to achieve apexification (closure of the root apex in the absence of further root development). In most instances, necrotic immature permanent teeth should be extracted. Uncomplicated crown fractures may also require treatment as the exposed dentine tubules allow communication between pulp and oral environment and can thus result in inflammation or death of the pulp. An uncomplicated crown fracture usually requires minimal treatment, e.g. removal of sharp edges with a bur and sealing of the exposed dentine with a suitable liner or restorative material. However, such fractures do require monitoring (clinical examination and radiography) at regular intervals to ensure that the pulp remains vital. If pulp and periapical disease develop-
op, the tooth requires either extraction or endodontic therapy.

Treatment of crown and root fractures depends on how far below the gingival margin the fracture line extends. If the fracture line does not involve the pulp and does not extend more than 4.5 mm below the gingiva, restorative dentistry can be performed. If the pulp is exposed, endodontic therapy needs to be performed prior to restoration. If the fracture line extends more than 5 mm below the gingiva then the tooth should usually be extracted.

Root fractures may be horizontal or oblique. In general, horizontal root fractures have the best prognosis. A tooth with a long axis fracture is an absolute indication for extraction. Abnormal mobility, horizontal or vertical, of a periodontally sound tooth may lead you to suspect a root fracture. Definitive diagnosis of root fractures depends on radiography. The choice of correct treatment i.e. fixation or extraction is only possible based on a definitive diagnosis. Fixation is by means of ligature wire and acrylics. Radiographic monitoring of treatment is required.

Trauma may also result in injuries to the periodontium, resulting in subluxation, luxation and avulsion of a tooth.

Subluxation occurs when the periodontium has been damaged so that the tooth is loosened in its alveolus. Tooth mobility is limited to increased horizontal movement: the tooth has not been displaced in a vertical direction. No treatment is indicated except soft food for a week. Pulp vitality of the traumatized tooth does need to be monitored, as pulp necrosis is a common complication of luxation.

Luxation of a tooth can be either in a vertical direction, i.e. intrusion or extrusion, or in a lateral direction. Treatment consists of repositioning and fixing the tooth in its correct location. Fixation is achieved by means of ligature wire and acrylic. Pulp vitality needs to be monitored to detect and treat complications.

An avulsed tooth has been totally luxated from its alveolus. It needs reimplantation and fixation (by means of ligature wire and acrylics) as soon as possible as the result of reimplantation depends on the viability of the periodontal ligament. As the ligament dehydrates it becomes less viable. Hence, the two most important factors determining the result of treatment are the length of time the tooth has been out of its socket and the medium in which the tooth has been stored during this period. The sooner an avulsed tooth is reimplanted, the better the prognosis. The best medium in which to store an avulsed tooth is saline, or if not available, milk. An avulsed tooth will undergo pulp necrosis and requires endodontic therapy, which is usually performed at the time the fixation appliance is removed, i.e. after 4-6 weeks. The endodontic therapy (pulpectomy and root filling) needs to be checked radiographically. This is generally after 6 months.

References

Anaesthesia in compromised dental patients

Paul Theuns

Introduction

Good dentistry for animals can’t be performed without general dentistry. The animals that are treated for dentistry are predominately older animals. This means that safe anaesthesia is even more important. Technicians often work on dental patients without a veterinarian monitoring the patient. When working in the mouth we usually use a lot of water, the animals lie on a cold and very often wet metal table this predisposes the patient to hypothermia and its associated side effects and poses a great extra risk.

The main reason that veterinary dentists frequently treat compromised dental patients is that dental problems occur more frequently in geriatric patients.

As animals age there is a gradual decrease in the functional reserves of the major organs:

- Kidneys
- Cardiovascular (heart and vasculature)
- Lungs
- Liver
- Central nervous system

This in return will alter the response to many anesthetic drugs. In addition older animals may not tolerate the stresses of hospitalization and preoperative fasting as well as younger animals. For this reason, we need to be proactive and realize that the older patients generally will benefit when they are being treated as compromised patients. The age from which we start to call an animal a geriatric patient, depends on the breed and the species. Some breeds carry an extra risk at any age.

Kidney problems

Kidney patients have a decreased renal blood flow and glomerular filtration rate and there are fewer functional glomeruli. Renal tubular changes lead to an impaired ability to control electrolyte, fluid and acid-base balance. This makes these patients these patients intolerant of fluid losses or excessive fluid administration. Older animals may have underlying renal pathology, which they can compensate for until stressed in the perioperative period and overt post-anesthetic renal failure is a real concern! Many patients may be prescribed non-steroidal anti-inflammatory drugs (NSAIDs) for chronic pain. These drugs block prostaglandin production, which is important for maintaining renal blood flow during periods of hypotension. If an animal is on an NSAID at the time of anesthesia, great care must be taken to prevent hypotension and to maintain normal fluid balance.

Cardiovascular changes

Particularly older dogs often have audible murmurs; the impact of the murmur needs to
be assessed. The owner should be questioned on the animal’s exercise tolerance. ECG, echocardiography and radiology should be considered depending on the specific clinical findings. A very important age related change is decrease in ventricular compliance due to myocardial atrophy. This results in a decreased cardiac reserve and renders older animal less able to tolerate acute changes in intravascular volume. This could be either dehydration or fluid overload. Taking this into consideration, it is now considered better to lower the fluid rate during anesthesia from the standard 10 ml/kg/hr to 5 ml/kg/hr, except when there is severe blood loss. Cats could have a cardiomyopathy, which is often present sub-clinical and is frequently not discovered until the cat gets stressed or the disease is in a very advanced stage, or during a post mortem examination after a fatal anesthesia. Degenerative myocardial changes will make the patient more sensible to myocardial hypoxia. The oxygen demand will increase because of hypothermia especially during recovery because the shivering will cause higher metabolic demands. Tachycardia caused by for instance fear; anticholinergic agents and induction agents such as ketamine will also increase the myocardial oxygen demand.

Respiratory problems

When patients with respiratory problems are anesthetized, there is a decrease in the reserve of the respiratory system. Vital capacity is reduced and the chest wall and the lungs become less compliant, which increases in its turn the anatomic dead space.

Pre-oxygenation is recommended for patients with respiratory problems and for older patients. Optimal pre-oxygenation in animals likely takes 4-5 minutes, because animals can’t be asked to take a deep breath as being done in humans. For the pre-oxygenation a loose fitting transparent mask will be better tolerated than a tight fitting one. This technique reduces the oxygen desaturation time after induction of anesthesia, and will give an extra time span whenever problems are encountered, like apnea or problems with intubation after induction.

Liver

When animals with primary liver disease are anesthetized, the decreased liver function could cause a different clearance of the anesthetic agents. The half-life of most anesthetic agents will increase when administered to patients with liver disease. Especially alpha agonist administration may cause excessive sedation and central nervous system depression. However the possibility to reverse the alpha agonists with an antagonist is an advantage. As a general rule most anesthetic agents have a minimal effect on the hepatic bloodflow as long as the blood pressure remains within normal limits.

Central nervous system

Patients with intracranial masses and other extremely serious brain disorders should best not be treated for dental problems. As a general rule it seems wiser to first treat these disorders and treat the dental problems once that treatment is successful. Patients with neurological impairment and have for instance a history of seizures should be critically evaluated in order to prevent drug-induced seizures. Traditionally, drugs with side effects that may include seizure activity (e.g. ketamine) should be avoided. There appears to be a relevant basis for judicious use of acepromazine in dogs with a seizure history.

Preanaesthetic diagnostics:

Preferably do chemistry and CBC before anaesthetizing any animal, but consider to make it mandatory for the older patient.
Premedication:

Not only is premedication necessary to make induction of anaesthesia possible it is also an important factor in order to minimize the amounts of the induction agent, and during the anaesthesia the amount of inhalant gases.

Benzodiazepines such as midazolam and diazepam tend to more reliably produce sedation in compromised patients. For premedication midazolam has the advantage over diazepam that it can be administered intramuscular, this will result in a sedation occurring less suddenly and less deeper than intravenous administration of diazepam will do. However, the sedation has to be followed by induction agent like propofol, the use IV diazepam will dramatically reduce the required dose of propofol. Propofol will be dosed on effect so the risk of overdose is extremely low when using the benzodiazepines.

Conclusion

Safe general anaesthesia is impossible without using endotracheal tubes and inhalant gases.

The anaesthesia of the sick and compromised patient will be discussed stepwise. For each sickness a separate technique will be discussed.

Conclusion:

Offering a safe anaesthesia to dental patients is a primary concern, nowadays there are many possibilities but it is mandatory to make the right choices whenever you are treating a sick and or compromised patient.

Literature

3. Conference proceedings 19th veterinary dental forum
Equine odontoclastic tooth resorption and hypercementosis (EOTRH): a review

Sam Luis Hole

1 BSc(Hons) BVM&S CertAVP BAEDT MRCVS, Pool House Equine Clinic, Crown Inn Farm, Lichfield, Staffordshire, UK.

Equine odontoclastic tooth resorption and hypercementosis (EOTRH) is a recently described condition of aged horses. It affects canine and incisor teeth usually in a caudo-rostral fashion and is characterised by tooth lysis and destruction in addition to cemental deposition either subsequently or concurrently. This uncommon or possibly under-recognised condition will be reviewed in detail: the limited previous publications, pathogenesis, possible aetiopathogenesis, histological changes, similar dental syndromes in cats and man considered, clinical presentation and signs, diagnosis, radiographic changes, management, prognosis and case reviews.
Hypercementosis in geriatric horses

Jens Arnbjerg

Hypercementosis has been described (Staszyk et al., 2008) in a few cases associated with a painful resorption related to tooth root and infection in and around the roots of incisors in elderly horses. A routine screening radiological examination of 18 clinical normal horses older than 15 years showed various amount of hypercementosis, especially around the incisors in nine cases. The amount of cement formation varied from few mm to 2 cm especially around the roots of I 3. The periodontal membrane of the incisors was always seen as a homogenous and distinct radiolucent line surrounding the roots.

On CT examination the hypercementosis was more pronounced on the labial side. The distinction between the enamel and cementum was approximately 2500 - 2700 H and the cementum 1300 – 1500 H.

The lower the angle between the maxillary and mandibulary rows, the more pronounced was the hypercementosis. Therefore this material supports the idea that the stresses on the incisors is an etiological factor.

Since clinical signs are rare in uncomplicated cases, then specific treatment are not necessary before secondary complications arise.

Hypercementosis were also seen filling out the space between the roots of worn down cheek teeth and appear to facilitate the healing in the former infundibulum after loss of cheek teeth.

The histological examination of the hypercementosis showed no tumor or infectious process.

As in humans, simple hypercementosis does not need any treatment, except if infection develops and resorption gives rise to symptoms.
Incidence, positioning and anatomical dimensions of erupted wolf teeth in UK: results of a questionnaire completed by BAEDT members

Sam Luis Hole

Introduction

Equine wolf teeth or the first premolar are commonly encountered in equine veterinary or dental practice. Their extraction due to perceived bitting and behavioural issues is also commonplace. The aim of the study was to evaluate the current incidence, positioning and size of erupted wolf teeth (first premolar) by dental practitioners in the United Kingdom (UK) via questionnaire.

Method

Questionnaires were sent out with the quarterly journal to the 83 members of the British Association of Equine Dental Technicians (BAEDT). The BAEDT is a professional association consisting of equine dental practitioners: both veterinary surgeons and EDTs who have passed the British Equine Veterinary Association (BEVA) and British Veterinary Dental Association (BVDA) joint examination, have relevant insurance and work within the association’s code of conduct.

Each member was asked to complete one questionnaire per horse over a three-month period. The presence, position (rostral, medial, buccal), if extracted completely or partially, the diameter and length of extracted tooth, use of sedation, nerve blocks and pain killers, if rasping was performed, what after care was given and if any complications resulted were all recorded.

Discussion

The results of these questionnaires have been collected and are currently being tabulated and analysed. The results, their interpretation and relevance will be presented at congress.

Conclusion

What is the current incidence of wolf teeth in the UK? What proportion are extracted and are they completely or partially extracted? What are their average size and range of size? What proportions of horses are given adequate pain relief for the procedure? What aftercare is commonly given and what complications occur?
Imaging of oral proliferative lesions: a practical approach to reading CT-scans in dogs

Leen Verhaert

Tumours of the gingiva and hard palate are often locally invasive causing bone destruction. Depending on tumour type, surgery is the best option for successful treatment. Outcome in those cases highly depends on excision of the tumour with tumour-free margins. Traditionally, the surgical margins were estimated by careful evaluation of radiographs, looking at bone resorption, but it is generally accepted that using only radiography will underestimate the extent of most lesions, especially in the maxilla where overlap with nasal structures obscures the margins of the tumour. Furthermore, bone loss will only be visible on radiographs once around 50% of the mineral content of bone has been lost.

Currently, CT-scan and MRI are available for diagnosis in animals. While most studies in man have shown that with the use of CT-scan lesions are underestimated, other studies have shown high sensitivity and specificity with conventional CT scan provided thin slices (maximum 3mm) are used.

Due to the fact that a two-dimensional picture is made of an almost two dimensional structure (a 3mm slice), even a small amount of bone loss may be seen on the picture, making planning of surgical margins more accurate. It is often important for the surgeon to be able to 'visualise' the tumour before the actual surgery.

In CT-scan images, the white-to-grey-to-black contrast is comparable to what is seen on radiographic images. The use of contrast medium will enhance regions with higher blood supply. On a post-contrast CT-image the large lingual vessels clearly show.

A practical approach to reading CT-images of the canine skull will be given, comparing structures on CT to skulls and radiographic images. Several anatomical landmarks on a CT-image of the skull will help the clinician in accurately defining extent of tumour. Especially landmarks in the maxilla are very distinct.

Incisors visible, no canine teeth: incisive bone region
The canine tooth root ends at the level of the second premolar
At the level of the third premolar the infraorbital canal ends
At the level of the fourth premolar, the palatal root may be seen, and there will be an infraorbital canal
The shape and size of the first molar are very distinct, and the eye can be seen
Histologic subtypes of oral nontonsillar squamous cell carcinoma in dogs

Ana Nemec¹, Brian Murphy², Philip H. Kass³, Frank J.M. Verstraete⁴

¹ DVM, PhD
² DVM, PhD
³ DVM, MPVM, MS, PhD
⁴ DrMedVet

Background: Several histologic subtypes and grades of oral squamous cell carcinoma (SCC) are described in human literature and these subtypes have distinct morphologic features and biologic behavior.

Materials and methods: This retrospective study (1990-2010) included 84 dogs previously diagnosed with SCC of the oral cavity and oropharynx, excluding the tonsils.

Results: Sixty-nine of the SCCs (82.1 %) were further diagnosed as conventional SCC (33 [47.8 %]) well-differentiated, 31 [44.9 %] moderately-differentiated, and 5 [7.3 %] poorly-differentiated), 5 (5.95 %) each as papillary SCC and basaloid SCC, 3 (3.6 %) as adenosquamous carcinoma, and 2 (2.4 %) as spindle cell carcinoma. Compared to the general hospital population, ovariohysterectomized females, dogs aged 10 to 14.9 years, English springer spaniels and Shetland sheepdogs, were overrepresented. The majority (78.1%) of SCCs were proliferative with or without associated ulceration, although no significant association was observed between the macroscopic appearance and different SCC subtypes. 71.4 % of SCCs were located in dentate jaws, however, well-differentiated conventional SCC was statistically significantly (P = 0.0022) more often found affecting tongue and other non-dentate mucosal surfaces. No significant association was found between any of the SCC subtypes and tumor-associated inflammation (INF), perineural and lymphovascular invasion (PNI, LVI), nor between macroscopic appearance of the tumor and tumor location, PNI, LVI or INF, or PNI, LVI, INF and tumor location.

Conclusion: This study describes for the first time the major clinicopathologic characteristics of several histologic subtypes of SCC affecting the oral cavity and oropharynx of dogs.
Prognostic factors in dogs with malignant oral tumors treated with surgery: preliminary results

Lisa A. Mestrinho¹, Mauro Bragança¹, Pedro Faísca¹, Hugo Pissarra², Maria C. Peleteiro², Maria M.R.E. Niza²

¹ Centre of Research in Veterinary Sciences, Faculty of Veterinary Medicine, Lusófona University (Mestrinho, Bragança, Faísca), Av. Campo Grande, 376 – 1749-024 Lisboa, Portugal
² Interdisciplinary Centre of Research in Animal Health, Faculty of Veterinary Medicine, Technical University of Lisbon, (Pissarra, Peleteiro, Niza), Av. da Universidade Técnica – 1300-477 Lisbon, Portugal

Introduction

Diagnosis and treatment in oral oncology has improved in recent years but prognosis remains poor in most cases. Within the same histological tumor, type and grade, different clinical outcome and response to treatment can occur; also other clinical variables such as stage and location have variable prognostic impact. This study aims to determine the survival time in dogs with non odontogenic oral malignancy submitted to surgery and to assess the prognostic value of clinical and histopathological factors, as well as Ki-67 expression.

Materials and methods

Twenty three client-owned dogs submitted to surgery due to non-odontogenic tumors were included in this prospective study, between January 2008 and May 2010. Inclusion criteria were (i) presence of non-odontogenic oral tumor with surgical indication, (ii) determined TNM staging and (iii) 2 years post-surgical follow up. Age, gender and anatomical localization were also registered. Surgical samples were submitted to routine histology and immunohistochemistry study for Ki-67 proliferation marker (clone MIB-1, Dako) using the polymer system (Envision, Dako). Regarding the expression of Ki-67, tumors were classified in two groups according to expression limit of ≤50% (G1) and > 50% (G2) of marked cells. Kaplan-Meier method was used to estimate survival time and a log-rank test allowed the comparison between survival curves. Cox proportional-hazards regression was use for the analysis of the effect of risk factors in survival.

Results

Median survival time was 350 days [110-690 days] with 40% of live animals at 1 year and 10% at 2 years. Factors associated with survival were histological type (p=0.0292) and N stage (p=0.0365). For G1 median survival time was 255 days [52-365 days], with 18% of live animals at 1 year and 0% at 2 years. For G2 median survival time was 380 days [110-690 days], with 56% of live animals at 1 year and 10% at 2 years. A positive association, with statistical significance (p=0.0419), was established between the increased expression of Ki-67 and a shorter survival time. For squamous cell carcinoma (SCC) G1 average survival time was 374.2 days with 40% of live animals at 2 years; in G2 100% were alive after 2 years. For malignant melanoma (MM) 33% of the animals were alive at 360 days for both
groups. G1 average survival time was 221.5 days, and for G2 was 308.3 days. For fibrosarcoma (FS) G1 average survival time was 177.0 days, with 0% of live animals at 1 year and for G2 was 245 days with 50% alive at 1 year and 0% alive at 2 years. The unique case of osteosarcoma was excluded from the stratification.

Discussion

Reports about the beneficial use of Ki-67 expression on prognosis and response to treatment are controversial in Human Medicine\(^2\). While some authors relate high proliferation index with a bad prognosis and earlier local recurrence\(^3\)\(^,\)\(^4\)\(^,\)\(^5\)\(^,\)\(^6\), others defend the opposite\(^6\)\(^,\)\(^7\). In Humans, SCC is the most common oral tumor while in dogs the most frequent are MM, SCC, FS and OS\(^8\). These tumors express different clinical behaviors with different patterns of invasion and metastatic capacity. While in MM the development of metastasis in lymph nodes and distant is frequent, in FS and SCC this is not observed. In FS and SCC metastasis formation is rare, but the tumors are locally aggressive invading frequently soft tissues and bone\(^9\).

In Veterinary Medicine, Ki-67 expression (MIB-1), especially in oral tumors, was studied in MM and the results showed a positive relation between higher expression indexes and lower post diagnosis survival time\(^10\)\(^,\)\(^11\). Ki-67 index over 19.5% was suggested for dogs with oral melanoma in which higher expression was proved to be related with a shorter survival time\(^11\). This study included dogs with and without treatment; potential additional use of this index or other prognostic parameters in treated animals were also highlighted in this study. Ki-67 expression for oral FS and SCC in dogs has not been reported before and further studies are needed on the expression profile and post treatment impact.

In Human SCC, low Ki-67 score is related with increased risk of local recurrence after surgery and postoperative radiotherapy. Therefore, proliferative activity in these tumors is not always connected with pathological features although it is an intrinsic biological character\(^2\)\(^,\)\(^3\)\(^,\)\(^4\)\(^,\)\(^5\)\(^,\)\(^6\)\(^,\)\(^7\)\(^,\)\(^12\). In general, there is a relation between a high proliferative index and a better response to target therapies to active cell cycle such as radiotherapy and chemotherapy\(^6\)\(^,\)\(^7\).

In this study, histological type, N stage and Ki-67 expression were related with survival. Post surgical survival times according with histological type are in agreement with previous reports\(^9\). SCC showed the highest post surgical survival times while FS and MM are associated with shorter survival times. This situation occur due to the development of distant metastasis (exclusively MM) and to local recurrence (mostly FS).

The low number of animals per group only allowed determining the average survival instead median survival. Besides this limitation, rough differences after stratification were observed in post surgical outcome, showing a tendency to a better prognosis for increased Ki-67 expression, which is similar to observed in Human Medicine\(^2\)\(^,\)\(^6\)\(^,\)\(^7\)\(^,\)\(^12\). These observations can be explained by the fact that a higher expression of Ki-67 leads to a better treatment selection which in turns is reflected in a better prognosis, whether surgery or adjuvant treatment such as chemotherapy or radiotherapy\(^2\)\(^,\)\(^7\).

Conclusion

This study suggests a better surgical treatment response to high rate non odontogenic oral tumors. Contrarily, an increased Ki-67 expression, in general, seems to be related with a shorter survival time. However, more studies are needed to assess the prognostic value of Ki-67 in oral malignancy, specifically for each histological type, and also to evaluate its impact in new treatment strategies.

References


The occurrence and types of tooth resorption in dogs with oral tumors

Ana Nemec¹, Boaz Arzi², Brian Murphy³, Philip H. Kass⁴, Frank J.M. Verstraete⁵

¹ DVM, PhD
² DVM
³ DVM, PhD
⁴ DVM, MPVM, MS, PhD
⁵ DrMedVet

Objective: To describe the occurrence and types of tooth resorption in dogs with oral tumors and compare the findings to controls.

Design: Retrospective radiographic study.

Animals: 101 dogs presented with oral tumors and 128 control dogs for which dental radiographs were available. Exclusion criteria included underlying systemic disease, chronic administration of anti-inflammatory drugs, traumatic occlusion, severe semi-generalized and generalized periodontitis, and endodontic disease.

Procedures: Histological sections stained with hematoxylin and eosin and labeled as needed with immunohistochemistry stains were reviewed. Dental radiographs were reviewed for evidence of tooth resorption on a tooth-by-tooth basis. Statistical analysis was applied to compare tooth resorption at the tumor site, tooth resorption at distant teeth, and tooth resorption in control dogs.

Results: Teeth at the tumor site demonstrated evidence of external inflammatory resorption, significantly (p=0.046) more frequently in dogs with non-odontogenic tumors than in dogs with odontogenic tumors. The odds of external surface resorption of the teeth distant from the tumor site were 3.2-times (95% CI 1.3 - 7.9) and the odds for external inflammatory resorption 83.4-times (95% CI 9.7 - 719.6) more among dogs affected with oral tumors than control dogs.

Conclusions and Clinical Relevance: Local and distant tooth resorption is common in dogs with oral tumors. This study contributes to an understanding of the complex effects of the oral tumors on the surrounding and distant hard tissues.
Coincidental pathology of nasal cavity and oral structures

Jerzy Gawor

Nasal cavity due to its anatomic localisation is relatively often affected by pathology present in oral cavity. Some of oral/dental pathology causes signalments occurring in nasal cavity as nasal discharge, bleeding, sneezing, problems with breathing, snoring, panting, deformations of the face, palate or muzzle. Problems are categorized in 4 groups according to etiology: infectious, inflammatory, proliferative and other. Secondary nasal issues are illustrated by clinical cases. Review includes infectious pathologies, inflammatory diseases, proliferative lesions, congenital and acquired disorders in dogs and cats. Signalments, diagnosis, and management are the subject of presentation.

Infectious character of nasal pathology
Foreign bodies
Odontogenic problems:
Pulpal pathology and periapical complications Periapical cysts and granuloma Periodontal origin Perio-endo, endo-perio lesions Retained maxillary teeth: partly retained create periodontal pocket, fully retained predispose to DTC.
Fungal infections
Pseudomonas, Spirochetes (Vincent disease), Chlamydia

Inflammatory diseases
Feline Idiopathic rhinitis
Uveitis-dermatitis syndrome
Lupus erythematosus discoides

Proliferative
nonneoplastic
Dentigerous cyst
Eosinophilic granuloma complex
neoplastic: nasal tumors of the turbinates, mucosa, palatal tumors, sinus tumors.

Other disorders
Oronasal fistula as the consequence of periodontal disease or iatrogenic one
Congenital: cleft palate
Malocclusion: linguoverison of mandibular canines which occlude with palatal mucosa
Posttraumatic disorders: fractures of the bones, wounds, Brachycephalic obturative syndrome – narrowed nostrils causing mouth breathing what predispose to periodontal disease and infectious pression to tonsils.

Diagnosis of secondary nasal issues starts with clinical conscious examination and always require physical examination in general anesthesia. Prior to that, the qualification for anesthesia is necessary with pre-anesthetic laboratory tests. While sedation radiography, rhinoscopy or other imaging methods (CT or MRI) can be performed as well as collection of material for cytology, histopathology and cultures.
After the problem is diagnosed appropriate management can be proposed to the owner. Depending on the character of diagnosed problem numerous options of management may be
considered: conservative treatment, extraction of affected teeth, endodontic treatment (conventional or surgical), oral surgery, oncologic oral surgery, orthodontic treatment, odontoplasty or interceptive orthodontics.

Access to nasal cavity via palatal site and alternatively external access will be discussed. Both requires appropriate seal closure, bleeding control and providing post-op functionality.

Further reading:

Venker van Haagen AJ.ar, Nose, Throat and Tracheobronchial Diseases in Dogs & Cats 2005 Schlutersche GmbH
Canine lymphoplasmacytic rhinitis associated with dental disease?

Kevin S. Stepaniuk¹

¹ DVM, Fellow AVD, Dipl. AVDC

INTRODUCTION

Canine and feline chronic nasal discharge can be a frustrating condition for veterinarians, owners, and veterinary specialists. These diseases can persist for months or years. Common differential diagnoses include neoplasia, fungal rhinitis, foreign bodies, lymphoplasmacytic rhinitis, and nasopharyngeal pathology. In many published case series reports and retrospective studies, the differential diagnosis list often does not include dental/oral pathology; whereas other studies list “periodontal disease” or “tooth abscess” in discussion and introductions but do not explore the significance of these pathologies any further.¹²³⁴⁵⁶⁷⁸ Whether these are oversights during publication, lack of knowledge of how to perform a proper and thorough oral exam under anesthesia, or the authors did not evaluate the oral cavity at all, is unknown. Odontogenic infection needs to be placed on the differential list, and in some cases, high on that list based on history, oral examination, and signalment. The vague diagnosis of lymphoplasmacytic rhinitis remains a challenge since the definitive cause of this histological diagnosis remains elusive.

MATERIALS (REVIEW OF LITERATURE)

In cats with chronic rhinitis, feline herpes virus isolation rates were the same between treatment and control groups.⁹ This is important as many cats are diagnosed with “chronic ocular discharge and rhinitis” in practice without significant testing and treated for viral recrudescence rather than searching for an underlying cause. In a canine CT rhinitis study, 47% of the dogs had idiopathic inflammatory rhinitis with an overrepresentation of Dachshund and Terrier breeds;⁴ Both breeds are known to have significant periodontal disease.

From a veterinary dentist’s perspective, the proximity of the roots of the maxillary teeth, incisors, canine teeth, and premolar teeth are in many cases only separated by a few millimeters of bone from the nasal cavity.⁶¹⁰ In addition to the intimate oral and nasal anatomy, brachycephalic breeds suffer from challenges due to the anatomical disfiguration of tooth location relative to the nasal cavity and nasal lacrimal ducts that are intimately positioned to the apex of the canine tooth.¹¹¹² In normal cats, the nasolacrimal duct is separated from the canine tooth root by approximately 2 mm of thin bone and 1 mm in profoundly brachycephalic cats.¹¹¹² It is well established that the maxillofacial anatomical structures are in close proximity. It is quite plausible, although not yet studied, that some of these vague lymphoplasmacytic rhinitis cases could be associated with oral pathology. This is currently being investigated by the author. Anecdotally, many cases of chronic rhinitis with oral pathology, with or without advanced imaging, have resolved following surgical extraction and/or endodontic treatment for dental pathology. The author does concede that this is only observational, at this time. A prospective study including veterinary internists, radiologists, and veterinary dentists is necessary to evaluate the observational hypothesis that under recognized dental pathology may be a contributing factor to lymphoplasmacytic rhinitis and/or associated chronic nasal discharge in dogs and cats.

The author is not suggesting that dental pathology (endodontic disease and periodontal disease) is the cause of all LPR cases. However, the author is suggesting that general
practitioners and other veterinary specialists need to be certain a thorough oral exam with periodontal probing, on 6 surfaces of each tooth, intraoral radiograph imaging for all missing teeth, evaluation for fractured teeth and discolored teeth, intraoral radiographs for all oral/dental pathology, etc. should be a standard part of all chronic nasal discharge work ups. Particularly when the ambiguous diagnosis of lymphoplasmacytic rhinitis is diagnosed and corticosteroids, antibiotics, and antivirals are being used long term without a specific etiological cause in order to treat the histological diagnosis.

Many advanced imaging studies miss subtle dental pathology. For example, CT slices set at 6-7 mm for nasal diseases are too large and can easily miss subtle 1-2 mm dental lesions (intrabony pockets) and only identify the obvious large “dental abscess”. Even with narrow image slices, many, arguably all, small oronasal fistulas may be missed. This requires a high index of suspicion on the part of the clinicians requesting the CT evaluation.

RESULTS

The background for this research hypothesis stems from brief clinical report case series that review several dental/tooth related cases as causes for chronic nasal discharge after advanced imaging and solid medical work ups failed to identify a cause. Regional anatomy, review of the literature, review of human sinusitis/rhinitis odontogenic infection, and review of case examples are presented.

A clinical research project sponsored by a research grant from the Academy of Veterinary Dentistry is currently being carried out at the University of Minnesota College of Veterinary Medicine (Principal Investigator: Kevin Stepaniuk). The results from that study are planned to be presented at the VDF 2012 in Seattle, WA followed by publication in the J Vet Dent.

CONCLUSION

Odontogenic infection (endodontic disease and periodontal disease) needs to be consistently placed on the differential diagnosis list and pursued with the appropriate anesthetic oral exam, intraoral radiographs, and/or advanced imaging with sensitive settings to detect small (mm) lesions. The practitioner needs to use knowledge, clinical skills, and wisdom to evaluate the differential diagnosis list.

REFERENCES

Available upon request.
Increasing compliance with dental recommendations

Brook A. Niemiec

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

Why is marketing the dental department important?

1. Oral disease is by far the most common problem in veterinary medicine and there are generally only subtle to no clinical signs. However, patients afflicted with dental disease are quite often painful despite the lack of clinical signs. In addition, these disease processes cause significant localized and systemic medical problems. Ignorance abounds regarding dentistry both in the general public as well as in the veterinary field. This results in most patients being under treated. Therefore proper dental therapy is financially rewarding and good medicine.

2. Over the last decade or so, there has occurred a significant loss of traditional revenue streams due to many factors. Vaccine revenue has been markedly reduced by new studies. In addition, flea medication and other prescription revenue has been lost due to online prescriptions. Finally, increased reliance on the internet or other information decreases the client trips to the clinic.

How to Increase Dental Revenue

1. The first and most cost effective way to attain this goal is to increase the number of dental prophylaxis procedures performed.

   a. Client education: This is best performed by enlightening the population about dental disease. This should the veterinarian from AND the staff. By educating the veterinary staff, you educate the clients and sell more products. This can be in person, or via handouts and/or your website

   b. Superior, new equipment: Once the marketing plan is underway and the days are full, superior equipment will speed procedures. A new drill, ultrasonic scaler, elevator, or curette can markedly cut down on surgical time and increase the number of procedures performed a day. If a practice can do one more procedure a day 5 days a week at an average of say $400 it will pay off $8,000 worth of equipment in a month.

   c. Continuing education/training: By learning better techniques veterinarians and technicians can speed the dental procedures benefiting the practice and the staff. San Diego Veterinary Dental Training Center

2. The next way to increase income is by increasing the per dental procedure charge. Increase the number of treatment options for the clients. This does not mean doing things like root canals, jaw fracture repair and major oral surgery since what most DVM's charge for these it is not efficient time usage. By spending that time doing office calls the practitioner will increase income with less stress. A more efficient way to do this is by offering superior “basic” care. This should include: dental radiology, root planing/Doxirobe,
Oravet, nerve blocks, proper pain management, composite bonding, and fluoride therapy. All of these will greatly increase income without a significant investment of time or money.

3. Clinics can markedly improve their dental and income by improving their pre-operative testing protocol.
   a. Complete blood panel (renal, hepatic, CBC, T4)
   b. Urinalysis
   c. Chest radiographs
      HCM is often not ausculted
      Over 50% of patients over 6 have significant findings on chest films

4. Provide superior (and necessary!) post-operative treatment
   a. Pain management: Opiates, NSAIDS, Local Anesthetics, Acupuncture?
   b. Maxiguard, Oravet, homecare kits
   c. Rechecks

5. Specific cases where income can be increased
   a. Persistent deciduous teeth are a very common problem in small animal patients, especially toy breeds. Most clinics will do this and charge for it, but in general they will way under charge and under treat. These are large teeth that are time consuming extractions. By keeping the teeth, the clients can understand why the extraction is expensive. In addition, proper pain medication and radiology will increase the fee to a reasonable level.
   b. Fractured teeth with pulp exposure are a very common occurrence in veterinary medicine (approximately 10% of dogs have a broken tooth with pulp exposure). All teeth that are fractured with pulp exposure are painful and should be considered abscessed. Therefore, all teeth need to be treated via root canal therapy or extraction. This does “bother the dog” and therapy is critical. If a minor tooth, extraction is a viable option. If it is a major tooth and the client is to be referred for root canal therapy, the patient should be placed on pain medications and/or antibiotics and a minimum database performed.
   c. Worn teeth with root canal exposure need to be treated with root canal therapy or extraction. Teeth without root canal involvement should be radiographed to ensure lack of endodontic infection and then treated with composite bonding if indicated.
   d. Discolored (intrinsically stained) teeth. A study by Hale in 2001 reported that only 40% of discolored teeth have radiographic signs of endodontic disease. However, when physically examined, it was discovered that 93% of the teeth were in fact non-vital. Therefore all discolored teeth should be treated as dead and infected.
   e. Feline tooth resorptive lesions are reported to be present in up to 60% of all cats greater than 6 years of age. These are VERY painful lesions and require therapy. These are diagnosed with an explorer along the gingival margin. Full mouth dental radiographs are indicated when lesions are found as they will generally have additional lesions. These teeth need to be extracted.
   f. Periapical Abscess can be treated by root canal therapy or extraction. If electing to perform an extraction, remember that they are surgical procedures and should be charged as such. By calling it oral surgery it changes client perception of the procedure. Dental Radiographs and pain management including local anesthetics should be administered.
   g. Oral masses are incredibly common in small animal dentistry (especially dogs). All growths no matter how small and normal appearing should be sampled and submitted to the lab for histopathologic analysis. In my experience about 1% of these biopsies will turn out to be malignant and need additional therapy. In addition they should all be radiographed to evaluate for bony involvement. This will help the pathologist to determine level of aggressiveness.
   h. Uncomplicated Crown Fractures are a very common finding in large breed dogs (at least 50%). This occurs when a piece of the crown is broken off, without pulp exposure.
Occasionally, these teeth can become infected through the dentinal tubules which will go undiagnosed without dental radiology. However, teeth with no to small pulpal exposures tend to be the ones with clinical abscessation. Even if these are not infected, they are at least transiently sensitive and require restoration.

Ø Treatment
Ø Dental radiographs are WNL
Ø Bonded sealant (chemical or light cured)
Ø Recheck radiographs in 9-12 months
Ø Radiographic evidence of endodontic disease
Ø Root canal therapy
Ø Extraction

I: Periodontal disease is the number one diagnosed problem in small animal patients today. By the age of 2: 70% of cats and 80% of dogs have some degree of periodontal disease. This incidence increases with age. This has both local and systemic problems associated with it. By stressing these issues, the practitioner will greatly increase compliance with recommendations.

Severe local effects include: oronasal fistula, class II perio-endo abscess, pathologic fracture, osteomyelitis, and ocular problems.

Severe systemic effects include: renal disease, cardiovascular disease, hepatic Disease, Chronic Obstructive Pulmonary Disease, diabetes mellitus, adverse birth effects, osteoporosis, thromboembolic disease. In short, it is a state of chronic disease which the patient needs to deal with on a daily basis.

The majority of dental patients will have periodontal pockets greater than 3-mm. These pockets are pathogenic and need to be treated to control periodontal disease. This will not only increase the oral health of the patient, but also the overall health and practice income. These teeth should all be radiographed to rule out endodontic involvement and under diagnosed periodontal loss. If more than one or two teeth are involved, full mouth dental radiographs should be considered. Following this, all pockets between 3 and 6 mm are best treated with root planing and instillation of a sustained release doxicycline product.

CONCLUSIONS

Ø Dogs
Ø 80% have periodontal disease
Ø 10% have fractured teeth with pulp exposure
Ø 25% (conservative) have uncomplicated crown fracture
Ø 5% have other dental problems (neoplasia, orthodontic problems, cares, etc)

Ø Cats
Ø 70% have periodontal disease
Ø 40% have FORLs
Ø 10% have other problems (including fractures)
Ø 120% of veterinary patients have some type of dental disease!

There is no other area of veterinary medicine that has the potential that veterinary dentistry does. Just by doing proper and thorough dental work (do the basics well) practitioners can greatly increase dental income.

By educating the veterinarian as to the possibilities, you will increase their respect for veterinary dentistry and the profits (and good patient care) it will provide. This will in turn help you not only sell dental product, but the ancillary supplies and equipment. Finally,
Setting dental standards for your practice

Stephen Juriga¹

¹ DVM, Diplomate AVDC

Why is it important to set Dental Standards? This is the process in which a hospital, large or small, standardizes the diagnosis and treatment recommendations for the common dental diseases present in their patient base. A single doctor practice needs to set “dental standards” so the support staff can present a common message, driven by the veterinarian, of oral health and communicate the hospital’s ability to provide the needed dental services to their pet owners. More importantly in a multi-doctor practice, the veterinary team must agree to diagnosis oral pathology and offer a uniform treatment plan for each common dental condition they will encounter in the exam room. These standards are based on the hospital’s equipment, support staff training and veterinarian’s “dental/oral surgical skills” or the patient deserves a referral AVDC specialist for care.

First you must believe:
Dental disease is the most common infectious disease you will diagnose in your patients. Studies show that: 75% of companion animals over 3 years of age have periodontal disease, 70% of adult purebred cats and 40% of mixed breed cats have tooth resorptive lesion(s), 24% of canine patients present with tooth fractures. Moreover, if left untreated these conditions will result in pain, tooth loss and will affect the overall comfort and health of your patient(s).

Now we all must realize and agree:
Veterinarians must realize that a conscious oral exam can only estimate the extent of the periodontal disease (or other oral pathology) present and in most instances we will underestimate the extent or grade of dental disease. The diagnosis of each patient’s periodontal status must be entered in the patients medical record (SOAP) in a standardized way. Remember that attachment loss is measured by probing clinical attachment under anesthesia &/or by radiographic determination of the alveolar margin from the cementoenamel junction in relation to the length of the root.

Therefore I suggest you use the following terms for the diagnosis of periodontal disease for the conscious oral examination:

PD0: Clinically normal: no gingival inflammation is present although there maybe calculus present. Calculus maybe graded at C1 (mild), C2 (mod), C3 (severe).

PD1: Gingivitis without attachment loss. Patients have variable amounts of calculus. Gingivitis is reversible at this stage and without treatment this will progress to periodontitis which results is bone and attachment loss.

PD2: Early periodontitis-less than 25% attachment loss. Patients will variable calculus, halitosis, mild gingival recession and likely periodontal pockets.

PD3: Moderate periodontitis- 25-50% attachment loss. Patients will have variable calculus, periodontal pockets, gingival recession, furcation exposure of multi-rooted teeth.

PD4: Severe periodontitis- greater than 50% bone loss. Patients will have gingival recession, deep periodontal pockets, mobile or missing teeth and furcation exposure of multi-rooted teeth.

GR, GH, FX, PE, AB: Abbreviations for gingival recession, gingival hyperplasia, tooth fracture, pulp exposure and abrasive wear and are examples of common findings that require treatment. These will become part of the dental standard discussion at each hospital.
Medical records and the dental chart:
Along with setting standards for the diagnosis and treatment of dental conditions it is im-
portant to document the periodontal status of each patient in the medical record or SOAP. 
This is important for compliance audits to determine that a diagnosis (periodontal status) 
was made on every patient and most importantly the service was performed. Veterinarians 
must agree to recommend a professional cleaning and evaluation for Grades 1, 2, 3, 4, every 
tooth fracture, gingival hyperplasia... Finally each dental patient needs to receive pre and 
post therapy dental charting. This is an important piece of medical documentation that rec-
ords the need for therapy, specific therapy performed and it is vital reference point to assess 
response to therapy.

Dental knowledge and equipment:
Each hospital must assess their hospital’s dental equipment to determine their ability offer 
routine to advanced dental services. A practice they should realize that pathology noted on 
oral examination (gingival recession, furcation exposure, tooth fractures) or the loss of at-
tachment noted upon probing (pockets >3mm in the dogs, >1mm in the cats) must receive 
radiographic evaluation. Also, when appropriate refer case (root canal therapy, trauma, oral 
neoplasia) to dental specialists (www.avdc.org-locate a dental specialist). Here is a checklist 
of common dental equipment: What do you have or need?

- Dental treatment/estimate worksheet
- Anesthetic delivery/monitoring
- IV Fluid and Thermal support
- Dental chart
- Ultrasonic scaler
- Polishing unit
- Hand instrumentation
- Dental Radiography
- Air-powered instrumentation
- Exodontia equipment
- Oral surgical equipment
- Magnification
- Bone grafting material
- Restorative material

Now, what is our dental teams (veterinarian/technician) knowledge or skill set? This is 
important in terms of scheduling, time under anesthesia and patient care. Many practices 
will have 1 or 2 doctors with an interest and the skills to efficiently treat dental disease. 
These doctors should receive internal referrals and seek additional training. Also, it is im-
portant to schedule these dental patients as a “surgery patient”. Dental patients need a 
skilled technician and doctor engaged in the procedure working as a team to provide ade-
quate time to chart, clean/polish, probe, radiograph and treat all the disease identified.

Let’s set some standards!
I recommend creating a laminated document with a photo of each of these common oral pa-
thologies and the following description. Use this like the Smile Book (Pfizer), Hills atlas or 
your favorite brochure to illustrate their pet’s condition and your SOLUTION!

Fractured deciduous tooth is a painful condition and quickly becomes infected. This infec-
tion may cause a draining tract, facial swelling, bone infection, or damage to the developing 
permanent tooth. Treatment: Immediate extraction with intra-oral X-rays.

Class 1 malocclusions are when both jaws are a proper length and do not result in any over 
or underbite. Individual or multiple teeth maybe crowded, rotated, or misaligned. Treatment: Involves relieving pain, attaining a functional bite via orthodontic movement, extraction or oral surgery.
Class 2 malocclusions: A condition in which the maxillary teeth are markedly in front of the mandibular counterparts. Ideally diagnosed at the puppy’s first or second visit. Treatment: These young patients benefit from Interceptive Orthodontic Therapy. The lower incisors and canine teeth are carefully extracted to alleviate pain and allow the jaw (mandible) to grow to its genetic potential. Note: many patients require further treatment at 4-6 months of age.

Class 3 malocclusion is when some or all of the maxillary teeth are located behind the mandibular incisors or canine teeth. This malocclusion can result in gum trauma and tooth-to-tooth contact. Fortunately, few of these pets require therapy. In brachycephalic breeds (Boxer, Shih-Tzu), a Class 3 malocclusion is normal. Treatment: None or may require an extraction of a less functionally important tooth (commonly the lateral incisor). Relieve tooth to tooth or tooth to soft tissue trauma.

Persistent deciduous teeth are very common. The “Two Tooth Rule” states that if the crown of the permanent tooth is visible above the gum line, the primary tooth should be gone. If the primary tooth is still present then it has directed the permanent tooth into an abnormal position. Treatment: Intra-oral X-rays and timely extraction(s) are important to allow for the permanent teeth to erupt & move into a normal position. Re-examination in 2 weeks Missing tooth or teeth: Remember dogs have 42 teeth and cats have 30 teeth. If a pet over 6 months of age is missing 1 or more permanent teeth, a dental x-ray of the area should be taken. Treatment: Intra-oral X-ray(s), if a tooth is present: gingival incision or surgical extraction of the impacted tooth.

Rostrally erupted canine tooth can occur in any breed of dog, although it is more common in the Shetland Sheepdog. These teeth are prone to developing gingivitis, bone loss and the tooth-to-tooth contact is painful. Treatment: Intra-oral X-rays, orthodontic or extraction therapy.

Base narrow mandibular canine teeth result in a painful condition in which the lower canine strikes the roof of the mouth or palate. Therapy depends on the age of the pet and severity of the malocclusion. Treatment: Orthodontic therapy (Incline Capping or Incline Plane Therapy), crown reduction and pulp capping or extraction therapy.

Enamel hypoplasia is a developmental condition in pets. These pets’ teeth have abnormal or pitted enamel. This will appear as a rough and yellow stained surface of the affected tooth. Treatment: Full mouth X-rays and restorative therapy with composite resins will protect and seal the tooth while they develop. Regular brushing of these teeth is important to control plaque and tartar that easily accumulates on them.

Canine Patients:

Grade 1 Periodontal Disease: may show variable amount of dental calculus and mild gingivitis. Gingivitis is an infection of the gum tissue and is painful. Treatment: Ultrasonic scaling and polishing, probing, possible intra-oral x-rays and periodontal therapy as indicated by loss of attachment.

Grade 2 Periodontal Disease: will show a variable amount of dental calculus and gingivitis. Gingivitis is an infection of the gum tissue and is painful. These patients will have bad breath and periodontal pockets. Treatment: Ultrasonic scaling and polishing, intra-oral x-rays periodontal treatment as needed (root planing, guided tissue regeneration; antibiotic or bone implant).

Grade 3-4 Periodontal Disease: will show a variable amount of dental calculus and moderate gingivitis. These patients will have gum recession, bone loss, mobile teeth and are susceptible to systemic disease(s). Treatment: Ultrasonic scaling and polishing, intra-oral x-rays,
periodontal treatment as needed, local nerve blocks, multiple extractions and oral surgery.

Furcation exposure is a condition in which significant bone loss (periodontitis) has occurred. The bone loss in the region of multi-rooted teeth (furcation region) is progressive and requires immediate treatment. Treatment: Ultrasonic scaling and polishing, X-rays, periodontal therapy and extraction therapy for grade 3 lesions.

Gingival recession is a severe inflammatory/destructive condition. This occurs secondary to dental plaque (calculus and bacterial) and a pet’s individual immune response. Treatment: Ultrasonic scaling and polishing, intra-oral x-rays depending on the severity of the recession, periodontal therapy or oral surgery/extraction.

Gingival hyperplasia is an inflammatory condition secondary to dental calculus/plaque that may occur in any breed. This condition creates a “pseudo-pocket” and commonly results in bone loss if left untreated. Treatment: Ultrasonic scaling and polishing, regional nerve blocks and radiosurgical resection of the excessive tissue.

Abrasives/Attrition: This condition results in gradual tooth loss removes enamel (<1mm thick), exposes dentin and in some pets the pulp. These teeth are evaluated for pulp exposure and periapical lucency root-end bone infection. Treatment: Ultrasonic scaling and polishing, probing, intra-oral x-rays of affected tooth/teeth, and removal of object causing excessive tooth wear.

Uncomplicated Crown Fracture refers to a fracture involving the dentin but not the pulp. This condition is painful and depending on the depth can allow bacteria to access or infect the pulp. Treatment: Ultrasonic scaling and polishing, probing, intra-oral x-rays and if the fracture is recent (weeks) a composite restoration to seal the tooth surface.

Complicated Crown Fracture refers to a tooth fracture that exposes the pulp (vessels and nerve of the tooth). This is painful and over months bacteria will travel to the end of the tooth or bone and cause an infection. Treatment: Based on the pet’s lifestyle and functional importance of the tooth we recommend either root canal therapy or extraction. Root Canal Therapy: Allows a pet to retain functionally important teeth used for grasping and chewing (10 important teeth are the canine teeth, lateral third incisors, maxillary fourth premolars and mandibular first molars). The long-term success of root canal therapy is 95% and if needed a metal crown can be placed for additional protection.

Oral Mass refers to any abnormal growth of tissue in the oral cavity. There are many types of masses: inflammatory, benign, malignant or cystic. Treatment: Intra-oral x-rays, biopsy, lymph node assessment, and in most cases surgical resection is the preferred treatment pending biopsy results.

Feline Patients:

Grade 1-2 Periodontal Disease patients will show variable amounts of dental calculus and gingivitis. Gingivitis is an infection of the gum tissue and is painful. Treatment: Ultrasonic scaling and polishing, probing, intra-oral x-rays and periodontal therapy if needed.

Tooth resorptive lesions occur in 50% of cats over 5 years of age. The cause of these erosive, “cavity” like lesions is unknown. These lesions are progressive and painful. Unfortunately few cats will show noticeable symptoms. Treatment: Ultrasonic scaling and polishing, probing, full mouth x-rays and extraction or crown amputation therapy.

Super-eruption or Periodontal Disease may appear as gingival recession but in cats an affected canine tooth will become extruded with bone enlargement indicating an infection. Treatment: Ultrasonic scaling and polishing, intra-oral x-rays, root planning or extraction.
therapy.

Gingivostomatitis is a severe inflammation of the whole oral cavity. This is most commonly due to an abnormal immune response to dental plaque (bacteria and food proteins) and other unknown factors. Treatment: Pre-anesthetic blood profile(s), ultrasonic scaling and polishing, biopsy of oral tissues, full mouth radiographs, and surgical extraction therapy.

Tooth fractures in cats of any depth will expose the pulp. This is initially painful and over months bacteria will travel to the bone and potentially the blood stream. Treatment: Root canal therapy is preferred on the 4 canine teeth to prevent lip trauma and retain function, or surgical extraction therapy must be performed before an infection of the bone occurs.
The majority of horses with cheek teeth fractures have no known history of trauma and consequently the dental fractures are classified as idiopathic cheek teeth fractures. Because maxillary midline sagittal fractures have been shown to be associated with advanced infundibular caries – these could now be re-classified. A practice-based survey showed 0.4% of horses to be affected with idiopathic fractures. These fractures are often asymptomatic but can cause quidding and less often biting or behavioral problems, and halitosis. The upper 09s are most commonly involved and the predisposition of these teeth to infundibular caries is a likely factor for their midline sagittal fractures. The most common fracture pattern in idiopathic cheek teeth fractures are lateral “slab” fractures through the two lateral (buccal) pulp horns, possibly because the mineralised dental tissues are thinner at the sites of the pulp horns and therefore, the cheek teeth are weakest at this point.

Examination of dentine showed thinner dentine in 25% of CT with idiopathic fractures, indicating prior pulpar disease, with the resultant thinner adjacent dentine mechanically predisposing to fracture. Dental pulps are inevitably involved in every (maxillary and mandibular) cheek teeth idiopathic fractures. Despite pulpar involvement, some idiopathic fractures (lateral slab fractures in particular), can clinically resolve without the development of clinical signs of apical infections, indicating that the resultant pulpitis has remained low grade or that the underlying pulp has become sealed off from the fracture site by the deposition of tertiary dentine. Many such fractured CT that survive following an idiopathic fracture have long-term radiographic apical changes, a subclinical endodontic and apical response to these CT fractures.

A proportion of fractured CT will develop pulpar infection that extends to affect the apex, with the resultant clinical signs dependant on which tooth is involved. Clinical apical infection (including sinusitis) is common with maxillary midline sagittal fractures and with any type of mandibular CT fracture. Apically infected teeth always require extraction. In other affected teeth, mobile fracture fragments cause periodontal membrane stretching and pain during quidding. until smaller dental fragments are spontaneously shed or extracted. Some fractured cheek teeth develop food impaction in the fracture site causing lateral or less commonly, medial displacement of fracture fragments that causes soft tissue (usually buccal) ulceration and resultant quidding. Removal of the grossly displaced and/or of all mobile fracture segments is indicated. Prevention of dental fractures secondary to infundibular caries has been attempted by removal of carious infundibular cementum and filling the infundibular defect with endodontic restorative materials, but there is no objective research on the value of this treatment.

Suggested Reading

Taylor L, Dixon PM. Equine idiopathic cheek teeth fractures. Part 2: A practice based sur-
The treatment of fractured incisors in horses

Peter Fahrenkrug

A remarkably large percentage of horses experiences fractured incisor teeth, although they will not always require root canal treatment. In older horses especially, the PULP CHAMBER may be so reduced in size through the deposition of secondary dentine that there is no involvement of the pulp itself, and it is only necessary to round off of any sharp edges.

In most cases the tooth should immediately be root-canaled. The open canal provides a direct connection between the oral cavity and the alveolar bone, allowing food remnants and bacteria enter the canal, causing periapical abscesses and infections of the jaw.

VITAL PULPOTOMY

Newly fractured teeth, which have not yet become infected, can sometimes be saved by a Vital Pulpotomy, which is the removal of the damaged coronal part of the pulp. This is especially so in young animals, with a large pulp canal and a high resistance to infection, where the odontoblasts are capable of producing enough dentin to isolate the remaining pulp. The procedure is similar to that for pulp capping. A sterile round bur should be used to remove the damaged coronal part of the pulp, any bleeding should be controlled with a 3% hydrogen peroxide solution, and calcium hydroxide powder or concentrated paste placed over the exposed pulp. The cavity should then be treated with a base filler such as zinc oxyphosphate cement and a final restoration such as light cured composite or amalgam. Any sharp edges on the fractured part of the crown should be smoothed off and a radiograph of the tooth taken. Three months later a follow up radiograph should be taken and compared with the first. A reduction in the size of the pulp chamber should be noted if the treatment has been successful, and it may even be possible to see a DENTIN BRIDGE (REPARATIVE or TERTIARY DENTIN) sealing off the coronal part completely. If reparative dentin is not formed within 50 days, there will be none. If the treatment has not been successful the normal symptoms of pain will manifest themselves, such as slow or careful eating, a direct painful reaction to biting.

In severe cases there is often swelling of the gingival tissues and fistulas may occur.

It is often difficult to decide between vital pulpotomy and root canal therapy. Generally speaking, providing the fracture is fresh (ideally within a few hours, but sometimes up to a few days) if the remaining pulp is actually bleeding, or starts to bleed when lightly probed, then pulpotomy can be attempted. If there is no bleeding, or the black color or smell of necrosis can be detected, then root canal therapy is the safest course. Animals seem to have a greater resistance to early infections taking hold in exposed root canals, than humans. (Successful pulpotomies have been achieved in animals up to two weeks after exposure of the pulp, but there is a high risk of abscessation.)

ROOT CANAL PREPARATION (INSTRUMENTATION)

Root canal preparation (or instrumentation) is the complete removal of the vital pulp or the remains thereof. This branch of dentistry is known as ENDODONTICS, and has its own instruments.

Before endodontic treatment is started, a radiograph of the tooth must always be taken.
in order to determine the size, length and curvature of the canal, and to check for fractures of the root and any internal or external abnormalities. The next step is to provide a direct line access to the apical portion of the canal. The coronal access hole can be opened up with round or tapered burs. Next a small (#10 or #15) endo reamer or file is inserted down to the apex to establish the WORKING LENGTH of the canal. Endo-instruments for canine fangs (length: 60 mm) work fine in horses. After this a BARBED BROACH is used to remove any remaining living tissue. It is inserted as far into the root canal as possible, and slowly removed with a twisting movement. A vital pulp can usually be removed in one piece by this method, but a necrotic pulp may require several attempts, and even then pieces may remain. If the pulp was necrotic, all tissue must be removed from the pulp chamber and the walls. This can be achieved by a combination of flushing, reaming and filing (INSTRUMENTATION). Reamers or K-files are used to clean and shape the root canal and Hedstrom files to file, smooth and widen the root canal. The surfaces of a root canal is irregular and interspersed with recesses, crevices and fissures, the result of deposition of secondary and reparative dentin.

Root canals need to be cleaned and widened for four reasons:

1. To mechanically remove microorganisms from the canal surface.
2. To remove tags of pulpal tissue and odontoblasts that cling to the canal wall and will later undergo necrosis and provide an environment for bacterial growth.
3. To increase the capacity of the root canal to permit irrigating solutions to reach the apical third of the root canal for effective debridement.
4. To shape the root canal to receive gutta-percha, because the wider the canal, the easier it is to fill it, especially if it is narrow to start with.

The principles of instrumentation are as follows:

1. Always work files in a canal with irrigant.
2. Irrigate frequently and copiously. This is mandatory between each size of instrument change.
3. To gauge the canal size and configuration, always explore with smaller files. Never attempt canal enlargement until final corrected working lengths are established.
5. Loosen debris and remove dentin from the walls on the outstroke only (filing) or with a 1/4 to 1/2 rotating action (reaming).
6. Avoid having instruments bind on insertion. Careful insertion followed by planing on the outstroke will help avoid packing of debris at the apex.
7. Reaming is the action used for the apical preparation and cleaning. The remainder, or the step-back portion of the preparation, is by circumferential filing.
8. Reaming is accomplished by "twiddling" the instrument, then working it back and forth, 1/4 · 1/2 a turn, until it can be freely rotated continuously in a clockwise direction.
9. Filing is a planing or filing motion that is accomplished with a pull stroke. The file is "twiddled" until it locks slightly, and then withdrawn while pushing the tip alternatively against the walls.
10. Filing is accomplished with files only and not reamers.
11. After each insertion and planing, remove the file and clean the flutes of debris, use alcohol-soaked guaze or cotton, then reinsert to plane the next wall.
12. Return to the working length frequently with small files, in order to remove any debris that has become packed in the apical region. This is known as Recapitulation, and should be done at least between each size instrument. Do not plane the walls or enlarge the canal during recapitulation.
13. Do not overprepare the canal walls near the furcation of multi-rooted teeth, since the dentin tends to be thinner at this point.
14. Never try to force or continue rotating a file that binds. This tends to untwist, weaken and break the instruments.
During instrumentation frequent IRRIGATION of the root canal should be carried out at least between each instrument size change with 1 ml or more of 2.5% - 5.25% SODIUM HYPOCHLORITE (which destroys microorganisms, dissolves necrotic tissue and lubricates the canal) followed by 3% HYDROGEN PEROXIDE (the effervescent reaction forces debris and microorganisms out of the canal). The oxygen liberated assists in destroying anaerobic microorganisms). Sodium hypochlorite should always be used last, at the end of instrumentation, because hydrogen peroxide can react with pulp debris and blood to produce gas. Any gas trapped within the tooth will cause continuous pain.

The most important part of instrumentation is the apical preparation. The apical 1-2mm of the canal should be enlarged only one or two sizes larger than the first file that demonstrates any binding. Use care not to overprepare the apical region, particularly in a curved canal. The last instrument that binds slightly at length is called the MASTER APICAL FILE (MAF). When apical preparation is complete, the tapering is created by shortening the working length of each successively larger instrument by 0.5mm and by peripheral or circumferential filing. This is called the STEP-BACK TECHNIQUE. After each step-back file return to length with the MAF (or a smaller file) (reapitulation), in order to loosen any debris that has been forced down towards the apex.

Stepping-back further coronally may necessitate large files up to #60 or #70, (or even up to #140 in very wide canals) to give adequate debridement and provide a sufficient taper to the canal.

The final size of file that fits the apical third of the canal without binding should be recorded and used as a reference for selecting the size of the PRIMARY GUTTA-PERCHA POINT to be used for obturation, (or filling, see 7.14).

Following instrumentation the canal is flushed with saline, gently air dried and finally dried with tapered ABSORBENT PAPER POINTS. The paper points should be inserted down the entire length of the canal, and continually renewed until the tip of the point is dry. It is possible, especially in young animals where the apical opening is large, that difficulty is experienced with excessive bleeding caused by the mechanical irritation of the periapical tissues. Normally a paper point left at the apex for a few minutes will stop the bleeding, or so reduce it that a second attempt will succeed. A higher concentration of hydrogen peroxide (10-30%) will often have a more positive effect, (1:1,000 epinephrine can also be used). In extreme cases, the paper point must be left in the tooth for a day or two, although this is to be avoided if at all possible, because of the necessity of a second general anesthetic. When the root canal is clean and dry the canal can be filled.

ROOT CANAL FILLING (OBTURATION)

The object of obturation is to create a hermetic fluid seal in the entire length of the root canal system, from its coronal opening to its apical termination. The coronal seal is probably as important as the apical seal for long term success.

The main obturating materials are usually solid or semisolid (i.e. in paste form). Although there are a large number of materials to choose from there are only a few that are widely used. There are also those to choose from that have built-in medication and those without.

The major advantage of the solid obturation materials is length control and a reasonable ability to create an adequate seal. Gutta-percha is the most widely used solid material.

LATERAL CONDENSATION is the spreading of the gutta-percha point in a lateral direction in the canal using a SPREADER (a long tapered and pointed instrument). This spreading allows room for the next point alongside, although not to the same length as the 1st. A series of points are inserted this way until the entire diameter of the canal is filled with gutta-percha. When this is completed, and the protruding ends of the points are removed with a heated instrument. VERTICAL CONDENSATION is performed, using a long, straight and blunt instrument called a PLUGGER. This condenses the gutta-percha apically. Care must be exercised not to push the gutta-percha through the tip of the apex.

Although gutta-percha can fill the canal fairly well, it does not usually give a complete hermetic seal, either apically or laterally. In order to get around this problem a sealing ce-
ment is used in combination with gutta-percha. These are the semisolid obturating materials mentioned earlier. Various techniques are used to place the sealing cement. It can be placed on paper points, as a coating on the primary and subsequent points, injecting with a syringe, or with a lentulo spiral filler. The most commonly used method in veterinary medicine is the latter.

The lentulo spiral is covered with the sealing cement, inserted into the canal, and the slow-speed handpiece then started at its slowest speed to carry the material to the apex. Take care that the handpiece is rotating in the correct direction, clockwise to introduce the material and counterclockwise to remove the spiral. The lentulo spiral works best in a canal only slightly larger than the spiral itself, and in very wide canals will not work so well. In wide canals only the apex may be filled by this method, thus the rest has to be filled from a disposable syringe with the smallest needle that allows passage of the paste. The needle is inserted as far as possible into the canal, and then removed slowly and with a continuous pressure on the plunger to ensure complete filling. One or more gutta-percha points is pushed into the slow hardening sealing cement and laterally condensed to ensure complete diameter filling. The excess gutta-percha is then cut off with a heated instrument and vertical condensation performed. A radiograph must be taken either after the primary gutta-percha point has been inserted or after condensation of the subsequent points, to be sure that the canal is properly filled to within 1-2mm of the radiographic apex of the tooth. After the canal is adequately filled with gutta and condensed, the remaining coronal ends of the points have to be removed with a heated instrument. Gutta-percha should be removed to a level of 4-6mm below the access opening. After this the remaining part of the canal finished with a base and restoration. Any unsupported enamel, or sharp edges should of course also be removed.

A post-op X-Ray control should be performed some 6 months after the procedure.
Dental pulp necrosis in incisors in old horses

Jens Arnbjerg

1 Veterinary Imaging Department, Faculty of Life Sciences, University of Copenhagen, 1870 Frederiksberg C, Denmark. Tel.: +45 35332921; fax:+45 35332929. E-mail: jarn@image.dk

Introduction

Most of the non traumatic clinical problems with teeth in the horse affect the cheek teeth (Dixon et al., 1999; Baker and Easley, 2005; Dacre et al., 2008) and most of the literature about horse’s teeth is concerned with the diagnosis and treatment of these teeth. Very little is described about infection and other non traumatic lesions in the incisors (Dixon et al., 1999; Stascyk et al., 2008; Robinson and Sprayberry, 2009), and there is no description of pulp lesions in the incisors despite the fact that steadily increasing number of horses are radiographed for teeth problems. Most of the dental abnormalities described in incisors relates to development and to trauma of the maxilla or mandible (Enden and Dixon, 1999).

The purpose of this study is to describe an abnormality showing open incisor pulps in two aged horses that had no clinical signs related to the teeth.

Material

A 16 years old Shetland pony, gelding, was brought to the university clinics because of recurrent chronic laminitis in both thoracic limbs due to chronic diarrhea. The teeth were examined clinically and radiographed to see if dental diseases could be an underlying cause for the diarrhea. No clinical sign related to the teeth were found, and no signs of pain or discomfort was seen even when the two teeth (202 and 403) with open pulp cavities were tapped.

As no significant reason for the diarrhea or laminitis could be found and the problems could not be solved, the horse was euthanized. At necropsy no specific reasons could be found either for the diarrhea or the laminitis.

The other case was a 35 year old welsh pony, which was examined due to abnormal position and conformation/wear of the incisors. The horse had no problems with prehension of food or discomfort during riding. Again no pain related to the teeth (101, 103, 303 and 403) with open pulp cavities could be seen or provoked by tapping on the incisor teeth.

Methods

Radiographs of the incisors in both horses were taken. Intraoral position of the cassettes was used so that the mandible and maxilla were exposed separately. Slight sedation was used. A post mortem CT examination of the head of the Shetland pony was performed using a Siemens single slice helical computer tomography (CT) scanner (Emotion, Siemens, Germany) at the slice-thickness of 2 mm 1.3 pitch, 110 kV and 137 mAs.

Results

The clinical photographs of the incisors showing regularly worn occlusal surfaces with secondary dentine filled pulp except for 202 and 403 in the first horse and 101, 103, 303 and 403 in the second horse where open pulp cavities could be seen on the occlusal surface. The dentine around the open pulps were discoloured. The gingiva was without significant pathology around the affected teeth in case 1 but there was irregular loss of gingival around the
mandible teeth in case 2 which also had abnormally worn teeth – the crowns being shorter in the maxilla incisors and longer than normal in the mandible incisors.

Case 1

Except for the two open pulp cavities the occlusal surface and the length of the crowns were regular and normal looking at the clinical examination for this age of horse.

The radiographs of the incisors show an irregular and decreased density around the pulp of 202, with similar changes but to a much lesser extend and degree in 403. The length of 101 and 201 are significantly reduced compared with the rest of the incisors. In most of the incisors a straight narrow line representing the live pulp was seen and appeared normal for the horse’s age. In some of the teeth the root areas were not as slim as they usually are at this age, but covered by various amounts of hypercementosis – especially in the mandibular incisors. The periodontal membrane was clearly visible and distinct, but of slightly variable width around the teeth especially around those with severe hypercementosis. The shape of most of the incisors was broader and more irregular, than normal for this type and age of horses. The length of the 401 was significantly shorter than expected due to root replacement absorption.

The alveolar bone was not pathologically changed on the radiographs, as the trabecular pattern was normal outside the hypercementosis and the broader periodontal lines.

On the CT images the pulp-cavity was clearly demonstrated as being very irregular and the degree of destruction of the dentin was greater compared to what could be seen on the plain radiographs. Especially in 403, where the cavity is multi chambered eroded and empty, i.e. not filled with straw or other feeding stuff. Also on this modality the periodontal membrane is quite regular in size but the shape changed because of hypercementosis.

Many of the other teeth (102, 103, 202, 203, 302, 303 and 401) have hypercementosis on their roots pressing the periodontal membrane around the enlarged roots.

Case 2

In case 2 the occlusal surface was very irregular with uneven wearing of the different teeth. The maxillary incisors were worn down nearly to the gingival junction – the mandibular incisors were more than 1,5 cm too long. 301 was fractured at the gingival junction and had lost some alveolar bone. 402 had lost gingival and alveolar bone covering of the labial side for several cm (destructive periodontitis). 101, 103, 303 and 403 had open pulp on the clinical inspection of the occlusal surface. At clinical examination none of the teeth with open pulp showed any reaction on manipulation, palpation or tapping on the teeth.

On the radiographs severe (up to 2 cm in root diameter) sub gingival hypercementosis were seen around 103, 203, 303 and 403. Lesser amounts were seen around the roots of 102, 202, 302 and 402. Around 301 and 401 periodontitis was quite severe with bone loss in the respective alveoli with an irregular and broader periodontal membrane and sclerotic bone. 101 and 201 were the only roots being nearly normal for that age. All the periodontal membranes were thicker and surrounded the thickened enlarged roots.

The length of the roots differs very much from each other in the mandibles. They should normally be of more equal length and size.

At the time of writing 7 months after the first examination, no new clinical changes have developed.

Discussion

Dacre (2005) has described and other authors (van den Enden and Dixon, 2008, Dacre et al., 2008,) have accepted that anachorectic infection around the apical foramen can cause ischemic death of pulps in the cheek teeth in the horse later in life. In the hypodent equine teeth the continuous eruption of the teeth the occlusal surface the pulp area is normally filled in by formation of secondary dentin (Baker and Easley, 2005). Later on when the occlusal pulp covering dentine (primary or secondary dentine) is worn down the empty pulp
will show an opening of the dead pulp (Dacre, 2005). This might be the explanation that the pulp’s death will result in an empty pulp cavity in the incisors being visible on the occlusal surface. There is no sign of apical periodontitis present at the apex of the affected teeth on the radiographs nor on CT images in spite of the fact that the pulp is open at different surfaces on the CT images. The CT shows the pulp cavity more exact and precise than the radiographs, but severe pulp changes can be seen on good radiographs.

The miscoloured area around the open pulp seen on the occlusal surface indicates that the pulp cavity has been open for quite some time which is proven too be the internal resorption in the root seen on the CT images.

It is generally accepted, that an opening of the vital pulp to the oral environment will cause a severe apical periodontitis, with clinical signs of pain and malfunction of mastication process in most species (Human – Pindborg, 1970; Horses – Baker and Easley, 2005; Dacre et al., 2008; Dogs and Cats – Eisenmenger and Zetner, 1982; Gorell, 2008; Rabbits and Rodents – Capello, 2005; Primates – Lindhe, 1998).

Hypercementosis in man is directly related to apical foramen obstruction (Pinheiro et al., 2008). In horses hypercementosis is described in relation to inflammation in the periodontal tissue (Starzyk et al., 2008, Robinson and Sprayberry, 2009), and in the dog it seems related to pulp degeneration and periodontal tissue inflammation (Yaghmaiee, 2007). In these cases the hypercementosis can be described as “idiopathic cementosis” as there are no clinical signs and nonspecific reasons related to the teeth e.g. osteolysis in the alveolar bone surrounding the cementosis.

For the external resorption and hypercementosis in 401, a similar ethiology is proposed, as the same kind of external process in the periodontal tissue such as inflammation can result in such reactions (Vinkier et al., 1998; Robinson and Sprayberry, 2009).

Due to the fact, that the resorption areas of the length-reduced roots are very smooth and the replacement bone has a regular trabecular pattern, the ethiology of external resorption is probably not of bacterial origin, as those will result in radiolucent area in the alveolar bone and not stay smooth as pointed out histologically by Staszyk et al. (2008). Therefore the ethiology of the hypercementosis might also be of non-infectious origin. The destruction of the pulp foramen could occur for different reasons, but healing has taken place and no remnants of bacterial infection can be seen on the radiographs or CT pictures of the foramen area. This fact could be an explanation too that these radiological changes seen in teeth with hypercementosis do not cause clinical signs in the affected horse just as subgingival root resorption in man is very seldom associated with symptoms (Vinkier, 1998). In dogs external root resorption does not cause clinical signs (Arnbjerg, 1996).

This differs from what is seen in cats where pain is correlated with resorptive lesions and where the supra gingival affected part of the teeth are exposed and the oral microflora has access to the periodontal membrane (Gorell, 2008).

In the cases reported here no gingival abnormalities are seen in relation to the open pulp cavity and therefore there is no access for the oral microflora to the deeper periodontal membrane – this could explain the reason for the lack of clinical signs. There seems to be no significant correlation between the dead pulp and the hypercementosis, as hypercementosis is seen around different teeth and not related to the pulp or gingival status around the teeth.

The internal resorption might progress in such a way that the affected tooth will eventually break. This could result in irritating gingivitis which should be treated by removing the rest of the diseased teeth.

According to Robinson and Sprayberry (2009) recessed gingival can cause pain, but this does not seem to be the case in case 2 where some of the roots are uncovered by normal gingiva.

Conclusion

Open pulp in elderly horses does not necessarily result in painful disease even when severe changes are seen on radiographs. Therefore this condition does not always need specific treatment. Hypercementosis might as well be seen on the radiographs but can be seen as
incidental findings in normal functioning elderly horses. Specific treatment might not be necessary before destruction of the affected teeth due to internal resorption.

References

Mandibular reconstruction in dogs using rhBMP2 in an osteoconductive scaffold

Frank J.M. Verstraete¹, Boaz Arzi²

¹ DrMedVet MMedVet DAVDC DECVS DEVDC
² DVM University of California, Davis

Introduction

Critical size defects of the mandible may be of traumatic origin or as a sequel of extensive resective surgery. This results in a malocclusion that causes difficulty in eating, drinking and prehension. Moreover, malocclusion can result in traumatic insult to other oral structures as well as long-term damage to the temporomandibular joints. Historically, mandibular reconstruction has rarely been performed in dogs. The use of BMPs in for mandibular reconstruction in dogs has been described in very few case reports and with favorable outcome. BMPs are pleiotropic regulators of the bone and cartilage differentiation cascade, regulating chemotaxis of progenitor cells, mitosis of mesenchymal stem cells, and differentiation of cartilage and bone. It has been shown that BMPs induce new bone and cartilage formation in vitro and in vivo. Moreover BMPs are disulfide-linked homodimers that induce bone and cartilage formation and differentiation of mesenchymal cells to various lineages. BMP2 specifically plays an important role in inducing osteoblast differentiation and new bone formation. The purpose of this clinical study was to document the feasibility of reconstruction in clinical cases of dogs with a critical size mandibular defect.

Study Methodology

Clinical experience from the Dentistry and Oral Surgery Service at William R. Pritchard Veterinary Medical Teaching Hospital, University of California, Davis is reported. Dogs presented for mandibular non-union or segmental mandibulectomy were considered for inclusion in the study. The mandible was stabilized via internal fixation using mandibular locking plates or miniplates and screws. The critical defect site was filled with recombinant human bone morphogenetic protein-2 delivered in an absorbable collagen sponge containing hydroxyapatite and tricalcium phosphate granules.

Results

Utilizing the favorable biologic potential of BMPs in immediate and delayed mandibular reconstruction surgery in dogs is demonstrating early and robust bone response. In addition, the radiographic and computerized tomographic evaluation supports the clinical impression of early bone formation at the critical defect site. That result in almost immediate return to normal function.

Discussion

The canine patient is different from the human patient in multiple ways including the anatomy, masticatory forces, postoperative care, patient compliance and rehabilitation. In our clinical experience we find that using internal fixation combined with BMPs delivered with osteoinductive scaffold for mandibular reconstruction exhibit short and long-term positive outcome. Immediate postoperative occlusion with good cosmetic appearance is achieved with these procedures.
Bibliography


Radiation therapy—important treatment modality for different oral tumors in dogs and cats

Ana Rejec¹, Slovenia Matjaž Jeraž², Slovenia Janoš Butinar³, Slovenia David Crossley⁴, Janeane Fidel⁵

¹ DVM, Animal Hospital Postojna
² Radiology Ing, Oncology Institute of Ljubljana
³ PhD, Animal Hospital Postojna
⁴ PhD, Dipl EVDC, Animal medical Centre, Manchester, UK
⁵ Diplomate ACVIM (Medical Oncology) & ACVR (Radiation Oncology), Washington State University, US

Introduction

Radiation therapy is a useful treatment modality for oral/oropharyngeal cancer in cats and dogs. Often it can be used in conjunction with surgery and different types of localized tumors can be treated with intent to cure. Treatment can also be done in situations where there is little hope of a cure to palliate an animal's signs and give them better quality of life. Side effects of radiation are divided into early (occurring at less than 3 months after radiation) and late effects (occurring at greater than 3 months post radiation). Radiation side effects develop but are quite well tolerable.

Methods

42 patients (30 dogs, 12 cats) with different oral tumours have been presented for the treatment to Animal Hospital Postojna from 2007 – 2011. All cases had been histologically confirmed oral/oropharyngeal tumours: acanthomatous epulis (AE) (1 dog; 2,38 %), malignant melanoma (MM) (11 dogs; 26,2 %), oral squamous cell carcinoma (SCC) (5 dogs, 5 cats: 23,8 %), tonsillar SCC (1 dog: 2,38 %), fibrosarcoma (FSA) (8 dogs: 19,04 %), osteosarcoma (OS) (9 dogs: 21,42 %), lymphoma (LYM) (1 cat: 2,38 %) and multilobular bone tumor (MLO) (1 cat: 2,38 %). Prior the radiotherapy the complete diagnostic work-up (CBC, serum biochemistry, thoracic x-rays, abdominal US) was performed. Computed tomography of the head/neck was performed in all patients for staging and radiotherapy planning purposes. The radiotherapy protocols were tailored to the type of tumour and treatment intent: 4-6 fractions of 4-8 Gy for palliative, 12-19 fractions of 3-4 Gy for curative therapy and accelerated (chemo)radiotherapy 14 fractions of 3,5 Gy in 9 days.

Results

The best results and the longest survival has been achieved for patients with oral/oropharyngeal SCC that were treated with accelerated curative intent (chemo)radiotherapy (carboplatin added as radiosensitiser). Acute side effects were greater when higher doses were used (grade 2 for skin and grade 3 for oral mucosa). Acute side effects were minimal (skin 1, oral mucosa 2) for the protocols with low doses used and accelerated protocols. Good partial or complete response was achieved in 70-80 % of cases.
Discussion

In general, patients with oral tumours are good candidates for radiation therapy due to problems associated with surgical resection. Aggressive surgery can lead to loss of function or may be cosmetically unacceptable to the owner. Radiation alone or addition to a less aggressive surgery may bring better results.

Of the oral tumors, acanthomatous epulis is considered the most sensitive to radiation and tumour control is close to 90%.

Malignant melanoma (MM) responds well to radiotherapy, 83-100 % with up to 70 % having a complete response. Similar results have been achieved in our MM patients. Typically a dose fractionation protocol is used (3-4 fractions of 8-9 Gy). For patients with large tumors, where surgery is declined or when there is evidence of metastatic disease, radiotherapy is a palliative treatment that can reduce tumor burden and improve quality of life of MM patients.

Oral squamous cell carcinoma (SCC) can be treated with radiation. A smaller lesion located more rostrally does have a better chance of long term tumour control than larger lesions placed more caudally in the oral cavity, although rostrally located can be surgically removed easier. Also surgery can be used in a conjunction with radiation to increase chances of tumour control. Squamous cell carcinoma (SCC) of the tonsils carries a much poorer prognosis because regional lymph node or/and distant metastasis is common in the early stage of the disease. Median survival of 4-6 months has been reported even with a combination of conventional radiation and chemotherapy. Our result in 1 patient with tonsillar SCC show different result with complete response of 10 months at time of writing this proposal where accelerated (chemo)radiotherapy protocol was used. The difference can be ascribed to improved sensitivity of neoplastic cells to accelerated radiation with conjunction with tumour biology and its rapid doubling time.

Oral fibrosarcomas (FSA) are locally very difficult to control but they are unlikely to metastasize apart from histologically low grade but biologically high grade FSA. Radiation alone is rarely curative for these tumours and is more commonly used after surgical resection or debulking. After surgical removal and post surgical radiation recurrence rates are high and median survival is about 1,5 years. Our experience in non-resectable oral FSA show that curative intent radiation can give good partial remission with improved survival time.

Feline oral SCC is the most common tumour and due to its specific biology extremely difficult to treat. The majority of conventional radiation treatment approaches have been unsuccessful. An accelerated radiation therapy protocol with carboplatin as a radiosensitiser showed an improved local tumour control and resulted in increased survival of patients with these type of neoplasia.

Conclusions

Radiation therapy is a viable tool to treat oral/oropharyngeal tumours in dogs and cats. It can be used as a sole therapy or in a combination with surgery and chemotherapy. Both the tumour type and the tissues surrounding the tumours need to be taken into account when planning therapy and predicting response. Curative intent radiation therapy is most beneficial for tumours that remain localised.

References

Total unilateral mandibulectomy for advanced stage oral squamous cell carcinoma in a cat: surgical planning based on CT

Lisa A. Mestrinho1,2, Nuno Leal2, Margarida Serrano2, Luis Cruz3, Maria M.R.E. Niza4

1 Centre of Research in Veterinary Sciences, Faculty of Veterinary Medicine, Lusófona University (Mestrinho), Av. Campo Grande, 376 – 1749-024 Lisboa, Portugal
2 Aniaid-Veterinary Clinic (Mestrinho, Leal and Serrano), R. República Peruana nº 5B, 1500 Lisboa, Portugal
3 Veterinary Hospital of Laranjeiras (Cruz), Rua de S. Tomás de Aquino, 8 C, 1600-203 Lisboa, Portugal
4 Interdisciplinary Centre of Research in Animal Health, Faculty of Veterinary Medicine, Technical University of Lisbon, (Niza), Av. da Universidade Técnica – 1300-477 Lisbon, Portugal

In the cat 3% of all tumours occur in the oral cavity1. Squamous cell carcinoma (SCC) is the most frequent and is associated with a bad prognosis. Post surgical outcome for mandibular SCC reports 43% of live cats at 1 year1. The present case reports a Stage III SCC (T3bN0M0) in which, based in pre surgical computed tomography (CT) staging and surgery planning, resulted in clear margins of the surgical piece. The animal was discharged 72h post surgery with recovery of function.

A 14 year-old-male domestic European shorthair cat was diagnosed with a clinical stage III SCC on the right hemimandible. The lesion had approximately 1 month of evolution time leading a deformation of the medial side of the right mandible branch. Mass size has 4 cm at its maximum diameter. CT evaluation using a Philips Brilliance 16 system identified a mandibular ramus mass with extensive bone invasion and periosteal reaction measuring 4.8cm at his maximum diameter (axial and coronal views). 3D reconstruction of bone and soft tissue of the cranium and mandible, oral mass and submandibular lymph nodes was preformed (fig. 1). After thorax evaluation which revealed no distant metastasis and neoplasia staged as a T3bN0M0, Surgery was proposed to the owners. Radiotherapy and chemotherapy was also proposed as adjuvant treatment but was declined.

Anesthesia and pain management protocol included premedication with dexmedetomidine 5µg/kg IM (Dexdomitor, Esteve Pharma) associated with ketamine 5mg/kg IM (Chlorketam, Vetoquinol) and morphine 0.5mg/kg IM (Morfina 1%, BBraun). Propofol 2 mg/kg to effect (Propoclear, Pfizer) was used for induction. Maintenance was performed with isoflurane (Isoflo, Esteve pharma). Analgesia protocol included bupivacaine (Bupivacaina 0.25% BBraun) for local nerve blocking, fentanyl patch of 25µg (Durogesic, Janssen) and meloxicam at 4mg/kg (Metacam, Boehringer Ingelheim) in post surgery period. Amoxicillin associated to clavulanic acid at 12.5mg/kg (Synulox, Pfizer) was also administered pre and post surgically (Synulox, Pfizer).

The patient was positioned in dorsal recumbency, clipped and aseptically prepared with 0.2% chlorhexidine solution. Surgery was planned based on CT reconstructed images and 3D models consisting in right total mandibulectomy and soft tissue margins. Those comprised partially or near total excision of the masseter, digastric, pterygoideus, buccinator, geniohyoid and mylohyoid muscles and sublingual portion of the mandibular salivary gland. To allow maximum mouth exposure, a lip commissure cheilotomy was extended until the zigomatic arch. Incision at the ventral border of the zigomatic arch, with masseter miotomy allowed full exposure of the mandibular condyle and temporo-mandibular joint (TMJ). Incision of the TMJ capsule was followed by disarticulation through a lateral approach. Symphysis separation was performed with a scalpel blade. After achievement hemimandible mobility, medial soft tissue margin was incised and dissected. The right mandibular gland was partially excised and included in the surgical margin but the submandibular duct was preserved. Electrocoagulation was used to control local hemorrhage.
Reconstruction of the defect was achieved through an upper lip genial mucosal flap. Routine closure of mucosa, skin and remained soft tissue was performed using a 4-0 poliglicolate suture (Monosyn, BBraun). A cheiloplasty was carried out in order to control tongue protrusion. Partial coronal amputation of the left mandibular canine and vital pulpotomy was performed and post surgical feeding was assured with a esophagostomy tube placement (fig.2).

Recovery was quick with the animal gaining appetite 12h after surgery however, restricted feeding by tube was used for 72h. After this period food was presented and the animal started to eat. Grooming behavior was also observed 48h post surgery. No suture was removed and the surgical site was healed at the 15th day, time when the esophagostomy feeding tube was removed. Post surgical complication regarding suture dehiscence, hemorrhage and infection were not observed.

Histopathology analysis resulted in SCC diagnosis and the surgical piece was considered with clean surgical margins. In the presence of advanced tumor stage and medial short margin, owners were advised for the necessity of monitoring local recurrence. The animal still remains without signs of local recurrence 6 months after surgery.

Discussion

Surgery plays a key role, either with curative (definitive, adjuvant) or palliative intent, in the management of the oncological patient. This last objective aims to manage pain, provide relief and to increase the patient’s life quality 2.

Surgical excision is the primary treatment option for oral SCC and surgical techniques in oral oncology are chosen according to tumor type, location and TNM stage.

In the oncologic patient it is known that the first surgical approach has the biggest chance for success 3. For this reason surgical management with a curative intent must be done with wide safe margins.

For oral tumors, different authors defend bone margins between 1 to 2 cm for en bloc excisions 1,2,4, because more than half present bone involvement 5,6. Mandibular tumors allow wider safe margins when compared with those located in the maxilla. The same thing occur when were compared rostral and caudal located tumors 1,2. In this case report animal was presented with an advanced stage SCC. However, no lymph node or distant metastases were found during CT examination.

Safe margins of 1 to 2cm, as recommended in the literature 3,4 were not possible to achieve at the medial side. Nevertheless, based on pre-surgical CT and 3D reconstruction of the mass and soft tissue involvement, it was possible to identify and calculate healthy margins. Furthermore, pre-surgical CT planning allowed evaluation of the mass in all directions. 3D model rotation permitted the identification of anatomical points, references, nearby vessels and structures and allowed to plan the best surgical approach in order to minimize intra-surgical tumor contamination. In this case a full lateral approach was planned: first a wide lip commissure cheilotomy and extension to the ventral part of the zigomatic arch; second, disarticulation of the TMJ; third, symphysis separation and finally medial dissection. This approach, in the author’s opinion, can help to avoid tumor seeding. In fact, medial margins were not so wide as desirable, however histopathology confirmed clean margins.

Major oral surgery and specially total unilateral mandibulectomy is related with a high acute morbidity and long-term morbidity in cats 7. In order to minimize long term complications, a cheiloplasty and a coronal amputation with vital pulpotomy of the left canine tooth was performed. Mandibular drift, malocclusion, ptyalism and tongue protrusion are common consequences reported in this kind of surgery 7. During the hospitalization time and besides esophagostomy tube feeding, the animal was searching for food and, although sloppy, could eat and grooming at 24h after surgery. At 72h, solid food was presented and he was able to eat and rapidly adapted to his new condition.

References


Compound maxillary odontoma in a young cat

S. Papadimitriou¹, M. Kouki², D. Doukas³, D. Tontis⁴

¹ DVM, DDS, PhD, Assistant Professor, Companion Animal Clinic, Faculty of Veterinary Medicine, Aristotle University of Thessaloniki, Greece
² DVM, MSc, private practitioner, Athens, Greece
³ DVM, PhD, Laboratory of Histopathology, Faculty of Veterinary Medicine, University of Thessaly, Karditsa, Greece
⁴ DVM, PhD, Associate Professor Laboratory of Histopathology, Faculty of Veterinary Medicine, University of Thessaly, Karditsa, Greece

INTRODUCTION

Odontogenic tumors are uncommon in domestic animals. However, accurate diagnosis is an indispensable step towards appropriate management of the case. In human beings, there have been numerous attempts to classify odontogenic tumors.

The veterinary classification of odontogenic tumors is mostly based upon the inductive effects of odontogenic epithelium on the adjacent connective tissue (1).

Odontomas are rare odontogenic tumors or malformations appearing in small animals (1,2). Odontomas are rather regarded as hamartomas and not neoplastic proliferations (3). Odontomas may be subdivided, rather arbitrarily, into complex and compound malformations (4,5).

CASE REPORT

A 10 months old, male Domestic short-haired cat was referred to the Clinic. The owner reported the presence of right eye discharge for the past couple of months.

On presentation, the cat was in good body condition and the physical examination was normal. Apart from the epiphora and dermal staining, a facial swelling was noted on the right maxillary bone, ventrally and rostrally to the right eye. The eye examination was normal and there was no nasal discharge. The oral examination revealed a round and firm swelling, non painful on palpation, about 1.5 cm in diameter that occupied the area corresponding to the alveolar bone of 104 which had not erupted. An open mouth skull radiograph was obtained. The radiograph demonstrated a mass of mixed opacity at the level of the right maxillary recess.

Surgical removal of the mass was decided and a full thickness mucogingival flap was created. Dense connective tissue and multiple bone like small structures were discovered in the amorphous mass, 104 was not recognized.

Biopsy specimens were submitted for histopathology and histopathological examination revealed that the mass was a compound odontoma.

The cat was re-examined 6 months, 1 year and 4 years post operatively. There was no recurrence of the lesion but the owner mentioned the presence of epiphora in rare intervals.

DISCUSSION

Only a few cases of compound odontomas have been reported in dogs (6,7,8). To the authors’ knowledge, there are no reports concerning odontomas appearing in cats.

The cause of odontomas remains unknown. A tentative diagnosis of an odontogenic tumor can be made based on radiographs. It usually appears as a radiolucent, cystic lesion that may be expansile. Compound odontomas may also include well-formed tooth elements (9,10). Almost all epithelial odontogenic tumors warrant a good prognosis. None has ever been reported to metastasize (2,11). Differential diagnosis based on clinical and radiological
findings may include dentigerous cysts and epithelial odontogenic tumors, such as ameloblastoma or complex odontoma. Confirmation of the diagnosis in these cases can only be made with biopsy and histopathological examination of the tissue specimens. Complete surgical excision is usually curative.

References

Explorative investigation of cone beam computed tomography for the temporomandibular joint in the dog and cat

Bert Van Thielen, Olivier Jacqmot, Francis Siguenza, Bassam Hassan

Introduction

Temporomandibular joint (TMJ) disorders more commonly encountered in the dog and cat include luxation, open-mouth jaw locking and ankylosis [2, 3, 4, 5]. A diagnosis is made by means of clinical examination and radiography. Traditionnaly intra-oral or dorso 45° lateral oblique extra oral radiographic views are recommended for TMJ-imaging, but such imaging is asking for well trained radiographer skills and don’t avoid superpositioning of anatomical structures [5]. Computed Tomography can solve the problem created by superpositioning for interpretation by mean of Multi Planar Reformatted reconstructions (MPR) or Volume Rendered (VR) reconstructions. However this kind of scanners have only standard reconstruction options programmed in his software and is not alround present in veterinary clinics, due to the costs and place needed for installation, operation and maintenance. Cone Beam Computed Tomography (CBCT) is a new application specific scan technology developed in human medicine (e.g., maxillofacial imaging), which is used increasingly due to its capacity of a reduced radiation dose and its reduced costs and place needed for installation. It’s working completely different from a classical CT. Where a CT is working with a x-ray source which is turning around in a gantry with one or multiple rows of detectors, is a CBCT working with a detector [ CCD (Charged Coupled Device) – or FP (Flat Panel) ] and a x – ray source which are rotating in face of each other and which are making classical 2D – radiographs at different positions in the gantry [7 - 14]. All these 2D – radiographs are afterwards reconstructed to a digital volume by middle of a special developed reconstruction algorithm [1].

Cone Beam Computed Tomography (CBCT) has recently been evaluated for its use in veterinary dentistry [7 - 14]. Using a CBCT – device, operating with a FPD – detector, and working with a supine table and an open gantry, have a considerable potential of CBCT for its use in veterinary dentistry that is being suggested [7 - 12]. One of the big advantages in comparison with CT is the presence of application specific reconstruction software for the anatomical region that need to be scanned, which means for exemple that for maxillofacial radiological applications, panoramic and other parabolic curved reconstructions can be made.

The objective of this presentation is to evaluate the feasibility of TMJ – imaging of the dog and the cat with a CBCT – scanner and to describe the normal anatomical appearance of the TMJ – structures with multiple reconstruction techniques.

Material and Methods

CBCT – scan:
The heads of 4 dogs and 4 cats without any history of skull or jaw pathology were amputated and frozen in the 24 hours after death and defrosted 24 hours prior scanning. A CBCT –
dental device for supine patient positioning (NewTom 5G™) was used in order to easily perform positioning of the isolated heads and to be able to perform scans of living animals in a later study. The isolated heads were positioned with the ventral side on the scantable. The operator had the choice between a standard scan mode, a boosted scan mode and a High Resolution scan mode. The operator had also the choice between a field of view (FOV) of 6 X 6, 8 X 8, 12 X 8, 15 X 12 and 18 X 16 cm. The scan parameters including kV, mA and scan time, were automatically determined by the scan software for each patient with every chosen FOV.

Data analysis:
Panoramic, cross sectional, in plane longitudinal, Multi Planar Reformatted (MPR) and Volume Rendered (VR) reconstructions were made using the scanner software. The panoramic and in plane longitudinal images were reconstructed by drawing a curve following the mandibular and maxillar arch for each skull 15 reformatted panoramic reconstructions were made using a slice thickness of 1, 2 and 3 mm. Image quality was assessed on the visibility of anatomical structures and anatomical correlation was performed by gross standardized dissection.

Results
Satisfactory image quality was obtained for the reconstructions of all the skulls’ scanned in this study. Superior detail could be assessed on the images of the Temperomandibular joint in the dog and satisfactory detail could be assessed on the images of the Temperomandibular joint in the cat.
Using the Reformatted Panoramic and in plane longitudinal reconstructions, and in detail evaluation of the in profil temperomandibular joint anatomy was possible. Additional information about the anatomical detail could be obtained using cross sectional and coronal reconstructions.
Reference images in the multiple planes are presented.

Discussion
This study was performed to examine the feasibility of using CBCT technology for the examination of the temperomandibular joint in dogs and cats. Temperomandibular Joint Disorders are commonly seen in dogs’ and cats’ [2 - 5]. However, to obtain classical radiographs some trained skills are needed and different views are not so easy to interpretate due to the superpositioning of anatomical structures.
Computed Tomography (CT), can solve this problem and is indicated for a lot of indications, like in case of malformation of the joint and the facial skeleton, advanced degenerative joint disease, coronoid - blocking syndrome, posttraumatic arthropathy, rheumatoid arthritis, osteomyelitis and postoperative followup [15]. Nevertheless, CT scanners have only standard reconstruction options programmed in his software, where CBCT is application specific constructed and is commercialised with application specific reconstruction software for maxillofacial medicine. CBCT is recently evaluated for its diagnostic accuracy of mandibular condyle fractures in sheep [3] and for its potential value as imaging tool in veterinary dentistry [7 - 12].

Conclusion
Anatomical reference images of the temperomandibular joint with CBCT are presented in this study. This study shows the potential that an adapted CBCT could have for studying the anatomy and pathology of the temperomandibular joint in dogs’ and cats’. However further research on pathological cases is needed to dermine its exact value in clinic.
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Facial abscess in a guinea pig (*Cavia porcellus*) - case report

Andrea Minarikova¹, Vladimir Jekl²

¹ DVM
² DVM, Ph.D., Dip. ECZM (Small Mammal), Avian and Exotic Animal Clinic, Faculty of Veterinary Medicine, University of Veterinary and Pharmaceutical Sciences Brno, Czech Republic jeklv@vfu.cz

Introduction

Clinical syndrome of dental disease is in guinea pigs is the most frequent health disorder. Clinical symptoms are often nonspecific and animals are presented as loss of appetite, changes in feed preferences, weight loss, increased salivation, bruxism, or diarrhea.

To determine the correct diagnosis and prognosis, the oral cavity requires a very careful and thorough examination. Radiography, oral cavity endoscopy and in some cases computed tomography examination are necessary to exactly describe the extent and severity of the lesion. In guinea pigs, due to their skull and dental anatomy, computed tomography seems to be more important when diagnosing a dental disease and periapical pathology.

The aim of this paper is to present a clinical case of severe mandibular osteomyelitis and dental pathology in a guinea pig.

Case description

A 2.5 year old, 790 g, intact female guinea pig was presented to the clinic because of decreased appetite and progressive weight loss. Medical history consists of previous surgical treatment done at different clinic before 14 days. The skin over the right mandibular abscess was lanced and pus was excavated, flushed with antiseptics (chlorhexidine) and treated with T-sulpha for 14 days. No any other treatment, including supportive care and analgesics administration was performed. The owner did not notice any improvement after the surgery.

During the physical examination, the animal was slightly apathetic, had hunched posture, poor body condition (2/5) and with bilateral slight serous ocular discharge. The skin elasticity was decreased and the coat was dull. Palpation of abdominal cavity revealed watery content of the small intestines and caecum. On the ventrolateral side of the right mandible there was a severe bony swelling of the jaw, which easily detectable by palpation. A fistulation with pus inside was discovered at the edge of the lesion. Right mandibular and maxillary dental arcades were elongated coronally.

Blood for haematological and plasma chemistry analyses was obtained from cranial vena cava and was unremarkable. Skull radiography (rostrocaudal, ventrodorsal, right lateral with the open oral cavity and two lateral oblique views), oral cavity endoscopy and computed tomography were performed. These methods showed minor apical elongation of all cheek teeth on the left upper and lower jaws, marked apical and coronal elongation of all cheek teeth on the right upper and lower jaws, widening of interproximal coronal spaces between the right mandibular cheek teeth, buccal erosions, severe right mandible osteoproliferative changes, lysis of the anatomical roots of the right mandibular premolar and first and second right mandibular molars. On the right side of the lower jaw the clinical crown of the first and second molar were missing and when palpated with periodontal probe pus was seen.

Final diagnoses were determined as periapical infection of the right mandibular premolar and the first and second molar, osteomyelitis, and syndrome of dental disease. The prognosis was guarded.
In the first step, stabilization and clinical crown height adjustment were performed. The patient was then stabilized in an oxygen box and antibiotics (marbofloxacine 10 mg/kg IM), analgesics (butorphanol 0.3 mg/kg IM, meloxicam 0.6 mg/kg SC), prokinetics (ranitidine 5 mg/kg IM, metoclopramide 0.5 mg/kg), isotonic fluids (80 ml/kg/a day) and other supportive drugs (vitamin C, B-vitamins, butophosphanon) were administered. The animal was force-fed with instant herbivorous diet. A patient was sent to home care third day of hospitalisation, and owner continued with force-feeding and marbofloxacine and meloxicam administration.

Seven days after the first visit the major surgery was performed under general isoflurane anaesthesia with injectable premedication (butorphanol 0.3 mg/kg, ketamine 3 mg/kg, midazolam 0.2 mg/kg, medetomidine 0.03 mg/kg). Patient was monitored thorough the surgery (ECG, thoracic and cardiovascular auscultation). All necrotic tissue was removed along with the affected bones and teeth. Atipamezole was administered and patient was allowed to recover in oxygen cage. Bacteriology results showed the presence of Finegoldia magna (formerly Peptostreptococcus magnus), and Veillonella parvula sensitive to metronidazole and ampicilins and Eggerthella lenta (formerly Eubacterium lentum) sensitive to ampicilin, but resistant to metronidazole.

Five hours after the surgery a guinea pig start eating spontaneously. Fluid therapy and drug administration were continued as described above. Metrinidazole was administered at the dose of 30 mg/kg PO twice a day. After two das a patient was sent to home. Follow up examination in days 5, 14 and 21 after the surgery showed optimal healing process (healing and granulation was supported by using KMnO4) and at the day 21, the wound was healed completely.

Discussion

Facial abscesses present in small herbivorous mammals are a very serious problem. Rabbits seem to be more affected by the periapical infection and associate facial abscesses than guinea pigs, chinchillas or degus. Periapical infections are caused mainly by migration of bacteria or foreign bodies in dentogingival sulcus as a result of a disrupted of the dentogingival and dentoalveolar connection. Inflammatory changes are mostly in guinea pigs and rabbits associated with dental disease caused by lack of wear or metabolic diseases; such are hypovitaminosis C, secondary nutritional hyperparathyroidism or osteoporosis. Another possible cause is incorrect and inconsiderate iatrogenic correction of the overgrown clinical crowns with pliers or pincers, which can seriously damage the tooth which can result in extensive inflammation and abscedation of the adjacent bone Periapical abscesses (odontogenic, dentoalveolar abscesses) in guinea pigs often lead, due to the late diagnosis or improper treatment, to severe osteomyelitis with subsequent anorexia leading to death. Essential for a correct diagnosis and prognosis is a careful and complete examination of the oral cavity, using a paediatric laryngoscope and oral cavity endoscopy. Examination of bone and teeth should be complemented by X-ray examination and if possible by computed tomography. If the disorder is too advanced, it is suitable to consider euthanasia of the animal and the owner should be informed about this possibility. Surgery of facial abscesses in guinea pigs pets is not easy, given the small size of the oral cavity, the anatomical curvature of the teeth and for challenging in tubation. For the correct therapy, it is important, not only to open the abscess surgically and to remove the pus, but also to remove all necrotic soft tissues, the affected bone and the related teeth. Authors prefer marsupialization and leaving the wound to heal by secondary intention, which considerably reduces relapses and facilitates the healing process (Capello 2006).

During the surgical procedure it is appropriate to take samples for microbiological examination and for sensibility testing of the isolated bacteria to antibiotics. The optimal specimens are capsule of the abscess, the affected tooth and the affected bone. In the domestic rabbit, over 40 species of bacteria from such samples can be isolated, in guinea pigs is considerably less, owing to a lower incidence of the disease (Jekl et al. 2008). Anaerobes (Finegoldia magna, Eggerthella lenta) detected in present case, could cause also clinical human infections such are inflammatory changes of the CNS, head, neck, chest, abdomen,
pelvis, skin, bone, joint, intestines, and soft tissues (Fournier et al. 2008). Anaerobic bacteria are usually susceptible to beta-lactams and to metronidazole. Because of the toxicity of beta-lactams in guinea pigs metronidazole can be used instead. Risk of possible pathogenic microbes is minimal, however proper handling and sterile surgical approach should be performed in all cases of odontogenic abscesses in small mammals.

Acknowledgement

This paper was supported by grant project IGA No. 28/2011/FVL.

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Both side dens invaginatus of the mandibular first molar teeth in a poodle

Saskia Hintze

Trixie, a 4 years and 8 month old, female poodle was represented after a 14-month pre-treatment in the Department of Small Animal Medicine at the University of Leipzig.

The dog was operated due to a fistula of the lower jaw several times and was treated with antibiotics. An X-ray examination of the head was performed. A pathological examination of the affected tissue in the area of the fistula showed only signs of inflammation.

The dog showed a weight loss of more than one kilogram. The dog ate poorly and showed a weight of 4.6 kg at the initial presentation.

In the clinical examination all vital parameters were within normal limits. Furthermore, the right mandible showed a medial fistula. The oral cavity examination wasn’t possible completely, it showed a mild periodontal disease. A cause for the fistula couldn’t found. It was recommended a diagnostic imaging of the head.

A computed tomographic scan of the head was performed. There were multiple fistulae based on the roots of the first molars. The mandible showed a significant lysis in this area. Subsequently we made dental radiographs of the molars. It showed pronounced periapical processes with breakthrough of the cortical bone of the mandible. The roots were slightly convergent and the right mandibular first molar had a pulp stones, as a sign of chronic pulpititis.

The right mandibular first molar was extracted carefully. The risk of jaw fracture was increased in this region due to the significant bone loss. A part of the infected bone was removed and curettage was performed. The gingiva was closed by a flap. After extraction and treatment of bone and fistula there was a major bleeding due to the strong inflammatory reaction in this area. This bleeding could be stopped by compression without any problems. The fistula was also treated. The dog received a drain for a few days. In addition, the dog got analgesia and antibiotic therapy.

The supply of the second side was aimed for the next 4-6 weeks. Unfortunately, the owners made an appointment after four months. The healing of the right side went very well. The control X-rays showed a process in healing. There was no fresh fistula. The left madibular first molar was also extracted. After the curettage, the gingiva was closed by a flap.

Since that, the healing went very well. Trixie showed never again problems and showed post-operative a very good appetite and has reached her original weight.

This case shows that the dens invaginatus (dens en dente) is a disorder, which leads to pain and limitations of the affected individual. Although this is a rare malformation, which occurs during tooth development to partial invagination of the enamel organ, but it is a disease which you should know. Because of the changed tooth shape, it frequently occurs to a periapical periodontitis. The etiology of this disorder is still not completely clear, a genetic component seems exist, infections and trauma are discussed as a cause as well as an insufficient supply of the dental papilla during enamel formation.

References

Malocclusion associated with macroglossia in a dog

Gerhard Putter

Introduction

The term macroglossia describes an oversized or enlarged tongue but does not indicate the cause. It is a rare condition in dogs. At rest the tongue occupies the potential space on the floor of the mouth demarcated by the mandibular dentition and mandibles. Any protrusion beyond these margins could be considered as an enlarged tongue.

Congenital macroglossia in dogs is reported to be very rare. Macroglossia is one of the symptoms of Duchenne muscular dystrophy (DMD) or dystrophin-deficient muscular dystrophy; DMD have been diagnosed in dogs and affected animals have a severe dystrophic phenotype similar to the human form.

Acquired macroglossia reported in the veterinary literature describes some pathological conditions that have caused enlargement of the tongue and include trauma and abscessation. Although oral lesions are rare, Leishmaniases should be considered as a differential diagnosis for tumour-like lesions of oral mucous membranes.

Enlargement and swelling of the tongue can be associated with benign or malignant neoplasia.

This case report describes a case of tongue enlargement with protrusion from the left side of the mouth, causing a malocclusion affecting the left mandible and maxilla in a dog.

Case History

A five year old, 12 kg neutered male Cavalier King Charles Spaniel was presented with a complaint of an excessively long tongue. The owner reported normal eating and drinking behaviour with no indication of discomfort at these times. Normal play with toys had ceased 6 months previously.

During panting, the dog’s tongue protruded about 10cm from the left side of the mouth. Any attempt by the dog to withdraw the tongue into the mouth caused the left upper lip to be drawn into the mouth. It was therefore not possible for the dog to return the tongue to its normal intraoral position. Constant ptyalism also caused moistening of the cranial chest, cranial aspects of the front limbs as well as the rostral and ventral aspects of the left pinna.

The owner mentioned that as a young juvenile, the dog’s tongue was always visible and protruded slightly from the left side of the mouth. This protrusion progressively increased to the present extent.

Conscious clinical examination indicated an area moistened by saliva. The skin appeared inflamed with some crusting of the hair evident at the margins of the moistened area. On palpation, the left mandibular lymph nodes appeared slightly larger than the contra lateral lymph nodes.

The dog was sedated to facilitate more effective examination. With the tongue completely relaxed and without applying traction on it, the tip of the tongue extended 8cm past the mandibular incisors. The relaxed tongue could only be replaced on the floor of the mouth by folding it, and in this position it obstructed the oropharynx.
Palpation of the root, body and apex of the tongue, confirmed a normal consistency, free of any masses or localised thickening.

On the right side of the mouth a normal alternate occlusion of the maxillary and mandibular premolars was displayed. The interlock of the right mandibular canine (404) in the diastema between the right maxillary third incisor (103) and maxillary canine (104) was normal. From this rostral viewpoint the left mandibular canine (304) was displaced by about 40° laterally from its normal position (in the transverse plane). The left maxillary canine (204) was displaced 30° laterally from its normal position in the same plane.

The left mandibular first molar (309) occluded in the normal position palatally to the left maxillary fourth premolar (208). The left mandibular premolars all occluded laterally to the first three left maxillary premolars even though the latter teeth were also slightly laterally deviated. It therefore appeared that the rostral half of the body of left mandible was rotated about 30° laterally along the longitudinal axis.

The findings of this examination as well as the treatment options were discussed with the owners. And surgery to reduce the length of the tongue was scheduled for a later date.

Premedication of acepromazine (0,05mg/kg) and morphine (0,5mg/kg) was administered 40 minutes before induction of anaesthesia. General anaesthesia was induced with the intravenous administration of propofol (4mg/kg) and maintained with isoflurane (2-3%) vaporised in oxygen (1 l/min) in a closed anaesthetic circuit.

The patient was placed in sternal recumbancy. The relaxed tongue was placed on the floor of the mouth and the position of the mandibular incisors was marked on the dorsal aspect of the tongue. This line was just rostral to the attachment of the lingual frenulum on the ventral aspect of the tongue. Care was taken to ensure that the lingual frenulum with the curuncles that contain the openings of the mandibular and sublingual salivary glands were not damaged during amputation of the tongue.

A 20G hypodermic needle was inserted into the median sulcus and advanced through the tongue in a dorsoventral direction, 25mm caudal to the marked line. Two 10cm pieces of 1/0 monofilament nylon suture material were inserted through the needle. The needle was withdrawn to leave the suture material in position extending dorsoventrally through the midline of the tongue. The free ends of one piece of nylon were brought together on the lateral aspect of the tongue and clamped in this position with artery forceps. Tension on the suture material acted as a tourniquet to occlude the blood supply to the apex of the tongue. By repeating the process on the opposite side, the blood supply (from the base of the tongue) to both sides of the tongue was occluded. Multiple surgical gauze swabs were positioned sublingually to isolate the ventral aspect of the tongue from the floor of the mouth. A no 10 scalpel blade was used the cut through the tongue from the dorsal aspect. The incision was started in the midline and extended laterally. The incision curved caudally close to the lateral margin of the tongue to recreate a rounded rostral margin. A second incision was made in the opposite direction to complete amputation of the rostral 8 cm of the tongue.

The use of the tourniquet limited intraoperative haemorrhage very effectively. Tension on the tourniquet sutures was temporarily released to identify the lingual artery and these vessels were ligated. The wound edges were sutured using 5/0 poliglecaprone 25 on a reverse cutting 3/8 curved needle. A continuous suture pattern, with some additional single interrupted sutures, was used to close the wound.

The amputated rostral segment of the tongue was submitted for histopathological examination.

Apart from the expected blood tinged saliva, no signs of postoperative haemorrhage was noticed. The following morning the rostral ¼ of the tongue developed noticeable swelling. However the dog licked food and water offered without any apparent discomfort. The dog was able to retract the tongue completely into the mouth without any displacement of the upper lip.

The histopathology report confirmed normal structure of the tongue and failed to identify any cause for the condition.

The patient was again seen four months after the surgery. The owner reported that he appeared noticeably more playful that before the surgery. He often picked up and carried
toys in his mouth; something that not happened for many years. At rest, his tongue was completely retracted into his mouth.

Discussion

The primary problem in this case appears to be the presence of an enlarged tongue from a very early age. Even though extreme cases of congenital macroglossia in dogs have been described, a tongue that is slightly longer than normal would not necessarily be considered to be more than a peculiarity as long as the size of the tongue did not adversely affect its function.

It is possible that mechanical trauma, infection or other injury early in life could have caused the deviation of the tongue to the left hand side of the mouth. The pressure from the deviated tongue on the left maxillary as well as mandibular premolars has caused the deviation of these teeth laterally. This also explains the greater rotation and deviation of the rostral aspect of the left mandible because more pressure was exerted by the tongue on these teeth.

Resection of 40-60% of the rostral aspect of the tongue is well tolerated by most dogs and cats. This case was no exception and an even larger segment could have been resected.

Numerous arteriovenous anastomoses have been demonstrated in the tongue of the dog. Patients with tongue amputations would therefore have to be closely monitored during hot weather conditions.

The noticeable improvement in general behaviour and playfulness of this dog is a good indication of the effect that this condition had on the dog.

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Reverse incline plane for a class 2 malocclusion

Stephen Juriga¹
¹ DVM, DAVDC

The normal occlusal relationship for dogs, as it is in people, is a scissor incisal occlusion. The normal line of teeth is a smooth curve, not broken by rotated or misplaced teeth. The head and dentition should be symmetrical. This is not the definition for many of the breed standards, but all other relationships, must be considered to be in malocclusion to a greater or lesser degree and dental problems may result, secondary to occlusal trauma and inflammation.

The labial surface of the mandibular incisors should fit behind but be touching the palatal surface of the maxillary incisors, and the maxillary incisors should overlap the mandibular incisors. The Dental Interlock is a landmark to examine when determining genetically sound jaw relationships. Three teeth define the interlock. The mandibular canine should be seen between, equidistant to, and not touching the upper lateral (third) incisor or the upper canine tooth.

A class 2 malocclusion is a condition in which the mandible is significantly shorter than the maxillary counterpart. Palatal contact from a malpositioned mandibular canine tooth/teeth is a common problem in these dogs. The crown(s) of the mandibular canine teeth may embeded in the palate causing pain and further inhibiting further mandible growth. The lower canine teeth typically lie palatal and adjacent to the upper canines, and cannot move laterally.

Treatment options include: 1) Interceptive orthodontic extractions of the mandibular deciduous tooth prior as young as possible to relieve discomfort and allow the mandible to grow to it’s genetic potential. In some cases this will result in a more favorably positioned permanent tooth. 2) Incline capping therapy to extend and orient the tooth to erupt into the proper or more desirable position. 3) Acrylic incline plane to direct the mandibular canine into the proper or more desirable position. 4) Crown height reduction and pulp capping of the affected canine(s). 5) Extraction of the affected canine(s).

Case

A 6-month, castrated, male Rodisean Ridgeback canine patient was referred for crown reduction and pulp capping therapy. The pet-owner was not given the option of interceptive orthodontic therapy between 6-9 weeks of age and was directed, by the breeder, to seek crown reduction therapy at 6 months of age. Oral examination confirmed the class 2 malocclusion.

Orthodontic therapy was offered to direct the mandibular canine teeth into a non-traumatic position distal to the maxillary canines teeth using a “reverse” acrylic plane and incline capping therapy. Over 8 weeks the mandibular canine teeth were directed distally and buccally. The presentation will review the steps taken to create and secure the incline plane to the maxillary canine, PM1 and PM2 using inter-dental wiring, flowable composite and acrylic (ProTemp Garant).
Loose teeth: are we leaving our services on the exam table?

Ernest E. Ward, Jr.1

1 E3 Management, Inc., Calabash, North Carolina USA & Seaside Animal Care, Calabash, North Carolina USA

Veterinary practice is changing rapidly. We have entered an unprecedented time in which our clients are facing economic uncertainty, competition from outside retailers and service providers is expanding, and pet veterinary visits are declining. In order to thrive during lean times, we must focus on the services we can and should provide each pet patient. Too often we simply leave needed medical services in our exam rooms. We do this by not making consistent care recommendations, performing incomplete and hurried physical examinations, and failing to effectively communicate the importance of preventive care with our clients. Dentistry and pet dental care is a vital gateway to improving overall compliance.

CHANGES IN VETERINARY PRACTICE
The human–animal bond is constantly evolving—from its inception as a simple expression of the relationship between pets and people, it has grown into expectations about medical and surgical care, dental care, nutrition, safety, and behavior.

ARE YOU KEEPING UP?
Today’s pet parents expect and demand more from their veterinary visits than ever before. Are you keeping up? How has your role as veterinarian changed?

The goal of each veterinarian should be a celebration of this bond while improving compliance with your recommendations. It’s time to refresh routine care through innovation and compassion. It’s time to reinforce why yearly visits are more important than ever. It’s time to build a better bond with our clients and patients.

Meet Minnie
Minnie, a 10-year-old shih tzu, is described by her owner, Katy, as “queen of the house.” Katy, a widow who recently lost her husband, lives alone in a small modular home with Minnie and a collection of souvenir travel spoons. Minnie sleeps with Katy, a habit that dates back to puppyhood.

“She’s never slept on the floor or even a dog bed. I boarded her a few times when Jim was sick, but I always took my blanket for her.”

Minnie and Katy go everywhere together. Minnie is on a first-name basis with the bank teller and local coffee shop owner. “She’s my baby, my best friend. I don’t know what I’d do without her. I give her only the best.”

This picture depicts the human–animal bond in its most basic form. It’s what we most commonly think of when we refer to the bond.

It’s also a bit dated, perhaps misleading, and certainly incomplete.

The Bond Has Changed
Minnie is a new patient of mine. Not too long ago I diagnosed her mitral valve insufficiency. The trouble is that Minnie had not been examined by a veterinarian for almost 2 years.

Despite Katy’s proclamations of providing the “best care” and “doing everything for her baby,” her idea of what Minnie needs varied greatly from my medical recommendations:

Minnie was not current on core vaccinations or receiving heartworm and flea prevention plus she
had not had an intestinal parasite examination “in years.”
Minnie had never had her teeth cleaned by a veterinarian.
In contrast, Minnie has a standing appointment every 5 weeks at the groomer, who also “cleans
her teeth.”

I asked Katy about Minnie’s diet and learned she was completely convinced that Minnie
was being fed the absolutely best food. Who gave Katy the food recommendation? “The sales
person at the pet store—they're really into pet foods,” Katy announced.

I discussed the medical reasons for changing Minnie to a diet that would be more appropriate for
her heart condition.
Katy protested: “That sounds fine, but I also want to check with the pet store.”

As the conversation progressed, I recommended basic diagnostic tests to determine the
extent of Minnie’s heart disease: chest radiographs, blood pressure monitoring, ECG, blood
and urine tests—establishing a basic minimum database. I thoroughly discussed the link
between periodontal disease and heart disease and recommended we clean Minnie’s teeth
once we established the extent of heart disease.

“Um, before we do any tests or have her teeth cleaned I want to ask my chiropractor what she
thinks.”

_Seriously? Her chiropractor?_
“She does adjustments on Minnie every couple of months and knows a lot about dogs.”

This is also the human–animal bond, just not how we (veterinarians) commonly think of
it.

PETS & VETS: 2012 & BEYOND

Why Are We Seeing Fewer Patients?

FACT: Pet owners have more access to information, products, and services than ever be-
fore. Such fragmentation has left many veterinary clinics struggling.

There are a couple of reasons that APPA and other industry organizations are reporting
an increase in total veterinary expenditures while individual clinics are experiencing a de-
cline in patient visits. (source: Benchmarks 2011: A Study of Well-Managed Practices and
American Pet Products Association (APPA); Wutchiett Tumblin and Associates – total reve-
 nue per doctor in 2008 was $622,000, in 2011 $612,000 and IBISWorld Industry Report
54194 “Veterinary Services in the US” December 2011, S Snyder – growth of 3.6% in US vet-
erinary service expenditures; annual growth rate from 2006 to 2011 of 3.2% to $29.3 billion
in 2011 while number of veterinary clinics has declined an average 0.8% per year)

First, the definition of “veterinary services” is expanding. Minnie’s owner is one of a
growing number of concerned pet parents who are seeking advice outside the traditional vet-
erinary-patient-client relationship. More pet owners now consider pet chiropractors, train-
ers, and even groomers as valid providers and sources of pet services and information. Pet
owners still trust and value their veterinarians; they just accept other providers as equals.

Second, there has been an increase in veterinary providers. In short, we are entering into
an era in which veterinary supply may exceed demand. Aggregate spending with veterinari-
ans is up; spending at an individual veterinary clinic is down. For many years a small but
vocal minority of veterinary practice management consultants (me included) have raised
warnings about producing too many small animal veterinarians and having too many small
animal clinics. When an industry is highly fragmented with similar offerings, individual val-
ues can become diminished.

Now is the time for veterinarians to redefine their profession and come to terms with
what pet owners want from their veterinarian. It's not too late to correct our course. Pet
owners are plainly telling us what they want. It’s time to listen and change.
CATS ARE WHERE IT'S AT

FACT: There are an estimated 13% more cats than dogs in the United States. Yet cats account for only about a third of veterinary clinic expenditures and about 39% of the total veterinary patients. What's up with that? (source: 2011 Bayer Veterinary Care Usage Survey and American Pet Products Association (APPA) “2011 to 2012 National Pet Owners Survey” and American Veterinary Medical Association (AVMA) U.S. Pet Ownership & Demographics Sourcebook (2007 Edition))

According to the 2011 Bayer Veterinary Care Usage Survey, cat owners do not bring their cats to the veterinarian for simple reasons. No. 1 reason: cat owners reportedly do not visit the veterinarian because the event is too stressful for both the cat and the owner.

Most cats hate the carrier. The sounds of dogs barking, the motion of the car, long wait times, and rough handling by clinic staff are some other reasons why owners let cats stay at home but take their dogs to the doctor. Other obstacles to cat veterinary visits include the belief that indoor cats do not get sick (often), that veterinarians cannot do much to help older cats, and that cats do not need annual examinations.

Reality Check: Cats are different than dogs. Cat owners have different perspectives and opinions than dog owners do on what the veterinarian–pet relationship should be. Don’t fight it; try to accommodate it.

In the Bayer study, 18% of veterinarians surveyed reported that they disagreed that they should provide instructions on how to make travel to the clinic less stressful. How difficult is it to offer advice on travel tips? At the same time, 70% of veterinarians agreed that cat owners seemed more reluctant than dog owners to schedule visits to the practice.

Is there a clear disconnect going on? Cat owners have said for years that getting their cat to the vet was the most challenging aspect of providing veterinary care.

STEP 1 - What cats want—Redefining the visit
To redefine a feline veterinary visit, start by gauging your client’s interest. Send out an email or post on Facebook or Twitter that you’re trying to upgrade the clinic’s position on cat visits. Ask your clients what they’d like to see.

We asked our clients why they weren’t bringing their cats as often as recommended. We received responses such as: “The trauma my cats endure isn’t usually worth it.” “They’re indoor cats and overall healthy.” “We’ve only gone for illness/injury.” “Good health? Dread of car rides?” “Mine go when it’s necessary; illness, routine visits. It’s a struggle for them, but they go.”

We listened.

STEP 2 Give ‘em what they want—Better carriers, better service, better care
We focused on eliminating waiting times for cat appointments, being stricter about enforcing our cat and dog waiting areas, adding facial pheromone diffusers in each cat exam room, along with spraying a cat carrier with facial pheromones at the start of the visit.

I wrote several local newspaper articles on transporting cats to a veterinary clinic, and we created several “tip sheets” to aide nervous feline travelers. We began offering better contemporary cat carriers that many cat owners were unaware of. These advances provide better comfort and ease of transport for nervous cats.

We changed our cat rooms to an area farther away from our kennel area to reduce noise. We improved our cat restraint techniques and implemented a minimum-restraint policy based on client feedback.

Many cat owners requested home visits, so we began offering house calls. This has proved especially beneficial in multi-cat households. Many times we are able to see two or more cats during a basic house call.

We addressed the way our team communicates with cat owners about the importance of routine care:

- We focused heavily on the importance of year-round monthly heartworm and flea preventive.
- We focused staff training on the top 5 diseases we diagnosed in our cat patients: obesity, diabetes, kidney disease, periodontal disease and inflammatory bowel disease.
We emphasized litter box training, understanding inappropriate elimination and feline diet and nutrition. We issued a series of website blog articles and social media communiqués addressing the myth that indoor cats are healthier. We found that most cat owners didn’t fully understand how well cats hide even severe signs of disease.

FOCUS ON DENTAL CARE

Develop a systematic and methodical approach to addressing dental care with each patient during every visit. In my clinic, we begin by reviewing the last physical examination findings for weight and periodontal disease. Our staff documents this on the current physical exam report. This allows us to track progression of these two very important physical parameters. It also demonstrates how these subtle indices can worsen or progress over time. For example, take a cat that was classified as Grade 2 out of 4 periodontal disease on its examination one year ago. This year the cat is observed to have Grade 3—a worsening of the condition. The discussion can be centered on the urgency and immediacy of needed dental intervention.

In addition, reviewing and documenting the previous year’s dental classification helps our staff and veterinarians make better home care suggestions. Many pet owners still do not understand the importance of home care nor the wide variety of options. We need to make sure we are advising clients during each examination on practical and effective techniques to keep their pet’s oral cavity healthy.

The key to success with dental care is consistency. We must constantly raise our clients’ awareness of the dangers of periodontal disease and its impact on health and longevity. To ensure consistency, we must constantly train and re-train our support staff. This can be as formal as a structured lecture or informal as a quick two-minute review before or after an appointment. If dental health is at the forefront of each of our staff member’s minds, our dental programs will succeed.

When Will We See You Again?

For years we have trained our staff to answer this basic question before each client leaves. At the root of this philosophy is scheduling each pet’s next appointment during the current visit.

In the 2011 Bayer study, only 4% of clinics reported that this rule was followed at each appointment. Try it; you’ll be surprised how compliant clients can be. Dentists have known this for years and found great success by scheduling appointments 6 to 12 months in advance.

NOW IS THE TIME FOR CHANGE

If ever our relationship with our clients was in need of a facelift, now is the time. The past decade has witnessed an influx of outsiders who are infringing on our traditional veterinary responsibilities—our core services and products. We need to reclaim our central role in the human–animal bond by refreshing ourselves as the experts in diet and nutrition, behavior, alternative and natural therapies, and preventive care. We need to focus on providing pet parents with the best information, advice, and compassionate care possible so we can build a better bond together.
A study of subocclusal secondary dentine thickness in overgrowth equine cheek teeth

Rachel Marshall, P.M. Dixon, D. Shaw

Aims: Overgrowth of a cheek tooth due to a defect or loss of the opposing cheek tooth is a common finding in horse. Little is known about the factors controlling the deposition of sub-occlusal secondary dentine (SO2D) in normal equine teeth, but stimulation of the occlusal surface is likely to be very important. There appears to be no information on the possible alterations to this process when teeth develop overgrowths, and consequently of the net effect of reduced stimulation of the occlusal surface and of absent/reduced normal occlusal wear (attrition) on the thickness of SO2D. Knowledge of the likely thickness of SO2D of overgrown teeth should reduce the risk of pulpar exposure or pulpar thermal injury when therapeutic floating of overgrown teeth becomes necessary - in order to prevent soft tissue trauma and/or malocclusion-related dental disorders.

Methods: This study utilised 42 permanent equine cheek teeth - 24 overgrown and 18 control cheek teeth (mean overgrowth height 9.5mm, range 3.4 to 17.9mm) - obtained from horses and donkeys of different ages, sizes and breeds. The teeth were sectioned on a tile saw and the thickness of SO2D was measured above individual pulp horns and a mean SO2D value was obtained for each tooth.

Results: The mean SO2D thickness of overgrown teeth was found to 12.14mm, which was significantly thicker (p<0.001) than the mean value of control teeth (10.25mm). However, there was considerable variation in this finding with 48.9% of overgrown teeth actually having less SO2D than control teeth.

Conclusions and Practical Significance:Whilst this study suggests that overgrown cheek teeth can have thicker SO2D than cheek teeth of normal height, this is not a constant feature and great care should be taken when reducing such overgrowths to prevent pulpar exposure or thermal damage.
An investigation into the prevalence and some clinical characteristics of equine cheek teeth diastema in 472 horses examined in a primary equine practice (2008-2009)

Hannah Walker¹, Edward Chinn², Sarah Holmes², Padraic Dixon¹

¹ Royal (Dick) School of Veterinary Studies, The University of Edinburgh, Easter Bush Veterinary Centre, Midlothian, EH25 9RG
² Alnorthumbria Veterinary Partnership, Alnwick, Northumberland.

Aims: To determine the prevalence, and clinical characteristics of equine cheek teeth (CT) diastema in the general equine population by retrospectively examining 472 dental records from a first opinion equine practice over a 12 month period (2008 – 2009).

Methods: During all routine dental examinations (using a headlight and dental mirror and an agreed examination and charting protocol by all 5 clinicians) carried out in an equine practice during the study period, signalment; diastema location (using Triadan system) and diastema shape (open or closed); presence and degree of: food entrapment, periodontal pocketing, halitosis and gingivitis were recorded. The relationships between these variable were analysed.

Practical Significance: CT diastemata are a major cause of oral pain and quidding in UK horses and consequently are of major welfare concern. Equine practitioners should actively look for this disorder during all dental examinations, particularly in older horses, by performing a thorough oral inspection using a mirror and head torch.

Acknowledgements: To the Alnorthumbria clinicians for their help with this study
Radiographic investigation of the position of common bits relative to the first and second premolars in bridled horses

Sam Luis Hole¹, J. Manfredi², H.M. Clayton³

¹ Pool House Equine Clinic, Crown Inn Farm, Lichfield, Staffordshire, UK
² University of Minnesota, College of Veterinary Medicine, St Paul, MN, USA
³ Mary Anne McPhail Equine Performance Centre, College of Veterinary Medicine, Michigan State University, East Lansing, MI, USA

Introduction

The objective was to investigate the positions of different types of bit within the horse's oral cavity relative to the first premolar (wolf tooth) and the second premolar (first cheek tooth). Horses commonly have wolf teeth extracted and the rostral aspects of the second premolars profiled (bit-seated) for bitting reasons. This paper aims to investigate the bits possible interaction with these teeth and if wolf tooth extraction and bit-seating have a scientific rational.

Method

Eight horses were fitted with a bridle and six bits [jointed snaffle (JS), Boucher, KK Ultra, Myler snaffle (MylerS), Myler ported barrel (MylerPB), Myler correctional-ported barrel (MylerCPB)]. Lateral radiographs and custom software were used to measure the position and orientation of the bits relative to the horse's second premolar teeth without rein tension and with 25±5 N bilateral rein tension.

Measurements were used to assess possible contact with either the area occupied by a normally positioned wolf tooth and/or the rostral aspect of the second premolar. Measurements were taken using image software from the nearest radiographically evident part of the bit to the second premolar at both its rostro-coronal and rostral aspects. Two metal screw markers were set at 4.48 cm apart were used to calibrate the linear measurements.

Discussion

Analysis of the images for possible bit interaction with the area occupied by a normally positioned wolf tooth and the rostral aspect of the second premolars are still being collated and the results and interpretation will be presented at congress.

Conclusion

Is the practice of extracting normally positioned wolf teeth and bit-seating the second premolars for bitting reasons justified?
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Case report: first report of microglossia in one month-old female calf

Saeed Azimpour¹, Alireza Jahandide², Fatemeh Zahra Gharib³

¹ Department of Clinical Science, Babol Branch, Islamic Azad University, Babol, Iran.
Saeed.azimpour@gmail.com Tel:+989127095739, Fax No.+98 2166833923
² Assistant Professor of Surgery, Department of Surgery, Faculty of Specialized Veterinary Sciences.
Science and Research Branch. Islamic Azad University Tehran. Iran
³ Department of Clinical, Faculty of Veterinary medicine, Islamic Azad University, Babol Branch, Babol, Iran

Introduction

Microglossia is a rare congenital anomaly in human and dogs. It is characterized by the smallness of the tongue and in most cases is associated with other syndromes.²

Case presentation: A calf with excessive salivation and stunted growth was observed in a dairy farm in the suburb of Tehran. In clinical observation, the food was wet and wet food particles scattered on the floor which could indicate dysphagia. No other clinical sign such as pneumonia was seen. Further examinations showed that the calf tongue was very smaller than of normal calves. The tongue length was compared with same-age calves and resulted that the tongue length from frenulum to the tip was 3.3 centimeters; no other defect was observed. There is no abnormal finding in histopathological investigation.

Discussion: With regard to the fact that tongue plays an important role in the prehension and swallowing of food and milk intake, the observed clinical disorder is justifiable.

Many noninherited congenital defects in animals occur in outbreaks, which is a reflection of the exposure of the pregnant herd to a viral, plant or other teratogen during a period of fetal susceptibility. Role of treatogenic factors could not be suggested, because of lack of any sign of these factors and the herd history and management.³ Other environmental factors such as radiation were not seen.

Occurrence of the defect may be related to factors interfering in the development of the first esopharyngeal and its associated structures. In human Chromosomal study, metabolic screening, and all basic hematological tests revealed normal results.¹ Based on the results, the anomaly was a congenital microglossia which has not been reported yet in cattle species.

References

Oral canine transmissible venereal tumor

A.M.B. Prado¹, R. Bacchi, L.J.E. Isaka, N.E. Lewick, F.S.R. Ascaso, C.M.G. Ramos

¹ PhD, post doctorate by the Universidad Complutense de Madrid, Professor of anatomy and veterinary dentistry at the Catholic University of Parana, Brazil.

CASE REPORT

A canine, female, Rottweiler, with 12 years old was received at the Veterinary Hospital for companion animals of the Pontifícia Universidade Católica of Parana, with a history of appetite loss and progressive enlargement of the right maxilla with evolution of two weeks. Clinical evaluation revealed a tumor in the right maxilla, leading to facial asymmetry. On examination of the oral cavity was observed an irregular formation on the right maxilla with about two inches in diameter that extended from the canine (104) to the third premolar (107). In oblique extra-oral radiography was observed areas of osteolysis in the right maxillary bone, suggesting neoplastic invasion. It was also observed root resorption in upper right canine (104) and first right premolar (105). A needle of cytology aspiration was performed and showed that numerous cells also rounded shape with rounded nuclei with coarse chromatin, prominent nucleoli and moderate amount of cytoplasmic vacuoles, featuring Transmissible Venereal Tumor. She was treated with ampicillin, metronidazole, meloxicam and chemotherapy with vincristine sulfate. Currently, the animal is fine and shows no signs of recurrence of cancer.
A stage 4 unilaterally periodontal disease in a dog—a case report

Alireza Jahandideh1,*, Ahmad Asghari1, Mohamad Ashrafzadeh1, Rahim Alizadeh1

1 Department of Surgery, Faculty of Specialized Veterinary Sciences, Science and Research Branch, Islamic Azad University, Tehran, Iran
* dr.jahandideh@gmail.com Tel:+989143038505, Fax No.+982122110193

The most cause of gingival disease is plaque. Periodontal disease starts with the formation of plaque, a transparent adhesive fluid composed of mucin, sloughed epithelial cells and aerobic, gram-positive cocci. If the plaque is not removed, mineral salts in the foot precipitate to form hard dental calculus. The calculus is irritating to the gingival tissue, changing the pH of the mouth and allowing pathogenic aerobic gram-negative bacteria to survive subgingivally. By-products of these bacteria can destroy the tooth’s support, eventually causing the tooth to be lost. If teeth are not cleaned, after 4 days 20% of the plaques will be mineralized and change to calculus. More than 85% of cats older than four years old have periodontal pathology. Gingival and periodontal disease is staged from 1 to 4. Stage 4 teeth have lost more than 50% of their support and, in most cases, should be extracted.

A female intact six years old dog with sever calculus and infection of periodontal tissue in the right mandible referred to Small Animal Polyclinic, Islamic Azad University. Dental scaling was done and then, after antibiogram, antibiotic therapy and irrigation of mouth with chlorhexidine were done for one week. After 10 days dental abscess was revealed in the apex of teeth’s roots in radiograph that showed treatment was not successful. Therefore affected teeth were extracted.
Congenital cleft palate secondary (palatine congenital fissure) in dog: surgical treatment

Jesús M. Fernández Sánchez1,3,4, Fidel San Román Ascaso2,3, Nicolás Israeli-antz Gunz1,3, Alejandra Galíñanes Plaza1,3, Marta Pedraja Marqués1,3, María de la Morena Cabanillas1,3, Marta del Campo Velasco1,2

1 DVM
2 VM, MD, DDS, PhD, DipEVDC
3 Maxillofacial Surgery and Veterinary Dentistry Service. Veterinary Clinic Hospital. UCM. Madrid. Spain

Introduction

The cleft palate is one of the most frequent congenital anomalies in the puppies especially of pure breeds, with more predispositions in brachycephalic breeds. This alteration is characterized by an abnormal communication between the cavity oral and nasal that affects to soft palate, hard palate, bone premaxillar and lip.

The cleft palate is classified in primary and secondary and both are in intimate relation because they have the same embryonic origin.

The congenital cleft palate primary can be affect to the lip named a cleft lip (Cheiloschisis), to the alveolar process (Alveoloschisis) or to both (Cheiloalveoloschisis).

The congenital cleft palate secondary (palatoschisis) (Photo 1), is produced by a failure in the join of the palatine plates of the maxillary processes with the nasal septum and appears as a fault of the midline of the hard palate or soft palate.

It is also frequent that appear simultaneously the cleft palate primary and the secondary.

The origin of this fault has a hereditary base and there can be produced by mutations of the MTHFR gene (methylenetetrahydrofolate reductase), that allows the step to the folate active form and there exist many environmental factors that can influence his development. It is known that the primary palate or lip develops between the fourth and seventh week of gestation, and between the seventh one and the twelfth week are formed the caudal structures to the incisive papilla, they are the hard and soft palates.

The reasons that can happen during the period of gestation are: lacks of minerals, of vitamin A, exhibition of the mother to X-rays, toxic, corticosteroids, hormonal influences and mechanical reasons. Also there are studies in which it has appreciated a modification of the caliber of the palatine arteries in the animals that have a cleft palate.

The serious risk of this malformation consist in the difficulty that the puppies have in food, since it is impossible to suck and many animals die within a few days of life or are sacrificed. If the animals survive it is possible to control them surgically to solve the problem. The minimal age recommended for the surgery is 8 to 12 weeks but it is preferable to do it from 4 to 6 months (since to this age the cleft palate has been closed more and the animal can support a longer general anesthesia). During the period that the animal wait to be operated must be fed artificially preventing him from sucking of the mother, we recommend to feed him, depending on the age, with dog milk formula or with soft (semi-liquid) diet with syringe raising the head or even in serious cases with tubes orogastric.

The complications of this alteration are: problems of respiratory nature like irritant chronic rhinitis, pharyngitis, laryngitis, and otitis media with vestibular peripheral syndrome and pneumonias for aspiration, which they can manage to be mortal.
Surgical treatment

The techniques used for the surgical treatment of this problem depend on the size and location of the fault of the palate. In all the described techniques it is very important to realize tension free flaps with a good vascularization, is important to never damage and to respect always the palatine major artery, because this blood vessel will allow that the flap should be vascular and have a good heal.

It is recommended to realize the intubation across a faringostomy especially in faults of soft palate, because the endotracheal tube avoids the vision and the surgical access to the same time.

The most frequent complications of these techniques are the suture dehiscence.

For the surgery we place the animal in supine position, with the maxillary fixed assets with a tape on the incisor teeth or canine and it holds to the table of operating room. The jaw and tongue hold themselves towards the part distal with one dental mouths gags that there allows the major possible opening of the oral cavity.

We must place a few gauzes in the larynx, to prevent the blood of the surgery from going towards trachea. The extubation will produce pneumonia for aspiration and we must clean, meticulously, the oral and nasal cavity, first with saline solution eliminating all the remains of food that could be in the cleft palate and in the nasal cavity and then we disinfect very well the zone with washes with chlorhexidine to 0,15-0,20 %.

There are several techniques described for the surgical resolution of the congenital cleft palate secondary:

- Incision of the oral mucosa of every side of the cleft palate, remove the periosteum of the palatine bone and simple closing of the same one. This technique only is valid in small faults and the percentage of failure is very high.

- Use of autologous transplant of ear cartilage and suture of the same one to the palatine fault. This technique, as the previous one, only it is useful in not complete faults, of small size, in acquired cleft palate or as surgery of reintervention for small faults in the incisive bone.

- Incision in the oral mucosa to three millimeters of the palatine fault to both sides and from the beginning of the hard palate until the end of the soft palate. After we remove the periosteum of the palatine bone and give the return in order that the mucous oral one is the soil of the nasal cavity. Once sutured this layer we realize two incisions, of tension unload, in the oral mucosa parallel to the lingual face of the uppers premolars and molars and more possible long until the comes to the periosteum and we remove it. In this incision we must preserve the palatine major artery that runs near the teeth 108 and 208.

- Howard’s Technique or rotational flap of 180 ° of the palatine mucoperiosteum. This technique is the best recommended because have success and a minor quantity of complications. In addition it is useful for big palatine faults.

Howard’s techniques

In this technique it is realized a flap mucoperiosteum of oral mucosa of a side of the palatine fault and 180° are rotated, in such a way that the oral mucosa is the soil of the nasal cavity and the free edge of this flap is sutured below the oral mucosa of another side of the palatine fault. In case that the cleft palate is complete and concerns the soft palate, first we must be sutured the cleft palate.

The closing of the soft palate is realized by technique of double layers, with type of suture in " U horizontal " discontinuous with the first layer of sutures in the nasal mucosa with PGA suture 4/0 ó 3/0 with the knots towards the oral cavity (Photo 3) and the second layer of
suture of the oral mucosa, again with the knots towards oral cavity, with silk suture 4/0 ó 3/0 (Photo 4). Though there is described in the bibliography the use of sutures of the oral mucosa with monofilament reabsorbible suture (Monosyn) or not reabsorbible (Nylon) or with multifilament reabsorbible (PGA, Dexon), we recommend the use of silk suture for two reasons: his security in the knot (very low in case of multifilament reabsorbible) and for the minimal pain in the mouth of the knots in comparison with the monofilament not reabsorbible.

For the closing of the hard palate, we do the first incision with of scalpel nº 15 in a side of the oral mucosa parallel at the edge of the palatine fault. A hanging a mucoperiosteum flap rotational of 180 º with an elevator of periosteum, of a width always top up to the cleft palate, preserving always the irrigation from this one for the palatine major artery (Photo 5). The following step is to realize the second incision in the oral mucosa of another side of the palatine fault, we remove the periosteum, to create a fault or "pocket" where we will introduce the free part of the flap mucoperiosteum of another side, suturing the edge of the same one on the contralateral edge of the fault. This junction is realized with a double layer in “U horizontal” discontinuous with PGA suture 4/0 ó 3/0 and silk suture 4/0 ó 3/0.

It is very important to realize a relaxing incision of the oral mucosa in the contralateral side to approximately 2-3 mm of the lingual surface of the uppers premolars and molars to release tension, on which there is placed a membrane of collagen fixed by sutures (Photo 6).

Once concluded the surgery in oral cavity, we proceed to remove the endotracheal tube across the faringostomy and to close the incision of the skin.

**Postsurgical treatment**

It is recommendable, that the patient will be hospitalized of 12 - 24 hours, to avoid complications as pneumonias for aspiration for step of blood of nasal or oral cavity towards trachea and more serious complications as edema of glottis or laryngeal spasm.

The pharmacological postoperatory treatment, is very variable, we recommend oral antibiotic with Cefalexine and Spiramycin - Metronidazole and oral analgesia, depending of the pain of the patient, with oral opiates like Tramadol, Buprenorphina and Morphiine or with anti-inflammatory not steroids like Meloxicam or Carprofen.

The postsurgical recommendations are that the animal takes Elizabethan collar constant, that food with only a semi-liquid diet for 15-21 days, which no type of objects bites and which a level of activity supports controlled and reduced. The patient is checked to 2, 7 and 15 days after the surgery and reviews every 2 weeks.

**Conclusions**

A problem, with relative frequency, which appears in these surgery is the opening of a cranial orifice in the incisive bone of approximately 2-4 mm diameter that it communicates with the nasal cavity, but that produced neither dysphagia nor vomits: this orifice coincides with the incisive papilla that there separates the original primary palate of the secondary (Photo 7). There are studies that suggest that it is due to a lack of healing for having this zone a few vascularization and though it revives and returns to suture return to be opened again.

In this case, we are obtained good results to put in autologous graft of ear cartilage.

The cleft palate is a process of difficult solution, so for the most experienced surgeons, with multiple factors to considering. The percentage of failures in the operated animals is relatively high and seems to be that the factor that more influences it is the experience of the surgeon and the preservation of the vascularization of the flap that we use to close the fault.
O Fado (1910), de José Malhoa
The effect of different formulations of calcium hydroxide on healing of intention ally induced periapical lesions in dogs

H.E. Salma¹, A.M. Abu-Seida, M.A. Houry, K.M. El-Batouty, M.T. Abdel Fattah

¹ Professor of Endodontics, Faculty of Dentistry, Ain Shams University, Egypt.
*Corresponding author: ashrafseida@yahoo.com.

Introduction

Calcium hydroxide is considered to be the most frequent intra canal medicament. It gains its action through its chemical dissociation into calcium ions and hydroxyl ions.

Many vehicles were used for mixing of calcium hydroxide which have an effect on the degree and the rate of the chemical dissociation of the calcium hydroxide and also some vehicle has a direct antibacterial and anti-inflammatory effect which synergist the action of calcium hydroxide as Iodine, electrophoretically activated copper¹ and Chlorhexidine²-⁴ The hydroxyl ions released from calcium hydroxide act to raise the pH of the surrounding media⁵ to make it unsuitable for bacteria.

Calcium hydroxide is considered a potent anti-inflammatory compound through decreasing the adhesion capacity of the macrophage⁶ and the neutralization of the endotoxins in addition to the deactivation of many inflammatory mediators⁷.

Ca(OH)₂ based materials had a favorable action on periapical tissue healing and repair of orthodontic root resorption in dogs’ teeth⁸-¹⁰.

All these advantages are opposed by a critical disadvantage which is the weakening effect of the root canal dentin especially with the prolonged use of calcium hydroxide due to the denaturation of the dentinal protein and its effect on the mineral content by its strong alkalinity¹¹-¹².

This extra weakening of the endodontically treated teeth make it mandatory to determine the ideal combination and time for the use of calcium hydroxide to gain the maximum advantages of its use with minimizing of its disadvantages. Therefore the aim of the present work is to study the effect of different formulations of Ca(OH)₂ on healing of induced periapical lesions.

Materials and Methods

In the present study, six healthy mongrel dogs weighing about 15-25 kg and 10-18 months of age were used.

In each dog, sixteen teeth were used (four teeth in each quadrant) including the first, second, third premolar and first molar teeth. Animals were classified according to the observation period into:

- Group I: (2 dogs) were sacrificed after two weeks;
- Group II: (2 dogs) were sacrificed after four weeks;
- Group III: (2 dogs) were sacrificed after six weeks.
Each group was subdivided into four subgroups according to the dressing material as follows:

- Subgroup A: 8 teeth dressed with Ca(OH)$_2$ with saline;
- Subgroup B: 8 teeth dressed with Ca(OH)$_2$ with CHX;
- Subgroup C: 8 teeth dressed with Ca(OH)$_2$ with iodoform;
- Subgroup D: 8 teeth with no dressing (control).

The anesthetic regimen for each dog was performed using atropine sulphate 0.05mg/kg subcutaneously and xylazine Hcl 1.1mg/kg intramuscularly as premedications. The anesthesia was induced by using ketamine Hcl 5mg/kg using the cephalic vein. The anesthesia was maintained by 25mg/kg incremental doses of 2.5% solution of thiopentale sodium. Access cavities were opened in the desired teeth using a round bur size 2 with a speed of 4000 rpm. Then a k-file number 15 was introduced to the root canals for traumatization of the pulp. The accesses were left open for three weeks for induction of periapical lesions.

Pulp extirpation with irrigation by saline solution was performed. The dressing materials were applied to the root canals using metapex plastic application tips. The access cavities were closed using zinc phosphate cement.

At the end of each experimental period two dogs were sacrificed using 20 ml of 5% Thiopental sodium rapidly injected intravenously. Block sections were obtained including each tooth with its surrounding bone.

The apical third of the root was carefully removed with water cooled diamond wheel stone. Teeth were placed in 10%neutral buffered formalin for 72 hours then decalcified in 17% ethylene diamine tetra acetic acid (EDTA). A volume of 150 times that of the tissue was renewed every 5 to 7 days during decalcification process. After decalcification, specimens were dehydrated in 70% ethanol, embedded in paraffin blocks and serially sectioned in a buccolingual plane to the tooth main vertical axis into sections of 6 microns thickness.

The specimens were evaluated by histopathological examination and the total inflammatory cells count of each microscopic field using the image analysis software. The data were subjected to ANOVA and T-test for statistical analysis.

Results

I - Histopathological evaluation:

A - Group I:

Subgroup A:
Microscopic examination revealed the presence of generalized edema in the periapical region, numerous blood vessels, cementum resorption and inflammatory infiltrates composed of mononuclear cells.

Subgroup B:
Periapical generalized edema and inflammatory infiltrate mainly lymphocytes and plasma cells together with fibrillar dissociation were seen.

Subgroup C:
Periapical granulation tissue infiltrated with a large number of inflammatory cells mainly lymphocytes surrounded by delicate connective tissue fibrils together with high vascularity and edema was observed.

Subgroup D:
Microscopically, numerous dilated blood vessels with the periapical granulation tissue were seen. There was active alveolar bone and cementum resorption. Osteoclasts among mononuclear inflammatory cells and delicate connective tissue fibrils were also noticed.
B-Group II:

Subgroup A:
Generalized edema in the periapical area, cementum resorption, minimal inflammatory cells, fibrillar dissociation, degenerated connective tissue with almost complete lack of inflammatory cells and blood vessels were seen.

Subgroup B:
Periapical granulation tissue surrounded by generalized edema, areas of congested blood vessels, mononuclear inflammatory cell infiltrate and areas of fibrillar dissociation were observed.

Subgroup C:
Microscopically, periapical granulation tissue with intense inflammatory cells (lymphocytes, plasma cells and macrophages), areas of fibrillar dissociation and edema were seen.

Subgroup D:
A central area of hyaline degeneration surrounded by vascular granulation tissue, mononuclear inflammatory cells and edema were noticed.

C- Group III:

Subgroup A:
Microscopic examination revealed absence of any periapical lesion in the periodontal membrane area, direct contact of the periodontal ligament tissues with the surrounding bone, congested blood vessels and nearly complete absence of inflammatory cellular infiltrate.

Subgroup B:
Microscopic examination revealed cementum resorption, a mass of degenerated connective tissue in the periapical area surrounded by edematous connective tissue and mononuclear inflammatory cell infiltrate.

Subgroup C:
Microscopic examination revealed large periapical edematous area containing necrotic tissue together with fibrillar dissociation, mononuclear inflammatory cells and congested blood vessels.

Subgroup D:
A central area of degenerated connective tissue surrounded by vascular granulation tissue and mononuclear inflammatory cells was seen.

II - Total inflammatory cell count:

The data was collected and statistically analyzed. In group I, there was statistically significant difference between the four subgroups.
In both groups II and III, there was no statistically significant difference between subgroup B and C. However, the difference was significant when comparing subgroup A or D with the other subgroups.
It was found that there was statistically significant difference between the three groups for all subgroups.

Discussion

The main aim for the use of the calcium hydroxide as an intracanal medicament is its biological action.
Results showed that the use of any formulation of calcium hydroxide accelerates the healing potentiality of the periapical tissue. This is related to the antibacterial effect of calcium hydroxide, the inactivation of bacterial byproducts and prevention of macrophage adherence capacitance so it decreases the inflammatory reaction of the periapical tissue.

All these actions with the alkaline medium created by the calcium hydroxide allow the inhibition of the osteoclastic activity which is the main cells for bone resorption in addition to the activation of the osteoblasts to form new collagen fibers.

The histopathological analysis showed that there was better apical and periapical repair in the teeth in subgroup A compared with other subgroups. This could be explained by high rate of ionic dissociation of the calcium hydroxide with saline.

Subgroup A showed the least inflammatory cells count compared with other subgroups in all groups. In group III, no inflammation was seen in subgroup A. This means that the using of saline as a vehicle for Ca(OH)$_2$ potentiate the anti-inflammatory action of Ca(OH)$_2$. In conclusion, the use of saline as a vehicle for Ca(OH)$_2$ potentiate the healing of the periapical tissues much more than the use of chlorhexidine or iodoform.

References

Oral health status and level of oral hygiene in dogs and cats in Poland. Comparison of results collected in 2003-2004 and 2010-2011

J.P. Gawor¹,², K. Jodkowska¹,³, K. Kurski¹,⁴, I. Polkowska¹,⁵

¹ Dental Working Group in Polish Small Animal Veterinary Association
² ARKA Veterinary Clinic, Kraków
³ SGGW Warszawa, Warsaw Agricultural University
⁴ ELWET Veterinary Clinic, Warszawa
⁵ University of Life Sciences in Lublin

The Dental Working Group of the Polish Small Animal Veterinary Association ran the Pet Smile Campaign (PSC) since 2003. The PSC Team prepared materials for owners, instructions for the veterinarians, posters and the questionnaires for participating veterinary surgeons to fill in based on examined pet’s oral health status. This studies are comparing the results obtained in two periods: beginning of the PSC (2003-2004) and the latest editions (2010-2011)

Materials and Methods

Since 2003, every year members of the Dental Working Group of the Polish Small Animal Veterinary Association (PSAVA) recruited veterinary practices to provide oral examinations in cats and dogs. The examination procedure consisted of three parts: 3 minutes of dental/periodontal examination in the patient while it was awake, 3 minutes of interview and filling in a questionnaire with the owner, and 3 minutes of presentation of diagnosis to the owner, instruction of home oral hygiene methods, and recommendation of professional treatment. Parameters were recorded and scored, utilizing standardized charts, and included age of the patients, type of diet fed (dry, mixed [dry and soft], or soft food; home-made foods were classified as soft food), size of mandibular lymph nodes on palpation, presence of dental deposits, and presence of periodontal disease (Table 1). Extent of home oral hygiene were also assessed as: daily brushing, occasional performances or no hygiene provided.

The size of mandibular lymph nodes was determined as being either normal, slightly enlarged, or moderately to severely enlarged. The presence of dental deposits was determined visually of the most severely affected tooth and was recorded as absent, up to 50% of the crown affected, or more than 50% of the crown affected. The presence of periodontal disease was determined visually of the most severely affected tooth. Gingivitis was recorded when there was inflammation of gingival tissue, which was determined as abnormal reddening or bleeding of the gums. Periodontitis was recorded when a tooth had gingival recession or was mobile on digital palpation.

Results

Please see table 1 in the next page.
Table 1. Comparison of selected parameters evaluated in dogs and cats in two different periods.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of examined pets</td>
<td>29702 [76.6%]</td>
<td>9074 [23.4%]</td>
<td>3250 [72%]</td>
<td>1265 [28%]</td>
</tr>
<tr>
<td>Fed dry food [%]</td>
<td>22.5</td>
<td>33.7</td>
<td>45.0</td>
<td>44.5</td>
</tr>
<tr>
<td>Daily oral hygiene [%]</td>
<td>5.2</td>
<td>4.4</td>
<td>10.3</td>
<td>6.1</td>
</tr>
<tr>
<td>No hygiene at all [%]</td>
<td>60.1</td>
<td>71.4</td>
<td>33.9</td>
<td>70.4</td>
</tr>
<tr>
<td>Lymphnodes normal [%]</td>
<td>70.0</td>
<td>71.0</td>
<td>78.4</td>
<td>84.2</td>
</tr>
<tr>
<td>Lymphnodes enlarged [%]</td>
<td>4.0</td>
<td>3.3</td>
<td>3.2</td>
<td>1.6</td>
</tr>
<tr>
<td>No dental deposits (clean teeth) [%]</td>
<td>28.3</td>
<td>33.0</td>
<td>32.5</td>
<td>33.2</td>
</tr>
<tr>
<td>Dental calculus covering more than 50% of the crown [%]</td>
<td>20.1</td>
<td>17.4</td>
<td>12.3</td>
<td>6.1</td>
</tr>
<tr>
<td>Healthy gingiva [%]</td>
<td>63.2</td>
<td>58.0</td>
<td>66.7</td>
<td>59.9</td>
</tr>
<tr>
<td>Periodontitis [%]</td>
<td>10.7</td>
<td>10.3</td>
<td>7.6</td>
<td>7.7</td>
</tr>
</tbody>
</table>

Conclusions

The percentage of animals fed with dyr food remarkably increased in compared period. Lack of oral hygiene remained almost at the same level in cats since 2003. In dogs daily brushing as well as other methods of oral hygiene significantly increased.

All parameters evaluated in dogs and cats in 2010-2011 showed improvement in oral health status of the examined population. The most significant differences were related to presence of dental calculus and periodontitis.
>> Interactive Session <<
EVDC Interactive Session on Controversial Issues

Alexander M. Reiter1

1 Dipl. Tzt., Dr. med. vet., Dipl. AVDC, Dipl. EVDC

Evidence-Based Medicine

The goal of evidence-based medicine (EBM) is to use evidence gained from research for clinical decision making. There is a wide range of evidence quality. Double-blind, placebo-controlled clinical trials certainly provide more evidence than empirical knowledge obtained from case reports.

Sometimes, what we think is right may actually be wrong. Sometimes, what we think is wrong may actually be right. It happens all too often that we apply common treatment strategies without questioning the reasons behind their use. Evidence-based veterinary dentistry and oral surgery can only exist if we continue to evaluate our clinical work and have it backed up by science. Furthermore, we need to be open to change when there is evidence that such change is justified.

Possible Topics for Discussion

Should a plaque-preventing barrier sealant be placed onto teeth and gums after professional dental cleaning and closed periodontal pocket treatment?
Can you do a crown-lengthening procedure with apically positioned flaps on a mandibular canine tooth without extraction of the adjacent third incisor?
Does placing a bone graft or bone graft substitute in the absence of a membrane count as guided tissue regeneration procedure?
What is the current standard of treatment for luxated and avulsed teeth (timing, procedures, intracanal medications, systemic medications)?
What should the shape and dimension of a restorative cavity be at endodontic access/fracture sites and crown-root defects when considering final composite restoration?
Should the cusp of the mesiopalatal root of the maxillary fourth premolar tooth be included in a jacket crown preparation procedure?
Do root remnants always have to be extracted and do tooth extraction sites always have to be sutured closed?
Do you always have to place the interdental wire loops on the buccal surfaces of maxillary teeth and lingual surfaces of mandibular teeth when treating jaw fractures?
What are the appropriate margins of resection for benign noninvasive tumors, benign invasive tumors, and malignant tumors in cats and dogs?
Is low-speed equipment required when performing alveoleotomy and alveoloplasty?
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References:
3. Bayer Study No. 141903, 141906, 141912, 141913, 144246, 144250.

Veraflox 15 mg tablets for dogs and cats, Veraflox 60 mg tablets for dogs. Veraflox 120 mg tablets for dogs

Content: Each tablet contains: Pradofloxacin 15 mg. Pradofloxacin 60 mg. Pradofloxacin 120 mg. Dosage: 3 mg/kg b.w. once daily.

Indications for use:
Dogs: Treatment of wound infections caused by susceptible strains of the Staphylococcus intermedius group (including S. pseudintermedius), superficial and deep pyoderma caused by susceptible strains of the Staphylococcus intermedius group (including S. pseudintermedius). Acute urinary tract infections caused by susceptible strains of Entrococci coli and the Staphylococcus intermedius group (including S. pseudintermedius) and as adjunctive therapy to mechanical or surgical peritonitis therapy in the treatment of severe infections of the peritoneal and periportal tissues caused by susceptible strains of anaerobic organisms, for example Peptostreptococcus spp. and Prevotella spp. Cats: Treatment of acute infections of the upper respiratory tract caused by susceptible strains of Pasteurella multocida, Escherichia coli and the Staphylococcus intermedius group (including S. pseudintermedius).

Contraindications:
Do not use in animals with known hypersensitivity to fluoroquinolones.

Dogs: Do not use in dogs during the period of growth as development of articular cartilage may be affected. The period of growth depends on the breed. For the majority of breeds, pradofloxacin-containing veterinary medicinal products must not be used in dogs of less than 12 months of age and in giant breeds less than 18 months. Do not use in dogs with persisting articular cartilage lesions, since lesions may worsen during treatment with fluoroquinolones. Do not use in dogs with central nervous system (CNS) disorders, such as epilepsy, as fluoroquinolones could possibly cause seizures in predisposed animals. Do not use in dogs during pregnancy and lactation. Cats: Do not use in cats due to the lack of data. Pradofloxacin should not be used in kittens aged less than 6 weeks. Pradofloxacin has no effects on the developing cartilage of kittens of 6 weeks of age and older. However, the product should not be used in cats with persisting articular cartilage lesions, as these lesions may worsen during treatment with fluoroquinolones. Do not use in cats with central nervous system (CNS) disorders, such as epilepsy, as fluoroquinolones could potentially cause seizures in predisposed animals. Do not use in cats during pregnancy and lactation. Adverse reactions: Mild transient gastrointestinal disturbances including vomiting have been observed in rare cases in dogs and cats.

Veraflox: 25 mg/ml oral suspension for cats

Content: Each contains: Pradofloxacin 25 mg. Dose: 3 mg/kg b.w. once daily. Indications for use: Treatment of acute infections of the upper respiratory tract caused by susceptible strains of Pasteurella multocida and the Staphylococcus intermedius group (including S. pseudintermedius). Contraindications: Do not use in cats with known hypersensitivity to fluoroquinolones. Do not use in cats with persisting articular cartilage lesions, as these lesions may worsen during treatment with fluoroquinolones. Do not use in cats with central nervous system (CNS) disorders, such as epilepsy, as fluoroquinolones could potentially cause seizures in predisposed animals. Do not use in cats during pregnancy and lactation. Adverse reactions: Mild transient gastrointestinal disturbances including vomiting have been observed in rare cases in dogs.

For information on Special warnings for each target species, Special precautions for use, Adverse reactions and interaction with other medicinal products and other forms of interaction see the published SPC.

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