

SPORTS MOUTHGUARD – A PROTECTIVE GEAR

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Abstract

Prevention of traumatic dental injuries relies on the identification of etiologic factors and the use of protective devices during contact sports. Mouthguards are considered to be an effective and cost-efficient device aimed at buffering the impacts or blows that might otherwise cause moderate to severe dental and maxillofacial injuries.

Key words: – Contact sports, Mouthguards, Dental trauma.

Introduction

Serious injury as a result of trauma to the head and orofacial structures is one of the major threats to athletes involved in contact sports. Each player has one chance in ten of receiving a dental or oral injury while participating in contact sports.¹ The mean prevalence of dental and oral injuries reported in the literature ranges between 4% and 33%, depending on the gender and age of the patient.^{2,3,4} While only 9% of young adults (18–19 years) involved in a sport will experience a dental injury,^{5,6} the incidence is 39% in children, with an overall incidence rate of 27–30%.⁷

With such a high incidence of injuries, prevention becomes the principal goal. A preventive approach relies on the recognition of etiologic factors and taking measures aimed at avoiding these factors or, at least, reducing their impact. Mouthguards are considered to be an effective and cost-efficient device, mainly for contact sports, as it aims at buffering the impacts or blows that might otherwise cause moderate to severe dental and maxillofacial injuries.

Historic Background

According to Reed, the first known attempt to make a device specifically to protect the oral structures in organized sports was done in the 1890s when a London dentist named Woolf Krause put together strips of gutta-percha and attached them on the maxillary teeth of a boxer. The main purpose of those gutta-percha strips appears to have been to protect the boxer from lip lacerations and other soft tissue injuries rather than actual dental injuries. The main purpose of those gutta-percha strips appears to have been to protect the boxer from lip lacerations and other soft tissue injuries rather than actual dental injuries.⁸ Some years later or in the early 1910s, a boxer was reported to use a reusable mouthpiece that was designed by a dentist named Philip Krause, who was the son of Dr. W. Krause Young Krause was not only a dentist but also a keen amateur boxer himself.⁹ He apparently further developed the "gum shield" to something that approaches what is known today as a mouthguard.

Mouthguards are considered to be an effective and cost-efficient device, principally worn during contact sports, as it aims at buffering the impacts or blows that might otherwise cause moderate to severe dental and maxillofacial injuries.

Types of Mouthguards

The American Society for Testing and Materials (ASTM) classifies mouth guards by 3 categories.¹⁰

- **Type I** - Custom-fabricated mouthguards are produced on a dental model of the patient's mouth by either the vacuum-forming or heat-pressure lamination technique. The ASTM recommends that for maximum protection, cushioning, and retention, the mouthguard should cover all teeth in one arch, customarily the maxillary arch, less the third molar. A mandibular mouthguard is recommended for individuals with a Class III malocclusion. It is considered superior for adaptation, retention, comfort, and protection, and interferes least with speech intelligibility, the exchange of air, and fluid intake during athletic training and competition.¹¹
- **Type II** - Mouth-formed, also known as "boil and bite", mouthguards are made from a thermoplastic material adapted to the mouth by finger, tongue, and biting pressure after immersing the appliance in hot water. Available commercially at department and sporting-goods stores, these are the most commonly used mouthguards among athletes but vary greatly in protection, retention, comfort, and cost.¹²
- **Type III** - Stock mouthguards are purchased over-the-counter. They are designed for use without any modification and must be held in place by clenching the teeth together to provide a protective benefit.¹² Clenching a stock mouthguard in place can interfere with breathing and speaking and, for this reason, stock mouthguards are considered by many to be less protective. Despite these shortcomings, the stock mouthguard could be the only option possible for patients with particular clinical presentations (e.g., use of orthodontic brackets and appliances, periods of rapidly changing occlusion during mixed dentition).¹⁰

Of the three general types of mouthguards currently available custom-fabricated type is considered superior for adaptation, retention, comfort, protection and interferes least with speech intelligibility, exchange of air, and fluid intake during athletic training and competition.¹³

FABRICATION OF CUSTOM MADE MOUTHGUARD

Preparation of the mouth

As with all techniques for fabrication of custom mouthguards, the general dental needs of the patient must first be assessed. Following a thorough diagnosis, all necessary restorative procedures should be completed. Immediately prior to impression taking, a thorough dental prophylaxis should be performed to enhance adaptation of the impression material to the dental arch.

Preparation of the impression and cast

Before the impression is made, any removable appliances should be withdrawn from the mouth. The impression of the maxillary arch is taken with alginate material in a muscle-molded, rim-lock tray. Following proper setting of the material, the alginate impression is removed from the mouth, rinsed under running water, then sprayed or immersed in an approved disinfectant, such as sodium hypochlorite.¹⁴ Excess water or disinfecting solution should be removed with a gentle stream of air prior to pouring of the stone. For best results, the alginate impression should be poured in stone as soon as possible.

A thick mix of dental stone is vibrated over the impression. When the stone has set fully, the alginate impression is separated from the stone cast. The cast is trimmed to enhance adaptation and all the stone bubbles are removed. Voids in the cast should be filled with a fresh mix of dental stone.

Preparation of the mouthguard

The outline of the mouthguard is drawn in pencil on the stone cast and a thermoplastic material, most commonly poly (ethylene vinyl acetate-EVA) copolymer is used.¹⁵ The thermoplastic material is heated in a pressure or vacuum suction forming machine and the material is adapted closely to the cast. It is trimmed and polished to allow proper tooth and gum adaptation and comfort in the vestibule.

Care and maintenance

The mouthguard should be cleansed after each use with a soft toothbrush and regular toothpaste, or a mild soap. The mouthguard should be rinsed thoroughly after cleansing and rinsed again prior to insertion before practice sessions or games. When not in use, the mouthguard should be soaked in mouthwash and carried in a plastic container similar to those used for orthodontic retainers.¹⁶

Discussion

The Academy for Sports Dentistry (ASD) "recommends the use of a properly fitted mouthguard. It encourages the use of a custom fabricated mouthguard made over a dental cast and delivered under the supervision of a dentist. The ASD strongly supports and encourages a mandate for use of a properly fitted mouthguard in all collision and contact sports."¹⁷ During fabrication of the mouthguard, it is recommended to establish proper anterior occlusion of the

maxillary and mandibular arches as this will prevent or reduce injury by better absorbing and distributing the force of impact. The practitioner also should consider the patient's vertical dimension of occlusion, personal comfort, and breathing ability. By providing cushioning between the maxilla and mandible, mouthguards also may reduce the incidence or severity of condylar displacement injuries as well as the potential for concussions.¹⁸

Interestingly, besides their role in preventing injury, some authors claim that mouthguards can enhance athletic performance.^{19,20} Garner and Miskimin claimed that mouthpieces positively affected visual and auditory reaction time, which is a vital aspect to optimal sport and exercise performance.²¹ Teeth clench in response to elevated stress levels. This clenching mechanism completes a circuit and signals the brain to begin a complex series of responses in the hypothalamic-pituitary-adrenal (HPA) axis. As a result, the adrenal glands release adrenaline, noradrenaline, and cortisol, all enabling the body's stress response. Adrenaline increases blood pressure, reaction time, and heart rate and sends blood to the muscles. Cortisol releases glucose, to supply the brain and muscles with immediate energy. A properly designed oral appliance which prevents the teeth from occluding prevents the completion of the clenching mechanism.²²

Attitudes of officials, coaches, parents, and players about wearing mouthguards influence their usage.²³ Players' perceptions of mouthguard use and comfort largely determine their compliance and enthusiasm.^{24,25} Therefore, the dental profession needs to influence and educate all stakeholders about the risk of sports-related orofacial injuries and available preventive strategies.²⁶ Routine dental visits can be an opportunity to initiate patient/parent education and make appropriate recommendations for use of a properly-fitted athletic mouthguard.¹²

FUTURE RESEARCH IN PREVENTION OF DENTAL INJURIES

Unfortunately, there is a large void in our evidence-based knowledge on prevention of dental trauma. Many do believe that a mouthguard will protect the teeth and even the brain, but without good randomized clinical trial study, the evidence supporting that belief is weak at best.

Custom-made mouthguards had no detrimental effect on athletic strength and performance and are reported by the athletes as being comfortable and not causing difficulty in breathing. In contrast, boil-and-bite mouthguards did not perform as well and were reported as being uncomfortable and causing breathing difficulties.

There are still many organized sports that do not require mouthguard and/or any other protection device, yet the incidence of oral and dental trauma is relatively high in those sports. Focus should be placed on those, and hopefully good studies will enlighten us about the true effects of those devices.

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