TIPS TO HELP YOU WITH DIFFICULT EXTRACTONS IN THE DOG AND CAT

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The premise for any dental extraction of flap procedure is to appreciate the anatomy as well as the surgical principles necessary for this procedure to be accomplished.

Before any dental extraction should be undertaken, it is ESSENTIAL that a veterinarian has prior appreciation of the root structure of the tooth being removed. The only way this can be accomplished is via dental radiography. While many times complete removal of the affected tooth can be accomplished without radiography, can the veterinarian absolutely claim that there are no tooth shards, bone fragments, or tooth root structures remaining? Failure to completely remove the tooth in entirety without any remnants is tantamount to malpractice. In many clinical situations, existing endodontic disease causing apical periodontitis (abscess) will remain unless the entire tooth root is removed.

The flap procedure is an important consideration, as the veterinarian must choose a flap that allows exposure of the affected tooth and TENSION FREE CLOSURE without disruption of the neurovascular component of the gingiva. The ENVELOPE flap is considered with marginal amount of buccal or labial bone is needed to be removed to accomplish this extraction. This flap, as with others, must extend beyond the mucogingival line to allow for unattached gingiva to be released and facilitate a tension-free closure.

Vertical releasing flaps (single or bilateral) are mucoperiosteal flaps that allow the veterinarian full exposure of the tooth to be removed, thus allowing more buccal bone to be removed to facilitate extraction.

Three (3) Principles of flap surgery are as follows: If a vertical release is to be made, make it on the adjacent tooth at the appropriate LINE ANGLE, not the tooth to be removed. This is important in that you do not want your suture line over the alveolus, but rather over healthy bone (no suture line over a defect). Secondly, preserve blood supply and thirdly, selection of instruments that minimize tissue damage.1

Line Angle definition
This is an imaginary vertical line forming the intersection of two adjacent vertical dental surfaces. This denotes a specific position on a tooth and are important surgical landmarks. (Verstraete F, Lommer M. Oral and Maxillofacial Surgery in Dogs and Cats.)
The flap exposure is best accomplished after extraction by excision of the mucoperiosteum. Utilization of a scalpel blade nick followed by sharp dissection of this is made to allow the flap to fully cover the surgical extraction site. Any marginal tissue that looks irregular and inflamed should be removed.

4-0 poliglecaprone-25 with a reverse cutting edge needle is chosen as the oral suture material. This suture is rapidly absorbed and the reverse cutting edge is used to minimize inadvertent tissue tears. Since it is a monofilament suture, it pulls freely through tissue, has good knot security, stays in the mouth longer than chronic gut, and does not require removal. Simple interrupted patterns (2-3 mm apart) are needed.

Scalpel blade selection should be via a #15 or #15C blade. Rarely, a #11 surgical blade is needed. Proper instrumentation is needed to adequately remove large teeth. It is recommended to have a winged elevator kit (2-8) which allows one variability in selection of elevators. Periosteal elevators are ESSENTIAL for adequate flap preparation and a couple of sizes are needed for both the small dog and cat as well as for large breeds.

In order to facilitate extraction of teeth, a high speed dental unit is a must. One cannot adequately remove large single rooted or multirooted teeth without the benefit of a good high speed unit. BEFORE undertaking any dental extractions, the veterinary would be wise to consult with his/her distributor for a unit. There are many good units in the marketplace, and each has their own benefit or even restriction. It is recommended, however, to go the extra mile and purchase fiberoptics in your high-speed handpiece. Swivel-tip handpiece is also recommended.

Bur Selection: #1/2, #1, #2, #4, #6 round; 701 cross cut; medium grit football diamond; medium grit round diamond (I recommend surgical length burs in addition to the regular length)

Bone graft materials aid in filling the open socket with bone and connective tissue rather than allowing it to collapse or granulate in with soft tissue. Collapse of the socket can further alter facial features slightly because there is no longer any crown structure to support that portion of the upper lip, which is now vulnerable to trauma by the mandibular canine tooth. (for maxillary canine extraction). If there is marginal amount of ventral cortex remaining from extraction of a mandibular 1st molar tooth, a graft is warranted. Graft of mandibular canine teeth is also recommended if stability of the bone is needed. However, there is no substitute for a good clot formation in the site to help promote new bone formation.
Tips for extractions of the following teeth

Maxillary canine
- Single vertical diverging releasing incision advised (between the maxillary canine tooth and the maxillary lateral incisor tooth (or mesial line angle of the maxillary canine tooth)
- Use larger round bur (#4, #6) to remove buccal bone and DO NOT remove bone mesial or distal to the tooth itself
- Use #170, 701, 699 crosscuts OR #1 round bur to make moat. Make moat only wide enough to accommodate the winged elevators or luxators only.
- Start out by taking buccal bone 2/3 or greater to the apex of the tooth. (remember to follow the contour of the tooth) As you get better at removing teeth, you can take off less buccal bone
- Periosteal release is a MUST and freshen edges prior to closure
- Always perform alveoplasty (football or round diamond)
- If dog or cat has ONF, remove the epithelial downgrowth tissue PRIOR to closure, otherwise the flap will fail
- Tension-free flap (for all extractions)
- Simple interrupted pattern 2-3 mm apart. DO NOT USE PDS
- E-collar may be needed for cases

Maxillary 4th premolar tooth
- Single or bilateral diverging incision. Make sure you DO NOT make incision over tooth you are extracting
- Careful of the parotid papilla if making a bilateral diverging incision
- Remove buccal bone with #4 or #6 round bur
- Moat with same burs you use in canine
- Section all 3 roots prior to removal, regardless if tooth is mobile or not
- Remove caudal crown cusp adjacent to the maxillary 1st molar tooth to facilitate straight-line luxation/elevation. Care needed to avoid contacting the 1st molar tooth
- Remove middle section of tooth if need be to allow straight line removal (OR amputate crowns for better visualization of crowns to facilitate extraction)
- Remove interradicular bone between the mesiobuccal root and the palatal root (after removal of the mesiobuccal root)
- Make a moat around the palatal root carefully with very fine cross cut (#170, 701, or 699) or round (1/4-1/2 round)
- Surgical burs are a must in difficult extractions so keep some on board (#2, #1, #1/2, 701)
- Alveoplasty needed
- Avoid neurovascular bundle at infraorbital foramina

Mandibular 1st molar tooth
- Vertical incision at line angle of the mesial or distal aspect of the 4th premolar tooth, NOT at the mesial aspect of the 1st molar (as roots can diverge)
- Envelope flap if practical
- Amputate mesial and distal cusps of 1st molar to facilitate straight-line access
- Remove middle section of tooth to facilitate extraction if needed
- Alveoplasty after extraction, especially on the lingual mandibular marginal bone

Mandibular canine tooth
- Preservation of labial frenulum advised
- Vertical release from mesial line angle of the canine tooth
- Care with buccal bone removal to avoid the mental foramina (use periosteal elevators to protect this area and avoid the bur macerating/lacerating the vessels/nerve)
- Release of lingual gingiva needed
- Tension-free closure
- E-collar needed

Bone Grafts

The most common types of bone grafts in veterinary medicine are osteoinductive and osteoconductive agents. Osteoinduction is a chemical process by which molecules contained in the graft (bone morphogenic proteins) convert the neighboring cells into osteoblasts, which in turn form bone. An example of this is a decalcified freeze-dried bone allograft (DFBDA). Osteoconduction is a physical effect by which the matrix of the graft forms a scaffold that favors outside cells to penetrate the graft and form new bone. In veterinary dentistry, freeze-dried bone allograft (FBDA) or more commonly a synthetic bioactive glass are examples of this type of osteoconductive agent.

Equipment List

Dental radiograph system (Progeny generator; digital dental sensor)
High Speed/low speed dental system
4-0 and 5-0 Monocryl (or generic) or Chromic Gut
#15 or #15c surgical blades
Winged elevator kit (2-8)
Periosteal elevators (EX8-108; EX9-108)
Thumb forceps
Assorted burs (#1/2, #1, #2, #4, #6 round); 701, 701L Surgical crosscut burs
Diamond burs (medium grit football)
Goldman-Fox scissors
Kelly Straight Scissors
#100C and 1.3S luxators
Cawood-Minnesota retractors
Root tip pick
Small needle holders (with or without scissors)
Consil or Oste-Allograph Perio Mix

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ii 4-0 Monocryl, Ethicon, Inc. Somerville, NJ
iii Osteo-Allograft Perio-Mix. Veterinary Transplant Services, Inc. Kent, WA
CASE BASED REVIEW OF A VARIETY OF DENTAL CASES

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Overview
A ‘dental prophy’ doesn’t exist in veterinary medicine. As 80% of both dogs and cats have some form of periodontal disease by age 3. That means for every ‘dental’ scheduled by your team, 80% needs additional treatment.

To makes things worse, 30% of dogs and 40% cats have disease underneath the gumline that cannot be detected by the naked eye. Those cases need treatment; therefore, the clinician must be prepared to diagnose and either treat or refer those cases.

Cases that will be reviewed in this session
- Feline tooth resorption (TR) and how to differentiate Type I from Type II
- Dentigerous cysts and how they form What can we learn from early detection?
- Vertical bone loss of the maxillary canine tooth in dogs
- Class II malocclusions and why you really see them more than you think plus ways to prevent unnecessary oral pain
- The discolored tooth Why is this such a big deal?
- Tooth fractures not in the pulp cavity This can also be a big deal if you don’t look carefully
- Root resorption in the dog When should you be concerned?
ORAL ONCOLOGY FOR THE DOG AND CAT…A COMPLETE REVIEW OF MALIGNANT ANDE NON-MALIGNANT TUMORS AND HOW TO APPROACH EACH

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Introduction
Oral tumors compromise 5.3% of all neoplasia in the dogs and 6.7% in cats.1 Therefore, it is necessary for the clinician to be diligent in oral examinations and diagnostics. This lecture will review the most common oral tumors in dogs and cats, and treatment plans for each.
The most common oral malignancies in dogs in order of occurrence: Malignant melanoma, squamous cell carcinoma, fibrosarcoma. In the cat, squamous cell carcinoma.

Malignant versus benign tumors
Malignant tumors tend to destroy bone and soft tissue, while leaving teeth in their normal arcade positions. This gives the impression of teeth being suspended in soft tissue with marginal bone. Benign tumors can move teeth due to the soft tissue expansion, thereby redirecting teeth.1,2

Malignant melanoma (MM)
This is the most common oral tumor in the dog. Sex predilection: Males with a male-to-female ration of 1.4-6.0:1. Typically occurs in older dogs (mean 11 years). Cocker spaniels, Labrador retrievers, Golden retrievers and German Shepherds and dogs with heavily pigmented oral mucosa may be predisposed. Non-pigmented (amelanotic) tumors do occur as well (33%) Melanomas are rare in cats. Otherwise, dark pigmented raised masses are noted.

These tumors have focal infiltration, with early metastasis to regional lymph nodes. Metastasis to the lungs and liver are less frequent. Bone destruction is common.

Location – Any part of the oral cavity including the dorsal tongue surface and lips. Encompassing mandibular and maxillary together, 32% were located rostrally and 20% were located caudally,

Diagnostic tests- Intraoral radiographs are needed to assess bone involvement (57%). FNA of mandibular lymph node, incisional biopsy. Once MM has been diagnosed, conventional oncology workup is recommended (CT, CBC, Serum chemistries, UA, 3 view thoracic radiographs and abdominal US).
Treatment options – Curative intent surgery with wide margins (1-2 cm margins), even as a sole treatment often extends PFI (Progression free interval) and ST (Survival times). Metastasis at time of diagnosis carries a poor prognosis and a lower ST. Rostral mandibular and maxillary masses provide the surgeon a more favorable clean tumor-free margin. Also, tumor size directly affects the ability for a surgeon to achieve clean surgical margins. Other therapy: Maximum tolerable dosage (MTD) chemotherapy (Carboplatin), xenogenic canine melanoma vaccine, radiation therapy, metronomic chemotherapy (combination of doxycycline, NSAID, cyclophosphamide), and interferon.\textsuperscript{1,2,3,4}

Survival times – The survival time is short, ranging from <4 months to 5.8 months and 8 months in other studies. However, a longer survival time was noted with dogs with histologically well-differentiated melanocytic neoplasms (Mean survival time of 23 months and median survival time of 34 months after surgery)

**Squamous cell carcinoma (SCC) – Non-papillary / Non-tonsillar**

This is the most common oral malignancy in the cat and 2\textsuperscript{nd} most common one in the dog (17-25\%). This occurs in older dogs (mean 8-10 yrs) with larger dogs overrepresented. The gingiva is the most common site for this neoplasia. The gingiva usually appears ulcerated with secondary bone involvement (77\%). Metastasis to regional lymph nodes is rare (<10\%) and low to moderate metastasis to the lungs in dogs is noted (3-36\%). Some facial changes (exophthalmos) can be noted.\textsuperscript{3} These masses are slow growing, locally destructive mostly on the buccal mucosa. (See comparison of this mass with papillary SCC)

Location- In the dog, the gingival mucosa is the most common site. In the cat, premolar / molar area of maxilla, premolar region of the mandible, and sublingual lesion.\textsuperscript{3} Metastasis is late to regional lymph nodes and distant organs. SCC is locally aggressive with bone involvement. Tonsillar and lingual SCC are less common but have a higher and earlier metastatic rate.

Diagnostic tests- Incisional biopsy and regional lymph node aspirates are recommended. Once the non-papillary SCC has been diagnosed, conventional oncology workup is recommended.

Treatment options- Wide surgical excision (1-2 cm margins). Rostral mandibular SCC is more favorable with cats but case selection prior to aggressive excisional surgery must be considered. Rostral mandibular provide a more favorable long-term prognosis. SCC is responsive to radiation therapy with a medium survival time (MST) of 16 months. Radiation is radiosensitive but not radiocurative. Cisplatin and piroxicam have been reported to be effective.\textsuperscript{3}

**Papillary SCC (PSCC)**

Previously thought to only occur with young dogs, this form of SCC can occur with middle to older aged dogs as well. The mean age is ~4 years (0.5-9.0 years) in a 9 dog
study. CT of these lesions showed bone lysis with or without osteoproliferation. These masses are more infiltrated, rapid growth, and atypical cellularity. PSS do not metastasize.\(^5\)

Location - Most were large breed dogs and the most common location was the rostral maxilla (7/9), however, tumors were noted in the rostral mandible and mid/caudal maxilla.\(^2,3,5\)

Diagnostic tests – Same as SCC

Treatment options – Surgical wide margins (1 cm) provide excellent clinical results.

**Fibrosarcoma (FSA)**

This neoplasia is the 3\(^{rd}\) most common neoplasia in dogs (7.5-25\%) and 2\(^{nd}\) most common malignancy in cats (13\%). The median age of 7.3-8.6 years in dogs, and <25\% of dogs are <5 years of age. In cats, the average age is 10.3 years. There is a sex predilection of male to female of 1.4-2.8:1. Larger breed animals >50# (Golden Retrievers) have a higher predisposition for FSA. Metastatic potential is low and can occur late in the disease process with lymph nodes (19-22\%) and lungs (6-27\%) in dogs. The low metastatic potential is the same in cats.

Clinical appearance show a firm, flat, multilobulated and deeply attached to the underlying tissue with rare ulceration noted. Bone lysis occurs in 72\% of canine cases.

These tumors are histologically low-grade and biologically high-grade which potentially provides confusion to the DVM when interpreting an aggressive oral tumor. These tumors may be misdiagnosed as benign fibromas or low-grade sarcomas. High grade anaplastic oral FSAs have a more metastatic potential than do low-grade tumors.

Location – The site predilection in dog is maxillary arcade between the canines and carnassial teeth (56-87\%), hard palate (7-17\%) and buccal or labial mucosa (4-22\%). There is no site predilection in the cat.

Diagnostic tests – After initial incisional biopsy, routine staging with FNA of mandibular lymph nodes, 3 view orthogonal thoracic images, serum chemistries/CBC/UA and CT.

Treatment options – Wide surgical excision (2 cm) is warranted. Local recurrence occurs more frequently than metastasis. Radiation therapy post wide excisional surgery, radiation therapy alone, and radiation therapy with local hyperthermia can prolong the survival times.

Survival times- Median survival time (MST) is approximately 11-12 months for both mandibular and maxillary FSA resection with local recurrence rate of 46\%. Radiation therapy MST is 6-26 months.\(^2,3\)
Osteosarcoma (OSA)

Oral osteosarcomas are the 4th most common oral tumor in dogs (6-18%). Feline oral OSAs are much less frequent (2.4%). Medium to large breed dogs that are middle aged to older are mostly represented. Females appear to be more represented.

Location – Most OSAs occur in the maxilla (43%) followed by mandibular (32%) and the calvarium (23%).

Diagnostic tests – After incisional biopsy, regional lymph node aspirates, along with conventional oncological workup.

The metastatic rate of oral OSA is lower than the appendicular counterpart. Occurrence in the mandible and maxilla are noted, with a more unfavorable outcome with OSA in the TM joint and caudal maxilla / mandible.

 Treatment options – Wide radical excision (1-2 cm) of the tumor should be performed if possible. Dogs treated with surgical excision had a Median Survival Time (MST) of 329 days. Surgery resulting in complete excision improved prognosis, whereas calvarial tumor location and increased monocyte count were associated with a poorer prognosis. Radiation therapy and chemotherapy have not shown a decrease in hazard of death progression.3,6

Odontogenic tumors

These tumors are derived from ectodermal, ectomesenchymal, or mesenchymal components of the tooth forming apparatus. These include Canine acanthomatous amelolastoma (CAA), peripheral odontogenic fibroma (POF), and focal fibrous hyperplasia (FFH). Of the three, POF and FFH are relegated to the gingiva only.7

Canine acanthomatous ameloblastoma (CAA) – In a recent study of odontogenic tumors, CAA occurred 45% (68/152). This is an aggressive benign odontogenic tumor that is non-inductive in nature; therefore, the cells of ameloblastic origin do not induce the surrounding mesenchmal cells. Therefore, no dental hard tissues formed and is a soft tissue neoplasia. These raised, lobulated masses also cause local bone infiltration and tooth displacement. Metastasis to regional lymph nodes or distant organs has not been reported. CT is recommended prior to oral surgery to establish bone involvement. 1-2 cm margins are recommended. Intralesional bleomycin has been documented to resolve this oral mass with no recurrence. Local side effects to bleomycin injections have been documented. Predilection to the rostral mandible is common.7,8,9

Peripheral odontogenic fibroma (POF) – These are slow growing masses. These benign masses are not locally invasive, and occur in 31% of odontogenic tumors. Clinically, they appear as rough-surfaced masses on the gingiva. Radiographically and histologically, there may be dystrophic calcification within the mass, but no alveolar bone involvement. As with other odontogenic tumors, tooth movement due to expansion of the mass is possible. Regional distribution is mostly the rostral maxilla (47%) and
caudal mandible (21%), but these masses may occur anywhere along the gingival margin. There is controversy whether these tumors are actually remnants of the periodontal ligament, and whether removal of the tooth and adjacent periodontal ligament is warranted. Some recommend removal in the reactive zone and the surrounding pseudocapsule. Others recommend a more aggressive approach to remove the tooth and the PDL, which means removal of alveolar bone that supports the tooth, to achieve complete removal.\textsuperscript{3,7}

**Focal Fibrous Hyperplasia (FFH)** – This encompasses 16% of odontogenic tumors in the dog. Clinically, these appear raised, smooth and sometimes very firm. Regional distribution of these masses are mostly relegated to the rostral maxilla (57%) as well as rostral (22%) and distal (17%) mandible. Surgical removal is similar with POF.\textsuperscript{3,7}

**References**

9 Kelly JM, Belding BA, Schaefer AK. Acanthomatous ameloblastoma treated with intralesional bleomycin. Veterinary and Comparative Oncology. Vol 8 (2): 81-86
CANINE RADIOGRAPHIC INTERPRETATION AND DISCUSSION

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Radiology, whether direct or indirect digital, are essential for the practitioner in order to perform adequate dentistry. 60% of the tooth lies below the gum line, therefore, it would be impossible to give the pet owner a complete assessment of the entire tooth. This equates to washing and waxing a vehicle, making it look brand new, without evaluating the engine under the hood.

AAHA guidelines should be reviewed by each practitioner, regardless whether they are AAHA members or not. Taking dental radiographs with each annual ATP, or before any extraction or oral surgery, should be the norm and not an option.

Dental radiographs are also the legal documentation of the procedure performed. When you perform an extraction, you have contracted with the pet owner to perform the entire extraction, removing all roots. If you leave roots, you are legally liable. Without confirmation via dental radiography, you cannot prove you performed the procedure

A benchmark study by Verstraete proved the value of intraoral dental radiography. His findings (226 dogs/116 cats) showed the following:

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<th>Value of radiographs w/no clinical findings present</th>
<th>Dog (%)</th>
<th>Cat (%)</th>
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</thead>
<tbody>
<tr>
<td>Incidental radiographic findings</td>
<td>41.7%</td>
<td>4.8%</td>
</tr>
<tr>
<td><strong>Clinically important findings</strong></td>
<td><strong>27.8%</strong></td>
<td><strong>41.7%</strong></td>
</tr>
<tr>
<td>Radiographs of no value</td>
<td>30.5%</td>
<td>53.6%</td>
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This shows that almost 3/10 dogs and 4/10 cats that only receive a ‘dental’ go out of your door with oral pathology that needs to be identified.

<table>
<thead>
<tr>
<th>Value of radiographs with clinical findings present</th>
<th>Dog (%)</th>
<th>Cat (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conformational only</td>
<td>24.3%</td>
<td>13.9%</td>
</tr>
<tr>
<td>Clinical essential findings</td>
<td>22.6%</td>
<td>32.2%</td>
</tr>
<tr>
<td>Additional findings</td>
<td>50.0%</td>
<td>53.9%</td>
</tr>
<tr>
<td>No value</td>
<td>3.1%</td>
<td>0%</td>
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This shows that ‘where there’s smoke, there’s fire’ with regard to pathology under the gumline. 50% of both dogs and cats that have radiographically visible pathology have more findings that need attention.
In a recent JAAHA article, 16 predetermined categories of abnormal radiographic findings in 233 small breed dogs found almost 30% had abnormal findings. The most common tooth identified with pathology was the mandibular 1\textsuperscript{st} molar (70%) followed by the maxillary 4\textsuperscript{th} premolar (40%). Bone loss was noted in 15% of all findings. The conclusion was “full mouth radiographic evaluation should be performed to obtain important information for making accurate diagnoses”.

The indications for dental radiography are:
- Before and after extractions
- Periodontal disease
- Mobile teeth
- Discolored teeth
- Fractured teeth
- Gingival ulcers
- Missing teeth
- Malocclusions causing trauma
- Malformed teeth
- Gingival mass/bone swelling/soft tissue swelling
- Tooth Resorptions/root resorptions
- Pet dropping food
- Foul odor in mouth
- Reluctance to eat
- Reluctance to eat chews
- Nasal discharge

BEFORE AND AFTER EXTRACTIONS
How would you know if the root has a curved apex or that there is indeed a root fracture? What if the mandibular 1\textsuperscript{st} molar you plan to remove has its apex 1 mm from the ventral cortex of the mandible? A good dentist always knows the lay of the land before undertaking any procedure. As a radiograph is a legal document, this is the ONLY confirmation that the procedure you charged for was done to completion. Tooth root fragments/remnants are quite commonly left in the mouth with extractions.

PERIODONTAL DISEASE (PD)
Probing is the gold standard to assess bone loss and periodontal pockets. Radiography compliments this. There has to be 40% cortical bone loss for radiographic evidence of PD to be visible. The earliest sign of periodontal disease is the irregular alveolar margin between teeth. This should give the practitioner a sign that the periodontium is undergoing stress and needs treatment.
DISCOLORED TEETH
There is a 93% chance that discolored teeth are non-vital, but only 57% of those teeth will show evidence of premature maturation (tooth death).\(^1\) Regardless, it is important to radiograph all discolored teeth for evidence of apical periodontitis. Radiography will aid in deciding if this tooth is a candidate for endodontic therapy or extraction. Leaving a discolored tooth in the mouth without treatment is unwarranted and can be considered malpractice.

FRACTURED TEETH
Even uncomplicated crown fractures (dentin exposure with no pulp exposure) can cause kill a tooth and cause apical periodontitis. Dentin is microscopically porous and bacteria can ingress through these pores and cause premature maturation (tooth death). Treatment options depend on the radiographic structures of the pulp cavity and the surrounding periapical tissue. Uncomplicated crown fractures can be restored with a composite restoration, or with evidence of tooth death, extracted or root canaled.

Complicated crown fractures (and crown-root or even root fractures), which are fractures extending into the pulp cavity, must be radiographed prior to treatment as mentioned above. Treatment options for this type of fracture is either extraction (exodontia) or root canal therapy.

**Strategic teeth such as maxillary/mandibular canines, maxillary 4th premolars, 1st mandibular molars and even maxillary 3rd incisors should be endodontically treated if at all possible. Just because one knows how to extract a tooth doesn't mean it's the best option for this pet. Endodontic therapy saves the tooth and allows a pet to have a functional tooth for the lifetime of the pet**

MISSING TEETH/EMBEDDED TEETH
The only way you can legally document a tooth is not present is by a dental radiograph. Once it is confirmed, it is noted on the dental record as a permanent document. However, many teeth do not erupt and become entrapped under the gumline. A bone-destroying cyst (dentigerous cyst) can occur from any tooth that has not erupted. The reason is enamel does not belong below the gumline. It becomes a foreign body causing an osmotic gradient which leads to bone destruction. Therefore, all missing teeth should be radiographed to either A) confirm they are absent, B) identify tooth root remnants that may need to be removed, or C) identify embedded teeth that need to be removed.

MALOCLUSIONS
When a tooth contacts another tooth (attrition) due to a malocclusion, those teeth can die due to the continued trauma occurring. Direct contact (as in maxillary and mandibular incisors traumatizing each other or the maxillary lateral incisor traumatizing a mandibular canine tooth due to a Class III malocclusion) should not occur and in most cases, bad things happen. Dental radiography is needed to assess if the attrition has caused premature maturation (tooth death). Regardless, it is advised to remove those teeth that are traumatizing another tooth due to a malocclusion.
MALFORMED TEETH
Enamel defects (enamel hypocalcification or enamel hypoplasia) not only cause visible crown pathology, but also can cause root developmental pathology. Depending on what caused the enamel defect (localized trauma versus systemic disease), all teeth with enamel defects should be radiographed.

Any tooth that has any visible malformation of the crown should be radiographed. Dens invaginatus is a condition where the dentin is involutes into the pulp cavity and the tooth is endodontically compromised. In many instances, the crown has a lobular appearance and is not smooth.

GINGIVAL MASS/SOFT TISSUE SWELLING/BONE SWELLING
In many instances, radiography assists the practitioner in discerning whether a mass is malignant or not. While histopathology is needed for definitive identification of any soft tissue mass, radiography can be a vital aid. If a destructive mass is present but the teeth are not deviated from their normal anatomical position(s), one can assume this is a malignant mass. Odontogenic tumors tend to ‘move’ teeth as they grow.

All areas where an oral mass occurs should be radiographed. The pathology group this author uses request radiographs and clinical images with each sample to provide the most accurate clinical and histopathological diagnosis available.

There is no radiographic difference in many instances between a neoplasia and osteomyelitis. Therefore, histopathology is the only way to confirm this.

Root resorptions pose an interesting conundrum as to what therapy should be performed. A recent article was written describing each type of resorptions (external replacement resorptions, inflammatory root resorptions, etc…) While this is a human classification; it has relevance with dogs and cats. The practitioner should have a basic understanding among them all. The more common one seen is external replacement resorption. “This finding is the gradual disappearance of the periodontal ligament (PDL) with progressive replacement of root tissue by surrounding alveolar bone.” The long term prognosis for this tooth is not good. In many instances, the crown fractures and the owner or the practitioner notices a tooth missing.

Internal root resorptions involve the pulp cavity. Treatment is either exodontia (extraction) or root canal therapy. External root resorptions involve the surrounding dentin and the pulp cavity is not involved. The way one differentiates between the two is by adjusting the tube head of your dental radiographic machine. If the lesion remains in the pulp cavity, it is internal root resorption. If the lesion moves with the movement of the tube head, then external root resorptions is present. With external root resorption, if there is no co-existing endodontic or apical pathology, and the lesion is below the alveolar margin, the tooth can remain and be monitored every 6-12 months. Any crown resorption should be treated either via restoration or extraction.
CONCLUSION
The Verstraete study as well as the Chun-Guen study confirm that which veterinary dentists have been saying for decades...‘if you don’t have dental radiography, your patients will suffer…and so will your pocket book.’