



# Sports Dentistry: Dental Traumatology with Preventive Measures- A Review

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In sports, dental trauma is the main link between sport and dentistry. Sports dentistry is the treatment of sporting oral / facial injuries and associated oral disorders and manifestations. Sporting practices have been found to be responsible for 13 per cent of total oral trauma in children. It is emphasized that from high schools to professional teams there is a great need for a "Team Dentist." In this review, we discuss the relationship between sport and dentistry, and the importance of educating parents, teachers, and children on sport-related injury prevention.

**KEYWORDS:** Contact Sports, Dental Trauma, Mouth Guards, Protectors, Headgears

## INTRODUCTION

New booming exercises, competitions, self-enjoyment, fame, recreational activity, are attracting newer generation especially young youth toward sports activity, leading to more and more sports participants and related dental and craniofacial injuries.<sup>1</sup>

Sports dentistry is the branch of dental sciences which includes prevention, protection, clinical management of oral and maxillofacial region of athletes and sports active members and deals with the safety precautions concerning orofacial region and its disorders. Hence, precaution, prevention and safety measures are the key factors in avoiding oral and maxillofacial injuries.<sup>2</sup>

For all sports, particularly touch related, it is normal for children to get injured, with face being the principal area of injury. A dentist has to deal with various types of dental and facial bone fractures. Injury in sports is the key link between sports and dentistry. The combined effects of crime, accident traffic, and sporting events have helped to establish a public dental health issue with serious dental injuries.<sup>3</sup>

Contact sports are described as those sports in which players communicate physically with each other in an effort to prevent the opposing team or person from winning. As can be seen in Table 1, this leads to a very high incidence of dental trauma ranging from 16 to 80%.<sup>4</sup>

Threat of injury due to sports, including orofacial solid

and delicate tissue trauma, is unfortunate and often has life-long consequences. Tiwari V et al. reported that the occurrence of orofacial injuries during sporting activities was 39.1% in contact athletes and 25.3% in noncontact athletes.<sup>11</sup>

Tulunoglu et al. (2006) performed a study to assess the occurrence of dental firm and fragile tissue injuries in the young adult community during contact sports involvement, mainly in semi-professional or inexperienced boxers and tae kwon do. Their samples included 274 young adults, of which 185 (67.5%) were tae kwon do practitioners and 89 (32.5%) were boxers. The respondents replied to a standard questionnaire. Of the total sample of 274 participants, 228 (83.2 percent) were well notified about mouthguard use. 153 (55.8 percent) of the participants used mouthguards out of the overall study, all of which were of type boil-and-bite.<sup>12</sup>

Persic et al. conducted a survey to research dental squash injuries among players and coaches in Switzerland, Germany and France. A structured questionnaire interviewed a total of 653 people, 600 squash players, and their 53 coaches. 133 (20.4 per cent) of these 653 interviewees had already observed dental injury; 27 (4.5 per cent) had suffered dental injuries themselves. The ability for replanting avulsed teeth was known to less than half of all coaches and players interviewed (47.6 per cent). The package for tooth rescue was familiar to just 5.1 per cent. The findings reveal that the squash area requires more



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VARIOUS SPORTS	PREVALENCE	AUTHOR	YEAR
1. Basket Ball	80.6%(Professionals) 37.7 (semi-professionals)	Wenli Ma et al. <sup>5</sup>	2008
2. Base Ball	27%	Pasternack JS et al. <sup>6</sup>	1996
3. Foot Ball	16.6%	Esber C et al. <sup>7</sup>	2009
4 Handball	21.8%	Galic T et al. <sup>8</sup>	2018
5. Water polo	18.6%	Galic T et al. <sup>8</sup>	2018
6. Swiss Rugby	39.5%	Schildknecht S et al. <sup>9</sup>	2012
7. Hockey	33.8%	Praveena J et al. <sup>10</sup>	2018

**Table 1.** Prevalence of orofacial injuries in various contact sports

prevention information via associations for sports, trainers and dentists.<sup>13</sup>

## SPORTS INJURIES OF THE OROFACIAL REGION

### Incidence of sports injuries in orofacial region:

The face is highly vulnerable and often least protected section of the body. Depending upon the quantity of people involved, the magnitude of sports facilities and activities, of the most popular sports, the following facts have been presented:

- Athletes are projected to have 10 percent risk of being injured in face or mouth during the season of play according to National Youth Sports Organizations for Preventive Athletic Injuries.<sup>14</sup>
- Camp J reported that 13-39% of all sports-related incidents and 11-18% of all sports deaths are due to maxillofacial injuries.<sup>15</sup>
- Soft tissue injury and "T-zone" bone fractures (nose, zygoma and mandible) are very traditional types of injuries to face in sports.<sup>16</sup>
- The risk of sports trauma is twice in males as compared to females.<sup>17,18</sup>
- Meadow D et al. reported that in infants, 13% of the total oral trauma was caused by sports activities.<sup>19</sup>
- Kumamoto D et al. concluded that most dental and orofacial sports injuries have an impact on the upper lip, maxilla and maxillary incisors, with 50 % to 90% dental damage.<sup>20</sup>

## COMMON ATHLETIC INJURIES (Table 2)

**1. Soft Tissue Injuries:** Often in athletic competition, the face is the highly vulnerable area. Injuries to the body and surrounding tissues throughout the face are often seen. Abrasions, bruises and lacerations are frequent and therefore should be investigated for the purpose to rule out fracture or other severe underlying injury.<sup>15</sup> These usually occur over a bony prominence of the facial skeleton such as the brow, cheek, and chin. Lip lacerations are also common.<sup>22</sup>

**2. Fractures:** Facial bone fractures are an even more complex issue. A zygoma (cheekbone) is perhaps the most specific site of injury. Zygoma fractures account for about 10 percent of fractures in the maxillofacial region that occur during sport injuries due to the overt sharp damage resulting from fall, elbow, or fist.<sup>8</sup> In a research by Linn et al., of the 319 subjects treated for sports-related damages, males were much more vulnerable to zygomatic trauma than females due to heavy body interaction during sports.<sup>23</sup> The prominent form and elevation of the mandible, like the zygoma, also contributes to traumatization. About 10 per cent of fractures of the maxillofacial region happens in the mandible whenever the player hits, another player or equipment.<sup>23</sup> The most vulnerable area of the mandible in both kids and adults is the condyle and therefore can produce serious facial disfigurement as the development of the lower face

Injuries to the dental hard tissues and pulp	Infraction Enamel Fracture Enamel-dentin fracture Enamel-dentin-pulp fracture Crown-root fracture (uncomplicated) Crown-root fracture (complicated) Root fracture Alveolar fracture
Injuries to the periodontal tissue	Concussion (shock) Subluxation Intrusion (central luxation) Extrusion (peripheral luxation) Lateral luxation Total luxation (exarticulation)

**Table 2.** Classification of dental and periodontal traumas (Andreasen -WHO)

can change in children.<sup>22</sup>

**3. TMJ Injuries:** Most hits to the jaw don't really lead to injuries, but considerable force transferred to the temporo-mandibular disc as well as the mechanisms sustaining it can cause permanent injury, to a degree that perhaps the retrodiscal tissue is strained across and the condyle may then be forced posteriorly. This trauma sometimes results in bruising that could be intracapsular and can lead to joint ankylosis.<sup>22</sup>

**4. Tooth Intrusion:** Tooth intrusion happens, by an axially directed effect, when the tooth has been pushed into the alveolar process. This is perhaps the most extreme type of injury from displacement. Pulpal necrosis is far more probable to appear in full-formed rooted teeth and happens in 96% of cases of invasive displacement. Immature development of the root usually involves spontaneous re-eruption. The progression of mature root requires repositioning and splitting or orthodontic extrusion.<sup>22</sup>

**5. Crown and Root Fractures:** A most widespread permanent dental injury is crown fracture, which can happen in a variety of directions. Crown infarction is the easiest type. There is an enamel craze without losing the structure of tooth. No treatment is needed but appropriate pulpal vitality tests are necessary.<sup>18</sup> Fracture extended to dentine are usually sensitive to high temperature as well as other stimuli. A severe crown fracture induces the exposure of pulp completely and leads to contamination inside a closed apex tooth or can trigger a root fracture. Mobility is the major clinical predictor of a root fracture. To assess the site and seriousness of the fracture and the likelihood of related alveolar fracture, radiographic

assessment and evaluation of adjacent teeth must be conducted. The extent of injury defines treatment.<sup>14</sup>

**6. Avulsion:** Amongst the most severe sports-related dental accidents is the full avulsion of a tooth. Of all oral injuries, two to sixteen percent contribute to an avulsed tooth. A tooth completely depending on the length of the period outside the tooth socket, pushed out from the socket may be substituted with various degrees of performance. If, by improper treatment, periodontal fibres bound to the root surface have not been damaged, an avulsed tooth is likely to regain full function. The risk of success is considerably reduced after two hours. The fibres turn necrotic and the substituted tooth is resorbed and then lost.<sup>22</sup>

## DENTISTRY AND SPORTS

There are many aspects of engaging in sports as we as in physical activity, including fun and recreation, competitiveness, socialization, nutrition and health care, and development. Physical activities support all generations but participating in sports often entails a chance of injury alongside this, which can in some cases lead to continued disability.<sup>25,26</sup>

Jackson suggested a systematic approach for dental practitioners to involve in sports and for the athletic dentists' possibility. The author further emphasizes that a "team dentist" from high schools to professional teams is very much in need.<sup>27</sup>

## EVALUATION OF OROFACIAL INJURIES

Face damage assessment is important and should be focused on trauma assessment principles and begins with open airways, ventilation, circulation, injury and environmental controls. After the initial evaluation

and stabilization, the facial examination is then carried out. The procedure is used to determine the extent of the injury and the appropriate care of the wounded teeth, periodontium and structures involved.<sup>28</sup>

The examination includes a thorough medical and dental history, a clinical and x-ray review and further tests like palpation, percussion, stability and mobility assessment. Intraoral x-rays are useful for evaluation of dentoalveolar trauma. If the field of concern reaches the dentoalveolar complex, extraoral visualisation is possible.<sup>29</sup>

### TREATMENT OF OROFACIAL INJURIES

Treatment planning considers the state of the patient's wellbeing and developmental status, as well as the seriousness of the damages. Advanced behavioural guidance techniques or an adequate referral may be necessary to ensure proper diagnosis and care. Dental rescue kit for Sporting event includes gloves, mouth mirror, pen light, tongue depressor, scissors, rope wax, zinc oxide eugenol, spatula, mixing pad, clean gauze (2 x 2, 4 x 4), sterile small wire cutters (to replace damaged orthodontic wires), spare retail mouth guards, Save-a-Tooth urgent tooth protection solution.<sup>14</sup>

### PREVENTING SPORTS INJURIES

As the strength, pace, magnitude and sometimes even violent conduct of players among the plurality of professional teams continues to rise, there is a need for important prerequisites dental care. Wearing mouth guards and headgear comprising of a mask and face shield is the primary strategy for avoiding oral sports injuries. In sports requiring their use, the efficacy of sports mouthguards for dental trauma avoidance is reported.<sup>27,32</sup>

**Mouthguards or "Gumshields":** These were initially invented by London-based dentist Woolf Krause in 1890 to safeguard boxers against lip lacerations. Mouthguards also help reduce the probability of neck injury, concussion, cerebral haemorrhage, unconsciousness, significant injury of the central nervous system and death. Such casualties were a popular accompaniment to boxing competitions in that period.<sup>31</sup> Originally these gumshields were made of gutta percha, were held in position by clenching the teeth. By the 1930s, mouthguards became component of boxers' original kit and have stayed so since then.<sup>32</sup>

**Classification of Mouth Guard:** ASTM (American Society of Testing And Materials) reapproved the classification for athletic mouth guards as follows.

Type I - Stock Mouth guards. (Least preferred)

Type II - Mouth formed mouth guards.

Type III - Custom fabricated (over a dental cast) mouth guards (Most preferred).

**Stock Mouth Guards:** Stock mouth guards are either formed of rubber, polyvinyl chloride or polyvinyl acetate as a copolymer. Their major benefit is that they are fairly cheap. These are only available in small sizes, however, do not adapt well enough, hinder communication and respiration, and require jaw closure to hold the mouthguard in position.<sup>33</sup>

The ethylene-vinyl acetate copolymer materials which varied in thickness and stiffness were tested by Park et al. They observed that the thickness of the occlusal section of the mouthguard must be maintained ideal for greater energy uptake. The authors concluded that a mouthguard with a steeper insert which softens in the occlusal portion at a higher temperature is proposed as a more protective mouthguard.<sup>34</sup> The impact of occlusal supporting mouthguards in decreasing bone distortion and fractures was studied by Takeda et al. They believed that carrying of a mouthguard with insufficient occlusion can induce mandible bone fracture. Consequently, mouthguards should have proper occlusion.<sup>34</sup>

**Mouth-Formed Protectors:** Two forms of mouth-formed protectors are:

- The shell-liner type which comprises of a preformed shell with either a lining of acrylic plastic or silicone rubber. In the mouth and moulds of the athlete, the lining substance is put to the teeth and afterwards allowed to fix.

- The preformed, thermoplastic coating (also known as "boil and bite") is held for 10-45 seconds in boiling water, shifted to cold water and afterwards adjusted to the teeth. This mouthguard is perhaps the most common of the three classes and is used by more than 90% of the athletic population.<sup>35</sup>

**Custom Made Mouth Protectors:** A dentist is equipped with specially made mouthguards and has been proven to provide the highest level of protection from dental injuries. This mouthguard is manufactured of thermoplastic polymer and produced using the athlete's dentition pattern. The

dentist constructs the mouthguard and covers the athlete's mouth specifically. The advantages include fitness, communication ease, convenience and persistence.<sup>30</sup>

Stokes et al. compared the mouth-protectors of the laboratory (L) and intraorally formed (I). One mouth protector type was worn for eight weeks and then exchanged for another. They found both forms of mouth protector preventing dental injury, but the type L was better fit and more comfortable.<sup>36</sup>

While mouth guards are shown to be successful and have also been promoted for more than 30 years, mouth protectors are not considered as an essential part of safety gear in certain sports. Dentists need to educate patients regarding the needs and benefits of safeguards.<sup>2</sup>

**Helmets:** They are created to safeguard the skin of the scalp including ears from abrasions, contusions and lacerations. The skull bones, brain and central nervous system are protected from direct concussion, unconsciousness, cerebral haemorrhage, brain injury, coma, and death. During the years from the 1920s through the early 1950s, the sturdy leather helmet was the prevalent kind of football headgear. This form of helmet is made of various layers of leather knitted together to cover the head of the player, the lateral parts of the face as well as the ears. A further adjustment was the placement of a rubberized pad at the centre line of the forehead portion of the plastic helmet to avoid lacerations of the nasal pyramid induced by the helmet being pushed during touch or collision into the soft tissues of the front. Another important benefit of rigid plastic helmet has made it easier to add face masks to shield the mouth as well as other facial structures.<sup>36</sup>

**Face Masks:** These are meant to defend from traumatic forces such as a face-directed hand, ball, puck or stick in the eyes, nose, nasal pyramid, zygomatic arches, and mouth. Face masks improve player's health using varying diameters of plastic or rubber tubing or welded steel and decrease morbidity when used correctly. There are face masks constructed of aluminium and coated with a vinyl plastisol coating. The earliest type of facial mask implemented into football in the 1950s, begin with a single contoured bar. Both facial mask types provide the maxilla horizontally with varying levels of defence from an extended finger, tightened finger, forearm, or helmet to the zygomatic nasal pyramid or mandibular arch,

accordingly.<sup>36</sup> The highest level of overall facial safety is offered by the full cage face mask which is primarily selected by defensive players to prevent line play and tackle damages. Football players such as quarterbacks, running backs and wide receivers frequently choose a transitional style between the single bar and the complete cage to provide appropriate facial security while reducing constraints of peripheral vision and thereby enabling perception of a broader view of the playing field.<sup>36</sup>

## CONCLUSION

A broad range of oral/facial sports injuries and related oral disorders and their sources, including treatment and prevention modalities, are protected by sports dentistry. The dentist should have good clinical basic understanding of children and adolescents with sport-related orofacial injuries, as well as different preventive strategies. With the growing trend of sports involvement in schools and colleges, protective devices and preventive options are gaining in importance. Sport related dental injuries during involvement are not uncommon and deserve our immediate attention. In this regard, to ensure comprehensive dento-facial care, the dentist should work closely with the teachers, coaches / trainers, parents and other health professionals. Protective programmers should provide information on sport-related orofacial accidents, preventive measures such as helmets and mouthguards, and recovery. This will result in a significant understanding of the general public. It is therefore our duty to recognise, inform and provide athletes with preventive and protective measures.

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