Fabricating an Obturator Using Rapid Prototyping to Design the Framework: A Case Report

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Congenital or acquired maxillary defects cause various esthetic and functional problems. Maxillary deficiency can be prosthetically restored with an obturator. Computer-aided design/computer-assisted manufacture technology, which had been used exclusively in fixed prosthodontics, is now being more widely used in other fields, including removable prosthodontics, after the introduction of software and availability of a comprehensive solution for designing and manufacturing a removable partial denture (RPD). The rapid prototyping (RP) technique enables precise fabrication of the RPD framework in a shorter time period compared to conventional methods. This case report describes the fabrication of an obturator using the RP technique in a patient who underwent hemimaxillectomy of the soft palate. *Int J Prosthodont 2014;27:439–441. doi: 10.11607/ijp.3838*

Congenital or acquired maxillary defects cause various esthetic and functional complications. An *obturator* is an artificial plate that seals the maxillary opening or defect. It separates the oral cavity from the sinus and nasal cavities and restores phonetic, deglutition, and masticatory functions.

Milling technique, the conventional computer-aided design/computer-assisted manufacture (CAD/CAM) technology, is inadequate to handle the complex, thin shapes of retainers and proximal plates of a removable partial denture (RPD). To overcome this problem, Williams et al described a rapid prototyping (RP) technique in 2004 by which the resin was added to produce a sacrificial pattern for the metal framework of the RPD.[1]

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This case report describes the fabrication of an obturator using an RP technique in a patient who underwent hemimaxillectomy of the soft palate.

Case Report

A 40-year-old female patient presented to the Department of Dentistry at the Korea University Medical Center with a swelling of the maxillary right palate. A biopsy surgery was performed and the lesion was diagnosed as a mucoepidermoid carcinoma, a malignant salivary gland tumor. A hemimaxillectomy was performed from the maxillary right first premolar to the maxillary tuberosity.

Three months following the operation, the patient visited our clinic again for fabrication of the obturator (Fig 1). A preliminary impression was taken using a modeling compound (Impression Compound, Kerr) and alginate (Aroma Fine DF II, GC), and an individual tray was fabricated.

Because the defect pattern was classified as Aramany Class II, the obturator framework was designed according to the conventional Kennedy Class II RPD design.[2] Mouth preparation was conducted, and the final impression was taken with a soft reliner (Coe-Comfort, GC) and silicone impression material (Aquasil, Dentsply) using the functional impression method.

The resulting master cast was scanned using a model scanner and digitally surveyed using the FreeForm Modeling System of Intellifit (Sensable). The software was used to control the angulation of the cast, to

Fig 1 Intraoral postresection look at where the obturator would be inserted.

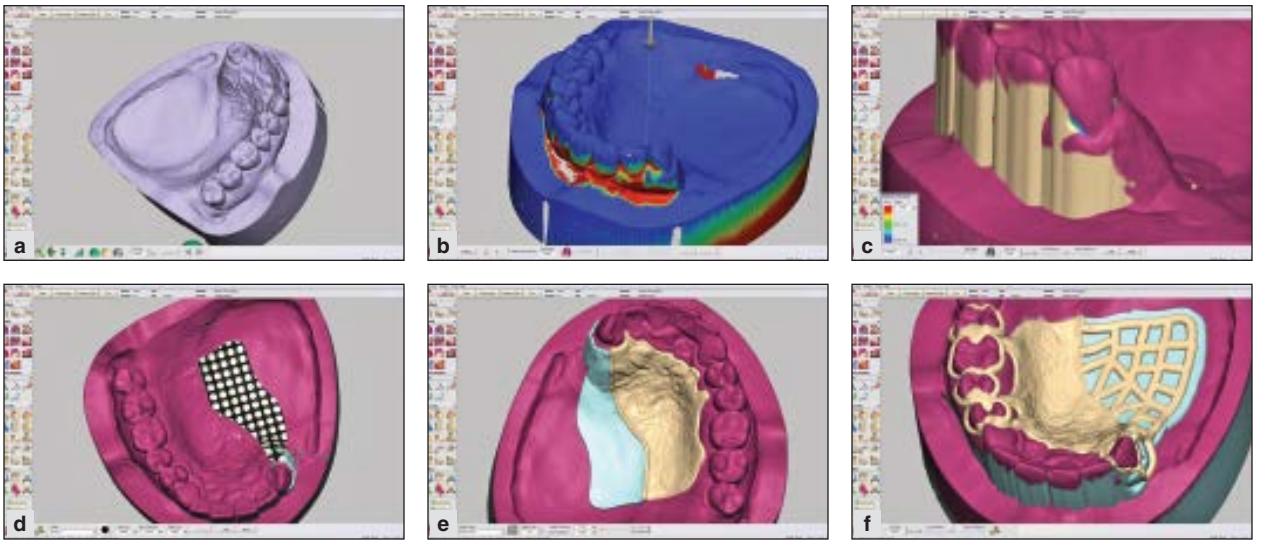

Fig 2 Digital design procedures using the Freeform modeling system of Intellifit. **(a)** Scanned model, **(b)** digital surveying, **(c)** blocking out the undercut, **(d)** design of the mesh, **(e)** design of the major connector, **(f)** design of the clasp.

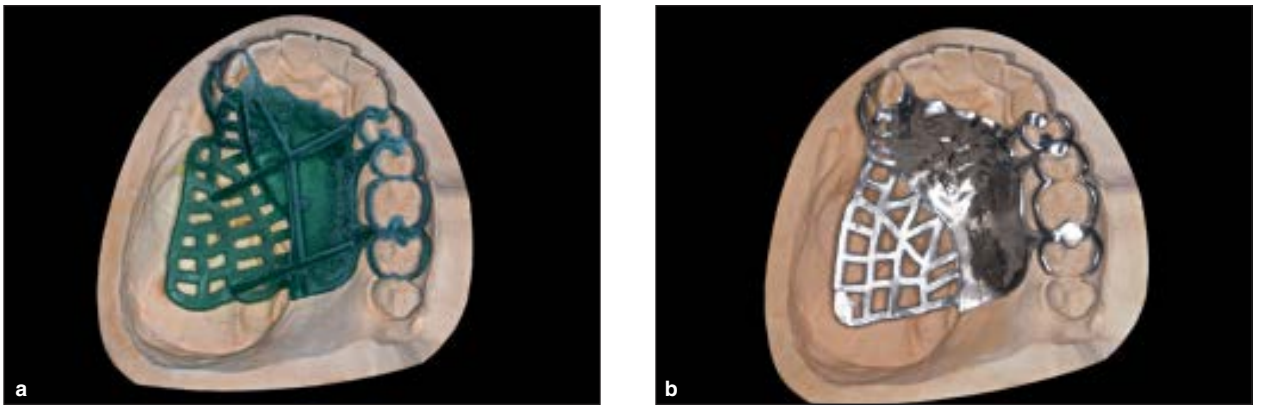

Fig 3 **(a)** Sacrificial resin pattern; **(b)** definitive framework.

measure the amount of undercut, and to determine the insertion and removal points. Unnecessary undercuts were blocked out, and a mesh was designed. The major connector design was for full palatal coverage, and the finish line was determined accordingly. Rest seats and direct and indirect retainers were prepared, and the framework design was completed (Fig 2). The final design was confirmed, and a sprue was added for casting (Fig 3a). The framework was fabricated with conventional investment casting and finishing methods (Fig 3b).

Figs 4a and 4b Definitive obturator. The peripheral extension of the obturator against the lateral wall of the surgical defect was adequate. The patient was satisfied with the final obturator design.

The framework was fitted in the patient's mouth. A functional impression was taken again to produce an altered cast. The occlusal rim was prepared on this altered cast, and the occlusal record was taken at the maximum intercuspation position. The casts were mounted in the articulator, and artificial teeth were arranged. The bulky portion of the obturator was fabricated as a closed-top design, and the inner portion was hollowed to reduce the weight (Fig 4a). The obturator was finally delivered, and the patient was satisfied with esthetics and function of the obturator (Fig 4b).

Discussion

Unfavorable defects, such as those that occur after a patient has hemimaxillectomy surgery, have different requirements for prosthesis support, stability, and retention than those of a conventional RPD: *(1)* a hollow-type denture base should be designed to decrease the stress on the supporting area and to improve patient comfort[3]; *(2)* to improve the compromised support, stability, and retention from the defect, multiple retainers, horizontal bracing, rest seats as far as possible from remaining tissue, palatal coverage, and a denture base inside the defects should be designed.[4]

The RP technique is actively used in the clinical application and evaluation. Bibb and colleagues stated that the fitness of RPDs made with the RP technique was clinically acceptable.[5] This study also demonstrated good adaptation of the metal framework to the inner shape of a patient's mouth without making chairside adjustments.

Advantages of the RP technique include the following: *(1)* easy verification of undercuts and paths of insertion and removal by digital surveying; *(2)* reduced processing time; *(3)* absence of limitations of the conventional milling process; *(4)* availability of the digitally saved design data for reproduction of the prosthesis, if needed. However, this technique has limitations, such as the high initial cost of the equipment and casting errors of the conventional method.

Conclusions

The use of the RP technique and functional impressions for obturator fabrication provided satisfactory results for closure of the palatal defect after resection.

Acknowledgments

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