How to Assess Pediatric Dentition:
A Visual Tour of Normal and Abnormal From Birth to 9 Months

Kevin S. Stepaniuk, DVM, AVD, DAVDC
University of Minnesota
Saint Paul, MN

Pedodontics is the branch of veterinary dentistry dealing with oral structures of immature patients and immature dental structures. In order to fully assess the juvenile patient in the exam room, the practitioner must be familiar with normal eruption times, dental anatomy, and odontogenesis. The oral cavity must be evaluated during each puppy or kitten vaccination visit, at 6 months of age, and until all adult dentition is accounted for. Early recognition and treatment of oral problems in the puppy and kitten can prevent future dental pathology, pain, and infection.

Teeth

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

The tooth is composed of organic and inorganic material. The 3 hard 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 in a vital tooth. Odontoblasts, produce dentin, 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).

Simplified odontogenesis and maxillofacial development

The jaws develop independently from the branchial arches and jaw growth is neither continuous nor synchronous. Normal occlusion and interdigitation of the deciduous dentition allow the mandible and maxilla to maintain a relatively proportionate relationship during growth. Deciduous tooth malocclusions can interfere with normal maxillofacial development. An adverse dental interlock, resulting from a deciduous tooth malocclusion, can lead to deviation of the jaws and a permanent skeletal malocclusion.

Odontogenesis is the embryological events during tooth development. Enamel is produced from the enamel organ (ectoderm origin). Dentin and pulp are derived from the dental papilla (mesoderm origin). The enamel organ develops through a bud, cap, and bell stage. The bud arises from the dental lamina in the regions corresponding to the deciduous dentition. For incisors, canines, and premolars, lingual extensions from the primary dentition form the successional lamina. Therefore, if a deciduous tooth does not form, its adult counterpart will not form. The buds for the molars and the 1st premolars in the dog develop directly from the dental lamina during the same period the deciduous tooth buds are formed.

Tooth eruption begins when the crown enters the oral cavity and ends when the tooth is exfoliated or the patient dies. Deciduous tooth exfoliation is not fully understood. It is believed that the adult tooth bud crown applies pressure to the root of the primary tooth causing resorption *and/or* the dental follicle of the erupting tooth signals resorption and eventual exfoliation of the deciduous tooth. Regardless, any retained deciduous teeth will affect the eruption of the adult dentition.

Deciduous dentition

There are 28 deciduous and 42 adult teeth in the dog. The cat has 26 deciduous and 30 adult teeth. No two teeth of the same type should be in the same place at the same time. That is, a persistent (retained) deciduous canine tooth should be immediately removed if the corresponding adult canine tooth is present, or in an eruptive process, and the deciduous canine tooth is not mobile and exfoliating.

There are no deciduous molar teeth. However, deciduous 3rd premolars look similar too, and function like, adult 4th premolars and deciduous 4th premolars look similar too, and function like, adult 4th premolars.

Approximate eruption times (breed differences)

	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

Tooth abnormalities identified include enamel hypoplasia, enamel hypocalcification, gemini teeth, supernumerary teeth, crowded teeth, rotated teeth, missing teeth, fused teeth, fractured teeth, discolored teeth, retained deciduous teeth, attrition, and abrasion.

Supernumerary teeth (extra teeth) can be crowded and potentiate periodontal disease. If there is not sufficient space for the crowns and roots, exodontics should be considered.

Some teeth may have supernumerary roots. These teeth with extra roots need to be radiographed to determine if the root is complete and normal. If the root is small, there could be communication between the periodontal and endodontic system leading to infection and loss of the tooth.

Gemini teeth are those in which two crowns are present with one radicular system. Fusion teeth are teeth with fused crowns but have two radicular systems. These teeth should be radiographed to be certain there are no subgingival abnormalities. If there is no crowding or abnormalities predisposing to periodontal disease, no treatment may be necessary.

Teeth morphology such as taurodontia, peg teeth, dens invaginatus, macrodontia, microdontia, shell teeth, etc. is reported and need to be recognized and radiographed to determine the treatment plan.

Normal occlusion

The normal mesocephalic skull has anisognathic mandibles. With orthocclusion, the mandibular incisors occlude on the cingulums of the maxillary incisors; the mandibular canines interdigitate, without touching, between the maxillary third incisors and canine teeth. The mandibular and maxillary premolars interdigitate, and the tips of the upper and lower second premolars are at the same horizontal level.

Malocclusions

Malocclusions are deviations from the normal occlusion. Considered to be genetic or developmental in origin, malocclusions can be the result of skeletal or tooth abnormalities, respectively. Malocclusions result in trauma from abnormal tooth to tooth contact and tooth to soft tissue trauma. Malocclusions are classified as symmetrical skeletal malocclusions, Class 1[(Neutroclusion) abnormalities of teeth position and number but normal jaw relationships], Class 2 (mandibular-distoclusion) with mandibular teeth distal to maxillary teeth, Class 3 (mandibular-mesioclusion) with mandibular teeth mesial to maxillary teeth, and asymmetrical skeletal malocclusions (maxillary-mandibular asymmetry). See www.avdc.org for current accepted veterinary dental nomenclature and classifications.

Class 1 malocclusion

A class 1 malocclusion involves normal jaw relationships but abnormal dental (tooth) relationships (e.g., linguoversed mandibular canines, mesioversed (lance) maxillary canines, rostral crossbites, caudal crossbites)

Linguoversion of the deciduous mandibular canines (704 and 804) traumatize the palatal tissue and cause an adverse dental interlock. The dental interlock interferes with jaw growth. It is recommended to extract 704 and 804 to allow the patient the best chance of normal mandibular and maxillary growth and normal occlusion.

Adult linguoversed canine teeth are a result of retained corresponding deciduous teeth or a developmental defect. This includes a class 2 malocclusion, brachygnathic mandible, excessive anisognathism, or retained primary mandibular canines. Linguoversion of 304 and 404 can lead to severe damage to the hard palate, oronasal fistulas, periodontal defects, tooth damage to 103, 104, 203, and 204, and inability to close the mouth. Local periodontal disease and oronasal fistulas can develop in the traumatized maxillary arcade. Treatment options include orthodontic movement, crown reduction and partial coronal pulpectomy with a direct pulp cap, crown reduction and total pulpectomy, or extraction of the offending mandibular canine tooth. Surgical extraction of the adult mandibular canine teeth is rarely performed since the teeth are strategic and the procedure is more traumatic and destabilizing compared to an endodontic procedure. Orthodontic movement is successful. Depending on the severity of the linguoversion, the owner's commitment, and compliance of the patient, various techniques have been discussed for moving 304 and 404. Treatments can consist of removable orthodontic devices (ball), direct acrylic incline planes, indirect acrylic or metal inclined planes, active expansion screws, vital pulpotomy, or extraction.

Mesially displaced (Mesioversed) maxillary canine teeth are encountered mostly in Shelties. A few other breeds such as Italian Greyhounds, Miniature Schnauzers, and some cats have been reported. One maxillary canine tooth is erupting dorsal to the cervix of the ipsilateral third incisor. The crown is pointing straight forward like the lance. Correction of this condition requires orthodontic movement or extraction of the misplaced tooth. If left untreated, mesioversed canine teeth and the adjacent dentition are predisposed to periodontal disease due to crowding. Additionally, the tooth may be in a position of traumatic occlusion with the opposing mandibular canine tooth leading to pulpitis, pain, and pulp necrosis.

A rostral crossbite is a malocclusion where one or more of the incisors is/are in version to the corresponding tooth in the opposite arcade. The malocclusion can lead to endodontic and periodontal compromise with resulting pain and infection. Chronic concussive forces could lead to complicated or uncomplicated crown fractures, pulpitis (reversible or irreversible), root fractures, and periodontal disease.

A level bite is a variation similar to a rostral crossbite where the maxillary and mandibular incisors occlude abnormally on the cusps. Sequelae and treatment are similar to a rostral crossbite.

A caudal crossbite occurs when the mandibular premolars and molar are buccal to their maxillary counterparts. If there is no traumatic contact with hard or soft tissue, then no treatment is necessary. If there is trauma, exodontics or crown reductions and endodontics will be necessary.

Crowded and rotated teeth often present in the brachycephalic breeds predisposed to periodontal disease. Interceptive extractions, following intraoral radiographs, to remove the less strategic premolars to preserve teeth 108, 208, 309, and 409 should be considered on an individual patient basis. Selective extraction of a few teeth can help prevent chronic periodontal infection and loss of several teeth and the strategic teeth.

Class 2 malocclusion

A class 2 malocclusion is a discrepancy of jaw length so that the mandibular incisors are now abnormally distal to the maxillary incisors. This is generally the result of a genetically short mandible. The malocclusion is commonly associated with linguoversed canine teeth causing palatal trauma. Treatment of linguoversion is discussed above.

Class 3 malocclusion

A class 3 malocclusion is commonly seen in brachycephalic breeds due to a genetically short maxilla. It may be considered "normal" for the breed but it is an abnormal skull and jaw conformation with consequences such as brachycephalic airway syndrome, crowded and rotated teeth predisposing to periodontal disease, and unerupted teeth. It is not normal from a dental, oral health, and genetic position.

Asymmetrical malocclusion

Maxillary-mandibular asymmetry is an asymmetry of the maxilla and mandible and can be the result of trauma (i.e. a puppy bit in the face) or genetic. The malocclusion may be rostro-caudal direction with mandibular mesioclusion or distoclusion on side of the face and the contralateral side is in normal dental alignment. A side-to-side direction is the loss of midline alignment between the maxilla and mandible. A dorso-ventral direction results in an open bite defined as an abnormal vertical space between opposing dental arches when the mouth is closed. A rostral open bite occurs when there is abnormal space between the maxillary and mandibular incisors when the mouth is closed. Treatment is often not needed. A caudal open bite occurs when there is abnormal space between the maxillary and mandibular premolars. Treatment is often not needed.

Fractured deciduous teeth

Complicated crown fractures (pulp exposure) of deciduous teeth result in periapical infections/inflammation adjacent to the developing tooth bud in addition to acute pain. The tooth bud can be damaged, develop enamel defects, or die. Deciduous teeth with complicated crown fractures require extraction.

Fractured young adult teeth

Complicated crown fractures in teeth less than 9 months of age require endodontic treatment or extraction. The pulp has good resilient potential at this age and endodontic treatment should be pursued in a timely fashion. If the patient is <12 months of age, a vital pulpotomy (partial coronal pulpectomy and direct pulp capping)/apexogenesis should be performed as soon as possible. If the tooth is not vital, apexification or apexification like procedures are necessary to create an apical portion of the tooth followed by standard endodontic treatment.

Cleft palates

Cleft palates can be primary if involving the lips and incisive bone or secondary if involving the hard and soft palate. Cleft palates are often genetic in origin. The communication between the oral cavity and respiratory system often cause the patients with secondary cleft palates due poorly. They have difficulty feeding and growing compared to litter mates. Milk often comes out of the nostrils. The puppies are prone to pneumonia. Assisted feeding (tube feeding) is needed until the patients are 8-12 weeks of age. At this time a surgery can be performed. As the patient becomes older, the defects may become proportionally larger. The owners are always advised that pneumonia can occur and additional surgeries may be needed. The first surgery is always the best chance at closure. With each surgery additional scar tissue forms and vascularization is decreased. Therefore, these surgeries are best performed by veterinarians familiar with different repair techniques and have experience. Regardless, dehiscence is common and additional surgeries to complete the repairs may be necessary. Movement of the tongue, changes in air pressure during respiration, and tension on surgical flaps contribute to failures.

References available upon request