

Review Article

Evaluation of Dental Injuries in Iranian Athletes: A Narrative Review

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Abstract

Background: Dental injury is an important public health problem that occurs in athletics. This study aimed to determine dental injuries in Iranian athletes.

Methods: By searching related keywords in the Scopus, PubMed, Web of Science, Google Scholar, and EMBASE databases, as well as the reference list of the eligible articles, and related published studies in English and Persian by the end of 2020 were included in the study, and the required data were extracted from them.

Results: Out of 475 papers initially identified, 10 satisfied the inclusion criteria and were fully evaluated accordingly. Most dental injuries belonged to combat disciplines, and the most common types of injuries were fractures and mobility in the maxillary incisors. Based on these studies, it was found that most reported injuries occurred in men during exercise. Studies have also shown that the lack of using dental protectors is one of the most important causes of injury, and the use of protectors is crucial in preventing dental injuries.

Conclusions: It seems that the emphasis on the preventive role of the use of dental protectors in controlling and preventing the occurrence of dental injuries can be decisive in this regard.

Keywords: Athletes, Dental Injury, Prevalence, Sports



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Introduction

Exercise accounts for one-third of dental injuries, and approximately 40% of dental injuries occur during exercise. The impact of dental injuries can be significant considering the annual involvement of approximately 30 million children and adolescents in sports in the United States (1). Dental injury is an important public health problem due to its challenging management, high prevalence, economic burden, and potential for long-lasting detrimental effects (2). Basketball, football, hockey, martial arts, and boxing carry the highest risk (3). In the study by Nilchian et al, exercise at school was reported as the cause of 51% of dental injuries (4). One of the reasons for the increase in dental injuries in children is their inability to diagnose traumatic situations (5). Apart from competitions, dental injuries also occur in training and training conditions (6-8). In the study of Akhavan et al, the most common causes of trauma were falls (46.2%) and sports (30.8%) in deciduous teeth, as well as falls (40.4%) and accidents (28.2%) in permanent teeth (9). In a similar study by Horri et al, there was a significant

relationship between the history of the trauma of urofacial structures and the history of sports activities, and facial injuries and oral structures increased with increasing the duration of sports activities (10). According to the report by Zuashkiani et al, dental injuries occurred during exercise, due to athlete falls, and due to factors unrelated to sports in 68.9%, 9.6%, and 21.5% of cases, respectively. In this study, the prevalence of dental injuries in August was higher compared to the other months of the year (20.9%), which is probably due to the increase in the time of activities and sports exercises of young people in the summer (11).

Demographic assessments indicated a higher prevalence of dental trauma in men than women (12,13). Although exercise is beneficial and promotes good health, some exercises increase the risk of injury to the teeth and oral tissues (14). Dental injuries can occur not only during competition but also during training, and the severity and persistence of the impact determine dental injuries (15,16). Athletes' dental injuries can lead to various physical and psychological complications (6). It may even prevent the



athlete from attending training sessions and competitions (17). According to some studies, most injuries occur in sports such as rugby, basketball, football, hockey, martial arts, and boxing where these contacts are direct, and there is a high risk of dental injuries (1,18). In Iran, most dental injuries have been reported in contact sports such as taekwondo, wushu, and kickboxing (5,7,10). One of the common problems in Iran is the lack of adequate training on how to protect and use protective equipment to prevent and reduce dental injury. In addition, the lack of medical-sports professionals in sports events to take the necessary measures during sports injuries leads to severe injuries. To the best of our knowledge, there are no coherent studies on the type of dental injuries and the type of sports in which dental injury is more common in Iran. Therefore, the present study aimed at investigating dental injuries in Iranian athletes.

Materials and Methods

Articles published from 2001 to the end of 2020 investigating the prevalence of dental injuries in Iranian athletes were sought in the current study. In this study, different keywords were applied for this purpose, including prevalence, rate, survey, dental injuries, dental injuries, athletes, sports, and Iran in the Persian and English language, as well as the combinations of “AND” and “OR” in the Irandoc, Magiran, SID, Google Scholar, EMBASE, Web of Science (ISI), Scopus, CINAHL, and PubMed databases. Using the above-mentioned keywords,

first, the articles were searched electronically, and then the reference lists of the articles published in the mentioned databases were searched manually.

The inclusion criteria for the selected articles were as follows:

1. Being in Persian or English language;
2. Being published in scientific research journals or higher levels;
3. Dealing with dental injuries related to participating in sports activities;
4. Studying the Iranian samples;
5. Being related to at least one of the cases such as the prevalence of injury, age and gender, sports, the severity of the injury, type of injury, cause and mechanism of injury, time of injury (training or competition), the season of injury (rest, bodybuilding, or competition), and provision of risk factors, strategies, and protocols for preventing information damage.

On the other hand, the exclusion criteria also included duplicate articles, letters to the editors, and case reports. Articles that did not provide the information needed for the study were excluded from the investigation.

Searches based on the inclusion criteria ultimately identified 200 articles in the field under study, and according to the exclusion criteria, unqualified research was excluded from the study, and finally, 10 articles were selected for the final review (Figure 1).

Eventually, the data extracted from the studies were

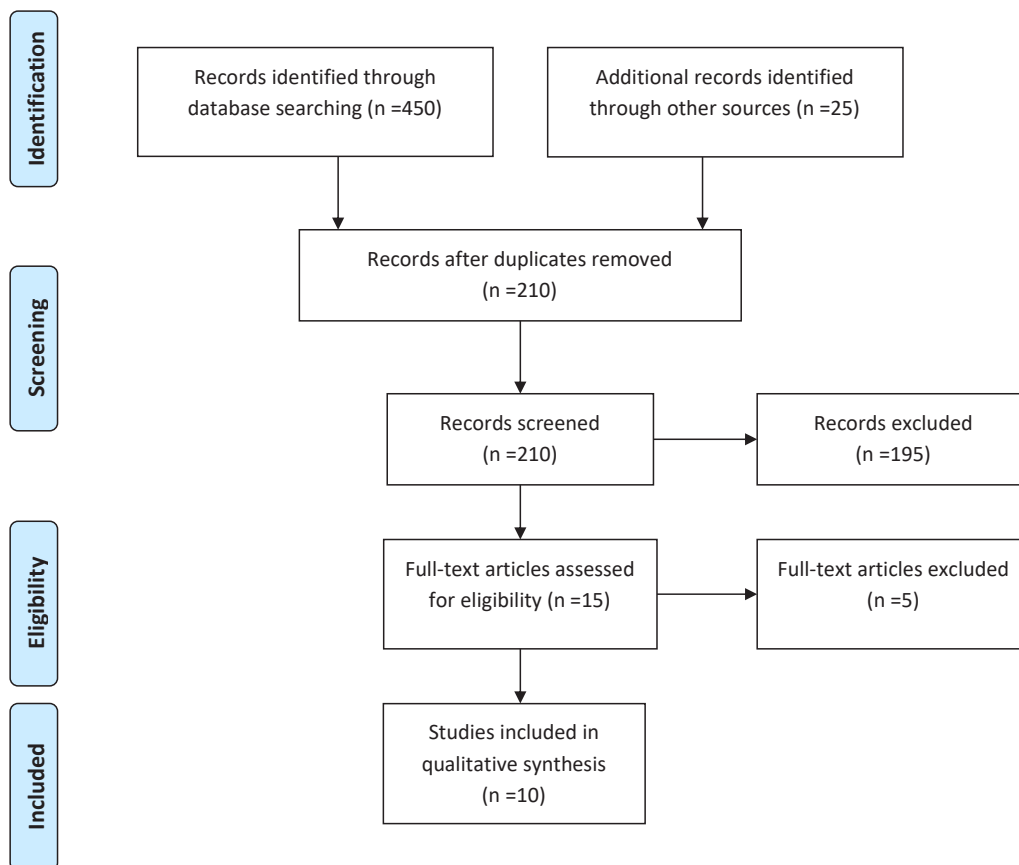


Figure 1. Diagram of Literature Search and Study Selection.

classified and reported in the form of a summary table.

Results

The results are provided in Table 1.

Discussion

Exercise is one of the most important causes of trauma and dental injuries (18). Dental trauma is a major health problem in many communities (19) usually causing

serious and permanent damage to the teeth (20). Moreover, due to the importance of maintaining oral health, this issue is one of the priorities of health research in the country (21). Approximately 40% of dental injuries occur during exercise (18) The amount of injury varies depending on the type of sports and age. Contact sports and children are more exposed to these injuries. Studies in different countries have reported different amounts of dental injuries in children. According to a systematic

Table 1. Summary of Included Studies

Study	Research Type	Sports	Prevalence of Injury	Participants	Gender	Activity Level	Aim of the Study	Type of Injury
Farhadian et al (2020)	Cross-sectional	Gymnastics, soccer, volleyball, basketball, karate, taekwondo, ship, boxing, judo	15.4%	356	Male	Professional-amateur	Sports-related dental injuries	Mobility (58%), Crown fracture (36.4%), Ovalgen (5.6%)
Mojarad et al (2020)	Cross-sectional	Soccer, baseball, gymnastics, taekwondo, karate, ship, judo, handball, boxing, volleyball	6 (10.9), 7 (12.7), 2 (3.6), 3 (5.5), 1 (1.8), 8 (14.5), 5 (9.1), 9 (16.4), 9 (16.4), 5 (9.1)	356	Male-female	Professional-amateur	Prevalence of sports-related dental injuries	Mobility (56%), Crown fracture (28.4%), Avulsion (15.6%)
Shahrabi et al (2019)	Descriptive-retrospective		6.06%	165	Male-female	Professional-amateur	Dental trauma in patients presenting to the dental clinic	Crown fracture with or without pulp opening 30.33% in maxillary incisors Oral trauma 37.8% includes: Tooth mobility, 43 (13.2%); Tooth fracture, 34 (9.7%); Tooth avulsion, 30 (5.7%); Scratching or laceration of the gingiva, 65 (18.5%); Scratching or laceration of the tongue, 45 (8%)
Horri et al (2016)	Retrospective	Taekwondo, boxing, Wushu, Karate, Kung Fu	23 (17.3%), 7 (5.3%), 31 (23.3%), 36 (27.1%), 8 (6%)	352	Male-female	Professional-amateur	Effect of mouth guard on sport-related orofacial injuries	Tooth looseness or laxation, 47.7%; Crown fracture, 42.1%; Tooth extraction or oval, 10.5%;
Rouhani et al (2016)	Cross-sectional	Contact sport	26.2%	80	Male-female	Professional-amateur	Dental injuries among contact sport	Sport injuries in 2 premier leagues of taekwondo Lip and mouth injury (teeth)
Ebrahimi varkiani et al (2014)	Descriptive-retrospective	Taekwondo	19.01%	401	Male	Professional	Sport injuries in 2 premier leagues of taekwondo	Lip and mouth injury (teeth)
Shirani et al (2010)	Retrospective	Boxing, taekwondo, kickboxing, muay thai	14 (46.7%), 5 (16.7%), 20 (66.7%), 14 (46.7%)	120	Male	Professional-amateur	Prevalence and patterns of combat sport related maxillofacial injuries	Tooth fracture, 43 (59.7%); Dis Police, 7 (9.7%); Luxion, 17 (23.6%); Ovalgen, 5 (7%)
Zuashkiani et al (2006)	Descriptive-cross-sectional	Soccer, basketball, wrestling	37.6%, 26.8%, 25.7%	409	Male	Professional-amateur	Prevalence study of traumatic dental injuries in male athletes	Upper jaw, 75.2%; Central teeth, 60.5%; One-third incisal, 26.1%; Enamel fracture, 40.5%; Enamel, dentin and pulp fractures, 25.3%; Enamel and dentin fractures, 17.8%; Complete tooth extraction, 11.1%; Other items: 5.3%
Hashemi et al (2005)	Cross-sectional	Taekwondo, karate, judo	4 (2.4%), (1.9%), 0 (0%)	938	Female	Professional-amateur	Maxillofacial injuries in sportswomen	-
Hashemi et al (2001)	Descriptive-retrospective	Football, Karate	32.4%, 41.6%	666	Male-female	Professional-amateur	Investigate the frequency of maxillofacial injuries among athletes	In men: Tooth sensitivity and looseness, 16 (2.4%); Tooth fracture, 14 (1%) In women: Tooth fracture, 3 (12.5%)

review study and meta-analysis, the prevalence of dental trauma in different countries varied from 6.1% in southern India to 36.6% in Brazil (7). Dental injuries can have significant negative economic, psychological, and social effects (6). Therefore, the prevention of dental injuries is highly important. In this regard, in developed countries, sports dentistry is included in sports competitions and recreational sports in order to prevent and treat oral and maxillofacial injuries.

The Role of Oral-dental Protectors in Preventing Dental Injuries

According to some studies, the use of mouth guards reduces soft and hard tissue damage (18-20) and the incidence of dental injuries (22, 23). The mouth guard distributes the impact force evenly throughout the mouth, thus reducing the impact of injuries (22,24,25). When mouth guards are not used, the risk of injury can increase 1.6-1.9 times (2,20) and even up to 9 times. Based on the results of previous research, the prevalence of injury in people who used mouth guards was significantly lower compared to others (22). A 26.6% and 41% reduction in maxillofacial injuries were reported in Japanese (26) and German (8) athletes who used mouth guards, respectively. Therefore, due to the importance of the subject, the use of mouth guards in some disciplines such as boxing, martial arts, American football, and ice hockey has become mandatory (24,27,28). However, many athletes in our country engage in sports such as wrestling in which facial protection is not common or at least incomplete, and this increases the risk of the jaw and facial injuries (29). According to Farhadian et al, using dental protectors and being aware of the benefits of dental protectors were the most important variables predicting sports-related injuries, followed by gender, age, and type of sports. In this study, the prevalence of dental injuries in athletes who used dental braces (7.8%) was significantly lower than in others (17.6%). Additionally, only 7.7% of people who used mouth guards were injured, while 23.7% of people who suffered from dental injuries were unaware of dental braces (22). Some studies, while examining the level of information and awareness of athletes and mothers about using oral and dental protectors, confirmed their effective role in preventing dental injuries (15,22,30,31).

Tulunoglu and Ozbek found that all boxers and 72.5% of taekwondo practitioners were aware of the benefits of dental protection (31). Ferrari et al reported that the level of awareness of using guards was 71.9% and 51% for martial arts athletes and handball players, respectively (15). In the study by Rouhani et al, 89.7% of athletes in the field of the collision were aware of the benefits of using mouth guards, but only 10.3% of them used bodyguards (5). Some of the factors affecting athletes' use of dental braces include comfort, the ability to speak, and breathe, and physical beauty (5,32). Jabarifar et al also assessed the level of information of mothers and found that mothers' awareness of dental injuries and preventive interventions

is poor. Although some mothers have commented on the usefulness of using dental braces, they have stated that they do not know where to buy and provide braces. Among the main concerns of the authors of this article were the low level of maternal dental health literacy, the lack of protective instructions in exercise and transportation sessions, and the lack of emergency equipment when people face dental injuries (30).

In another study by Horri et al, there was a significant and negative relationship between the history of trauma of unofficial structures and the use of dental protectors. Overall, 68% of the samples used mouth guards, so that 53.5% used mouth guards in both training and competition, while 44.8% and 1.7% of them only employed them only in competitions and training, respectively. The highest rate of mouth guard use was in taekwondo, while the lowest rate belonged to boxing. In addition, 93.8% of the guards were made from suitable sports shops, and 5.4% were made by a dentist. According to the answers, 71.5% of the jaw and tooth protectors were suitable, and 73.2% of the participants had difficulty using the protectors, which included difficulty breathing (53.1%), difficulty speaking (47.5%), nausea (25.7%), dry mouth (20.7%), unpleasant odor (20.7%), and other problems (7.8%). In total, 31.5% of them did not use a bodyguard, of which 36.7%, 31.5%, 31.2%, and 16.5% were due to discomfort during use, lack of advice from their instructor, lack of information about the protective role of the mouth guard, and lack of belief in usefulness, respectively. They did not use mouth guards (10).

As mentioned earlier, the majority of articles agreed on the preventive role of dental protectors in the occurrence of dental injuries, and the level of awareness of athletes and their parents about the role of dental protectors in reducing the incidence of dental injuries is extremely crucial. Therefore, increasing awareness and developing appropriate rules to force athletes to use oral protective equipment can be effective in reducing dental injuries. Further, children, and especially their parents, should be well aware of the risks of dental injuries and the benefits of using the right type of mouth guards.

Dental Injuries Based on the Type of Sports

According to evidence, dental trauma in athletes is more than in the other sections of society, reporting that 28% of dental trauma is caused by exercise (33). On the other hand, only 13.4% of athletes have referred to medical centers (34). The highest prevalence of dental injuries has been reported in collision sports such as boxing, football, basketball, and hockey (8). In the study by Rouhani et al, dental injury in professional athletes had a prevalence of over 26.2% (5). In another study by Ferrari et al, the prevalence of dental injuries was 28.8% (15). According to the results of the study by Mahmoud Hasehmi, the highest and lowest prevalence of dental injuries in male athletes in football and diving was equal to 32.4% and 1.4%, respectively, and in women, the highest prevalence (41.6%) was found in karate, while the lowest prevalence

(4.2%) was related to mountaineering, diving, and skiing (35). The chance of tooth damage in collisional fibers is significantly higher than in non-collisional filaments (22). In Iran, the incidence of sports injuries to the jaw and face accounts for 18.74% of all sports injuries, and jaw and cheek fractures are more common in contact sports (35). In the study by Shirani et al, kickboxing had the highest prevalence of dental injuries (66.7%) such as tooth fractures among other martial arts (boxing, taekwondo, and Muay Thai). The nature of the mentioned field can be mentioned as the reason for this result. The impact is mostly on the jaw compared to the fist, thus the prevalence of dental injuries in this field was higher compared to the other factors studied (36).

Horri et al found a significant relationship between the history of trauma of urofacial structures and the type of martial arts. According to the study, 33% of the athletes had dental injuries, of which 37.6%, 26.8%, and 25.7% were involved in wrestling, football, and basketball, respectively (10). The most common cause of injuries in the wrestling industry is the collision of the heads with each other or the pressure of the teeth together to create focus and, of course, the application of excessive force to the teeth during wrestling. However, this increase in prevalence was not statistically significant (11). The highest prevalence of maxillofacial injuries in Japan, France, Northern Ireland, and the United States was related to rugby (26), soccer (37), soccer (38), and martial arts, respectively (39). Such differences can be due to the different presence of men and women in different sports and countries.

According to studies, dental injuries are highly common in martial arts. Although the reported values differ from the results of studies in some countries, such differences in the prevalence of dental injuries can be due to differences in the popularity of a wide range of disciplines in them, leading to the presence of different numbers of athletes in these disciplines. Furthermore, different levels of sports facilities such as dental protectors are other reasons that can be mentioned in this regard.

Dental Injuries by Age

Children are more prone to dental injuries. The most important cause of dental injury in children is the inability to recognize traumatic situations. Studies in different countries have reported various amounts of dental injuries in children. The International Association of Dental Injuries reports that one in two children in the age range of 8-12 suffers from dental injuries (24). The most common age of dental injuries is 7-11 years (40). The high prevalence of dental injuries in Brazilian children was reported to be 12 years old and equal to 34.9% (41). According to a single study by Tsuchiya et al, 12-year-old children had the highest prevalence of dental injuries (18). Moreover, the probability of injury increased significantly with increasing age, so that the chance of injury increased almost 1.3 times with increasing one year (18).

Among other studies, Farhadian et al (22) found that the

mean age of children with a history of dental injury (11.31 years) was significantly higher than that of the group of children without a history of dental injury (10.61 years). Likewise, Horri et al reported a significant relationship between the history of the trauma of urofacial structures and age variables, so that the injury rate was higher at older ages (10).

According to studies, a certain age group cannot be introduced as the age group that has the highest prevalence of dental injuries. One of the important reasons for this is the difference in the average age of the samples studied in different articles. Therefore, this issue requires matching the information about the age variable in different articles. Contradictions in results can also be due to differences in populations, type of sports activities, and prevention program (7,42).

Tooth Injuries by Gender

Many studies have acknowledged that gender is an important risk factor for dental injuries in contact sports, and men experience more oral-dental injuries than women (43). However, some other studies found no relationship between these two variables (44,45). Among the studies conducted in Iran, we can mention that of Salehi Shahrabi et al. In this study, the prevalence of dental injuries in male athletes aged 1-14 years was higher than in girls (46). This finding is in line with those of many studies conducted in different countries. The prevalence of dental injuries in boys was 5.6 times higher in Italy than in girls (47) and 7.6 times higher in France (37). A review study in Australia also revealed that boys were significantly more likely to have permanent tooth damage than girls. The rate of involvement of boys in dental injuries, compared to girls, has been reported from 1.3 to 2.31 times in different countries (48).

Among the reviewed studies is the study of Horri et al. In this study, there was a significant relationship between the history of the trauma of urofacial structures and gender variables. More precisely, the experience of the trauma of urofacial structures in male athletes of taekwondo, boxing, wushu, karate, and kung Fu was extremely more than such an experience in female athletes (10). In the study of Farhadian et al, the prevalence of dental injuries in male athletes (13-16 years) in the fields of gymnastics, football, volleyball, basketball, karate, taekwondo, wrestling, boxing, and judo was significantly higher compared to female athletes (22). Although there was no significant difference between the prevalence of dental injuries between men and women in the study of Rouhani et al (5), the higher prevalence of dental injuries in boys was reported in most studies (10,35,43,49). According to a study on 356 athletes from football, taekwondo, volleyball, boxing, karate, wrestling, judo, handball, gymnastics, and baseball, dental injuries were more common in male athletes than in female athletes (24). Investigating traumatic dental injuries in patients who referred to Isfahan Dental School from 2005 to 2011, Akhavan et al

found a higher frequency of traumatic dental injuries in men than women in all age groups. Boys are out of the home in childhood, and the presence of more men on the streets and their participation in dangerous jobs are associated with a high risk of trauma (49). In another study by Mahmoud Hashemi, the total prevalence of maxillofacial injuries in novice and elite male athletes in the collision, semi-collision, and non-collision disciplines was 26.7 times higher than in female athletes, although the rate of dental injuries was higher in women than men. The presence of women in some disciplines is limited compared to male athletes participating in this study (35). Shokri et al also concluded that the prevalence of dental trauma was higher in men than in women (50). As mentioned in most studies, the prevalence of dental injuries in male athletes was higher than in female athletes, which could be due to the wide range of the interest rates of both genders in different sports, the lack of use of dental protectors in boys, and a tendency to do more sports activities (22).

Dental Injuries Based on Etiology: Competition or Training

This finding was reported in a study conducted by Mahmoud Hasehmi on 7-14-year-old students in Tehran; the highest prevalence of anterior crown fractures was observed in August (35). Based on the results of the study of Ranalli, the highest prevalence of injuries (31.7%) was reported in summer (33). It can also be noted that the prevalence of trauma is directly related to the increase in the hours of physical activity and the length of an athlete's athletic history (23). In another study it was revealed that for one hour of basketball exercise in girls, there is a 0.4% chance of developing dental trauma (35). In the study of Shirani et al, dental injuries were significantly higher in professional martial art athletes than in amateur athletes (36). Similarly, Salehi Shahrabi et al reported a variable share of participation (6.06%) in sports activities in the occurrence of dental injuries (46).

On the other hand, the athlete's use of dental guards can be decisive in the rate of injury in training or competition conditions, so that some athletes use dental guards only during competitions and some of them apply them only in training sessions. In addition, the use of dental guards is mandatory in the competitions of some sports, while in training conditions, the athlete may be lazy in using guards. For example, we can refer to the field of taekwondo in which the use of dental protectors in competitions has been declared mandatory since 2009 (51).

According to the review of studies, it can be acknowledged that except for a single study (24), other studies have not separately evaluated dental injuries in training and competition situations (33,46). Therefore, this issue will cause the lack of the accurate etiology of dental injuries in the present study.

Type of Dental Injuries

In the study of Rouhani et al, most injuries were loose

teeth and crown fractures, which were reported at 47.7% and 42.1%, respectively (5). The most common dental injury in the study of Shirani et al was tooth fracture (59.7%) in which the lack of use of facial protection by athletes in boxing, taekwondo, kickboxing, and Muay Thai was one of the effective factors in its occurrence (36). Further, Farhadian et al reported mobility (58%) as the most common dental injury in athletes (22). Among other studies, we can mention the study of Zuashkiani et al (11). In this study, the most common type of injury was enamel fracture (40.5%), followed by enamel and dentin fracture with pulp exposure (25.3%), enamel and dentin fracture without pulp exposure (17.8%), complete tooth extraction (11.1%), and other cases (5.3%). In the study by Salehi Shahrabi et al, most dental injuries caused by sports blows in the maxilla were reported, and then crown fracture with or without pulp opening was the most common (30.33%) type of injury (46). In some other studies, crown fractures without pulp opening have been found as the most common type of tooth injury (52-54). The most prevalent types of dental injuries include enamel fractures, resulting in dentin and enamel fractures (1,13).

In relation to the type of damaged tooth, the high prevalence of injury was observed in the middle incisor teeth and lateral incisors, which were 60.5%, and 16.3%, respectively in Zuashkiani et al study. Additionally, in the posterior teeth, the prevalence of injury in the first molar was higher than in the other teeth (11). The results of Salehi Shahrabi et al also showed that trauma occurs in the maxilla much more than the mandible, and the highest frequency of injuries (72.09%) was related to the maxillary incisors (46). In the study by Young et al, the most damaged teeth were associated with the maxillary incisors and the maxillary lateral teeth, respectively (1). According to the mentioned studies, the maxillary incisors of the maxilla are usually damaged, and fracture and mobility injuries are the most common types of dental injuries.

Conclusions

The findings of the present study confirmed the limited number of studies on the prevalence, causes, and type of dental injuries in Iranian athletes and the scarcity of information in this regard. In addition, there are obvious differences between the reporting methods of the existing studies on dental injuries in athletes, which makes it difficult to summarize the desired results; therefore, there is a need to match these features in future research. Certainly, the implementation of dental injury prevention programs in athletes, which will be achieved by conducting more comprehensive studies and identifying all the effective factors in the occurrence of these injuries, should be given special attention. It seems that the emphasis on the preventive role of the use of dental protectors in controlling and preventing the occurrence of dental injuries can be decisive in this regard. Increasing knowledge about the importance of the use of dental protective equipment in athletes and coaches, as

well as strict implementation of international regulations on the protection of athletes by sports federations, will be effective steps to reduce dental injuries. Finally, providing dental services to athletes to prevent and treat oral jaw injuries can be highly beneficial.

Authors' Contribution

Original idea, writing the manuscript, protocol development, abstract, and data analysis: All authors

Conflict of Interest Disclosures

The authors declare that they have no conflict of interests.

Ethical Statement

Not applicable.

References

- Young EJ, Macias CR, Stephens L. Common dental injury management in athletes. *Sports Health*. 2015;7(3):250-5. doi: [10.1177/1941738113486077](https://doi.org/10.1177/1941738113486077).
- Capote R. Epidemiology of Sport-Related Traumatic Dental Injury Among United States High School Athletes [dissertation]. Washington: University of Washington; 2015. <http://hdl.handle.net/1773/33857>.
- Welch CL, Thomson WM, Kennedy R. ACC claims for sports-related dental trauma from 1999 to 2008: a retrospective analysis. *N Z Dent J*. 2010;106(4):137-42.
- Nilchian F, Jabbarifar SE, Akhavan A, Ghafari Farsani M. Evaluation of reasons for dental trauma in 7-12-year-old children in Isfahan in a 2-year period based on Iran Insurance Company files. *J Isfahan Dent Sch*. 2013;8(7):622-8. [Persian].
- Rouhani A, Ghoddsi J, Rahmandost MR, Akbari M. Prevalence of traumatic dental injuries among contact sport practitioners in Northeast of Iran in 2012. *J Dent Mater Tech*. 2016;5(2):82-5. doi: [10.22038/jdmt.2016.6618](https://doi.org/10.22038/jdmt.2016.6618).
- O'Malley M, Evans DS, Hewson A, Owens J. Mouthguard use and dental injury in sport: a questionnaire study of national school children in the west of Ireland. *J Ir Dent Assoc*. 2012;58(4):205-11.
- Azami-Aghdash S, Ebadifard Azar F, Pournaghi Azar F, Rezapour A, Moradi-Joo M, Moosavi A, et al. Prevalence, etiology, and types of dental trauma in children and adolescents: systematic review and meta-analysis. *Med J Islam Repub Iran*. 2015;29(4):234.
- Bemelmanns P, Pfeiffer P. [Incidence of dental, mouth, and jaw injuries and the efficacy of mouthguards in top ranking athletes]. *Sportverletz Sportschaden*. 2000;14(4):139-43. doi: [10.1055/s-2000-8950](https://doi.org/10.1055/s-2000-8950).
- Akhavan A, Nilchian F, Salehi A. Traumatic dental injuries and their follow-up in patients attending Isfahan Dental School during a 5-year period (2005-2011). *J Isfahan Dent Sch*. 2014;10(1):53-66. [Persian].
- Horri A, Shojaepoor R, Jahanimoghdam F, Bahador A, Pouradeli S. Effect of mouthguard on sport-related orofacial injuries in adolescents in Kerman, Iran. *Int J Adv Biotechnol Res*. 2016;7(4):2228-34. [Persian].
- Zuashkiani T, Ajami B, Kalali B. A prevalence study of traumatic dental injuries in male athletes in non martial sports in Mashhad in 2001. *J Mashhad Den Sch*. 2006;30(Issue 1,2):55-64. doi: [10.22038/jmds.2006.1456](https://doi.org/10.22038/jmds.2006.1456). [Persian].
- Garbin CA, Guimarães e Queiroz AP, Rovida TA, Garbin AJ. Occurrence of traumatic dental injury in cases of domestic violence. *Braz Dent J*. 2012;23(1):72-6. doi: [10.1590/s0103-64402012000100013](https://doi.org/10.1590/s0103-64402012000100013).
- Marchiori EC, Santos SE, Asprino L, de Moraes M, Moreira RW. Occurrence of dental avulsion and associated injuries in patients with facial trauma over a 9-year period. *Oral Maxillofac Surg*. 2013;17(2):119-26. doi: [10.1007/s10006-012-0354-5](https://doi.org/10.1007/s10006-012-0354-5).
- Daly PJ, Sim FH, Simonet WT. Ice hockey injuries. A review. *Sports Med*. 1990;10(2):122-31. doi: [10.2165/00007256-199010020-00005](https://doi.org/10.2165/00007256-199010020-00005).
- Ferrari CH, Ferreria de Medeiros JM. Dental trauma and level of information: mouthguard use in different contact sports. *Dent Traumatol*. 2002;18(3):144-7. doi: [10.1034/j.1600-9657.2002.00017.x](https://doi.org/10.1034/j.1600-9657.2002.00017.x).
- Sane J, Lindqvist C, Kontio R. Sports-related maxillofacial fractures in a hospital material. *Int J Oral Maxillofac Surg*. 1988;17(2):122-4. doi: [10.1016/s0901-5027\(88\)80165-6](https://doi.org/10.1016/s0901-5027(88)80165-6).
- Adegbesan OA, Onyeaso CO. Perception of Nigerian athletes of the use of mouth guards to prevent the stresses of sports injury. *Br J Sports Med*. 2004;38(6):685-9. doi: [10.1136/bjism.2003.004838](https://doi.org/10.1136/bjism.2003.004838).
- Tsuchiya S, Tsuchiya M, Momma H, Sekiguchi T, Kuroki K, Kanazawa K, et al. Factors associated with sports-related dental injuries among young athletes: a cross-sectional study in Miyagi prefecture. *BMC Oral Health*. 2017;17(1):168. doi: [10.1186/s12903-017-0466-2](https://doi.org/10.1186/s12903-017-0466-2).
- Soares TR, Jural LA, Sant'Ana I, Luiz RR, Antunes LA, Risso PD, et al. Risk factors for different types of traumatic injuries in primary teeth. *Pesqui Bras Odontopediatria Clin Integr*. 2020;20:e5150. doi: [10.1590/pboci.2020.051](https://doi.org/10.1590/pboci.2020.051).
- Labella CR, Smith BW, Sigurdsson A. Effect of mouthguards on dental injuries and concussions in college basketball. *Med Sci Sports Exerc*. 2002;34(1):41-4. doi: [10.1097/00005768-200201000-00007](https://doi.org/10.1097/00005768-200201000-00007).
- Tschan JD, Röthlisberger B, Hegg L, von Arx T. [Frequency and nature of anterior tooth injuries and the use of mouth protectors in sports clubs in Bern]. *Schweiz Monatsschr Zahnmed*. 2003;113(1):20-6.
- Farhadian M, Torkaman S, Mojarad F. Random forest algorithm to identify factors associated with sports-related dental injuries in 6 to 13-year-old athlete children in Hamadan, Iran-2018 -a cross-sectional study. *BMC Sports Sci Med Rehabil*. 2020;12(1):69. doi: [10.1186/s13102-020-00217-5](https://doi.org/10.1186/s13102-020-00217-5).
- Knapik JJ, Hoedebecke BL, Rogers GG, Sharp MA, Marshall SW. Effectiveness of mouthguards for the prevention of orofacial injuries and concussions in sports: systematic review and meta-analysis. *Sports Med*. 2019;49(8):1217-32. doi: [10.1007/s40279-019-01121-w](https://doi.org/10.1007/s40279-019-01121-w).
- Mojarad F, Farhadian M, Torkaman S. The prevalence of sports-related dental injuries and the rate of awareness of mouthguard use among child athletes. *J Pediatr Res*. 2020;7(4):358-64. doi: [10.4274/jpr.galenos.2020.92678](https://doi.org/10.4274/jpr.galenos.2020.92678). [Preprint].
- Li B, Bai X, Sun H, Cui C, Liu W. Knowledge and Implementation of Protective Measures for Oral and Maxillofacial Injuries of Ice Hockey Players in Primary and Secondary Schools in Beijing. *Res Sq* [Preprint]. March 19, 2021. doi: <https://doi.org/10.21203/rs.3.rs-329328/v1>
- Yamada T, Sawaki Y, Tomida S, Tohnai I, Ueda M. Oral injury and mouthguard usage by athletes in Japan. *Endod Dent Traumatol*. 1998;14(2):84-7. doi: [10.1111/j.1600-9657.1998.tb00816.x](https://doi.org/10.1111/j.1600-9657.1998.tb00816.x).
- Chisholm DA, Black AM, Palacios-Derflinger L, Eliason PH, Schneider KJ, Emery CA, et al. Mouthguard use in youth ice hockey and the risk of concussion: nested case-control study of 315 cases. *Br J Sports Med*. 2020;54(14):866-70. doi: [10.1136/bjsports-2019-101011](https://doi.org/10.1136/bjsports-2019-101011).
- Ozler CO, Doğan BG, Bilgin E, Demirhan G, Dicle AR, Çetin E, et al. What do Turkish sports sciences students know about dental trauma and mouthguards? A descriptive study. *Acta Odontol Turc*. 2020;37(2):29-35.
- ADA Council on Access, Prevention and Interprofessional Relations, ADA Council on Scientific Affairs. Using mouthguards to reduce the incidence and severity of sports-

- related oral injuries. *J Am Dent Assoc.* 2006;137(12):1712-20. doi: [10.14219/jada.archive.2006.0118](https://doi.org/10.14219/jada.archive.2006.0118).
30. Jabarifar E, Khadem P, Heidari M. Mothers' awareness of dental trauma environmental and individual risk factors and prevention modalities for susceptible elementary pupils of Isfahan/Iran. *Braz J Dent Traumatol.* 2011;2(2):50-64.
 31. Tulunoglu I, Ozbek M. Oral trauma, mouthguard awareness, and use in two contact sports in Turkey. *Dent Traumatol.* 2006;22(5):242-6. doi: [10.1111/j.1600-9657.2006.00386.x](https://doi.org/10.1111/j.1600-9657.2006.00386.x).
 32. Ranalli DN. Prevention of sports-related traumatic dental injuries. *Dent Clin North Am.* 2000;44(1):35-51.
 33. Ranalli DN. Sports dentistry and dental traumatology. *Dent Traumatol.* 2002;18(5):231-6. doi: [10.1034/j.1600-9657.2002.00122.x](https://doi.org/10.1034/j.1600-9657.2002.00122.x).
 34. Canakci V, Akgül HM, Akgül N, Canakci CF. Prevalence and handedness correlates of traumatic injuries to the permanent incisors in 13-17-year-old adolescents in Erzurum, Turkey. *Dent Traumatol.* 2003;19(5):248-54. doi: [10.1034/j.1600-9657.2003.00199.x](https://doi.org/10.1034/j.1600-9657.2003.00199.x).
 35. Mahmoud Hasehmi H. Frequency of maxillofacial injuries among athletes-members of various sports federations in Iran form 1998-2001. *J Dent Med.* 2003;15(4):59-67. [Persian].
 36. Shirani G, Kalantar Motamedi MH, Ashuri A, Sadr Eshkevari P. Prevalence and patterns of combat sport related maxillofacial injuries. *J Emerg Trauma Shock.* 2010;3(4):314-7. doi: [10.4103/0974-2700.70744](https://doi.org/10.4103/0974-2700.70744).
 37. Maladière E, Bado F, Meningaud JP, Guilbert F, Bertrand JC. Aetiology and incidence of facial fractures sustained during sports: a prospective study of 140 patients. *Int J Oral Maxillofac Surg.* 2001;30(4):291-5. doi: [10.1054/ijom.2001.0059](https://doi.org/10.1054/ijom.2001.0059).
 38. Abernethy L, McNally O, MacAuley D, O'Neill S. Sports medicine and the accident and emergency medicine specialist. *Emerg Med J.* 2002;19(3):239-41. doi: [10.1136/emj.19.3.239](https://doi.org/10.1136/emj.19.3.239).
 39. Pinkham JR, Kohn DW. Epidemiology and prediction of sports-related traumatic injuries. *Dent Clin North Am.* 1991;35(4):609-26.
 40. Stewart GB, Shields BJ, Fields S, Comstock RD, Smith GA. Consumer products and activities associated with dental injuries to children treated in United States emergency departments, 1990-2003. *Dent Traumatol.* 2009;25(4):399-405. doi: [10.1111/j.1600-9657.2009.00800.x](https://doi.org/10.1111/j.1600-9657.2009.00800.x).
 41. Paiva PC, de Paiva HN, de Oliveira Filho PM, Côrtes MI. Prevalence and risk factors associated with traumatic dental injury among 12-year-old schoolchildren in Montes Claros, MG, Brazil. *Cien Saude Colet.* 2015;20(4):1225-33. doi: [10.1590/1413-81232015204.00752014](https://doi.org/10.1590/1413-81232015204.00752014).
 42. Marwaha M, Bansal K, Srivastava A, Maheshwari N. Surgical retrieval of tooth fragment from lower lip and reattachment after 6 months of trauma. *Int J Clin Pediatr Dent.* 2015;8(2):145-8. doi: [10.5005/jp-journals-10005-1302](https://doi.org/10.5005/jp-journals-10005-1302).
 43. Onyaso CO. Secondary school athletes: a study of mouthguards. *J Natl Med Assoc.* 2004;96(2):240-5.
 44. Hersberger S, Krastl G, Kühl S, Filippi A. Dental injuries in water polo, a survey of players in Switzerland. *Dent Traumatol.* 2012;28(4):287-90. doi: [10.1111/j.1600-9657.2011.01083.x](https://doi.org/10.1111/j.1600-9657.2011.01083.x).
 45. Andrade RA, Evans PL, Almeida AL, da Silva Jde J, Guedes AM, Guedes FR, et al. Prevalence of dental trauma in Pan American games athletes. *Dent Traumatol.* 2010;26(3):248-53. doi: [10.1111/j.1600-9657.2010.00884.x](https://doi.org/10.1111/j.1600-9657.2010.00884.x).
 46. Salehi Shahrabi M, Mokhtari S, Sharabi M, Heidari A, Ghadimi S, Mosharafian S, et al. Epidemiologic study of dental trauma in patients presenting to the dental clinic of school of dentistry of Tehran University of Medical Sciences during 2011-2018. *Iran J Pediatr Dent.* 2019;14(2):33-44. [Persian].
 47. De Gioanni PP, Mazzeo R, Servadio F. [Sports activities and maxillofacial injuries. Current epidemiologic and clinical aspects relating to a series of 379 cases (1982-1998)]. *Minerva Stomatol.* 2000;49(1-2):21-6.
 48. Bastone EB, Freer TJ, McNamara JR. Epidemiology of dental trauma: a review of the literature. *Aust Dent J.* 2000;45(1):2-9. doi: [10.1111/j.1834-7819.2000.tb00234.x](https://doi.org/10.1111/j.1834-7819.2000.tb00234.x).
 49. Petti S, Glendor U, Andersson L. World traumatic dental injury prevalence and incidence, a meta-analysis—One billion living people have had traumatic dental injuries. *Dental traumatology.* 2018;34(2):71-86.
 50. Shokri M, Afsharloo S, Tarjoman A, Borji M, Mahdikhani S, Maleki M, et al. Dental trauma among Iranian children and adolescents: a comprehensive study. *Int J Pediatr.* 2021;9(1):12901-8. doi: [10.22038/ijp.2020.49893.3980](https://doi.org/10.22038/ijp.2020.49893.3980).
 51. Aljohani YR, Alfaiif KH, Redwan SK, Sabbahi DA, Zahran MH. Dental injuries in taekwondo athletes practicing in Saudi Arabia. *Saudi Med J.* 2017;38(11):1143-7. doi: [10.15537/smj.2017.11.21111](https://doi.org/10.15537/smj.2017.11.21111).
 52. de Carvalho Rocha MJ, Cardoso M. Traumatized permanent teeth in Brazilian children assisted at the Federal University of Santa Catarina, Brazil. *Dent Traumatol.* 2001;17(6):245-9. doi: [10.1034/j.1600-9657.2001.170601.x](https://doi.org/10.1034/j.1600-9657.2001.170601.x).
 53. Forsberg CM, Tedestam G. Traumatic injuries to teeth in Swedish children living in an urban area. *Swed Dent J.* 1990;14(3):115-22.
 54. Onetto JE, Flores MT, Garbarino ML. Dental trauma in children and adolescents in Valparaiso, Chile. *Endod Dent Traumatol.* 1994;10(5):223-7. doi: [10.1111/j.1600-9657.1994.tb00074.x](https://doi.org/10.1111/j.1600-9657.1994.tb00074.x).