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Prosthetic Rehabilitation of a Complete Bilateral Maxillectomy Patient: a Technical Report.

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Abstract: A complete bilateral maxillectomy defect presents a considerable reconstructive challenge for the prosthodontist. It results in devastating effects on cosmetic, functional, and psychological aspects of the patient. The purpose of this clinical report is to present a description of the prosthetic rehabilitation of a bilateral complete maxillectomy patient using a two piece magnetically connected prosthesis which has dramatically improved the patient's speech, masticatory efficiency, and swallowing dramatically improved after insertion.

Key words: complete bilateral maxillectomy, hollow bulb obturator, prosthesis, magnetic assembly

INTRODUCTION

Extensive bilateral midfacial defects involving the upper jaw, palate, and sinus presents a formidable reconstructive challenge (Panje, W.R., H.E. Hetherington, 1995). Bilateral complete maxillectomy is a relatively uncommon surgical procedure resulting in devastating effects on the cosmetic, functional, and psychological aspects of a patient's life (Sjowall, L., C. Lindqvist, 1992). Prosthetic restorations have become the preferred method for the rehabilitation of complex mid-facial defects like the bilateral maxillectomy. They allow rapid, single stage reconstruction which is important since improvement in the quality of life is of paramount concern because for many of these patients surgery may be only palliative (Johnson, J.T., M.A. Armani, 1983). Post surgical prosthetic rehabilitation of complete maxillectomy patients is a subject seldom discussed in the literature (Sjowall, L., C. Lindqvist, 1992). Many of these patients show poor prosthetic prognosis due to lack of a stable underlying bed of supportive hard tissue for stability and retention of the prosthesis.

Bilateral maxillectomy affects a variety of functions like mastication, speech, olfactory, and gustatory sensations. These patients also experience problems like seepage of nasal secretions into the oral cavity, poor lip seal, xerostomia, (Wang, R.R., 1997) exophthalmoses, and diplopia (Panje, W.R., H.E. Hetherington, 1995). Complete rehabilitation of a bilateral maxillectomy patient can be achieved using a multidisciplinary team approach involving both surgical and prosthetic personnel.

Factors influencing the prognosis of prosthetic reconstruction in these patients are the size of the defect, availability of hard and soft tissues in the defect area to provide support for the prosthesis, (Des Jardins, R.P., 1978) proximity of vital structures, patient attitude, temperament, systemic conditions, and the patient's ability to adapt to the prosthesis (Brown, K.E., 1970). The fabrication of a closed hollow obturator connected to a separate denture component using a closed field magnetic system is a challenge for the prosthodontist. The closed field magnetic system has several advantages over the open field magnetic system. In the former, complete encasement of the magnetic assembly inside the hollow acrylic bulb of the obturator eliminates the cytotoxic effects of corrosion products released from magnets to minimize the effect on local tissues. It also provides greater retention while reducing the magnetic field effect compared to open field magnetic systems.

There are numerous applications for magnets in prosthetic dentistry. The use of magnets for retention is a popular strategy because of their small size and strong attractive forces which allow their incorporation into a prosthesis without being obtrusive in the mouth. It is possible to achieve positive and dynamic retention using magnets.

Magnetic systems have been used for many years as aids for denture retention with excellent clinical results and patient acceptability. In the field of prosthetic dentistry both attractive and repulsive properties have been utilized. Magnetic repulsion has been used to limit the displacement of dentures by the incorporation of magnets into the posterior segments of the dentures with likepoles in apposition. Attractive forces have been

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employed by implantation of magnets within alveolar bone, root, or soft tissue along with unlike-magnetic pole magnets being incorporated in overlying dentures to establish the attractive forces.

The use of magnets in the retention of overdentures creates the challenge of overcoming the difficulties of readjustment and wear as well as the utilization of specialized equipment and sophisticated laboratory techniques required for conventional attachment systems. Magnets are also used in sectional prostheses, which consist of buccal and lingual sections joined together by magnetic assembly. They are also used in implant supported overdentures and for retention, maintenance, and stabilization of a combined maxillofacial prosthesis. This report describes the rehabilitation of a patient after bilateral complete maxillectomy by using a closed hollow obturator connected to the teeth bearing denture portion by a magnet.

Case Report:

A 46-year-old woman presented with a chief complaint of missing teeth in the upper jaw. Her primary concerns were poor facial appearance, inability to chew food, and the regurgitation of the food into the nasal cavity. She had been diagnosed with carcinoma of the maxillary sinus for which a bilateral maxillectomy was done followed by post-surgical radiation therapy. She also had complete monoplegia of the right upper limb.

The extraoral examination revealed a collapsed midface, with the lower lip in contact with the tip of nose (Figure 1). Intraoral examination revealed both maxillae and a considerable portion of her nasal septum had been resected and a brownish black patch was noted in the right side of the nasal cavity (Figure 2). The lesion was diagnosed as an Aspergilosis infection for which she was prescribed Itraconazole (100 mg) for 15 days and then recalled. After the lesion subsided, the patient was referred for prosthetic rehabilitation. At this point, the treatment objectives were to separate the nasal and oral cavities, restore the mid-facial contour, and improve her masticatory functions by providing a full complement of maxillary teeth. To accomplish these objectives a two-piece hollow obturator-denture prosthesis connected by a magnet was designed and fabricated.

Fig. 1: Pre-treatment photograph showing the collapsed midface with the lower lip in contact with the tip of the nose.

Fabrication of the Prosthesis:

A primary impression (Figure 3) was made using Panasil Putty Soft™ putty consistency impression material (Kettenbach Dental, Eschenburg, Germany). The impression was then poured in Type III dental stone (Dentstone; Pankaj Industries, Mumbai, India). A special tray was then constructed following a predetermined outline on the stone model using DPI-RR™ auto polymerizing acrylic resin (Dental Products of India Ltd, New Delhi, India). Border molding of a special tray was done with green stick compound (DPI-Pinnacle; Dental Products of India Ltd) to record the functional anatomy of the buccal and labial soft tissues surrounding the

Fig. 2: Intraoral view of the resected maxilla and considerable portion of nasal septum with brownish black patch in the right side of the nasal cavity.

Figure. 3: The initial impression of the maxillary arch.

defect. To make the final impression the gross extent of the defect was recorded by using Panasil Putty Soft™, soft putty addition polyvinylsiloxane impression material (Kettenbach Dental, Eschenburg, Germany) (Figure 4). The final wash impression was made using medium body Reprosil™ addition polyvinylsiloxane impression material (DENTSPLY-Caulk, Milford, DE, USA).

Two master casts (one split and one intact) were fabricated from this impression (Figure 5). The split cast was used for laboratory verification of the fit of the obturator and the intact cast for wax up and flasking. Undercuts on the intact master cast were blocked with modeling wax, and the remaining portion of the defect was waxed to a minimum thickness of 3 mm to provide an adequate thickness of heatcured acrylic resin for the strength of the obturator. A contoured wax lid was fabricated on the master cast to close the hollow

Fig. 4: The final impression of the defect area.

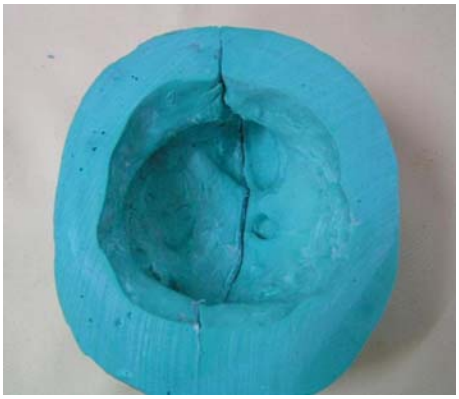

Fig. 5: The split cast used for laboratory verification of the fit of the obturator.

obturator. Flasking, investing, and the wax boil-out of master cast and wax lid was in the conventional manner. Both the obturator and lid were processed in heat-cured acrylic resin followed by deflasking, finishing, and polishing (Figure 6). Try-in of the obturator portion was done, the fit was found to be satisfactory, and a dramatic improvement in the patient's speech was noted.

Fig. 6: The processed obturator portion of the final two-piece prosthesis.

A closed field, permanent, rare earth (Nd-Fe-B) commercially available magnet (Ambika Corporation, New Delhi, India) was used. The magnet was supplied with two carbon Martensitic steel plates attached on either side. The heat-cured acrylic lid along with the magnetic assembly was attached to the obturator with autopolymerizing resin so only the terminals of the carbon steel plates extended to the outer surface of acrylic lid (Figure 7). By doing so, the magnets were completely isolated from the oral environment (Figure 8).

Fig. 7: The terminals of the carbon steel plates extending to the outer surface of the acrylic lid.

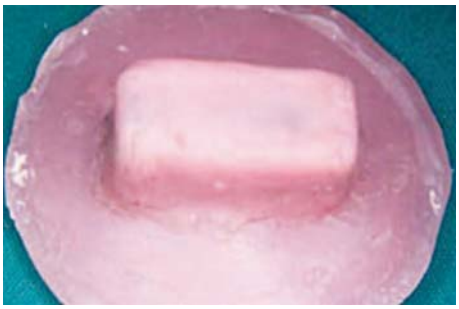

Fig. 8: The enclosed magnetic assembly on the lid of the obturator portion of the prosthesis.

The entire hollow obturator along with the magnets was tried-in to verify whether retention had been compromised due to the increased weight of the obturator as a result of the incorporation of magnets. No change in retention was found (Figure 9).

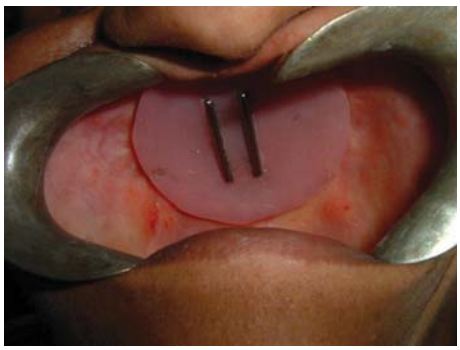

Fig. 9: The try-in of the hollow obturator along with the magnetic assembly.

Four rectangular indentations were made on the palatal surface of the obturator. An impression of the palatal surface was then made using Imprint™ irreversible hydrocolloid impression material (Dental Products of India Ltd, New Delhi, India). The resultant impression was poured with Type III dental stone, and autopolymerizing resin was manually adapted to the indentations of the stone cast to create an index for the record base. A carbon steel plate was fixed on the inner surface of the record base exactly opposite of the magnetic assembly to create a means for the denture portion of the prosthesis to attach to the obturator portion of the final prosthesis.

During the visit to determine jaw relations, the obturator portion of the prosthesis was inserted into the defect. The denture portion was attached to the obturator by means of the magnetic assembly and the jaw relations were recorded. The casts were then mounted and denture teeth set-up completed. Wax up of the palatal portion was done by taking care to facilitate the acceptable pronunciation of palatolingual and linguodental related sounds (Figure 10).

Fig. 10: The wax up of the denture portion of the prosthesis.

After try-in and the patient's approval, the waxed denture portion was invested and processed using heat cure resin. The finished, polished prosthesis was inserted into the patient's mouth (Figure 11) to assess the fit between the two portions of the prosthesis. Instructions for insertion, removal, and maintenance of the obturator were given. The patient's speech, masticatory efficiency, and swallowing dramatically improved after insertion. Figure 12 shows the pre-operative and post-operative photographs of the patient.

Fig. 11: The finished prosthesis in place.

RESULT AND DISCUSSION

The complete maxillectomy defect creates a significant rehabilitative challenge as it creates problems with speech, deglutition, and esthetics. The basic objectives of prosthodontic therapy should include preservation of tissue, positive support, retention, and prosthesis stability for patients requiring obturator therapy for such maxillectomy defects (Des Jardins, R.P., 1978; Brown, K.E., 1970; Devan, M.M., 1952).

Fig. 12: Pre and post-treatment images of the patient. Left: Pre-treatment. Right: Post-treatment

The retention and stability of an obturator can be increased by weight reduction. Lightening the obturator portion improves the cantilever mechanics of suspension, avoids the over taxing of remaining supportive structures (Brown, K.E., 1970), and enhances retention. It also simulates the functional anatomy of the maxillary sinus and adds resonance to the speech.

Very few surgical and prosthetic approaches to rehabilitate patients with bilateral maxillectomy have been reported in the literature (Sjowall, L., C. Lindqvist, 1992; Wang, R.R., 1997; Wood, R.H., W. Carl, 1977; Cheng, A.C., D.A. Somerville, 2004). Prostheses supported by implants, (Sjowall, L., C. Lindqvist, 1992) Steinnmann pin and magnets, (Panje, W.R., H.E. Hetherington, 1995) and circumzygomatic wiring have been used and reported for patients with bilateral maxillectomy. However, the generalized debilitations of systemic health in the patients after surgery, radiotherapy, and chemotherapy, as well as cost factors have tarnished their practicality.

A sectional prosthesis has been reported in which two halves of an obturator aligned by magnets were used to facilitate easy insertion and removal of the prosthesis from the locking effect of the soft tissue undercuts of a surgical defect (Wang, R.R., 1997). But such a design is problematic for geriatric patients and patients with compromised motor skills.

In addition, even a slight movement between magnetically aligned sections can result in undue stress on the underlying soft tissues of the defect.

However, the design of the prosthesis described in this report offered several advantages which include the ease of placement for the patient and the dentist, constant retention, and stability in terms of preventing movement of the prosthesis to avoid undue stress on the underlying soft tissues of the defect. A hollow silicon obturator with an acrylic palatal section has been described in the literature (Wood, R.H., W. Carl, 1977). However, there is a limitation of the use of this type of prosthesis because of the difficulty in the insertion and removal of a single large prosthesis in patients having a restricted mouth opening.

In the present case a sectional prosthesis was used which facilitated easy insertion and removal. Lack of rigidity and strength of the hollow silicone obturator compared to using heat-cured acrylic resin could result in poor stability of the prosthesis, but this was eliminated through the use of a sectional prosthesis to facilitate easy insertion and removal.

Insertion and removal of large prostheses used for rehabilitation of midfacial defects requires good neuromotor coordination and an adequate mouth opening. Both of these factors were unfavorable in the patient described in this report and could have compromised the prognosis of the treatment. For these reasons, the treatment plan was modified to fabricate a two-piece magnetically connected prosthesis. Microvascular surgical techniques have revolutionized surgical reconstruction but have not eliminated the need for prosthetic rehabilitation (Davison, S.P., D.A. Sherris, 1998). The closed field magnetic system used in this prosthesis reduces the magnetic field effect in the oral cavity when compared to open field magnetic systems (Riley, M.A., A.D. Walmsely, 2001). It also eliminates the cytotoxic effects of corrosion products released from magnets.

Several materials have been used for the fabrication of the obturators. Silicone rubber (Wood, R.H., W. Carl, 1977) and light polymerizing acrylic resin lack strength leaving the long-term durability of these materials in question. On the other hand, heat polymerizing acrylic resin has been proven to be one of the most durable tissue compatible materials to date (Brown, K.E., 1970)January 20, 2009.

The disadvantage of these heat-cured prostheses is they require a few additional laboratory steps to fabricate them.

Summary:

The debate about prosthetic and surgical reconstruction of maxillary defects continues.
The majority of maxillary defects can be ideally reconstructed with a simple obturator. However, the insertion and removal of a large prosthesis used for the rehabilitation of midfacial defects requires good neuromotor coordination and an adequate mouth opening. Because these factors were problematic for this patient, a two-piece magnetically connected prosthesis was fabricated. The patient's speech, masticatory efficiency, and swallowing dramatically improved after insertion.

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