DENTISTRY

Diagnosis and Treatment of Fractured Teeth

***Brook A. Niemiec**, DVM, DAVDC, DEVCD, FAVD*
Veterinary Dental Specialties & Oral Surgery, San Diego, California

Broken or fractured teeth are a very common problem in animal patients.[1-3] Treatment often depends on which layer(s) of the crown are involved—enamel, dentin, and/or pulp.

TOOTH ANATOMY

Enamel, which makes up the outermost layer of the tooth, has no sensory ability and cannot regenerate if damaged or lost.[4,5] The innermost pulp chamber, or root canal, contains blood vessels, nerves, and connective tissue. Dentin, the middle layer, has a similar mineral content to bone and comprises most of the mature tooth. Canine dentin contains 50 000 to 100 000 dentinal tubules/mm^2 that radiate from the root canal.[6] Each tubule contains an odontoblastic process with nervous innervation,[7] making dentin a living structure with the ability to register pain and respond to damage.

A lack of obvious signs of oral pain should not be misinterpreted as an absence of pain, and all patients with direct pulp exposure should be prescribed pain management at the time of the consult.

COMPLICATED CROWN FRACTURES

Fractures that directly expose the root canal (pulp) are called complicated crown fractures (CCFs, **FIGURE 1**). In 1 study, 1 out of 10 dogs with a broken tooth had a complicated crown fracture.[8] These teeth are painful; however, it is typical for animals to continue to eat normally despite intense oral pain. Therefore, a lack of obvious signs of oral pain should not be misinterpreted as an absence of pain, and all patients with direct pulp exposure should be prescribed pain management at the time of the consult.

When a broken tooth dies, pain may subside; however, long-term low-grade pain and infection can persist.[9] The root canal system also acts as a bacterial pathway, allowing bacteria to spread into the bloodstream. Bacteria in the bloodstream can negatively affect numerous vital organs, leading to serious systemic disorders.[10-13] However, antibiotics are not indicated for CCFs.[14]

UNCOMPLICATED CROWN FRACTURES

Fractures that do not directly involve the root canal system are called uncomplicated crown fractures (UCFs, **FIGURE 2**). UCFs are a very common finding on oral examination, particularly in large-breed dogs. These fractures result in direct dentinal exposure, and exposed dentinal tubules can create significant pain.[15] The exposed tubules also result in indirect pulp exposure by connecting to the root canal system. A recent study revealed that 29.5% of UCFs of maxillary fourth premolars in dogs were infected.[16] Therefore, these teeth must be radiographed to ensure vitality.

FIGURE 1. Complicated crown fracture.

FIGURE 2. Uncomplicated crown fracture.

TREATMENT OF FRACTURED TEETH

All fractured teeth should receive some form of therapy.[2,17]

Complicated Crown Fractures

All teeth with direct pulp/nerve exposure must be treated with either root canal therapy or extraction.[2,18] When properly performed, either treatment should permanently resolve pain and/or infection. Vital pulp therapy was previously recommended for fresh fractures (< 48 hours), but most dentists reserve this for immature teeth (pets aged < 1 year). Vital pulp therapy performed on a fractured tooth carries the risk of eventual tooth death; therefore, the client must be informed of the possible need for further therapy (root canal or extraction).[19,20]

Briefly described, root canal therapy involves removal of the nerve and associated structures, disinfection and filling of the canal, and restoration of the surface of the tooth.[18,21] Extraction involves complete removal of the tooth and its root(s). Retained roots are a very common complication with extractions, but only complete extraction will resolve pain and/or infection.[22]

The advantages of root canal therapy compared to complete extraction include minimizing pain and discomfort; retaining tooth function; maintaining jaw strength; and decreasing surgical complications, particularly when a larger tooth such as a canine or carnassial tooth is involved. The lower canine teeth are specifically associated with jaw strength. Fractured teeth treated by root canal are ideally protected with a cast metal crown.

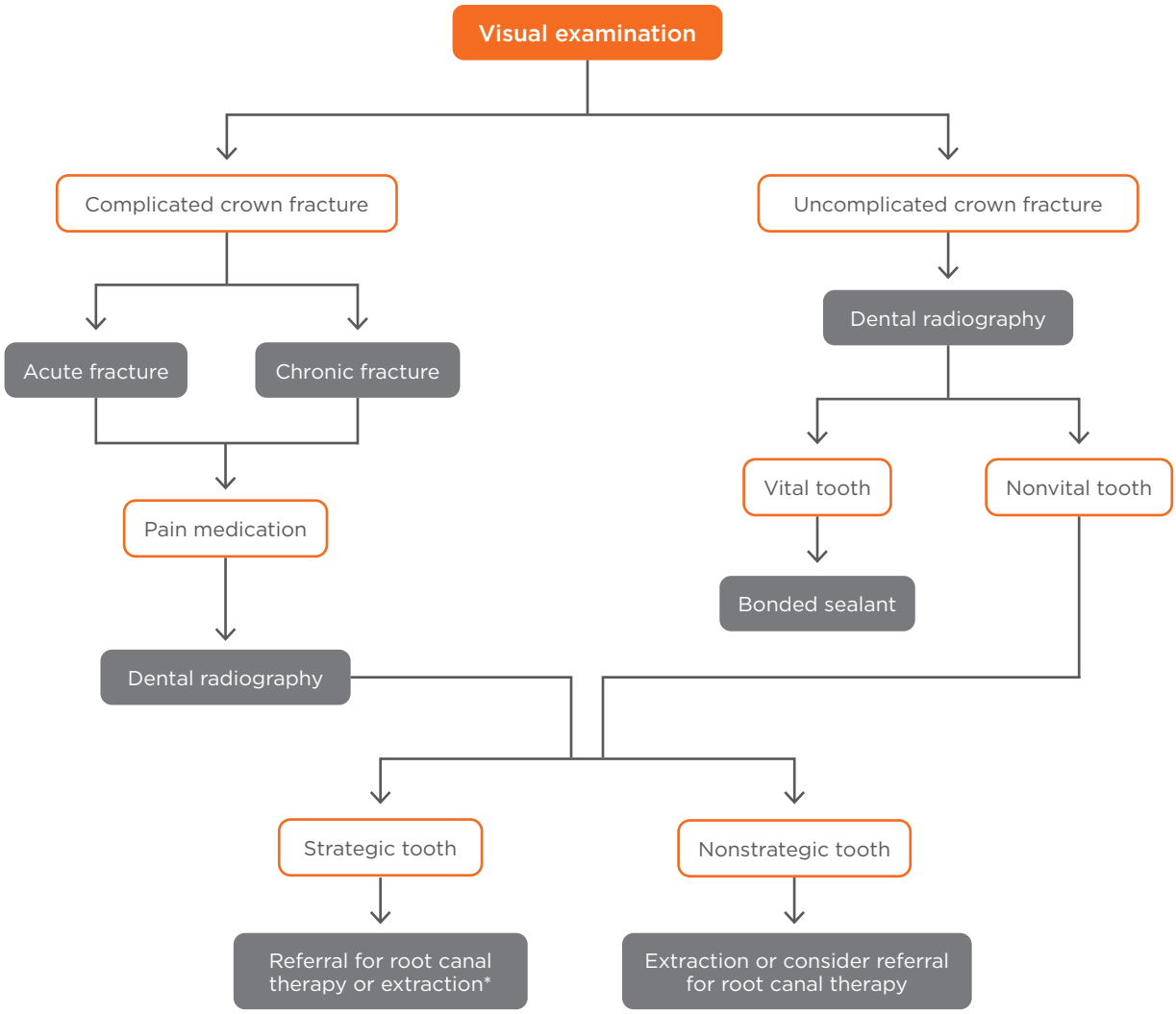
Uncomplicated Crown Fractures

In addition to the potential for pain and infection, a UCF creates a rough tooth surface, which increases plaque and calculus retention and thus hastens periodontal disease. Therefore, the author recommends treating all UCFs. Some dentists do not recommend treating chronic UCFs, as reparative dentin will likely have formed, blocking the sensitivity and pathway for infection. While this may be true, it takes at least a month for this process to begin.[7,11,23] Further, at least in humans, the variability of reparative dentin formation makes it impossible to know if the barrier formed is effective.[24]

For all the above reasons, once exploration has established that the pulp is not exposed and imaging has shown the tooth to be vital, the author recommends that all UCFs be treated with a bonded sealant.[25-27] Bonded sealants[15]:

- Decrease sensitivity
- Block the pathway for infection
- Smooth the crown of the tooth
- Decrease periodontal disease

These products are inexpensive and easy to learn to use in a short hands-on course or from journals/textbooks.[15,28]



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**Referral veterinary dentist may recommend vital pulp therapy or apexification for teeth with an immature apex.*

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Brook A. Niemiec

Dr. Niemiec is the chief of staff of Veterinary Dental Specialties & Oral Surgery, with 14 offices throughout the United States. He is a regular speaker on local, national, and international levels and was elected Clinical Instructor of the Year for the 2016 Western Veterinary Conference. He has authored many articles, chapters, and books and founded the veterinary dental telemedicine website vetdentalrad.com. Finally, he coordinates the San Diego Vet Dental Training Center, with 3 to 4 meetings per year covering basic and intermediate veterinary dentistry.