



# Guarding the Smile: A Case Report on Mouth-Guard Appliance

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## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Case Study

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## ABSTRACT

Orofacial injuries vary in complexities and affects people of all age group. Dental trauma in sports is the major linking channel between sports and dentistry. Sports dentistry is the prevention of oral/ facial athletic injuries and related oral diseases and manifestations. The preventive measures like usage of helmets, *mouthguards* and other protective gears have reduced the impact of these injuries in the athletes.

This report presents a case where a patient came for follow up appointment regarding a replanted avulsed tooth in the anterior region that was carried out 1 year back. Also, it was stated by the patient that he was involved in contact sports related activity.

The patient was motivated regarding the various protective mechanisms and the advantages of using them during sports activities and custom- made mouthguard was fabricated for this patient.

**Keywords:** Mouthguards; sports dentistry; preventive gears; dental trauma.

## 1. INTRODUCTION

Oro-facial injuries can come with any form of sports and can victimize people of all ages. The

overall prevalence of dentofacial injuries associated with contact sports have been found to be 27.57%, and the most common being dental injury that accounts for 19.61% [1] In

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children, sports activities were found to be responsible for 13% of oral trauma [2]. The incidence and distribution of sports related injuries vary upon sport affiliation, player position, participation level, gender of the player, intensity and frequency [3].

Sports dentistry is the prevention of oral/ facial athletic injuries and related oral diseases and manifestations. It deals with the treatment of the orofacial injuries and prevention of sports related orofacial injuries. Various dental trauma associated with sports include luxation of tooth, avulsion, fracture of the facial bones, concussion injuries, the simplest form being crown infraction, involving crazing of enamel without any loss of tooth structure and usually not requiring any treatment [4]. Apart from these, young athletes are also vulnerable to injuries to the cartilage, tendons, apophysis and growth plates [5]. The consequence of traumatic dental injuries (TDI) involves altered physical appearance, speech defects, emotional impacts, thus affecting the child's quality of life. Predisposing factors to TDI include physical features such as increased incisal overjet, open bite, protrusion, and lip incompetence. The preventive measures like usage of helmets, mouthguards and other protective gears have reduced the impact of these injuries in the athletes.

## 2. CHARACTERISTICS OF MOUTHGUARD

Mouthguard is defined as "a resilient device or appliance placed inside the mouth to reduce oral injuries, particularly to teeth and surrounding structures". They can be either stock mouthguards (prefabricated), mouth formed (boil and bite) mouthguards or custom fit mouthguards and can be fabricated using a variety of materials like rubber, vinyl laminate, polyurethane and rubber, silicone rubber, urethane rubber, acrylic resin and thermoplastic vinyl, polyvinyl acetate, plasticized acrylic resin, and polyvinyl acetate and polyethylene and should be worn when there is a possibility of body-to-body or body-to-equipment contact.

A mouthguard should be properly fitted to the wearer's mouth and accurately adapted to his oral structures to provide adequate protection. It should be made of resilient material approved by the U.S. Food and Drug Administration, cover all teeth in an arch, stay in place securely, be physiologically compatible with the wearer, relatively easy to fabricate and clean, and have

high-impact energy absorption and reduce transmitted forces upon impact [6,7]. It should be tear-resistant, odourless, tasteless and should not interfere with speech [8].

The optimal thickness of custom-made mouthguards ranges between 4 to 5 millimeters occlusally, 3 mm labially and 1 mm palatally for enhanced reduction and absorption of transmitted forces during impact [9,10]. But according to ADA, the final thickness of the mouthguard should depend upon clinical judgment, patient preferences and the specific needs of the athlete or sport.

Custom-made mouthguards are fabricated by dental laboratories from dental impressions. They are usually made from polyethylene vinyl acetate (EVA), and can be given to both orthodontic and non- orthodontic patients [11]. The two categories of custom mouth guards are the vacuum mouthguard and the pressure laminated mouthguard.

## 3. CASE REPORT

A 9 years old male patient reported to the department for follow up appointment regarding the replanted avulsed tooth in the anterior region that was carried out 1 year back.

The past dental history revealed that there was avulsion wrt 11 when he suffered a fall injury while he was playing football 1 year back. Replantation was done 2 hours following the injury and intentional extraoral RCT was also done followed by biodentin monoblock obturation. This was confirmed by IOPAR irt 11 which revealed the same. The patient was asymptomatic at present.



Fig. 1. Pre operative photograph

Extraoral examinations revealed that patient had convex profile with competent lips. Intraoral

examination revealed proclined maxillary anteriors, crowding in the mandibular anteriors, with increased overjet and overbite (Fig. 1). This could be correlated with the increased tendency for traumatic injuries. Further it was stated by the patient that he was involved in different sports related activities including contact sports.

The patient was motivated regarding the various protective mechanisms that can be followed and fabrication of custom- made mouthguard was planned for this patient.

#### 4. MOUTHGUARD FABRICATION AND DESIGN

Mouthguard fabrication begins with an alginate impression covering all anatomical structures, especially all teeth in the arch and vestibular regions (Fig. 2). Type III dental stone was be used for pouring the cast. After the cast had hardened, it was trimmed carefully to include the vestibular borders. For an adequate vacuum, a hole in the centre was made. The cast was rinsed periodically to avoid slurry build up and dried thoroughly. The vestibule was removed to ensure good adaptation and avoid bridging of the material during formation. A soft, thin polyethyl sheet material of 5mm thickness was needed, along with a vacuum former (Automatic Unident vacuum forming machine, Unident Instruments Pvt Ltd). The material was placed in the machine in the sandwich holder. Initially, the heater took about 10 minutes to heat. The material was closed slowly to the vacuum deck and the machine was turned on (Fig. 3). A temperature of 90°C and 1atm pressure was achieved. After about a minute of vacuum suction, the machine was turned off. It had been removed by grasping a corner and peeling the material from the machine. It was cooled under running water to avoid distortion of the cast. When cooled, the material was inverted to remove the cast. The margins were smoothly cut using a sharp scissor with spring back features to avoid jagged edges. No further adjustment is generally needed for the tray when trimmed smoothly. An optimum thickness of 4mm occlusally, 3mm labially and 1 mm palatally was maintained. Distally it extended upto the distal surface of permanent 1<sup>st</sup> molar. It was then evaluated for rough edges, blanching of tissues and irritation to the frenum (Fig. 4). The appliance was delivered to the patient (Figs. 5,6). The patient was asked to wear it while participating in contact sports and during practice sessions. Post- delivery instructions were given where he was asked to rinse the mouth guard

with cold water before and after use, avoid contact with hot water and not to chew on or cut pieces off it. He was recalled after 1 week for follow up check up to note whether any irritation or discomfort occurred during its use or not. The patient was also instructed to come for follow up visits periodically after every 6 months to check for any distortions, tears or bite.



Fig. 2. Primary impression of the maxillary arch taken



Fig. 3. Laboratory fabrication of the mouthguard



Fig. 4. checking the extension of the mouthguard within the cast



**Fig. 5. Final adjustments done within mouth**



**Fig. 6. Post operative photograph after delivering the mouthguard**

## 5. DISCUSSION

Mouthguards offer protection against sports-related dental injuries. They reduce the severity of the impact or prevent the occurrence of injuries. Mouth guard is meant to act as a buffer by moving the soft tissues away from the teeth, thereby preventing laceration injuries, bruising of the lips, cheek and tongue during the impact. It prevents the tooth fracture or dislocations by cushioning the teeth from direct frontal blows while redistributing the force of blow over the teeth present. The opposing teeth are protected by seismic contact with each other. Muscles of face, jaw and neck are some of the mostly used muscles. Because of constant use and increased propensity for stress to affect these muscles, most people have tension, nerve pinching and even toxin build up in these areas. Mouthguards have been shown to bring about neuromuscular relaxation too in these cases [12].

Mouthguards also provide substantial protection to patients undergoing orthodontic treatment

because they are highly susceptible to soft tissue injuries and damage to brackets due to blow to the face. In cases of class III malocclusion, they can be worn on mandibular teeth as they are more prone to injury unlike the maxillary teeth. The American Academy of Pediatric Dentistry (AAPD) recommends the use of properly fitted mouthguards in “organized sporting activities” with risk of orofacial injury [13].

Mouthguards not only protect one from orofacial injuries but also benefit both head and cervical spinal injuries. Stenger et al reported that mouthguard in situ, causes an altered mandibular position on lateral skull radiographs, so that the condyles were distracted from their fossae [14,15]. It also benefits the player psychologically as they feel more confident cause they are less likely to sustain injuries. This can be related to neurophysiologic feedback mechanism, the release of cortisol hormone and lactate level. It has been found that non-functioning biting (i.e., biting with an oral appliance) can impede this feedback mechanism, therefore it decreases the buildup of stress hormone. Furthermore, by the repositioning of the mandible, the patency of nerves and arteries in the TMJ are improved, thereby increasing the blood flow and oxygen perfusion which in turn may improve the function and strength [12]. More recently it has been proved that mandibular position and oral appliances not only affect the strength of upper body, but also endurance, recovery after athletic competition, concentration and response to stress.

Custom fabricated mouthguards give maximum protection, superior fit, better adaptability over orthodontic appliances and considerable advantages over manufactured mouth protectors. They provide better retention and comfort because they maintain their position in mouth without the need for the wearer to bite down. There is also less interference with speech and breathing and thereby does not affect the player's concentration. They are more durable compared to the pre-fabricated ones and the design and colours can be customized. The most commonly used material is a thermoplastic polyvinyl-acetate-ethylene copolymer, typically ethylene vinyl acetate (EVA) due to its ease of manipulation, availability and formability. Although costly, if the guidelines of maximum safety, protection, design, comfort, and advantages are standardized and ruled over by wearers the rate of sports-related dentofacial

injuries can be decreased. Therefore, we chose a custom-made mouthguard over the pre-fabricated one for our patient in this case.

Waked et al conducted an in vitro study on the effect of aging on dimensional stability of custom made mouthguards and concluded that most of the changes occur in central incisor region, which is the most significant area in protecting the maxillary incisors and the premaxilla [16]. Miura et al the stress concentration during the thermoforming procedure and concluded that maximum stress accumulation occurred in the anterior region resulting in greatest deformation [17]. To avoid this, laminated double layered mouth guards should be used instead of single layered ones as they cause less stress accumulation. The advantage of pressure machine is that they provide higher temperature and pressure that causes better fitting internal adaptation in the mouth.

## 6. CONCLUSION

Injuries during sports activities are inevitable. Thus, preventive measures should be adopted so that they become less traumatic and also enhance the competitiveness among players. Mouth guard used during sports activities offer significant protection against orofacial injuries. However, its usage among players is considerably less and so sports dentistry in conjunction with the respective contact sports associations must make the use of mouth guards mandatory in all sports activities.

## CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

## ETHICAL APPROVAL

It is not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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