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MANUFACTURING OF SPORTS MOUTHGUARDS FOR PREVENTION OF DENTAL INJURIES: CASE REPORT¹

RUNNING TITLE: SPORTS MOUTHGUARDS FOR DENTAL INJURIES

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ABSTRACT

Objective: To describe the fabrication of a custom-made mouthguard for a 25-year-old male patient in good general health, who practices contact sports such as soccer. **Methods:** After an initial evaluation, impressions were taken to obtain plaster models, on which a 3mm EVA plate was fabricated for the upper arch. Adjustments were initially made outside the mouth, then the mouthguard was positioned, allowing for various movements to verify its comfort, fit, and the necessary retentiveness to maintain it in place during sports. The occlusion was adjusted, the contact points were checked, and a final finishing was performed. Finally, the patient received detailed instructions on proper hygiene and storage of the mouthguard. The precise fit and comfort provided encourage consistent use, while its ability to absorb and dissipate impacts protects the orofacial structures. **Conclusion:** Custom-made mouthguards are indispensable devices in preventing dental injuries, promoting greater safety during sports activities and helping to preserve the oral health of users.

Keywords: Mouth Protectors. Sports Medicine. Soccer.

INTRODUCTION

Mouthguards are essential intraoral devices that protect teeth, gums, and soft tissues during sports by cushioning and absorbing impacts. They reduce the risk of dental injuries, tooth fractures, and soft tissue damage, as well as offering some potential protection against concussions by stabilizing the jaw during impacts. Their usage is crucial, particularly in sports with a high risk of facial trauma (1-3).

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Mouthguards are classified into three types in the literature. Type I, or prefabricated mouthguards, are ready to use. Type II, known as "boil and bite," are also prefabricated but may be thermoplastic to fit the user's mouth. Type III are custom-made from plaster models of the patient's mouth, ensuring an individualized fit. (4).

Prefabricated mouthguards are easily accessible and affordable but often fit poorly due to their generic sizing, leading to discomfort and reduced protection. Users may also experience difficulties breathing or speaking. In contrast, custom mouthguards provide superior fit, comfort, and protection by adapting precisely to the user's dental anatomy. However, they can be more expensive and require dental consultations, which may limit accessibility (1,5,6).

Mouthguards are particularly important in contact sports such as soccer, basketball, hockey, and martial arts, where the risk of collisions, falls, or facial trauma is significant. They are also beneficial in non-contact activities like gymnastics and skateboarding, where accidents commonly occur. Despite their importance, adherence remains low, highlighting the need for awareness campaigns to emphasize the benefits of dental protection in sports (7,8).

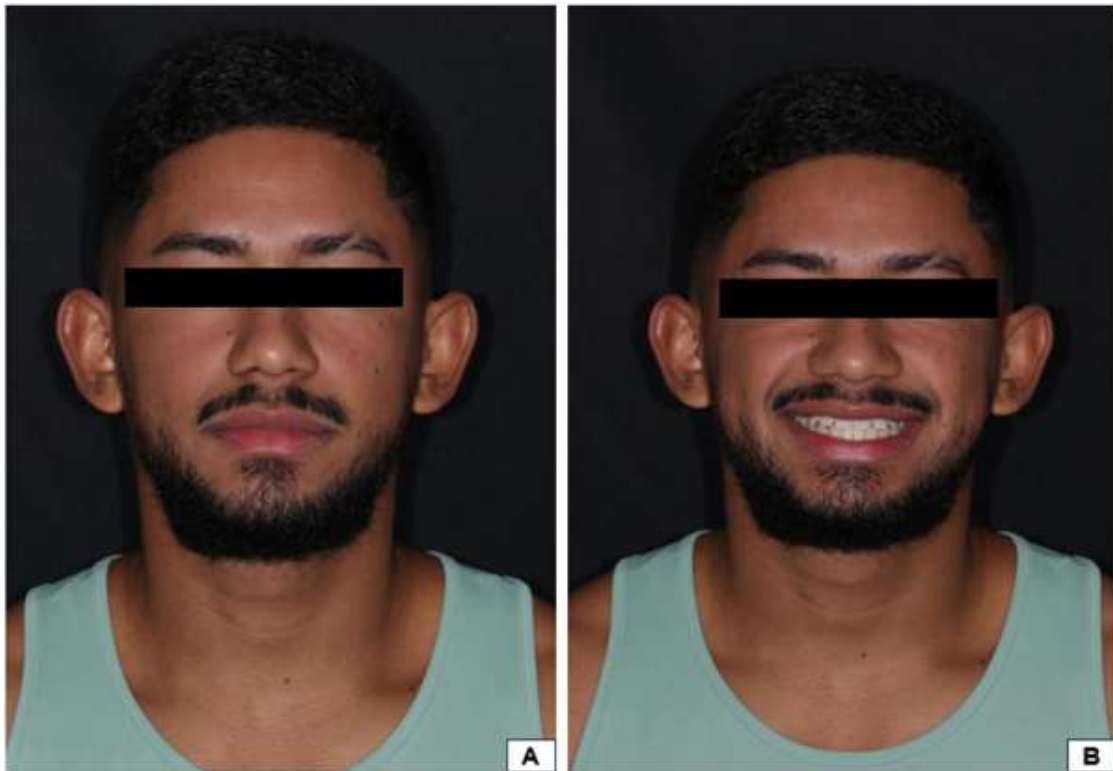
This case report explores the use of an individualized mouthguard for an athlete, serving as a basis for educational programs and awareness campaigns. The lack of information about mouthguard benefits may contribute to low usage rates. Research

and educational initiatives can help address these gaps, ensuring that athletes, coaches, and sports organizations prioritize dental protection for injury prevention (9).

CASE REPORT

A 25-year-old male patient in good general health sought care at a private practice to obtain a mouthguard. As a practitioner of contact sports such as soccer and CrossFit, he aimed to prevent dental trauma associated with these activities. Figure 1 (A-B) shows the patient's facial characteristics prior to receiving the mouthguard.

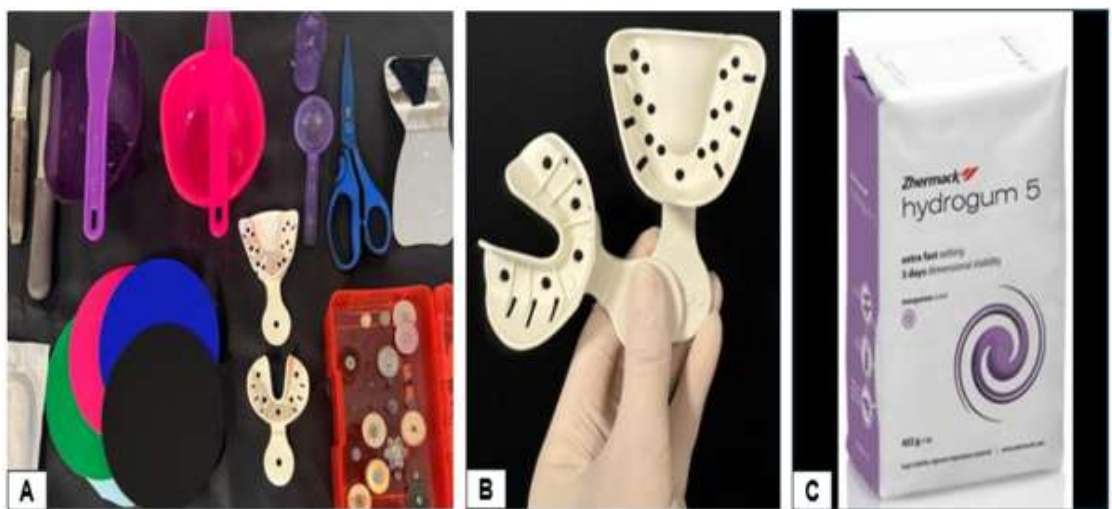
Figure 1: Initial extraoral photograph of the patient.



Source: The authors.

During the initial consultation, the patient reported no health issues, allergies, or medications in use. After evaluation, a custom-made mouthguard for the upper arch was recommended to prevent potential dental injuries. Written informed consent was obtained for the publication of this case report and associated images. The materials used for molding the mouthguard are shown in Figure 2 (A-C).

Figure 2: Materials used in molding to make the mouthguard.

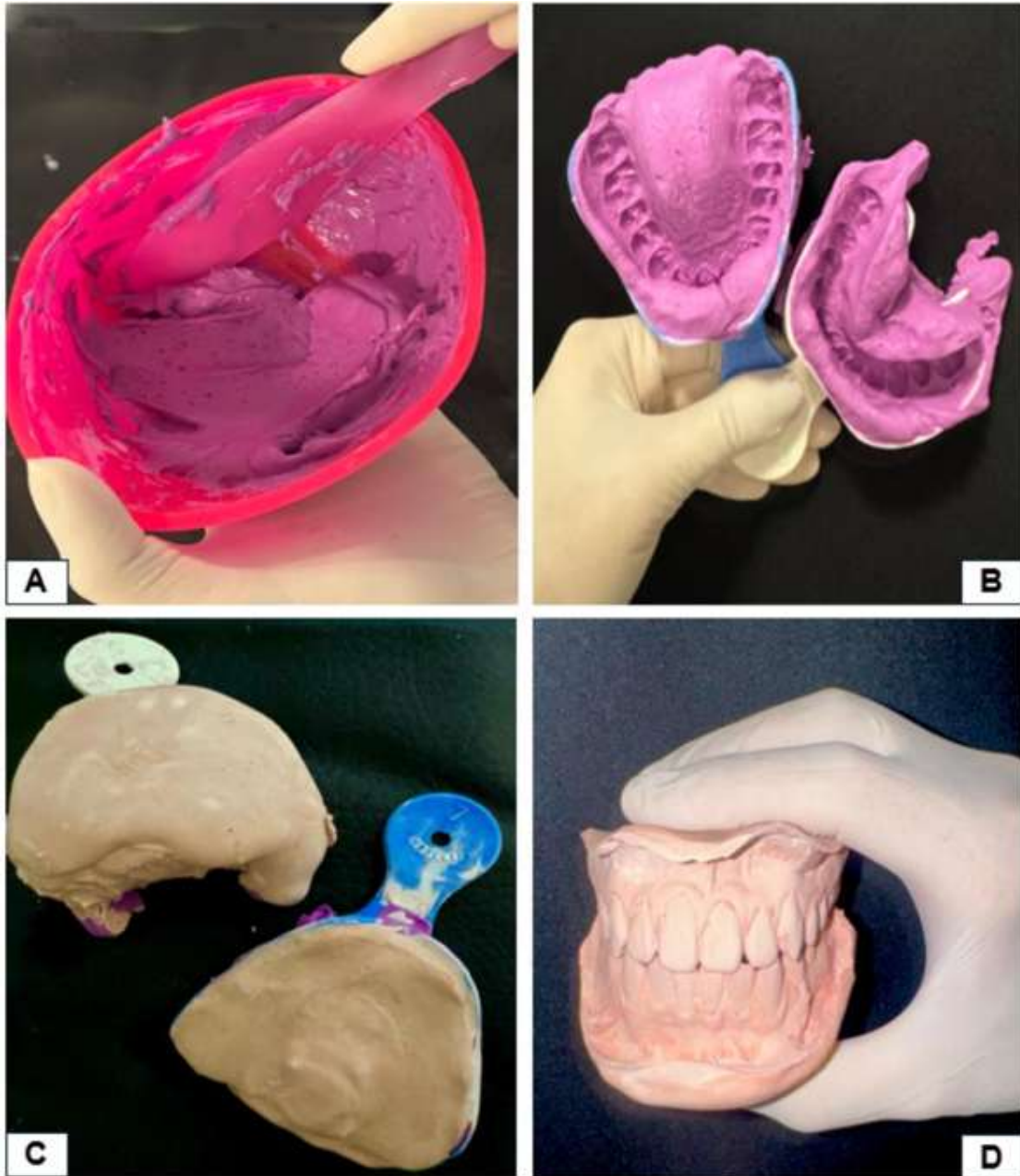


A: Materials for making the mouthguard; B: Selection of impression trays - upper impression tray number 7; C: Selection of alginate for impression - HIDROGUM 5.

Source: The authors.

A Type IV plaster model was created using an impression of the upper arch, which served as the foundation for mouthguard production (Figure 3 A-D).

Figure 3: Process of obtaining plaster models of the patient for making the mouthguard.



A: Handling of the material for molding;

B: Patient molds;

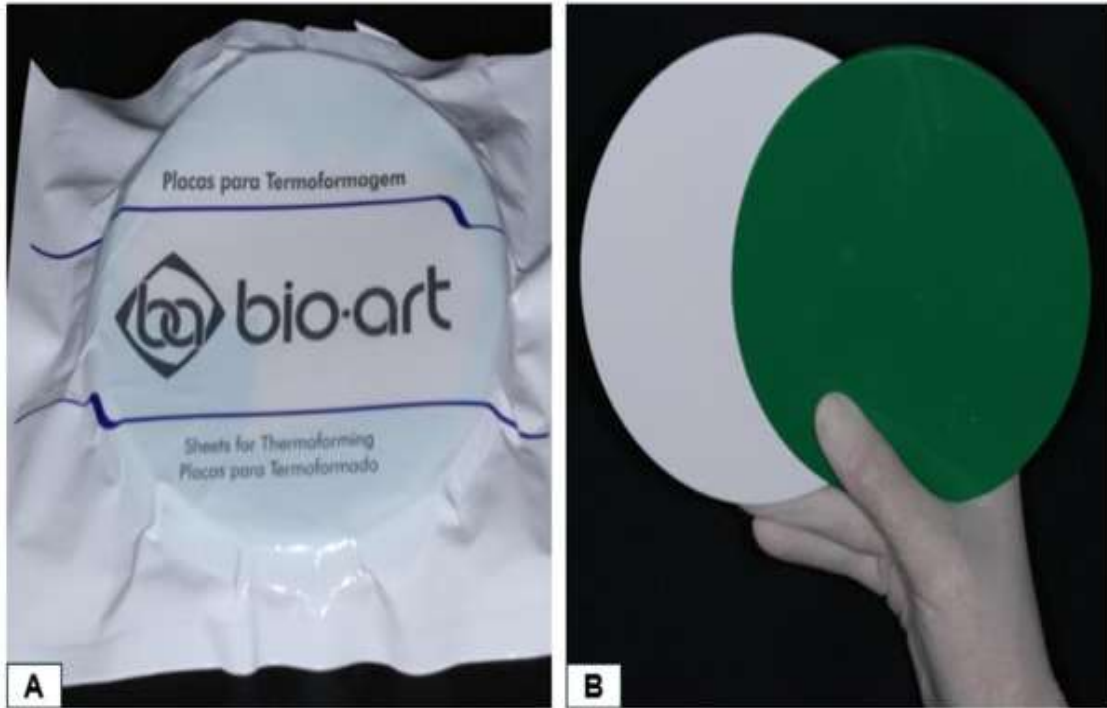
C: Casting with type IV plaster;

D: Made plaster models.

Source: The authors.

The next step involved selecting 3 mm BIO-ART SOFT Ethylene Vinyl Acetate (EVA) plates in white and green (Figure 4 A-B).

Figure 4: Selection of plates for thermoforming.



A: Selection of thermoforming plates - 3 mm BIO-ART SOFT;
B: Patient's color choices- White and Green (both 3 mm).
Source: The authors.

These plates were laminated using the PLASTVAC P7 thermoplasticizer (Figure 5).

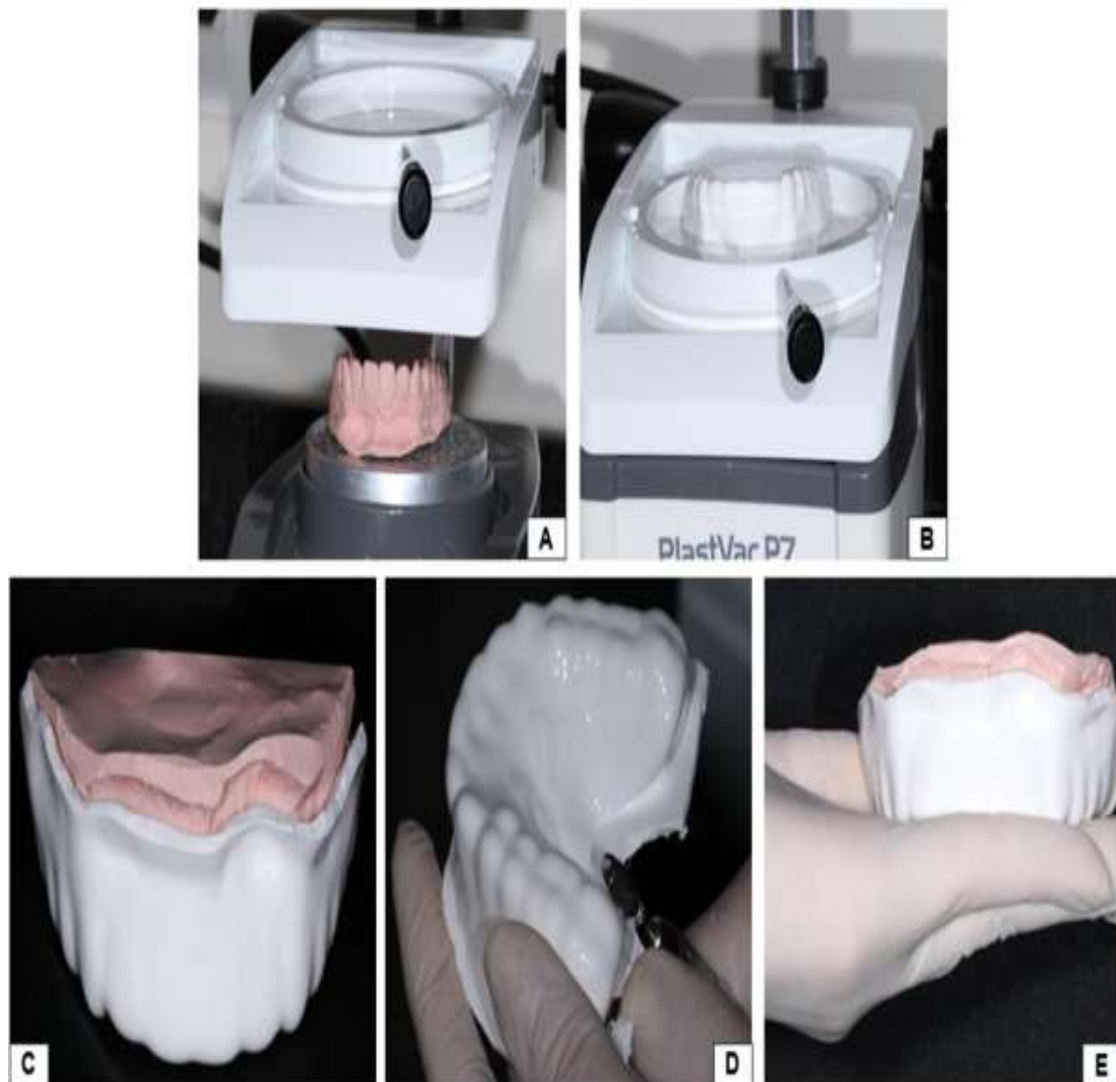
Figure 5: Thermoplasticizer used to plasticize the plates.



Source: The authors.

The first layer (white plate) was thermoformed and trimmed of excess material. A second layer (green plate) was subsequently thermoformed over the first layer, ensuring additional strength. The laminating process is illustrated in Figures 6 (A-E) and 7 (A-D).

Figure 6: Laminating the first white EVA plate.



Source: The authors.

Inserting the model into the laminator; B: First thermoplasticized plate; C: First thermoplasticized plate outside the device; D: Finishing the first plate with a MaxiCut tungsten burr; E: First plate after finishing.

Figure 7: Laminating the second EVA plate, in green.



A: Cleaning the second plate with 70% alcohol; B: Second plate being inserted into the thermoplasticizer; C: Second thermoplasticized plate; D: Second thermoplasticized plate - pre-finishing.

Source: The authors.

The final mouthguard measured 3 mm in thickness after all laboratory steps were completed. Clinical fitting was then performed, assessing the device's fit, stability, and comfort in the patient's mouth (Figure 8).

Figure 8: Final extraoral photograph of the patient with the mouthguard in position.



A and B: Finished mouthguard positioned in the patient's mouth, extraoral aspect; C: Finished mouthguard; D: Finished mouthguard inside the mouthguard case.

Source: The authors.

The patient received instructions on maintaining the mouthguard, including cleaning it with water and a soft-bristled toothbrush, storing it in the provided case to avoid humidity and fungal growth, and avoiding exposure to heat.

Finally, the patient was informed about the risks of facial impacts without the use of a mouthguard. Findings in the literature demonstrate that intermaxillary forces can be transmitted to the periodontal ligament and alveolar bone, increasing the likelihood of injury; however, some studies still disagree regarding this information, and more research is needed to confirm these findings, but this guidance is essential for preventing potential risks.

RESULTS

The creation of a customized mouthguard for a young patient involved in contact sports demonstrates a proactive measure to prevent dental trauma. As a soccer player and CrossFit practitioner, the patient faced a high risk of facial impacts. The customization of the mouthguard ensures a superior fit and comfort, effectively absorbing impact forces and minimizing the likelihood of dental and soft tissue injuries (10-13).

The precise molding process is fundamental to the effectiveness of the device. In this case, type IV plaster was used due to its high strength and low expansion, allowing for detailed reproduction of dental surfaces and gingival contours. Precise molding not only maximizes the efficiency of the protection but also reduces discomfort, promoting patient adherence to treatment (4, 12, 15). Advances such as digitization and 3D printing may further enhance precision in future applications.

Custom-made mouthguards, manufactured with high-quality materials such as the BIO-ART SOFT EVA plates used in this study, provide an ideal balance between flexibility and impact resistance. Appropriate laboratory techniques, such as laminating plates with the PLASTVAC P7 thermoplasticizer, ensure durability and precise adaptation to the patient's anatomy. The use of a 3 mm thickness, as established in previous studies, offers effective protection against trauma, maintaining comfort and facilitating breathing and speech during sports activities (4, 15, 18).

Clinical fit and patient education are essential for the success of custom-made mouthguards. Assessing fit, stability, and comfort ensures patient acceptance, while guidance on cleaning, storage, and wear monitoring maintains the protective properties of the device over time. These preventive practices are aligned with the findings of Freitas et al. (2018) and Silva et al. (2023), where regular adjustments and hygiene care contributed to the longevity and effectiveness of mouthguards (15, 18).

In conclusion, educating patients about the risks of practicing sports without proper dental protection promotes a preventive attitude, emphasizing the importance of personalized solutions such as mouthguards. A multidisciplinary approach that integrates clinical assessment, material selection, and patient awareness is essential in sports dentistry. By prioritizing these practices, dental professionals can improve both oral health and injury prevention in athletes.

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