Using a Silicone Core to Reduce the Weight of Maxillary Obturator Prosthesis

Ali Hafez Qoran * Soran Aminifar Amin Rezaee Adli Hamed Abachizadeh

1Assistant Professor, Dept. of Prosthodontics, Dental School, Tabriz University of Medical Sciences, Tabriz- Iran.
*2Corresponding Author: Postgraduate Student, Dept. of Prosthodontics, Dental School, Tabriz University of Medical Sciences, Tabriz- Iran. E-mail: soranaminifar@gmail.com
3Postgraduate Student, Dept. of Prosthodontics, Dental School, Shahid Beheshti University of Medical Sciences, Tehran- Iran.
4Postgraduate Student, Dept. of Prosthodontics, Dental School, Tabriz University of Medical Sciences, Tabriz- Iran.

Abstract

Objective: In prosthetic reconstruction of maxillectomy defects, the weight of prosthesis is usually high due to the extension of prosthesis base into the surgical defect. In order to reduce the weight, this area should be formed hollow. This study describes a modified technique for hollowing out the obturator bulb to reduce its weight.

Case: Our patient was a 56 year-old man with a completely edentulous maxilla. Due to an anaplastic carcinoma involving the palate and right alveolar ridge, a large segment of hard and soft palate and the whole right alveolar ridge were resected. After the surgery, the patient was unable to masticate or swallow and was not satisfied with the speech. The suggested treatment plan included fabrication of a complete denture along with a palatal obturator for the maxilla and a removable partial denture for the mandible. Silicone core method was used on the master cast for fabrication of the hallow bulb obturator.

Conclusion: Maxillary hollow bulb obturator prosthesis can greatly help in restoring functional capabilities of mastication, deglutition, and speech. Silicone core method on the master cast is a simplified approach for fabrication of the hallow bulb. This method helps to achieve a smooth surface in inner aspects of the bulb.

Key words: Maxillectomy, Obturator prosthesis, Anaplastic carcinoma

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Introduction:

Hard palate, maxillary sinus and in some cases buccal mucosa or nasal cavity tumors require a type of surgical procedure called maxillectomy or maxillary resection (1). Maxillectomy defects can be classified as limited, partial, complete and radical based on their extensiveness (2). In all types of maxillectomy procedures the surgeon should try not to compromise the integrity of the hard palate. However, preserving the hard palate is more of an exception rather than a general rule. Invading the hard palate causes an anatomic defect that allows the oral cavity, maxillary sinus, nasal cavity and nasopharyngeal duct to become one compartment (1). More extensive maxillectomy procedures cause a hard palate defect along with soft tissue involvements that affect mastication, deglutition and speech mechanisms (2). Some advanced surgical modalities like preservation of the hard palate, use of skin flaps and elimination of the inferior concha have been suggested to achieve a smooth surface for placement of prosthesis. For prosthetic rehabilitation of small maxillectomy defects, usually the conventional prosthesis base extension would be sufficient without the need for extension into the defect; but for lesions involving more than one-third of maxilla usually
the base of prosthesis should extend into the defect to achieve sufficient stability and support (3, 4). However, by extending the base of prosthesis into the defect, its weight will increase. To reduce the weight of the prosthesis, the bulb portion of the obturator is hallowed. Silicone core method on the master cast is a modified technique to hollow out the bulb portion of the obturator (4).

Anaplastic or undifferentiated sinonasal carcinoma is a rare, severely invasive cancer that is undifferentiated clinically and pathologically. Histogenesis of the lesion is unclear but some researchers believe that the cell origin of the lesion may be of olfactory epithelium. Its pathogenesis is not very well understood. However, tobacco consumption and Epstein-Barr virus may be associated with its development. Patients are mostly elderly men in their sixties. Rapid growth pattern and local invasion are of the characteristics of this disease. It usually involves some areas of the sinonasal tract including the nasal cavity, maxillary sinus and ethmoid sinuses. By rapid progression of the lesion, several sinonasal symptoms such as nasal obstruction or secretion, nasal bleeding, swelling and pain may develop. Radiographic evaluation with the help of CT scan and MRI is usually indicative of a large swollen mass along with bone destruction and invasion to the adjacent tissues. Treatment of this lesion is excision of the involved tissues until reaching a safe and intact margin. Adjuvant therapies like radiotherapy and chemotherapy are also indicated after surgery (5).

**Case Report:**

Our patient was a 56 year-old man classified as a rational patient according to House classification (6). He mentioned no previous specific disease in his medical history. During the last 14 months, the patient had undergone resection surgery for an anaplastic carcinoma involving the palate and right maxillary alveolar ridge. A large segment of his hard and soft palate and the whole right maxillary alveolar ridge had been resected. Immediately after surgery, the patient had undergone radiotherapy for 3 months. When taking a dental history, the patient mentioned extraction of all of his maxillary teeth during the last 3 years. In the frontal view of patient’s face, apparent asymmetry in the middle and lower one-third of the face was noted which was attributed to tissue contractions due to surgical scar. When examining the masticatory muscles and tempromandibular joint, severe mouth opening limitation—approximately 17 mm from the incisal edge of the mandibular incisors to the anterior segment of the intact alveolar ridge of maxilla—deflection towards the surgical side during opening and towards the intact side when closing were observed. Intra-oral examinations revealed complete healing and repair of surrounding tissues and surgical margins with no inflammation or wound (Figure 1). Maxilla was completely edentulous and in the mandible some of the posterior teeth had been extracted. Inability to chew, swallow or speak was the patient’s chief complaints.

**Figure 1—Extensive lesion involving the hard and soft palate and the whole right maxillary alveolar ridge**

**Treatment:**

At first, primary impressions were made of the maxilla using a stock tray, red impression compound cake and alginate and mandible with a stock tray and alginate. Base plate and occlusal rims were fabricated and adjusted for the maxilla
and diagnostic casts of the maxilla and mandible were mounted in centric relation with the help of facebow on a semi-adjustable Hanau articulator. Adjustment and reconstruction of the mandibular occlusal plane were performed after confirming the position of anterior teeth considering the tip of lower cuspid and two-third of retromolar pad (7). Various phases of fabrication of mandibular removable partial denture frame after rest seat preparation were done according to Kennedy Class III classification.

In order to fabricate a special tray for maxillary obturator prosthesis with self-cure acrylic resin, first relief and block out of the duplicate primary cast were done. Since ZOE was going to be used for the intact side of the alveolar ridge, the non-surgical side of the cast was relieved for 0.5 mm. For the surgical side, ISO Functional compound along with light body condensation silicone was used. After complete block out of the undercuts, 2 layers of base plate wax-with approximate thickness of 3 mm- were used. Since 2 different impression materials were used for 2 sides of the tray, a finish line was specified on the tray to place a border between these 2 materials. To achieve sufficient stability of the tray when making impression, first borders of the non-surgical side were molded with green stick compound and an impression was made with ZOE. By doing so, a stable tray was fabricated for making impression from the surgical defect. The process of making impression from the surgical defect was started by incremental addition of ISO Functional compound. By adding each layer of compound, patient had to do head and deglutition movements. After using compound, light body condensation silicone wash was applied (Figure 2). The final impression was poured with dental stone type III to obtain the master cast.

For patients who have undergone maxillectomy, heat-processed record base should be used for registration of the maxillomandibular jaw relationship because due to the lack of some anatomic structures and abnormal healing, retention and stability of the bases made with self-cure acrylic resin greatly decrease (1).

**Figure 2- Final impression of maxilla**

Phases for the fabrication of heat-processed record base for the hollow bulb obturator are as follows:

1- At first, approximate outline of bulb opening on the tissue surface of the surgical defect was drawn on the cast with a black pencil (Figure 3)

**Figure 3- Approximate outline of the bulb opening on the tissue surface of the surgical defect drawn by black pencil**

2- Two layers of base plate wax were placed and formed on the surgical defect and its vertical walls except for the bulb opening outlined by black pencil. Extra thickness of the wax resulted in extra thickness of the prosthesis base at the surgical defect making it possible to trim the base in case of tissue changes.
3- Three 5mm depth holes in 3 points away from one another were drilled through the bulb opening with a hand piece (Figure 4).

![Figure 4- Two layers of base plate wax on the surgical defect and its vertical walls-except for the bulb opening- and drilling 3 holes in 3 points away from one another through the bulb opening](image)

Three dental screw posts with 2 cm length (Swiss) were selected. After ensuring the stability and parallel insertion of metal screws in the holes, they were fixed in their respective locations using adhesives (Quickstar, China) (Figure 5).

![Figure 5- Insertion of metal screw posts into the holes drilled in the master cast](image)

Lab-Putty silicone material (Ormalab 75, Italy) without the activator was used for filling the hallow space inside the bulb up to 2 mm distance from the intact palatal surface. Required amount of putty was provided, mixed with the activator and packed in the remaining area (Figure 6).

![Figure 6- Silicone core on the master cast](image)

4- After setting of the Lab-Putty, its upper surface along with the non-surgical side was covered with base plate wax to provide adequate thickness for the tissue surface of the palatal area of the prosthesis base (Figure 7).

![Figure 7- Final wax-up of the master cast for the fabrication of the maxillary heat-processed record base](image)

5- The master cast of the maxilla was then flasked and packed in 100 psi pressure for an hour. The flask was placed in boiling water for 10 minutes to boil out the wax. After wax boil out and partial drying of the two halves of the flask and application of biofilm without changing the location of the silicone core (Figure 8), translucent heat-activated
acrylic resin was added incrementally to the surgical defect and after application of each layer, the flask would be closed and packed. By doing so, acrylic resin would completely fill all the cavities created through dewaxing. After ensuring complete application of acrylic resin, the curing was performed (Figure 9).

Figure 8- Position of silicone core after dewaxing

Figure 9- Heat-processed record base of the maxilla

After fabricating the heat-processed record base of the maxilla, pressure areas in the base were detected (using tissue conditioner for the surgical defect and pressure indicating paste for the non-surgical side) and relieved. Using base plate wax, occlusal rim was formed on the base plate. An important point to consider when adjusting the rim in such patients is the contraction of the lip and chick at the surgical side which usually requires negative horizontal overlap or producing an edge to edge occlusion. This condition starts from midline and extends for posterior teeth. Also, due to the contraction and shortening of the upper lip, lip closure may be impaired when using the obturator denture. In order to resolve this issue, we can decrease the vertical dimension which per se may result in lip or tongue biting at the non-surgical side. The best solution for this problem is to change the buccolingual inclination of teeth (1).

After assessing the lip and chick support and determining the VDO of patient and checking the functional plane, phonetics and esthetics, rim was adjusted and CR record was obtained. After selecting the acrylic teeth and mounting the casts in a semi-adjustable Hanau articulator, the acrylic teeth were placed.

Maxillary full denture and mandibular partial denture were tried in and after making the necessary adjustments, the maxillary obturator denture and mandibular removable partial denture were flaked using heat-activated acrylic resin. Dentures’ occlusion was adjusted by laboratory remounting and dentures were inserted for the patient. Also, the patient was trained and provided with the instructions on oral hygiene and cleaning the maxillary obturator and mandibular removable partial denture. During follow up sessions, the patient expressed relative satisfaction with his mastication, deglutition, speech and appearance. The major complaint of patient was the lack of retention of the prosthesis which was improved by using denture adhesives.

Discussion:

Extensive oral defects following maxillectomy can be associated with complications like
impaired speech, deglutition and mastication. Prosthetic rehabilitation usually provides satisfactory results. However, retention of such prosthetics is a major issue. Several methods like extension of denture base into the undercuts, use of implants and adhesives may improve the retention of prosthesis (8). Using dental implants is the best and most reliable method for this purpose. However, in our patient, use of implants was not indicated due to the lack of adequate bone, history of radiotherapy, high cost, and presence of natural teeth in the mandible and consequently increased destructive forces on the implants. Extension of denture base into the undercuts would result in a bulky heavy prosthesis and consequent reduced retention. Various methods have been suggested for reducing the weight of obturator through hallowing out the bulb. Use of a stone core inside the surgical deflection the master cast is among the common methods. First, the external circumference of the bulb is waxed up with a few millimeters thickness and dental stone is poured through a hole made in the back of the master cast designed specifically for this purpose. By doing so, a stone core would be fabricated inside the bulb. Another method for the stone core is fabrication of the bulb space in the second phase of flasking and forming a stone core inside it. The main problem of using a stone core is the adhesion of stone to the acrylic resin. Separating the stone from the internal walls of the bulb is difficult and can cause an irregular surface which makes the hygiene control difficult especially when there is an opening in the upper surface of the bulb (1).

Method of a silicone core on the master cast is a modified technique for fabricating a hallow bulb. It has the advantages of better control over the extension of the upper part of the obturator, creating smoothed-surface internal walls inside the bulb- which is hard to polish- (9) and easier laboratory procedures. For the reported patient, hallow bulb design with a superior opening was used. Due to the smoothness of the internal walls of the bulb, adequate extension of the upper opening and small secretions from the surgical area we concluded that the patient was totally capable of maintaining oral hygiene. Therefore, we decided not to close the superior opening (10).

Conclusion:

Maxillary hollow bulb obturator can significantly enhance mastication, deglutition and speech. An appropriate method for fabrication of the hollow bulb is the silicone core method on the master cast which helps to achieve a smooth surface in the internal walls of the bulb.

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