



Dental Trauma Due to Sport in the Pediatric Patient

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Abstract

Dental trauma due to sport is devastating to any athlete but is made worse when the athlete is young and still growing. Orofacial trauma is relatively common in the pediatric population and can have significant management problems. Continued maxillary and alveolar growth, development, and maturation of individual teeth, as well as behavioral considerations create unique challenges in the management of this population. Children and youths have increased risk factors for dental trauma due to sports, including untreated malocclusions, an increase in risk-taking behavior, and undeveloped coordination and skill levels. This review article aims to increase awareness as to the role of sports in dental and orofacial injuries, discuss risk factors for this trauma as well as its prevention, and outline risk minimization for the pediatric athlete.

Dental trauma is relatively common in the pediatric population with dental injuries occurring with a prevalence of 6 percent to 19 percent for all children and adolescents.¹⁻⁴ Injuries are described as occurring predominantly during the late primary school years to early teenage years when risk-taking behavior is more likely to occur.^{1-3,5} It is often reported that there is a significantly greater tendency for injuries to occur in males than females (ratios of 1.8-2.7:1).^{2,6} This timing of injuries creates significant long-term management problems due to continued growth and maturation of the dentoalveolar and facial complex.

Etiology of Orofacial Trauma in the Pediatric Population

Traumatic injuries to the face and teeth may occur due to a number of etiological factors, including motor vehicle accidents, acts of violence, accidents at home, during play, as well as those occurring during organized sporting activities. The relative weight of each of these etiological factors varies depending on the population, mode of data collection, and category definitions. The description of injuries in the pediatric population often cites “play” as the etiology of an injury. Informal sporting activities may be considered “play” in the pediatric population. Informal sport is recognized as a time when injuries often occur, and by the use of the definition “play” in this situ-

ation may lead to an underestimation of the relative role of sport as an etiological factor for dental trauma.⁷

The availability of central databases for the recording and reporting of dental injuries, and the nature and etiology of these injuries varies between regions and populations. Individuals presenting to private dentists, medical practitioners, public dental hospitals, and community dental clinics are often not reported to a central register accessible by sporting bodies or government agencies. This situation is made worse as the peak incidence for dental trauma coincides with weekend sports training or competitive games.⁷ Statistics often used are those provided by insurance companies, which represent only those injuries for which compensation has been sought. This lack of reported data might further lead to considerable underestimation of dental injuries occurring in sports.^{7,8}

The role of sports as an etiological factor in dental trauma varies in the literature. The contribution of sporting activities to the reason for presentation within the maxillofacial unit of an Austrian university hospital was reported to be 36 percent of all presenting with orofacial injuries.⁶ Other authors



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have reported that of all dental trauma requiring professional attention, approximately 10 percent to 30 percent have been due to sporting injuries.^{2,3} One pediatric study in Norway reported that sporting activities were responsible for 8 percent of injuries within a population of seven to 18 year olds.⁹ When this population was considered in age groups, the role of sports, as an etiological factor for trauma varied, with figures for 13 to 15 year olds (28 percent) and 16 to 18 year olds (23 percent) as the highest.⁹

When looking at the risk of a dental injury due to sports, the National Youth Sports Foundation for Prevention of Athletic Injuries, Inc. (United States), estimated a one in 10 risk of orofacial injury for athletes during a single athletic session.¹⁰ It, therefore, may be hypothesized that the relative risk of receiving an orofacial injury, and the etiology of that injury due to a sporting activity, is high in the pediatric population.

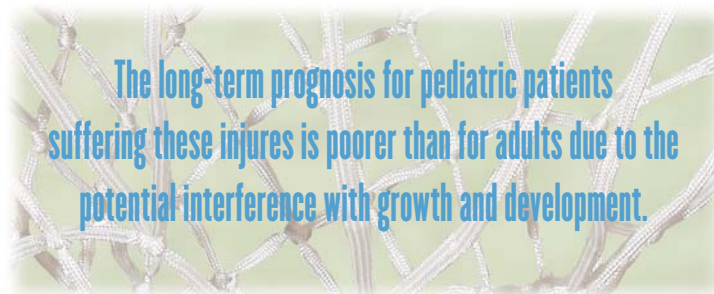
Pattern of Injuries in the Pediatric Population

Injuries frequently resulting from sporting accidents range from soft tissue lacerations and contusions; dental fractures, concussions, luxations and avulsions; dentoalveolar fractures; and mandibular dislocations and fractures.^{8,12} These injuries have been described in both the pediatric and adult populations, however, statistically significant differences in the nature of injuries between these populations have not yet been described.^{8,12} The long-term prognosis for pediatric patients suffering these injuries is poorer than for adults due to the potential interference with growth and development.

Traumatic injuries to the teeth, due to contact team sports, most frequently

include the maxillary incisors.^{9,12,13} Anatomical features, which may increase the risk of these injuries, include an Angle Class II malocclusion, prominent incisors and lip incompetence.¹⁴ Burden described inadequate lip coverage as the most important of these factors.¹⁴ This pattern of malocclusion is often seen in children in the late mixed dentition prior to orthodontic correction.¹⁵

The presence of impacted mandibular third molars have been demonstrated as increasing the risk of fracture at the angle of the mandible.^{16,17} While



these injuries tend to occur in an older population, pediatric patients should undergo an assessment of third molar teeth such that removal can be timed around athletic activity.

Orofacial injuries in the growing patient are recognized as being difficult to manage with the long-term prognosis of teeth, as well as retardation of growth being significant problems for the clinician. Severe injuries to the periodontal structures such as luxation, intrusion, and avulsion injuries can result in the ankylosis of a tooth.^{18,19} Growth of the maxilla, particularly in a vertical direction, complicates the management of these injuries due to the potential for infrapositioning of a tooth or teeth.¹⁸ If these injuries occur prior to the onset of puberty or in early adolescence, the consequences can be the severe infraposition of teeth, up to 1 millimeter per year prior to the cessation of growth in early adulthood.^{18,19}

Sports Responsible for Dental Trauma

Few studies have assessed the relative risk of individual sports, and again, regional variations in the implementation of rules, as well as requirements for protective equipment, make it difficult to make comparisons between individual sport activities. Ball sports and stick-and-ball sports are, however, considered to be responsible for most orofacial injuries in sports, 59 percent.⁹ Sports recognized as a significant risk for dental trauma include soccer, football, Australian Rules football, rugby union and rugby league, cycling, basketball, wrestling, hockey, cricket, and baseball.

The frequency of orofacial injuries in contact team sports has been best described in the various football codes. In a U.S. study of 2,470 high school football players, 9 percent reported a

dental injury requiring medical or dental attention.²⁰ In Australia, both rugby union and Australian Rules football have been investigated and injury rates described.^{21,22} In a survey of Victorian football players, Jolly and coworkers noted that injuries were common, with 25 percent to 31 percent of athletes reporting a previous orofacial injury due to Australian Rules football.²²

Basketball has a high injury rate when compared to other sports activities.²³⁻²⁵ Of all injuries occurring in basketball and requiring medical/dental attention, a significant proportion have been reported to have occurred to the oral and facial region, ranging from 7.6 percent to 40 percent.²⁶⁻²⁹

Dental trauma to the pediatric population is relatively common in basketball.^{20,28,30,31} In an Australian survey of 208 youths, 12-16 year olds, participating in competitive basketball, 11 percent reported an orofacial

injury while playing basketball.⁸ In another study, 315 (30.9 percent) out of 1,020 U.S. high school varsity basketball players sustained an orofacial injury.¹¹ These players reported a total of 633 orofacial injuries to both the soft and hard tissues, of which 140 required professional care.¹¹ Another prospective study using a sample of high school students in the United States recorded 18.3 orofacial injuries per 10,000 athletic exposures, representing 34 percent of all injuries in basketball.³² A similar prospective study of Minnesota high school athletes reported an extremely high orofacial injury experience rate — 55.4 percent in basketball per playing year.³³

Injury at Training, Games, and Play

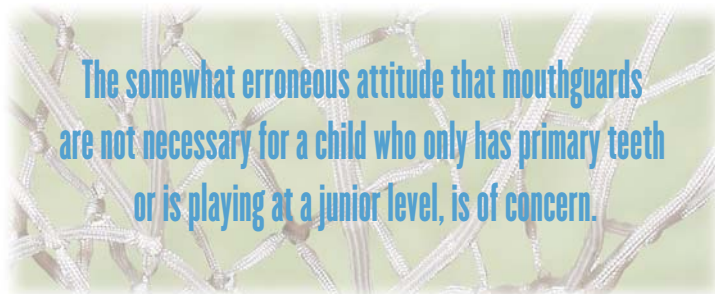
The timing and location of orofacial injuries due to sports includes games, organized training sessions, and outside of organized sessions. One study of injuries in basketball suggested that the majority, up to 80 percent, of these injuries occurred outside of organized sessions, during recreational time or “play.”³⁴ Studies that separated training and competition when analyzing when injuries occurred due to sports, reported similar numbers between the two time periods.^{27,33} Differences in the location and timing at which injuries occurred between these studies may be influenced by the way data was collected. As injuries occurring outside of organized training and competition are unlikely to be reported, their significance may be underestimated.

Orthodontics and Dental Trauma

Orthodontic treatment is often a consideration for the pediatric athlete. Case reports within the literature indi-

cate that the presence of orthodontic appliances may change the risk and nature of dental injuries. In a prospective study into the incidence of orofacial injury in Minnesota, an increased risk was reported for participants with fixed orthodontic appliances.³³

Case reports of injuries to athletes undergoing orthodontic treatment include lip entrapment over an orthodontic bracket following tackle in football, as well as the avulsion of two teeth due to a collision in basketball.^{35,36} Of concern is the fact that while mouthguards can be constructed



for the orthodontic patient, “orthodontic treatment” has been given as a reason for not wearing a mouthguard during contact sports.^{8,35}

Injury Prevention for the Pediatric Patient

Mouthguards have been repeatedly demonstrated as an effective and efficient method of reducing the severity and modifying the nature of orofacial injuries in sports. This reduction in dental injuries has been clearly demonstrated where mouthguard use has become mandatory, such as in American football and ice hockey.^{35,20,22,37,38} Laboratory studies, using animal models, have established the dramatic effect a mouthguard has on the force required to damage dental and alveolar structures.³⁹ In an *in vitro* animal model, the level of force increase required to result in damage to the dentoalveolar structures with a mouthguard *in situ* was demonstrated at 24-fold for the

primary dentition and 14-fold for the permanent dentition.³⁹

The timing of when mouthguard wear should begin has been a point of confusion among parents. In particular, the somewhat erroneous attitude that mouthguards are not necessary for a child who only has primary teeth or is playing at a junior level, is of concern. The role of trauma to the primary dentition in causing defects of the developing permanent dentition is recognized.⁴⁰ Developmental defects to teeth may be severe, requiring complex management, particularly if the defects involve the morphology of the tooth, such as a dilaceration. Early introduction of mouthguards may therefore assist in the reduction of injuries due to sports and potential damage to succedaneous teeth.

If introduced early, children may more readily accept and form a positive habit of wearing a mouthguard.⁴¹ In a study of international rugby union players, Chapman and Nassar found much variation in the average age at which the athletes began wearing mouthguards: from 12.7 years for an Australian team to 18.1 years for a Welsh team.⁴¹

Mouthguard use in the pediatric patient population was reported as low when compared to adults both at training and at competition.^{7,8,20,22} Studies of mouthguard use in children have described a higher use of Type II (mouth-formed or “boil and bite”) mouthguards compared to adults, who tend to use a greater proportion of custom-fitted mouthguards.⁸ Mouth-formed guards are recognized as having a poorer fit compared to custom-made guards and as such, the comfort level and oral function are reduced.¹¹ Discomfort due to bulk and inappropriate fit are two of the most-cited reasons as to why mouthguards are not worn.^{8,11,42}

Advice about wearing mouthguards comes mainly from coaches, family and friends, not dental professionals.^{8,43} This source of advice may adversely influence the type of mouthguard selected due to a lack of understanding about the differences between mouthguards.^{8,43} Limited understanding as to the different types available, as well as their comparative costs, may be the reason why certain guards are selected for children.⁸ A lack of professional understanding about the construction of mouthguards for children also may be responsible for the low promotion of use in this population.^{35,37,44}

Guidelines for the replacement of mouthguards for children have been vague and may require more regular replacement than for adults due to changes in growth and mixed dentition.^{45,46} Dentoalveolar and palatal growth are recognized as occurring with greatest velocity at a similar time to peak vertical growth in height.⁴⁷ This oral growth is up to 1 millimeter per year. Therefore, it is recommended that mouthguards be assessed by a dental practitioner every athletic season and in conjunction with regular dental inspections. Additionally, during periods of peak growth, the mouthguard should be replaced to ensure maximum comfort and fit.

Summary

Orofacial injuries are common in the pediatric population. Organized sports, as well as informal sporting activities, are significant etiological factors for dental trauma, particularly during adolescence. Risk factors for trauma include untreated malocclusions; a lesser developed skill level and physical coordination; and a higher level of risk-taking behavior of children.

To minimize the risk of dental trauma, it is important to promote the teaching of sporting skills and safe play for young children. Safety equip-

ment, including mouthguards, should be introduced as soon as children are participating in a sport, with mouthguards considered part of the team uniform. Dental professionals should promote custom-fitted mouthguards for children and check them regularly for integrity and fit. Dentists should promote mouthguard wear by providing information to parents, coaches and other people involved in youth sports, as well as asking their patients about their sports involvement. Dentists also can be involved by educating parents and coaches on dental first-aid and the immediate management of dental trauma.

Injury prevention for pediatric patients should also include timely orthodontic management, particularly in children with prominent maxillary incisor teeth and a high lip line. Prior to discharge, the pediatric patient should be assessed for the presence and status of mandibular third molars.

Future research to assist in the understanding of dental trauma due to sport in the pediatric population should include a prospective study to assess potential risk factors, both individual and sports-related, and develop predictive factors for analysis and discussions. CDA

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