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A vacuum technique to increase anterior thickness of athletic mouthguards to achieve a full-balanced occlusion

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Abstract – A full-balanced occlusion is essential for mouthguards. It has been reported that a balanced occlusion for upper and lower anterior teeth is essential for prevention of injuries occurring to the maxillary anterior teeth and alveolar bone caused by horizontal direct impact. The support of the mandibular teeth through the mouthguard is critical to prevent maxillary front tooth injury from a direct impact force. However, some vacuum mouthguard designs may not achieve a full-balanced occlusion. For example, when a player has a malocclusion, an elongated molar or premolar tooth, an open bite, a large over jet or a maxillary protrusion. An improved vacuum fabrication method is necessary to obtain full balanced occlusion in these cases as opposed to conventional vacuum type single-layer mouthguard technique.

Outline

The area where a balanced occlusion (especially in an anterior area) cannot be achieved by the conventional one-layer vacuum type mouthguard should be confirmed by examining the mounted casts. The first (additional) piece of EVA material is applied by using Erkostic (Erkodent, Pfalzgrafenweiler, Germany) and Gluefix 3002 (Steinel, Herzebrock-Clarhols Germany) etc. to the designated area. As in alternative methods, the cut sheet material is heated with the torch and pressed onto the cast. Next, the contour is straightened using silicon seating material and occluded with the opposite teeth. The vacuum formation is completed by the usual method of thermoforming an EVA sheet. The appropriate adhesive (Dreve: Drufosoft primer etc.) should be applied before vacuum sheet formation. This method will achieve a high safety full-balanced occlusal mouthguard easily using the conventional vacuum type machine. This technique is also useful to add materials to thicken the buccal surfaces as well as achieving correct mouthguard contours where teeth are missing. Full-laminated mouthguards have the advantages of better adaptation, are more comfortable and longer wearing. This newly designed mouthguard is recommended for young adults and children, for athletes undergoing orthodontic treatment, and urgent cases when player has lost a mouthguard.

Full-balanced occlusion is necessary for mouthguards. It is reported (1) that the occlusion of the anterior teeth are essential for prevention against most common injuries occurred in the maxillary front teeth and alveolar bone caused by horizontal direct impact. Also, the support by the mandibular teeth through the mouthguard is critical to prevent maxillary front teeth injuries from the direct impact force.

Recently, vacuum type and a laminated type mouthguards are increasingly used. The vacuum type has an advantage that the mouthguard can be fabricated easily and inexpensively. However, the vacuum type cannot necessarily achieve the full-balanced occlusion. Examples are when a player has a malocclusion, such as an elongated molar or premolar tooth, an open bite and a large over jet or maxillary protrusion. Conventional vacuum techniques cannot compensate for the decrease of the thickness during the fabrication (2). However, the laminated type can secure necessary thickness and enough occlusion (3–5), and thus have many advantages so as to recommend it as the best option. However, it is difficult to convince all players to use the laminated type mouthguard for reasons such as cost, time or time spent to deliver the mouthguard. We introduce an improved vacuum fabricated method for those cases where a full-balanced occlusion is difficult to obtain by the conventional vacuum type single-layer method.

Procedure

This method can provide a full-balanced occlusal mouthguard easily and reasonably even with the conventional vacuum type machine, which are inexpensive and in widespread use. This technique can also be used to increase the thickness of the mouthguard on the buccal surface (Figs 1–8).

Fig. 1. Prefabrication examination: the area where it appears that enough occlusion (especially in an anterior area) by the conventional one-layer vacuum type Mouthguard cannot be achieved should be confirmed. Anterior space is examined using upper and lower mounted cast.

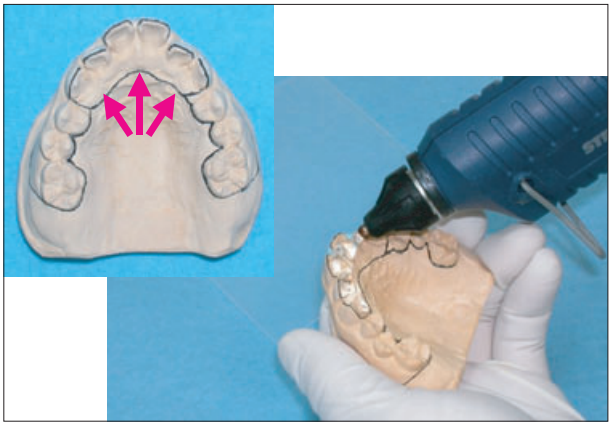

Fig. 2. Out-line of the Mouthguard and the area where first EVA material is to be applied is drawn on the upper cast. Before fabricating the mouthguard, prepare the cast by blocking out undercut caused by deciduous, partially erupted teeth, and spaces of separated with an appropriate material such as a silicone and different coloured dental stone if necessary.

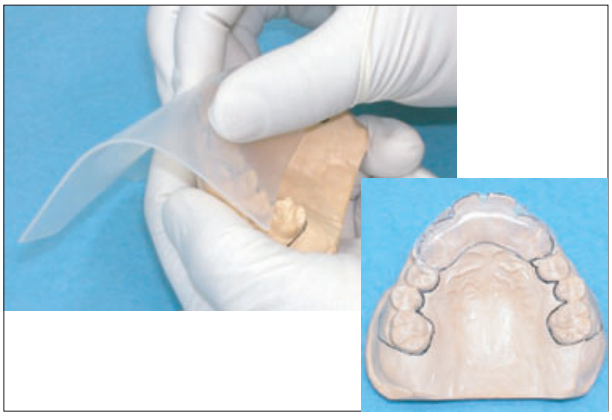

Fig. 3. Silicon sheet (Super-sheet, Dental Aid, Tokyo, Japan) is used to mould the EVA material while it is warm.

It is conceded that laminate mouthguards can be better adapted and are usually more comfortable for the patient (3–6). However, the mouthguard described here is useful for children and young patients when they will

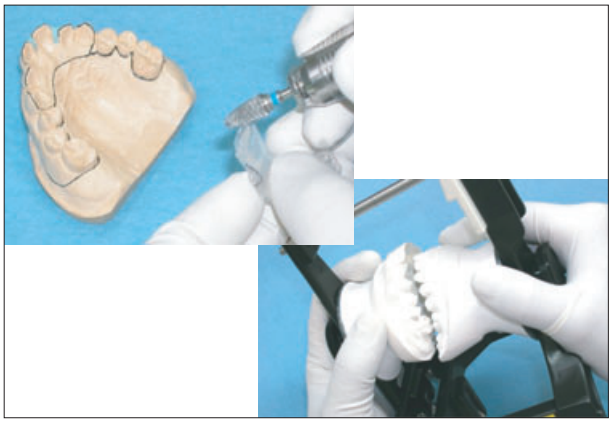

Fig. 4. The form of the EVA material is corrected while confirming the occlusion.

Fig. 5. Drufosoft Primer (Dreve-Dentamid GMBH, Unna, Germany) is applied and the surface is heated (until becomes it sticky. These surface treatments will improve the bond between the two EVA materials and prevent separation.

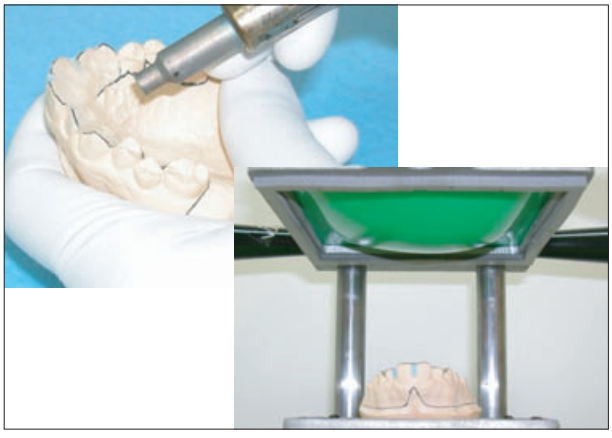

Fig. 6. Vacuum moulding of the second EVA material layer.

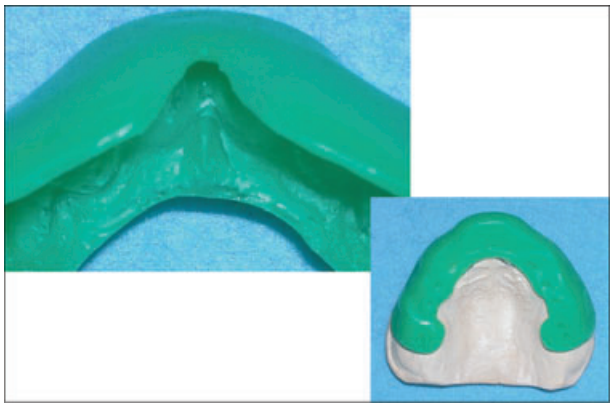

Fig. 7. Mouthguard sheet is cut and trimmed, the occlusion is adjusted on the model and using a Burner or a Gas torch and a Super-sheet (Molten Medical co. Ltd, Osaka, Japan) polished.

Fig. 8. Final adjustments in the mouth.

have to be replaced many times or in emergency cases when an athlete has lost his/her mouthguard.

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