

Traumatic Dental Injuries in Children

A Clinical Guide to
Management and Prevention

Rebecca L. Slayton
Elizabeth A. Palmer

 Springer

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and Prevention

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ISBN 978-3-030-25792-7 ISBN 978-3-030-25793-4 (eBook)
<https://doi.org/10.1007/978-3-030-25793-4>

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The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

Traumatic injuries that involve the teeth and mouth are common and frequently devastating for the individual involved. Strategies to prevent or minimize the risk of traumatic dental injuries in children should be a part of the anticipatory guidance that all dentists provide to their patients and families.

This book is meant to be a clinical guide for dentists, educators, and dental students to increase awareness of ways to prevent and manage traumatic dental injuries in children. The challenges that are unique to young children and children with special health care needs are discussed and techniques for addressing these needs are described.

Because traumatic injuries occur unexpectedly, dental and other health care providers need to have an easily accessible resource available to them to ensure timely and appropriate treatment is provided. This book is intended to serve as that resource and to complement the existing trauma guidelines developed by the International Association of Dental Traumatology.

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Introduction: Epidemiology of Traumatic Dental Injuries

1

Traumatic dental injuries (TDIs) occur at all ages and although there are ways to limit these injuries, they are not completely preventable. The etiology is complex and includes oral characteristics of the individual such as excessive overjet, factors related to human behavior such as risk-taking or impulsiveness and environmental factors including socioeconomic status and/or deprivation [1]. Within the behavioral component, the etiology can be further divided into intentional and unintentional causes, where unintentional refers to falls or collisions and intentional is more likely to involve a violent act that is either self or other inflicted [1]. It is thought that violent injuries may be under reported because often when the injury was reported, the intent was not divulged.

1.1 Pediatric Trauma

Unintentional injuries vary with age. Toddlers fall as they are learning to walk. School-aged children fall during play or sustain injuries during sporting activities. Adolescents and adults may get injured while participating in sports, on bicycles or in cars. Children with special health care needs (SHCN) often have poor coordination or limited mobility. The risk for injury is always there. In a review of the literature in 2008, Glendor reported that one-third of all children had sustained a TDI to primary dentition and one-fourth of all school-aged children had experienced a TDI to the permanent dentition [1]. Recently, Petti and colleagues investigated the incidence and prevalence of TDIs worldwide [2]. They reported the world prevalence of TDIs to primary teeth to be 21% and for permanent teeth, 15%. Their study demonstrated that TDIs are the second most frequent oral disease with dental caries being the most frequent. A recent systematic review and meta-analysis of the prevalence and etiology of TDIs in children evaluated 44 papers from countries throughout the world [3]. These authors estimated the prevalence of dental trauma in children and adolescents to be 17.5%. Injuries were more common in boys. The most common

cause of dental trauma was from falls at home with enamel fracture being the more frequent type of injury [3].

TDIs in children present challenges beyond what is experienced in more mature patients. In very young children, a traumatic dental injury may be the reason for their first visit to the dentist. This adds to an already potentially emotionally charged visit for both the child and the parent or caregiver. In this situation, the dentist has not had the opportunity to establish rapport or instill confidence and trust in their abilities to provide appropriate care for the child. Even if this is not the child's first dental visit, traumatic injuries and the treatment required are often beyond the ability of the child to tolerate. Pediatric dentists are skilled in behavior guidance techniques. However, many of the more advanced techniques such as sedation and general anesthesia require advanced planning and may not be available for emergencies in the office.

Fearful or anxious patients of any age present additional challenges and these behavioral challenges must be taken into account at the time of the initial assessment and treatment plan. Proper management of most TDIs requires multiple visits to the dental office over a period of months or years. Children or adolescents who are unable to comply with recommended treatment may require modifications to what is considered "ideal." In addition, these modifications may adversely affect the prognosis of the injured tooth and should be carefully explained to the caregiver and patient.

Children with SHCN and/or complex medical diagnoses may also present behavioral challenges due to their inability to understand or cooperate for treatment in the traditional dental setting.

This book will focus on the unique characteristics of children and adolescents that significantly influence how TDIs are managed. Because the person responsible for a child's well-being may be a parent, foster parent, grandparent, or other relative, throughout this book, the adult who is responsible for a child or adolescent patient will be referred to as caregiver.

1.2 Trauma Management Education

Considering how frequently dental injuries occur, it is unfortunate how little time is spent in the dental school curriculum regarding prevention and treatment of dental traumatic injuries. The Commission on Dental Accreditation Standards for Dental Education Programs state that "graduates must be competent in providing oral health care within the scope of general dentistry, as defined by the school, including: dental emergencies." This leaves a lot of room for interpretation of what is meant by "dental emergencies." Management of TDIs may be discussed in courses offered by the pediatric dentistry, endodontics, and oral surgery departments, but the depth of information provided varies considerably. In the standards for advanced education in pediatric dentistry, in-depth didactic education in the "care of orofacial injuries in infants, children, and adolescents" as well as clinical competence in managing these injuries is expected [4]. The standards are similar for Advanced Specialty Education

Programs in Endodontics with the stated intent: “To ensure that students/residents are trained to manage all aspects of the endodontic care of teeth with traumatic injuries” [5].

Studies regarding the proper management of TDIs in the primary and permanent dentition have shown a general lack of knowledge among dentists worldwide. Ravikumar et al. [6] surveyed general dentists regarding the management of injuries in the primary dentition. The authors reported that about half of the dentists responded accurately regarding the management of avulsed primary teeth, 55% answered appropriately for the management of luxated teeth and 36% for crown/root fractures.

The International Association of Dental Traumatology developed guidelines for the management of TDIs in 2001. They have been updated twice and are freely available to practicing dentists worldwide. In two recent studies, Hartmann et al. [7] and Alyasi et al. [8] surveyed practicing dentists to determine their knowledge of these guidelines. Hartmann and colleagues sent 14,753 surveys to registered dentists in Rio Grande do Sul. The response rate was low (9.59%) with only 1414 dentists participating. The authors judged the overall knowledge of the guidelines to be moderate with slightly higher knowledge for specialists in endodontics and pediatric dentistry [7]. Alyasi et al. compared knowledge of the trauma guidelines between general dentists and pediatric dentists in the United Arab Emirates. On average, general dentists correctly answered 37.5% of the questions and pediatric dentists answered 42.8% correctly. Both scores were considered a reflection of poor knowledge [8].

There is clearly a need for more education about management of TDIs for both general dentists and specialists.

1.3 Incidence of TDIs

There are significant differences in the cause of TDIs for different age groups. This is not surprising due to the types of behaviors that are most common for different ages. It is important to be aware of activities that put children at risk for dental injuries so that health care providers can educate families about ways to prevent or minimize injuries. This education is part of the anticipatory guidance that is provided during routine dental and medical visits.

1.3.1 Birth to 5 Years

From birth to 5 years of age, children are learning to walk, run, and climb. They are still developing coordination and may react impulsively. Dental trauma is most likely the result of a fall during this age group. One prospective study found that 25% of the children studied had a traumatic injury prior to their fourth birthday. The majority of injuries occurred inside the home and as the result of a fall [9]. The most common age for injuries in toddlers is between 18 and 30 months, reflecting the age that most children learn to walk [10].

Health care providers who treat children are mandated to recognize and report suspected child abuse. When the description of an injury provided by the caregiver does not match what is seen clinically, further investigation is warranted. More than half of child abuse cases involve craniofacial, head, face and neck injuries including fractured, displaced or avulsed teeth, and intraoral lacerations [11]. Careful assessment and investigation into the cause of the injury is imperative. When child abuse is suspected, the dentist must report their findings to the appropriate authorities in their state or country.

1.3.2 Age 6–12 Years

During the ages of 6–12 years, children are in school and spending most of the day out of the home. They participate in recess during school hours and may be involved in sports. The peak incidence for TDIs in this group has been reported to be between 9 and 10 years of age and the most common injury is an uncomplicated crown fracture [10]. The currently accepted terminology for fractures of teeth uses “uncomplicated” to describe fractures of enamel and/or dentin that do not involve a pulp exposure. Fractures that include a pulp exposure are called “complicated.”

Among fifth and sixth grade children in Jerusalem, the most commonly traumatized teeth are maxillary incisors [12]. This is consistent with other studies that demonstrate that maxillary incisor trauma is correlated with the extent of incisor overjet [13]. For example, in a meta-analysis of traumatic injuries to incisors, 9% of the moderate to severe injuries occurred in individuals with less than 3 mm overjet while 32% occurred in those with greater than 6 mm overjet [13].

Recently, it was recognized that children and adolescents with Attention-Deficit/Hyperactivity Disorder (ADHD) are at increased risk for TDIs. When children with or without TDIs were evaluated for hyperactivity, those with higher hyperactivity scores were significantly more likely to have suffered a TDI [14]. Similarly, a review of 10 years of trauma literature concluded that ADHD is a significant risk factor for TDIs [15].

Children with SHCN are also at increased risk for dental trauma due to a number of factors including intellectual, behavioral, neurologic, and physical challenges [16]. In a cohort of school-aged children, 9% of the children with SHCN had experienced trauma compared to 4% of typically developed children [16].

1.3.3 Age 13–18 years

In children between the ages of 13 and 18 years, many of the same risk factors as those in the 6–12-year age group apply. However, in this age group, there are likely to be more contact sports and more time spent away from home for social and sporting activities. By age 13, individuals usually have complete permanent dentition and the consequences of serious dental trauma are long lasting. Adolescents often have the feeling of omnipotence and immortality, leading to risk-taking behavior, lack of impulse control, testing authority, and a shift away from dependence on caregivers.

1.4 Risk Factors

There are many activities, behaviors, and physical characteristics that put a child at increased risk for TDIs. Knowing what the risks are at the individual level provides an opportunity to develop a preventive plan for each patient that can be shared with caregivers. The more common risks for TDIs are discussed below. Preventive strategies are discussed in Chap. 10.

1.4.1 Sports

Most sports put children and adolescents at increased risk for traumatic injuries, including dental trauma. Protective equipment is recommended but not always enforced. In the United States, the National College Athletic Association (NCAA) and High School Athletic Association require the use of mouthguards for football, field hockey, ice hockey, and wrestling [17]. In spite of this, a study of sports injuries showed that in 72% of dental traumatic injuries, no mouthguard was worn [17].

1.4.2 Overjet

Maxillary central incisors are the most frequently traumatized teeth, followed by maxillary lateral incisors and mandibular incisors [18]. The susceptibility of maxillary incisors is increased by their extent of overjet (Fig. 1.1). In a meta-analysis of studies done over a 25-year period, having a large overjet doubled or tripled the risk for anterior tooth trauma [13]. In most studies, 6 mm is used as the threshold for large overjet. Even an overjet greater than 3 mm increases the risk for maxillary incisor trauma significantly.

Cavalleri et al. found that 40% of fractures to permanent teeth occurred in children with maxillary overjets greater than 3 mm [19].

Fig. 1.1 In both the primary and permanent dentition, excess overjet increases the risk for traumatic dental injuries and maxillary incisors are the most frequently traumatized teeth



Borzabadi-Farahani et al. found that those most likely to have maxillary incisor trauma were boys, with class II sagittal skeletal relationship, and a decreased Frankfort-Mandibular Plane Angle (a short facial profile), and an overjet greater than 3.5 mm [20].

1.4.3 Bicycles

Accidents involving riding bicycles are relatively common and result in injuries to the head, limbs, and teeth. Twenty-two U.S. states require children to wear a bicycle helmet [21]. The age requirement varies by state and it is unclear how frequently these laws are enforced. Internationally, a number of countries have mandatory helmet laws either for all ages or just for children [21]. When worn properly, helmets protect against head injuries but may or may not protect against facial or dental injuries. Bicycle helmets have been shown to reduce both the number and severity of head injuries [22]. In addition, helmets have been shown to reduce the severity of upper and midface injuries but not lower face injuries [23]. Since the maxillary incisors are the teeth most frequently injured during falls, the use of a bicycle helmet should be encouraged to prevent both head injuries and dental injuries.

1.4.4 Automobile

Seat belts, car seats, and air bags have significantly decreased the number and severity of injuries related to automobile accidents. In the United States, the National Highway Traffic Safety Administration estimated that the use of seatbelts and airbags was 75% effective in preventing serious head injuries [24]. More recent data showed that seat belt use increased from 82.5% in 2007 to 90.1% in 2016 [25].

The incidence and severity of maxillofacial injuries occurred in 1 out of 449 accidents when the driver and passenger used both seat belts and airbags while this rate was 1 in 40 for individuals that used neither seat belts nor airbags [26]. Many states have laws regarding the use of child restraints such as car seats and booster seats. The lowest risk of injury occurs when age appropriate safety restraints are used in the rear seat of the car. Inappropriately restrained children were at almost twice the risk of injury and unrestrained children were at greater than three times the risk of injury [27]. A study focusing on the etiology of mandibular fractures reported that the most common cause of mandibular fracture was from road traffic accidents (68%) and the second most common was fall from a height (30%) [28]. In this study, the male to female ratio was 4.5:1.

1.4.5 Violence

Child maltreatment is a global issue that occurs at all ages. According to the World Health Organization, one-fourth of all adults report having been physically abused

as children [29]. Although there have been a number of national surveys on this topic, the data from many countries is missing or incomplete. The Centers for Disease Control and Prevention provides access to data from Violence against Children Surveys (VACS) from a few countries [30]. These surveys report on incidence of physical and sexual abuse toward children under 18 years of age. Unfortunately, these surveys do not report data on dental or maxillofacial trauma.

In the United States, the most common age for physical maltreatment is in children under 7 years. National statistics in the U.S. demonstrate that of the children who died from child abuse, 70% were under 3 years of age [31].

Dentists are vital for the recognition and reporting of child abuse because they see children on a regular basis and because more than half of child abuse cases involve injuries to the head, face, and neck [11]. When the description of an injury does not match what is seen clinically, there should be further investigation. For example, preambulatory children rarely have bruises and bruises to the torso, ears, and neck in children under 4 are suggestive of abuse [32].

Fighting has been documented as one of the causes of dental trauma in adolescents. Maxillofacial trauma as a result of interpersonal violence (IPV) has been reported to have a prevalence rate ranging from 9 to 52% [33]. In a study of 790 patients with maxillofacial trauma from IPV, 17% were found to have dental trauma. These numbers included both domestic and urban violence. Four percent of those with dental trauma were under 19 years of age [33].

In a study of 6000 patients (of all ages) with facial injuries, 48% had dental trauma. Of those with dental trauma, 36% were from acts of violence [34].

One of the challenges of gathering reliable data about the prevalence of maxillofacial and dental trauma is that there is not a central repository for this information. For injuries that are primarily dental in nature, the patient is most likely seen by their dentist of record. If the injury is more extensive or involves the face, jaws, or head, the patient is more likely to be seen in a hospital emergency room and managed by a maxillofacial surgeon. National trauma databases exist in a number of countries and generally collect data for traumatic injuries requiring a visit to the emergency room or hospitalization. Some of these databases include maxillofacial injuries [35, 36] but not specifically TDIs.

In a study in the UK, 71% of maxillofacial injuries were due to a combination of assaults and traffic accidents [37].

1.4.6 Attention-Deficit/Hyperactivity Disorder (ADHD)

According to the ADHD Institute [38], the prevalence worldwide of this disorder for children and adolescents is between 5.3 and 7.1% making it one of the most common neurodevelopmental disorders of childhood. It affects individuals of all ages and has been reported to have a higher prevalence among males. The primary characteristics of ADHD are hyperactivity, inattentiveness and impulsivity. In addition, their increased accident proneness contributes to the risk for injury of all types, including dental [39].

It has been recognized for over 10 years that children and adolescents with ADHD are at increased risk for TDIs. In a recent review of the literature, 9 out of 12 studies confirmed the link between ADHD and TDI in children and adolescents [15]. The increased risk for dental trauma among children with ADHD is estimated to be three times that of children without ADHD [40].

1.4.7 Tongue Piercing

Tongue piercing has become more popular in the last decade or two and consists of one or more metal studs that extend from the dorsal to the ventral surface of the tongue and have balls screwed onto each end (Fig. 1.2). Numerous case reports have documented traumatic injuries to teeth caused by the tongue stud. The most common dental injuries are chipping or fracture of teeth and restorations, abrasion, and pulp injury [1].

Fig. 1.2 A double barbell type piercing shown from the (a) ventral and (b) dorsal surfaces of the tongue increases the risk for dental trauma. The habit of tapping them against the teeth or inadvertently biting down on the metal balls may cause traumatic dental injuries

