Prevalence of orofacial injuries in contact sports: A systematic review

Dr Raghavendra.K
Physical Education Director
Govt First Grade College
Ranebennur

Abstract
Aim: The aim of this study was to determine, on the prevalence of orofacial injuries among athletes of various contact sports through a systematic review.
Materials and Methods: Relevant studies were included from the period of January 1996 to December 2018 via Medline (Pubmed), Cochrane and Google Scholar. A detailed search strategy was developed for Medline through the use of mesh terms and was revised for Google Scholar, Cochrane also. Only full papers written in English were included. Only 8 met the inclusion criteria and were selected for a qualitative synthesis.
Result: The various orofacial injuries (fractured tooth, loosening of tooth, hematoma formation, fracture of mandible, TMJ stiffness, loss of sensation, soft tissue laceration, ear laceration, tongue, lip injuries etc). Were assessed and it was observed that the prevalence of orofacial trauma within the included studies varied between 7.1% and 80.5 % among athletes.

Keywords: Orofacial injuries, atheletes, contact sports, mouth guards

1. Introduction

Sports is defined as an activity involving physical exertion and skill in which an individual or team competes against one another for entertainment. Risk of dental injury is high among sports, especially in contact sports activities. Consequently a new branch of dentistry called sports dentistry has evolved at 1980 [1] Sports dentistry is closely related to another dental discipline called dental traumatology. It focuses on preventing and treating orofacial athletic injuries and related oral diseases. According to international academy for sports dentistry, the main goals of sports dentistry include prevention and treatment of sports related dental/orofacial injuries, information collection, information dissemination and promotion of research on the preventive procedures related to injuries of such a specific etiology [2, 3].
Contact sports are defined as those sports in which players physically interact with each other trying to prevent the opposing team or person from winning. This results in very high incidence of dental trauma ranging from 16% to 80% as shown in table 1. Exposed to physical fitness programme.

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

Various Sports	Prevalence	Author	Year
1. Basket Ball	80.6%(Professionals) 37.7 (semiprofessionals)	Wenli Ma *et al.*	2008
2. Base Ball	27%	Pasternack JS *et al.*	1996
3. Foot Ball	16.6%	Esber C¸ aglar *et al.*	2009
4 Handball	21.8%	Galic T *et al.*	2018
5. Water polo	18.6%	Galic T *et al.*	2018
6. Swiss Rugby	39.5%	Stefan Schildknecht *et al.*	2012
7. Hockey	33.8%	Praveena J *et al.*	2018

Sports related dental injuries occur in unacceptably high rate in contact sports partly due to the prominence of the face and relatively poor adherence to personal protective equipment use during sports activities. The increasing participation of the individuals of varied age in sporting activities, from organized team to the occasional weekend for self-defense, health and relaxation purpose also contributes to the increasing prevalence of dentofacial injuries[4].
The face is the most defenseless area of the body and is frequently the least protected. Approximately 11–40 % of all sports injuries involve the face. These injuries most often occur by clash with a ball or object or player-to-player contacts.

A blow to the face cannot only cause tooth or soft tissue injuries but can also result in fractures of the jaw or facial bones or even head injury. The complex anatomy of the face presents a challenge for the clinicians for the diagnosis and the treatment of these injuries [5]. Tuli *et al*, in Austria reported that sport accidents are six times and three times more likely to cause facial injuries than work accidents and violence or traffic accidents respectively.

The most common types of sports-related trauma are the soft tissue injuries and the fractures of face bones (nose, zygoma, mandible). Sports injuries may cause potentially serious fractures of the facial bones and teeth. According to the literature, injury is described as macro-trauma versus microtrauma. Macro-trauma includes injuries that are the result of a sudden, acute major force such as bone fractures, sprains, contusions, concussions, tooth fractures, avulsions, and lacerations. Microtrauma is a trauma that is attributable to chronic, repetitive injury over an extended period of time and includes stress fractures, bursitis, tendinitis, dental attrition, and temporomandibular joint disorders. Each contact sport appears to have a specific injury profile [6].

The majority of the sports related traumatic injuries are preventable with the use of appropriate, properly fitted athletic equipment such as helmets, facemasks, and mouthguards. These personal protective equipments which are highly recommended in collision and contact sports are crucial in protecting against these injuries.

In developed countries "The German society for dentistry and oral surgery" has made a strong recommendations for athletes who participate in various contact sports to use mouthguards and other protectors in an attempt to reduce the incidence of dental trauma [7]. Protective devices such as mouthguards also may help to reduce the incidence or severity of dental injuries if they are worn during participation in contact sports. In 1962, The National collegiate athletic association (NCAA) mandated the use of mouthguards for football players at colleges and universities [8, 9]. Before 1962, the annual incidence of football related injuries to the face and mouth region was estimated to be 50 percent [10] after 1962, injuries decreased to 1.4 percent [11]. Despite these results, the NCAA mandated the use of mouthguards for only five amateur sports: boxing, football, ice hockey, men's lacrosse and women's field hockey [12]. Recently, the American Dental Association Council on Access, Prevention and Inter professional relations and the council on scientific affairs recommended that athletically active people of all ages use a properly fitted mouthguard in any sporting or recreational activity that may pose a risk of injury [13].

However, the use of personal protective equipment are still not mandatory, or rules not enforced, in many sporting activities in developing countries.

Data on the prevalence and the prevention of dentofacial injuries are lacking in the literature despite the increasing participation across cities in the country. There is a need for a universal system to report the orofacial sports-related injuries in order to establish a valid database that may be used to enhance treatment outcomes. This will assist in improving protective equipment design and to promote the better education of coaches, officials, players, and parents. The objective of the study was to determine the prevalence of orofacial injuries and related factors among individuals participating in contact sports.

2. Materials and Methods

2.1 Design

This systematic review followed the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta- Analysis-(PRISMA)-(http://www.prisma-statement.org), recorded in the PROSPERO database under the protocol CRD42019121037.

2.2 Eligibility criteria

On applying the PICO analysis to the articles searched the criteria were set as shown below:

PICO analysis

- Population – Contact sport players.
- Intervention/ Interest- Contact sport.
- Comparison- Not applicable.
- Outcome- Traumatic orofacial injuries.

2.3 Inclusion criteria

- Studies which included contact sports participants.
- Studies which assessed the orofacial injury using WHO as well as Ellis and Davey's classification of traumatic dental injuries and their primary and secondary objective were included.
- The search included only studies published in English.
- Studies which had a sample participants with the age group of 10 to 55years.
- Studies published in the last 25 years were included.
- Cross sectional, cohort studies

2.4 Exclusion criteria

- Studies which assessed the non-contact sports injuries.
- Qualitative studies, reviews, expert opinion, systematic reviews, meta-analysis and case studies/ series.
- Publications with no abstract and those which were widely out of scope of the study were eliminated.

- Studies that required translation to English language.

The remaining studies were sorted on basis of their title and abstract. Finally, those studies in which the abstract fulfill all inclusion criteria were selected for full-text reading. In those cases in which a study met the eligibility criteria but the information in the abstract was insufficient, full texts of the articles were also obtained. Further literature search was performed based on the bibliography of the selected articles.

2.5 Search strategy

Relevant studies were included from the period of January 1996 to December 2018 via Medline (pubmed), Cochrane and Google Scholar. A detailed search strategy was developed for Medline through the use of mesh terms and was revised for Google Scholar, Cochrane also. The first set of terms include 'traumatic', 'orofacial' separated by Boolean operator OR. The second set included the term 'contact sports', 'prevalence' separated by Boolean operator "AND" 'and the third set included the term 'Prevalence and contact sports,' separated by Boolean operator "AND". Data searches were done at September 2018. Hand searches of reference lists of included studies were conducted to ensure additional relevant references were identified. Although systematic reviews, qualitative studies were excluded, reference lists werechecked to ensure all primary research was located for inclusion. Only full papers written in English were included. Where multiple publications reporting on the same study existed in different databases data from the study were extracted and reviewed only once.

Database	Search pattern
Pubmed	((PREVALANCE[All Fields] AND ("wounds and injuries"[MeSH Terms] OR ("wounds"[All Fields] AND "injuries"[All Fields]) OR "wounds and injuries"[All Fields] OR ("traumatic"[All Fields] AND "injuries"[All Fields]) OR "traumatic injuries"[All Fields])) OR (OROFACIAL[All Fields] AND ("injuries"[Subheading] OR "injuries"[All Fields] OR "wounds and injuries"[MeSH Terms] OR ("wounds"[All Fields] AND "injuries"[All Fields]) OR "wounds and injuries"[All Fields]))) AND (("Contact"[Journal] OR "Contact"[Journal] OR "Contact (Thousand Oaks)"[Journal] OR "contact"[All Fields]) AND ("sports"[MeSH Terms] OR "sports"[All Fields]))
Cochrane	'PREVALENCE in Title Abstract Keyword AND OROFACIAL INJURIES in Title Abstract Keyword OR TRAUMATIC INJURIES in Title Abstract Keyword AND CONTACT SPORTS in Title Abstract Keyword - (Word variations have been searched)'
Google scholar	((Prevalence of orofacial or traumatic injuries in contact sports))

2.6 Study selection

Study selection was conducted by two authors who independently screened titles and abstracts against the inclusion/exclusion criteria and identified relevant papers. Then the same two authors independently reviewed the full text studies unable to be excluded by title and abstract alone. Comparison of papers was completed between the two authors with no disagreements regarding inclusion.Data extraction

The data extraction from final 8 articles was done using a data extraction form. It includes the first author name, year of publication of the article, study population, objectives of the study, study design, method of obtaining relevant information (assessment tool), results and primary outcome and author's conclusion shown in table 2.

Table 2: Summary of included studies.

Author name, year and country	Study population, age	Type of game & Gender	Objectives	Study design	Assessment tool	Outcome and result	Author's conclusion
P.J. chapman 1996 Australia	Rugby game players aged between 13 to 16.	Rugby Males	Not clearly mentioned.	Cross sectional	Pre validated questionnaire	Players attitude regarding mouthguards as well as details of any orofacial injuries sustained during rugby union. Result: Overall,9 players (7%)had sustained an orodental injury which needed treatment. 5 sustained dental injuries, all involving upper anterior teeth, while 4 sustained lip lacerations. School level -7% Club level -16% International level -33 to 50%	High usage rate of mouyhguards in high school rugby union and very low incidence of orofacial injuries.
C.o. onyeaso 2004 Nigeria	Nigerian atheletes aged btwen 10 to 29	Football (soccer) Basketball Taekwon do Karate Judo Handball Table tennis Long tennis Badminton Lawn tennis Swimming 'Field events Both gender	To determine the extent of awareness concerning mouthguard Use for sports as well as the amount and type of oro-facial trauma Associated with sporting activities among nigerian athletes.	Cross sectional	Questionnair e survey	Distribution of types of previous orofacial injuries.the relationship between awareness of mouthguards And usage for sports in the study population. Result: 62.1% of the females had one form of oro- facial injury against 53.9 % of the males. Laceration of soft tissues accounted for 65 (23.8 %) of the injuries. Contact sports contributed the majority of the injuries (78.5 %)oro-facial injuries. The prevalence of oro-facial injuries was significantly lower while wearing mouthguards	There is need to properly educate Nigerian athletes on the proven Protective ability of mouthguards Against sports-related Oro-facial injuries.
Amy.e *et al* l2005 Central America& Caribbean	Central american and caribbean sports games aged between 16	Boxing Basketball Handball 'Field hockey	To examaine the incidence of dental and orofacial trauma from	Cross sectional	Questionnair e Survey	Result: Acute conditions involves 1 tooth avulsion (boxing), 2 tooth fractures (field hockey/track and field), 2 lip lacerations (wrestling/basketball), 3	Custom made and properly fitted mouthguard should be made for all participants participating in

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	to 50 years.	Track and field Wrestling Baseball Karate-do Boxing Rifle shooting Males	participating country in central american and carribean sport games			maxillary fractures (two basketball/one baseball), 4 lip contusions (two karate-do/two boxing), 2 periapical lesions (one baseball, one track and field, one basketball) and 3 periodontal abscess (one rifle shooting, one track and field, one administration).	contact or collision sports.
Lieger o, *et al* ,2006 Switzerland	Atheletes in switerzland average aged age 26	Soccer, Handball, basketball and ice hockey Male	The objective of the present study was to measure the Occurrence of orofacial and cerebral injuries in different sports and To survey the awareness of athletes and officials concerning the use Of mouthguards during sport activities.	Cross sectional	Questionnaire	Measured the Occurrence of orofacial and cerebral injuries in different sports. Result: 119 players (45%) informed they had suffered injuries. Soft tissue lesion n=181 Tooth fracture n=130 Tooth dislocation n=15 Tooth avulsion n=27 Lower jaw fracture n=7 Cerebral concussion n=55 (Multiple injuries per athlete is possible were accounted)	Doctors and dentists need To recommend a more intensive education of students in sports Medicine and sports dentistry, and to increase their willingness to Become a team dentist.

Wenli ma 2008	Basketball players age - 20 to 26	Basket ball	The objective of the present study was to describe the occurrence of Orofacial, particularly dental injuries in basketball, and to survey the athletes' Awareness concerning the use of mouthguards during basketball training and Competition.	Cross sectional	Pilot questionnaire	Experience of orofacial and dental injuries Result: The oral injury incidence in the professional players was 80.5%, and in the semi- professionals 37.7%. Type Profl Semi- Soft-tissue laceration 20 (32.2) 41 (68.3) Tooth Fracture 8 (12.9) 4 (6.7) Dislocation8 (12.9) 5 (8.3) Avulsion 5 (8.1) 0 No detail 21 (33.9) 10 (16.7)	Limited knowledge about oral Injury prevention and limited use of mouthguards are a Reality. Athletes and the public should be informed about The high risk of oral injuries when participating in Contact sports.
Vidhatri tiwari 2014 India	Contact and non contact atheletes Age 12yr to 22yrs	Boxing Basketball Handball 'Field hockey Track and field Wrestlin g Baseball Karate-do Boxing Rifle shooting	Association of mouthguard awareness with the rate and type of orofacial injuries during spoting activities among professional indian atheletes.	Cross sectional	Structured questionnaire	Association of mouthguard awareness with the rate and type of orofacial injuries Result: Analysis of orofacial injury among the athletes front teeth 20.4% in contact athlete and soft tissue 25.9%. 65 (39.1%) contact athletes athletes reported that the reason for injury was sports activity. Overall, tooth injuries were more common among contact athletes (31; 18.6%).	Limited knowledge about oral Injury prevention and limited use of mouthguards are a reality.

		Both gender					
Erhan dursun-2015 Turkey	Weekend warrior soccer players Age -20 to 55 yrs.	Soccer Males	Prevalance of dental trauma and knowledge of traumatic dental injuries among weekend warriors in ankara, turkey.	Cohort study.	Structured questionnaire	Result Ninety-six players (9.8%) had experienced facial/dental trauma. The most frequent type of trauma was nose trauma (n = 40)., n=7 had injuries to teeth, n=6 had mandible injuries, and n=1 had an injury to the tongue. In total, 191 players stated that they knew what to do immediately after dental trauma resulting in avulsed teeth.	Specific programme on trauma occurrence are needed at educational lvels, starting at childhood level.dental students,dentist and physicians working with sports dentist should incresas their awareness of dental trauma among weekend warriors.
Mateja petrovik *et al* , 2016.	Swiss Handball athelets	Swiss Handball Both gender	To examine the prevalence and the Type of injuries, especially the occurrence of orofacial Trauma, habits of wearing mouthguards , as Well as degree of familiarity with the tooth rescue Box.	Cross sectional	Quesstionnar ie	Reasons for not wearing a mouthguard according to gender. Percentage of players suffered dental or oral injuries according To playing position Result: 19.7% (n = 100/507) of the players experienced dental trauma in their handball careers, with 40.8% (n = 51/125) crown fractures being the most frequent. In spite of the relatively high, lip injury (n=49/125) Dislocation (n= 20/125) Avulsion (n=5/125)	Education of players, coaches, and Medical attendants in swiss handball seems important and necessary, Especially in junior league, in order to reduce lifelong Consequences and costs of dental trauma

2.7 Quality assessment

Each study was assessed using the evaluation method described in the study Quality Assessment tools-National Heart, Lung and Blood Institute.-NIH. The quality assessment of the included studies was undertaken independently by two reviewers. The domains evaluated were research question or objective, study population, a sample size justification, power description, or variance and effect estimates, exposure measures (independent variables),outcome measures (dependent variables), outcome assessors blinded to the exposure status, confounding variables measured and adjusted. Each domain was classified as having a Good, Fair, or Poor. Among eight studies, four studies rated as good and remaining four studies rated as fair. The results are summarized in table 3.

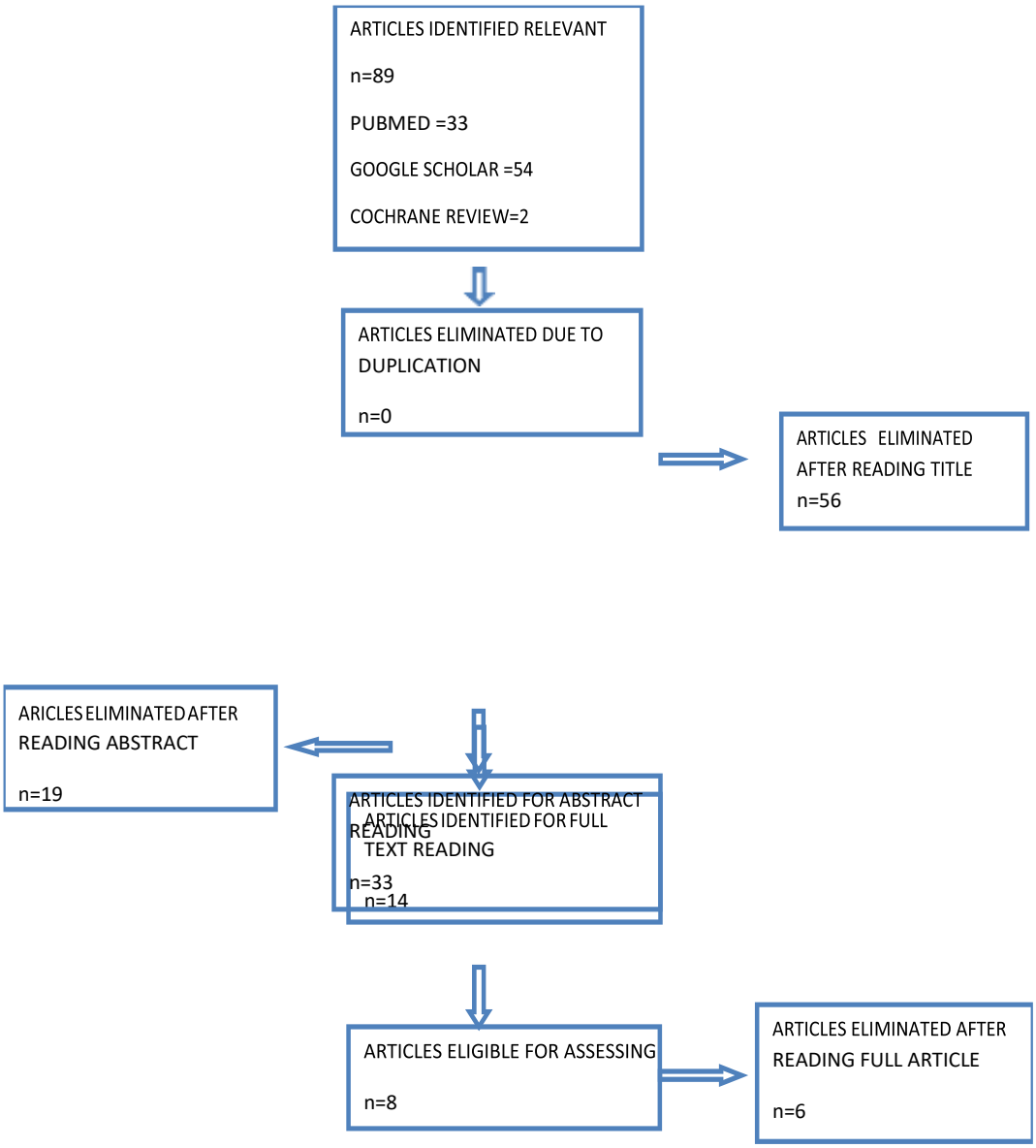
Table 3: Quality assessment of included studies (Quality Assessment tools-National Heart, Lung and Blood Institute.-NIH.)

Criteria	P.J. Chapman et.al	C.O.Onyeaso et.al	Amy E, *et al*	Liegeer *et al*	Wenli ma *et al*	Vidhatri tiwari *et al*	Erhandursun *et al*	Mateja petrovic *et al*
1. Was the research question or objective in this paper clearly stated?	NO	YES	YES	YES	YES	YES	YES	YES
2. Was the study population clearly specified and defined?	YES	YES	YES	YES	YES	YES	YES	YES
3. Was the participation rate of eligible persons at least 50%?	YES	YES	YES	YES	YES	YES	YES	YES
4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?.	YES	YES	YES	NO	NO	YES	NO	NO
5. Was a sample size justification, power description, or variance and effect estimates provided?	NO	YES	YES	NO	YES	YES	NO	YES
6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?	NO	NO	NO	NO	YES	YES	YES	YES
7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	YES	YES	YES	YES	YES	YES	YES	YES
For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?	YES	YES	YES	YES	YES	NO	YES	YES
9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	YES	YES	YES	YES	YES	NO	NO	YES
10. Was the exposure(s) assessed more than once over time?	NO	NO	NO	NO	NO	NO	NO	NO
11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	YES	YES	YES	YES	YES	YES	YES	YES
12. Were the outcome assessors blinded to the exposure status of participants?	NO	NO	NO	NO	NO	NO	NO	NO
13. Was loss to follow-up after baseline 20% or less?	NA	NA	NA	NA	NA	NA	NA	NA

14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	NO	NO	NO	NO	NO	NO	NO	NO
Quality of studys	FAIR	GOOD	GOOD	FAIR	GOOD	FAIR	FAIR	GOOD

3. Results

While typing the meSH terms, relevant articles identified (Pub med=33, Google scholar=54 Cochrane review =2).Fifty five articles were eliminated after reading the title. None of the article were eliminated due to duplication. Thirty three articles were selected for the abstract reading. After the abstract reading fourteen articles were included and nineteen were excluded. After reading the full text, six were excluded and eight studies which met the inclusion criteria were taken for the present systematic review shown in flowchart 1.



Flow chart 1: Flow diagram for studies included in the review (n=number of article)

3.1 Types of participants

We included the atheletes and officials who were enrolled in their respective sports clubs and their associations. We included atheletes with the age group of 10-55 years. We did exclude players with non-contact sports and age below 10 years.

3.2 Types of outcome measures Outcome

Orofacial injuries

The primary outcome was orofacial injuries which were assessed during the sports activities. The various orofacial injuries which included were fractured tooth, loosening of tooth, hematoma formation, fracture of mandible, TMJ stiffness, loss of sensation, soft tissue laceration, ear laceration, tongue, lip injuries etc.

4. Discussion

This systematic review throws light on the. prevalence of orofacial injuries in various contact sports. Although a considerable number of articles were found in this study, only 8 met the inclusion criteria and were selected for a qualitative synthesis. For this, a methodological investigation of these studies was made following the guidelines provided by National Heart, Lung and Blood Institute.-NIH where the study design and the methods used by the researchers were carefully explored, obtaining at the end a qualitative evaluation.

It was observed that the prevalence of dental trauma within the included studies varied between 7.1% and 59% among athletes. Although this percentage varied significantly, six studies indicated that the prevalence of trauma was less than 40%, depending on the type of sport practiced. Another factor relevant to these prevalence was that the use of mouthguards were not a current habit among sports practitioners such as soccer, basketball or volleyball.

Sports activities are unfortunately associated with injury risks that include orofacial soft- and hard-tissue trauma and such accidents often have life-long consequences. Vidhatri *et al* showed that the prevalence of orofacial injuries during sporting activities was 39.1% in contact athletes and 25.3% in noncontact athletes [14].

Studies done by Tulunoglu and Ozbek and Persic *et al*., showed that 22.3% and 20.4% of the participants have experienced oral injuries, respectively [15, 16]. The prevalence of dental trauma among Pan American games athletes was 49.6%, where 63.6% of them sustained injuries during training or competition.

Sports-related dental injuries have accounted for high percentage among all types of traumatic injuries worldwide.[17] Studies have shown that chipping/fracture of teeth is more while injuries such as loosening of teeth, broken teeth, and facial bone were comparatively lesser. These type of injuries occurred in players when they accidentally fall on their face or they were hit by the equipment used for sports and also due to collision among players [18].

Frontera *et al* [19]. observed that 69.7% of the athletes were affected with trauma during basketball practice, in which only 7% of the total players used mouthguards. Vidovic-Stenevic *et al* [20]. Interviewed 420 athletes and reported that 98% used mouthguards and 10.47% experienced trauma. Possible explanatory factors of the trauma prevalence discrepancy can be attributed to the specific and cultural characteristics of each sport, which can modulate both the adherence to the use of the mouthguard, as well as a greater severity in the contact sports practice.

Athletes generally do not wear mouthguard regularly while they are playing or training. This is probably due to the poor knowledge of athletes themselves and technical staff, as observed in the literature [19, 21, 22, 23, 24, 25]. Besides stimulating the use of mouthguards, a preventive practice in contact sports should also include information about emergency procedures, such as the preservation of the tooth after avulsion. Although the included studies exhibited different methodological quality, mouthguards should continue to be used in sport activities where there is significant risk of dental trauma [26]. The World Dental Federation recommends that national dental associations inform the public and oral healthcare professionals of the benefits of sports mouthguards. Mouthguards offer protection by separating the cheeks and lips from the teeth, making users less susceptible to soft-tissue laceration, and preventing opposing arches from traumatic contact, and these protective devices provide a resilient, protective surface to distribute and dissipate transmitted forces on impact. Though a variety of advantages have been also favoring use of mouthguards, they are seldom used in routine practice [13].

Collaborations between sports authorities and dental professionals are recommended to increase awareness and promote the use of mouthguards among athletes and coaches [27]. Players should be informed that the physical impacts of having injuries far exceed the costs of purchasing and the inconvenience of wearing a mouthguard. Studies have shown that common reasons why athletes did not wear mouthguards were that their coaches did not urge them to wear and fear of discomfort to wear. It is important to inform players and coaches about the use of mouthguards in both contact and noncontact sports. Also studies have shown that cost is not a factor in not wearing a mouthguard, but lack of consideration on the importance of mouthguard in preventing oral injury was the main reason for not wearing a mouthguard. Resistance for wearing of mouthguard might be due to discomfort such as interference with breathing and speech and the effect on the players' image [28].

With the support of dentists and public health professionals, the risks of orofacial injury should be made known to athletes, parents, coaches, and school and college officials. Coaches and teachers should be encouraged to insist that players wear mouthguards during training and matches. Sports governing bodies and major games organizing committees should work with dental hospitals and colleges in taking a more active role in promoting programs to prevent oral injury and disease and in requiring mandatory mouthguard use.

5. Conclusion

This systematic review highlighted the prevalence of orofacial injuries in various contact sports. These orofacial injuries are mainly due to the lack of awareness among atheletes about mouthguards and their use. Sports behavior and injuries are

areas of growing concern in Public health dentistry. The incidence of orofacial injuries is high among athletes, particularly those participating in contact sports. This is most likely due to insufficient knowledge of the benefits of mouthguards and limited use of mouthguards, which should be addressed by providing more information regarding dental injuries and their prevention.

Prevention is an obligation of dentistry as well as critical patient responsibility. Since safe sport participation should be the goal of any sport program, mouthguards should be part of every athletes gear.

6. References

1. Ranalli DN. Sports dentistry and dental traumatology. Dental Traumatology. 2002; 18(5):231-236.
2. Kumamoto DV, Maeda Y. A literature review of sport- related orofacial trauma. General Dentistry. 2004; 52(3):270-281.
3. Skrinjaric I. Orofacial injuries in sports and mouthguard wear: types of mouth protectors, production techniques and modes of protection, 1995, 263-272
4. Azodo CC, Ngagoue NEF, Agbor MA. Dentofacial Injuries in Contact Sports in Yaounde, Cameroon, 2012, 24.
5. Saini R. Sports dentistry. Natl J Maxillofac Surg. 2011; 2(2):129-131
6. Soporowski NJ, Tesini DA, Weiss AI. Survey of orofacial sports-related injuries. J Mass Dent Soc. 1994; 43:16-20.
7. Mischkowski RA, Zöller JE. Retrieved, 1999, 11, from: http://www.dgzmk.de/index.php?site=std84&backlink= m034.
8. American Dental Association Bureau of Dental Health Education and Bureau of Economic Research and Statistics. Mouth protectors: 1962 and the future. JADA 1963; 66:539-43.
9. Nowjack-Raymer RE, Gift HC. Use of mouth guards and headgear in organized sports by school-aged children. Public Health Rep. 1996; 111(1):82-6.
10. Mouth protectors: 11 years later. Bureau of Dental Health Education, Council on Dental Materials and Devices. JADA. 1973; 86(6):1365-7.
11. Sane J. Comparison of maxillofacial and dental injuries in four contact team sports: American football, bandy, basketball, and handball. Am J Sports Med. 1988; 16(6):647-51.
12. Gardiner DM, Ranalli DN. Attitudinal factors influencing mouthguard utilization. Dent Clin North Am. 2000; 44(1):53-65.
13. ADA Council on Access, Prevention and Inter professional Relations; ADA Council on Scientific Affairs. Using mouthguards to reduce the incidence and severity of sports-related oral injuries. JADA. 2006; 137(12):1712-20.
14. Vidhatri Tiwari, Dental trauma and mouthguard awareness and use among contact and noncontact athletes in central India. 2004; 56(4):239-243.
15. Tulunoglu I, Ozbek M. Oral trauma, mouthguard awareness, and use in two contact sports in Turkey. Dent Traumatol. 2006; 22:242-6.
16. Persic R, Pohl Y, Filippi A. Dental squash injuries – A survey among players and coaches in Switzerland, Germany and France. Dent Traumatol. 2006; 22:231-6.
17. 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; 26:248-53.
18. Kay EJ, Kakarla P, Macleod DA, McGlashan TP. Oro-facial and dental injuries in club rugby union players. Br J Sports Med. 1990; 24:271-3.
19. Frontera RR, Zanin L, Ambrosano GM, Flório FM. Orofacial trauma in Brazilian basketball players and level of information concerning trauma and mouthguards. Dent Traumatol. 2011; 27:208-16.
20. Vidovic -Stesevic V, Verna C, Krastl G, Kuhl S, Filippi A. Facial and dental injuries facial and dental injuries in karate. Swiss Dent J. 2015; 125:810-4
21. Onyeaso CO. Secondary school athletes: a study of mouthguards. J Natl Med Assoc. 2004; 96:240-5.
22. Berg R, Berkey DB, Tang JM, Altman DS, Londeree KA. Knowledge and attitudes of Arizona high -school coaches regarding oral -facial injuries and mouthguard use among athletes. J Am Dent Assoc. 1998; 129:1425-32.
23. Caglar E, Kargul B, Tanboga I. Dental trauma and mouthguard usage among ice hockey players in Turkey premier league. Dent Traumatol. 2005; 21:29-31.
24. Ozbay G, Bakkal M, Abbasoglu Z, Demirel S, Kargul B, Welbury R. Incidence and prevention of traumatic injuries in paediatric handball players in Istanbul, Turkey. Eur Arch Paediatr Dent. 2013; 14:41-5.
25. Galic T, Kuncic D, Poklepovic Pericic T, Galic I, Mihanovic F, Bozic J, Herceg M. Knowledge and attitudes about sports -related dental injuries and mouthguard use in young athletes in four different contact sports -water polo, karate, taekwondo and handball. Dent Traumatol. 2018; 34:175-8.
26. Takahashi M, Araie Y, Satoh Y, Iwasaki SI. Influence of continuous use of a vacuum -forming machine for mouthguard thickness after thermoforming. Dent Traumatol. 2017; 33:288-94.
27. Goswami M, Kumar P, Bhushan U. Evaluation of Knowledge, awareness, and occurrence of dental injuries in participant children during sports in New Delhi: A pilot study. Int J Clin Pediatr Dent. 2017; 10:373-8. Banky J, McCrory PR. Mouthguard use in Australian football. J Sci Med Sport. 1999; 2:20-9.