



USE OF MOUTHGUARD (MG) IN SPORTS DENTISTRY: A SYSTEMATIC REVIEW

Dental Science

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KEYWORDS

INTRODUCTION

Athletes participating in many types of sporting activities are exposed to considerable risk of orofacial injury and concussion.

Traumatic orofacial injuries commonly occur during basketball, soccer, and other athletic activities. Contact sports represent an important group in dental trauma etiology. As the number of athletes in contact sports and competitiveness increase, the traumatic accidents in the last few years have also increased thus insisting the need for prevention. In recent years, mouthguards have become a core component of the safety equipment used to reduce the risk of oral injury during athletic activities, with numerous studies suggesting their preventive effects against traumatic injury during sports.

However dental trauma in sports differ from other dental trauma as it is possible to easily prevent it by use of protective devices such as mouth guards that protect all dental and periodontal structures. While some coaches or athletic rules may require athletes to use mouthguards, the decision to use a mouthguard for orofacial protection is generally left to the individual athlete. Athletes may avoid using mouthguards for many reasons. It has been reported that some athletes hesitate to use mouthguards because they believe that mouthguards constrict the airway and thus have a negative effect on athletic performance.

Mouthguard use is clearly a critical topic in the field of sports medicine. Today, most athletes should use mouthguards to prevent injuries. A few studies have investigated the relationship between mouthguards and sports-related orofacial injury. In the present manuscript, it has systematically reviewed and discussed various aspects of sports related dental and orofacial injuries, the risk factors associated, protection and prevention of trauma.

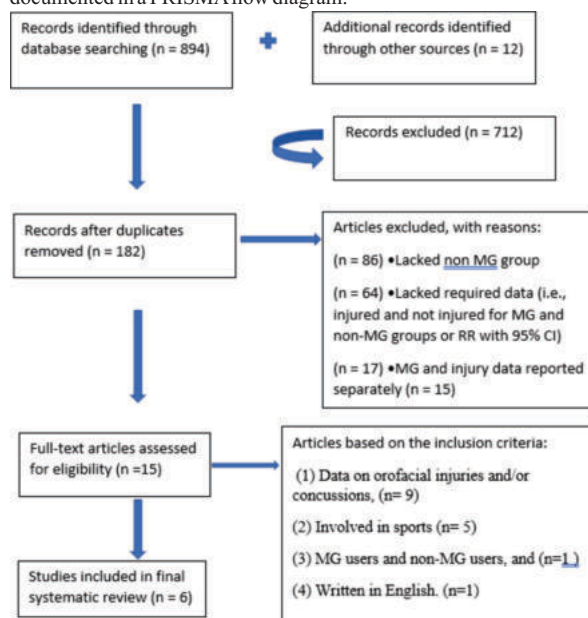
Methodology

The present systematic review was conducted in accordance with PRISMA (Preferred Reporting Items for Systematic Review and Meta-analysis) guidelines.

Search Strategy

MEDLINE (accessed from PubMed), Cochrane Library, Scopus, and Google Scholar were systematically and extensively Search strategy MEDLINE (accessed from PubMed), Cochrane Library, Scopus, and Google Scholar were systematically and extensively searched to identify published data on the importance of mouthguard use in preventing sports injury. Search strategy was implemented using keywords such as 'Sports Dentistry'; 'Mouth-guard'; 'Orofacial Dental injury'; 'Sports-related'; 'Prevention' in combination with Boolean Operators 'AND' and 'OR'. All the manuscripts published in English language till the month of April 1986 were reviewed for inclusion in the study. Attempts were also made to screen grey literature and

references of all the manuscripts to obtain additional data for the present review. The results of the search and selection process were documented in a PRISMA flow diagram.



Study Selection And Data Extraction

Data from the studies was extracted by two reviewing all the titles and the abstracts obtained by applying the search strategies and inclusion criteria. Full manuscripts were obtained for the studies that appeared to meet inclusion criteria or in case of any uncertainty. Though the quality assessment could not be done formally for all the studies, the findings were tabulated and synthesized narratively.

To determine the effectiveness of MGs in preventing injuries, studies were included in the review if they (1) contained data on orofacial injuries and/or concussions, (2) included groups involved in sports (3) included MG users and non-MG users, and (4) were written in English. Studies were not included if (1) they involved activities other than sport, (2) they compared different types of MGs and did not have a non-MG group, (3) they lacked injury data, or (4) all or most ($\geq 95\%$) of the athletes in the study wore MGs. To guide the data extraction, a spreadsheet was constructed that contained the study name, study design, country where the data were collected, sport/exercise activity, sample sizes, injury definition, type of MG, data collection methods, injury outcomes, and numerical results.

Characteristic of the study included on the importance of mouthguard in prevention of orofacial dental injury.

SI No.	Study	Study design	Level of activity	Sample Size (n)	Injury type	Mouth guard type	Data collection	Injury incidence (%) or injury rate (injuries/exposures)
1	Garon MW, 1986	Epidemol-ogical	Football	N value= 754	Concussion, Soft tissue lacerations	Not clear	Inspected by dentist at pre-season medical and dental screening at the Children's Hospital in Birmingham, AL.	63% of the total traumatic injuries, occurred while the players were not wearing mouth protectors.
2	Banky, J. & McCrory (1999)	Epidemol-ogical	Australian footballers	N value= 961	Oro-facial injuries	Custom fitted mouth guards, 27% wore non-custom mouth guards.	Footballers from Australian Football League (AFL) competition and sub-elite team of Australia were surveyed from 19 football clubs using the standardized reporting form. This represents approximately 100% of the registered players at the sampled clubs.	72% wore a mouthguard during matches. 28% of players interviewed did not wear a mouthguard during matches. Of those, 24% had never worn a mouthguard and 76% had previously worn a mouthguard, usually a non-custom type, which they had found unsatisfactory.
3	Dorney B (1993)	Case Report	First Grade Rugby League player	N value = 1	A double mandibular fracture from a traumatic incident involving an opposing player's knee.	The mouthguard worn at the time of the initial accident was six years old and only fitted the upper teeth from canine to canine.	A new mouthguard was prescribed to cover all the occlusal surfaces of the upper teeth. It was a triple laminated, pressure-moulded mouthguard with a measured thickness of 3 mm on the occlusal surfaces of the upper first molars. The buccal surfaces were extended to provide a buccal shield of 4 mm around the outer surfaces of the mandibular teeth. A flat occlusal plane was provided inside this buccal shield	Exactly eight weeks after fracturing his jaw the patient played his first game of Rugby League wearing his new prescription mouthguard. Unfortunately, he was involved in an identical incident again being struck in the mandible by a knee. This time, there was no loss of consciousness. Radiographs revealed no damage to the recent fracture sites and no new fractures. The two identical accidents document the protection that can be provided by correctly designed and manufactured mouthguards.
4	C Finch (2005)	Randomised Controlled trial	Australian football	N value= 301	Head/orofacial injuries	Custom made mouthguards	Players completed a piloted baseline questionnaire on their demographic profile, football playing history, previous football injury history, general attitudes towards protective equipment, self-reported usual behaviors in relation to protective equipment, and risk perceptions.	The most common H/O injury was a facial laceration (38% of all H/O injuries) and these were 1.4 times more common in control players than MG players. Concussions (19% of all H/O injuries) were distributed roughly equally across study arms. The only player from the MG arm to receive a dental injury was not wearing their mouthguard at the time of injury. There was a higher rate of H/O injury in the control arm than in the MG arm, when training and game exposures were combined.
5	Chisholm DA (2020)	Case-Control Study	Ice Hockey	N value=315	Concussion	. Off the shelf . Custom made	A nested case-control design was used. Cases and controls were identified from two prospective cohort studies employing the same validated method of injury surveillance in youth ice hockey. Cases were defined as those who sustained a suspected concussion during a game or practice. Controls were players who sustained a nonconcussion (eg, trunk or extremity orthopaedic) injury and outcome information was present at most games/practices and completed the injury report form (IRF) at the time of injury.	Among 315 cases, 236/315 (75%) were wearing a mouthguard at time of injury, while 224/270 (83%) controls were wearing a mouthguard at time of injury. Any mouthguard use was associated with an adjusted OR for concussion of 0.36 (95% CI 0.17 to 0.73). Off-the-shelf mouthguards were associated with a 69% lower odds of concussion (adjusted OR: 0.31; 95%CI 0.14 to 0.65). Dental custom-fit mouthguards were associated with a non-significant 49% lower odds of concussion (adjusted OR: 0.51; 95%CI 0.22 to 1.10). No dental injuries were identified in either cohort.

6	Padilha AC (2021)	Cross-sectional study	Brazilian rugby	N value= 244	Orofacial Trauma	. Ready-to-wear . Boil and bite . Custom-made	An online questionnaire was sent to the 16 best rugby union clubs in Brazil. The questionnaire contained questions about the training history of each athlete, prevalence of orofacial trauma, and details about mouthguard use. Only participants who reported using a mouthguard were selected for this analysis.	The prevalence of orofacial trauma was 34.4%, and 61.9% of them did not wear a mouthguard at the time of the incident. The only type of mouthguard reported was the pre-fabricated ("boil and bite" and "ready-to-wear") type. A stronger association was observed between the reason for using a mouthguard and the outcome, whereas a lower proportion of trauma was observed among individuals who claimed mandatory mouthguard use at the gym/sport (20.0%).
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RESULT

The PRISMA diagram indicating the number of publications included and excluded at each stage of the literature search and selection process. There were 182 full text articles retrieved for further examination after inspecting titles and abstracts. After reviewing these, articles were found to meet the inclusion criteria. One of the study done on 754 football players reported 63% of the total traumatic injuries, occurred while the players were not wearing mouth protectors. Another study on 961 Australian Football players 72% wore a mouthguard during matches. 28% of players interviewed did not wear a mouthguard during matches. Of those, 24% had never worn a mouthguard. A recent study from the year 2021 on 244 Brazilian Rugby players, it was found that a stronger association was observed between the reason for using a mouthguard and the outcome, whereas a lower proportion of trauma was observed among individuals who claimed mandatory mouthguard use at the gym/sport (20.0%).

DISCUSSION

This study found that MGs users had a considerably lower risk of orofacial injury compared to individuals who did not wear a MG, but the effect of MGs on laceration and concussion risk was minimal. There was considerable heterogeneity among the orofacial injury studies, but this was expected given the variations in study designs, injury definitions, sports involved, and other factors. In the epidemiological studies, because of the limited size and non-random nature of the sample in the studies, exact frequencies of oral trauma in the different sports could not be determined and it is found that all total traumatic injuries occurred while the players were not wearing mouth protectors. And talking of the comfort of the mouthguard in one study on 961 sample size it was found that 76% had previously worn a mouthguard, usually a non-custom type, which they had found unsatisfactory. One study from 2005 on 301 players, it was found that the most common H/O injury was a facial laceration (38% of all H/O injuries) and these were 1.4 times more common in control players than MG players and concussions (19% of all H/O injuries) were distributed roughly equally across study arms.

In most of these studies, the use of mouthguards is highly recommended to prevent further sports trauma as it is a resilient device that reduces the incidence of trauma by absorbing and dissipating the forces received during an impact. Custom-made mouthguards are found to be comfortable but have better occlusal fit, retention, and stability but the type most commonly used type in this study is poor in thickness and retention, with a consequent risk of airway obstruction. With regard to concussions, there were several investigations that used study designs or outcome measures that could not be included in this review, but nonetheless found that MGs did not influence concussion incidence or factors related to concussions. A case-control study of young ice hockey players found that at the time of injury, 74% of concussed player (n=143) and 78% of non-concussed players (n=156) were wearing MGs (odds ratio=1.23, 95% CI 0.68–2.22). With regard to design, it has been hypothesized that if MGs are properly fitted (custom type) with 3–4 mm of thickness posteriorly they may be more affective for concussion prevention. Despite differences in injury definitions and low methodological quality of some studies, this review suggests that MGs offer significant protection from orofacial injuries and MGs should be used in all sport activities where there is significant risk of orofacial injury.

CONCLUSION

The primary goal still remains for prevention, supporting the

recommendation of mouthguard use during any level of participation. In this context, it is important to emphasize the need to improve access to custom-made mouthguards among the players specially ones involving with Contact sports. As these players are a population at risk for orofacial trauma, and this review sought to foster the discussion that helps in the development of health education and orientation programs for athletes and coaches, in an effort to reduce the prevalence of orofacial trauma and its complications.