Initial Assessment and Management of Pediatric Dental Emergencies

In the middle of a busy shift in the ED, a nurse tells you she has just placed a 5-year-old boy with a mouth injury in an examining room. The boy reports that less than an hour ago he was playing basketball and lost a tooth when he was accidentally “elbowed” by his older brother. His mother reports that an adolescent nephew had a similar incident last year, and the dentist recommended that they place the tooth in milk, and she produces a small jar of milk containing the lost tooth. On physical examination, the child denies having any jaw pain or swelling, but the socket where the central maxillary incisor should be is empty and oozing blood. Can this tooth be saved? What sort of dental injuries might this child have suffered in addition to the lost tooth? How does the management of dental trauma change in light of a patient’s age or the location of the traumatized tooth? Is there something else a parent should have done prior to arrival in the ED to help save the tooth?

Meanwhile, one of your patients has just been taken to the cardiac catheterization laboratory since you diagnosed his myocardial infarction. After intubating a woman with lung cancer and respiratory failure secondary to acute H1N1 influenza, her condition has finally stabilized. You think you’ve caught a break until a 4-year-old boy reports that less than an hour ago he was playing basketball and lost a tooth when he was accidentally “elbowed” by his older brother. His mother tells you that an adolescent nephew had a similar incident last year, and the dentist recommended that they place the tooth in milk, and she produces a small jar of milk containing the lost tooth. On physical examination, the child denies having any jaw pain or swelling, but the socket where the central maxillary incisor should be is empty and oozing blood. Can this tooth be saved? What sort of dental injuries might this child have suffered in addition to the lost tooth? How does the management of dental trauma change in light of a patient’s age or the location of the traumatized tooth? Is there something else a parent should have done prior to arrival in the ED to help save the tooth?

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CME Objectives
Upon completion of this article, you should be able to:
1. Identify differences between types of dental trauma/dental infections and how they appear clinically in your patients.
2. Apply evidence-based treatment of primary versus permanent teeth in cases of dental trauma in your patients.
3. Recognize and treat/refer dental trauma and infections in your patients that require emergent or urgent dental follow-up.

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the dental clinic. The reports also document transport assistance provided to the family as well as their need for financial aid. Before you enter the examining room, you ask yourself several questions. Are this child’s primary or permanent (secondary) teeth affected? What is the likely cause of her dental pain? If there is an infection, what are the indications for antibiotics? Given the repeated history of visits to the ED without appropriate follow-up, should you report her parents to Child Protective Services?

What is the evidence base for the assessment and treatment of dental emergencies in children? The emergency clinician must be able to quickly recognize injury patterns in the pediatric population and must be familiar with the anatomy unique to this group. Of specific concern is the emergency treatment of primary teeth versus permanent (secondary) teeth. This article is divided into 2 sections: dental trauma and dental infections. This review of available evidence in the literature will equip the emergency clinician with the information needed to provide the most up-to-date care.

Part I. Dental Trauma

Critical Appraisal Of The Literature

The literature search was performed in November 2009 using MEDLINE, the National Guideline Clearinghouse, the Database of Abstracts of Reviews of Effects (DARE), and the Cochrane Database of Systematic Reviews. The articles chosen for review included those published after 1995 and in the English language, with children and adolescents as subjects; articles published before 1995 were included as needed to provide background information. Search terms included dental trauma, oral trauma, dental intrusion and extrusion, dental avulsion, emergency dental care, dental subluxation, dental injury, dental fracture, crown fracture, and root fracture. After careful review, a total of 40 articles were selected; in addition, textbooks on dentistry, trauma, radiology, and emergency medicine were reviewed. Few large, prospective clinical trials on dental injuries have been carried out, especially in children; large trials that were reviewed were primarily observational or retrospective. Case reports have been included to illustrate rare but important outcomes in children.

Epidemiology And Etiology

Dental trauma occurs in 7% to 50% of all children, peaking between 18 and 36 months of age and between 7 and 15 years of age.1,2 Physical activity at home, in kindergartens, at playgrounds, and in schools accounts for a significant proportion of dental injuries in young children.3,4 The unsteady gait of the toddler leads to injuries of the primary teeth from falls and collisions with stationary objects, whereas among older adolescents and adults, injuries to the permanent teeth are inflicted mostly during sports, traffic accidents, and some forms of violence (eg, fights, assaults, battery).6,7

Anatomic features can increase the risk of injury. The central maxillary incisors are the most commonly injured teeth.2,8-10 Protrusion of the upper teeth (ie, overbite) and inadequate coverage by the lips double the risk of injury to these teeth, particularly if the protrusion is greater than 5 mm.11,13

Human factors also play a role in trauma risk. Boys are 2 to 3 times more likely than girls to sustain injury to their permanent teeth.3,8,14,15 Hyperactivity and increased risk-taking behavior heightens this risk.16 Not surprisingly, victims of bullying sustain more dental trauma. Oral piercings with metal jewelry are increasingly more common and can lead to dental injuries. Research has shown that lip and tongue piercings may lead to chipping and fracturing of teeth and restorations, pulp damage, the cracked tooth syndrome, tooth abrasion, pain, swelling, and infections.8,17,18

Pathophysiology

In order to understand the pathophysiology of dental injuries, one must have a basic understanding of the anatomy of the tooth and its surrounding structures. (See Figure 1.) The tooth has 2 regions: the crown is the part of the tooth covered by enamel that develops below the gingiva and then erupts into place and becomes visible in the mouth. The root is the part of the tooth covered by cementum that remains below the gumline.

Four major tissues make up the tooth: enamel, dentin, cementum, and dental pulp.

The enamel is the hardest and most mineralized layer of the tooth, designed to withstand decades of chewing (incising and grinding) and tearing of food. It is important to note that the enamel has no regenerative capacity and must be supported by the underlying dentin.

Dentin is the substance between the enamel or cementum and the pulp chamber. It is produced by the dental pulp and acts as a protective layer to support the crown of the tooth. More dentin is produced when the tooth is subjected to trauma, excessive wear, or decay (caries). It is deposited along the pulpal wall to protect the pulp from injury. However, it is a softer tissue than enamel, with a higher organic content, making it more susceptible to caries if not properly treated.19

Cementum is a specialized bony substance that covers the root of a tooth and serves as a medium by which the periodontal ligaments can attach to the tooth, providing stability. It helps prevent the tooth from becoming fused to or resorbed by the adjacent
alveolar bone. In conjunction with the periodontal ligament and surrounding alveolar bone, the cementum allows for flexibility and movement of the tooth, which helps it withstand the powerful forces generated by chewing.

The dental pulp is a specialized tissue that contains odontoblasts, fibroblasts, blood vessels, and nerves. The pulp provides the neurosensory function of the tooth and allows for repair. It is important to maintain a healthy dental pulp until the walls of the root become thick enough to sustain traumatic forces transmitted from the crown during mastication. If the root is not completely formed, the pulp may become nonvital and tooth retention is diminished. Therefore, prompt treatment of dental trauma and caries in children is critical to maintaining oral health.

Tooth eruption begins when a child is about 6 months old and continues until they are approximately 2 years of age, at which time they typically have 20 primary teeth (incisors and molars). (See Figure 2.) Adult or permanent (secondary) teeth begin to erupt (initially the central incisors) when the child reaches 7 or 8 years of age, and they continue to erupt into adolescence, with the arrival of the molars. Anatomically, the permanent anterior teeth develop in close proximity to the apices of primary incisors; thus, periapical infection caused by necrotic pulp tissue or intrusion injuries of the primary dentition can irreversibly damage the permanent tooth.

There are important differences between primary and permanent teeth. In primary teeth, the crown tends to be shorter and narrower, and the enamel and dentin layers are thinner relative to those of the permanent teeth. Also, the pulp of the primary tooth is larger and closer to the outer surface. These characteristics make the primary tooth susceptible to more significant injury compared with a permanent tooth that sustains an equal force.

Traumatized teeth are at substantial risk for devitalization because relatively minor blows can easily injure the small inner chamber of pulp tissue at the root apex. Disruption of the neurovascular supply to the tooth results in ischemic necrosis of the pulp and can become manifest externally by a color change in the tooth crown. Left untreated, these teeth may form an abscess or undergo inflammatory resorption of the roots. When a primary tooth becomes infected, inflammation can extend to developing tooth buds and impair development of the permanent dentition. Trauma to primary teeth must be evaluated for problems involving not only the injured tooth but also the developing tooth yet to erupt.

**Differential Diagnosis**

The differential diagnosis of dental trauma includes concussion, subluxation, luxation, intrusion, extrusion, avulsion, and fracture.

**Concussion And Subluxation**

Dental concussions result from mild trauma and cause slight injury to the periodontal ligament without causing tooth mobility or displacement. There is usually no significant injury to the tooth or surrounding tissues, but often there is mild inflammation of the periodontal ligament. Patients may complain of mild dental pain on biting or may have no pain at all. Subluxation occurs from slightly more significant trauma and leads to loosening of the tooth, without displacement, because of damage to the periodontal ligament and inflammation. On examination, the tooth is mobile, and bleeding from the gum may be present.

**Luxation, Intrusion, Extrusion, And Avulsion**

Luxation is the loosening and displacement of a tooth from its normal anatomic position that occurs when the periodontal ligament is torn. The tooth is often nontender and immobile and may be fixed in its new position. Lateral luxation is an angular displacement of the tooth while it is still within the socket. Since there is usually an associated fracture of the supporting alveolar bone, especially with labial and palatal luxations, it is prudent for the emergency clinician to search for additional occult injuries. Since the alveolar bone surrounding the primary tooth is relatively elastic, dental luxation is a common injury during the toddler years. The primary upper incisors are often pushed in toward the palate when the child falls forward.

An intrusion injury is the most severe type of luxation injury. Intrusion occurs when a tooth is
Fracture of the enamel and dentin combined may cause pain on light pressure and a sensitivity to air. Pale-yellow discoloration of the tooth indicates dentin exposure. Patients younger than 12 years of age have immature teeth, so much less dentin spans the space between the pulp and the enamel layer. The chance of infection and damage to the pulp is much greater in this age group because the pulp area is larger and the distance across the dentin is shorter, allowing the infection to reach the pulp more rapidly.

A complicated fracture involves the enamel, dentin, and pulp. Patients often complain of pain on manipulation or exposure to air or hot or cold temperatures. This injury may present as pinkish markings on the outside of the tooth, with the surrounding dentin appearing yellowish, or blood may be seen in the center of the tooth from the exposed pulp.

A root fracture involves the dentin, pulp, and cementum and is difficult to diagnose clinically. These fractures are almost always seen in permanent teeth, and patients may notice abnormal mobility and sensitivity to percussion.

(Figure 2. Primary Teeth)

Fractures of the permanent teeth are more commonly seen, since the primary teeth tend to become displaced only with more significant trauma. Crown fractures may be uncomplicated or complicated. Uncomplicated crown fractures result from injuries to the enamel alone or to both enamel and dentin. An enamel fracture alone is not considered a dental emergency and often goes unnoticed by the patient, who might feel roughness when running the tongue over the chipped tooth. The injury is often asymptomatic and discovered during a routine dental examination.

(Figure 3. Permanent (Secondary) Teeth)

Patients with dental trauma in association with significant head injury should first be evaluated for life-threatening injuries, airway compromise, and neurologic deficits. Airway, breathing, and circulation, in addition to cervical spine stability, should be
evaluated while emergency medical services is notified to transfer the patient to the hospital for more advanced care.

Pain control and tooth preservation are the goals of prehospital care for isolated dental trauma. Acetaminophen can be given for analgesia and an ice pack may help reduce local swelling and stop bleeding to facilitate evaluation of the oral tissues in the emergency department (ED). Avulsed teeth and fragments should not be wrapped in tissue or cloth or be allowed to dry, and they should be handled only by the crown to avoid damaging the periodontal ligament at the root. Debris should be removed with gentle rinsing in saline or water; scrubbing should be avoided because it may cause further damage.

An avulsed permanent tooth should be reimplanted as soon as possible and maintained in position with gentle pressure until the ED evaluation. If it cannot be reimplanted within 5 minutes, the tooth should be stored, in order of preference, in UW-Belzerer solution, Hanks’ balanced salt solution, cold milk, saliva, physiologic saline, or clean water.²³

Emergency Department Evaluation

The ED evaluation should begin with a complete assessment for closed head injury, quickly determining whether there are any life-threatening injuries. Once airway, breathing, and circulation have been assured and stabilized, the emergency clinician can proceed to a more thorough dental examination.

Since management differs between primary and permanent (secondary) teeth that have sustained a traumatic injury, it is crucial for the practitioner to first determine which type of tooth has been affected and then what type of injury has occurred. The mechanism and time of injury are particularly important aspects of the history because they are used to stratify the risk of associated injuries, the available treatment options, and the ultimate viability of the tooth. The patient’s tetanus vaccination status should be determined as well as the need for spontaneous bacterial endocarditis prophylaxis based on the patient’s medical history.

The dental examination should begin with an evaluation of the extraoral structures. Any bruising, swelling, and lacerations should be noted. The emergency clinician should also maintain a high level of suspicion for abuse when examining young children who have oral injuries. Particular attention should be paid to any pattern of bruising or bruises in various stages of healing. Jaw movement should be assessed by having patients open and close their mouths; any evidence of difficulty or pain may suggest a mandibular fracture or dislocation at the temporomandibular joint (TMJ). Palpation of the bony structures may reveal step-off fractures. Lacerations should be explored for foreign bodies (eg, dirt) or avulsed teeth.

Through-and-through lip lacerations are not uncommon with dental trauma and should be evaluated with the possible need for cosmetic repair in mind.

The intraoral examination begins with visual inspection of the soft tissues. Debris and clots should be gently removed to allow a thorough evaluation. Intraoral lacerations should be explored to detect foreign material, avulsed teeth, or tooth fragments. Frenulum tears heal well with no intervention. The patient should be asked to bite down and report any feelings of misalignment or malocclusion that could indicate luxation. The emergency clinician should also palpate the alveolus for any evidence of a step-off or other type of fracture.

Evaluation of the dental structures begins with visualization to look for any gross abnormalities (eg, fractures, missing teeth, displacements). The emergency clinician should note any gingival or sulcular bleeding as a sign of sustained trauma even if the tooth itself appears normal. Each tooth should be palpated for movement, and percussion may elicit pain in a traumatized tooth that otherwise appears to be uninjured.

Diagnostic Studies

Dental films can be obtained to further assess the type and extent of injury. When possible, a panoramic radiograph (also known as an orthopantomogram) can help identify fractured, avulsed, intruded, and extruded teeth. Injuries to the maxillary or mandibular teeth are best assessed with an occlusal radiograph. If a root fracture is suspected, radiographs taken from 2 different angles are required for a definitive diagnosis but would be better obtained in a dental office. A computerized tomographic (CT) scan may be obtained when additional injury is suspected, such as in LeFort fractures of the maxilla and/or facial bones.

Treatment

Injuries To Primary Teeth

The management of injuries to the primary teeth should focus on controlling pain and preventing damage to the permanent teeth that are developing in close proximity to the apices of the primary incisors or molars.²⁶,²⁷ With dental concussions and subluxations of the primary teeth, the risk of injury to the underlying permanent teeth buds is low. These injuries can typically resolve spontaneously and can generally be treated with supportive care, pain control, and outpatient dental follow-up. Radiographs may be advised to detect any damage to the surrounding alveolus, although bone injury is unlikely. A soft diet is recommended for comfort.

The most common injuries to primary teeth are luxation injuries, in which the teeth become loose,
are displaced, or are completely avulsed. Lateral luxated primary teeth may be allowed to passively reposition, although consultation with a dentist is recommended in cases of significant angulation and displacement to ensure that the developing permanent teeth have not been harmed.\(^{28}\) (See Table 1.) An intruded primary tooth may be allowed to spontaneously erupt over a 2- to 3-month period, as long as the developing permanent tooth bud has not been injured.\(^{29}\) If eruption does not proceed within 2 months, it will be necessary to extract the intruded primary tooth. Extraction of intruded primary teeth is indicated in the ED when the apex is displaced toward the permanent tooth bud, as determined by radiography. Injured primary teeth may be removed by the emergency clinician if a dentist is not immediately available for consultation and there is the possibility of aspiration. The premature loss of primary anterior teeth does not irreversibly affect the child’s speech or the position of the permanent teeth.\(^{30,31}\)

Extruded teeth should be repositioned and allowed to heal unless the tooth is severely injured or near exfoliation (natural loss), in which case extraction is necessary. If the tooth is splinted, the patient should be seen by a dentist within 7 to 10 days to re-evaluate the tooth’s vitality.

Avulsed primary teeth should not be reimplanted because of the potential for injury to the underlying tooth bud.\(^{28,32}\) The tooth should be examined to be sure that the entire crown and root are present. Obtaining radiographs of the head, chest, or abdomen are occasionally necessary to locate the avulsed primary tooth, which might have been swallowed or aspirated or have intruded into the alveolus.\(^{33,34}\)

Crown fractures of the primary teeth require a thorough dental evaluation to determine the risk of further injury and infection. Uncomplicated fractures of the enamel alone do not require emergency dental evaluation and can be followed up by a dentist, who can then smooth the rough edge of the tooth to prevent additional injury to adjacent soft tissues.\(^{28,35}\) Exposed dentin should be restored with dental cement to prevent infection, and urgent referral to a dentist should be made within 24 hours. Complicated fractures involving the pulp are treated with pulpotomy or pulpectomy. Root fractures of the primary teeth are rare occurrences. If the tooth cannot be restored, it should be removed unless removal would cause injury to underlying tooth buds.\(^{25}\)

### Injuries To Permanent (Secondary) Teeth

Concussed permanent teeth generally require no intervention. Subluxed permanent teeth may require splinting if there is more than 2 mm of movement.\(^{22}\) Several splinting options exist in the ED, including periodontal packing, the use of bondable reinforcement ribbon, and placement of a flexible wire. A recent randomized cross-over study showed that emergency clinicians could become proficient at placing a temporizing splint with minimal training.\(^{23}\) Dental follow-up, with radiographic monitoring at 4 weeks, is recommended to detect any inflammatory resorption or pulp necrosis, which may lead to tooth discoloration. (See Table 1.) Parents should be informed about the possibility of future discoloration.

Luxation injuries of permanent teeth constitute true dental emergencies and should be managed immediately to achieve the best possible outcome. Management should be focused on maintaining the vitality of the periodontal ligament. For lateral luxation and extrusion injuries, the tooth should be repositioned with a semirigid (flexible) splint for 2 to 3 weeks. Intrusion injuries of a permanent tooth found to have an immature root on radiography may be allowed to re-erupt over 3 to 6 weeks, whereas injured teeth with mature roots require prompt orthodontic or surgical extrusion and eventual root canal therapy by a dentist.\(^{22}\)

The prognosis for avulsed permanent teeth worsens in direct proportion to the length of time they are outside the mouth. Permanent teeth require urgent reimplantation because success is time-dependent.\(^{36}\) There is an 85% to 97% survival of permanent teeth when they are reimplanted within 5 minutes, but survival is near zero after 1 hour.\(^{37}\) The avulsed tooth should be handled by the crown only and simply rinsed, with no excessive handling or scrubbing of the root, which would remove any of the remaining live periodontal cells. The tooth should be re-implanted with gentle pressure and held in place. A flexible, functional splint should be placed for 7 to 10 days (as previously described). If an alveolar fracture is also present, a rigid splint should be applied and kept in place for 4 to 6 weeks. The patient’s tetanus vaccination status should be updated, and a 10-day course of antibiotics should be prescribed to prevent oral infections.\(^{22}\) A follow-up visit to a dentist should be scheduled for 7 to 10 days after the injury to determine the need for root canal therapy.

### Table 1. Need For Follow-Up By A Dentist According To Type Of Injury

<table>
<thead>
<tr>
<th>Type Of Injury</th>
<th>Dental Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concussion</td>
<td>As needed</td>
</tr>
<tr>
<td>Subluxation</td>
<td>As needed</td>
</tr>
<tr>
<td>Intrusion</td>
<td>Within 24 hours</td>
</tr>
<tr>
<td>Extrusion</td>
<td>Within 24 hours</td>
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<tr>
<td>Avulsion</td>
<td></td>
</tr>
<tr>
<td>• Primary</td>
<td>As needed</td>
</tr>
<tr>
<td>• Permanent</td>
<td>Emergent</td>
</tr>
<tr>
<td>Fracture</td>
<td></td>
</tr>
<tr>
<td>• Enamel only (Ellis I)</td>
<td>As needed</td>
</tr>
<tr>
<td>• Enamel and dentin (Ellis II)</td>
<td>Within 24 hours</td>
</tr>
<tr>
<td>• Enamel, dentin, and pulp (Ellis III)</td>
<td>Within 24 hours</td>
</tr>
<tr>
<td>• Root fracture</td>
<td>Within 24 hours</td>
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</tbody>
</table>
The treatment of uncomplicated fractures of permanent teeth should focus on maintaining pulp vitality, tooth function, and appearance. Small fractures that involve the enamel only are not emergent, and a dentist could smooth out any rough edges to prevent injury to surrounding soft tissues on an outpatient basis. Larger injuries or fractures that involve the dentin or pulp should be restored with dental cement to reduce the risk of infection, and urgent referral to a dentist should be made within 24 hours. Definitive treatment of complicated fractures involving the pulp involves pulpotomy, pulpectomy, or root canal, preferably, by an endodontist. The prognosis depends on the extent of injury to the periodontal ligament, the extent of dentin and pulp exposure, and the stage of tooth development at the time of injury.25

Treatment of a root fracture should focus on stabilizing the coronal fragment. If the fracture is in the apical one-third of the tooth and the crown segment is stable, the tooth can be left in place. However, when the root is fractured in the middle or coronal one-third of the tooth, extraction is necessary because the crown segment is unstable and the fracture site will become contaminated with bacteria from the saliva. This allows for possible abscess formation and extension of infection into the bone.

Special Circumstances

As with any injury in the pediatric patient, non-accidental trauma must be considered. Up to 75% of abused children have orofacial injuries.36,39 In addition to traumatic injury to the maxillary incisors and mandible, children subjected to abuse may sustain a variety of perioral and intraoral injuries, including bruises, lacerations, and broken bones. The presence of bruises in various stages of healing, with or without dental trauma, may indicate multiple traumatic incidents. A torn upper labial frenulum and bruising of the labial sulcus in young, preambulatory patients should alert the emergency clinician to possible abuse. Accidental falls are more likely to cause bruising on the skin overlying bony prominences of the forehead or chin.40 Children with bruising to the softer areas of the cheeks or neck should be thoroughly evaluated for possible abuse. The emergency clinician must maintain a high index of suspicion when evaluating young children for dental trauma and report possible abuse to Child Protective Services.

Disposition

All patients with traumatized teeth ultimately need a follow-up appointment with a dentist for a more complete diagnosis and decisions about long-term care. In the ED, adequate pain control should be achieved with oral analgesics, and the patient should be advised to follow a soft diet until outpatient dental follow-up has been arranged. Long-term sequelae to traumatized teeth include pulp death, root resorption, and displacement or developmental defects of permanent tooth successors, all of which should be discussed with the patient and parents.

Summary

Dental trauma is common in children. To properly manage dental injuries, the emergency clinician must first determine whether the traumatized tooth is primary or permanent and the length of time since the injury occurred. Management of injuries to the primary teeth should focus on controlling pain and preventing damage to developing permanent teeth, whereas the focus in injuries to the permanent teeth should be on maintaining the viability of the periodontal ligament and dental pulp. Regardless of the extent of care provided in the ED, the patient should always be referred for outpatient dental follow-up.

Part II. Dental Infections

Critical Appraisal Of The Literature

The literature search was performed in November 2009 using MEDLINE, the National Guideline Clearinghouse, the Database of Abstracts of Reviews of Effects (DARE), and the Cochrane Database of Systematic Reviews. Reviewed articles included those published after 2000 and in the English language, with children as subjects. Search terms included dental infection, dental caries, gingivitis, pulpitis, periodontal abscess, periodontitis, periodontal abscess, peri-implantitis. After careful review, a total of 56 articles were selected for inclusion. Articles published before 2000 were included as needed for background information; in addition, textbooks on dentistry, infectious disease, and emergency medicine were reviewed. Not many large, prospective clinical trials have focused on dental infections, especially in children. The large trials described here were observational or retrospective. Case reports and anecdotal articles in the literature were not included, and the majority of published guidelines focused on the prevention of dental infections rather than their treatment.

Epidemiology, Etiology, And Pathophysiology

Epidemiology

In the United States (US), 50% of children 6 to 8 years of age have dental caries.41 Among children 2 to 11 years of age, 41% have caries of the primary teeth; among those 6 to 19 years of age, 42% have caries of the permanent teeth.42 These statistics have improved compared with a century ago, when 60%
of the adult population eventually lost all 32 of their permanent teeth.43 Today, children who receive regular appropriate dental care can expect to maintain an entire set of healthy teeth over a lifetime. As a consequence of poor oral hygiene, gingivitis affects 2% to 34% of 2 year olds.44

In 2007, the amount of money spent on dental services alone in the US was $95.2 billion — a 5.2% increase over the previous year and representing 4.3% of the $2.2 trillion spent in total on healthcare.45 The cost of hospital care for caries-related visits is between 3 and 10 times the cost of outpatient preventive services, as based on Medicaid reimbursement data.46 The median charge of admitting a patient to the hospital following a visit to the ED for caries-related problems is $3,223.47

While it is generally known that an ED is not usually the best venue to obtain dental care, given the absence of dentists and the lack of dental training in emergency clinicians, ED visits for dental problems from 1992 to 1999 nevertheless increased 14%.48 From 1997 through 2000, the average number of visits per year to an ED for the treatment of dental pain or injury was 738,000.49 The uninsured appear to be disproportionately represented, with 4.2 million children having unmet dental needs because their families could not afford dental care50; in many cases, parents considered the ED the child’s primary source of dental care.51 There are social disparities as well, with the strongest positive association being between tooth loss and low educational level. The highest rate of caries has been reported to be among Mexican-American children (54.9%) and in families whose income is below 100% of the federal poverty level (55.3%).52

**Etiology**

In the pediatric population, infections range from dental caries to periodontitis. Dental caries is the most common and preventable infectious disease in childhood.52 Until recently, parents were counseled not to seek dental care for their children until the child reached 6 years of age or later, around the time when the first permanent tooth erupted. However, painful and preventable infections can and do occur in the deciduous teeth. Despite public education, the prevalence of caries in children 2 to 11 years of age has not improved.52

**Pathophysiology**

The cause of dental caries is multifactorial and involves the composition of the biofilm (also known as plaque), the extent of exposure of the teeth to fluoride and dietary sugars, and the effectiveness of preventive behaviors such as toothbrushing and flossing. Biofilms are microenvironments on the tooth surface that are composed of highly organized microorganisms encased in an extracellular matrix. Although an estimated 500 species of bacteria inhab-

it the oral cavity,53 *Streptococcus mutans* is the only organism found to have an etiologic association with caries formation.54 Prolonged and frequent exposure of the mouth to dietary sugars allows bacteria such as *S mutans* to metabolize these carbohydrates and convert them into weak organic acids, leading to decay of the tooth surface.

Gingivitis may be caused by local trauma or by a shift in the normal bacterial composition of plaque from gram-positive organisms to anaerobic gram-negative rods, such as *Prevotella intermedia*, *Capnocytophaga* species, and *Peptostreptococcus* species.54 It is the most common form of periodontal disease.54 Periodontitis involves the loss of connective tissue and alveolar bone support to teeth. The chronic presence of anaerobic bacteria in plaque, in addition to the host’s inflammatory response, can lead to a periodontal pocket, at which point the process is irreversible.55 Risk factors associated with periodontitis include the presence of specific subgingival bacteria, diabetes, obesity, poor oral hygiene, tobacco use, male gender, age, and diet.56,57 Individuals that maintain normal weight, engage in regular exercise, and have a high-quality diet are 40% less likely to develop periodontitis.58 It has been shown that periodontal disease, as measured by clinical attachment loss and bone loss, progresses in a 52-month period without preventive dental care.59

Early-onset (or aggressive) periodontitis affects the young and although the childhood form is typically differentiated from adult periodontitis, there appears to be no obvious bacteriologic distinction between the two. Invariably, these infections contain *Porphyromonas gingivalis*, *Treponema denticola*, and *Tannerella forsythia*, although other bacteria may be isolated.60

Inflammation of the dental pulp occurs when bacteria encroach upon the pulp, either through the apical foramen or through fracture or caries via the dentin. Irreversible pulpitis occurs with ischemia and necrosis of the pulp. A periapical abscess may ensue. Pericoronitis is an infection of the gingiva that overlies partially erupted teeth or impacted wisdom teeth. It is the result of food particles and microorganisms that become trapped within the gingiva. Peri-implantitis refers to inflammation of the tissue surrounding dental implants.

**Differential Diagnosis**

**Dental Caries**

In the earliest stage, caries appear as a chalky white spot on the surface of the tooth, at which point the lesion is still reversible. Surface defects that manifest golden-brown to black discoloration are irreversible but are sometimes difficult to distinguish from unrelated staining of the enamel, for example from nicotine use. More serious decay may extend to the pulp.
Early Childhood Caries
Formerly known as nursing-bottle or baby-bottle caries, prolonged and frequent bottle-feeding can lead to caries in early childhood. This condition is also associated with the use of training cups, breastfeeding on demand, or the use of sweetening agents applied to the pacifier. The upper anterior and posterior teeth are mainly affected, since the lower teeth are protected from direct exposure to milk and other substances by the pooling of saliva, as well as by the position of the bottom lip and tongue. Early childhood caries are typically found on the anterior surfaces of the exposed teeth.

Gingivitis
Gingivitis is the most common form of periodontal disease. Early in its course one might detect only a bluish-red discoloration of the gingiva, with swelling and thickening at the margins. This condition is typically painless, but bleeding may be triggered easily by eating, toothbrushing, or probing by the examiner. Of special note is a condition known as Vincent’s angina, or acute necrotizing ulcerative gingivitis (ANUG). Patients with ANUG may report malaise and pain, and examination of the oral cavity may reveal the presence of a grayish pseudomembrane, along with halitosis, fever, and lymphadenopathy.

Periodontitis
Gingivitis is a precursor of periodontitis, which occurs when the gingiva surrounding the affected teeth become erythematous, bleed easily, and form periodontal pockets. Supporting tissues, such as the periodontal ligament, cementum, and alveolar bone, become eroded, leading to a loosening and loss of teeth. Periodontal abscesses may drain spontaneously or may be expressed using external digital pressure and probing. These lesions usually present as erythematous, tender, fluctuant masses of the gums.

Pulpitis
Pain may be mild early in the course of pulpitis and may be elicited by thermal changes, especially contact with cold drinks. Persistent, severe throbbing and poor localization may indicate irreversible pulpitis, by which time necrosis has developed. Tenderness to percussion of the tooth and regional lymphadenopathy may indicate the development of a periapical abscess.

Pericoronitis
In pericoronitis, the tissue overlying impacted teeth or over the wisdom teeth (teeth #1, 16, 17, 32) appears erythematous and edematous. Exudate may be expressed when pressure is applied. Trismus may be present owing to localized inflammation of the adjacent masseter muscle and/or medial pterygoid muscle.

Peri-implantitis
Erythema of the tissues surrounding dental implants constitutes peri-implantitis. This condition may or may not involve loss of alveolar bone adjacent to the implant.

Prehospital Care
Patients typically treat themselves at home with over-the-counter medications such as acetaminophen and nonsteroidal anti-inflammatory drugs. Only when the pain becomes severe or progresses, as in fascial plane infections, do patients resort to visiting the ED for evaluation and treatment.

Emergency Department Evaluation
As with any emergency, the child’s airway must be assessed first. The presence of trismus may portend a difficult intubation (should such a step become necessary) and secondary airway intubation devices should be readily available. In babies, turning back the child’s lips should allow the examiner to detect early childhood caries. Any staining of the teeth, from white spots to black discoloration, warrants referral to a dentist for further evaluation. Phlebotomy is not usually indicated, since a thorough physical examination and radiography, when indicated, can be used to diagnose any dental infections.

Diagnostic Studies
An orthopantomogram can reveal caries, periodontal abscesses, and bone loss due to periodontitis. (See Figure 4.) Computed tomography (CT) is the modality of choice for the evaluation of odontogenic infections.

Figure 4. Panoramic Dental Radiograph
Clinical Pathway For Treatment Of Traumatic Dental Injuries

Type of injury

Concussion — is tooth primary?

YES

Analgesics
Soft diet

NO

Analgesics
Soft diet

Subluxation — is tooth primary?

YES

Analgesics
Soft diet

NO

Splint, if severe
Analgesics
Soft diet

Intrusion — is tooth primary?

YES

Allow to re-erupt
If no re-eruption after 2 months: extract

NO

Reposition
Splint

Extrusion, lateral luxation — is tooth primary?

YES

Reposition
Splint

NO

Allow to re-erupt
If no re-eruption after 3 to 6 weeks: extract, splint, root canal

Avulsion — is tooth primary?

YES

Do not re-implant

NO

Re-implant immediately

Fracture of the crown (primary and permanent) — Is the fracture complicated (ie, involves enamel, dentin, and pulp)?

YES

Pulpectomy or pulpotomy

NO

Enamel only: analgesics
Enamel and dentin: cap, restoration

Fracture of the root, primary and permanent

If apical: restoration
If coronal or middle: extract

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient's individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

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infections.\textsuperscript{63} Guidelines are now being developed for the use of cone-beam CT. As with any study, radiographs should be obtained only when the findings are expected to affect patient care.\textsuperscript{64}

**Prevention And Treatment**

Prevention is key to maintaining healthy teeth, whether they are primary or permanent (secondary). The American Academy of Pediatric Dentistry (AAPD), the American Dental Association, and the American Association of Public Health Dentistry all recommend that children have their first dental evaluation within 6 to 12 months of eruption of the first primary tooth.\textsuperscript{65-67} The American Academy of Pediatrics recommends that a dental “home” be established within the child’s first year of life where a primary pediatric dentist can provide continuity of care.\textsuperscript{68} It is estimated, however, that there are only about 4000 pediatric dentists currently practicing in the US.\textsuperscript{69}

Pediatricians, primary healthcare providers, and even emergency clinicians are in a unique position to provide anticipatory guidance for dental care and have been called upon to do so, especially for disadvantaged families.\textsuperscript{70} After 2 to 5 hours of training, it has been found that physicians, nurses, and physician assistants are able to identify caries almost as accurately as dentists can and, subsequently, can refer patients appropriately for definitive dental treatment.\textsuperscript{69,71,72}

Although primary prevention of dental caries cannot usually be provided in the ED, many of the same treatments can be recommended to patients with reversible conditions and to arrest progression of existing disease. Topical fluorides, in the form of varnishes applied professionally 2 to 4 times yearly, as well as mouth rinses, used in conjunction with fluoride-containing toothpaste, have been reported to reduce caries.\textsuperscript{73-75} There is clear evidence that the application of fluoride gels a few times a year reduces the development of caries in children and adolescents.\textsuperscript{76} It has now been firmly established that children who brush their teeth at least once daily with a fluoridated toothpaste have less tooth decay.\textsuperscript{77}

Parents should wipe their infant’s tooth with a brush or washcloth at the first sign of eruption. Such brushing without toothpaste is recommended for children under 2 years of age. Between the ages of 2 and 6 years, children should use no more than a pea-size amount of fluoridated toothpaste to avoid possible enamel fluorosis. Children 6 years of age and older can safely use fluoridated toothpaste and should brush twice daily.\textsuperscript{78} Any caries should be referred to a dentist for definitive restorative treatment.

Gingivitis rarely progresses to periodontitis in children with primary teeth. Good hygiene should be emphasized, since these habits can be carried over into late childhood and for the care of permanent teeth, which are more susceptible to disease progression. Chlorhexidine gluconate 0.12% oral rinse or hexetidine 0.1% rinse is sufficient for treating gingivitis in most cases.\textsuperscript{82} Antibiotics may be required when the disease is progressing rapidly or in patients with ANUG, which should be treated with local debridement and lavage using oxidizing agents.\textsuperscript{82} Antibiotic choices to treat ANUG include penicillin, amoxicillin, amoxicillin–clavulanate, metronidazole, and clindamycin.

Acute infections of the periodontium and oral mucosa require immediate referral and treatment by a dentist.\textsuperscript{79} Dental interventions may include plaque removal, root debridement, surgical removal of inflamed periodontal tissues, and chlorhexidine rinses, as well as education regarding primary prevention. In the absence of systemic signs of infection such as fever and facial swelling, antibiotics are usually not indicated.\textsuperscript{80} However, in a study of treatments for advanced periodontitis, 81% of the patients who received metronidazole or doxycycline in combination with locally delivered antimicrobials (metronidazole, chlorhexidine) did not require periodontal surgery or tooth extraction.\textsuperscript{81} If an antibiotic is prescribed, the choice of agent should be guided by the duration of symptoms, since odontogenic infections contain primarily aerobic, penicillin-sensitive bacteria in the first 3 days. Infections that persist for longer than 3 days harbor anaerobic bacteria, which are frequently penicillin-resistant.\textsuperscript{82} Commonly prescribed antibiotics include metronidazole, clindamycin, doxycycline or minocycline, ciprofloxacin, azithromycin, metronidazole plus amoxicillin, and metronidazole plus ciprofloxacin. Periodontal abscesses should be referred to a dentist for incision and drainage.

Patients diagnosed clinically with pulpitis and periapical abscesses should be referred to a dentist for definitive surgical treatment, which may involve pulp removal and/or tooth extraction. Antibiotics do not appear to significantly decrease dental pain caused by irreversible pulpitis, and they offer no significant benefit in the concurrent treatment of periapical abscesses that are drained.\textsuperscript{83,84}

Depending on its severity, pericoronitis should be treated with removal of food particles, mouth rinses using warm saltwater or chlorhexidine, and referral to a dentist. Antibiotics may be indicated in patients with overlying facial cellulitis or when the infection extends along fascial planes.

Antibiotics may be started in cases of peri-implantitis, although this treatment appears to be no more beneficial than other modalities, which include polishing or scaling of the teeth; the local application of antibiotics; ultrasonic, laser, or manual debridement; chlorhexidine irrigation; resective surgery, smoothing of the implant surface or its decontamination with abrasive powder; autogenous bone grafting, with or without resorbable membrane; and the use of bone graft substitutes. To date, no specific
Special Circumstances

Dental neglect is defined by the AAPD as the “willful failure of parent or guardian to seek and follow through with treatment necessary to ensure a level of oral health essential for adequate function and freedom from pain and infection.” Caregivers who do not understand the importance of dental care must be distinguished from those whose knowledge of such care is adequate. Those caregivers who understand the need for dental care and who, despite having received assistance with transportation and costs and having been directed to low-cost or

Risk Management Pitfalls To Avoid In Pediatric Dental Emergencies

1. “The patient must have an avulsion and lost his tooth with the injury because the socket is empty and they weren’t able to find the tooth.” A severe intrusion injury can appear to be an avulsion in the setting of significant swelling and bleeding. It is prudent to maintain a high level of suspicion for a retained tooth and obtain radiographs of the maxilla and mandible whenever the location of the tooth is unknown.

2. “The tooth looks fine.” A dental concussion, mild subluxation, or root fracture can all have a relatively normal appearance on examination. Pay close attention to any slight movement of the tooth, pain on palpation, or pain with chewing, since these findings may indicate more significant injury to the tooth.

3. “The primary tooth was knocked out, but the family put it back in place.” An avulsed primary tooth should not be re-implanted, since doing so may cause damage to the underlying tooth buds and impair development of the permanent teeth. Although some families find it hard to accept the cosmetic effect of a missing tooth, the patient will have the best outcome if the avulsed tooth is removed.

4. “The parents don’t know how the baby injured himself.” Be wary of nonspecific or unknown circumstances of injury or a mechanism of injury that is incongruent with the patient’s developmental stage, especially in very young children. Oral and dental injuries are often seen in children who are abused and, if deemed suspicious, must be evaluated and reported to Child Protective Services.

5. “We scrubbed the tooth clean before putting it back in.” An avulsed tooth should not be cleaned and scrubbed vigorously before being re-implanted because the removal of any surviving periodontal ligament cells will compromise tooth viability. The tooth should simply be rinsed with clean water, gently reinserted in the socket, and held in place until a splint can be applied.

6. “I think I saw a case of child neglect last night.” Even if no evidence of physical abuse is found, emergency clinicians are mandated reporters and must inform Child Protective Services when a case of child neglect is suspected.

7. “My patient with gingivitis is back and looks worse.” Antibiotics are not usually indicated in patients with gingivitis, except in those with ANUG. The presence of a grayish pseudomembrane should be a clue to this diagnosis.

8. “How can a 12-month-old have cavities? Should the patient be using a fluoride toothpaste?” Fluoridated toothpaste is not indicated for children under 2 years of age, since they tend to swallow the toothpaste and are at increased risk for fluorosis and permanent staining of the enamel. Daily brushing without toothpaste should be sufficient for a child who is 12 months of age.

9. “I told the patient to wrap the tooth in gauze before it can be re-implanted.” An avulsed tooth should not be allowed to dry. If it cannot be re-implanted within 5 minutes, the tooth should be stored, in order of preference, in UW-Belzer solution, Hanks’ balanced salt solution, cold milk, saliva, physiologic saline, or clean water.

10. “It wasn’t a dirty wound.” Patient with an avulsion injury should be screened to determine their tetanus vaccination status. If the patient has not received a tetanus booster within 5 years, their vaccination status should be updated.
public facilities for follow-up, continually fail to seek proper care for their children should be reported to Child Protective Services.

**Controversies/Cutting Edge**

Vaccines to prevent dental caries that specifically target *S. mutans* have shown promise in animal models; however, their clinical application in humans is not likely to take place in the near future. Teledentistry may offer access to regular dental care for the disadvantaged and may be as efficient as a visual examination in screening for caries.

Periodontal disease has been linked to preterm birth, cardiovascular disease, the metabolic syndrome, and ischemic stroke. Although certain studies have demonstrated such links, other researchers have not found significant associations. In one study of 1859 patients with periodontitis, the increase in risk for coronary heart disease was found to be insignificant. A meta-analysis of 9 cohort studies showed a 19% increase in risk of cardiovascular disease, including stroke, in patients with periodontal disease; this association was more prominent in patients 65 years of age or younger, among whom the risk increased to 44%. One study of 41,380 men suggested an increased risk of stroke in those with periodontal disease and 24 or fewer teeth. Because patients with periodontal and cardiovascular disease share the same risk factors (ie, body fat content, tobacco use, increasing age, stress, and socioeconomic status), this research may be subject to confounding bias.

In a cross-sectional study of 1328 participants in which the analysis was controlled for potential confounders (such as age), exposure to mercury was found to be independently associated with periodontitis. Bone preservation in periodontitis may be achieved with the inhibition of tissue-destructive enzymes, such as matrix metalloproteinases, and the inhibition of alveolar bone destruction with the use of bisphosphonates.

**Disposition**

In the absence of fascial plane extension, patients with odontogenic infections can usually be discharged home from the ED, with arrangements made for adequate dental follow-up. The presence of trismus or findings suggestive of airway compromise, such as tracheal deviation or stridor, may warrant admission to the hospital for observation, intravenous antibiotic therapy, and in-house consultation.

**Summary**

With minimal training, the emergency clinician should be able to identify carious lesions and refer these patients to dental providers. Antibiotics are not usually warranted except in cases of ANUG, advanced periodontitis, reversible pulpitis, and peri-coronitis, all of which may be difficult to diagnose clinically in the ED. The selection of antibiotic(s) is based on empiric treatment rather than on evidence-based research.

**Case Conclusions**

Your thorough evaluation of the 5-year-old-boy reveals no concerns about significant intracranial injury, so you obtain an orthopantomogram, which reveals that the patient has no injuries other than the avulsed tooth. The mother’s report, the boy’s age, and close examination of the tooth support your conclusion that this is a primary tooth. You review the radiograph with his mother and explain that the primary tooth should not be reimplanted because of possible deleterious effects on the development of his permanent tooth. The patient’s immunization status is up-to-date, and a tetanus booster is not required. You recommend a short course of penicillin and advise the mother to arrange a follow-up appointment with the child’s dentist for the following week.

Your second patient appears to have diffuse periodontitis, with obvious luxation of the primary teeth and alveolar bone loss. At this point, dental follow-up for probable surgical debridement of devitalized tissue is required. Antibiotic therapy is not warranted. The parents tell you that they have just been too busy to take their son to the dentist. You discharge the patient home with his parents after having informed them that Child Protective Services will be contacting them to arrange for a home assessment and follow-up. Although there does not appear to be any abuse, this is a case of dental neglect.
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References

Evidence-based medicine requires a critical appraisal of the literature based on study methodology and number of subjects. Not all references are equally robust. The findings of a large, prospective, randomized, and blinded trial should carry more weight than a case report.

To help the reader judge the strength of each reference, pertinent information about the study, such as the type of study and the number of patients in the study, will be included in bold type following the reference, when available. In addition, the most informative references cited in this article, as determined by the authors, are designated by an asterisk (*) next to the number of the reference.

33. Luna AH, Moreira RW, de Moraes M. Traumatic intrusion of maxillary permanent incisors into the nasal cavity: report of


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1. Which of the following does NOT increase the risk of dental trauma?
   a. Female sex
   b. Hyperactivity
   c. Involvement in sports
   d. Overbite

2. Proper handling of an avulsed permanent tooth includes:
   a. Holding the tooth by the root only
   b. Drying the tooth with gauze
   c. Scrubbing the root clean
   d. Re-implanting the tooth as soon as possible

3. Which teeth are most likely to be involved in dental trauma?
   a. Molars
   b. Canines
   c. Mandibular incisors
   d. Maxillary incisors

4. Treatment of an avulsed tooth includes all the following EXCEPT:
   a. Handling by the root
   b. Tetanus immunization booster as needed
   c. Oral antibiotics
   d. Re-implantation
   e. Outpatient dental follow-up

5. A concussed primary tooth should be managed with:
   a. Supportive care
   b. A flexible splint for 7 to 10 days
   c. A rigid splint for 4 to 6 weeks
   d. Pulpectomy/pulpotomy

6. Which dental tissue has no regenerative capacity?
   a. Enamel
   b. Dentin
   c. Cementum
   d. Periodontal ligament
7. Findings in Vincent's angina include:
   a. Shortness of breath
   b. Diffuse arthralgias
   c. Erythematous rash
   d. Grayish pseudomembrane
   e. All of the above

8. In early childhood caries, which side of the tooth is most commonly affected?
   a. Medial
   b. Lateral
   c. Anterior
   d. Posterior

9. Which organism has an etiologic association with dental caries?
   a. Treponema denticola
   b. Streptococcus mutans
   c. Prevotella intermedia
   d. Tannerella forsythia

10. Periodontal disease has a clear and established association with which of the following diseases:
    a. Cardiovascular disease
    b. Metabolic syndrome
    c. Preterm birth
    d. None of the above

11. Antibiotics are indicated in the treatment of:
    a. Irreversible pulpitis
    b. Dental caries
    c. Vincent’s angina
    d. Dental concussion

12. Risk factors associated with periodontal disease include which of the following:
    a. Hyperlipidemia
    b. Pregnancy
    c. Diabetes
    d. Ischemic stroke

13. Avulsed permanent teeth can be stored temporarily in all of the following EXCEPT:
    a. Saliva
    b. Milk
    c. Saline
    d. Orange juice

14. A chalky white spot on teeth indicates what condition?
    a. Periapical abscess
    b. Acute necrotizing ulcerative gingivitis
    c. Dental caries
    d. Periodontitis
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### EVIDENCE-BASED PRACTICE RECOMMENDATIONS

**Initial Assessment and Management of Pediatric Dental Emergencies**

Caglar D, Kwun R. June 2010; Volume 7, Number 6

The emergency clinician must be able to quickly recognize dental injury patterns in the pediatric population and must be familiar with the anatomy unique to this group. Of specific concern is the emergency treatment of primary teeth versus permanent (secondary) teeth. This review of available evidence in the literature will equip the emergency clinician with the information needed to provide the most up-to-date care. For a more detailed and systematic look at pediatric dental emergency injuries, see the full text article at [www.ebmedicine.net](http://www.ebmedicine.net).

<table>
<thead>
<tr>
<th>Key Points</th>
<th>Comments</th>
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<td>First determine which type of tooth has been affected. (The management of dental trauma in children differs between primary and permanent teeth.)</td>
<td>The mechanism and time of injury are particularly important aspects of the history because they are used to stratify the risk of associated injuries, the available treatment options, and the ultimate viability of the tooth. The patient’s tetanus vaccination status should be determined as well as the need for spontaneous bacterial endocarditis prophylaxis based on the patient’s medical history.</td>
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<td>The management of injuries to primary teeth should be focus on controlling pain and preventing damage to the permanent teeth that are developing in close proximity to the apices of the primary incisors and molars. Intruded teeth should be removed, and avulsed primary teeth should not be re-implanted. 26,27</td>
<td>Acetaminophen can be given for analgesia and an ice pack may help reduce local swelling and stop bleeding to facilitate evaluation of the oral tissues in the emergency department (ED). With dental concussions and subluxations of the primary teeth, the risk of injury to the underlying permanent teeth buds is low. These injuries can typically resolve spontaneously and can generally be treated with supportive care, pain control, and outpatient dental follow-up. Radiographs may be advised to detect any damage to the surrounding alveolus, although bone injury is unlikely. A soft diet is recommended for comfort.</td>
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<td>Luxation injuries to the permanent teeth are true dental emergencies. The tooth should be repositioned in an anatomically correct position, if possible, and splinted with a flexible splint. The patient should have outpatient dental evaluation within the following week to assess the viability of the injured tooth.</td>
<td>Management should be focused on maintaining the vitality of the periodontal ligament. For lateral luxation and extrusion injuries, the tooth should be repositioned with a semirigid (flexible) splint for 2 to 3 weeks. Intrusion injuries of a permanent tooth found to have an immature root on radiography may be allowed to re-erupt over 3 to 6 weeks, whereas injured teeth with mature roots require prompt orthodontic or surgical extrusion and eventual root canal therapy by a dentist.22</td>
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<td>An avulsed permanent tooth should be handled only by the crown and re-implanted as soon as possible to improve the tooth’s viability. The tooth should not be allowed to dry and should not be scrubbed, which would remove the remaining periodontal cells that are critical to tooth viability.</td>
<td>The prognosis for avulsed permanent teeth worsens in direct proportion to the length of time they are outside the mouth. Permanent teeth require urgent reimplantation because success is time-dependent.26 There is an 85% to 97% survival of permanent teeth when they are replaced within 5 minutes, but survival is near zero after 1 hour.27 If the tooth cannot be reimplanted within 5 minutes, the tooth should be stored, in order of preference, in UW-Belzer solution, Hanks’ balanced salt solution, cold milk, saliva, physiologic saline, or clean water.25</td>
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<td>Child abuse should always be a consideration in cases of facial and dental trauma, especially in young infants and toddlers.</td>
<td>Up to 75% of abused children have orofacial injuries.38,39 An inconsistent history or the presence of atypical bruising or developmentally inappropriate injuries should alert the ED clinician to possible abuse. A torn upper labial frenulum and bruising of the labial sulcus in young, preambulatory patients should alert the emergency clinician to possible abuse. Accidental falls are more likely to cause bruising on the skin overlying bony prominences of the forehead or chin.30 Children with bruising to the softer areas of the cheeks or neck should be thoroughly evaluated for possible abuse.</td>
</tr>
<tr>
<td>Preventive measures must be incorporated in the home care of primary and permanent teeth in order to maintain good dental health.</td>
<td>Since patients often present to the ED only after symptoms of progressive disease have become severe, it is crucial to provide anticipatory guidance for dental hygiene at each opportunity.</td>
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See reverse side for reference citations.