Intraoral Radiographic Interpretation (Part 1): Reading Radiographs and Radiographic Pathology

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Normal dental radiology requires understanding normal dental anatomy.

Dogs, cats, horses, cows, etc. are diphyodont [two sets of teeth: primary (deciduous) and adult]. Each tooth has a crown and a root. The apex of the root is the terminal end of the root where the neurovascular bundle enters the tooth. The cusp is the terminal end of the crown.

The tooth is composed of organic and inorganic material. The 3 hard (mineralized) tissues of the tooth include the enamel (crown only), dentin (root and crown) and cementum (root only). The cementum and enamel meet at the cementoenamel junction (CEJ). A tooth is a living structure and dentin is continually produced throughout the life of an animal, if the tooth remains vital. Odontoblasts produce dentin and are located in the pulp with the blood vessels, lymphatics, and nerves. The pulp (endodontic system) is divided into the root (pulp) canal (in the root), the pulp chamber (in the crown), and the pulp horns (in the cusps of the crown).

The tooth is anchored in the jaws by the periodontium. The incisive bones, maxillary bone, and mandibular bone anchor the teeth. The periodontium consists of the 1) gingiva, 2) alveolar bone, 3) periodontal ligament, and 4) cementum. Radiographically, the alveolar bone and periodontal ligament space are commonly evaluated to assess periodontal disease. Normal cementum cannot be seen radiographically as it consists of just a few cell layers.

Normal intraoral radiographic anatomy

Radiographs are 2-D representations of 3-D structures. Therefore, overlying structures causing summation and superimposition frequently create artifacts.

In the young patient, the dentin walls are thin and the pulp system is large. The root will not be fully formed until apexogenesis is complete. As the tooth ages, secondary dentin production continues, the endodontic system becomes smaller, and a root is formed. There is a radiolucent structure around each tooth (lamina lucida) that represents the space of the periodontal ligament. Immediately adjacent to the lamina lucida is the lamina dura (where the periodontal ligament attaches to the alveolar bone). This structure is a radio-opaque structure that loses opacity as the patient ages. The trabecular pattern of supporting bone becomes coarser and less distinct with age. The veterinarian should become familiar with normal structures (e.g., mental foramen, developmental grooves) so as not to mistake them for pathology.

Normal anatomical landmarks visualized include the radiolucent mandibular canal, mental foramen (rostral, middle, and caudal), and mandibular symphysis. Particularly, the middle mental foramen can be superimposed on the apex of the mandibular canine tooth and/or 1st and 2nd premolars and misinterpreted as pathology. When in doubt, take a second film at a different angle. If the radiolucency stays with the tooth it is likely pathology; if it moves away, it is likely the normal foramen. In the maxilla, the nasal structures, nasopalatine foramen, and intersections between the maxillary bones are visualized.

Dental formulae for the dog and cat

It is necessary to understand the correct number of teeth in the dog and cat. Any missing teeth, extra teeth (supernumerary teeth), malpositioned teeth, etc., require intraoral radiographs.

Dog

- Deciduous: 2 X (3I/3I, 1C/1C, 3PM/3PM) = 28
- Adult: 2 x (3I/I, 1C/1C, 4PM/4PM, 2M/3M) = 42

Cat

- Deciduous: 2 X (3I/3I, 1C/1C, 3PM/2PM) = 26
- Adult: 2 x (3I/I, 1C/1C, 3PM/2PM, 1M/1M) = 30

Normal canine and feline tooth eruption times

It is necessary to understand normal tooth eruption times. If teeth are missing or delayed in eruption, immediate intraoral radiographs are recommended. If a tooth is embedded beneath thick gingival connective tissue, intervention with an operculectomy during the window of tooth eruptive force, may allow the tooth to move into the correct position. Waiting until the patient is older is too late as no eruptive force will be left.

	Deciduous (Weeks)	Adult (Months)	Deciduous (Weeks)	Adult (Months)
	Puppy	Adult Dog	Kitten	Adult Cat
Incisors	3-4	3-5	2-3	3-4
Canines	3	4-6	3-4	4-5
Premolars	4-12	4-6	3-6	4-6
Molars		5-7		4-5

Dental terminology

Dental nomenclature can be found at the American Veterinary Dental College Website (www.avdc.org).

Modified triadan system

Teeth can be named by various tooth numbering systems. The anatomical names of the teeth and the modified Triadan System are the commonly used nomenclature in veterinary dentistry. The modified Triadan System allows easier electronic medical records and can be used across veterinary species; even with morphological tooth differences between carnivores and herbivores.

The adult right maxillary quadrant = 100
The adult left maxillary quadrant = 200
The adult left mandibular quadrant = 300
The adult right mandibular quadrant = 400

The deciduous right maxillary quadrant = 500
The deciduous left maxillary quadrant = 600
The deciduous left mandibular quadrant = 700
The deciduous right mandibular quadrant = 800

The teeth are then numbered from mesial to distal starting with the number 1. All canine teeth will end with the number "4" and 1st molars will end with the number "9". If teeth are missing, a gap is left in the numbering sequence. Felines are missing the first maxillary premolar. Therefore the first teeth distal to the canine teeth are 106 and 206, right and left respectively. Likewise, felines are missing the first two premolars in the mandibles. Therefore the first teeth distal to the canine teeth are 307 and 407, left and right respectively.

Anatomical directional terms in the oral cavity (www.avdc.org)

Mesial and distal are terms applicable to tooth surfaces. The mesial surface is the surface of the tooth toward the median line of the oral cavity following the curve of the dental arcade. The distal surface is the surface of the tooth away from the median line of the oral cavity following the curve of the dental arcade.

Lingual and Palatal: The surface of a mandibular or maxillary tooth facing the tongue is the lingual surface. Palatal can also be used when referring to the lingual surface of maxillary teeth.

Vestibular or Buccal or Labial is referring to the surface of the tooth facing the vestibule or lips.

Rostral and Caudal are the positional and directional anatomical terms applicable to the head in a sagittal plane in non-human vertebrates. Rostral refers to a structure closer to, or a direction toward the most forward structure of the head. Caudal refers to a structure closer to, or a direction toward the tail.

References available upon request