

Managing Injuries to the Primary Dentition

Dennis J. McTigue, DDS, MS

KEYWORDS

- Dental injuries • Primary teeth • Avulsion • Luxation
- Intrusion • Crown fractures • Root fractures

Dental injuries to preschool children can be challenging to manage because of the child's and parents' anxiety and the potential for damage to the developing permanent tooth buds. A conservative treatment approach that minimizes the potential emotional trauma to the child while prioritizing the healthy development of the permanent incisors is advised.

ETIOLOGY AND EPIDEMIOLOGY

Differences in study design and sampling criteria make it difficult to accurately determine the incidence and prevalence of traumatic injuries to the primary dentition. Reports indicate that 30% to 40% of preschool children suffer injuries to the primary dentition with the prevalence equal between boys and girls.^{1,2} This probably underestimates the actual occurrence of trauma as many apparently minor injuries go unreported.

The teeth most commonly injured are the maxillary central incisors.^{2,3} Predisposing factors include increased overjet and incompetent lip closure. Falls are the most common cause of injuries to young children particularly in the toddler stage as they develop mobility skills. A disturbing cause of oral injuries in children is child abuse. Up to 75% of all injuries of abused children occur in the head and neck region.^{4,5} Signs of abuse include tears of labial frena, injuries in various stages of healing, and injuries whose clinical presentation is inconsistent with the history provided by the caregiver.⁶ Other signs include bruising of the labial sulcus in patients who are not walking, bruising of the soft tissues of the cheek or neck (accidental falls are more likely to bruise the forehead or chin), and human hand marks or pinch marks on the cheeks and ears.⁷

EXAMINATION AND DIAGNOSIS

History

A thorough medical and dental history is required to accurately diagnose the injured child's condition. The potential severity of the injury is determined by knowing

Division of Pediatric Dentistry, Ohio State University College of Dentistry, 305 W. 12th Avenue, Columbus, OH 43210, USA

E-mail address: mctigue.1@osu.edu

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when, where, and how it occurred. The time elapsed since the injury affects the treatment and, most often, the prognosis. Knowledge of the mechanism of the injury helps determine its severity and the risk of associated injuries.

The child's medications and drug allergies should be determined with particular attention paid to immunizations. Tetanus prophylaxis is significant when the child suffers wounds that are contaminated by dirt as can occur with avulsions, intrusions, or deep lacerations. Reports indicate that increasing numbers of children in the United States are not getting appropriate immunizations because their parents believe that vaccinations are harmful or because of their growing cost. Children can achieve immediate passive immunity to tetanus with an injection of tetanus toxoid and tetanus immune globulin so any question about the adequacy of a child's tetanus protection should prompt a medical referral.⁸

Severe head injury should also be ruled out. If there is a history of loss of consciousness, confusion, vomiting, headache, personality change, nausea, seizure or disorientation, patients should be referred for immediate neurologic evaluation.⁹⁻¹¹

Clinical Examination

It is essential that the clinician conduct a comprehensive and thorough extraoral and intraoral examination. Many clinicians find it helpful to use a trauma assessment form to record data and to organize the management of care (**Fig. 1**). An injured preschool child is frequently unable to cooperate and lay passively in a dental chair for the examination. In some cases a thorough examination can be obtained by using the knee-to-knee technique with the parent or an assistant (**Fig. 2**). On rare occasions it may be necessary to use techniques of protective stabilization using a restraining device (**Fig. 3**). Informed consent from the parent is required before protective stabilization is employed.¹²

Extraoral examination

All extraoral injuries to the head and neck region, including bruises, contusions, swelling, and lacerations, should be recorded. Facial bone fractures can be detected by careful palpation to determine discontinuities. Mandibular function and range of motion in all excursive movements should be checked. Neck stiffness or pain can signal cervical spine injury and immediate medical referral is indicated.


Intraoral examination

A soft-tissue examination should be completed to rule out lacerations and perforations. Careful attention should be paid to the presence of foreign bodies embedded in lacerated tissues as lack of thorough debridement can cause chronic infection and scarring.


Each tooth should be checked for mobility, fracture, and dislocation. Gently percussing each tooth is an excellent way to detect periodontal ligament (PDL) inflammation, though a frightened child provides an exaggerated response to any stimulus. For this reason, vitality tests are not routinely performed on primary teeth.

Radiographic examination

Radiographs are critical to an accurate diagnosis of an injured tooth. Films taken soon after an injury detect acute changes, such as dislocations, root fractures, foreign bodies, alveolar fractures and, possibly, injuries to developing permanent teeth. Follow-up radiographs taken at 3 to 4 weeks postinjury can help detect inflammatory root resorption, apical osteitis and calcific changes in the pulpal lumen.



Trauma Form



Date of treatment _____
 Doctor treating _____

Patient's Name _____
 Medical Number _____
 Age _____ yrs _____ mos
 Sex male female
 Race Cau Afr-Amer
 Asian Native Amer

Date of Injury _____
 Time Since Injury _____

Tetanus Concern No Yes
 Date of Last Booster _____

How Injured Fall Hit MVA
 Skateboard Other

EXTRAORAL ASSESSMENT

CNS Status Normal
 Dizziness Seizure
 Headache Other
 Unconscious Nausea

Hard Tissue Normal
 Infection Cranial Fx
 Mand Fx Max Fx
 Zyg Fx

Soft Tissue Normal
 Laceration Abrasion
 Contusion Infection
 Embedded Material
 Swell Other

INTRAORAL ASSESSMENT

Hard Tissue Alveolar Fx Deglove
 Other

Soft Tissue Lips Tongue
 Buccal mucosa Frenum
 Gingiva Palate

Dental Occlusion: Normal Abnormal

Classification: Molar _____ Cuspid _____
 Overjet _____ mm Overbite _____ %
 Openbite _____ X-bite _____

Jaw Opening: WNL Limited

Radiographs Periapical Occlusal
 Lateral Anterior Panorex
 Soft Tissue Lat Jaw Film
 Other _____

Behavior problem Yes No

Radiograph Findings: _____

Tooth No.					
Concussion					
Class I Fx					
Class II Fx					
Class III Fx					
Intrusion					
Extrusion					
Avulsion					
Subluxation					
Lateral luxation					
Root Fx					
Fragments					
Other					

Tooth No.					
Exposure					
Hemorrhage					
Heat					
Cold					
Contamination					
Vitalometer					
Percussion					
Mobility					

SUMMARY & DIAGNOSIS

Crown _____
 Pulp _____
 Root _____
 Periapical _____

TREATMENT

Soft tissue Suture Other _____
 Pulp Cvek Direct Pulp Cap
 CaOH Formo Dycal
 Restoration ZOE Composite
 Ketac
 Splinting No Yes, type _____

Medication Antibiotic _____
 Analgesic _____
 Other _____

Consult requested No Yes

RECALL FOLLOW-UP

1 week 2 weeks 3 weeks
 month 6 weeks 2 months
 None Other _____

Fig. 1. Trauma assessment form.

The standard occlusal view is a simple and reliable exposure to detect injuries to anterior primary teeth (Fig. 4). In cases of multiple tooth injuries or suspected root fractures, additional occlusal views taken from slightly different horizontal angles can improve the accuracy of the diagnosis. A lateral anterior view can also be helpful to determine the relationship between an intruded primary incisor and its permanent successor, or to localize foreign bodies embedded in soft tissues (Fig. 5). Exposure times will vary according to the radiographic equipment used but doubling the exposure time is usually adequate for the lateral anterior film. A reduction to one third of the normal exposure time may be necessary to secure an adequate soft-tissue film.



Fig. 2. Knee to knee examination technique.

TREATMENT

As noted earlier, the most important consideration in managing injured primary teeth should be the well being of the developing permanent successors. Parents should be thoroughly informed of the intimate relationship between the apex of the primary incisor and the developing permanent tooth bud. The benefits of saving an injured primary tooth versus the potential risk of damage to the developing permanent tooth should be explained and documented. This understanding is integral to acquiring valid informed consent from a distraught parent requesting heroic measures to save an injured primary tooth.

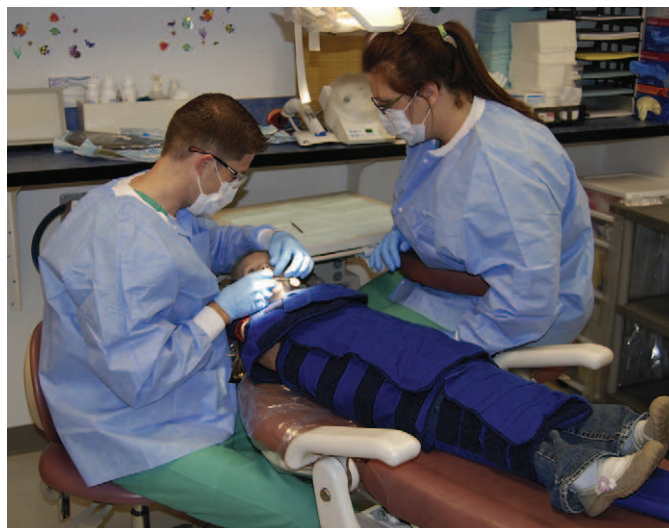


Fig. 3. Papoose Board (Olympic Medical Corp., Seattle, WA).



Fig. 4. Occlusal radiograph.

Luxation Injuries

Luxation injuries imply damage to the PDL and are the most common injuries in the primary dentition.¹³ This frequency is because the supporting tissues in young children are pliable and allow the teeth to move, frequently without fracturing.

Concussion

A concussion injury transmits the force of the blow to the PDL but causes no mobility. The only clinical sign will be tenderness to percussion. Treatment is rarely needed, but adjusting the occlusion may relieve symptoms in a hypersensitive child. The concussed tooth should be monitored for several months to rule out potential complications.

Subluxation

The subluxated tooth has increased mobility but is not displaced from its socket. Sulcular bleeding may be present. Parents are instructed to keep the area clean and to have the child avoid incising on the involved teeth for 2 weeks. Subluxation is a common injury in the primary dentition and return to normal function occurs in the majority of cases, though close monitoring for pathologic sequelae is indicated.

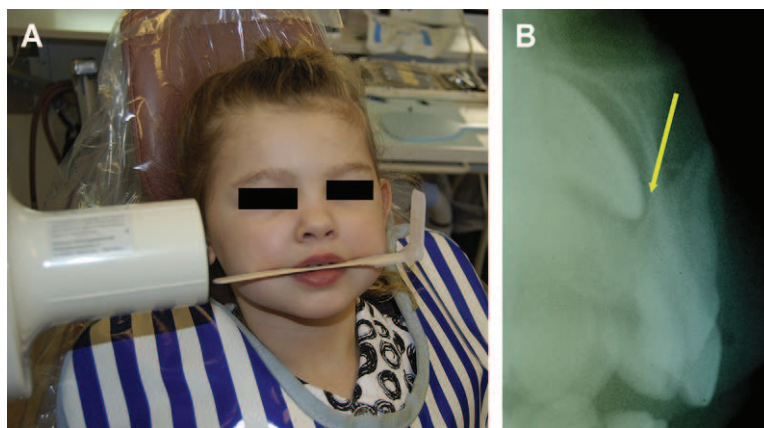


Fig. 5. Lateral anterior radiograph. (A) Clinical view. (B) Radiographic image demonstrating lack of contact between intruded primary incisor and the developing permanent successor (arrow).

Lateral luxation

This is a more serious injury with the tooth displaced out of its normal position, frequently in a palatal direction. Radiographs are indicated to rule out root fractures and to indicate the position of the root in the alveolus. If the tooth is not interfering with the occlusion it may be allowed to reposition spontaneously.¹³ Some authors recommend that when occlusal interference does occur the tooth should be manually repositioned and splinted for 2 to 3 weeks.¹⁴ Owing to the increased risk of pulpal necrosis and to the potential for damage to the developing permanent successor, however, this author recommends extracting severely displaced primary incisors.^{15,16}

Intrusion

Intrusion of a primary incisor implies a high risk of damage to the permanent successor and the injured child's parents should be so advised at the time of injury.¹⁷ Conservative treatment is indicated as damage to the permanent tooth bud can occur during extraction of the intruded primary incisor.¹⁸ A lateral anterior radiograph (see **Fig. 5**) is taken to determine the position of the intruded primary incisor relative to the developing tooth bud. The majority of intruded incisors are displaced labially and away from the tooth bud (see **Fig. 5B**). These incisors are allowed to re-erupt spontaneously anticipating that most will survive without complications.¹⁹ If the intruded tooth impinges on the developing tooth bud it is carefully extracted with the forceps gently engaged on the tooth's mesial and distal surfaces.¹⁵ The great majority of intruded primary incisors will partially or completely re-erupt within 4 to 5 months (**Fig. 6**).^{19,20}

Extrusion

The extruded tooth is displaced centrally from its socket and has increased mobility. Radiographs should be taken to rule out other injuries. Treatment is determined by the degree of extrusion, mobility, and the child's ability to cope with treatment. Minor extrusions can be repositioned, but severe extrusions should be extracted.¹⁵

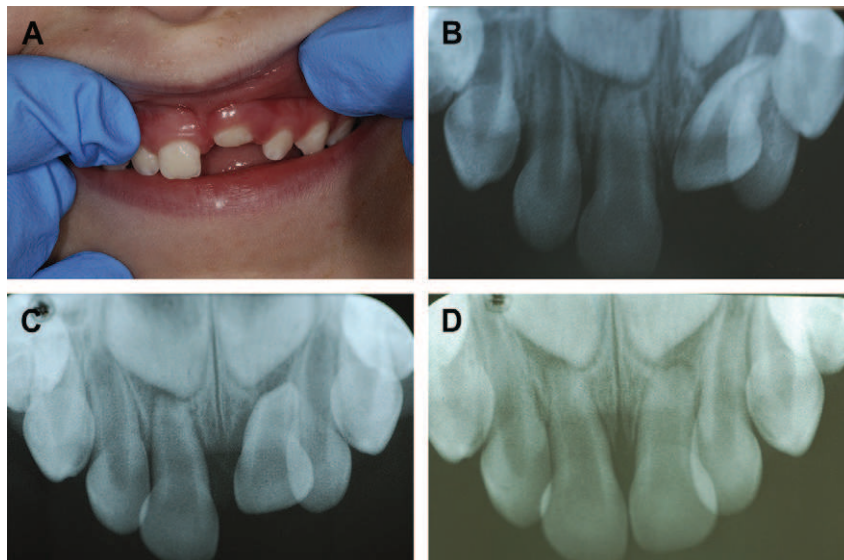


Fig. 6. Intruded primary incisor. (A) Day of injury. (B) Radiograph on day of injury. (C) 3 weeks postinjury. (D) 5 months postinjury.

Avulsion

Avulsed primary incisors should not be replanted because of the risk of damage to the permanent successors.^{15,17,21,22} Radiographs are indicated to confirm that the tooth is not intruded. Losing anterior primary teeth is often more traumatic for the parents than it is for the injured child and the clinician must thoroughly explain the rationale against replantation. Once the primary canines have erupted, there is little concern about loss of space in the anterior segment with early loss of primary incisors.²³ If esthetics is a major concern, a fixed or removable partial denture can be fabricated (**Fig. 7**).

Crown Fractures

Any blow that causes a tooth to fracture is likely to also cause a luxation injury. The clinician is advised to carefully examine all fractured teeth and to manage associated luxation injuries as noted previously.

Uncomplicated crown fractures

These fractures include the enamel only, or enamel and dentin, but without a pulp exposure. Periapical radiographs are indicated to rule out other injuries and to assess the degree of physiologic root resorption. In minor fractures, the sharp edges can be smoothed with sandpaper disks or finishing burs. In larger fractures, including the incisal angle, adhesive resin-based composite restorations or preveneered stainless steel crowns may be indicated.²⁴

Complicated crown fractures

These injuries involve a pulp exposure and treatment is predicated on the life expectancy of the tooth and the child's behavior (**Fig. 8**). In young children with immature

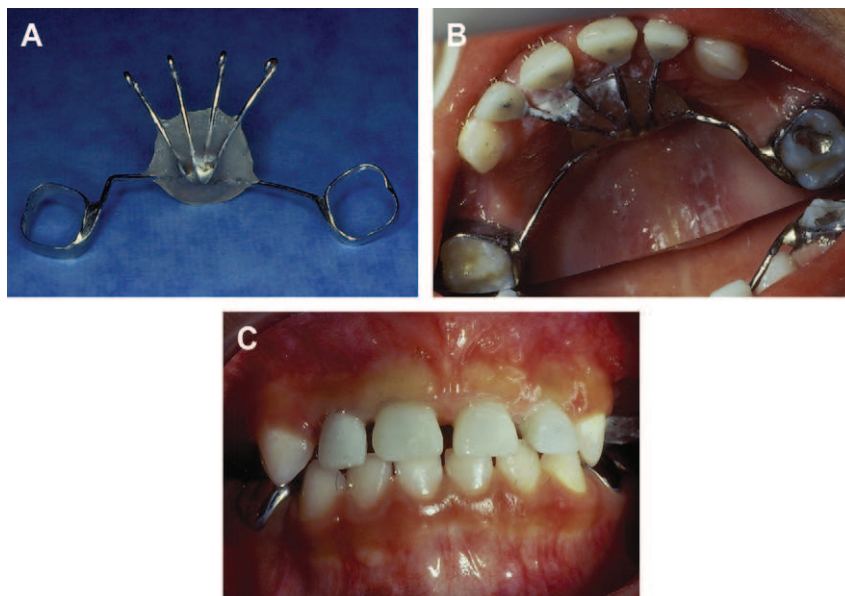


Fig. 7. Pediatric fixed partial denture. (A) Before placement of celluloid crown forms. (B) Immediate postinsertion demonstrating composite resin extruding from crown forms. (C) Facial view of finished appliance. (Courtesy of James W. Presich, Mishawaka, IN.)



Fig. 8. Complicated crown fracture.

roots (less than 3 years) a pulpotomy is indicated to preserve the pulp vitality in the root.²⁵ When the root is mature, a complete pulpectomy with a resorbable paste, such as zinc oxide and eugenol, may be performed. Treatment of complicated crown fractures should be completed as soon as practical after the injury, usually within 1 or 2 days. As noted earlier, the child must be controlled to complete the pulpal therapy and to restore the tooth, often indicating sedation²⁶ or protective stabilization.¹² Parental informed consent is required for these management techniques.

Crown/Root Fractures

Primary teeth with fractures that extend through the crown to the root should be extracted. A radiograph is indicated to assess the degree of damage. To avoid injuring the developing tooth bud, root fragments should be left to resorb spontaneously if they cannot be extracted easily.¹⁵

Root Fractures

When primary roots fracture in the apical third, the coronal fragment may not be displaced and may have adequate stability to allow its retention in the mouth. If the coronal fragment is displaced it should be extracted and the apical fragment left to resorb spontaneously.¹⁵

SEQUELAE OF INJURIES TO THE PRIMARY DENTITION

Pulpitis

Pulpitis is the tooth's initial response to trauma and it accompanies almost every injury. Signs include sensitivity to percussion and capillary congestion that may be clinically apparent from the lingual surface of the tooth using transillumination. Pulpitis may be reversible in minor injuries or may progress to irreversible pulpitis and pulp necrosis.

Pulp Necrosis

Injured pulps may lose their vitality either because of damage to the vascular tissue at the apex and the resulting ischemia or because of necrosis of exposed coronal pulp tissue. If the necrotic pulp becomes infected with oral microorganisms, either caused by luxation of the root and ingress through the lacerated PDL or by way of an exposed

pulp, pain and root resorption can occur. Once the inflammatory exudate vents to the oral cavity, usually through the thin labial alveolar plate, the condition becomes chronic and painless. Extraction is indicated to prevent damage to the permanent successor. The necrotic pulp may remain asymptomatic, clinically and radiographically, when it is not infected.

Tooth Discoloration

Injuries to the primary incisors frequently cause tooth discoloration (**Fig. 9**). Blood vessels within the pulp chamber can rupture depositing blood pigment in the dentinal tubules. This blood pigment may resorb completely or can persist to some degree throughout the life of the tooth. Teeth that discolor are not necessarily necrotic, particularly when the color change occurs within a few days of the injury. However, teeth with dark discoloration that persists for months after the injury are likely to be necrotic, but may remain asymptomatic.²⁷

In healthy children, tooth color alone does not dictate treatment. Other signs or symptoms of infection, such as periapical radiolucency, pain, swelling, parulis, or increased mobility, should be detected before the tooth is extracted (see **Fig. 9B**).

Inflammatory Resorption

Inflammatory resorption can occur internally or externally. It is related to an infected pulp and an inflamed PDL. It can resorb roots quickly and the inflammatory process can damage developing teeth, so extraction of the offending tooth is indicated.

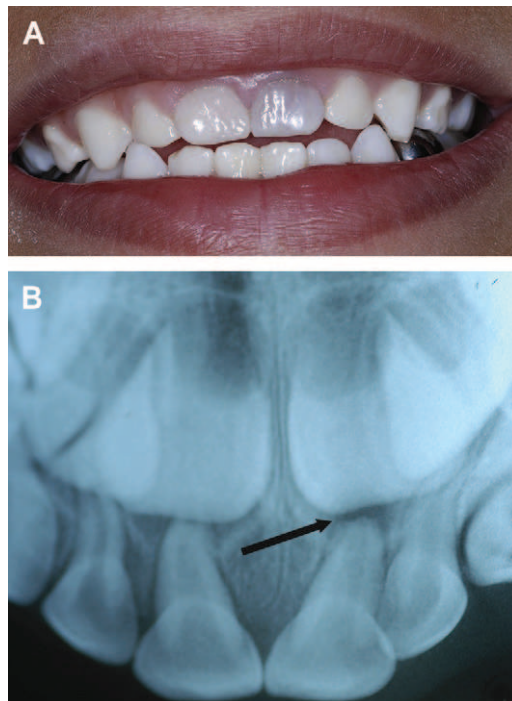


Fig. 9. Tooth discoloration. (A) Discolored primary incisor. (B) Periapical radiolucency (arrow).



Fig. 10. Permanent incisors damaged secondary to trauma to their primary predecessors.

Pulp Canal Obliteration

Pulp canal obliteration is a common finding in luxated primary incisors, particularly when the injury occurred before completion of the tooth's root development. The entire pulp chamber and canal appear radiopaque in radiographs and the crown may have a yellowish color. The process of accelerated dentinal apposition in pulp canal obliteration is not well understood but these teeth tend to resorb normally and treatment is usually not indicated.²⁸

Injuries to Developing Teeth

As noted throughout this article, the close proximity of the apices of primary incisors to the developing tooth buds of their permanent successors creates a potential for damage to the latter when the former are injured. The greatest risk for injuries to permanent teeth exists when the primary teeth are intruded or avulsed and before 3 years of age, when the permanent tooth crowns are calcifying.^{17,29} White or yellow-brown discoloration is the most common deformity but enamel hypoplasia, crown and root dilacerations and ectopic or delayed eruption have all been reported (**Fig. 10**).^{30,31}

SUMMARY

The management of injuries to the primary dentition is complicated by the child's age, ability to understand and cooperate for treatment, and by the potential for collateral damage to the developing permanent tooth buds. Clinicians treating children should be readily available after hours to provide care. Treatment priorities should include adequate pain control, safe management of the child's behavior, and protection of the developing permanent teeth.

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