Management of dental trauma is often a team effort involving general dentists, along with one or more of the specialty disciplines. This issue of ENDODONTICS: Colleagues for Excellence will address the management of traumatic dental injuries from an endodontic perspective. Detailed clinical illustrations are provided to assist general practitioners in understanding how wound healing affects the pulp, so that accurate assessments of a trauma situation can be made.

**Levels of Treatment for Traumatic Dental Injuries**

Treatment of traumatic dental injuries can be categorized as primary, secondary and tertiary care. A *primary level of treatment* would involve urgent care provided soon after an accident in which dental injury has occurred. Such urgent care could include replanting an avulsed tooth, stabilizing luxated teeth or re-attaching a broken tooth fragment. Most often, these services are provided by general dentists, pediatric dentists, and oral and maxillofacial surgeons, either in hospital emergency rooms, dental offices or other clinics.

Three priority categories have been identified for dental trauma based on the effect time has on the outcome. *Acute priority* includes avulsion, alveolar fracture, extrusive and lateral luxation, and root fractures. These traumas respond most favorably if treated within a few hours. *Subacute priority* includes intrusion, tooth concussion, subluxation and crown fractures with pulp exposures. Delaying treatment several hours does not appear to affect the outcome of these injuries. Finally, *delayed priority* can be assigned to crown fractures with no pulp exposure, which appear to respond well even after more than a 24-hour delay in treatment. These guidelines were developed to provide information to help in treatment planning; obviously, primary treatment should be provided as soon as possible in any trauma situation.

Recognizing that treatment priority can be assigned to various dental traumas can lead to a more effective use of dental resources. The goal of the urgent care—whether it is acute, subacute or delayed—is to promote wound healing in damaged tissues. In minor injuries, e.g., tooth concussion, the primary treatment, such as adjusting any premature occlusal contact, is often all that is necessary. In most other cases of dental trauma, secondary, and possibly tertiary, treatment will be needed.

**Secondary level of treatment** for traumatic injuries includes:

1. Monitoring and evaluating the condition of the pulp and the supporting structures clinically and radiographically.
2. Endodontic therapy in situations where the pulp is not expected to survive (e.g., avulsed and replanted mature teeth) and in situations in which pulpal disease develops subsequent to primary treatment procedures.
3. Soft tissue surgery to repair damaged gingival and periodontal tissues that heal unsatisfactorily.
4. Definitive restorations of teeth with crown fractures in which the primary treatment goal was to protect the pulp.
5. In rare cases, decoronation of a tooth in a young patient to maintain alveolar bone integrity until a dental implant or fixed partial denture can be placed. Decoronation is a procedure in which the crown of an ankylosed tooth is resected to just below the crest of the alveolar bone and the root is left in the
A tertiary level of treatment may take place any time from a few years to many years after a patient has had primary and secondary levels of treatment. A wide variety of dental procedures would constitute tertiary treatment, including dental implants, fixed partial dentures, orthodontic treatment or autotransplantation.

The Role of Pulp in Dental Trauma

As can readily be seen from the preceding description of the management of traumatic dental injuries, general dentists and various specialists often need to work as a team to accomplish the necessary tasks. It is understood that not all patients with a dental injury will need to go through all three levels of care; some heal completely after primary or secondary care, but many go through years of procedures. The goal for all dentists involved in caring for patients with dental injuries is to help their patients get the best possible short- and long-term result.

Endodontists are by training and experience prepared to function as productive members of treatment teams managing trauma patients. Since the pulp invariably plays an important role in the outcome of dental trauma, understanding how wound healing affects the pulp is important in assessing a trauma situation and projecting the prognosis and possible outcome. Endodontists can provide expertise in making these assessments.

Along with pulp biology, the cementum-PDL complex and the interaction between the status of the pulp and the affect pulp space infections have on root and bone resorptions are essential components of managing dental trauma. Based on their expertise in this area, endodontists can contribute valuable insight into successful treatment planning, in addition to providing essential care for traumatized teeth.

Publications in recent years have provided considerable evidence for selecting treatment, much of which has been used as a basis for the American Association of Endodontists’ treatment guidelines. Following are clinical case illustrations describing current treatment recommendations based on the best available evidence.

Clinical Examples

Crown Fractures

The endodontic consideration in crown fractures is to protect the pulp in young, developing teeth. In fully formed teeth, root canal treatment is often a practical choice.

A fractured tooth in a child can be restored by bonding the broken tooth fragment to the tooth; this is also a good way to protect the pulp to allow continued root formation (Fig. 1).

When a crown fracture exposes the tooth pulp in a child with an immature apex and a vital pulp, the goal of treatment should be to protect the exposed pulp with a material that is biocompatible with pulpal tissues. For years, calcium hydroxide has been the material of choice for vital pulp therapy, and it continues to be used with good success. Recently, a new material, mineral trioxide aggregate (MTA), has been developed for various endodontic situations including pulp protection. MTA provides a very good seal against microleakage and is well tolerated by pulpal tissues (Fig. 2).

Root Fractures

Because they are an infrequent occurrence (approximately five percent of all traumatic dental injuries), horizontal root fractures are frequently mismanaged, resulting in either unnecessary extractions or root canal treatment. Most teeth with root fractures will recover successfully following repositioning of the coronal segment (if displaced) and stabilization for
four to six weeks. Stabilization of a root-fractured tooth can be done using a functional, nonrigid splint (Fig. 3; also see Dental Splints inset below).

In some cases, the pulp in a root-fractured tooth becomes necrotic and infected. When that happens, root canal treatment can save the tooth. The necrotic pulp tissue is usually confined to the coronal part of the tooth and root canal treatment can be confined to the coronal segment only; the apical segment can be left untreated (Fig. 4).

**Luxation Injuries**
The most common dental injuries are the various types of tooth luxations. From least to most severe, they are:

- **Concussion**—the tooth is sensitive to percussion but it is not excessively mobile.
- **Subluxation**—the injury has left the tooth with increased mobility.
- **Extrusive luxations**—the tooth is partially extruded in the socket and as a result, is also very mobile.
• **Lateral luxation**—the tooth has been displaced horizontally; often it is “locked” in position and has no mobility.

• **Intrusive luxation**—perhaps the worst of all dental injuries, the tooth is forced into the alveolus and as a result, appears ankylosed with no mobility.

With the exception of concussion injuries, luxation injuries frequently result in pulp necrosis requiring root canal treatment (Fig. 5).

### Avulsions

The best outcome for a tooth avulsion is when the tooth can be replanted within a few minutes after the accident. A very high percentage of teeth replanted within 15 minutes will have the PDL restored within a few weeks. The pulp, however, cannot be expected to survive, so root canal treatment becomes a very important component of successful treatment. The only exception to routine root canal treatment of replanted teeth is the case of a very immature tooth in which revascularization of the pulp is possible and desirable.

Root canal treatment should ideally be done on a replanted tooth during the second week after replantation. Using calcium hydroxide for a short period of time (up to one month) before filling the root canal will help disinfect the root canal system. Stabilizing the tooth with a functional, nonrigid splint for two to three weeks will assist in re-establishing the PDL support of the tooth (Fig. 7).
If an avulsed tooth has been left dry for more than one hour, the odds of restoring the PDL are very poor. It may, however, still be worthwhile to replant such a tooth, because in spite of the likely ankylosis and resorption, the patient could get several years’ use of the tooth. The procedure is relatively simple (Fig. 8).

**Alveolar Fractures**

Fractures involving the alveolar ridges can have adverse effects on the teeth located in the fracture lines. It is important to examine and monitor the condition of the pulp in such teeth; if pulp necrosis is diagnosed, root canal treatment is indicated (Fig. 9).

**Conclusion**

Traumatic dental injuries present difficult problems for both patients and their dentists. Current evidence allows the dental health care provider to manage situations that, in the past, often resulted in crippled dentition and unsightly appearance. Appropriate treatment can turn what at first glance looks like a hopeless situation into a very satisfactory outcome for patients. The endodontic specialist can play an important role in the team approach to treating patients with traumatic dental injuries.
Reading List


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