MOUTHGUARDS IN SPORTS DENTISTRY: A REVIEW

Dr. Konark Patil[1], Dr. Anushtha Jain[2], Dr. G. Chandrasekhar[3], Dr. Gargi Sarma[4]

[1]Additional Associate Professor, Department of Prosthodontics, Crown and Bridge Sri Dharmasthala Manjunatheshwara College of Dental Sciences and Hospital, SDM University Dharwad, 58009 Karnataka, India, Email id: dockonark@gmail.com
[2]Post Graduate Student, Department of Prosthodontics Crown and Bridge, Sri Dharmasthala Manjunatheshwara College of Dental Sciences and Hospital, SDM University Dharwad, 58009, Karnataka, India, Email: anushtha.jain95@gmail.com
[3]Post Graduate Student, Sri Dharmasthala Manjunatheshwara College of Dental Sciences and Hospital, SDM University Dharwad, 58009, Karnataka, India, Email: chandrasekhar.1025@gmail.com
[4]Post Graduate Student, Sri Dharmasthala Manjunatheshwara College of Dental Sciences and Hospital, SDM University Dharwad, 58009, Karnataka, India, Email: Gargisarma2016@gmail.com

Corresponding Author: Dr. Konark Patil, Additional Associate Professor, Department of Prosthodontics, Crown and Bridge, Sri Dharmasthala Manjunatheshwara College of Dental Sciences and Hospital, SDM University Dharwad, 58009 Karnataka, India Email id: dockonark@gmail.com

ABSTRACT:
Sports medicine and physiotherapy have been involved in the sports scenario for a long time. They play a role in treatment and management of injuries to the athletes. With increasing awareness of dental and orofacial injuries, sports dentistry is also growing. Management of dental trauma has become a priority. Mouthguards play a major role in prevention of dento-facial injuries. Understanding their importance and creating awareness for their use can significantly reduce chances of injuries especially in contact sports.
Many types of mouthguards are available which serve preventive or performance enhancing functions.
Keywords: Mouthguards, sports dentistry, sports injuries, dentofacial injuries, trauma

INTRODUCTION

Getting hurt during play is very common. Many injuries can be inflicted during sports and sporting activities, among all ages of the population. Sports medicine has played a major role in comprehensive health management of athletes. Sports and exercise medicine, including physiotherapy has gained a large amount of recognition around the world. However, sports dentistry, is a relatively newer field. It is getting more popularized gradually, with increasing awareness towards oral health and its importance in athletic performance. (1) Sports can cause orofacial injuries due to falls, collisions with other athletes or hard surfaces, especially contact sports like soccer, rugby, football, boxing, karate, basketball and hockey, making players susceptible to fractures, dislocations, crushing injuries, avulsions and concussions. (2)

It has been seen, that polyclinics during major sporting events, like the Olympics, are flooded with participants suffering from muco-skeletal injuries and dental issues. Thus, emphasizing the importance of sports dentistry. Many a times, athletes are not aware of the implications of a traumatic injury to the mouth or of the potential for incurring severe head and orofacial injuries while playing. (a)

Dental trauma is prevalent, especially in contact sports, at all levels with no bias between ages and genders. This makes preventive aspect of sports dentistry a must. These measures include usage of helmets, mouthguards, and other protective gears. They reduce the impact on the athlete, thus reducing the injuries. (7) With every sports team, a medical expert and a physiotherapist is generally attached, in recent times, demand for a dental practitioner has also significantly increased. With the development of performance enhancing mouthguards, the role of a dentist has become all the more valuable in the sports industry.

The sports dentistry movement is experiencing new momentum worldwide, dentists along with oral hygiene therapists, lab technicians and dental assistants can work in conjunction to provide the best care to our sportsmen and become more involved in the sports health care scene.

IMPORTANCE OF SPORTS DENTISTRY

Sports Dentistry acts in the prevention, maintenance and treatment of oral and facial athletic injuries, as well as the collection and dissemination of information on dental trauma. It establishes that it is the duty of the dentist to detect problems related to the athlete's stomatognathic system. [4]

It has two major components:

- The treatment of orofacial injuries; and
- The prevention of sports-related orofacial injuries.

Thus, the field of sports dentistry is not only about treating trauma to jaws and teeth but also prevention and treatment of the whole stomatognathic system for trauma and diseases. It deals with players of all ages, genders and sports.

The dentist must be able to provide comprehensive care to the patient. [5] They must detect changes and pathologies such as dental malocclusion. Alterations in occlusion are significantly compromising to the performance of the athlete, as it interferes with efficacy of chewing, subsequently reducing the nutrient intake and absorption in the body. [6]

Preventive aspects during sports have changed the incidence of the injuries to the athlete. The preventive measures like usage of helmets, mouthguards, and other protective gears have reduced the impact on the athlete, thereby reducing the injuries. Modifications of these protective gears also have been studied and changes have been made to make them more comfortable, user-friendly, and also safer.

RISK FACTORS FOR SPORTS INJURIES

Players can get injured at any time, mostly in contact sports. Highest incidence of such injuries is noted in sports like football, basketball, rugby, wrestling, biking etc. Most injuries are a result of a direct hit with a ball or full contact impact between players. Sports injuries may result from accidents; at other times they are due to poor training practices, improper equipment, or insufficient or lack of warm up and stretching. (3) It has been noticed that type of coaching, specifically the experience of the coach also relates to injuries suffered by their players. Lesser experience in coaching is seen to be associated with increased injuries in the players. (7)

It is important to understand risk factors and determinants to prevent injuries. There are two broad categories to classify the type of risk factors in sports. These are extrinsic and intrinsic risk factors.

EXTRINSIC RISK FACTORS:

These risk factors are independent of the individual and are actually injury predictors that are related to the physical activities required by the particular sport. For example, extrinsic factor of participation in running or jogging is more likely to produce stress injuries, than that caused by engaging in contact sports like American football or boxing. [8]

Improper training can also be a significant extrinsic risk factor to injuries in sports. Sports equipment, surfaces (e.g., ice, water, grassy field, wooden flooring etc.) on which it is played, weather and climate conditions, coaching etc., are also considered as sports injury risk factors of the extrinsic type.

INTRINSIC RISK FACTORS:

These risk factors are the individual characteristics present in the individual player. They are different for each person; these are biological and psycho-social characteristics that may predispose the player to a particular type of sports injury. [9]

Taimela et al [5] have laid down a list of intrinsic factors and their relationship with athletic injuries. They emphasize on intrinsic factors playing a vital role in evolution of certain sports injuries.

a) Age
b) Gender
c) Injury History
d) Body Side
e) Central Motor Control

f) Psychosocial Factors
g) General Mental ability
h) Other Factors

With these many risk factors, it is of no doubt that getting injured in sports is common, thus prevention of injuries of utmost importance. This is where mouthguards, face shields and helmets come into play.

MOUTH GUARDS AND THEIR TYPES

Mouthguards are defined as "resilient device or appliance placed inside the mouth to reduce oral injuries, particularly to teeth and surrounding structures." The purpose of a mouthguard is not only to protect teeth but also the temporomandibular joint along with protection from neurological trauma or concussion. They are also called sports guards or mouth protectors but a more correct term is 'properly fitted mouth guard' as given by the Academy of Sports Dentistry.

Mouthguards are to be used actively for protection of the players from getting hurt. Some may even use headgears and face shields for protection. The likelihood of getting injured during sports is as high as twice without mouthguards than with them. [11,12] Mouthguards relieve the stress concentrated on the frontal teeth by absorbing and dispersing shock energy and readily stopping the vibration of the upper anterior teeth. [13]

A mouthguard should have a snug fit but be comfortable, allow normal breathing, speech and swallowing. It should not predispose to gagging or irritation and be odourless and tasteless. Different thicknesses of mouthguards can be constructed and reduction post fabrication is also possible. However, ideal thickness to provide protection against impact is considered to be 4mm. [22]

Mouthguards need to be shock absorbent to reduce the force or impact energy towards the tissue, they should be moderately hard and have adequate tensile and tear strength, this increases the durability as they are constantly bitten and chewed. [14] Nowadays, mouthguards are made of a variety of materials:

- Poly (vinyl acetate-ethylene) copolymer clear thermoplastic
- Polyurethane
- Laminated thermoplastic

Several types of mouthguards are available.

- Depending on the placement they can be:
  1) Extraoral
  2) Intraoral
  3) Combined
- Depending on the type of fabrication:
  1) Ready Made or Stock Type Mouthguards
  2) Mouth Formed or Boil and Bite Type Mouthguards
  3) Custom Fitted Mouth Guard
     A) Vacuum Mouthguard
     B) Pressure Laminated Mouth Guard
- Depending on the action:
  A) Preventive Mouthguards
  B) Performance Enhancement Mouthguards

- Depending on the number of arches involved:
  A) Monomaxillary- cover only one arch, usually the maxillary
  B) Bimaxillary- cover both maxillary and mandibular arches

Stock Type Mouthguards:

They can be bought from sports stores, pharmacies or departmental stores as specified by the ADA. They are prefabricated and are available in different sizes. They are relatively inexpensive as they are not custom fitted to one's mouth. They are the least effective type of mouthguards as they are less retentive and do not fit snugly. They hamper speech and breathing at times and cause discomfort to the wearer. They can provide certain amount of protection to the tissues. They are mostly made of PVA copolymer, rubber or PVC. They are available as monomaxillary and bimaxillary mouthguards.

Mouth Formed Mouthguards:
They can be of two varieties, shelliner or the thermoplastic mouthguard. The shelliner type is composed of a preformed shell with a liner of plastic acrylic or silicone rubber. The second type i.e., the preformed thermoplastic has a lining that is immersed in boiling water for 10- 45 seconds to soften, then it is adapted in the sportspersons mouth by allowing them to bite on the plastic mold to fit the occlusal surface. After this it is transferred to cold water. This type is also known as 'boil and bite' guard. It is the most popular of the available three types, but they do not provide the proper thickness, comfort, or critical protection of
the posterior teeth. Often, because of the inaccurate fit, clenching pressure is required to obtain satisfactory retention. They are a little more comfortable than stock mouthguards.

Custom-Made Mouthguards:
It is the most effective type of mouthguard in terms of protection of teeth and the temporomandibular joint. They are individually designed for a person by their dentist or a commercial dental laboratory. Impressions are made for both the arches and the mouthguards are fabricated on them. They can be monomaxillary or bimaxillary.

Orthoguard:
These mouthguards were developed for patients undergoing fixed orthodontic treatment. A channel is made on the fitting surface to accommodate the orthodontic appliance and tooth movement. These mouthguards require constant relining and refabrication as orthodontic treatment progresses.

Preventive Mouthgaurds
Wearing protective devices is the most important aspect in prevention of orofacial injuries. These can be well fitted helmets, facemasks or faceshields and/ or mouthguards. [(A)] However, for intraoral protection from tooth fractures, luxations, bruises, avulsions, lacerations, fractures etc., well fitted mouthguards are of chief importance. They prevent injuries to teeth, gingiva, tongue, lip and the mucosa and act as a shock absorber for the TMJ, protecting it from fractures, dislocations and trauma. They can be of any type- preformed, boil and bite or custom-made.
Mouthguards should be worn whenever there is a possibility of body to body or body to equipment contact. A well fitted laminated mouthguard of at least 3mm thickness has been shown to be effective in reducing impact force to teeth.[(15)] Clenching while wearing a mouthguard enhances the effectiveness of reducing impact force.

Preventive Role of Mouthguards:

- Dental/Orofacial Trauma Prevention:
  They act as a buffer by moving the soft tissues of the oral cavity away from teeth. This prevents lacerations, bruising and contusions of the oral tissues like lips, tongue and cheeks, tooth fractures and dislocations. Opposing teeth are protected from seismic contact with each other. They provide support to the mandible and prevent fractures at the angle of the mandible. Mouthguards should be worn on the maxillary teeth, as maxillary anterior teeth were most prone to injury except in class III malocclusion, where they are preferred for mandibular teeth.
- Concussion Prevention:
  Mouthguards provide an effective means of preventing concussion and spinal injuries. Stenger et al., claimed a benefit for both head and cervical spinal injuries by mouth guard use. They concluded that with wearing a mouthguard, there was an altered mandibular position on lateral skull radiographs, so that the condyles were distracted from their fossaeIt has also been noted that mouth guard use does not result in any difference in neurocognitive test performance after concussion. [(16)]
- Neuromuscular Relaxation:
  Facial and masticatory muscles are some of the most used muscles in the body. Because of constant use and a high stress on these muscles, most people experience tension, nerve pinching, and even a build-up of toxins in these areas. With neuromuscular treatment, all these problems

are addressed and corrected by releasing the tension and aligning the jaw. However, it is often difficult to get muscles to relax and in their proper position as our bodies naturally form their own tension spots and misalignments. A properly fitting mouthguard relaxes the neuromuscular system of the neck and face, which has a ripple effect on the muscles throughout the body.

Performance Enhancement Mouthguards

Mouthguard wearing has increased significantly in the recent years, especially with sportsmen involved in weight strengthening exercises, golf and during training sessions in general. Mouthguards help in enhancing performance during certain sports. It has been claimed by some authors that mouthguards may increase athletic performance, this however, is not universally accepted. [17,18] For performance enhancement, custom made, well fitted mouthguards are a major requirement. The effects of performance oral appliances are related to neurophysiologic feedback mechanisms related to the release of cortisol and lactate levels. The principle behind this is to reduce the level of the stress hormone (cortisol) produced in the facial muscles as the athlete clenches their teeth together. According to Duddy et al., teeth clench in response to elevated stress levels. Clenching mechanism completes a circuit and signals the brain to start a series of responses at the hypothalamic- pituitary-adrenal (HPA) axis. This causes release of adrenaline, noradrenaline and cortisol from the adrenal glands, enabling the body's stress response. Adrenaline increases blood pressure and heart rate, and increases blood flow to the muscles. Cortisol releases glucose and supplies brain and muscles with immediate energy. However, at excessively high levels for particularly longer periods, endocrine system is affected negatively.

High cortisol levels limit peripheral vision, decrease metabolism, cause fatigue, reduce muscle building and suppress the immune system. When stress is excessive, performance and health get adversely affected, a properly designed oral appliance which prevents the teeth from occluding and thus the completion of the clenching mechanism. [19]

Types Of Performance Enhancing Mouthguards:

1. Under Armor- Armour Bite

Armour Bite technology with patented Power Wedges™ increases strength, improves endurance, and reduces athletic stress. UA Performance Mouth wear mouthguards are intended to stop clenching, clenching is known to trigger the body to overproduce stress hormones such as cortisol, which decreases strength and muscle growth. Cortisol is known to regulate the immune response, but chronic overproduction can have significant negative effects on the body. (20)

2. Pure Power Mouthguards:

They are a great option for sports players looking for protection of their mouth and jaw for prevention of dental traumas. Misaligned jaw can result in headaches, muscle contractions, and neck and back problems, these can interfere with your ability to perform at full capacity. They align the muscles in the face and jaw for full-body harmony and optimal performance.

3. Powerbite Mouthguards:

These mouthguards offer maximum protection for dentition as well as reduction of concussions and neck injuries. They increase player strength over traditional mouthguards. They help in proper TMJ alignment and increase airway. It can also increase strength and endurance and can show a noticeable difference in athletic performance.

4. Agility Guard:

Agility guards enhance strength by giving the wearer an optimised bite position. It improves reaction time and speed. It gives the person a more centred performance by improving their balance. They increase agility as the name suggests. They are believed to improve the focus duration as well.

CONCLUSION

The appreciation for sports is increasing and with that the chances of getting hurt is also increasing. Contact sports have a higher risk of injuries, body to body contact or body to equipment contact can take place anywhere, the field or during training sessions. Facial and dental injuries are very common during cricket, football, boxing, cycling, etc., lacerations, bruises, tooth fractures, avulsions, facial fractures, TMJ injuries and concussions are commonly seen along with other medical injuries. Thus, a role of a sports dentist becomes equally important to a sports physician.

Mouthguards play a major role in sports dentistry. They have slowly become popular and being widely used among the sports community. They can be prefabricated, boil and bite type or custom made for every individual. Custom made mouthguards the more effective. Other than mouthguards, some sports require the use of helmets or faceshields.

Mouthguards have two major types depending on the function they serve, preventive and performance enhancement. Preventive mouthguards as the name suggests, prevent injuries to dento-facial structures, performance mouthguards on the other hand increase efficiency of the players.

All in all, mouthguards play a very important role in sports dentistry, and sports dentistry plays an equally important role in the world of sports.

REFERENCES

1. Sports Dentistry Textbook
2. Https://Www.Aegisdentalnetwork.Com/Ida/2013/06/Mouthguards-Safeguarding-That-Smile?Token=Jutjmwlonlp3pmblsoc947mfd
3. Saini R. Sports Dentistry. National Journal Of Maxillofacial Surgery. 2011 Jul;2(2):129.
4. Https://Www.Scielo.Br/J/Rbefe/A/Nhwtnsghvjsppxwptwkpgvz/?Lang=En&Format=Pd
5. Https://Www.Ncbi.Nlm.Nih.Gov/Pmc/Articles/PMC4304050/#!Po=81.2500
6. Https://Www.Ncbi.Nlm.Nih.Gov/Pmc/Articles/PMC4304050/#!Po=81.2500
7. Gay-Escoda C, Duarte-Pereira DMV, Ardèvol J, Pruna R, Fernandez J, Valmaseda-Castellón E. Study Of The E€ Ect Of Oral Health On Physical Condition Of Professional Soccer Players Of The Football Club Barcelona. Med Oral Patol Oral Cir Bucal. 2011;16:436-9.
8. Taimela S, Kujala UM, Osterman K. Intrinsic Risk Factors In Athletic Injuries. Sports Med. 1990;9:205–15.
9. Chambers RB. Orthopaedic Injuries In Athletes (Ages 6 To 17). Comparison Of Injuries Occurring In Six Sports. Am J Sports Med. 1979;7:195–7
10. Taimela S. Individual Cahracterristics Are Related To Musculoskeltal Injuries. Inpaado Nurmi Congress, Turuku, Finland, August 28 To September, 1, 1989 1989.
11. De Wet, F.A. (1981). The Prevention Of Orofacial Sports Injuries In The Adolescent. *International Dental Journal* 31(4): 313–319.
12. Lee- Knight, C.T., Harrison, E.L., Price, C.J. (1992). Dental Injuries At The 1989 Canadian Games: An Epidemiological
13. Sports Dentistry And Mouthguards Suryakant C. Deogade1*, Gunjan Dube2, K. Sumathi1, Prashant Dube1, Utkarsh Katare3 And Divya Katare4)
14. The Role Of Mouthguards In Preventing And Reducing Sports-Related Trauma James JJ Green Prim Dent J. 2017;6(2):27-34
15. Winters J, Demont R. Role Of Mouthguards In Reducing Mild Traumatic Brain Injury/Concussion Incidence In High School Football Athletes. *Gen Dent*. 2014;62:34–8.
16. STENGER JM, LAWSON EA, WRIGHT JM, RICKETTS J. MOUTHGUARDS: PROTECTION AGAINST SHOCK TO HEAD, NECK AND TEETH. J Am Dent Assoc. 1964 Sep;69:273-81. Doi: 10.14219/Jada.Archive.1964.0290. PMID: 14178758
17. Garner, D.P., McDivitt, E. (2009). Effects of mouthpiece use on airway openings and lactate levels in healthy college males. *Compendium of Continuing Education in Dentistry* 30 Spec No. 2:14–7.
18. Roettger, M. (2009). Performance enhancement and oral appliances. *Compendium of Continuing Education in Dentistry* 30 Spec No. 2:4–8
19. Duddy FA, Weissman J, Lee Sr RA, Paranjpe A, Johnson JD, Cohenca N. Influence of different types of mouthguards on strength and performance of collegiate athletes: a controlled- randomized trial. Dental traumatology. 2012 Aug;28(4):263-7.
20. Ferrari CH, Ferreria de Mederios JM. Dental trauma and level of information: mouthguard use in different contact sports. Dent Traumatol. 2002;18(3):144–47.