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# Treatment of Hemi-Mandibulectomy Defect with Implant-Supported Telescopic Removable Prosthesis. A Clinical Report

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## Abstract

Excision of head and neck tumors (benign or malignant) often leads to large segmental resections of the mandible. The following clinical report describes the oral rehabilitation of a 60-year-old Caucasian man after partial mandibulectomy due to primary oral leiomyosarcoma. Treatment consisted of a free fibula flap and an implant-supported telescopic removable prosthesis.

Oral cancer is an important public health concern and has presented an alarming global increase during the last few decades. Statistics show oral cancer to be one of the most common forms of the disease.[1,2] Primary oral leiomysarcoma is an extremely rare malignant mesenchymal carcinoma with only 70 cases reported worldwide.[3] Farman and Kay estimated an incidence of 0.064% for primary smooth muscle tumors with oral appearance.[4] The tumor presents aggressive behavior with local or distal metastasis and high recurrence.[5] Traditional treatment modalities primarily include surgical interventions by means of oncologic tumor resection.

Contemporary advances in surgical techniques and grafting procedures have enabled surgeons to correct tumor postablative defects with predictable and effective means. Large volumes of autogenous combined soft- and hard-tissue grafts can be transferred from various donor sites and used for the reconstruction of deficiencies.[6,7] Among the numerous available options, the osteocutaneous free fibula flap (FFF) represents a widely used treatment modality for the reconstruction of mandibular defects and allows for repair of the mandibular continuity.[8-11]

After reconstructive surgery, drastic changes in oral anatomy as well as the establishment of new anatomical relationships make dental rehabilitation with a conventional prosthesis challenging.[11-14] Although removable prostheses can adequately support the facial soft tissues, the new denture-bearing surfaces occasionally fail to provide ideal retention and stability.[11,12,15]

During the last few decades, osseointegrated implants have become a very important adjunct treatment option for tumor patients. Their placement significantly adds to the retention and support of the prostheses, thus improving chewing efficiency and comfort.[12,15] Numerous studies report favorable survival rates for implants inserted in FFFs and indicate long-term success of the corresponding restorations.[14,16,17] Implant-supported prostheses can help restore facial contours and function.[15,18,19]

Implant-supported telescopic restorations (also referred to as "double crown" or "conical crown" retained removable prostheses) may fulfill the requirements for a successful treatment concept.[14,20,21] The objective of this clinical report is to describe the oral rehabilitation of a patient who underwent a mandibular resection due to a leiomyosarcoma. The prosthetic rehabilitation included the use of implants in conjunction with conical crowns to support a removable dental prosthesis (RDP).

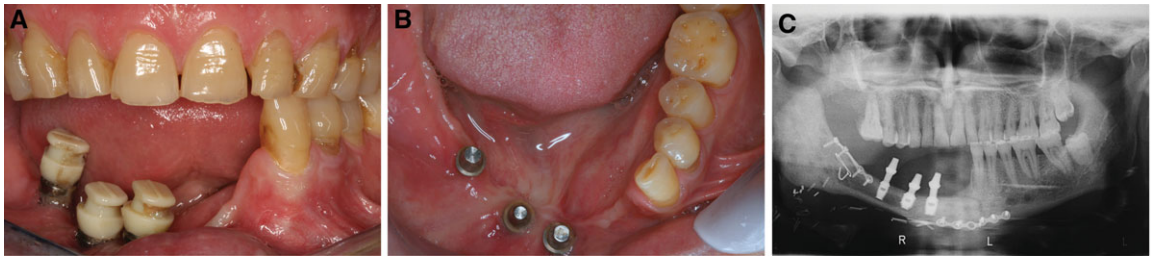


**Figure 1** (A) At initial clinical presentation, a severe Siebert class III defect[26] can be appreciated. Note the plastic impression copings on the abutments, and lack of implant parallelism. (B) Occlusal view of the implant abutments after removal of the impression copings. (C) Orthopantomograph revealed the restored continuity of the mandible with the FFF and good bone integration of three Bicon implants.

## Clinical report

A 60-year-old Caucasian man presented to the Maxillofacial Prosthetics Unit, University of Athens, Greece, to restore his missing dentition. His chief complaint was, "I want to get teeth on the bottom right side." The patient reported a history of leiomyosarcoma on the lower right side a year previous. He had been treated with a segmental mandibulectomy, followed by chemotherapy. The defect was reconstructed at the time of surgery with an FFF, and 1 year later three Bicon (Bicon, Boston, MA) implants were placed.

Initial intraoral examination revealed partial edentulism, a Siebert class III defect[22] on the lower right side, and the presence of three nonparallel Bicon implants. Interestingly, plastic impression copings were present over the implants at initial presentation (Fig 1). In addition, lack of keratinized periimplant mucosa was noted. Radiographic evaluation revealed good integration of the implants in the free fibula graft with no signs of radiographic bone loss.

Following data collection and preliminary impressions using alginate (Jeltrate, Denstply, York, PA), a facebow transfer (Denar Mark II Earbow, Whip Mix Corp., Louisville, KY) and jaw registration with a lower occlusal rim facilitated mounting of the study casts in a semi-adjustable articulator (Denar Mark II Plus articulator, Whip Mix Corp.). A design cast was fabricated using type III dental stone (Microstone, Whip Mix Corp.) and surveyed (Ney Surveryor, Dentsply). Treatment options, including a proposed soft-tissue grafting procedure to increase the width of keratinized mucosa around the implants, were discussed with the patient, who declined to have any further surgical interventions. The restorative treatment plan included the fabrication of double conical crowns on the mal-aligned implants and an RDP to restore both function and esthetics. The prosthesis was designed to achieve combined tooth and implant support and retention.

A number #6 round bur (Brasseler USA, Savannah, GA) was used to prepare occlusal rest seats. The occlusal rest seats were prepared on the distal lingual aspect on the occlusal surface of the second molar as well as the embrasure space between the premolars, extending on the adjacent interproximal marginal ridges and occlusal surfaces. A natural guide plane was present on the mesial surface of the left mandibular canine, and preparation was not necessary. Prior to final impression of the lower arch, an interocclusal record was made using vinylpolysiloxane (Regisil, Dentsply) over the plastic impression copings. An acrylic custom tray was fabricated using Triad Blue Tray material (Dentsply), and conventional border molding was performed using green stick modeling compound (Impression Compound; Kerr Corp, Orange, CA). An impression was made using polyether impression material (Impregum; 3M ESPE, Monrovia, CA). The impression captured the implant positions and ensured maximum extension of the acrylic base. The working cast was fabricated using type IV dental stone (Silky-Rock, Whip Mix Corp.). The working cast incorporated one-piece implant analogs of the specific implant system (Bicon) (Fig 2A). The cast was surveyed (Ney Surveryor) to accurately determine the most favorable path of insertion and aid in the final framework design.

Unfavorable implant positioning required the fabrication of three primary copings (conical crowns). The primary copings were splinted in a one-piece superstructure using a Type III gold alloy (Degulor C, Degussa, Hanau, Germany). The superstructure corrected the inclination of the implant abutment and was milled to match the insertion path of the RDP (Fig 2B). The axial walls of the primary superstructure were fabricated with a 4° convergence, to achieve at least 10 N retention force.[23] Finally, a secondary superstructure was fabricated of the same alloy (Figs 2C, 2D). Retention was tested with the use of a special instrument (Koni-Meter, Krupp, Essen, Germany). Partial denture design consisted of a lingual bar major connector, occlusal rests in the premolar region, and a circumferential clasp on the lower left second molar. A guide plane mesial to the lower left canine was added to provide additional stability of the final prosthesis. The final Co-Cr alloy cast (Vitallium 2000 Plus, Austenal, Dentsply) was then connected to the secondary coping by laser welding (LaserStar 8000 Series, Crafford-LaserStar Technologies, Orlando, FL) (Fig 3).

Framework try-in took place, and passive fit was verified using Occlude disclosing medium (Pascal Company, Bellevue, WA) (Fig 4). Custom shades were selected for the teeth (Vita 3D-Master Shade Guide) and mucosa (Natur-cryl, GC America Inc, Alsip, IL). Digital photos were taken and sent to the laboratory. Multi-layered teeth (Visio.Lign veneering system, Bredent GmbH & Co. KG, Senden, Germany) were used for ideal color matching and long-lasting esthetics. During the set-up appointment, esthetic factors and phonetics were evaluated, and patient approval was obtained (Fig 5). Conventional processing of the superstructure followed.

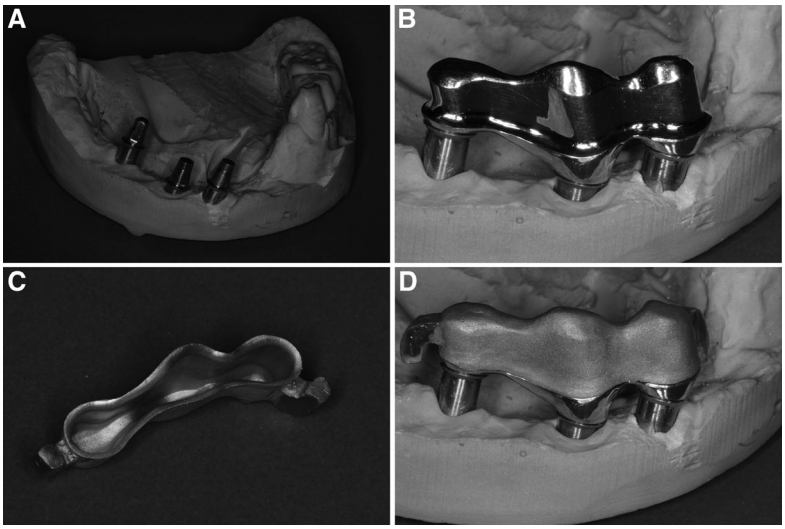


**Figure 2** (A) Working cast. Bicon uses one-piece implant replicas. (B) After the insertion path of the RPD was determined, the primary component of the telescopic prosthesis was fabricated. The milled primary coping corrected the unfavorable inclination of the implant abutments, thus establishing an agreement with the insertion path of the RPD. (C) Intaglio surface of the secondary copings. Two extensions were fabricated to connect the telescopic superstructure and the RDP framework. (D) Secondary coping in place on the working cast. The external surface was sandblasted to enhance mechanical retention of the acrylic resin.

At the time of delivery of the implant-supported partial overdenture, the primary crowns were luted on the abutments with resin cement (C&B Cement, Bisco, Schaumburg, IL) and the RDP immediately seated, thereby ensuring accurate fit of all parts of the restoration (Fig 6). The patient was seen for follow-up appointments for minor occlusal adjustments. The patient was provided with prosthesis care and oral hygiene instructions. Subsequent recall visits were scheduled. The patient adapted to the removable prosthesis easily and did not require any further revision. Remarkable stability of the prosthesis, enhanced facial support, and improved overall appearance were reported by the patient.

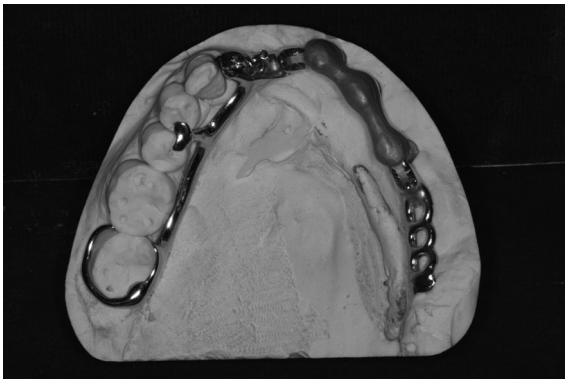

**Figure 3** Complete framework on master cast. The telescopic component was laser welded to the major and minor connectors of the RPD framework.

## Discussion

In recent years there have been significant advances in treatment options for oral rehabilitation of the cancer patient through a multidisciplinary team approach.[13] With contemporary surgical interventions, excellent results can be accomplished with the resection of malignant lesions and simultaneous reconstruction by means of osteocutaneous free flap tissue transplants.[4,6,7] This method has become an established treatment modality that predictably restores the continuity of resected mandible.[6,7] Sufficient length, good vascularization, and good bone quality are some of the significant advantages provided by FFF.[6,7] However, the resulting height of the hard tissue in sites restored with the FFF is usually deficient. This is critical in cases of partial mandibular resection where the contralateral side is unaffected and the occlusal plane is found further cranially,[11] and an unfavorable "crown-to-implant ratio" is introduced to the implant-supported restoration. To overcome this disadvantage, several techniques have been proposed, such as the "double barrel" fibula transfer[24] or the use of vertical distraction osteogenesis[25] to improve bone height.

For the present patient, a large discrepancy between the fibula transplant and the unaffected area was present. Important considerations included the nonideal implant positioning as well as the need for tissue support to restore normal facial contours.[26] In addition, the designed prosthesis should be able to facilitate optimal hygiene around the implants. A removable instead of a fixed prosthesis was selected, since it can provide better support of the buccal mucosa and underlying musculature, thus restoring facial appearance. Removable prostheses can also accommodate comfortable hygiene practices that ensure long-term periimplant tissue health.[26] This is critical since the patient refused to undergo gingival augmentation to increase the width of periimplant keratinized tissue. In the vast majority of similar cases, a loss or absence of keratinized mucosa is observed.[17] Although clinical evidence on the role of keratinized mucosa on implant survival is still a point of discussion,[27-29] it has been shown that an adequate zone of keratinized mucosa is associated with less gingival inflammation.[27,28] However, another study concluded that acceptable periimplant tissue health can be maintained even in the absence of keratinized mucosa when optimal oral hygiene is performed.[29]

Dental implants provide considerable solutions as supporting elements, where lack of adequate support and retention from the remaining teeth and compromised edentulous areas exist.[11,12,15] Implants placed in FFFs have been shown to achieve adequate osseointegration and comparable long-term success to implants

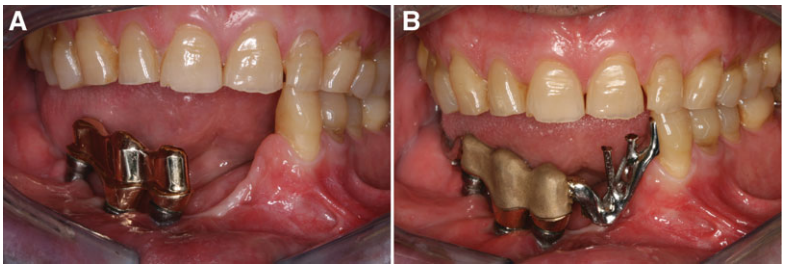


**Figure 4** (A) Try-in of primary coping. (B) Clinical view of secondary coping and RDP framework seated. Note the proximal guide plate mesial to the lower left canine, as well as the incisal projections of the framework to compensate for the vertical defect and to provide additional acrylic support.

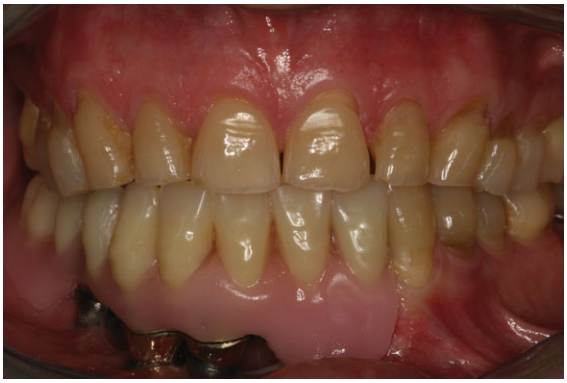

**Figure 5** Try-in of teeth set-up.

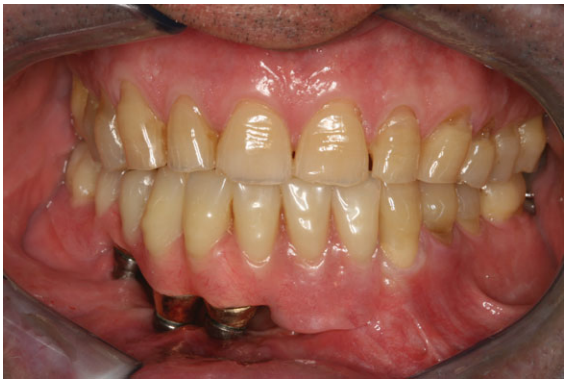

**Figure 6** Final prosthesis in place. Note the enhanced esthetics provided by multilayered teeth and optimal color matching of the pink acrylic.

placed in native bone.[8,14,15-17] However, the literature supports the notion that the estimated lower implant survival rates in cancer patients may be attributed to grafting, unfavorable anatomic relationships, compromised surgical field, or contributory medical history.[8,12,17,30]

The use of implant-supported removable prostheses makes treatment more feasible for rehabilitation of orofacial defects.[12] Various clinical studies and case reports have demonstrated the use of different clip and bar designs, stud attachments, or magnets[11,30] for such cases. The use of a double crown system (conical crowns) on implants, in combination with an overdenture, has been shown to be very successful.[31] The aforementioned conical connection provides increased stability, retention, and reciprocation due to the friction between the primary and the secondary copings.[32] This type of connection also provides axial implant loading and can potentially eliminate the increased maintenance needs of stud attachments and bar/clip connections, while providing comparable stability and retention of the prosthesis.[33] It is also a flexible design that can be combined with other retentive elements once an insertion path is established. In this case, the use of friction fit copings was successfully combined with a conventional RDP design.

The design selected provided cross-arch stabilization, thus eliminating potential lateral forces on the implants, as well as equally distributing the functional loads between teeth and implants.[26] The disadvantages of this prosthesis design are the increased cost due to the gold alloy used for the coping fabrication, as well as the technically sensitive laboratory procedures that require a highly trained and experienced dental technician.[34,35]

## Conclusion

The primary objective of prosthetic treatment following an ablative oncologic surgery is to create a functional and esthetic dentition. In addition to restoring function and esthetics, oral rehabilitation addresses social disability parameters and plays a key role in providing an acceptable quality of life.[6] In this case, prosthetic rehabilitation included the use of implants in conjunction with conical crowns to support an RDP.

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