Veterinary dental radiology: Detecting and interpreting pathology

Veterinary dental radiography is an integral part of the provision of dental services for small animal patients. Interpreting dental radiographs can initially be challenging. However, by adopting a systematic approach to interpretation, the clinician can be confident in being able to identify normal structures and their variations, and also pathological changes. By assessing the anatomical form and structure of the tooth, followed by the periodontal health, endodontic health and finally bone health, the clinician is more likely to detect all significant changes. The patient obviously benefits as all relevant pathology is detected and treated in an optimal manner. This article describes the common pathological changes detected in dental radiographs of canine and feline patients.

**Key words:** veterinary, dental, radiology, pathology, endodontic, periodontitis

**Introduction**

The acquisition of dental radiographs in small animal dentistry is recognised as the current optimal standard of care (AAHA 2013, www.wsava.org/guidelines/global-dental-guidelines). It is understood that animals with dental diseases rarely show outward signs of a problem. The animal’s appetite is usually unaltered, with dysmasesis often being so subtle as to go unnoticed. However, commonly encountered dental diseases such as periodontitis, tooth resorption and fractured teeth are frequently associated with pain and discomfort. Limited information may be obtained from a conscious oral examination, with a complete and thorough oral and dental examination only possible under general anaesthesia. This examination should include probing, documenting / findings on a comprehensive dental chart and dental radiography (AAHA 2013, Perry 2014). The value of full mouth dental radiography in both the dog and cat has been demonstrated, with additional pathology being detected in 50% patients (Verstraete et al. 1998).

Once diagnostic dental radiographs can be produced quickly and efficiently, the next challenge the clinician faces is interpreting the resultant images. A sound knowledge of the normal dental radiographic appearance of canine and feline teeth and other oral structures (including anatomical variations) is a pre-requisite in order to detect and correctly interpret pathological changes. Previous publications have described the normal oral and dental radiographic anatomy of the dog and cat (DuPont and DeBowes 2009, Niemiec 2014, Perry 2017).

**Diagnostic processing pathways**

Dental radiology describes two main methods of reaching a diagnosis, including; analytical (systematic) and non-analytical pathways (Baghdady 2014). While experienced clinicians often rely on a complementary fusion of both techniques, the novice is encouraged to take a systematic approach to interpreting dental radiographs so that subtle pathology is not overlooked. The two pathways are summarised in Figure 1.

A useful systematic approach is to assess these separate features one at a time:

- **Anatomy** - Dentition (deciduous/permanent), crown and root shape, size and number

- **Periodontal health** - Structures supporting the tooth (periodontal ligament and alveolar bone)

- **Endodontic health** - Pulp system within the tooth

- **Bone** - Alveolar margin, cortical bone, cancellous/trabecular bone and periosteum.

In addition, it is helpful to ascertain:

- Localised or generalised nature of lesion
- Shape and size of lesion
- Periphery appearance (well- or ill-defined border)
- Internal structure and appearance (radiolucent vs. radiodense or mixed)
- Effect on adjacent structures

Having considered the above, the clinician should be able to determine if the
lesion is normal or abnormal, whether it is developmental or acquired, and lastly the disease category (cystic/inflammatory/benign neoplastic/malignant/traumatic/metabolic/bone dysplasias) (Baghdady 2014).

**Anatomy**

The expected size, shape and number of roots of all teeth in the dog and cat should be **a priori** knowledge, however variations of normal anatomy are known to occur (Verstraete and Terpak 1997). For instance, an estimated 10% of maxillary 3rd premolars in the cat have a supernumerary third root, (rather than the anticipated two roots). Single rooted variations of multi-rooted teeth are also observed (Figures 2–4). This becomes clinically significant during extraction attempts.

**Developmental anomalies**

These can occur due to genetic or traumatic reasons. Treatment decisions are based upon the likelihood of the problem to contribute to pain, infection or dysfunction.

**Supernumerary teeth**

Extra (supernumerary) teeth are usually caused by genetic aberrations, and can cause a problem where they contribute to crowding if the gingival collar cannot form a tight attachment to each individual tooth (Figures 5 & 6). Supernumerary teeth may also be impacted and contribute to dentigerous cyst formation (see below).

**Missing teeth**

A clinically missing tooth may be absent for several reasons, including: lack of development (oligodontia/hypodontia), lack of eruption (embedded/impacted), previously extracted, or the crown has fractured but the root remains (Figures 7 & 8). Once the clinical examination reveals a missing tooth, radiography is obligatory. Retained roots can be a source of pain and infection and should be extracted if either the overlying gingiva is inflamed, or there is radiographic evidence of periapical pathology (see below).

**Failure of eruption**

Impacted or embedded teeth that have not erupted properly can form a particular type of pathological cyst, known as a dentigerous cyst (Figures 8 & 9). A retrospective case series of 41 dogs with odontogenic cysts revealed 71% of the cysts to be dentigerous cysts, and in half of the dogs these were an *incidental* finding (Verstraete et al. 2011). Dentigerous cysts occur around the crown of an unerupted tooth, and have been reported in the canine and 1st pre-molar teeth of dogs. In Verstraete’s case series (2011), 83% of the dentigerous cysts involved the first premolar, particularly in brachycephalic breeds such as Boxers, Pugs and Shih Tzus. 20% of the dogs in this case series had >1 cyst, so it is vital to evaluate each quadrant radiographically, even if the ‘correct’ number of teeth are clinically apparent. Unerupted supernumerary premolars may also cause cyst formation. A good time to check is during neutering—count teeth, and if premolars are missing, offer dental radiography. The maxillary carnassial is the 4th premolar, while the mandibular carnassial is the 1st molar tooth.

**Altered morphology**

Aberrations of morphology can occur during embryological tooth formation stages due to genetic influence or trauma (DuPont and DeBowes 2009b). Fusion of two tooth germs can result in a single large tooth (Figure 10). **Gemination**