

Small Animal Dental Procedures for Veterinary Technicians and Nurses

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The Basics

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Learning Objectives

- Learn the anatomy of the skull and teeth
- Discover the relationship between structures surrounding the oral cavity
- Obtain knowledge of tooth development
- Understand the dental formula
- Realize the unique oral directional terminology

This comprehensive text on small animal dentistry meets the need for both novice and experienced veterinary technicians to advance their knowledge and explore new career paths. To learn advanced techniques, one needs to begin with the basics. This chapter discusses the anatomy of both the skull and teeth. With this knowledge, the veterinary technician learns the complex relationship between all structures surrounding the oral cavity. Dental disease, while normally thought of as a condition of the mouth, can also affect the nares, sinuses, and eyes.

Most mammals—including humans, dogs, and cats—have two sets of teeth in their lifetime: primary (or deciduous) and permanent (or secondary). Normally, the primary teeth exfoliate prior to the eruption of the permanent teeth. Malocclusions and dental disease can occur if this natural progression does not happen. (Two teeth should not occupy the same place at the same time.) Knowing the normal age of tooth eruption and the development of the tooth aids the veterinary technician in performing an oral exam.

In the mouth, the usual directional terminology of dorsal, ventral, medial, and lateral do not apply. The oral structures create a unique set of terms to determine location. Learning this special language simplifies charting, surgical assisting, and explaining oral pathology.

Anatomy of the Skull¹

Oral Cavity

The primary structures of the oral cavity consist of teeth, gingiva, tongue, soft palate, and hard palate. These important organs of mastication and breathing can be involved with oral disease. Knowing what is normal helps to recognize abnormalities.

Teeth²

Each species has a distinct dental formula. A dental formula is the number and types of teeth expected in a normal mouth. Most mammals have two sets of teeth in their lifetime: primary (or deciduous) and permanent. Dogs and cats have four types of teeth, each with separate purposes for eating and chewing. Domesticated animals, fed commercial diets, do not always use the teeth in the same manner as their wild ancestors. Incisors cut, pick up, and groom. Canines rip, tear, and hold. Premolars and molars grind food into a more digestible size (Figs. 1.1 and 1.2). Carnassials are the largest chewing teeth in the mouth. In both the dog and cat, they are the upper fourth premolar and the lower first molar.

Primary dental formula: Canine (Total 28)

- Maxilla: incisors (6), canines (2), premolars (6), molars (0)
- Mandible: incisors (6), canines (2), premolars (6), molars (0)

Permanent dental formula: Canine (Total 42)

- Maxilla: incisors (6), canines (2), premolars (8), molars (4)
- Mandible: incisors (6), canines (2), premolars (8), molars (6)

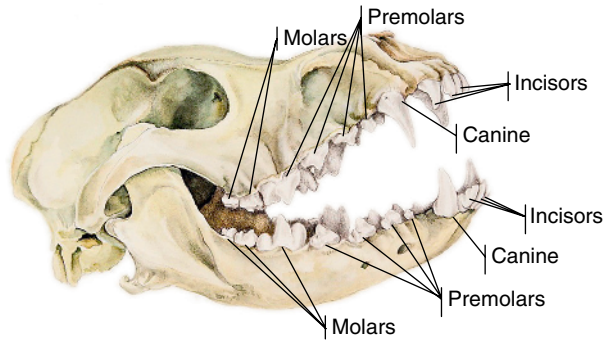


Figure 1.1 Canine skull showing permanent dentition (Illustration by Brenda Gregory).

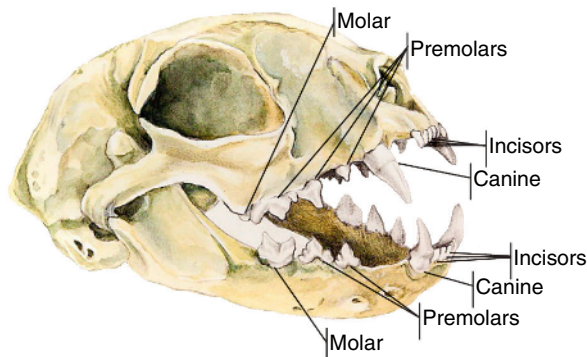


Figure 1.2 Feline skull showing permanent dentition (Illustration by Brenda Gregory).

Primary dental formula: Feline (Total 26)

- Maxilla: incisors (6), canines (2), premolars (6), molars (0)
- Mandible: incisors (6), canines (2), premolars (4) molars (0)

Permanent dental formula: Feline (Total 30)

- Maxilla: incisors (6), canines (2), premolars (6), molars (2)
- Mandible: incisors (6), canines (2), premolars (4), molars (2)

Dental formulae are often written as: canine (permanent): $2 \times (I3/3, C1/1, P4/4, M2/3)$; and feline (permanent): $2 \times (I3/3, C1/1, P3/2, M1/1)$. Anatomically, cats normally are missing their first upper premolars, first lower premolars, and second lower premolar teeth.

Gingiva³

The gingiva is the soft tissue surrounding and supporting the teeth. It also covers the alveolar bone supporting the teeth. Most often pink, the gingiva may be fully or partially pigmented. It should be glossy and smooth. Gingiva is modified epithelial and connective tissue. It divides into attached and unattached (or free) gingiva. The juncture of the gingiva



Figure 1.3 Incisive papilla in a canine (Courtesy of Jill Jecevicus).

to the rest of the oral mucosa of the lips is the mucogingival junction. Attached gingival tissue protects bone and tooth supporting structures from infection, trauma, and periodontal disease. The junction between the free gingiva and the tooth is the gingival sulcus. Normal depth of this space is 3 mm in dogs and 1 mm in cats. Depths greater than these depths indicate the presence of connective tissue loss, and are often associated with gingivitis, an early form of periodontal disease.

Tongue

The tongue has four primary functions: to taste food; to lap up liquids; to form food into a bolus; and to aid in swallowing. Canines have a relatively smooth and overlong tongue. Panting provides an efficient method for dogs to cool their body temperature. Feline tongues are rough from firm, upright papillae. These structures aid in grooming and cleaning. The tongue can be pink or pigmented. In certain breeds (i.e., Chow Chows), the tongue is near to black. A median groove is present on the dorsal surface. Hairs may grow in this groove. While aesthetically displeasing, they rarely cause injury.

The dorsal surface of the tongue contains papillae, some of which are specialized into taste buds. Different tastes and combinations—sweet, sour, bitter, and salty—are sensed over all surfaces of the tongue, not just in specific sections as previously understood.

Specialized muscles and nerves of the tongue provide animals with the ability to drink fluids. A cat's tongue creates a “bowl” formation to allow cats to scoop up water. In dogs, the tongue curls and twists water into the mouth. The tongue rolls food around the mouth forming a bolus or smooth round ball. With the aid of the tongue muscles, this bolus of food is then pushed to the back of the mouth and swallowed.

Hard and soft palate

The hard and soft palates comprise the “roof” of the oral cavity. The hard palate, created by the incisive, maxillary, and palatine bones, is covered by the soft tissue of the palatine rugae. The rugae, on each side of the palatine raphe (or midline), are symmetrical. Clefts or openings in the hard palate create direct access to the nasal cavity and sinuses. Surgical correction is appropriate for this genetic condition. The incisive papilla located at the most rostral area of the hard palate is a raised round structure (Fig. 1.3). It aids in the senses of smell and taste and should not be confused with an oral mass. The soft palate



Figure 1.4 Mesaticephalic head shape: Labrador retriever.



Figure 1.5 Brachycephalic head shape: pug.

is a continuation of the soft tissue overlying the hard palate. This movable fold of tissue connects the oral cavity to the pharynx. It is smooth and does not contain rugae.

Bones

The skull is composed of two sections: cranium and face. The cranium protects the brain and associated structures. The face comprises the bones of the oral, nasal, and ocular cavities. Bones provide the basic structure and support for blood vessels, muscles, tendons, all soft tissue structures, and teeth. Dogs and cats have three primary head shapes: mesaticephalic or average (i.e., Labrador retriever [Fig. 1.4], German shepherd dog, domestic cat); brachycephalic or short faced resulting in crowded and rotated teeth (i.e., pug [Fig. 1.5], Persian cat, English bulldog); and dolichocephalic with a long narrow nose and face (i.e., Irish wolfhound, greyhound, Siamese cat [Fig. 1.6]).



Figure 1.6 Dolichocephalic head shape: Siamese (Courtesy of Rebecca Johnson).

Skull⁴

The primary bones of the cranium are

1. Frontal
2. Parietal
3. Interparietal
4. Temporal
5. Ethmoid
6. Occipital
7. Sphenoid

The facial bones consist of

1. Lacrimal
2. Temporal process (includes zygomatic arch)
3. Nasal
4. Maxilla
5. Incisive
6. Pterygoid
7. Ventral nasal conchal
8. Mandible

The primary bones of the oral cavity are the mandibles and maxilla and the incisive. They support the teeth, attach to muscles and provide protection to vessels and nerves. Within the mandible, maxilla and incisive bones, the alveolus surrounds the tooth root and connects to the periodontal ligament (Figs. 1.7–1.9).

Mandible

The mandible supports the teeth of the lower jaw. Two separate bones meeting at the rostral midline (symphysis) create the mandible. The mandibular symphysis is a fibrous joint. Unlike in humans, it is rare for this juncture to fuse completely in canines and

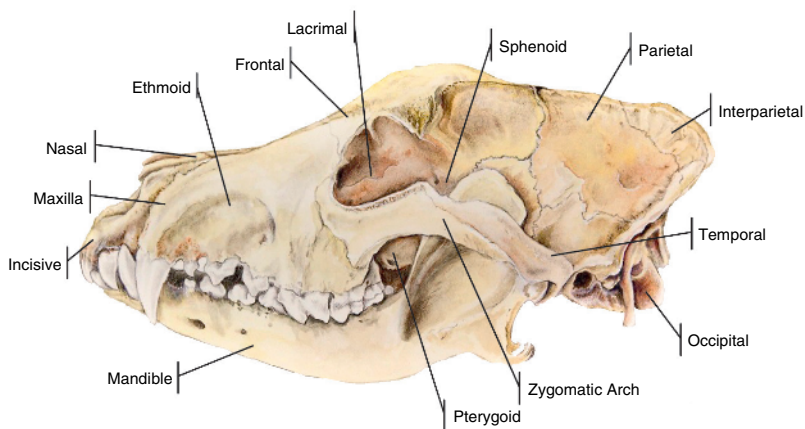


Figure 1.7 Lateral view of skull bones (Illustration by Brenda Gregory).

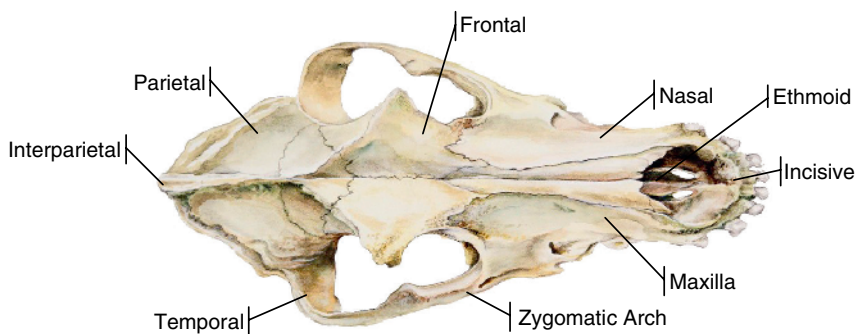


Figure 1.8 Dorsal view of skull bones (Illustration by Brenda Gregory).

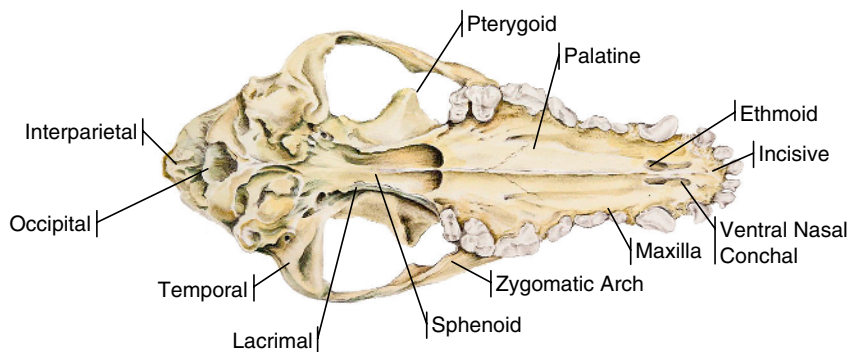


Figure 1.9 Palatine view of skull bones (Illustration by Brenda Gregory).

felines. Cats tend to have a very “loose” mandibular symphysis. The ends of the mandibles meet the temporal bone to form the temporomandibular joint or TMJ. It is a hinge joint. Muscles of mastication, originating along the cranium, insert into the body of the mandible near the TMJ. They provide the ability to open and close the mouth, eat, chew, and bite. In rare cases, the TMJ can luxate preventing the animal from closing its mouth.

Incisive

The incisive bone is the rostral section of the maxilla. It supports the upper incisor teeth. Defects in formation of this bone can cause a cleft palate.

Maxilla

Supporting the remainder the upper canines, premolars, and molars, the maxilla also includes the palatine bones creating the hard palate. The maxilla separates the oral cavity from the nasal cavity.

Muscles

Muscles of the skull allow movement, facial expression, chewing, eating, and biting. While these are not the sleek muscles of the limbs, the strong muscles of the face are designed to rip and tear food. They also create an extreme ability to bite. In humans, the biting force is 250–300 pounds per square inch (psi) with the ability to create a sudden snapping force of 25,000–30,000 psi. Contrast this to the canine with the normal range of 300–800 psi and a potential for 30,000–80,000 psi when provoked.

Nerves

The trigeminal nerve (cranial nerve V) begins at the brain stem and divides into three branches: ophthalmic, maxillary, and mandibular. The trigeminal nerve and its subsidiary branches provide sensory and motor function. To keep within the confines of this text, the author will only discuss the dentistry related branches.

The **maxillary nerve** provides sensation to the lower eyelid, nasal mucosa, maxillary teeth, upper lip, and the nose. Branching from the maxillary nerve, the **minor and major palatine nerves** provide sensation to the soft and hard palates as well as giving rise to taste fibers. The **infraorbital nerve** branches into the three alveolar branches. These nerves enter the alveolar canal and each tooth root. The caudal superior, middle superior, and rostral superior alveolar nerves supply the maxillary molars, premolars, and canines/incisors, respectively.

The **mandibular nerve** provides motor function to the mouth by innervating muscles of biting and eating. The mandibular nerve and its many branches provide sensation to the cheeks, tongue, mandibular teeth, lower lip, and the skin of the head. The mandibular nerve branches into the masticator nerve, which aids in opening the mouth. The related masseteric and deep temporal nerves allow closing of the mouth. The lateral and medial pterygoid nerves aid in raising the mandible while eating. The buccal nerve provides sensation to the skin and mucosa of the cheek. The inferior alveolar nerve supplies sensation to all the mandibular teeth. It exits the mandible through its mental nerve branches

and foramens. The mental nerves provide sensation to the lower lip and rostral intermandibular region. The lingual nerve creates tongue sensations of touch, pain, temperature, and taste.

Vascular System

Arteries

The external carotid artery and its branches supply blood flow to the oral cavity. The **palatine branch** runs ventrally in the lateral wall of the pharynx and provides blood supply to the palatine glands, mucosa, and muscles. **Pharyngeal arteries** serve the mucosa and muscle of the pharynx. The largest branch of the external carotid artery is the **lingual**. Running from the tip to the base of the tongue, it further bifurcates into the hyoid and tonsillar branches. The **facial artery** supplies blood flow to the mandibular and sublingual salivary glands and facial muscles and gives rise to the **sublingual artery**. Running parallel to the mandible, it supplies the rostral mandible and lower incisor teeth. The **superficial temporal artery** and its many branches bring blood to the parotid salivary gland, zygomatic arch, and temporal muscle. The **maxillary artery** divides into the **mandibular and pterygopalatine branches**. The **mandibular portion** of the **maxillary artery** supplies the TMJ and the roots of the mandibular teeth. It terminates as the mental arteries in the rostral mandible. The **pterygopalatine portion** of the **maxillary artery** gives rise to many branches. They provide blood flow to the eye, nose, sinuses, and facial muscles. The alveolar arteries, terminal branches of the maxillary artery, serve all the maxillary teeth.

Veins

Terminating in the **external jugular vein**, the arteries' corresponding veins drain blood from the head. These include the lingual-facial, facial, mandibular, temporal, and maxillary veins.

Lymphatic System

Of importance in dentistry are the following lymph nodes (LNs) of the head:

- Parotid LNs lying at the level of the TMJ and rostral to the parotid salivary gland
- Mandibular LNs are rostroventral to the mandibular salivary glands
- Retropharyngeal LNs are deep and caudal to the mandibular salivary gland and dorsolateral and caudal to the pharynx

Dental conditions, gingivitis, and periodontal disease can manifest themselves with enlargement of the adjoining lymph nodes.

Eye

While the eye is not an organ involved with oral anatomy, the close approximation between the two systems is considered. Infected and abscessed maxillary premolars or molars may present as suborbital swelling. Minimal distance is present between the orbit



Figure 1.10 Cat skull showing minimal distance between the infraorbital foramen and the eye socket.

and the infraorbital foramen. Careful administration of a regional nerve block in this area prevents puncture of the eye. This is especially important in the cat (Fig. 1.10).

Larynx and Pharynx

The oral cavity and oral portion of the respiratory system coincide in formation. The larynx is the oral opening to the trachea and lungs. The epiglottis closes to prevent food from entering the trachea. The pharynx opens into the esophagus to provide passage of food. Tonsils are located within the pharyngeal opening. Tonsils are modified lymph tissue that can be indicative of or a focal point of disease.

Odontogenesis⁵

Odontogenesis is the development of teeth: odont = tooth and genesis = origin. The development of the gastrointestinal (GI) tract, including the oral cavity and teeth, is a complex series of events. In the embryo, the GI tract begins as an endodermic tube. In a short period, this structure folds in on itself to form three distinct sections—foregut, midgut, and hindgut. The foregut gives rise to the pharynx, esophagus, stomach, duodenum, respiratory tract, liver, gallbladder, and pancreas. The midgut becomes the jejunum, ileum, cecum, appendix, ascending colon, and part of the transverse colon. The hindgut forms the rest of the transverse colon, rectum, and anal canal. The oral cavity develops from the pharyngeal end of the foregut as the oral plate. From this, the maxilla, mandible, and their associated structures form.

Tooth Formation⁶

Teeth form from the gathering of mesenchymal cells from the ectoderm along the epithelium of the mandible and maxilla at specific sites.⁷ A variety of growth factors interacts

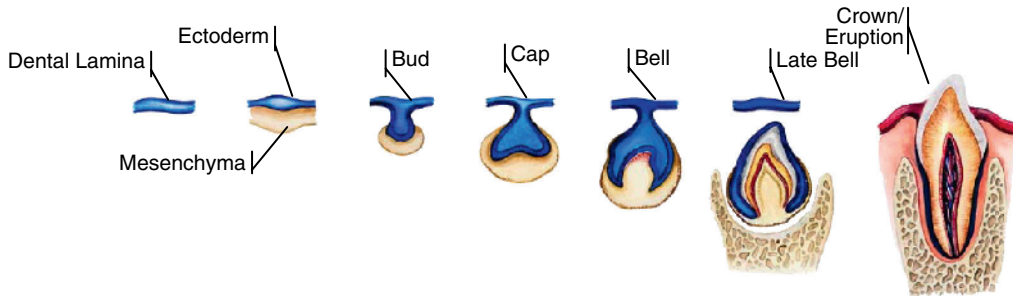


Figure 1.11 Tooth development (Illustration by Brenda Gregory).

with this follicle to form the tooth bud. Additional growth factors create the enamel knot and the cap stage of development when the tooth cells begin to align. During the cap stage, nerves and blood vessels begin to develop and enter the developing dentin, eventually becoming the pulp of the tooth. The bell stage then follows and begins the differentiation into the tooth components of dentin and enamel. In the final, crown stage, enamel forms with the mineralization of odontoblasts. Ameloblasts aid in the creation of enamel toward the outer surface of the developing tooth. Odontoblasts move toward the center of the tooth creating dentin. (Secondary dentin continues to form in permanent teeth throughout life causing a gradual narrowing of the pulp chamber.) Cementoblasts form the cementum in the very late stages of tooth development (Fig. 1.11).

Eruption⁸

Many theories exist on the mechanism of tooth eruption. The three current theories are as follows.

Root formation

As the tooth root develops, it elongates the tooth pushing it through the gingival tissues; however, rootless teeth develop.

Alveolar bone remodeling

Bone formation at the apex of the tooth and resorption of bone at the coronal end of the tooth follicle interact to create penetration of the mucosa.

Periodontal ligament

Periodontal ligament formation and renewal are involved in the continuous growth of teeth in some species (i.e., rodents and rabbits); however, this has not been proven in species of animals with only two sets of teeth.

If a path does not develop for the eruption of a tooth, it may become impacted or embedded. An impacted tooth is one prevented by bone from erupting. Soft tissue inhibits an embedded tooth's eruption. If there is a disruption of a tooth bud during development, it may grow in an abnormal location or create a dentigerous cyst (Fig. 1.12).



Figure 1.12 Radiograph of the permanent upper right canine tooth of a dog bitten in the face as a puppy. Note the development of the tooth within the nasal sinus.

Table 1.1 Primary tooth eruption schedule

Tooth Type	Canine (Week of Eruption)	Feline (Week of Eruption)
Incisors	3–4	2–3
Canines	3	3–4
Premolars	4–12	3–6
Molars	None	None

Primary Teeth

Dogs and cats are diphyodont with two sets of teeth during their lifetime. As permanent teeth erupt, roots of primary (deciduous) teeth are absorbed, become loose, and eventually fall out. Other species, such as most rodents and lagomorphs, have open-rooted teeth that continue to grow throughout their life. Many types of snakes and sharks are polyphyodont and continuously replace teeth as they exfoliate. Table 1.1 shows the tooth eruption schedule for primary teeth of dogs and cats.

Permanent Teeth

Primary and permanent teeth do not fall out and erupt at the same rate. A mixed dentition is often present. Normally, as the permanent tooth emerges, the primary tooth is

Table 1.2 Permanent tooth eruption schedule

Tooth Type	Canine (Month of Eruption)	Feline (Month of Eruption)
Incisors	3–5	3–4
Canines	4–6	4–5
Premolars	4–6	4–6
Molars	5–7	4–5

lost. If this does not occur, the primary tooth is retained. Two teeth should not occupy the same space at the same time. Retained primary teeth can lead to rotation and malocclusion of permanent teeth. The close interdigitation of the primary and permanent tooth prevents normal teeth cleaning causing food and debris to accumulate leading to periodontal disease. This can cause long-term damage to the developing permanent tooth and potential tooth loss.

Tooth eruption varies with sex, breed, overall health and well-being, body size, and season of birth. Teeth of females, larger breeds, summer-born, and healthy animals erupt earlier than their counterparts. Table 1.2 shows the permanent tooth eruption schedule for dogs and cats.

Anatomy of the Tooth

Every tooth, no matter its form or function, contains the same elements. Multirooted teeth have additional structures but internally are equivalent to single rooted teeth. The tooth structures are crown, enamel, cementum, dentin, pulp, root, and periodontal ligament (Fig. 1.13).

Crown

The crown is the most visible portion of the tooth and is primarily made of enamel. The tip of a crown is the cusp. It meets the tooth root at the cemento-enamel junction (CEJ).

The neck and cervical line are common terms for the CEJ. Crowns are subject to wear, fractures, and discolorations. Wear occurs from excessive chewing on rocks, cages, tennis balls, sticks, and so on. Fractures are the result of trauma. Discoloration can be the result of tetracycline or doxycycline administration during tooth formation causing the teeth to yellow. Trauma may also cause discoloration resulting from injury to the internal tooth structures. In a vital tooth, the injured tooth is pink to red from hemorrhage within the pulp. If left untreated, the tooth may “die” or become nonvital. The crown will then become purple, gray, or black.

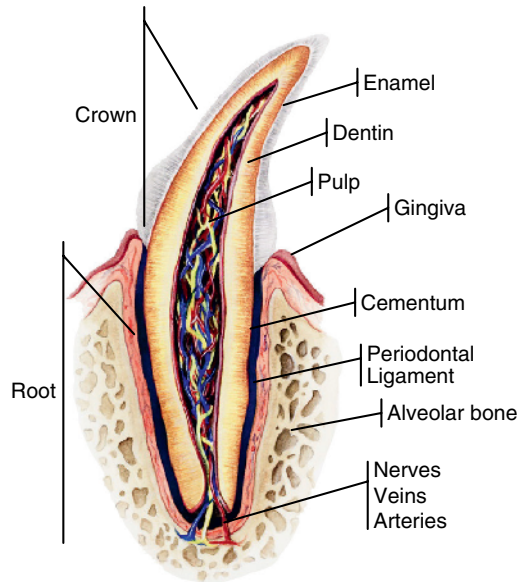


Figure 1.13 Anatomy of a tooth (Illustration by Brenda Gregory).

Enamel

Enamel covers the crown of the tooth. The strongest surface in the body, enamel is composed primarily of mineral with a small quantity of water and organic matter. It is shiny and varies in color from white to ivory. Canine teeth are often more bright white than human teeth. The mineral content creates the strength of the enamel, but also makes it brittle. Enamel chip fractures are a common finding when animals chew on hard surfaces such as rocks and bones. Due to an absence of a blood supply, enamel cannot heal itself when injured. In the adult dog, enamel is approximately 1 mm in depth. In young animals, enamel fractures easily because it is very thin with a large underlying pulp chamber. See Dentin.

Cementum

Cementum is mineralized connective tissue covering the root of the tooth. It begins at the CEJ and continues apically. The CEJ or “neck” of the tooth is the location where the enamel and cementum meet. Unlike shiny enamel, cementum is dull and often pitted. The lower mineral content of cementum makes it softer than enamel, dentin, and bone. Collagen fibers of the periodontal ligament penetrate cementum to aid in retention of the root in the alveolar bone. Cementum’s connective tissue provides nourishment allowing it to remodel and repair throughout life.

Dentin

The majority of a tooth is made of dentin. It is 70% inorganic material with the remainder being collagen fibers and water. It is porous and yellowish in color. Made up of

odontoblasts (odonto = tooth, blast = germ or embryo), the dentin continues to fill in the pulp cavity of a vital tooth. This continual laying down of odontoblasts causes the pulp cavity/root canal to narrow with age. There are three primary types of dentin. Primary dentin forms prior to a tooth's eruption. Secondary dentin develops after eruption and through life. Trauma to the tooth causes the formation of tertiary dentin. This reparative material may be brown or darker yellow than the surrounding tooth structure.

Pulp

The pulp is the most vital portion of a tooth. Veins, arteries, lymphatic vessels, nerves, odontoblasts, and other cellular structures make up the pulp or endodontic (endo = within, dontic = tooth) system. The pulp chamber joins the periodontal ligament at the apex of the tooth. The coronal or crown section and the root section (root canal) divide the tooth into two areas. The structures of the pulp provide nourishment, sensation, and defense. The veins and arteries keep the tooth alive. The nerves react to trauma by transmitting pain sensation. Odontoblasts from the pulp form dentin. As noted earlier, the pulp chamber continues to narrow, through life, from the continuous deposition of odontoblasts. Damage to a tooth early in life may cause pulp inflammation or death stopping odontoblast production and resulting in a continued large pulp chamber.

A variety of insults cause tooth death and loss by injuring the pulp. Crowns with no gross sign of trauma may be discolored indicating internal trauma to the pulp. In an intact tooth, the pulp chamber is a closed space. Swelling within the pulp chamber often leads to pulpal necrosis from internal pressure applied to the arteries cutting off blood supply to the tooth. Impact trauma creating a fracture with an open pulp chamber, left untreated, most often leads to tooth death. Aggressive and improper use of dental power tools—scalers, polishers, and drills—can cause excessive heat buildup within the pulp chamber resulting in inflammation. Bacteria from untreated periodontal disease or bacteremia can ascend into the pulp chamber causing pulpitis and necrosis. Without treatment, bacterial pulpitis may spread apically (toward the apex or root) creating an abscess and alveolar bone loss.

Roots

Tooth roots contain the living tissues of the tooth. Composed mostly of dentin and covered with cementum, roots anchor the tooth with the attached periodontal ligament. The tip of the root is the apex. Dog and cat teeth have an apical delta composed of several openings leading into the pulp chamber or root canal. Human teeth have a single opening. The importance of the apical delta becomes evident during endodontic (root canal) therapy.

In dogs, incisors, canines, first premolars, and the third mandibular molar are all single rooted. The only three-rooted teeth in dogs are the maxillary fourth premolar and first and second molars. All other teeth have two roots. In cats, the incisors, canines, maxillary second premolar, and molar have one root. The rest of the teeth are double rooted except the fourth maxillary premolar—the only three-rooted tooth in the cat mouth (Table 1.3). The space between roots in a multirooted tooth is the furcation. It is the area where the roots bifurcate or divide.

Table 1.3 Tooth root numbers

Tooth	Canine		Feline	
	Maxilla	Mandible	Maxilla	Mandible
Incisors—all	1	1	1	1
Canines—all	1	1	1	1
First premolar	1	1	Absent	Absent
Second premolar	2	2	1	Absent
Third premolar	2	2	2	2
Fourth premolar	3	2	3	2
First molar	3	2	1	2
Second molar	3	2	Absent	Absent
Third molar	Absent	1	Absent	Absent

Periodontal Ligament

The periodontal ligament attaches the cementum of the tooth to the alveolar bone and the cementum of adjoining teeth. Collagen fibers are its primary component, but it also contains blood vessels, nerves, and elastic fibers. The strong fibers of the periodontal ligament counteract forces put onto teeth from chewing, trauma, and extraction. The elasticity of the ligament allows the tooth to move slightly during normal activity. Strong forces from either trauma or extraction are required to dislodge a tooth. Unlike the nerves within the pulp cavity, the nerves of the periodontal ligament contribute to the sensations of pressure, heat, and cold.

Inflammation of the gingiva (gingivitis) is an ascending condition leading to periodontal disease—the number one most common condition in dogs and cats. Periodontitis (inflammation of the periodontium) causes destruction of the periodontal ligament, gingiva, bone, and eventually tooth loss. It is a treatable condition if managed in its early stages.

Directional Terminology⁹

The mouth has its own terminology related to location of tooth, direction in mouth, and position related to the tongue and cheeks. Learning this terminology will aid the veterinary technician in performing an oral exam and assisting the veterinarian. The following terms relate to the tooth surface (see Fig. 1.14):

- **Mesial:** Toward the midline of the face
- **Distal:** Away from the midline of the face
- **Vestibular:** Toward the vestibule or lips (interchangeable with labial or buccal)

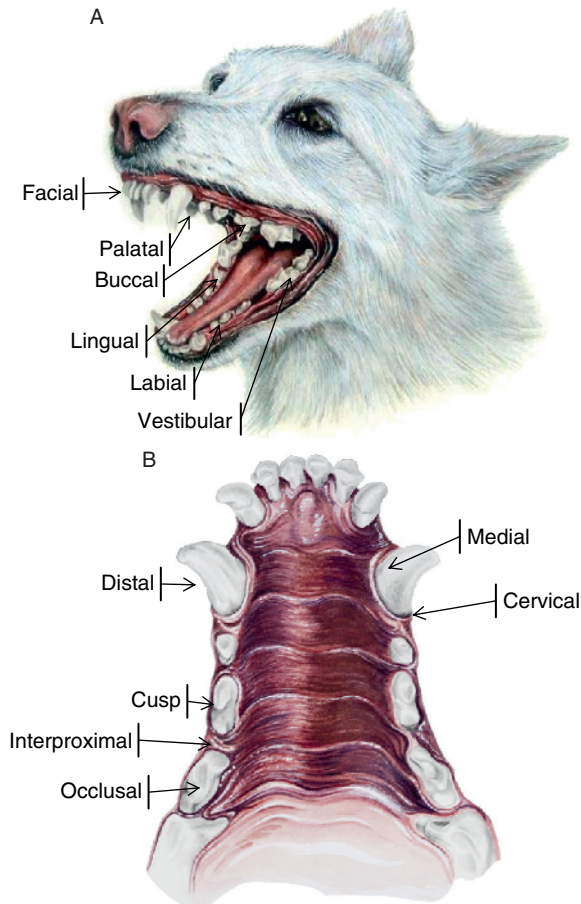


Figure 1.14 Directional terminology (Illustration by Brenda Gregory).

- **Labial:** Toward the lips, used for the incisors and canines
- **Buccal:** Toward the cheeks, used for premolars and molars
- **Facial:** Surfaces of rostral teeth visible from the front
- **Lingual:** Toward the tongue, used in the mandible
- **Palatal:** Toward the palate, used in the maxilla
- **Coronal:** Toward the crown of the tooth
- **Apical:** Toward the root of the tooth
- **Contact, proximal, or occlusal:** Toward adjoining teeth in same jaw
- **Interproximal:** Between two teeth
- **Cusp:** Point of the tooth
- **Cervical or neck:** Area of tooth where crown and root meet

Abbreviations

Abbreviations aid dental charting and record keeping. The two primary forms of abbreviation for tooth identification in veterinary dentistry are the proper identification sequence

and the Triadan system. Chapter 5 discusses abbreviations for oral pathology. The American Veterinary Dental College continuously updates abbreviations.

Proper Identification Sequence

This version of tooth identification involves using dentition (permanent or primary—indicated with small case “d” for deciduous), arch (maxilla/mandible, often upper/lower), quadrant (left or right), and tooth (using tooth formula abbreviations: I, C, PM, and M). The proper identification is, for example, the permanent mandibular left first molar using subscripts and superscripts, the shorthand is $1M$. The primary (deciduous) maxillary right third incisor is indicated as dI^3 .

Triadan System

Adopted by the American Veterinary Dental College, the Triadan system identifies each tooth with a three-digit number. The first number indicates the quadrant of the tooth's location and its dentition (primary or permanent): maxillary right = 1 (5 for primary), maxillary left = 2 (6), mandibular left = 3 (7), and mandibular right = 4 (8). Based on the full dentition of a pig, second and third numbers follow sequentially with incisors being numbers 01, 02, and 03, canines = 04, premolars = 05, 06, 07, and 08, and molars = 09, 10, 11. Adult cats normally are missing the maxillary first premolar and mandibular first and second premolars. The numbering system remains intact and skips these missing teeth. An easy device for remembering the Triadan system is the canine teeth are always number 4 and the fourth premolars are always number 8. Using the above examples, the permanent mandibular left first molar is tooth 309. The primary (deciduous) maxillary right third incisor is tooth number 503. A cat's permanent right mandibular fourth premolar, even though it is the second premolar found in the mouth, is tooth number 408. Remember, cats normally are missing teeth 405 and 406 (Figs. 1.15 and 1.16).

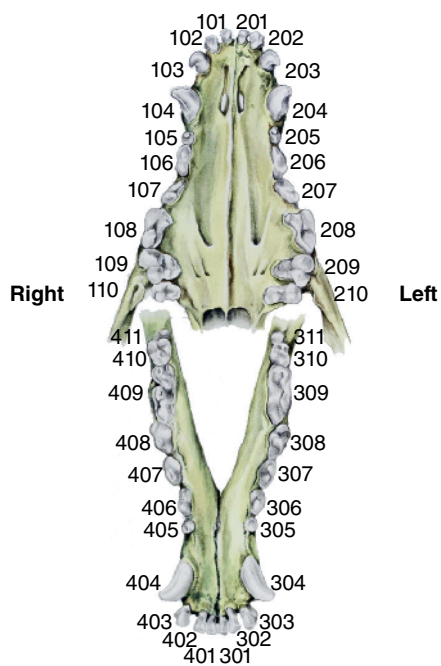


Figure 1.15 Canine Triadan tooth numbering system (Illustration by Brenda Gregory).

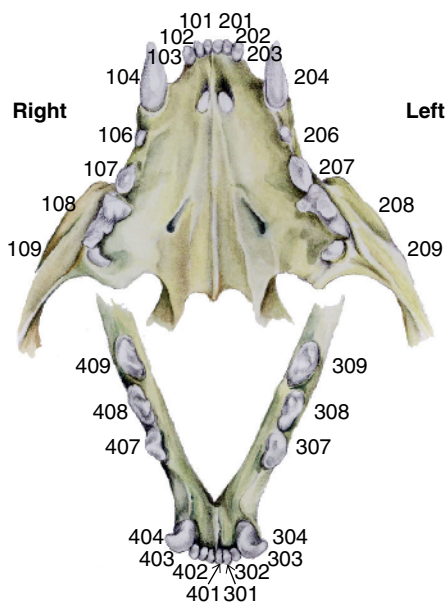


Figure 1.16 Feline Triadan tooth numbering system (Illustration by Brenda Gregory).

References

1. Evans, HE. 1993. *Miller's Anatomy of the Dog*, 3rd ed., Philadelphia: Saunders.
2. Wiggs, RB, Lobprise, HB. 1997. *Veterinary Dentistry Principles and Practice*. Philadelphia: Lippincott-Raven.
3. Gioso, MA, Carvalho, VGG, Holmstrom, SE (editors). 2005. *Oral Anatomy of the Dog and Cat, Veterinary Clinics of North America, Small Animal Practice-Dentistry*. Philadelphia: Saunders.
4. Budras, KD, McCarthy, PH, Horowitz, A, Berg, R. 2006. *Anatomy of the Dog, Fifth Edition*. Hanover: Schlütersche.
5. Gilbert, SF. 2006. *Tooth Development—Developmental Biology Eight Edition Online*. Sunderland, MA: Sinauer Associates.
6. Harvey, CE, Emily, PP. 1993. *Small Animal Dentistry*. St. Louis, MO: Mosby.
7. Theslaff, I. 2003. Epithelial-mesenchymal signaling regulating tooth morphogenesis. *Journal of Cell Science* 116:1647–1648.
8. Johnson, C. 2001. Mechanisms of tooth eruption, University of Illinois at Chicago Courses online: Oral Sciences.
9. Holmstrom, SE. 2000. *Veterinary Dentistry for the Technician and Office Staff*. Philadelphia: Saunders.