Dentistry: Oral anatomy and tooth development

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Peter is happy to discuss or give advice on all matters relating to small animal veterinary dentistry or oral surgery.

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Periodontal disease is amongst the commonest diseases that is seen in companion animal practice. A thorough understanding of the normal oral, periodontal and dental anatomy is necessary in order to be able to understand, diagnose and treat oral disease in cats and dogs. This article reviews important aspects of oral anatomy and gives indications of its clinical relevance.

Key words: Oral; Periodontal; Dental; Normal Anatomy

Introduction

A good knowledge of the anatomy of the oral cavity is necessary in order to be able to recognise what's normal and therefore to identify disease. It's also important in understanding how disease processes develop over time and how healthy tissue interacts with disease.

General Anatomy

The mouth can be divided into the vestibule (the cavity between the teeth and lips) and the oral cavity proper. The oral cavity is bounded by the palate dorsally, the tongue ventrally, the dental arches rostrally and laterally and the palatoglossal arch caudally.

Skull Shapes

Skull shape varies significantly between breeds in cats and dogs:
A **mesocephalic** skull shape, which can be seen in breeds such as the Labrador and Border Collie, has a lower jaw shorter and narrower than the maxilla with teeth evenly spaced and normally positioned, in line, in both jaws. **Brachycephalic** breeds, such as the Bulldog and Cavalier King Charles spaniel, have a shorter than normal maxilla often resulting in overcrowded, rotated and abnormally positioned teeth. **Dolicocephalic** breeds, including greyhounds and rough collies, have longer than normal maxillas resulting in widely spaced teeth (Fig 1-3).

Skeletal Anatomy

Understanding the bony anatomy of the skull is important when undertaking dental and oral surgery. The position of vascular canals such as the infraorbital and mandibular canals and foraminae such as the infraorbital and middle mental foraminae will affect planning for the raising of mucoperiosteal flaps, extraction of teeth and the administration of local and regional nerve blocks.

Figure 1: Brachycephalic skull shape

Figure 2: Mesocephalic skull shape

Figure 3: Dolicocephalic skull shape

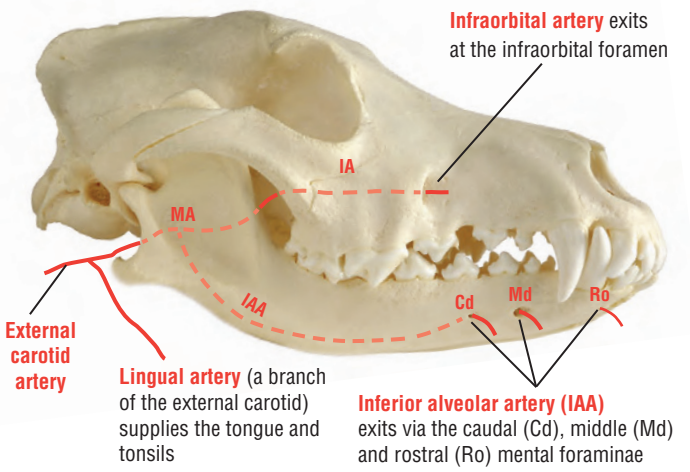
Skull images: Dolicocephalic and mesocephalic skulls: © Fotolia.co.uk Brachycephalic: Courtesy www.skullsunlimited.com

It is important to understand the proximity of the eye to the caudal maxillary molars and the huge variation in the thickness of the alveolar bone surrounding different tooth roots.

These factors must be considered in planning suitable techniques to extract different teeth in order to effect efficient extraction and avoid unnecessary complications.

Vascular Anatomy

The blood supply to the tongue, tonsils, oral soft tissues, jaws and teeth comes from branches of the **external carotid artery**.



The maxillary artery (MA) is the terminal branch of the external carotid.

- **The inferior alveolar artery (IAA)** branches from the ventral surface of the first part of the maxillary artery and enters the mandible through the mandibular foramen into the mandibular canal from where it supplies the mandibles and mandibular teeth. It exits via the caudal(Cd), middle(Md) and rostral (Ro) mental foraminae, supplying blood to the skin and mucosa of the lower lip.
- **Infraorbital artery (IA):** The maxillary artery terminates as the infraorbital artery which branches to give off the caudal dorsal alveolar artery which supplies the maxillary first and second molars and then passes through the maxillary foramen into the infraorbital canal. Within the canal there are branches to the premolars, canine and incisors. The infraorbital artery exits through the infraorbital foramen and divides into the lateral and rostral dorsal nasal arteries.
- **The sphenopalatine and major palatine arteries** branch from the descending palatine artery (a terminal branch of the maxillary artery) and pass through the major palatine and sphenopalatine foraminae. The **sphenopalatine artery** runs along the ventral aspect of the nose. The **major palatine artery** exits from the major palatine foramen and runs rostrally in the palatine groove and supplies the palatal mucosa, periosteum and alveolar bone.

Innervation

- The superficial muscles of the head and face are innervated by the **facial [seventh cranial] nerve**. The facial nerve also innervates the platysma muscle and the caudal belly of the digastricus.
- Sensory innervation of the teeth, oral mucosa, facial skin and rostral two thirds of the tongue is by the **trigeminal [fifth cranial] nerve.**
  - The maxillary teeth are supplied by the superior alveolar branches of the **infraorbital nerve** which runs in the infraorbital canal.
  - The mandibular teeth are supplied by branches of the **inferior alveolar nerve** which runs in the mandibular canal.
- The muscles of mastication have their motor innervation from branches of the **mandibular nerve – which is also a branch of the trigeminal [fifth cranial] nerve.**

A good understanding of the blood and nerve supply is important when planning extractions, oral surgery and local anaesthesia.

Dental Anatomy

Each tooth has a crown and root (or roots), which are embedded in bone (the alveolus) of the jaw. The junction of root and crown is at the level of the cemento-enamel junction (Fig 7).

Teeth in dogs and cats are divided into incisors (I), canines (C), premolars (P) and molars (M).

Dogs: The dental formula for temporary (or deciduous) dentition in a dog is: I 3/3 C 1/1 P 3/3 (28 total).

The dental formula for the permanent teeth of the dog is: I3/3 C1/1 P4/4 M2/3 (42 total).

There are no deciduous precursors for the mandibular and maxillary first premolars and the molars.

In adult dogs the incisors, canine teeth and maxillary and mandibular first premolars and mandibular third molar are single rooted teeth; the maxillary fourth premolar, first and second molars are three rooted teeth; all other teeth are typically two rooted.

Eruption of the deciduous incisors starts at about 28 days and premolars at about 42. However there is considerable individual variation with reports in some breeds of deciduous tooth eruption being complete by 35 days. Exfoliation of the deciduous teeth and permanent tooth eruption starts at about 100 days and should be complete by about 200 days of age.

Cats have fewer teeth than dogs. In the permanent dentition, the maxillary 1st premolar is missing and cats only have 1 maxillary molar. The mandibular 1st and 2nd premolars are missing, and cats also only have 1 mandibular molar.

The dental formula for the deciduous dentition is : I3/3 C1/1 P3/2 (26 total)

The permanent dentition of the cat is : I3/3 C1/1 P3/2 M1/1 (30 total).

In cats the incisors, canines and maxillary second premolars are single rooted teeth; the maxillary fourth premolar is a three rooted tooth; all other teeth have two roots though the maxillary molar commonly has either two fused roots or a single root and in 10% of cases the maxillary third premolar has an additional (third) root.

Eruption of the deciduous teeth in cats starts at 11 days and is complete by 60 days. The secondary or permanent dentition starts erupting at about 100 days, and is complete by 175 days of age.

In some breeds the failure of exfoliation of deciduous teeth is a common problem. This can be associated with malocclusions or make the site prone to periodontal disease because of plaque retention (Fig 4).

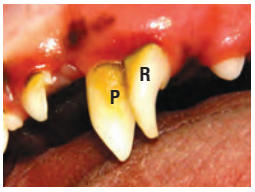


Figure 4: Retained deciduous canine tooth (R) with permanent tooth (P) also seen in situ makes the area prone to plaque retention and periodontal disease.

Abnormalities in development and eruption can also occur. Missing teeth may be unerupted or truly missing and therefore areas where teeth are absent should be radiographed. Unerupted or impacted teeth can form a dentigerous cyst.

Developmental problems include:
• Gemination (development of more than one tooth from a single tooth bud)
• Fusion (the development of a single tooth from two toothbuds), • Supernumerary or misshapen (dilacerated) roots (Fig 5). Dental radiography is essential to assess developmental problems.

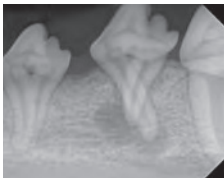


Figure 5: Misshapen roots