Closed Hollow Bulb Obturator—One-Step Fabrication: A Clinical Report

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Abstract
A method is described for the fabrication of a closed hollow bulb obturator prosthesis using a hard thermoforming splint material and heat-cured acrylic resin. The technique allowed the thickness of the thermoformed bulb to be optimized for weight reduction, while the autopolymerized seal area was covered in heat-cured acrylic resin, thus eliminating potential leakage and discoloration. This technique permits the obturator prosthesis to be processed to completion from the wax trial denture without additional laboratory investing, flasking, and processing.

Maxillectomy defects can result in oroantral communication that causes difficulty in swallowing, deglutition, impaired speech, and facial disfigurement. The prosthodontist plays an important role in the rehabilitation of such defects, as good functional results have been reported for patients provided with obturator prostheses postsurgically.1,2

Obturator prostheses are fabricated to seal congenital or acquired tissue openings and defects of the maxilla, and depending on the extent of the defect, this type of prosthesis may vary in size and shape.3,4 The Glossary of Prostodontic Terms defines an obturator as “a maxillofacial prosthesis used to close a congenital or acquired tissue opening, primarily of the hard palate and/or contiguous alveolar/soft tissue structures.”5

The bulb portion, which accommodates the defect area must add retention and stability by extending adequately into the defect to achieve a seal.4,6 However, greater extension means additional weight to the prosthesis and with the gravitational force, these forces may exert a dislodging effect on the obturator.4

Several methods have been described for open and closed hollow bulb obturator fabrication. Both of these types of obturators are lightweight prostheses that can be easily tolerated by the patient.5,7,8 However, open hollow bulb obturators often collect mucous, food, and fluids and need numerous cleanings or a vent placement to eliminate accumulation in the hollow bulb.9 Closed hollow bulb obturators, on the other hand, do not pool moisture, while still extending adequately into the defect.10

To obtain a lightweight, closed hollow bulb obturator prosthesis, various materials and methods have been advocated. Some of these materials include light-cured resin,11,12 autopolymerizing acrylic resin, and silicone rubber.

Silicone rubber, while advantageous in specific clinical conditions, is still porous, and has poor long-term durability, requiring routine periodontal replacement.7,13 Another advantageous material is heat-cured acrylic resin, which is still considered one of the most durable and biocompatible materials for fabrication of the obturator.5

Numerous methods have been introduced for the fabrication of the hollow bulb obturator, including the use of materials such as sugar and ice14–16 as matrices inside the bulb to maintain its hollow nature during processing, and processing the obturator in separate segments and then luting them with autopolymerizing acrylic resin.17,18 However, the previously mentioned methods generally create a sealed area, which is a potential site of leakage and discoloration. They also require complex and multiple laboratory procedures. Chalian and Barnett19 introduced the placement of an acrylic resin shim, while Tanaka et al20 advocated the incorporation of polyurethane foam into the defect area to produce the hollow section. These methods have the disadvantages of adding more weight to the obturator and nonessential thickness to the hollow bulb obturator walls.9

Minsley et al21 suggested the use of a plaster index for the fabrication of the hollow bulb of the obturator, while simultaneously fabricating a heat-cured acrylic denture base used for maxillomandibular records followed by final waxing and processing of the obturator. Another technique is the double-flask technique described by El Mahdy,22 allowing for the complete fabrication of the hollow bulb obturator from the wax try-in
stage to completion of the prosthesis; however, this technique requires extra laboratory steps, including heat processing of the obturator bulb and the tooth portion separately with two denture flasks and then heat processing these sections for the second time together—double processing. Acrylic resin may also flow into the hollow portion during the final processing stage.\(^9\)
Similarly, McAndrew et al. introduced an investment method for fabrication of a closed hollow bulb obturator. That technique included the use of three sections of a denture processing flask; however, the procedure incurred additional laboratory procedures where multiple flasks were required.
This article describes a clinical report of a patient with an acquired maxillary defect, managed with a closed hollow bulb obturator processed using a single flask and one-time processing method. The bulb template was fabricated from hard thermofoming splint material using a plaster index.

Clinical report

A 62-year-old man was referred to the prosthetic department, requesting a new obturator prosthesis. He had a history of squamous cell carcinoma of the left maxilla, which invaded the maxillary sinus on the left side. The tumor was resected in 2005 by subtotal maxillectomy.

The patient complained that his current definitive obturator was loose. On examination, the maxillary arch was partially edentulous, with a well-healed defect of the maxilla (Armany Class II maxillary defect).

A new one-piece cobalt-chromium maxillary obturator prosthesis using the remaining natural teeth on the nonresected side for retention, support, and stability was fabricated to restore the physical separation of the oral and nasal cavities and the paranasal sinus. This would facilitate speech, deglutition, esthetics, and masticatory function.

Procedure

A preliminary impression was made using irreversible hydrocolloid material in a perforated stock tray modified with impression compound (Havard, Berlin, Germany) to record the extension of the defect. A severe undercut around the defect in the preliminary cast was blocked out in wax, and one layer of modeling wax was used as relief before a custom tray was fabricated to cover the teeth and extended well into the defect, particularly the superior extension of the lateral defect. The tray extension was checked intraorally, and border molding of the defect was performed in sections using low-fusing modeling compound (impression compound Type 1, SDS Kerr, Orange, CA). The patient was asked to perform various movements during border molding and before final impression taking. Subsequently, the modeling compound was slightly cut back. The final impression was made using medium-body polyvinyl siloxane (Aquasil Ultra, Dentsply, Waltham, MA) and during this, the patient was again asked to perform various movements to obtain a functional impression.

The master cast was poured in dental stone (Type III dental stone, Moldano, Heraeus Kulzer, Hanau, Germany), then the cobalt-chromium metal framework was designed and cast in the conventional way. Subsequently, it was tried in for retention and fit (Figs 1 and 2). One layer of modeling wax was adapted on the entire defect surface on the master cast. Three spaces were relieved in the wax at the roof of the defect to act as stoppers (Fig 3).

A plaster index was fabricated within the waxed defect area. Then, the metal framework was fitted on the cast to ensure that the plaster index would not interfere with the retentive mesh of the metal framework with at least 2 mm clearance (Fig 4).

The completely set plaster index was retrieved (Fig 5), and using a pressure-forming unit (Erkopress ES-200 E, Erkodent, Pfalzgrafenweiler, Germany), a clear template of the upper half of the plaster index was made (Fig 6). For this purpose a 1-mm-thick polyethylene terephthalate glycol thermoplastic sheath (Erkodor, Erkodent) was preheated and pressed under vacuum onto the plaster index. This material is recommended by the manufacturer for the fabrication of bruxism splints, dressing plates, and occlusal splints.

For the fabrication of the other half of the bulb template, another thermoplastic sheath of similar thickness was selected. Before the second half was thermoformed, petroleum jelly was applied all around the previously made template surrounding the plaster index, except for one end, at which both halves would be joined together to preserve their positioning (Fig 7).

Once the plaster index was removed, the formed templates were trimmed at the periphery, leaving a 1 mm edge to be joined and sealed using the autopolymerizing acrylic resin (ProBase Cold; Ivoclar Vivadent AG, Schaan, Lichtenstein) (Fig 8).

The template of the hollow bulb was fixed to the cast at the stopper areas using cyanoacrylate adhesive (Fig 9). The previously tried-in artificial teeth arrangement was replaced on the master cast using the previously prepared silicone index. The obturator prosthesis wax-up was conventionally finished (Fig 10).

Flasking, boiling out, packing, and processing were carried out in the conventional manner, using one flask and one-time processing. The processed closed hollow bulb obturator is shown in Figures 11 and 12.

Discussion

Several methods have been described to overcome the difficulty with fabrication of hollow bulb obturators. One of the conventional methods is to hollow out the bulb after processing through an opening, while in another method, the weight and thickness are optimized at record base preparation, where strategic openings allow access for bulb thickness reduction. The type of prosthesis produced employing the techniques mentioned are normally open hollow bulbs, which require a separate lid fabrication and subsequent luting to close the bulb.

Asher et al, in an attempt to avoid fabricating a separate lid, used autopolymerizing acrylic resin to process the bulb portion; however, the final sealed area was exposed to the oral, nasal, and antral environment. This sealed area was a potential site for leakage and discoloration. The method described in the present report avoided this potential problem, since the processing method allowed the bulb templates and the sealed junction all to be covered in heat-cured acrylic resin. A similar procedure was described by McAndrew et al, where obturator surfaces were processed with heat-cured acrylic resin; however, with the double-processing technique employed in their method, there would be a tendency for some dimensional changes of the prosthesis.

The use of thermoplastic splint material as an interim obturator has been reported and with adequate stiffness, the material was advocated for fabrication of an obturator baseplate. The thickness of the obturator wall could easily be controlled, since the preformed thermoplastic sheath used in this report comes in various thicknesses. At the same time, the internal hollow bulb could be fabricated independent of the master cast as the plaster index could be retrieved for thermoforming.
One potential problem with this method, however, is related to the accuracy of repositioning the finished hollow bulb template before the artificial teeth were set and waxed up. A movement or error in repositioning may lead to inaccuracy of the finished prosthesis. Another concern regards its strength to withstand pressure during processing, in particular with the compression molding technique, and its stability with the polymerizing temperature employed to process the prosthesis. To the authors’ knowledge, there has not been much information on this process, except for previous reports on the use of thermoplastic material as an interim obturator and obturator baseplate. This merits further research.

Conclusion

The procedure followed in this report has the advantage that the closed hollow bulb obturator could be fabricated with one-time processing, therefore reducing laboratory time while maintaining the obturator’s light weight and cleanliness. This technique could also provide an obturator that promotes a good seal and is completely covered with heat-cured acrylic resin. Another advantage was that separate lid fabrication and subsequent luting of the lid to the prosthesis were avoided.

References