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Prosthetic Rehabilitation of a Maxillectomy with a Two-Piece Hollow Bulb Obturator. A Clinical Report

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Abstract

Extensive bilateral midfacial defects involving the upper jaw, palate, and sinus present a formidable reconstructive challenge. A combination of total and subtotal maxillectomy is, in general, a rare surgical procedure that affects the cosmetic, functional, and psychological aspects of a patient's life. Prosthetic restoration has become the preferred method for the rehabilitation of such conditions. The use of magnets is an efficient means of providing combined prostheses with retention, quality, and stability. This clinical report describes the rehabilitation of a total and subtotal maxillectomy patient with a two-piece hollow bulb obturator retained with the help of magnets and a retention clasp.

Maxillofacial prosthetics is the branch of prosthodontics concerned with the restoration and/or replacement of the stomatognathic and craniofacial structures with prostheses that may or may not be removed on a regular or elective basis.[1] These deficiencies may be due to surgical treatment, trauma, pathology, or congenital malformation.[2]

Special prostheses are necessary to seal congenital or acquired defects of the palate and/or contiguous structures such as subtotal or total maxillectomy patients. Subtotal maxillectomy refers to surgical removal of a part of the maxilla, whereas total maxillectomy refers to removal of the entire maxilla of either the right or left side. Rehabilitation with an obturator is a predictable intervention as it allows restoration of esthetics and function, such as mastication, deglutition, and speech, by creating an anatomic barrier.[3] These prostheses vary in size and shape depending on the extent of the defect and should be easily fabricated, lightweight, and provide retention, stability, and patient comfort.[4] By fabricating a hollow maxillary obturator, the weight of the prosthesis may be reduced by up to 33%.[3]

Numerous references in the literature describe various methods for fabricating open and closed hollow obturator prostheses.[5,6] Both types of obturators allow for the fabrication of a lightweight prosthesis readily tolerated by the patient, while effectively extending into the defect. Although open hollow obturators are easy to clean, these types of prostheses often collect moisture and require frequent cleaning or placement of a vent to eliminate the collection of moisture in the hollow section. Closed obturators have the advantage of eliminating the pooling of moisture while extending superiorly into the defect and reducing air space.

In this article, impression techniques and method of fabrication of a complete obturator for a combination of total and subtotal maxillectomy patient are described.

Clinical report

The patient, age 35 years, was referred by the ENT Department to the Department of Prosthodontics after surgery due to osteosarcoma for prosthetic management. On examination, it was observed that left total and right subtotal maxillectomies had been performed. The patient presented with a surgical obturator with inadequate retention.

Extraorally, the patient had a collapsed midface, and intraorally very little portion of the maxilla remained on the right side, with tooth #15 present. A considerable portion of the nasal septum, part of the inferior nasal conchae, and the superior wall of the maxillary sinuses on either side could be appreciated (Fig 1). The aim of the treatment was not only to restore function and speech, but also to improve esthetics, allowing the patient to lead a more productive life. An immediate surgical obturator was fabricated and inserted immediately following surgical resection. After 1 month, an interim obturator was fabricated

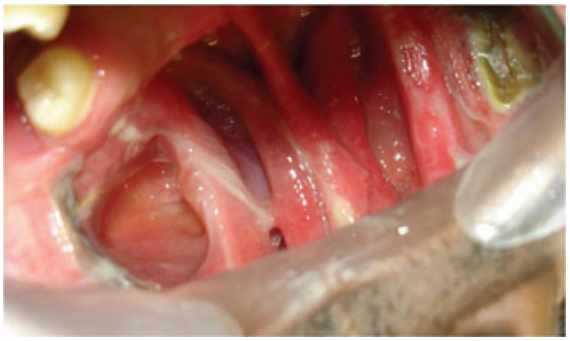

Figure 1 Preoperative photograph showing portion of maxillary sinus and terminates.

Figure 2 Antral part of the obturator and bulb fabricated with permanent soft liner.

and inserted. Four months later, fabrication of the definitive prosthesis was conducted in the form of a two-piece hollow bulb sectional obturator retained with the help of three retention systems—anatomic, magnetic, and clasp. The fabrication involved three basic steps: (1) impression procedure, (2) fabrication of the antral part of the obturator, and (3) fabrication of the oral part of the obturator.

Figure 3 Seal of the antral part of the obturator.

Figure 4 Depressions for orientation of oral part of the obturator.

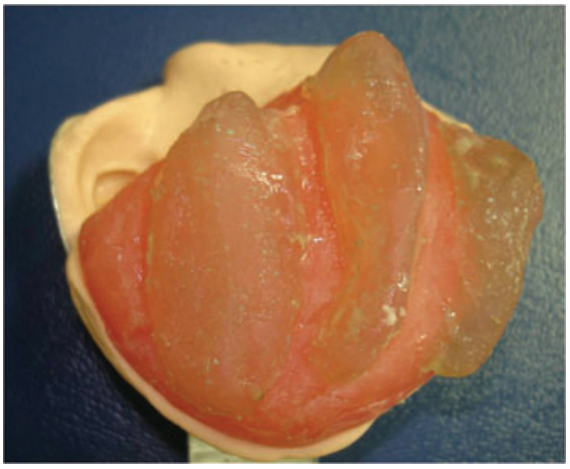

Figure 5 Alginate impression—pick-up of the antral portion of the prosthesis.

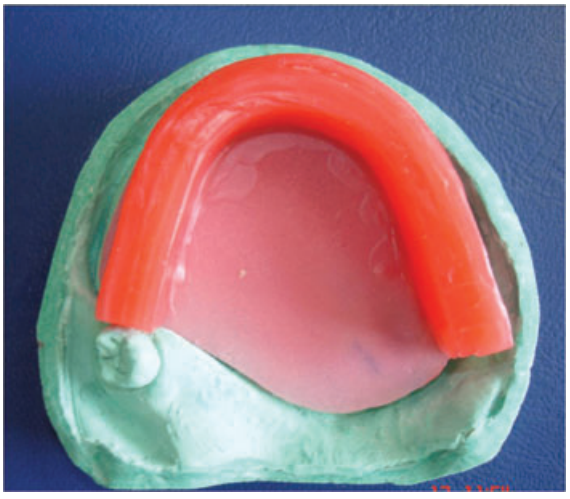

Figure 6 Occlusal rim fabrication.

Fabrication

Impression procedure

A perforated stock dentate tray was selected and modified according to the size of the defect. Prior to making the impression, the procedures were explained to the patient. Small gauze pieces were rolled and luted with petroleum jelly and placed to partially block the undercuts present on the superior wall of the space between the nasal septum and the inferior nasal conchae. An impression was made using irreversible hydrocolloid (Zelgan 2002, Mumbai, India). The impression was made with gauze placed to partially block the undercuts in position. Beading and boxing procedures were carried out, and a stone model was prepared. It was noted that due to the presence of gauze strips in the impression, the space between the conchae and nasal septum was reproduced in the cast. This was to aid in the proper positioning of the antral portion of the obturator.

Antral part of obturator (hollow bulb)

A thin pencil line marking was made between the tentative assumed positions of the oral and antral area. The space between the nasal septum and the inferior nasal conchae was blocked by filling with equal mixture of plaster and pumice. A 2-mm thick baseplate wax was then adapted over the antral part, and flasking and dewaxing procedures were completed. The mold space was packed with heat-polymerizing acrylic material (DPI, Mumbai, India), and curing procedures were performed according to manufacturer's instructions.

Both flask counterparts were separated without deflasking. The acrylized portion of the antral part was separated from the cast and examined. The plaster/pumice mix blocking the space between the nasal septum and the conchae was removed. The superior surface of the antral part of the obturator, which was to come in contact with this space, was roughened with an acrylic bur, and a soft liner adhesive was applied over the acrylic portion. Permanent soft liner material (Ivocap-Ivoclar, Schaan, Leichtenstein) was then mixed and placed into the mold space. The previously fabricated antral portion was placed over this, and the counterpart of the flask was closed tightly for curing of the soft liner. The antral part of the obturator was then removed and cleaned (Fig 2).

Autopolymerizing resin (DPI) was mixed and formed into an approximately 3-mm thick sheet, and during the dough stage, the inferior surface (open part) of the antral part was placed over the resin. The excess was cut with a Bard Parker blade, and pressure was maintained until polymerization of the autopolymerizing resin was complete (Fig 3). If any open margin and small gaps persisted, they were sealed with self-cure resin. Three button-like depressions were fabricated with autopolymerizing resin on the inferior surface of the antral part of the obturator. One button-like depression was positioned in the anterior (central incisor) region, and one button-like depression was made on either side (first molar region). This was to orient the oral part of the obturator during the jaw relation, try-in, and insertion procedures (Fig 4).

Trimming, finishing, and polishing procedures were carried out. The antral part was tried in to correct overextensions and sharp margins. The patient had no complaints in breathing, and no hyponasal speech was observed; however, the patient was excessively sneezing and complained of some irritation in the space between the conchae and maxillary sinus areas. Soft liners between the conchae areas were trimmed until the patient was comfortable. Retention was acceptable because of the undercuts present in the maxillary sinus areas and the perioral musculature.

Oral part of obturator

The antral part of the obturator was then positioned in the mouth, and the impression of the inferior portion of the antral part of the obturator and mandibular arch was recorded with alginate (Fig 5). The antral part of the obturator was then separated from the impression, and dental stone models were fabricated. A 2-mm thick denture base was fabricated with autopolymerizing resin, and the occlusal rim was fabricated over that (Fig 6). There was difficulty in the positioning of the oral part of the obturator on orientation of the plate over the antral part of the obturator. Moreover, the depressions on the antral part encroached beyond the seal of the bulb, leading to inferior surface thinning. Hence, it was decided to make acrylic elevations on the corresponding depression areas and depressions on the corresponding areas on the oral part of the obturator. Vertical and horizontal jaw relations were recorded. Once the tooth arrangement was completed, the prosthesis was tried in the patient's mouth and checked for occlusion and esthetics.

Baseplate wax was added to the inner slopes of the occlusal rim and center of the palatal plate to get a palate-like contour. This was performed until the patient felt comfortable with his tongue. The center of the palatal plate was removed due to insufficient space, and both the anterior and posterior slopes of the occlusal rim were contoured to form a palate.

After the try-in procedure, the trial denture was removed. A clasp was fabricated using 19-gauge stainless steel wire, which was to be placed on tooth #17. The prosthesis was then processed in acrylic. Trimming, finishing, and polishing procedures were completed (Fig 7), and the prosthesis was tried in the patient's mouth. Occlusal errors were corrected, and passive contact of the teeth during occlusion was obtained. Five depressions (2 mm depth) were created on the inferior surface of the antral part of the prosthesis, and another five depressions (2 mm depth) were created on the superior surface of the oral part of the prosthesis for placement of magnets. Five pairs of commercially available magnets (cobalt-samarium, Ambica Corporation, New Delhi, India) were positioned with the help of autopolymerizing resin (Fig 8) and inserted into the patient's mouth (Fig 9).

Insertion and review

The prosthesis was examined for speech, comfort, retention, and esthetics. The patient was taught to insert and remove the prosthesis. During insertion, the patient was instructed to wear the antral portion. If it was comfortably seated, then the oral part of the obturator was to be inserted. Magnetic forces, guiding slots, and retention clasps facilitate easy insertion of the oral

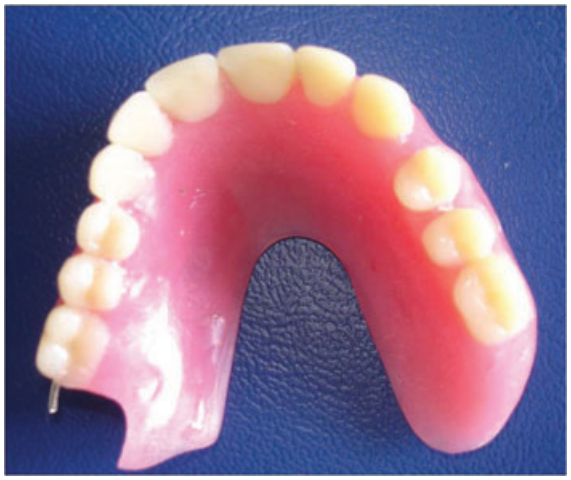

Figure 7 Oral part of the obturator.

part of the obturator. During removal, the patient was instructed to hold the central part of the antral part of the prosthesis in his left index finger and remove the oral part of the obturator with his right hand. This was to avoid removal or displacement of the antral part of the obturator along with the oral part of the obturator.

The first follow-up was performed after 24 hours. The patient complained of pain in the conchae and maxillary sinus areas and difficulties in pronouncing a few words. Overextensions were trimmed and polished. A second follow-up was performed after 1 week. The patient was satisfied with his speech, but was unable to chew food comfortably. The limitations of the prosthesis were explained, and the patient was instructed to eat semisolid food. A third follow-up was performed after 1 month during which the patient had no complaints. After a period of 3 months, the patient was comfortable during speech and eating semisolid food.

Discussion

Total maxillectomy combined with subtotal maxillectomy is a relatively uncommon surgical procedure and usually results in a surgical and prosthetic reconstructive challenge.[7] The goals of prosthetic treatment include separation of oral and nasal cavities, which allows for adequate speech and deglutition, along with restoration of esthetics. Lack of support, retention, and stability are common prosthodontic treatment problems for patients who have had a maxillectomy. Factors affecting the prosthetic prognosis for these patients are the size of defect, number of remaining teeth, amount of remaining bony structure, quality of existing mucosa, radiation therapy, and the patient's ability to adapt to the prosthesis.[2] For patients who receive a total maxillectomy on one side, saving as many of the remaining teeth as possible could be critically important for successful prosthesis design and function.[8]

For completely edentulous patients, the maxillectomy procedure usually results in poor prosthetic prognosis because of inadequate denture-bearing area, lack of cross-arch

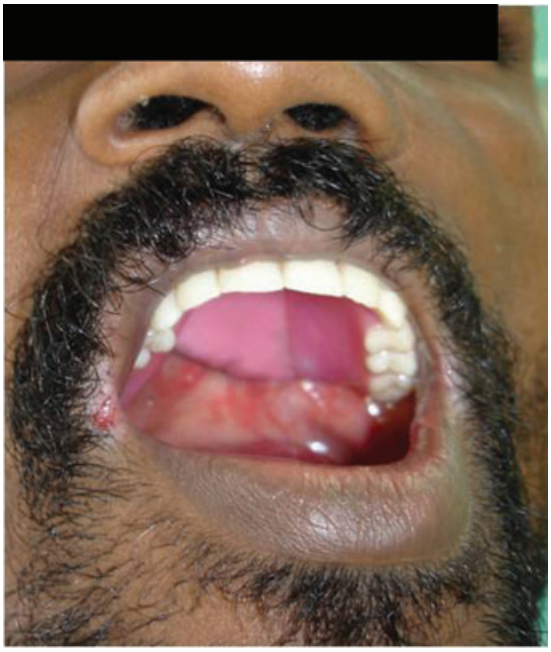

Figure 9 Post-insertion view.

Figure 8 Obturator with magnets.

stabilization, and lack of structures for denture retention. Prosthodontic treatment becomes extremely difficult after total resection, and only with close cooperation between the surgeon and the prosthodontist will an acceptable result be possible.

Several materials have been used for the fabrication of obturators. Silicone rubber and light-polymerizing acrylic resin are not durable on a long-term basis, as they lack inherent physical strength.[9] Silicone rubber has an added disadvantage of the inability to maintain adequate hygiene and may result in Candida infection. Heat-polymerizing acrylic resin has been proven to be one of the most durable tissue-compatible materials. The weight of the obturator has a major role in retention and stability. Creating a lighter obturator portion improves the cantilever mechanics of suspension, avoids the overtaxing of remaining supportive structures, and enhances retention.[4]

The retention of the antral part of the obturator is achieved with the help of resilient liners. The use of a resilient liner is a simplified rehabilitative treatment modality, readily modified or repaired, and comparatively inexpensive.[4] It enables the use of soft-tissue undercuts at the level of the meatus, providing for adequate anatomic retention.

Magnets are used because of their small size and strong attractive forces, attributes that allow them to be placed within prostheses without being obtrusive in the mouth.[10] Advantages also include ease of cleaning, ease of placement for both dentist and patient, automatic reseating, and constant retention with number of cycles.[11] A commercially available magnet (Cobalt-samarium, Ambica Corporation, New Delhi, India), which provided the essential retention, was used. Cobalt-samarium magnets are rare earth magnets used since the 1960s for dental applications. Cobalt-samarium has superior characteristics in terms of magnetic permanence (hardness). In the 1980s neodymium-iron-boron became available. Though neodymium–iron–boron was efficient for dental applications, it did have a few limitations, including brittle nature and low corrosion resistance; however, the long-term use of this type of magnet is not advisable. To rectify these limitations, a samarium-iron-nitride magnet is being researched for intraoral use in dental applications.[11,12] In our case, we used the cobalt samarium magnet available in our country. This was cost effective for the patient.

One of the problems associated with the sectional prosthesis occurs during removal. On attempting to remove the prosthesis, both units of the prosthesis may get dislodged as a whole. Hence, the horseshoe shape was employed while fabricating the oral part of the prosthesis to facilitate separation of the prosthesis into two units on application of digital pressure on the center of the antral part of the obturator.

The patient was informed about the procedure and materials used, and informed consent was procured. The patient also accepted the need for frequent review calls after insertion of the prostheses. A constant follow-up on a longitudinal basis is necessary, and further research on the magnetic field of commercially available magnets is needed.

Summary

Extensive bilateral maxillectomy defects involving the maxilla, palate, and sinuses present surgical and prosthodontic rehabilitative challenges. Surgical reconstruction for such patients is often precluded because of large defects. A sectional magnet-retained obturator was used to restore speech, deglutition, and mid-facial contour for a patient with a combination of total and subtotal maxillectomy. The sectional prosthesis, retained by magnets, eliminated long-term use of a nasogastric tube, rehabilitated the patient's speech, and restored proper mid-facial esthetics. Magnetic retention for maxillectomy patients is advantageous as it serves to dissipate lateral forces; however over a period of time the magnets used intraorally require replacement due to lack of long-term durability in oral conditions. As we have used such intraoral magnets, the patient was informed about the limitations, and he was instructed to report to the clinic once in 6 months to replace the magnets if required.

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