CLINICAL REPORTS

Magnetic Retention for Obturators

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Prosthetic rehabilitation can be challenging in cases of maxillectomy or developmental defect. This article describes a case in which a magnetically retained, implant-supported denture was used to restore the maxilla following hemi-maxillectomy. Use of the Oral Health Impact Profile before and after treatment showed a marked diminution in the number of adverse impacts 2 weeks post-placement and during review 6 months later.

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FOLLOWING TUMOR RESECTION IN the maxilla, current reconstructive techniques include placement of a prosthetic obturator, restoration by local and regional flaps, and restoration by microvascular free flaps.[1] Edentulous patients requiring prosthetic rehabilitation pose particular challenges, but implant techniques can provide the necessary denture retention and stability with measurable improvements in quality of life (QoL).[2] The main aim of the maxillofacial prosthodontist is to achieve normal orofacial appearance as well as to restore masticatory function.

To retain conventional dentures, two implants can be placed, one on either side of the jaw. The dental implants must be parallel, otherwise the divergent paths of insertion of the retaining elements will hinder engagement of the prosthesis. This creates difficulties when much of the maxilla has been removed and insufficient bone remains along the operated side to support a correctly oriented dental implant.[3] A dental implant could be placed in the zygomatic bone, but the medial angulation would render any associated stud abutment inoperative. Magnets could be a most appropriate means of retaining dentures, as they would overcome the need for parallel paths of implant placement. They have been used for some time to retain small dentures, but have not been popular in the past, due to their relatively large size and the tendency for intra-oral corrosion.[4]

This case report demonstrates successful fabrication of a magnetically retained, implant-supported overdenture for a patient who has undergone tumor resection of the left maxilla. It is a typical example of a treatment taken from a study being currently undertaken to quantify the improvements in QoL brought about for such patients by prosthetic rehabilitation.

Clinical Report

A 73-year-old edentulous Caucasian female originally presented complaining of loose dentures. The patient had undergone a left hemimaxillectomy (Fig 1) for squamous cell carcinoma 4 years earlier. Two sets of complete dentures (with a maxillary obturator) had been provided since the operation, neither of which had been satisfactory. Examination revealed a large maxillary defect extending from the left incisor region to the soft palate. The mandibular edentulous ridge was atrophic. The current maxillary complete denture/obturator had inadequate border extensions, tissue adaptation, occlusion, and esthetics (Fig 2). The mandibular complete denture was unstable, non-retentive, and generally underextended.

Initially, two dental implants (3.75 mm × 15 mm Branemark System, Nobel Biocare, Goteborg, Sweden) were placed in the anterior mandible in

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Figure 1. Maxillary defect.

the canine/first premolar region. Three months later, following osseointegration of the implants, an implant-retained mandibular overdenture and an adequately extended transitional maxillary denture/obturator were made (Fig 3). The new dentures were more satisfactory than the previous prosthesis with regard to retention, stability, and esthetics; however, the patient continued to complain of discomfort in the obturator area and of migration of food into the maxillary defect. Completion of a 14-point Oral Health Impact Profile (OHIP-14, Table 1) confirmed significant impacts on QoL. These types of problems were unlikely to be resolved by further conventional treatment and reinforced the need for an implant-supported and -retained maxillary prosthesis/obturator.

Subsequently, four dental implants were placed in the maxilla (Branemark System)—three in the right alveolar maxillary ridge area (one 5 × 7 mm and two 4 × 13 mm), and one 4 × 13 mm placed into the left zygomatic bone (Fig 4). The

Figure 2. Original conventional upper and lower dentures.

Figure 3. Implant-retained lower overdenture and conventional upper denture.

maxillary implants were uncovered 6 months postplacement, and a primary maxillary impression was made with irreversible hydrocolloid (Bayer Alginate, Bayer Dental, Henry Schein Inc., Melville, NY) for fabrication of diagnostic casts and custom impression trays. A magnet keeper (B-MC2 Maxi Magnacap, Technovent, Leeds, UK) was fitted directly into the implant. An implant level pick-up impression with a transfer magnet (MT2 Maxi Transfer Magnet, Magnacap, Technovent, Leeds, UK) was made using silicone (Xantopren Green, Heraeus Kulzer, Dental Product Division, Hanau, Germany), for fabrication of the first master cast and record base. Jaw relations were recorded in conventional fashion, and the casts were mounted on an articulator (Gerber model 5, Condylator, Zurich, Switzerland). A wax try-in was performed, and the patient approved of the denture set up.

Multiple abutments were selected (Branemark System)—the mesial abutment was a 1-mm regular platform, and the distal a 3-mm wide platform. The heights of the selected abutments were based on silicone indices made using the wax try-in (Fig 5). The central implant in the right alveolar ridge area was not used. The abutments were placed, and the abutment screws were torqued to 35 Ncm (prosthetic procedure for Replace Select and Branemark System). An abutment level impression, which also included an impression of the transfer magnet (MT2 Maxi Transfer Magnet), was made in silicone (Xantopren Green). In the laboratory, the master cast was poured in type 4 dental stone (Prima Rock, Whip Mix Corporation, Louisville, KY), and a model verification index

Table 1. Oral Health Impact Profile

Oral Health Impact Profile (14)
Please Place XXX in Appropriate Box

	Never	*Hardly ever*	*Occasionally*	*Fairly often*	*Very often*
1 Have you had trouble pronouncing any words because of problems with your dentures?					
2 Have you felt that your sense of taste has worsened because of problems with your dentures?					
3 Have you had any painful aching in your mouth?					
4 Have you found it uncomfortable to eat any foods because of problems with your dentures?					
5 Have you been made self-conscious because of problems with your dentures?					
6 Have you felt tense because of problems with your dentures?					
7 Has your diet been unsatisfactory because of problems with your dentures?					
8 Have you had to interrupt meals because of problems with your dentures?					
9 Have you found it difficult to relax because of problems with your dentures?					
10 Have you been a bit embarrassed because of problems with your dentures?					
11 Have you been irritable with other people because of problems with your dentures?					
12 Have you had problems doing your usual jobs because of problems with your dentures?					
13 Have you felt that life in general was less satisfying because of problems with your dentures?					
14 Have you felt totally unable to function because of problems with your dentures?					

fabricated (Fig 6) on the multiunit abutments using autopolymerizing acrylic resin (Duralay, Reliance, Worth, IL). The Duralay beam was tried in the mouth to confirm fit. Passive fit of the

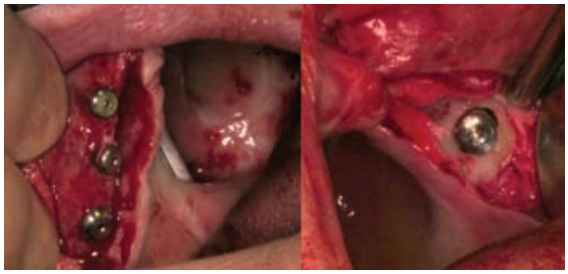

Figure 4. Implant placement in the maxilla.

index on the torqued abutments was first tested by the transfer of the impression copings from the master cast using the Duralay index. In the laboratory, the bar pattern was waxed on gold cylinders (Regular/Wide Platform Multiunit Gold Cylinders, Branemark System). The waxed pattern was trimmed to a 2° taper and cast in type 4 gold alloy (V-44, Metalor, Neuchâtel, Switzerland). A try-in of the cast gold bar ensured accuracy (Fig 7). A second wax try-in confirmed the location of the retention mechanism and confirmed appearance.

The final denture was processed in acrylic resin (Trevalon Veined heat cured, Dentsply, Milford, DE). The intaglio surface of the denture contained the magnet (M3 Maxi Magnet, Magnacap) on one side and two CEKA (M2:RE 0795 TI, CEKA,

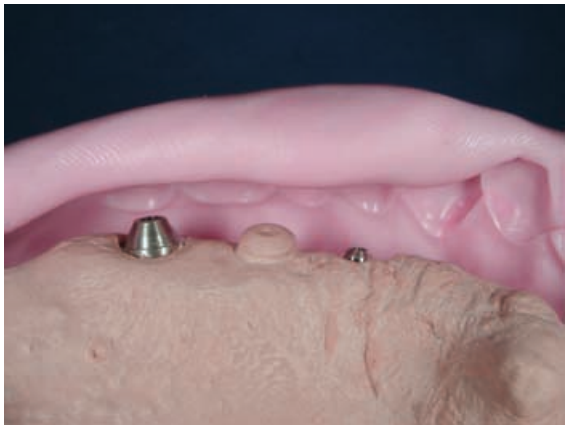

Figure 5. Silicone index and multiunit abutment selection.

Antwerp, Belgium) spring pins on the other side. The completed gold bar was attached to the implants with prosthetic screws (Torqtite screws, Nobel Biocare) torqued to 15 Ncm (prosthetic procedure for Replace Select and Branemark System). The retention and stability of the overdenture were determined to be satisfactory by its resistance to manually applied direct displacement and lever-type forces.

The patient was examined two weeks later (Fig 8) and completed the 14-point OHIP form. All negative impacts ("fairly often" and "very often") had been eliminated, and positive impacts ("never") increased from 1 to 6 (Table 2).The patient was reviewed again 6 months later and completed a further OHIP form confirming an even higher level of satisfaction with the prostheses. The responses to the 14 questions consisted of 7 "Never," 4 "Hardly Ever," and 3 "Occasionally."

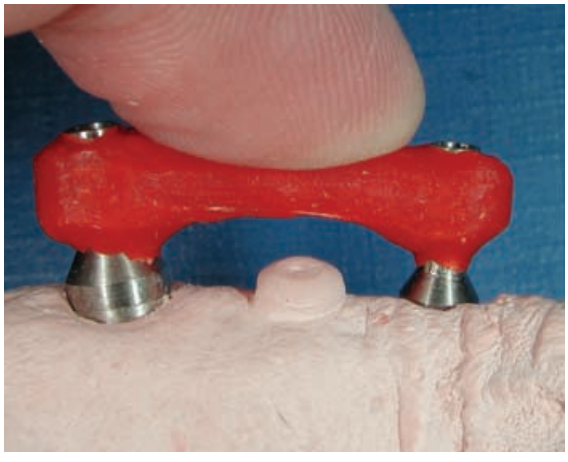

Figure 6. Duralay index.

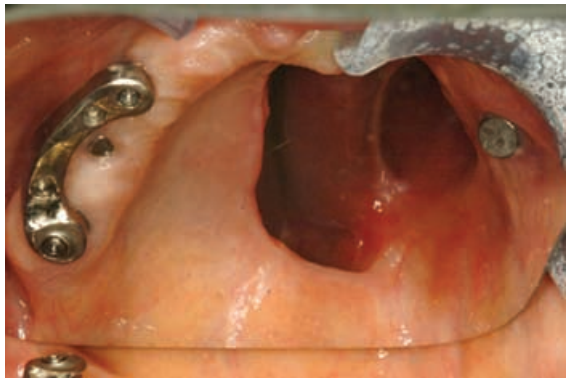

Figure 7. Gold bar and magnet keeper in place.

Discussion

Magnet technology is constantly improving, and the problems encountered in the past (size and corrosion) have been substantially overcome.[4] Magnets provide a useful method for attaching dental prostheses to osseointegrated implants. The magnet used in this case was based on the rare earth alloy neodymium–iron–boron (Nd–Fe–B). It was small enough to be incorporated into a maxillary prosthesis without interference but had sufficient attractive force (7.2 N) to prevent displacement of the prosthesis. The magnet was attached to a single dental implant placed in the zygomatic bone and overcame the problems caused by non-parallel implants.

Figure 8. Buccal view of new dentures.

Table 2. Results of Oral Health Impact Profile 2 Weeks Post-treatment

Impacts	*Before Provision of Implant-Supported Overdenture*	*After Provision of Implant-Supported Overdenture*
Never	1 (12)	6 (1, 6, 8, 11, 12, 14)
Hardly ever	3 (2, 11, 14)	3 (2, 10, 13)
Occasionally	4 (3, 6, 8, 9)	5 (3, 4, 5, 7, 9)
Fairly often	3 (5, 7, 10)	0
Very often	3 (1, 4, 13)	0

Numbers in parentheses refer to specific questions on OHIP form.

A secure obturator/prosthesis is necessary for satisfactory QoL after maxillectomy. The original conventional dentures made for this patient were unstable and non-retentive due to the size of the defect following maxillary surgery. An implant-supported maxillary obturator that was more retentive and stable than the original conventional prostheses was provided. While it is known that implant treatment has a positive impact on a patient's psychological state,[5,6] there is little documentation of the impact of this form of treatment on the patient's QoL. Ways of measuring QoL, which are applicable to dentistry, have recently been developed. The original OHIP[7] quantified the impact of oral disorders by 49 questions. To make it more patient-friendly, it was developed into a 14 question form (OHIP-14) and validated for patients receiving prosthetic dental treatment.[8] When, as in this case, it compares a conventional obturator made by an experienced practitioner with one incorporating magnetic retention, it demonstrates dramatic improvements in QoL.

Detailed examination of the completed OHIP-14 after provision of an implant-supported maxillary obturator showed marked positive changes in the patient's responses to the questions. For example, Question 13 (dealing with the patient's dissatisfaction with life in general) shifted from 'very often' to 'hardly ever' after two weeks (Table 2) and to 'never' after six months. Although clinically complex, the improvements demonstrated should encourage the use of magnetic retention in cases where parallelism of dental implants might be a problem.

Summary

The fabrication of an implant-supported obturator prosthesis for a patient following a maxillectomy was presented. A form of magnetic retention was used to overcome the problems created by the divergence of zygomatic and conventional maxillary implants. The provision of this prosthesis markedly improved the patient's QoL.

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