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MOUTHGUARDS FOR ATHLETES RECEIVING ORTHODONTIC TREATMENT WITH FIXED APPLIANCES: A REVIEW

Orthodontics

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ABSTRACT

It is frequently questioned whether children wearing braces cannot participate in sports. Because of their worries about sustaining a mouth injury on the court or in the field, parents and student-athletes commonly ponder whether they should stop participating in athletics. Every athlete who participates in a contact sport must wear a sports mouthguard. Fixed orthodontic appliances may make sports-related tooth injuries more likely. Non-custom mouthguards may not fit comfortably, be insufficient to protect the teeth and other structures, and have poor retention compared to mouthguards made especially for each wearer. Due to the use of permanent orthodontic devices and the possibility of tooth movement, providing the orthodontic patient with custom-made items is problematic.

KEYWORDS

Athletes, Custom Mouthguard, fixed orthodontics, orthodontic treatment, sports, athletes

INTRODUCTION

Mouthguards are essential for preventing oral injuries and safeguarding players' oral structures in both contact and non-contact sports[1]. Patients and their parents may have severe social, psychological, and financial effects as a result of dental injury[2]. A sports mouthguard is a durable device worn within the mouth to prevent or reduce damage to the teeth and other related structures while engaging in physical activity. It functions by dispersing some of the energy from a direct strike at the point of impact and redistributing and cushioning the remaining energy[3]. Anyone participating in sports requiring physical contact and/or moving objects, i.e., any sport where a blow to the jaw or teeth is likely, is encouraged to wear a mouthguard[4]. Participants with a particular type of occlusion were not particularly tested for MGs and oral trauma. Patients or athletes with malocclusions are known to be more prone to dental injuries than those without malocclusions, particularly in the maxillary anterior region because of a big overjet and/or a short upper lip, depending on the exact type of malocclusion present[5[A mouthguard is a durable item worn in the mouth to assist prevent damage to the teeth and related tissues. It functions by dispersing some of the energy from a direct blow at the point of impact and redistributing and cushioning the remaining energy[6]. Because the mouthguard keeps the soft tissues of the lips and cheeks away from the sharp edges of the teeth, there are fewer lacerations and soft tissue injuries as a result of less force being transmitted to the underlying teeth and orofacial tissues. When placed properly, they provide significant protection against dentoalveolar injuries and possibly some benefits against concussions[7]. Ethylene vinyl acetate is typically used to make mouthguards (EVA). originally a single, 3–5 mm thick sheet. In a vacuum-forming machine, EVA polymer was applied to a plaster cast model made from a patient's mouth impression. Non-toxic, elastic, little moisture absorption, and simplicity of manufacture are some of EVA's qualities[8]. The purpose of this article is to discuss the various mouthguards that are currently offered to orthodontic patients who have fixed orthodontic appliances.

Commercially available selection of different types of custom-made mouthguards

- Shock Doctor Braces
- Stock and mouth formed
- Masel double guard Stock
- The TotalGard2 Athletic Mouthguard Stock
- Grays Razor mouthguard Mouth formed
- Signature type I Orthodontic mouthguard Mouth formed
- Braces single and double guard Mouth formed
- Rainbow mouthguards Custom and A custom-made mouthguard from O-PRO

1. Stock Mouthguards

These are pre-made mouthguards that can be purchased over the counter in various sizes to fit mouths of all shapes and sizes. They are made of polyurethane or a copolymer of vinyl acetate or ethylene and are intended to be utilized without further modification. Due to their minimal protection and a false sense of security, they are typically regarded as the least satisfactory. Most sports stores sell them for reasonable prices and in a convenient manner. These are pre-made mouthguards that can be purchased over the counter in a variety of sizes to fit mouths

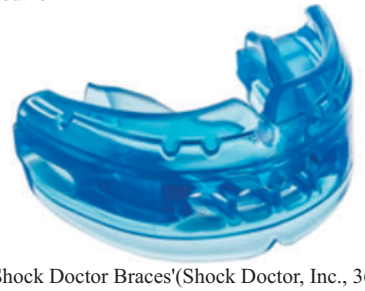

Figure 1: 'Shock Doctor Braces'(Shock Doctor, Inc., 3650 Annapolis Lane, Suite 115,Plymouth, MN, USA)

of all shapes and sizes. They are made of polyurethane or a vinyl acetate/ethylene copolymer and are designed for use without further alterations. They are often thought to be the least satisfactory due to their inadequate protection and a fictitious sense of security. The majority of sporting goods retailers offer them at fair costs and in convenient formats.[9].

2. Mouth-formed mouthguards

Figure 2: Mouth-formed mouthguards

Thermoplastic material is heated and soaked in hot water to soften it. mouthguards are sometimes known as "boil and bite" mouthguards. The mouthguard is then put in place and adjusted to fit the teeth by

biting with the fingers and tongue. Similar to the conventional variety, these mouthguards used to be bulky, unpleasant and had poor retention. Some required constant chewing to keep them in place. This could affect both speech and respiration. Any mouthguard that is maintained in place by a person clenching their teeth frequently is considered insufficient and harmful. They frequently have a poor fit on protruding teeth vulnerable to injury and tend to be dimensionally thin. Most sports stores sell them for reasonable prices and in a convenient manner [10].

3. Custom-made mouthguards

These were made precisely from a cast of a dental impression of the jaw taken by the dentist. Traditionally, these have been made by vacuum or pressure molding polyvinyl acetate-ethylene copolymer (EVA). They are often much more comfortable to wear and provide greater protection against damage and concussions than the other types. Some people may find them pricey and require a trip to the dentist. Mouthguards fall under the category of personal protective equipment, and for the manufacturer to certify the product and apply the CE mark, it must be deemed fit for use as protective equipment. Dentists should confirm that the laboratory has properly tagged customized mouthguards in this way.[11]. As one might assume, a patient would normally need to visit a dentist to obtain an imprint.

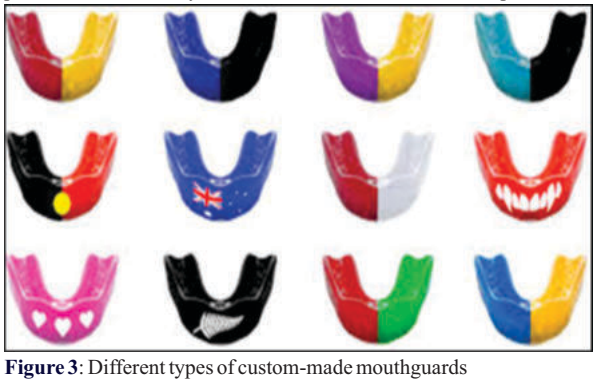

Figure 3: Different types of custom-made mouthguards

However, some companies promote online that they can make mouthguards specifically for patients who submit their impressions. To do this, the business offers self-impression kits that could include tubs of impression putty, a tray for the impression, instructions, and a Freepost return package in which the impression is given. There are alternatives for mouthguard personalization and design online, from multicolored stripes to pre-made selections. Additionally, a company will be established to capture imprints at the patient's workplace or sports team.[12]

4. Masel double guard Stock

Non-custom mouthguards, like OrthoguardTM, have a channel to fit fixed orthodontic devices, like brackets, tubes, molar bands, and archwires, as well as future orthodontic treatment.

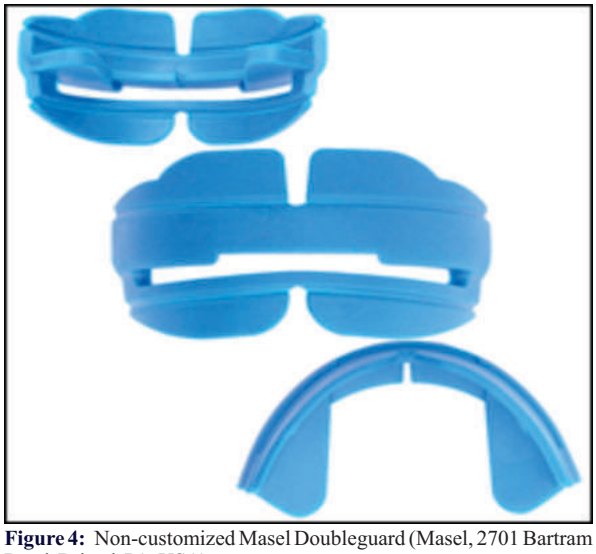

Figure 4: Non-customized Masel Doubleguard (Masel, 2701 Bartram Road, Bristol, PA, USA)

Teeth movement has been noted. Although less expensive, they could not be as durable, provide less protection against tooth damage, and need to be replaced more frequently. prevents gagging and breathing issues not swallowable or impact-resistant[13].

5. The Total Gard 2 Athletic Mouthguard Stock

The orthodontist-designed TOTALGARDTM sets new standards for patient safety and comfort during contact sports. superior to any other mouthguard worn in terms of both design and functionality. Cover all braces and appliances (ie Expanders etc) Keep the lower and upper teeth healthy.

Figure 5: TotalGardTM full mouth protection for fixed appliance wearers

It protects the TMJ and lips. It has extensions with hinges that fold into the buccal area for comfort. 4.25mm posterior bite tabs, an anterior aperture for easy breathing, and tabs to stop anterior teeth from rubbing against one another and gagging. natural retention caused by the muscles of the face and lip, comfort and safety, ease of speaking and breathing simple fitting - no boiling interferes in any way with orthodontic therapy, retaining oneself[14].

6. Grays Razor mouthguard Mouth formed

Figure 6: Grays Razor Mouthguard

Pre-Contoured Shield: Reduces shrinkage of the material while providing the best level of protection and supporting the upper palate for straightforward breathing. Extra Wall Thickness - Absorbs the force, protecting the front teeth, which are more vulnerable to trauma, from the shock. You get the appearance and feel of a specially constructed guard with the Boil & Bite guard.[15].

7. Signature type I Orthodontic mouthguard Mouth formed

Since the user may need to purchase several items over the course of a season as the patient's orthodontic therapy progresses, this style is best suited for orthodontic patients. All contact sports' entry-level and intermediate levels of competition can use it.

Figure 7: Signature Mouthguards

It provides superior protection by precisely fitting the mouth and teeth and shielding the teeth, gums, jaws, and joints while absorbing impact. It is simple to talk, breathe, and drink thanks to its comfortable fit. Additionally, the design is suitable and reasonably priced. most prevalent mouth shapes[16].

8. Braces single and double guard

While some sports leagues simply demand that athletes wear single mouthguards, others demand that they wear double mouthguards. Single mouthguards just cover the player's upper jaw teeth, while double mouthguards cover both the player's upper and lower jaws. If a player has braces on their bottom teeth, double mouthguards are sometimes necessary in high-contact sports.

Figure 8: Braces single and double guard for Upper and Lower Teeth Protection

The smooth, hygienic silicone used in sports mouthguards with double braces is free of BPA, Latex, and PVC. Because it safeguards both the top and lower teeth, the athletic mouth guard is appropriate for sports that require dental protection. The force of a collision is evenly distributed by a sturdy cushioning base, which also absorbs shock. Smooth Breathing & No Boiling Required - The mouthguard is designed to fit quickly and comes with a carrying pouch. Molding is not required, and changes are simple. Additionally, respiration is unaffected[17].

9. Rainbow mouthguards Custom and A custom-made mouthguard from O-PRO

Patented Dual Compression Cage

To construct an identical reproduction of the mouth, the innovative dual compression cage uses hyperflex technology to harness the power of the jaw. This easy, quick-to-fit process creates a customized dentist-level gum barrier that drapes smoothly over teeth and has unrivaled retention with the same accuracy as a dental thermoforming machine.

Patented Fin Technology

The only mouthguard featuring cutting-edge self-impression fin technology is the Instant Custom-Fit. The unusual shape of the hi-flow gel fins securely molds around teeth in conjunction with the compression cage for a fit that is comparable to a dentist's.

Dental Grade Protective Shell

The Instant Custom-Fit mouthguard offers the highest level of damage defense as worn by elite sportsmen thanks to its dentist-class protective shell. The novel triple-layer structure absorbs shock waves from a strike, cushions impact, and reduces the risk of sports-related tooth damage. As a result, you can play better and feel safer.[18].

Figure 9: Custom-made Rainbow mouthguards and A custom-made mouthguard from O-PRO

The mouthguard should meet the following fundamental criteria for the patient to wear it successfully and protectively:

- Enclose all the maxillary teeth to the distal surfaces of the second molars in class I and class II patients.5 Enclose all the mandibular teeth to the distal surfaces of the second molar in class III patients. If the patient has a severe gag reflex, the mouthguard may be reduced to cover the distal surfaces of the first molars.
- The labial flange should extend to within 2 mm of the sulcus.
- The palatal flange should extend approximately 2 mm above the gingival margin.
- The edge of the labial flange should be rounded, and the palatal edge should be tapered.
- Be fabricated from a material approved by the U.S. Food and Drug Administration that can reduce the impact force on teeth, surrounding soft tissues, and bone.
- Be comfortable and retentive and fit properly.
- Be easy to clean.
- Not interfere with breathing or speech[19]

Advantages of Mouthguards

- The material's thickness on the labial, occlusal, and palatal surfaces should be between two and three millimeters.
- Within 2 millimeters, the labial flange should touch the vestibular reflection.
- Around 10 mm should separate the gingival margin from the palatal flange.
- The edge of the labial flange should have a circular cross-section.
- The outside border of the palatal flange should have a tapered cross-section.
- Up until the distal margin of the maxillary second molars, all teeth should be considered.
- The distal surface of the maxillary first molars in the mixed dentition should be reached by the MG.
- When the mouth is closed, the occlusal surface of the mouthguard ought to make even contact with the bottom teeth[20].

Properties of an ideal Mouthguard material

- The material must be biocompatible,
- Easy to manipulate during pre-fabrication,
- Resistant to water damage,
- It should have a sufficient elastic modulus to reduce stress beneath the material at the point of impact,
- It is rigid enough to distribute forces over a large area of the dentition,
- It should be tough enough to withstand cutting by biting,
- The resistance to fracture under the sudden impact,
- It should be tolerant of common cleaning agents,
- Resistant to low pH,
- Tasteless
- Odorless
- Inexpensive[21].

The material used to fabricate a mouthguard

- Polyvinyl-acetate-polyethylene or ethylene vinyl acetate (EVA) copolymer;
- Polyvinylchloride;
- Latex rubber;
- Acrylic resin;
- Polyurethane[22].

General design features of Mouth Guard

- The material should be between two and three millimeters thick on the labial, occlusal, and palatal surfaces.
- The labial flange should reach the vestibular reflection within 2 millimeters.
- The gingival edge should be around 10 mm below the palatal flange.
- The labial flange's edge ought to be circular in cross-section.
- The palatal flange's outer edge ought to have a tapered cross-section.
- Include all teeth up to the distal edge of the maxillary second molars.
- The Mouth Guard should reach the distal surface of the maxillary first molars in the mixed dentition.
- The occlusal surface of the mouthguard should make even contact with the bottom teeth when the mouth is closed[23].

Instructions for Mouth Guard Wear and care

- Wear only a custom-made mouth guard with balanced occlusion.
- Wear your mouthguard both during practice and games.
- Rinse your mouthguard before and after use.
- Wash your mouthguard only with soap and cold water.
- Clean surfaces with a soft toothbrush or nailbrush after wearing.
- Do not let anyone else use your mouth guard; it is made specifically for you.
- Store your mouth guard in a clean, rigid, and ventilated plastic container.
- Check your mouth guard regularly for signs of deterioration, and

replace it if it is cracking, splitting or the bite is changing
- Contact your oral health professional if your mouth guard becomes loose, too tight, or uncomfortable.
- Children whose mouths are developing and where baby teeth are falling out and being replaced by permanent teeth may want to consider having their mouth guard replaced regularly.
- Have your mouth guard checked as part of your routine dental review, or at least once a year, by your oral health professional[24].

DISCUSSIONS

Although there is little data to support this claim, several authors assert that mouthguards are an effective way to avoid spinal injuries and concussions. Stenger et al. asserted that using a mouthguard provided a solid impression that was beneficial for both head and cervical spine injuries. The "custom created" products, which come in a variety of varieties and are made in a professional laboratory or specifically developed and fitted in a dentist's office, had eliminated the symptoms. Even though they can be the most expensive option, custom mouthguards are preferred because they offer better retention and comfort, less interference with Meniere's disease, cervical nerve root compression, chronic "burners" (cervical radicular syndrome), dizziness/low back pain, and repeated concussion. Hickey et al. showed that a mouthguard could attenuate the forces applied to the head as the result of a blow on the point of speech and breathing and more adaptability to an orthodontic chin[25] However, it is unlikely that a mouthguard would appliance.5,10 offer effective protection against brain or spinal cord injury

The simplest of these is a vacuum-formed guard made of polyvinyl acetate-polyethylene, which is by the pathophysiology of such a single layer known at the time. Complex designs that sandwich many injuries are used. In high-pressure situations without a mouthguard worn, the likelihood of an orofacial sports injury rose by 1.6–1.9 layers or laminations of the material. This method of preventing concussions allows for the incorporation of sport-specific designs such as hard inconsistent, and no conclusions can be taken as to the efficacy of inserts over the incisors for ball or missile sports or the use of mouthguards in preventing concussions for impact sports. For present enhanced reduction and absorption of transmitted forces during impact, a material thickness of 4 to 5mm is best. A material thickness of 4 to 5 mm works well for the current enhanced reduction and absorption of transmitted forces after impact.

CONCLUSION

It is recommended that all orthodontic patients wearing fixed appliances and participating in contact sports should wear a sports mouthguard to protect against the possible dangers described.16 Currently the authors would continue to recommend a custom-made mouthguard, blocking out areas on the construction cast to allow for tooth movements and dental development. Future research is required to determine whether some of the specialized mouth-formed guards described in this article could offer similar levels of protection

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