

REVIEW ARTICLE

GENERAL DENTIST VENTURING INTO THE FIELD OF VETERINARY DENTISTRY

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ABSTRACT:

Veterinary Dentistry is the field of Veterinary Sciences which is gaining more importance. As the tooth structure and supporting apparatus of tooth is quite similar in humans and vets, so a general dentist may venture into the field of Veterinary Dentistry. Scope of Dentistry has broadened from scaling and extractions to more complex procedures, so a general veterinarian cannot do justice as a dentist can do. Today Veterinary Dentistry can be counted as a challenging discipline in dentistry as performing procedures on pets can be demanding considering the differences as well as similarities between humans and vets, probable risk factors, difficulty in handling vets, need to complete procedures in single sitting to avoid multiple anesthesia episodes, differences in drug dosage and monitoring, adequate precautions to be taken keeping in mind the possible zoonosis, viral and bacterial infections. Further, it is well known to us that the pets are commonly kept by rich people and they are generally ready to spend any amount on them. So, it may be considered as a lucrative alternative of general dentistry.

Key words: Veterinary Dentistry, veterinary sciences

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I NTRODUCTION

Veterinary dentistry is the field of dentistry applied to the care of animals. It is the art and science of prevention, diagnosis, and treatment of conditions, diseases, and disorders of the oral cavity, the maxillofacial region, and its associated structures as it relates to animals. Veterinary dentists offer services in the fields of endodontics, oral and maxillofacial radiology, oral and maxillofacial surgery, oral medicine, orthodontics, pedodontics, periodontics, and prosthodontics. Similar to human dentists, they treat conditions such as jaw fractures, malocclusions, oral cancer, periodontal disease, and stomatitis and other conditions unique to veterinary medicine (e.g. feline odontoclastic resorptive lesions).

CANINE DENTAL ANATOMY

Accepted dental formulas for the deciduous and permanent dentition in the dog:

Deciduous teeth: (3/3 incisors, 1/1 canine, 3/3 premolars) × 2 = 28 teeth.

Permanent teeth: (3/3 incisors, 1/1 canine, 4/4 premolars, 2/3 molars) × 2 = 42 teeth.

The modified triadan system is the most common numbering system in veterinary dentistry. Each quadrant is numbered as follows:

- Right upper quadrant = 100 (500 for deciduous teeth)
- Left upper quadrant = 200 (600 for deciduous teeth)
- Left lower quadrant = 300 (700 for deciduous teeth)
- Right lower quadrant = 400 (800 for deciduous teeth)

Each tooth is assigned a number within each quadrant. Beginning with 01 for the first incisor, teeth are consequently numbered from mesial to distal. Since the dog has a full complement of permanent premolars, tooth numbering is consecutive from 01 to 10 on the maxilla, and 1 to 11 on the mandible.

Eruption times of deciduous and permanent teeth in the dog:

	Deciduous teeth	Permanent teeth
Incisors	3-4 weeks	3-5 months
Canines	3 weeks	4-6 months
Premolars	4-12 weeks	4-6 months
Molars	No deciduous molars	5-7 months

Feline dental anatomy

Accepted dental formulas for the deciduous and permanent teeth in the cat:

- Deciduous teeth: (3/3 incisors, 1/1 canine, 3/2 premolars) × 2 = 26 teeth.
- Permanent teeth: (3/3 incisors, 1/1 canine, 3/2 premolars, 1/1 molar) × 2 = 30 teeth.

The rule of 04 and 09 refers to the fact that the canine (tooth 04) and the first molar (tooth 09) are present as reference teeth to allow for counting forward and backward when numbering teeth. Quadrants are numbered as described under canine dental anatomy.

Eruption times of deciduous and permanent teeth in the cat.

	Deciduous teeth	Permanent teeth
Incisors	2-3 weeks	3-4 months
Canines	3-4 weeks	4-5 months
Premolars	3-6 weeks	4-6 months
Molars	No deciduous molars	4-5 months

The groove on the buccal surface of the canine teeth of cats has been referred to as bleeding groove.

Rodent and lagomorphs dental anatomy

Rodents have single set of teeth without precursors or successors. There is one large chisel shaped incisor tooth in each quadrant (2/2 incisors). These teeth generally have yellow enamel and evolved for dorsoventral slicing action. Rodents have three small molar teeth in each quadrant. Lagomorphs have two sets of teeth. Rabbits have peg teeth palatal to the first incisors. There are three maxillary and two mandibular premolar teeth on each side, with three molar teeth in all quadrants.

History and Physical Examination

The history must include the prior home care delivered by the client, diet, access to treats and chews, chewing habits, current and previous dental care, anesthetic procedures, prior and current diseases (including allergies), and medications or supplements currently administered.

Assessment by Life Stage

Focus on age related dental conditions and common abnormalities in the dog and cat.

- From birth to 9 months of age, evaluate the patient for problems related to the deciduous teeth, clinically missing or extra teeth, swellings and oral development.
- From 5 months through 2 years, evaluate the patient for problems related to developmental anomalies, permanent dentition, and the accumulation of plaque and calculus. Periodontal disease may begin at this time, especially in small breed dogs and cats. In a small breed dog without home care, periodontal disease can start as early as 9 months of age. In a large breed dog, it may not start until years later. Most small dogs have periodontal disease by three years of age.
- From 2 years of age and on, evaluate the progression of periodontal disease, as well as the existence and adequacy of home dental care. Continue to evaluate for progressive periodontal disease and oral tumors in pets as they age.

Oral/Dental Examination in the Conscious Patient

Evaluate the head and oral cavity visually and by palpation. Abnormal signs to look for include pain, halitosis, drooling, dysphagia, Asymmetry, discolored, fractured or mobile teeth, inflammation and bleeding and changes in the range of motion of or pain in the temporomandibular joint. Areas to evaluate include the eyes, lymph nodes, nose, lips, teeth, mucous membranes, gingival, vestibule (i.e., area between gum tissue and cheeks), palatal and lingual surfaces of the mouth; dorsal and ventral aspects of the

tongue, tonsils and salivary ducts. Note all abnormalities such as oral tumors, ulcers or wounds. The oral examination of the awake patient allows the practitioner to design a preliminary treatment plan. Only when the patient has been anesthetized can a complete and thorough oral examination and precise treatment plan be formulated.

The initial examination of both cats and dogs is attempted with the mouth closed. To avoid injury to the patient and the examiner, it is helpful to have an assistant restrain the patient. The upper and lower lips are viewed and then gently separated to get views of the dentition, oral mucosa, and dental occlusion. Front and side views of the oral cavity may allow observation of some surfaces of all of the teeth. Use a 6-inch cotton-tipped applicator to help avoid personal injury while viewing oral anatomy. For cats, prefer to sit or stand directly behind the patient. To reduce stress and help comfort the cat, speak softly and gently pet the cat's head and neck before palpating the neck and mandibular lymph nodes. Then tilt the cat's head back to point the nose toward the ceiling. This relaxes the lower jaw, which gently pull down with a finger to open the mouth. One can then view the oral cavity. For dogs, approach from the side, using gentle techniques to relax the patient. Many dogs respond favorably to their name spoken in a slow, calm, soft voice. Repeated gentle patting can also be reassuring. An assistant gently secures the dog's head and body while performing a closed-mouth examination from the front and both sides. The assistant then holds the mandible and maxilla in the premolar region to slowly and gently encourage the dog to open its mouth. Caution and patience are strongly advised. Some fearful or aggressive animals require chemical restraint. The gingiva, alveolar mucosa, cheek mucosa, lips, palate, incisive papilla, tongue, and floor of the mouth are briefly viewed during the awake patient oral examination. Any discharge, discoloration, draining tract, fistula, foreign body, inflammation, mass, swelling, fracture or ulceration should be noted on the dental chart. These abnormalities can be investigated further after the animal is sedated or under anesthesia.

Examination of the Anesthetized Patient

Anesthesia allows a meticulous, systematic approach to the intraoral examination. The larynx, oropharynx, tonsils, soft palate, hard palate, incisive papilla, gingiva, alveolar mucosa, buccal mucosa, tongue, floor of the mouth, and salivary structures can all be visualized. After thorough scaling (above and below the gum line) and polishing, the teeth, along with the periodontal tissue, are evaluated visually, by tactile probing, by dental radiography, and by transillumination. The number, color, shape, size, and condition of the teeth are assessed. The use of objective indices allows for consistent dental evaluations.

Recommendations and Client Education

Discuss the findings of the initial examination, as well as further diagnostic and/or therapeutic plans with the client. Discuss diet, gingival exercise (e.g., chewing), and which

treats are appropriate from a dental perspective. To keep the pet functional and comfortable, educate the client about home plaque prevention and daily oral health maintenance, including how and when to perform oral hygiene (e.g., brushing the teeth and/or the use of oral rinses). The next diagnostic step consists of a thorough oral examination and dental cleaning under general anesthesia. Perform this cleaning and evaluation when abnormalities are noted, or at least on an annual basis starting at 1 year of age for cats and smallbreed dogs, and at 2 years of age for largebreed dogs.

Caries

Many owners are unaware that dogs may also be subject to caries. Though the incidence of caries in dogs is lower than it has been in humans, it does occur and we must watch for areas at risk or already undergoing decay and recommend such preventive or restorative treatments as are reasonable. Oral Cavity Overview should form part of every physical examination. Among the reasons proposed for the lower incidence of caries in dogs compared with historical rates in humans are: conical tooth shape and wider interdental spacing with less area for food impaction and stagnation, diets which include little fermentable carbohydrate, higher salivary pH (in dogs, mean pH of 7.5 compared with 6.5 in humans) to buffer acids produced by bacterial fermentation of carbohydrates; in dogs, a relatively low level of salivary amylase to break down starches which are retained in and around the teeth. They can occur in the pits sometimes found on the occlusal tables of the maxillary molars. Other locations at risk are the deep developmental grooves on the buccal surface of the maxillary 4th premolars and on the lingual side of the mandibular 1st molars between the mesial and central cusps. These grooves are often filled with calculus, but on deeper exploration, there may be soft, carious dentin at the base.

For established caries, the decayed enamel and dentin and all debris are removed from the lesion. Intraoral dental radiographs are required to determine if there are any signs of endodontic (pulp) disease. The depth of the lesion needs to be examined and explored to determine if there is pulp exposure or near pulp exposure. Endodontic (root canal) therapy is performed if indicated and then the prepared cavity is filled with a bonded dental restorative material (a filling). Advanced caries will often involve both pulp exposure/necrosis and dramatic loss of coronal structure. In these cases, extraction of the remnants of the tooth is indicated.

Extraction

Damaged teeth are common but often go unnoticed, or the consequences are ignored or at best underestimated. Damage is usually traumatic and is most commonly seen following excessive tug-of-war games with abrasive or breakable toys. Several techniques have been developed to extract teeth in different animal species regularly seen in veterinary practice. Many of these techniques have a lot of

similarities with human extraction techniques, whereas others are species specific.

In dogs, simple extraction can be used for removal of all incisors, and for the 1st premolar and 3rd molar, whereas in cats it can be used for removal of the upper 2nd premolar and upper 1st molar, depending on the periodontal health of these teeth. However, several authors strongly recommend the use of surgical extraction techniques in cats because of the brittle nature of their teeth and because the increased chance of root ankylosis in the presence of feline odontoclastic resorptive lesions is the primary indication for feline exodontias. Closed extraction is the standard technique for oral extraction of cheek teeth in horses. The incisors of rabbits and rodents can be readily extracted using the closed technique. However, limited visibility and difficult access to the oral cavity generally makes the use of this technique more difficult for the removal of the long-crowned cheek teeth, with the exception of the first cheek tooth. In pet animals, the use of elevators as well as luxators of appropriate size has been described, although scalpel blades have also been recommended for the same purpose. In the horse, severing of the gingival attachment to the cheek teeth is performed using a long-handled, flat bladed dental pick or a customized periodontal elevator. In man, it is sometimes beneficial to use an adjacent tooth as an abutment to exert force on the diseased tooth, provided that this element is firmly supported by surrounding structures and not weakened by dental decay or interproximal tooth restorations. This action is discouraged in dogs and cats because the relatively small diameter of the tooth neck in relation to the length of the roots increases the risk of crown fracture.

The shape of the 'Crossley luxator' has been specifically developed to break down the periodontal ligament of incisors and cheek teeth in lagomorphs and rodents, although other dental elevators or properly bent 18 to 20 gauge hypodermic needles can also be used in these species. In contrast to luxators for human and small animal use, the 'Crossley luxator' can be used to exert limited levering force on the teeth. Equine retained deciduous incisors and the 1st premolar, which is also called the wolf tooth, are amenable for dental elevator procedures. To stretch and tear the periodontal ligament of the equine cheek teeth, a molar spreader or separator is used. The wedge-shaped blades of this instrument are gradually forced into the interdentalspace rostral and caudal to the affected tooth, just above the gingival margin. Pressure on the instrument is maintained for 1 to 3 minutes to induce tearing of the rostral and caudal periodontal attachments, taking care to avoid undue force. By alternating the instrument's position rostral and caudal to the tooth, and repeating the wedging action of the spreader, the instrument will eventually close completely, facilitating further extraction with the use of forceps. Only Scheels and Howard (1993) described the same principle for exodontia in dogs or cats, whereas most authors recommend the

elevator technique to first loosen the tooth and then to apply a dental extraction forceps for the actual extraction. The small size of most rodents often precludes intra-oral attempts for hypodont cheek tooth removal. Extra-oral techniques are therefore preferred in most cases. In lagomorphs, the extra-oral approach is used whenever an intraoral technique fails.

Intra-oral approach for surgical tooth extraction: Reduction of the height of the alveolar rim: By removing a small portion of the alveolar rim, the surface of exposed crown will increase, allowing a more secure fixation of the tooth with extraction forceps. Thin bony margins can be removed by crushing them with rongeurs or an extraction forceps, as described in man. However, this procedure is currently advised against in human dentistry in favor of atraumatic tooth extraction to maximally preserve the height of the alveolar ridge for immediate or future placement of implants. For extraction of the canine tooth in small animals, a distally directed triangular, rectangular or trapezoidal mucoperiosteal flap is created on the buccal side to follow the caudal (distal) extension of the root. The buccal alveolar bone is completely (Scheels and Howard, 1993) or partially removed to expose 1/3 to ½ of the root. Afterwards, longitudinal superficial grooves or localized slots (Smith, 1998) are made along the mesial and distal borders of the tooth to allow the use of a dental elevator for gradual loosening of the periodontal ligament. Extraction is accomplished with elevator or forceps techniques. More recently, a lingual approach has been described for extraction of the mandibular canine tooth in dogs to avoid possible damage to the neurovascular structures of the mental foramen and the roots of the mandibular 1st and 2nd premolar teeth. A mucoperiosteal flap is created near the lingual frenulum and intermandibular symphysis, and this is followed by removal of a large part of the lingual alveolar bone. Canine tooth removal is then performed using previously described elevators and extraction forceps.

Dental cleaning

Use well monitored inhalation anesthesia with cuffed intubation when performing dental cleanings. This increases safety, reduces stress, decreases the chances of adverse sequelae (e.g., inhalation pneumonia), and is essential for thorough and efficient evaluation and treatment. Prevention of hypothermia is essential because the patient may become wet and dental procedures can be lengthy. Provide safe immobilization of the head. If oral surgery is planned, institution of intraoral, local anesthesia is warranted in conjunction with the general anesthesia to decrease the amount of general anesthetic needed and to reduce the amount of systemic pain medication required postoperatively. Local anesthetic blocks can last up to 8 hrs. Manually stabilize the head and neck when forces are being applied in the mouth. Avoid using mouth gags, as they may cause myalgia, neuralgia, and/or trauma to the

temporomandibular joint. If a mouth gag is necessary, do not fully open the mouth or over extend the temporomandibular joint. Disconnect the endotracheal tube when repositioning the patient to prevent trauma to the trachea.

The essential steps for a dental cleaning and treatment of periodontal disease are as follows:

1. Perform an oral evaluation as described for the conscious patient, above.
2. Radiograph the entire mouth using intraoral or digital radiographic systems.
3. Scale the teeth using a hand scaler or powered device. Do not use a rotary scaler, which excessively roughens the tooth.
4. Polish the teeth using a low speed hand piece with prophylactic paste that is measured and loaded on a prophylactic cup for each patient to avoid cross contamination.
5. Perform subgingival irrigation to remove debris and polishing paste, and to inspect the crown and subgingival areas.
6. Apply antiplaque substances, such as fluoride and/or sealants.
7. Evaluate for abnormal periodontal pocket depths using a periodontal probe.
8. Perform periodontal therapy as determined by radiographs and probing.
9. Administer perioperative antibiotics when indicated, either parenterally or via local antimicrobial administration.
10. Perform periodontal surgery to remove deep debris, eliminate pockets, and/or extract teeth.
11. Biopsy all abnormal masses (visualized grossly or in radiographs) and submit samples for histopathology.

Occupational Health hazards in Veterinary Dentistry

Veterinary practices are unique environments that bring humans into close contact with many different species of ill animals. Some of the documented zoonotic infections that have occurred in veterinary personnel include: Risk of zoonosis such as brucellosis, rabies exposure, animal bites, erysipelothrix infection, leptospirosis, salmonellosis, plague, MRSA, Dermatophytosis, tuberculosis, toxoplasmosis, Q-fever. Animal related injuries because pathogens are carried in the mouth of many species, animal bites can result in cellulitis, abscesses, sepsis, arthritis (on exposure to latex gloves, blood proteins, parasites) endocarditis, CNS infections, risk of occupational asthma. Routes of transmission could be aerosol, droplet spray, direct contact, indirect contact (fomites), through body fluids, contaminated tools or surfaces.

Zoonotic disease transmission

A. Transmission Mechanisms

1. Contact
2. Aerosol
3. Vector-borne

B. Veterinary standard precautions

A. Personal Protective Actions and Equipment	B. Protective Actions During Veterinary Procedures	C. Environmental Infection Control	D. Employee health
1. Hand Hygiene 2. Use of Gloves and Sleeves 3. Facial Protection 4. Respiratory Protection 5. Protective Outerwear a. Lab Coats, Smocks, and Coveralls b. Non-Sterile Gowns c. Footwear d. Headcovers 6. Bite and Other Animal-Related Injury Prevention	1. Intake 2. Examination of Animals 3. Injections, Venipuncture, Aspirations a. Needlestick Injury Prevention b. Barrier Protection 4. Dental Procedures 5. Diagnostic Specimen Handling	1. Isolation of Infectious Animals 2. Cleaning and Disinfection of Equipment and Environmental Surfaces 3. Handling of Laundry 4. Decontamination and Spill Response 5. Veterinary Medical Waste 6. Rodent and Vector Control 7. Other Environmental Controls	(General and Immunocompromised Personnel) 1. Infection Control Personnel 2. Employee Immunization Policies and Record Keeping a. Rabies b. Tetanus c. Seasonal Influenza d. Immunization and Other Health Records 3. Staff Training and Education 4. Documenting Exposure Incidents

Precautions:

1. Use of disposable articles such as bowls, litter pans, gowns.
 2. Protective eyewear, gloves, facial protection, use of 0.12% chlorhexidine to avoid or decrease bacterial aerosolization during dental solution.
 3. Barrier protection: Gloves should be worn during venipuncture of animals suspected of having an infectious disease.
 4. Disposable particulate respirator fits closely to face and are designed to filter small particles.
- Inexpensive respirators such as NIOSH- certified N95 respirator designed to filter atleast 95% of airborne particles are readily available.

Pregnancy

Many women choose to continue practicing veterinary dentistry while pregnant. With proper education, precautions can be taken so as to minimize the risk to the developing fetus. The primary areas of concern are anesthesia, radiation, toxoplasmosis, listeriosis, carbon monoxide, prostaglandins, physical exertion and trauma to the fetus. A possible source of infection to veterinarians is *Toxoplasma gondii* sporulated oocysts present in the feces of cats. Cats shed the oocysts for approximately 2 weeks after initial infection, 18 and the oocysts are not infective until after sporulation which takes from one to five days.

- Congenital toxoplasmosis starts as a fetal parasitemia and general infection that can have several outcomes. Spontaneous abortion or premature birth is possible, or some children are born live but manifest encephalitis at a few days to few weeks of age. Some are born with hydrocephalus, or it may develop later. If a pregnant woman contracts.

- *Listeria monocytogenes* septicemia, one of several things may happen to the pregnancy. The fetus may die in utero, or parturition may ensue with delivery of a stillborn or acutely ill infant.
- Carbon monoxide is a colorless, odorless gas that is produced by inefficient combustion of any carbonaceous fuels. When inhaled, it quickly combines with blood hemoglobin to form carboxyhemoglobin, as hemoglobin has a much greater affinity for carbon monoxide than for oxygen. High levels of fetal carboxyhemoglobin can therefore cause fetal anoxia which can have one of two outcomes: sudden fetal death and expulsion of the fetus; or a fetus that is live before birth but which is so stressed that the trauma of birth kills him/her.

Vaccination for the employee

A. Rabies:

Preexposure rabies vaccination, antibody titre checks, preexposure rabies prophylaxis.

- a. Rabies vaccination: i.m. on days 0, 7, 21/28.
 - b. Serological testing: rabies titre assessed every two years by use of a rapid fluorescent foci inhibition test.
 - c. Rabies booster vaccination: Single booster vaccination is given when rabies titre is less than 1:5 as determined via the rapid fluorescent foci inhibition test.
 - d. Post exposure rabies prophylaxis for preexposure vaccinated person.
- Two rabies vaccinations are given on day 0 and 3.
 - No serum titre is performed.
 - No human rabies immunoglobulin is given.

B. Tetanus:

- Routine tetanus vaccination every ten years (AGP recommendation)
- If a person has a wound that is contaminated with dirt, faeces, saliva, puncture wound, avulsion, crushing, burns and it has been greater than five years since that individual last received a tetanus booster vaccination, a single dose T dap (Tetanus, diphtheria, pertussis) or Td (Tetanus, diphtheria) should be administered.

C. Influenza vaccines are given.

CONCLUSION

Dentistry-related problems are by far the most common medical/surgical problem in daily small animal practice. A general dentist may venture into the field of Veterinary Dentistry so as to do justice to the vets for dental procedures and broaden the scope of general dentistry from humans to vets. Veterinary dentistry is a low investment with a high return.

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