Diagnosis & Treatment of Crown Fractures

Brook A. Niemiec, DVM, FAVD, Diplomate AVDC

Crown fractures are very common, especially in large-breed dogs.

Tooth fractures are defined as complicated or uncomplicated:
- **Uncomplicated crown fractures** have direct dentin but no pulp exposure
- **Complicated crown fractures** have direct pulp (nerve) exposure.

**TOOTH ANATOMY**

Teeth are essentially comprised of 3 layers: enamel, dentin, and pulp.

- **Pulp**: The innermost layer is the endodontic system (root canal or pulp). The endodontic system contains nerves, blood vessels, and connective tissue that nourish the tooth. The blood and nervous supply enter the tooth through the very tip (or apex) of the root.
- **Enamel**: The outer layer of the tooth crown is enamel. It is virtually all (97%) calcium and phosphorus and is the hardest substance in the body. Enamel has no nervous or circulatory system. It is applied in a very thin layer (< 1-mm thick) over the tooth surface during development. Once tooth eruption occurs, enamel cannot be naturally replaced or repaired.
- **Dentin**: The central layer, which is the vast majority of the tooth structure in mature patients, is dentin. Dentin has roughly the same mineral content as bone. It has a nervous supply and responds to stresses. Running at right angles to the root canal are dentinal tubules. Each dentinal tubule contains an odontoblastic process, which is basically a nervous supply that is limited to sensory function and can only report changes as pain.
Both types require therapy, but treatment differs depending on the physical and radiographic appearance. The most commonly affected teeth are the canines and carnassials (maxillary fourth premolars and mandibular first molars).

**UNCOMPLICATED CROWN FRACTURES**

Uncomplicated crown fractures are very common in large-breed dogs, affecting approximately 60% of these patients in my experience. These types of fractures occur when a piece of crown is broken off, exposing the dentin but not the pulp (Figures 1 and 2).\(^1\) This can be a very painful condition, but veterinary patients rarely show clinical signs. Consequently, these tooth fractures are only diagnosed by careful oral examination, often under general anesthesia.

**COMPLICATED CROWN FRACTURES**

A complicated crown fracture is a fractured tooth with direct pulp exposure (Figures 3 and 4).\(^1,2\) It has been reported that 10% of dogs have teeth with pulp exposure.\(^3\)

Prior to tooth necrosis, the viable nerve can be very painful. Over time, the constant bacterial attack from the oral cavity results in tooth death. Once a tooth becomes nonvital, the root canal system acts as a bacterial superhighway, leading to local infections as well as bacteremias, which have been linked to serious systemic disease.\(^4\)

Pet owners are often reluctant to pursue therapy for fractured teeth because they think “it does not seem to bother the dog.” However, fractured and/or infected teeth do affect animals by creating pain, infection, and fatigue; but these signs are often subtle or hidden. Pet owners should be educated that animal patients are typically much more stoic than their human counterparts when dealing with pain.\(^5\) Most owners see a noticeable improvement in their pets’ attitudes and energy levels after therapy is provided.
DIAGNOSTICS
Complete diagnosis of fractured teeth requires 3 distinct modalities: visual, tactile, and radiographic.1,6

- **Visual**: Most cases of direct pulp exposure are obvious, but it is important to evaluate all sides of the tooth for direct pulp exposure (Figure 5).

- **Tactile**: Even the smallest amount of pulp exposure is sufficient to cause pulp necrosis. In fact, these small exposures are the ones that most commonly result in clinical abscesses (Figure 6). Therefore, it is best to use a dental explorer or small endodontic file to definitively rule out pulp exposure, and any soft spot should be suspect (Figure 7).

- **Dental radiographs**: Dental radiographs are a critical part of endodontic therapy. All fractured teeth are potentially nonvital and infected; radiographs should be taken of all fractured teeth with dentin or pulp involvement.7 Radiographic evidence of endodontic disease is most commonly seen as periapical rarefaction (Figure 8) or a wider endodontic space (Figure 9).8

TREATMENT
**Uncomplicated Crown Fractures**
Confirmed uncomplicated crown fractures with no radiographic evidence of disease (Figure 10) should be treated with a bonded sealant (see Practice Step by Step: Bonded Sealant Application for Crown Fractures, page 44). This will resolve sensitivity, block infection, improve aesthetics, and smooth the tooth to decrease plaque accumulation, delaying periodontal disease.

**Complicated Crown Fractures**
Teeth with complicated crown fractures or radiographic evidence of nonvitality should be treated with root canal therapy or extraction.1,2,6

Large teeth, such as canines and carnassial teeth, are considered strategic teeth and should ideally be saved with root canal therapy. This gives an excellent long-term prognosis (up to 100%).9 Furthermore, when root canal therapy is provided for large strategic teeth, the patient maintains jaw strength and tooth function and treatment is much less painful than surgical extraction.

For minor teeth, such as incisors and premolars, extraction is a viable alternative; however, many clients are interested in maintaining all teeth.

FOLLOW-UP
Follow-up dental radiographs are strongly recommended in 6 to 9 months to ensure continued vitality. (If the client declines this, radiographs should be performed during the next prophylaxis.)
Diagnosis & Treatment of Crown Fractures

References

Suggested Reading

Figure Credits
Tooth Anatomy figure reprinted from Small Animal Dental, Oral and Maxillofacial Disease: A Colour Handbook, with permission from Manson Publishing.
Figures 9 and 10 reprinted from the Client educational Poster, with permission from vett4entalrad.com.

Figure 8. Dental radiograph of the maxillary left fourth premolar (208) in a dog. This tooth has periapical rarefaction (arrows), which is indicative of nonvitality and active infection.

Figure 9. Dental radiograph of the mandibular incisors of a dog. Note that the mandibular right second incisor (402) has a widened endodontic system [arrows]; this also indicates nonvitality.

Figure 10. Dental radiograph of the maxillary left fourth premolar (208) of the dog in Figure 5. This tooth has no periapical rarefaction, which is indicative of vitality and a good candidate for bonded sealant therapy.

Brook A. Niemiec, DVM, FAVD, Diplomate AVDC, is chief of staff of Southern California Veterinary Dental Specialties, with offices in San Diego and Murrieta, California, and Las Vegas, Nevada (dog beachdentistry.com). He has authored many articles and chapters, including the recently published Small Animal Dental, Oral and Maxillofacial Disease: A Colour Handbook (Manson Publishing). Dr. Niemiec founded the veterinary dental telemedicine website vett4entalrad.com, which also offers instructional videos and educational posters. He lectures extensively at national and international conferences and is the coordinator and instructor of the San Diego Veterinary Dental Training Center (vett4entaltraining.com). Dr. Niemiec received his DVM from University of California–Davis.