The Complete Dental Prophylaxis: Protocols including Oral Examination Oral Radiography Canine and Feline Extraction Techniques

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Introduction

Veterinary Dentistry has become an important component of the medical and surgical management of our pets. Clients are more “dentally aware” and today; they demand better dental care for their pets.

Most vet practices now have some form of mechanical scaler for performing a ‘dental prophy’ and some practices are realising the value of having dental bases with slow and high speed handpieces for the sectioning of teeth and the removal of bone, as well as performing more complex procedures such as endodontic therapy (root canal therapy). Still more practices are seeing benefits in purchasing a dental X-ray machine, to assist in the diagnosis of oral disease.

This lecture will look at the most common disease in veterinary medicine today, namely periodontal disease and also the techniques involved in tooth extractions in small animals.

Periodontal Disease

Periodontal disease (PD) is arguably the most common disease in small animal practice today (Harvey C., 1998; University of Minnesota- National Companion Animal Study, 1996).

A large proportion of adult dogs and cats have some degree of periodontal disease. The disease is so common that clinicians should always examine the oral cavity thoroughly as a part of any routine health assessment.

Periodontal disease is made up of a number of plaque induced diseases involving the supporting structures of teeth. The two main forms of PD are gingivitis, the reversible inflammation of the gingiva, and periodontitis, the inflammation and irreversible destruction of the tooth’s supporting structures, namely the gingiva, the periodontal ligament, cementum and alveolar bone.

Plaque accumulation leads to gingival inflammation (gingivitis). Gingivitis always precedes periodontitis, but gingivitis does not always progress to periodontitis. PD is caused by plaque bacteria. However, it is the interaction between plaque and the host’s immune system that can lead to the loss of alveolar bone that supports the teeth. The veterinarian’s goal for the successful management of PD is to minimise plaque accumulation through daily homecare and, if required, regular recalls/professional cleans.
Aetiology and natural progression of periodontal disease

The primary etiological factor that causes PD is bacteria. Also, there are secondary factors that can contribute to the severity of the disease. Secondary factors such as tooth crowding, persistent deciduous teeth, systemic illnesses like renal failure or diabetes mellitus, FIV in cats, and in man, smoking, will all contribute to the extent of PD.

It is within the gingival sulcus, that the bacteria that cause PD reside. Bacteria, bacterial products and toxins as well as the body's own defence mechanisms contribute to the initiation and continuation of PD. PD is not a continuous non-stop process. It represents a process that is characterised by periods of active tissue destruction and then periods of quiescence. It can occur at different locations within the oral cavity, and not always occurring at the same time (Random burst theory).

Pathogenesis

For PD to occur, one needs bacteria. Bacteria attach to the tooth surface by adhering to the tooth pellicle (Salivary glycoproteins). The pellicle is firmly attached to the teeth and even after ultrasonic scaling; it will reform on the tooth surface within minutes.

Once attached, plaque can only be removed from the tooth surface by mechanical means i.e. tooth brushing.

Initially, gram positive aerobic bacteria attach to the tooth surface supragingivally (in man—often seen as a thin white film covering the teeth).

But over a period of time, as the gingiva becomes irritated by this plaque, it swells and lifts away from the tooth (chronic marginal gingivitis). Chronic marginal gingivitis is defined as inflammation of the marginal gingival tissues and is characterised by redness, swelling and bleeding.

Gingivitis, if treated correctly, is reversible and the health of the periodontium can be restored to normal. If the plaque is left undisturbed, it eventually penetrates subgingivally. Once subgingival, the bacterial composition of the plaque changes to a predominantly gram negative anaerobic motile flora. This flora is responsible for the initiation of PD. The principle bacteria incriminated in PD are Bacteroides spp. and Fusobacterium spp.

The bacteria and their toxins penetrate the sulcular and junctional epithelium and initiate a rapid acute inflammatory response by the body. The end result of this process is periodontal soft tissue damage and alveolar bone resorption. This leads to deep pocket formation as well as to tooth mobility and eventual tooth loss. PD is not only a localised disease but can also cause bacteraemia and possibly lead to other organ involvement.

Bacterial plaque is often attached to calculus. Calculus is merely mineralised plaque and in itself is not harmful. However, it provides a roughened surface for plaque to adhere to. Saliva contains phosphoproteins which normally prevent the formation of calculus on teeth. But, plaque bacteria produce proteases which break down these phosphoproteins and allow the
mineralisation of the plaque. This is why calculus is often heaviest around the duct openings of the major salivary glands.

**Presenting signs of PD**

One of the most common signs of PD is halitosis (oral malodour). Oral bacteria, especially anaerobic bacteria produce volatile sulphur compounds (VSC) which lead to oral malodour. VSC are also toxic to mucosal epithelium and contribute to periodontal breakdown.

Other symptoms can include excessive salivation, blood tinged saliva, dysphagia, ulceration, pain on chewing and lethargy. However, dogs with PD often show little or no symptoms until the disease is well advanced. This may contribute to the late presentation of these dogs to the veterinary practice, making management of their disease more difficult.

**Diagnosis of PD- Oral examination**

A systematic approach is necessary when assessing and recording the extent of periodontal disease in the dog and cat. This should always include a thorough clinical examination of other organ systems before the oral examination begins.

The oral examination will include inspection and palpation of the extra-oral structures including face, lips, muscles of mastication, temporomandibular joints, salivary glands, lymph nodes, maxillae and mandibles, looking for swelling, atrophy, or asymmetry.

Inspection of the intra-oral structures follows, including hard and soft tissues and focusing on the dentition, gingiva, mucosa, tongue, tonsils and occlusion. On visual inspection, a dog with periodontitis may show evidence of gingival swelling, redness and an altered gingival contour around the teeth. There may also be areas with gingival recession, furcation exposures (in multi-rooted teeth) or purulent discharge from periodontal pockets. There can be variable amounts of plaque and calculus present, although, as a general rule, the more plaque and calculus covering the tooth surface, the more severe the disease.

PD often affects the mouth uniformly, with the disease being similar on both sides of the mouth, but sometimes to varying degrees of severity. However, if the disease presentation is not uniform or presents as a localised lesion, other causes such as immunopathy or neoplasia need to be ruled out.

Oral pathology, such as fractured teeth, may lead to altered chewing patterns with a subsequent increase in plaque, calculus and periodontitis on the affected side. The contra-lateral side can often have clean teeth with healthy gingivae.

The presence and extent of plaque and calculus accumulation should be noted. The use of a plaque disclosing dye (iC plaque™ IM3 company) on the teeth will demonstrate to the owner the extent of the problem.

However, a thorough periodontal examination can only be performed with the animal under general anaesthesia. Because periodontitis can worsen with increasing age, periodontal therapy
under general anaesthesia is often performed on middle aged to geriatric pets. It is therefore important to carry out an anaesthetic risk assessment prior to embarking on what can often be a lengthy procedure.

**Grading periodontal disease**

There are a number of methods for grading the severity of the disease. However, different degrees of severity can all occur in the same mouth or even at different sites on the same tooth.

Grading is based on the extent of attachment loss as measured with a periodontal probe.

Attachment loss is indicative of the periodontal destruction that occurs due to the effects of both bacterial toxins and the host’s own defence system. The disease progresses in stages often over a long period of time.

However, if untreated, the natural progression of the disease can lead to tooth loss.

**Treatment of gingivitis**

Gingivitis is usually caused by the build up of undisturbed plaque (non specific plaque) around the tooth.

The aim of treating gingivitis is to restore the affected gingival tissues back to clinical health through the thorough removal of plaque and then to maintain gingival health thereby preventing progression to periodontitis. This can often be simply accomplished by instigating such measures as homecare (e.g. daily tooth brushing) with periodic professional assessment/treatment to maintain gingival health.

**Treatment of periodontitis**

A. Nonsurgical periodontal therapy
B. Periodontal surgery

The ultimate goal of periodontal therapy is to provide treatments that will predictably arrest disease progression and give long term stability by preventing further tissue destruction at those sites already affected whilst also preventing disease occurrence at unaffected sites.

Effective control of periodontitis depends upon the identification and treatment of the bacterial infection and subsequent prevention of its recurrence.

Plaque removal is essential in preventing and controlling periodontitis. This follows the non-specific plaque hypothesis where removal of plaque to below a certain threshold will control disease.

Plaque removal can be accomplished by a combination of mechanical and chemical plaque reduction techniques, dietary manipulation and regular professional periodontal therapy.
However, the removal of supragingival plaque has little effect on established subgingival plaque. Pockets deeper than 3mm in dogs require root debridement (closed or nonsurgical). A decision regarding open root debridement (requiring periodontal surgery) would depend on the response of the periodontium to closed root debridement.

After the initial periodontal assessment, a treatment plan should be formulated, that will address the patient’s disease and the owner’s concerns. The plan should include on-going monitoring and if necessary, alterations to the periodontal management which may include more advanced periodontal therapy.

Of course, no treatment plan can be formulated without a detailed discussion of homecare/plaque control with the owner. Homecare and the continuing removal of plaque remains the cornerstone of periodontal disease prevention/control.

The complete dental prophylaxis - Standard protocols

Dental prophylaxis involves the inspection of the periodontium and charting of the teeth, probing of the gingival sulcus, supra- and subgingival scaling and root planing. It is followed by polishing and home care advice.

It cannot be done without a treatment plan, nor can it be done quickly.

The 12 steps involved in the complete dental prophylaxis are

1. Periodontal probing and charting
2. +/- Oral radiographs
3. Recording of all findings and development of a treatment plan
4. Gross removal of supragingival plaque and calculus
5. Supra-/Subgingival debridement
6. +/- Gingival surgery and open root debridement
7. Polishing for removal of more plaque
8. Sulcular lavage
9. Antimicrobial treatments ie Perioceutics
10. The use of osteo-inductive agents to regain attachment loss
11. Home-care advice and instructions
12. Recall and review.

1. Periodontal probing and charting

As periodontitis is a disease of the periodontium and involves the loss of periodontal attachment to the tooth, then the only way to assess this loss or its reattachment (the gain of attachment is the aim of periodontal treatment) is by assessing the extent of disease (by probing and radiography) and recording this information.
2. **Radiography**

Oral radiography allows one to assess the bone height surrounding the tooth and this gives an indication of attachment loss and the severity of periodontal disease. Radiography can also reveal subgingival calculus deposits, as well as showing other forms of pathology such as periapical lesions, odontoclastic resorptions and tumours both of soft and hard tissues.

3. **Recording and treatment planning**

The periodontal probing depths are recorded on a dental chart along with any other abnormalities such as missing, fractured, rotated and crowded teeth, retained deciduous teeth and an assessment of the gingival health including its colour, contour and consistency. Probing depths of 1-3mm is normal in the dog, whereas 0-1 mm is normal in the cat.

After all abnormalities including gingival recession, probing depths and loss of attachment have been recorded, one can then formulate a treatment plan that takes into account individual teeth, the dentition as a whole, and the ability of the owner to perform home care.

The primary role of treatment is to remove plaque and to formulate a plan that will prevent or slow down its reformation.

4. **Gross removal of supragingival plaque and calculus**

The gross removal of calculus with an old pair of extraction forceps or other purpose made equipment aids in the speedier removal of smaller deposits by mechanical scalers.

5. **Supra-/subgingival debridement**

The removal of supra- and subgingival plaque is achieved by a combination of mechanical scaling and hand scaling.

There are two forms of mechanical scalers. The ultrasonic scaler is the most widely used. Ultrasonic scalers include the magnetostrictive scaler (‘Cavitron’ type) and the piezoelectric scaler.

Magnetostrictive instruments operate between 18,000 to 45,000 cycles per second (Cps). When an electrical current is applied to a wire coil in the handpiece; a magnetic field is created around the stack or rod causing it to constrict. An alternating current causes an alternating magnetic field resulting in tip vibration. The tip movement of magnetostrictive scalers ranges from linear to elliptical or circular, depending on the type of unit and shape and length of the tip. Magnetostrictive tip movement allows for activation of all surfaces of the tip at once.

Water spray is essential to dissipate heat as well as producing cavitation activity within the water. This cavitation effect disrupts bacterial cell walls and can operate slightly beyond the reach of the tip (a benefit when used in deep pockets).

The piezoelectric scaler has crystals within the handpiece that undergo dimensional change. The piezoelectric unit operates at 25,000-50,000 Cps with a linear tip movement and only two sides of the tip are active at any one time.
The other form of scaler is the sonic scaler. Sonic scalers are air turbine units that operate between 3,000-8,000 Cps. In veterinary dentistry, they are used less often than ultrasonic scalers mainly due to their expense and their slowness in removing plaque and calculus. Their benefits include lower heat production (thus reducing the chance of thermal injury to the pulp) and reduced tooth surface damage when compared to ultrasonic scalers. Scalers should be held, so that the long axis of the scaler tip is parallel with the tooth surface, so as to prevent the concentration of heat in one area or gouging the tooth. One should not spend more than 15 seconds on any one tooth at a time.

Light strokes with minimal pressure should be employed. The use of the modified pen grasp and finger rests is recommended.

The fine spray that develops with the use of mechanical scalers is laden with bacteria. It is recommended that face masks and protective eyewear be worn at all times to protect the operator and assistant.

Mechanical scalers can be used subgingivally, so long as they are used for short periods of time, and that there is adequate water cooling. Some mechanical scalers are purpose built to clean subgingivally by directing the cooling water spray onto the tip of the scaler (IM3 42-12 ultrasonic scaler), therefore minimising thermal damage to the tooth.

Hand scalers are then used to remove any remaining plaque and calculus.

The H6-H7 sickle scaler is ideal for supragingival plaque removal. Curettes are used for supragingival and subgingival scaling. Curettes come in a number of types. Gracey curettes are popular choices for subgingival scaling and root planing. Curettes remove necrotic cementum and plaque as well as calculus.

Overlapping strokes, when hand scaling, are used to remove as much calculus and plaque as possible.

It is imperative to ascertain the thoroughness of subgingival scaling by probing the gingival pocket after scaling for any remaining deposits and re-scaling if necessary.

With any form of hand scaling, the instruments must be sharp. Therefore, it is important to sharpen these instruments during and after hand scaling, in order to give the best results.

6. +/- gingival surgery and open root debridement (periodontal surgery)

Open curettage is reserved for deeper pockets (>4-5mm.).

The consensus of opinion favours the use of closed curettage first, and then if on subsequent reassessments of the gingival pocket, if periodontal attachment has not been stabilised or regained, then open curettage should be considered. Open curettage involves the raising of a gingival flap, hand or mechanical scaling, and then replacing the flap in its original position or more apically, so as to reduce the pocket (apically repositioned flap).
7. Polishing

After scaling and root planing has been performed, polishing of the tooth surface is carried out with the use of a slow speed handpiece, prophy head, polishing cup, and polishing paste (abrasive).

The aim of polishing is not to smooth over the roughened tooth surface (caused by scaling), as previously thought, but to remove any residual plaque.

8. Sulcular lavage

It has been shown, through a number of human studies, that sulcular lavage is not necessary.

The flow of gingival fluid from the sulcus is enough to dislodge any unattached debris. Removal of prophy paste and other debris can be done by the use of the air/water spray on the triplex syringe.

9. Antimicrobial treatments

Chlorhexidine gluconate is a broad spectrum antimicrobial with excellent efficacy in the oral cavity. It requires a certain amount of contact time with the oral tissues to be effective, but it has good substantivity and will last some time in the mouth.

Chlorhexidine can be used as a pre-prophy wash to reduce the amount of oral bacteria and hence decrease the bacterial aerosol that can occur during scaling. This will minimise aerosol inhalation by the operator or assistant.

Chlorhexidine has a somewhat unpleasant taste and will also stain teeth, calculus and plaque if used continuously for more than two weeks (in man).

The use of systemic antibiotics should be reserved for procedures that involve gingival surgery or surgical exodontia, although systemic antibiotics can be used for short term improvement in periodontal disease. Perioperative antibiotics can be administered to those patients with heart valve dysfunction or who are immunocompromised either through illness or drug administration.

The advent of local delivery antibiotics (perioceutics) offers a better approach to the management of difficult to clean deep periodontal pockets.

10. The use of osteo-inductive agents

Guided tissue regeneration has been the mainstay of promoting attachment gain with a newly formed periodontal ligament.

11. Home care

This is an integral part of the dental prophylaxis, because without it, the plaque and calculus would quickly return.
Home care needs to be tailored to the needs of the animal and the compliance of the owner.

For home care to work, one needs a firm and continuing commitment from the owner, but also advice from the veterinarian that is seen to be practical and realistic. Unwilling owners or head shy pets make for an unrewarding and fruitless exercise.

The aim of home care is the removal of plaque. However, the periodic disturbance of subgingival plaque and the removal of plaque from areas that cannot be accessed by home care (i.e. furcation sites), should be performed on a regular basis under general anaesthesia by the veterinary dentist.

**Homecare products**

There are a large number of homecare products available to the pet owner.

The gold standard for plaque removal and for the prevention of periodontal disease still remains daily tooth brushing. Without this, plaque accumulation is inevitable. Chemical agents such as chlorhexidine gluconate have also been shown to help prevent gingivitis in dogs.

The use of flavoured “dog” dentifrices may aid in making the brushing experience more enjoyable for the pet. All owners should be offered a demonstration of the tooth brushing technique (Modified Bass method) and ideally, the owner should then be observed performing the brushing technique on their pet. A soft filament brush is used with the modified Bass method.

For the maxillary teeth, the tooth brush filaments are angled upwards at 45° and the tooth brush moved across the teeth in a circular motion, concentrating on the tooth/gingival margin. For the mandibular teeth the bristles are angled down at 45° and the same circular action used.

Power driven tooth brushes have an oscillating action also and can be used in dogs.

The use of dietary texture (TD™ diet, Hills Pet Nutrition) to control plaque accumulation is an important part of periodontal disease prevention, especially when tooth brushing compliance by pet owners is low. However, with established periodontitis, the effects of ‘dental’ diets and chews in controlling the disease is unknown.

Soluble zinc salts have been used in a number of homecare products for their antibacterial properties. Zinc salts may also be effective in controlling oral malodour (volatile sulphur compounds) by binding to sulphur and forming insoluble compounds that emit little odour.

Polyphosphates such as hexametaphosphate have been incorporated into foods and other homecare products due to their ability to bind to salivary calcium. This binding helps prevent the formation of calculus although there is no effect on plaque formation.

A recent study (Roudebush et al. 2005) reviewed homecare products based on current evidence-based veterinary dentistry. The study made a number of recommendations regarding homecare products that are used to prevent periodontal disease in both dogs and cats. The study showed that for dental homecare to control plaque accumulation and gingivitis in dogs, the highest quality of evidence existed for tooth brushing, chlorhexidine, dental foods with textural characteristics, proprietary dental treats, and short term use of dental sealants. Furthermore,
tooth brushing, dental foods with textural characteristics, dental foods or treats with polyphosphates, and proprietary rawhide chews were recommended for the control of calculus formation in dogs.

The study concluded that other homecare dental products used in dogs that were supported by a lower quality of evidence should not be recommended without further published studies.

In 1997, the Veterinary Oral Health Council (VOHC) was established to offer a seal of acceptance to those oral hygiene products that were shown in controlled studies to retard plaque and calculus.

Today, the VOHC Seal of Acceptance system for plaque and tartar control products is endorsed by a number of Veterinary Dental Organisations throughout the world. A list of endorsed products can be found at the VOHC website: www.vohc.org

12. Recall and review

The veterinary dentist should advise a revisit for the patient within six months of the prophylaxis treatment, to reassess the success of home care and to establish the time intervals between professional scaling and cleaning.

References


Oral Radiology

Introduction

Oral radiology is an important but often neglected component in the successful practice of veterinary medicine today.

Oral radiology is a vital diagnostic tool in veterinary dentistry. It allows the visualisation of tooth structure below the gingiva, without the superposition of the opposite jaw and other anatomical structures which may interfere with reaching a diagnosis. It offers an assessment of the periodontal and pulpal health of the tooth as well as any bony/soft tissue pathology that may be present.
It is divided into intraoral and extraoral radiography and can utilise either non-screen dental films or screen cassette type films. The lecture will mainly discuss the use of dental films in oral radiology. Extraoral radiography poses problems of anatomic superposition which interferes with radiographic interpretation.

However, extraoral radiographic views are helpful when looking at the temporomandibular joint and bone abnormalities of the maxilla and mandible.

**Some of the indications for dental radiography**

1. Periodontal disease- assessment of bone levels, type of bone loss, combined periodontal-endodontic lesions, success or failure of periodontal therapy.
2. Endodontic disease including periapical pathology, pulp exposures and draining fistulae.
3. Pathology of the oral soft and hard tissues including tumours, fractures.
4. Temporomandibular joint dysfunction.
5. Crown/root pathology including odontoclastic resorptive lesions, crown or root fractures, extra roots, dilacerated roots.
6. Pre and post tooth extraction.
7. Root canal therapy.
8. Oligodontia/supernumerary teeth especially in breeds with a family history of missing or extra permanent teeth.
9. An assessment of tooth development and chronological age of the animal.

**Equipment**

A. **Dental X-ray machine**
B. **Dental film**
C. **Film processing**

To perform high quality veterinary dentistry, the use of a dental X-ray machine and dental film is preferable. However, practices without dental X-ray machines can still take high quality dental radiographs with a standard X-ray machine and intraoral dental film.

A. **Dental X-ray machine:**

Dental X-ray machines are usually wall mounted or mobile units that can be wheeled from room to room. Wall mounted units with the longest extension arm are ideal for veterinary dentistry.

The unit can be positioned next to the dental operative and when not in use, folded against the wall to free up space and lessen any risk of damage to the unit.

The units usually have fixed kilovolts peak (KVP) often between 50 and 90 KVP. The milliamperes are also usually fixed (5-20 mA) so that the only variable is the duration of the exposure. The timer can be either an electronic or a countdown manual timer and newer machines often have preset times for each tooth type in dental arches. The timer button is of a dead man type so that positive pressure must be maintained on the button during the entire exposure.
Any dental X-ray machine can be used with computerised digital systems (CDS) of which some use a sensor (charged coupled device or CCD) to pick up the image. The CCD then transfers the image to a computer and after the interpretation of the image (with specific software), the radiographic image appears on the monitor within seconds. This saves on time and developing/fixing costs as well as delivering a 95% reduction in radiation exposure to the patient (more important in human dentistry) compared to conventional dental radiography. However the contrast of the image still appears better in conventional radiography with dental films, although digital radiographic contrast is improving all the time. The downside is the cost, with CDS’s costing well above $10,000 AUD.

Second hand dental X-ray machines are available and usually can be purchased for as little as $1200 AUD. If you intend to increase the quality and amount of dentistry that you do in your practice, a dental X-ray machine is an ideal purchase and will pay for itself many times over in the first year of usage.

Most dental X-ray machines are long collimator “cone” units (positioning-indicating device or PID). The cones are usually lead-lined to allow for more concentrated and near parallel x-rays. These units have a focal-film distance (FFD) of between 20-40 cm. Scatter of X-rays can be reduced further if the FFD is approximately 30 cm. The long cone minimises the amount of scatter and concentrates the beam of X-rays. They also allow the beam to be aimed directly at the area of interest and give greater radiographic detail than conventional X-ray units.

Remember the inverse square law when choosing FFD. This law states that the intensity of radiation required varies inversely with the square of the distance, so that if the FFD is doubled, with kilovoltage and milliamperage remaining the same, the exposure time needs to be quadrupled to maintain the same exposure. This law becomes important when considering using a standard veterinary X-ray machine usually with a FFD of 100cm. Most units these days can be manoeuvred to reduce the FFD down to a long cone type set up, as well allowing vertical tilt. Vertical angulation is important when using the bisecting angle technique (see in the other lecture).

B. Dental film

*Intraoral dental films* are non-screen films made of transparent, flexible, blue-tinted film base coated on both sides with emulsion and secured with an outer protective coating. The films are flexible to a point and will allow the bending of the film when it is placed. The films are marked with a raised dot indicating the tube side of the film.

The emulsion consists of X-ray and light sensitive crystals of silver halide embedded in gelatine that are exposed directly to x-rays. They differ to normal screen film which uses a light-tight cassette with a double emulsion film sandwiched between two intensifying screens. The screens phosphorescent crystals illuminate from direct contact with x-rays and give off light to capture the latent image on the film.

Dental film has no intensifying screens (non-screen) but contains a sheet of lead foil in its packet behind the film. This reduces radiation that would normally be produced by backscatter from the deeper tissues of the oral cavity. The size of the film also means that you radiograph only what is of diagnostic importance to you, thus eliminating the inclusion of unnecessary images that can complicate interpretation.
Dental film has four main components. The film itself is wrapped in black paper to protect it from light exposure. As mentioned before, the back of the film contains lead foil to shield the film from back scatter that may cause fogging. These components are then wrapped in a plastic outer wrap, which is moisture resistant.

Dental film should be stored in a cool, dry place at temperatures between 10-21 degrees Celsius with humidity no greater than 60%. The film should be stored on end rather than be stacked one on top of each other.

Film speed: Film sensitivity (speed) is a measure of how much radiation is required to produce a certain density in the processed film; the faster the film, the larger the silver halide crystals, the less radiation needed to become exposed. Currently available for dental radiography are the D-speed (ultra-speed), E-speed (Ekta-speed) and more recently F-speed (insight). However the trade off for increased speed is less contrast and detail. The E-speed film requires one-half the radiation dose of the D-speed film and the newer F-speed film 20% less than the E-speed film. Exposure times for digital radiography are 50-80% shorter than those for E-speed film.

D-speed film is reasonably priced and offers excellent diagnostic quality for veterinary dentistry. It is commonly used in veterinary dentistry.

The three useful film sizes often used in veterinary dentistry are No. 0 periapical children’s film (Kodak DF54) for cats and toy breeds of dogs, No. 2 periapical adult film (Kodak DF58) for cats and medium size dogs or individual teeth of larger dogs, and No. 4 occlusal film (Kodak DF50) for larger breeds of dogs or for dental surveys including bone pathology/trauma.

No. 0 film 22X35 mm
No. 2 film 31X41 mm
No. 4 film 57X77 mm.

No. 2 film can be purchased either packaged singly or with two films per packet. In a referral practice, this allows two films to be exposed simultaneously so that an identical film can be forwarded to the referring veterinarian.

C. Film processing

Dental films can be processed in the normal manual way in a dark room. Dental radiograph holders can be purchased to hold individual films or multiple films. To save costs, one can also use the corners of a standard cassette radiograph holder when processing in a dark room. Standard developer/fixer is acceptable for the processing of dental radiographs. Usual developing time is longer than for standard films (about 4 minutes).

Chair-side processing units are available and allow for the rapid processing of films without the need for a dark room. Because smaller amounts of developer and fixer are used, the solutions can be replaced more often without great expense.

There are also automatic processing units specially made for dental films. They work best for dental film compared to standard automatic processors, because the rollers are the appropriate size for the film. However, they are expensive and in my experience tend to malfunction on a
consistent basis as they age. They may be more ideal for those practices taking large numbers of dental radiographs.

There are also available rapid developer and fixer solutions (more concentrated than standard) to speed up the processing process. These will aid in shortening the general anaesthesia time for the pet. The developing time can be reduced to 20 seconds (normally 4 minutes) and fixing time down to 2 minutes (normally 10 minutes).

E-speed films require a red filter safe light, whereas D-speed films can utilise an orange or red filter safe light. Chair-side processors tend to have an orange tinted plexiglass window which allows the operator to visualise the handling of the film during the processing procedure.

Reading the film: The end result of a processed film is a negative with various degrees of lightness and darkness that is best viewed on a clean viewing box. The blackness of the film is the density and the range of densities, or shades of grey from white to black, is the radiographic contrast. When the contrast between structures is sufficient for the eye to distinguish one shade from another easily, the radiograph is said to have good detail. In human dentistry, the ability to differentiate between shades is important in the early detection of dental caries. The radiographic diagnosis of feline odontoclastic resorptive lesions also requires an ability to differentiate between shades. Magnification also aids in the interpretation of dental radiographs.

Storage of films- Due to their small size, dental films can be easily lost. Storage of films in envelopes or in dental frame mounts is advisable. Also with the advent of digital photography, dental films are easily converted into digital images for storage on a computer.

Techniques for oral radiography

The object of dental radiography is to produce a radiographic image that is dimensionally accurate reproduction of the actual object i.e. there is no foreshortening or elongation of the image.

Vertical versus horizontal angulation

Vertical angulation is the degree of angulation above or below the neutral line 0 degrees, a line perpendicular to the long axis of the tooth. Foreshortened images result from excessive vertical angulation and elongated images result from too little angulation. Vertical angulation is intentionally used for the bisecting angle technique.

Horizontal angulation refers to the movement of the tube head in a mesial or distal direction from the centre of the object being radiographed. Horizontal angulation is used so that there is no overlapping of structures and it is used also in the tube shift technique (discussed later).

For intraoral radiography the two techniques that are used most often are the parallel technique and the bisecting angle technique.
Parallel technique:

The simplest technique is the parallel technique and as the name implies the film and the long axis of the object are parallel to each other and perpendicular to the primary X-ray beam. The technique is used to image the mandibular premolars and molars. The vertical angulation can be plus or minus up to 20 degrees and still be acceptable for a parallel technique.

Bisecting angle technique:

The bisecting angle technique (BAT) is the most often used in dental radiography because it provides the least distortion and the most easily reproducible positioning technique for periapical studies. It is used to image all the incisors, canines and maxillary premolars and molars.

BAT is implemented by placing the film as close to parallel to the long axis of the tooth as possible. The primary beam is then directed perpendicular to the line that bisects the angle formed by the film and the long axis of the tooth. In doing this, the image is neither foreshortened nor elongated.

Special techniques

The lateral projections of the mandibular and maxillary canines are helpful in assessing the periapical region, and overcome the overlap of the canine tooth with the third incisor and premolar teeth around the canine apex.

Intraoral views of the temporomandibular joints may be done by placing a size 2 dental film in the oro-pharynx as far dorso-caudally as possible, with the white side of the film packet facing dorsally and the dot positioned rostrally. The x-ray beam is directed towards the film over the patient’s ear.

The tube-shift technique (SLOB rule- same lingual opposite buccal) provides the operator with the ability to differentiate a three dimensional three rooted tooth on a two dimensional radiograph. The technique can be used to separate and identify the roots of a three rooted tooth or show the buccal/lingual position of e.g. an impacted tooth. After taking a standard BAT lateral projection of the maxillary fourth premolar with the consequential superimposition of the mesiobuccal and palatal roots, a second radiograph is taken by moving the tube head rostrally (Primary X-ray beam coming from a more rostral position) by about 30 degrees- this rostrocaudal oblique view allows for the separation of the mesiobuccal and palatal roots of the maxillary fourth premolar. In this second view the palatal root will move in the same direction as the tube head namely in a rostral or mesial direction. Occasionally this positioning will result in superimposing the apex of the distobuccal root over the first molar. This will necessitate an additional 30 degree caudorostral oblique view to isolate the distobuccal root of the maxillary fourth premolar radiographically.

The separation is valuable in defining the pathology associated with advanced periodontal disease, or when diagnosing and treating endodontic disease in this region.
In cats and brachycephalic dogs, the zygomatic arch may be superimposed over the maxillary premolar tooth roots. If the collimator is placed in a rostral oblique position, the zygomatic arch can be shifted off the area of interest.

**Summary**

Today, oral radiography and the use of dental X-ray units are considered standard practice for those people wishing to offer a quality veterinary dental service.

Intraoral radiographs provide a wealth of information, information that usually cannot be found during a visual inspection of the oral cavity. This information will certainly aid in reaching a diagnosis for a particular case as well as possibly altering your management of that case.

**Canine and Feline extraction techniques**

Teeth extractions in domestic pets are performed for a number of reasons. Quite often extractions are carried out due to severe periodontitis and foreseeable problems with homecare or in the case of complicated fractures of teeth due to the owner’s financial constraints or inability to perform root canal therapy.

**The most common reasons for extraction are:**

1. Advanced periodontal disease especially with tooth mobility/furcation involvement
2. Complicated crown/root fractures and subsequent periapical pathology.
3. Traumatic occlusion
4. Odontoclastic resorptive lesions in cats
5. Retained deciduous teeth
6. Dental caries
7. Supernumerary teeth
8. Impacted teeth

Tooth extractions in dogs and cats can be difficult due to the large root/crown ratio and in the case of multi-rooted teeth, the divergence of the roots.

Some of the complications seen in exodontia include fractured roots, soft tissue trauma, haemorrhage, oronasal fistula and jaw fracture. These complications are usually due to poor extraction technique and can be minimised by following appropriate extraction principles. Careful planning, patience and atraumatic technique are essential components in successful exodontics.
Extraction techniques

Due to the large root/crown ratio in domestic pets, the removal of the lateral (buccal) wall of alveolar bone overlying the root is often a necessary component of extraction. In multi-rooted teeth, sectioning of the tooth into individual root segments aids in the tooth’s removal.

The use of air driven or electric driven equipment is ideal for sectioning teeth as well as removing the lateral bony wall.

In the case of air driven equipment, the water cooled high speed handpiece (350,000 RPM) with a tungsten-carbide round bur is used to remove the buccal bony plate, and with a straight or tapered fissure bur, to section multi-rooted teeth.

When using the electric driven equipment, the handpiece allows the bur to spin at up to 30,000 RPM but with better torque than the air driven handpiece. Electric driven equipment can be used for sectioning teeth, removal of the lateral bony plate and with a prophy attachment, for polishing teeth. However, because there is no water spray, the burs must be cooled by dripping saline or water onto the bur head. This avoids thermal trauma to the the underlying bone. The electric driven equipment is a reliable and cheaper alternative to air driven units for those veterinarians who only want to perform extractions and polish teeth post scale and clean.

Basic steps

When performing dental extractions, certain basic steps should be followed.

Firstly, the gingival attachment to the tooth should be severed with a number 11 or 15 scalpel blade. This frees up the gingiva from the tooth surface and allows for the introduction of a dental elevator (coupland chisel 2mm. and 4mm.). It is imperative when using elevators that the jaw be supported by the fingers and palm of the free hand so as to avoid possible jaw fracture. The dental elevator should be grasped in a tennis racquet grip with one finger extending along the blade of the instrument to act as a stop, should the instrument slip while elevating. Elevators are angled at 10-20 degrees to the long axis of the tooth to avoid slipping. Elevators should have sharp cutting surfaces to facilitate severing the periodontal ligament. The elevator is placed between the gingiva and the tooth and pressure is applied as the elevator is swung in a small arc.

At the end of each arc, the elevator is held for a few seconds, so that the PDL fibres are cut. The dental elevator can also be used as a lever, especially in the extraction of multi-rooted teeth. The leverage force is applied as close to the apex of the tooth as possible, and this force tears the PDL fibres. Once the tooth is loosened, and only then, does one use extraction forceps. The extraction forceps are used to gently rotate the tooth one way and held for a few seconds and then to rotate in the opposite direction and held. Once the tooth has been sufficiently loosened, it can be gently extracted with extraction forceps. Force should be avoided when using extraction forceps. If the tooth cannot be extracted easily with the forceps then more elevation is required, before retrying with the forceps.
Canine tooth extraction

The canine tooth has a very long root making extraction a difficult and time consuming proposition. Even with advanced periodontal disease and alveolar bone loss, there is still a large amount of root attachment present.

The best method of extracting canines is to raise a mucoperiosteal flap (usually mesial/rostral to the canine) and bur away the lateral bony plate overlying the root, to aid in tooth removal. The mucosal incision is best made well away from the tooth to prevent suturing over a dead space when closing. The flap is raised with a periosteal elevator and then a round bur in a slow or high speed handpiece is used to remove the lateral alveolar plate (remember to ascertain where the apex of the canine is by palpating the juga). Once the plate of bone is removed, an elevator of appropriate size can be introduced and the tooth loosened mesially, distally, labially and lingually. Be careful when using an elevator palatally in the maxillary canine, so that an iatrogenic oronasal communication is not created. Once the tooth has been loosened, the extraction forceps are used to grasp the tooth as far apically as possible and a mesial-distal rocking action with slight amounts of labial-lingual rotation is performed which will further loosen the tooth. When the tooth has become very mobile, it can be extracted.

The alveolus is then flushed out with saline or chlorhexidene to remove any debris and then closed with absorbable simple interrupted sutures. Healing should be uneventful and rapid.

Multi-rooted tooth extraction

The example of a multi-rooted tooth used here will be the maxillary fourth premolar (carnassial tooth), however the principles apply to any multi-rooted tooth.

Again a mucoperiosteal flap is raised after the gingival attachment of the tooth is severed. Be careful when making the mesial/rostral incision for the flap, so as to avoid the infraorbital foramen, with its rich supply of vessels and nerves. The foramen can be palpated very easily being just mesial to the maxillary fourth premolar about level with the distal root of the third premolar, however there can be breed variation.

Once the flap is raised, the tooth is sectioned with a fissure bur (ie701) starting at the furcation and running the bur at right angles to the tooth towards the coronal tip.

When the mesiobuccal and distobuccal roots have been separated, a dental elevator also directed at right angles to the tooth is introduced. It is used as a wedge to tear the PDL fibres. Removal of the lateral bony wall overlying the distobuccal root will aid in its removal.

Then, the mesiobuccal and mesiopalatal roots are separated with a fissure bur starting at their furcation and running the bur towards the crown. Alternatively, the bur can be directed in an angled mesial-distal direction just missing the distal coronal edge of the maxillary third premolar and starting coronally, the bur is run apically until the two mesial roots are separated. Once separated, the mesiobuccal root is removed first, followed by the mesiopalatal root.

Quite often, when closing the gingival flap, one must perform alveoloplasty first, to smooth off the rough bone edges and allow closure of the wound without tension.
Complications

Complications can occur before/during/ or after extraction.

Any adverse, unplanned event that tends to increase morbidity above what would be expected from a particular operative procedure under normal circumstances is a complication.

Factors involved in complications

- Patient factors including sick, debilitated or immunocompromised patients.
- Surgeon factors including inexperience, poor planning, use of excessive force, poor technique, lack of patience.
- Procedural factors including inappropriate tools, difficult access.

Extraction complications (iatrogenic) include

- Fractured roots
- Soft tissue trauma
- Haemorrhage
- Jaw fracture
- Oronasal fistula
- Infection
- Nerve damage
- Root(s) lost into soft tissue spaces or bony cavities

To Minimise extraction complications

- DO have a plan i.e. cut multi-rooted teeth into single units.
- DO have patience. Extractions take time.
- DO use atraumatic techniques.
- DO NOT use excessive force.

In summary

Remember

- Be patient, do not use excessive force to extract teeth as this will result in root fracture
- Cut the mucosal attachment first, and then raise a mucoperiosteal flap to expose the lateral bony plate when doing a surgical extraction
- Divide all multi-rooted teeth into single rooted segments for ease of extraction
- Your anatomy, the proximity of the orbit, infraorbital foramen, nasal cavity etc.
- Use finger/palm rests to prevent soft tissue damage or jaw fractures
- Do not use extraction forceps until the tooth has been sufficiently loosened with dental elevators
- Smooth off any sharp edges of bone and then place resorbable sutures without tension.