Multidisciplinary Approach to Dental Trauma

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> "Sometimes when things are falling apart, they may actually be falling into place."
> —J. Lynn

Long-awaited summers in Indiana begin with warm sunshine, blooming peonies, and for dental professionals, with the unavoidable Saturday morning phone call: "My child was hit by a baseball and their front tooth fell out!"

Avulsions of permanent teeth account for 0.5-16 percent of dental trauma cases. The American Association of Endodontists (AAE) and the International Association of Dental Traumatology (IADT) developed the Guidelines for Management of Traumatic Dental Injuries[1,2] using literature and expert opinions based on current best evidence and practices.

Avulsion is a significant dental injury. Multidisciplinary team approach, combining the efforts of a general or pediatric dentist, an orthodontist, an endodontist, and other dental and medical specialists is needed to successfully diagnose, manage, and monitor traumatic injuries of avulsed permanent teeth.

Replantation of a permanent tooth is the common treatment of choice. The prognosis of replantation is dependent on two main factors: the maturity of the root (open or closed apex) and the condition of the periodontal ligament (PDL) cells, which is dependent on the extra-alveolar dry time and the storage medium used prior to replantation.

Clinically, the PDL cells condition is divided into three groups in relation to the prognosis:

1. The PDL cells are most likely viable when the tooth is replanted within 15 minutes.
2. The PDL cells may be viable, but compromised, when the tooth has been stored in the appropriate medium (milk, HBSS, saliva, or saline) and the extra oral dry time (EODT) has been less than 60 minutes.
3. The PDL cells are most likely non-viable when the EODT has been more than 60 minutes, regardless of the storage medium.

AAE and IADT Treatment Guidelines for Avulsed Permanent Teeth with a Closed Apex[1,2]

In addition to studying the outlined recommendations, there are several details to highlight:

- Closed apex is defined as having an apical foramen less than 1 mm in size.
- If the tooth has already been replanted, leave it in place.
- If the tooth is malpositioned, correct with slight digital pressure.
- If the tooth was replanted in a wrong socket, consider repositioning into the correct socket within 48 hours after the incident.
- Keep the tooth moist, do not handle or brush the root surface, and hold by the crown only.
- Gently clean debris from the root surface and rinse with HBSS or saline.
- Socket: gentle aspiration and saline irrigation without curettage.
- Soft tissue lacerations should be sutured.

Critical time is one hour:

1. If the tooth is in physiological storage medium and extra oral dry time (EODT) is less than one hour: Replant immediately.
2. EODT is more than one hour: Soak in an accepted dental fluoride solution, rinse and replant.

Administer local anesthesia without vasoconstrictor, if possible, although regional anesthesia (e.g., infraorbital nerve block) with a vasoconstrictor is acceptable for severe injuries.

Stabilize with a passive flexible splint (wire of a diameter up to 0.016" or 0.4 mm or a nylon fishing line (0.13-0.25 mm) for 2 weeks. Nylon splints are not indicated for children with only few permanent teeth because of the risk of loosening it.

Splint should be bonded away from the gingiva and preferably on the labial surface to avoid occlusal contacts. A more rigid splint left for four weeks is indicated with an alveolar or jaw bone fracture.

Initiate root canal treatment within two weeks after replantation.

Administer age and weight appropriate antibiotics. Amoxicillin or penicillin are the first choice due to their effectiveness and low rate of side effects. Doxycycline is appropriate for patients older than 12 years because of its anti-microbial, anti-inflammatory and anti-resorptive effects, while risk of discoloration of the teeth should be considered for patients younger than 12.

Referral to patient's physician for a tetanus booster as needed.

AAE Treatment Guidelines for Avulsed Permanent Teeth with an Open Apex

- Open apex is defined as having an apical foramen more than 1 mm in size (divergent).
- Rinse the avulsed tooth with saline or HBSS.
- Teeth with an open apex and greater than one hour EODT: soak in doxycycline solution (1 mg/200 ml saline) for five minutes.
- Rinse the clot from the socket.

Flexible splint for two weeks. Short immature teeth can be splinted for longer than two weeks. Antibiotics prescription, tetanus booster as needed.

Pulp revascularization with further root development is the goal of replanting avulsed teeth in children. Consideration should be given to the risk of external infection-related (inflammatory) root resorption, which can be very rapid, against the chances of revascularization.

Once pulp necrosis is diagnosed, apexification, pulp revitalization/revascularization, or root canal treatment are indicated.

Clinical and radiographic monitoring of open apex teeth should be more frequent because of the risk of inflammatory and replacement resorption at two weeks, one month, two months, three months, six months, one year, and yearly thereafter for at least five years.

Endodontic Considerations

When endodontics is indicated (teeth with closed apices), it should be initiated within two weeks. Rubber dam should be used and stabilized on the uninjured teeth.

Calcium hydroxide is the recommended intracanal medicament for up to one month followed by root canal obturation. If corticosteroid or corticosteroid/antibiotic mixture is used as an anti-inflammatory and anti-resorptive intracanal medicament, it should be placed immediately or shortly after replantation and left for at least 6 weeks. Corticosteroid intracanal medicament can be ordered from compound pharmacies.

Some components of intracanal dressings, such as tetracycline and minocycline, can cause tooth discoloration and should be avoided in the coronal segment.

Core outcome set

The IADT developed a core outcome set (COS) for traumatic dental injuries (TDI) in children and adults:

Generic outcomes:

1. Periodontal healing
2. Pulp space healing (for open apex teeth)
3. Pain
4. Discoloration
5. Tooth loss
6. Quality of life
7. Esthetics (patient perception)
8. Trauma-related dental anxiety
9. Number of clinic visits

Injury-specific outcomes:

1. Infra-occlusion (replacement resorption, ankylosis)

Trauma Related Dental Discolorations

Three general types:

Pink: internal hemorrhage or internal coronal resorption. The blood hemoglobin breakdown products enter the dentinal tubules and stain the dentin. Evaluation for a need in endodontics is indicated.

Yellow: pulp canal obliteration or calcific metamorphosis. This pulp chamber calcification is caused by excessive dentin apposition by the odontoblasts that may be accelerated because of trauma.[3] Consequently, there is a decrease in the translucency of the tooth resulting in a yellowing to dark discoloration.[3] Management includes evaluation for vitality and periapical pathology with a CBCT as needed. Cosmetic options vary from external or internal bleaching to veneer or crown.

Dark (light brown to gray and black): different stages of pulp necrosis.

The study by Holan G.[4] of dark coronal discoloration in primary incisors after traumatic dental injuries summarizes the theories of this type of discoloration: hemosiderin or necrotic pulp toxins stain the dentin with the formation of a surface film (of iron) on the dentin; microorganisms produce hydrogen sulfide which discolors the tooth. The author concluded that in these cases the color is a sign of pathology (i.e., pulp necrosis). However, because most of the discolored maxillary primary incisors remain asymptomatic, he does not recommend removal of the pulp without clinical evidence of pulpal infection. The hypothesis suggests that pulp in primary asymptomatic teeth is necrotic, but not infected, or infected by low virulence microorganisms. While this hypothesis might be appropriate for the primary dentition, for permanent teeth with dark discoloration and pulpal pathology, endodontic treatment is indicated.

Conclusion

Multidisciplinary approach to dental trauma with efficient and effective communication between all the dental team members ensures the best possible management and outcome for the patient, who underwent a stressful health related event. Keeping up with the evidence-based research and clinical studies of dental trauma presents as an ultimate goal for the dental professionals, who strive to provide excellent patient care.

References

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ABOUT THE AUTHORS

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Case Report 1
Courtesy of Dr. Irene Nosrati

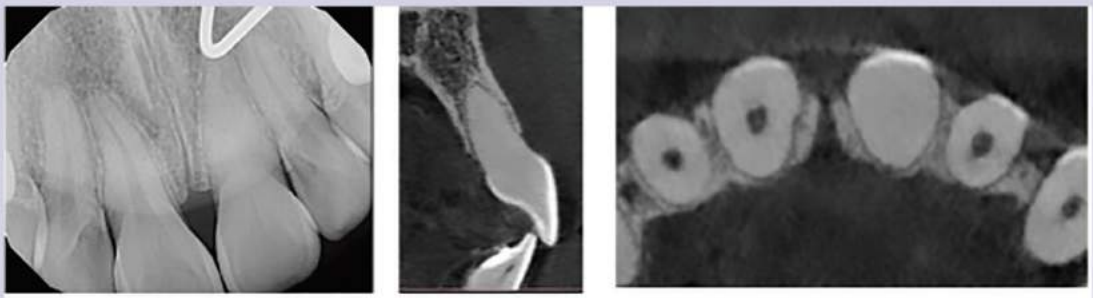
Avulsion of a permanent anterior tooth with an open apex and less than 60 minutes EODT

A 10-year old boy presented to the general dentistry practice 30 minutes after a tooth #9 avulsion injury in a trampoline park with his tooth in a Ziploc bag. The tooth was determined to have an open apex. It was immediately rinsed and soaked in saline. Under the local anesthesia with 3 percent mepivacaine, the socket was rinsed with saline, and the tooth was replanted and held with finger pressure in place. Adequate placement was confirmed radiographically. Due to the malposition of the teeth, a wire splint was created only from #8-#10 and bonded on the facial surfaces. Glustitch was placed on the laceration. Amoxicillin and Peridex were prescribed. The patient was referred to a physician for further evaluation of the fall and for the need for a tetanus shot. The patient was instructed to avoid contact sports, eat soft foods, and brush gently. The splint was removed at three weeks (due to patient's availability). One year after the incident, vitality of the tooth was verified, it responded positively to Endo Ice. Two and a half years post avulsion, the patient started Invisalign treatment to correct the remaining malocclusion. Treatment was only 16 weeks long due to the expansion accomplished with the RPE expander and the lingualization achieved with only the forces of the lip. The replanted tooth remained vital, asymptomatic, with no discoloration. Evaluation over time, and up to four years post op (as of the writing of this article), shows a closed apex with complete obliteration of the pulpal canal and no periapical pathology.

Case Report 2
Courtesy of Dr. Irene Nosrati

Internal Bleaching of a Vital Tooth with History of Trauma and Calcific Metamorphosis based on the technique described by David Keinan, Eugene A. Pantera Jr.[5]

A 23-year old female presented with a chief complaint of a dark front tooth, history of trauma at the age of eight due to falling. She tried external bleaching without satisfactory results. Clinical and radiographic evaluation revealed an asymptomatic vital tooth with calcific metamorphosis. Internal bleaching was recommended based on the literature. Tooth was matched to shade A2, and remaining teeth were matched to shade B1. No anesthetic was administered. Tooth was accessed from the lingual, the height on the CT from incisal edge to top of crestal bone was 11.7mm with the goal not to go deeper than that. Bond and flowable composite liner were placed apically to prevent the whitening material from leaking into the calcified canal. Ultradent Opalescence Endo (35 percent hydrogen peroxide) was placed in the chamber, covered with a cotton pellet and Cavit. The process was repeated after one week for another week, the bleaching material was removed and the access sealed with permanent composite. The patient was asymptomatic and very happy with the results.



X-Ray and CT Pre-Op

Before **2 Weeks of Treatment**