

# Implant-Supported Obturator Overdenture for Extensive Maxillary Resection Patient: A Clinical Report

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## Keywords

Overdenture; implant; maxillary resection; case report; obturator.

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Accepted April 29, 2009

doi: 10.1111/j.1532-849X.2009.00545.x

## Abstract

This clinical report presents an implant-retained obturator overdenture solution for a Prosthodontic Diagnostic Index Class IV maxillectomy patient with a large oronasal communication and severe facial asymmetry, loss of upper lip and midfacial support, severe impairment of mastication, deglutition, phonetics, and speech intelligibility. Due to insufficient bone support to provide satisfactory zygomaticus implant anchorage, conventional implants were placed in the body of the left zygomatic arch and in the right maxillary tuberosity. Using a modified impression technique, a cobalt-chromium alloy framework with three overdenture attachments was constructed to retain a complete maxillary obturator. Patient-reported functional and quality of life measure outcomes were dramatically improved after treatment and at the two-year follow-up.

Extensive surgeries for maxillary tumor resection commonly result in severe functional, emotional, and social impacts on patients. Minor maxillectomy defects can be successfully repaired by surgical reconstruction combined with prosthetic rehabilitation to close the communication between the oral cavity and sino-nasal cavities.<sup>1</sup> In most patients, prosthodontic treatment with an implant-supported or conventional obturator prosthesis is extremely complicated due to tooth loss, limited bone support, and the need to restore large parts of oral and/or facial soft tissue. In cases of severely compromised patients, treatment may be unfeasible due to local or systemic conditions.

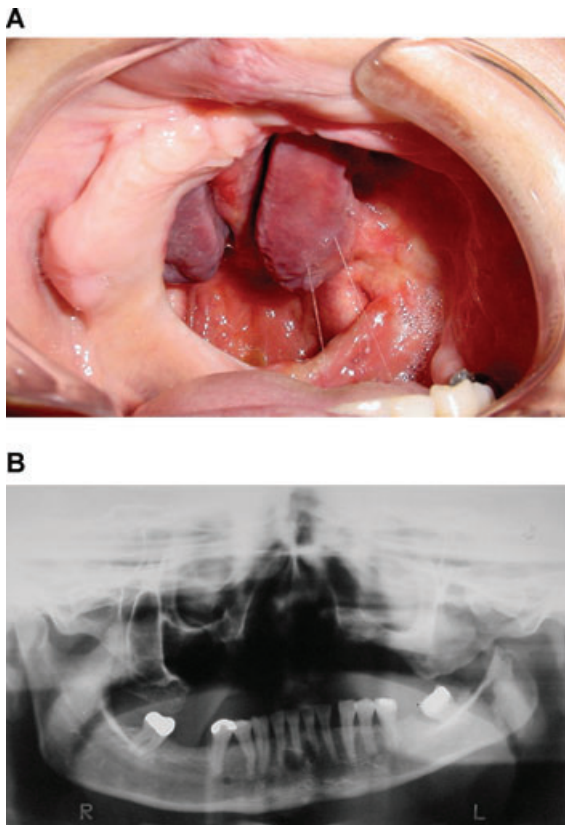
The fabrication of a maxillary obturator is especially challenging for edentulous maxillectomy patients and is essential for restoration of facial contour, functional mastication, articulation, and speech intelligibility and reduction of drooling.<sup>2,3</sup> The closure of the defect depends on a pressure-resistant seal of the obturator bulb and a prosthetic design that uses the remaining hard palate and dentition to maximize support, stability, and retention.<sup>1</sup> Placement of endosteal implants in available bone sites would provide prosthetic anchorage, but special attention is needed to achieve acceptable retention, stability and long-term maintenance of implant osseointegration, because potential implant sites are frequently scarce and poorly distributed. Consequently, anchoring implants in the residual maxilla are usually overstressed because of the lack of contralateral support.<sup>4</sup>

In severe maxillary defects, extending prosthodontic anchorage in remote locations minimizes cantilever forces. Conventional

implants and zygomaticus implants are an alternative to bone grafting in the prosthetic rehabilitation of the severely resorbed maxilla.<sup>4-6</sup> Limited anatomic conditions may result in severe angulation of conventional implants in remote bone sites, which complicate prosthodontic solutions and prohibit cross-arch stabilization. Zygomaticus implant anchorage requires intraoral access to the zygomatic buttress area through a trans-sinus approach, which restricts the application to an ideal residual anatomy.<sup>5</sup> This article describes the surgical and prosthodontic rehabilitation of a patient with a severe intraoral defect resulting from an extensive surgical resection, using conventional osseointegrated implants connected by a transpalatal bar with an alternative design and a maxillary obturator overdenture.

## Clinical report

A 40-year-old female Prosthodontic Diagnostic Index (PDI) Class IV patient was referred for oral rehabilitation by a regional referral hospital in November 2003. The patient had a history of a complete maxillectomy of the left side for resection of a recurrent pleomorphic adenoma tumor. The initial surgery had been performed 13 years previously (in 1990) and a second, more invasive, surgery to treat a recurrent lesion had been performed 2 years before prosthodontic referral (in 2001). Surgical treatment was complemented by a postoperative radiotherapy protocol.

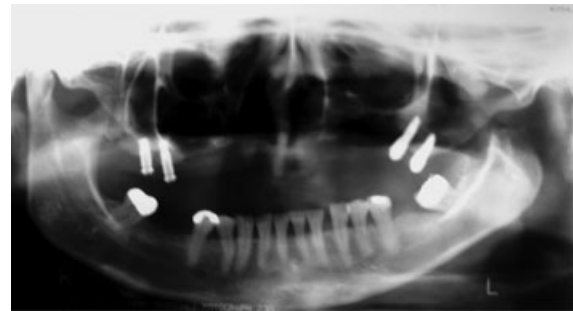


**Figure 1** (A) Intraoral view of maxillary defect. (B) Pretreatment panoramic radiograph.

Extraoral examination revealed significant facial asymmetry, severe loss of upper lip support, and left maxillary facial depression. Intraoral examination revealed an edentulous maxillary arch with a large oronasal communication. Only the right posterior tuberosity and frontal alveolar process of the maxilla were preserved. The hard and soft palate and all other anatomic structures of the left maxilla had been removed, extending to the perpendicular lamina of the ethmoid bone, part of the vomer, and septal cartilage (Fig 1). Radiographic examination revealed minimal remaining bone. The mandibular arch had bilateral bounded short edentulous spaces with minimal functional and esthetic impacts and did not require prosthodontic treatment (PDI Class I).

The patient did not have previous prosthodontic rehabilitation, leading to severe impairment of mastication, deglutition, phonetics, and speech intelligibility. Poor esthetics and functional limitations had serious impacts on family relationships, social interactions, psychological status, and quality of life of the patient.

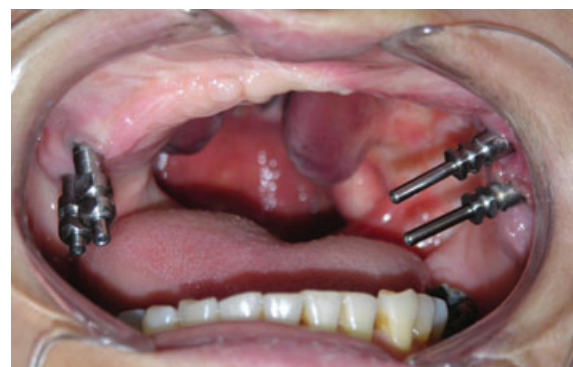
A conventional obturator complete denture was contraindicated due to limited residual ridge and palatal support. Implant therapy was indicated, but limited alveolar bone availability also restricted the use of conventional techniques to provide sufficient stability to an overdenture prosthesis. Zygomatic implants were not considered an option due to insufficient bone support to provide satisfactory implant anchorage.



**Figure 2** Panoramic view after conventional implant placement.

The patient was hospitalized, and surgery for implant placement was carried out under general anesthesia. Five regular diameter implants (3.75-mm width) were installed (Neodent Implantes Osseointegráveis, Curitiba, Brazil). Three were placed in the body of the left zygomatic arch (9.0, 11.0, and 13.0 mm length) and two in the right maxillary tuberosity (13.0 and 11.0 mm length). In the left side, implants were covered with 9.0-mm healing caps due to the large depth of soft tissues. All implants demonstrated good primary stability with maximum torque greater than 30 Ncm.

One month after surgery, an infectious process developed around the anterior left implant. Antibiotic therapy was administered (Cefalexin 500 mg for 7 days), and the failed implant was removed during the second stage surgery. After 6 months the implant platforms were exposed, and healing abutments were placed under general anesthesia in a hospital environment. On the left side two 9 mm-collar-height non-angled Mini Conical Abutments and protection caps (Neodent Implantes Osseointegráveis) were placed to protect the abutments during prosthesis fabrication. UCLA abutments were planned for the right side due to reduced interarch space and tissue height (Fig 2). Healing abutments were removed using a 0.12-mm hexagonal driver. To help prevent accidental swallowing, floss was threaded through the spinner on the driver. Intraoral radiographs of the interface were taken to verify accuracy of fit. Torque of the Mini Conical abutment screws was 20 Ncm, and protective cylinders were used to protect the abutments during prosthesis fabrication.



**Figure 3** Intraoral view of impression transfer copings.

A modified impression technique was used to transfer the position of the implant (right side) and abutment platforms (left side). A preliminary impression of the upper arch was made to locate the position of the protective cylinders and healing abutments using a silicone putty/wash impression system (Xantopren & Optosil, Heraeus Kulzer, Armonk, NY). The impression transfer copings were positioned (Fig 3), and those of the same side were splinted together intraorally with autopolymerizing acrylic resin. A posterior transpalatal autopolymerizing acrylic resin strap was made and splinted to the transfer copings intraorally. The conjunct was removed, and the implant and abutment position were transferred to a working cast.

A working cast with analogs was obtained, and castable cylinders were splinted to the posterior transpalatal autopolymerizing acrylic resin strap with an anterior extension bar. Two castable O-ring attachments were intraorally attached to the posterior portion of the bar bilaterally (Conexão Sistemas de Prótese, São Paulo, Brazil) and one ERA abutment (Sterngold Implamed, Attleboro, MA) was attached in the midline portion of the anterior bar. All attachments were parallel to each other, and the path of insertion was verified in a parallelometer. The acrylic resin framework was cast in cobalt-chromium alloy using a vacuum-injection casting machine (Discovery, EDG Equipments, São Carlos, Brazil).

Accuracy of the metal framework was checked on the master cast and under direct intraoral verification. The metal framework presented a passive fit to the implants, and the degree of misfit was clinically acceptable. No soldering was needed.

The framework was screwed into position (Fig 4), and a new silicone impression was made to transfer the position of the framework to produce an improved peripheral sealing zone and record the main supporting region of the denture to the functional master cast. The framework in the master cast was blocked out with wax, and a hard acrylic resin baseplate was fabricated. A wax rim was constructed to replicate the desired arch form, labial support, and occlusal plane at the patient's vertical and horizontal jaw relations. Maxillomandibular relations were registered, and casts were mounted in a semi-adjustable articulator. Artificial anatomic teeth (Trilux, Dental Vipi, Pirassununga, Brazil) were arranged in balanced occlusion.

The trial dentures were tried in the patient's mouth with the metal framework in position. Tooth arrangement and jaw relations were verified and tooth position modified until esthetics and function were satisfactory (Fig 5). Silicone impression was used to record the contact area of the framework, to border mold the peripheral borders, and to make a functional impression of the posterior soft palatal seal to prevent escape of air, liquids, and food particles under the obturator during speech and deglutition. The denture was processed using microwave polymerization according to standard procedures.

Attachments were placed in position, and interferences between the intaglio surface of the denture and the attachment system were disclosed with a low-viscosity silicone material. Interferences were removed with a bur to allow complete seating of the obturator. Before the intraoral attachment pick-up procedure, undercuts surrounding the overdenture abutments were blocked out with small rings of rubber dam to prevent the obturator from locking into the tissue bar. The prosthetic housings were coated with autopolymerizing acrylic resin (Duralay

Acrylic Resin, Reliance, Worth, IL). The denture was placed with firm finger pressure and then with the patient in occlusion until polymerization was complete. After removing the obturator, excess acrylic resin was carefully removed from the intaglio surface (Fig 6).

Following delivery of the prosthesis, the patient's immediate response was extremely favorable in relation to esthetics, speech, and swallowing. The patient's oral and facial appearance dramatically improved (Fig 7). Postinsertion instructions were given with respect to insertion, removal, and maintenance of the obturator, intraoral hygiene, and the need of routine recall appointments.

At the one-week follow-up, the patient expressed great satisfaction with treatment and reported no complaints related to poor retention and stability of the denture, denture sores, or speech impairment. She also reported improvements in general well-being and quality of life.

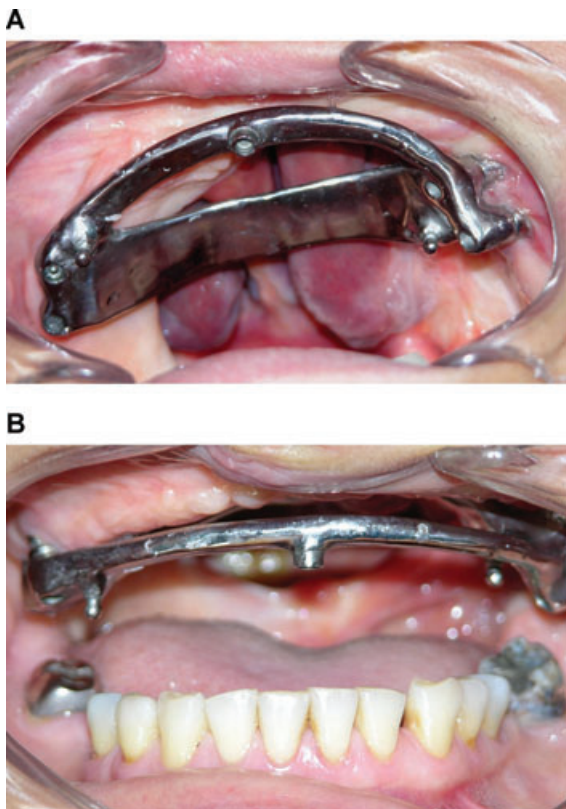
Periodic recall sessions for replacement of denture attachments were carried out when loss of denture retention was detected. Two-year follow-up showed no clinical changes and no radiographic signs of significant bone loss around implants (Fig 8). Considering the difficulty in following the progression of the bone level over time due to angulation of the radiographs, the metal framework was detached at the long-term follow-up, and bone level changes were monitored with periapical radiographs. No significant complaints were recorded, and denture function and patient satisfaction were rated as excellent.

## Discussion

A pleomorphic adenoma tumor is a highly recurrent benign neoplastic lesion. The unclear biological behavior of this tumor demands aggressive surgical resection of the entire lesion and underlying bone tissue, resulting in an extensive intraoral defect.<sup>7,8</sup> The broad range of variations following extensive maxillary resections limits the possibility of conventional treatment options. When conventional prosthodontics is not feasible, alternative treatments with osseointegrated implants allow inventive solutions for extremely compromised patients. The type and distribution of implant anchorage is dependent on the extent of bone resection, which is the crucial element of prosthodontic decisions and long-term implant survival rates.

The risk of conventional implant failure is greater in resected patients, mainly with shorter implants (lengths to 10 mm), due to radiotherapy, limited anatomic conditions as a result of the large resection area, and presence of insufficient soft tissues for coverage.<sup>9</sup> The proximity of the failed implant to the orbital floor and the possible contact with an adipose stratum underneath the periosteal layer associated with a local infection episode may contribute to the implant failure during the osseointegration period.

On the other hand, Nelson *et al*<sup>10</sup> considered long-term survival rates of implants and implant-retained dentures in oral cancer resection patients similar to those in patients without prior cancer surgery. Rigid fixation of the prosthesis is essential to minimize technical and biological complications.<sup>10</sup> Careful considerations must also be given to the type and design of prostheses and timing of implant placement. Extensive implant therapy should be delayed for at least a year, particularly in



**Figure 4** (A) Metal framework in position. (B) Frontal view of the framework.

partially edentulous patients, due to the high rate of recurrence following ablative surgery.<sup>11</sup> Most implant failures occur either at stage-II surgery, or before loading. Implants placed during tumor resection, implants placed within the maxillectomy defects, and implants receiving postoperative radiation have low survival rates, as observed by Roumanas *et al*.<sup>12</sup> The negative effect of radiotherapy is also a major problem in a cancer resection patient. Hyperbaric oxygen therapy has been shown to increase osseointegration in an implant-supported maxillary



**Figure 5** Intraoral view of the trial denture.



**Figure 6** Intaglio surface of the obturator.

obturator prosthesis, when implant site locations are unfavorable, and implant overload is a major concern.<sup>13</sup>

Framework design and prosthodontic retention systems may differ according to position of implants and availability of bone anchorage. Combined surgical and prosthodontic planning may provide the most extensive bone support, reducing cantilever stress and enhancing cross-arch effect.<sup>5</sup> Implants with great divergent angles also complicate impression and other procedures, requiring alternative techniques and inventive solutions.

The selection and placement of specific attachments and different bar designs may affect the retention and clinical performance of maxillary implant-retained overdentures.<sup>14</sup> A rigid bar is essential to join the implants across the arch to avoid potentially damaging off-axis loads to the implants.<sup>5</sup> A variety of retention mechanisms have been reported for implant-retained overdentures in resected patients including magnets,<sup>15</sup> clip-bar system,<sup>4-6</sup> and milled-bar prostheses.<sup>2</sup> In the present report, O-ring and ERA attachments were selected due to the limited vertical space provided by the position of implants and the custom bar design and the need to create a harmonious path of insertion for all attachments. The elected system provided satisfactory retention and comfort to the patient. In clinical



**Figure 7** Frontal view of patient with the maxillary obturator prosthesis.



**Figure 8** Panoramic and periapical views of the prosthesis framework and implants after two years.

situations, determination of a clinically acceptable degree of retention should be made relative to prosthesis behavior during function along with the patient's ability to adequately place and remove the prosthesis.<sup>14</sup>

Use of endosseous implants in resected patients poses complex considerations that demand a multidisciplinary team approach. Psychological support and speech therapy are also frequently needed to improve speech function, patient motivation, and well-being. Monitoring of treatment outcomes should be periodically assessed by the oncologist, dental surgeon, and prosthodontist to maintain the effectiveness of the treatment.

## Acknowledgments

The authors thank laboratory technicians Paulo Batista de Silva, Hobson Fernandes Silva, and José Batista da Silva for their technical expertise in fabrication of this complex prosthesis.

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