



Cranio-maxillofacial

Implant Directions®

Vol. 20 No. 1

April 2026

English Edition



REHABILITATION OF HEMIMANDIBULECTOMY CASE WITH CORTICOBASAL® IMPLANTS: A CASE REPORT

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ISSN 1864-1199 / e-ISSN 1864-1237

Published by IF Publishing, Germany
continued since 2024 as:

- CMF Implant Direction (CMF)
- Journal of unwanted Results (JUR)
- Experience-based and evidence-oriented
Corticobasal® Implantology (EECI)



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International Implant Foundation IF®
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ISSN 1864-1199
e-ISSN 1864-1237

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How to Cite This Article

Shah D V. Rehabilitation of Hemimandibulectomy Case with Corticobasal® Implants: A Case Report, CMF Impl Dir, Vol. 20, No. 1, International Implant Foundation Publishing, 2026

Abstract

Introduction: The prosthetic rehabilitation of mandibular defects owing to tumor resection is challenging, especially when the patient has undergone subsequent radiotherapy.

Case presentation: A 60-year-old male presented with partial resection of mandible and marginal maxillectomy on the left side. Following surgery, the patient received adjunctive radiation therapy. On clinical examination, upper arch was dentate with teeth present from 17 to 23 and lower arch was completely edentulous. Deviation in the movements of the mandible were present due to post-oncological resection of the muscles of mastication on the left side.

A multidisciplinary team was formed, and a treatment plan was agreed on between the experts, to give the patient fixed prostheses with retrievability on the edentulous right lower jaw.

A total of six basal screw-retained Corticobasal® implants (BECES® MU) were inserted to support the fixed prostheses. No complications were observed, and at the end of 6 months follow-up, the patient presented with excellent peri-implant soft tissue health; increased bone-

implant contact; and stable, well-functioning prostheses.

Discussion: The construction of a stable, retentive, well-supported removable prosthesis may be complicated in cases of hemi-mandibulectomy or partial resection of mandible. Corticobasal® implants can eliminate the need for bone grafting, and reduce the treatment period required for providing a fixed prosthesis.

Conclusion: To our knowledge, this is the first evidence reporting the use of fixed retrievable Corticobasal® implant-supported prostheses in irradiated bone. A treatment modality that significantly improves the peri-implant tissue health, and ensures an excellent implant-bone contact.

Keywords: Screw-retained prosthesis on Corticobasal® implants, retrievability in Corticobasal® implants, mandibular resection, immediately loaded fixed prosthesis, Corticobasal® implant-supported prosthesis.

Introduction

Hemimandibulectomy, the surgical removal of half of the mandible, can severely impact a patient's quality of life. Rehabilitation of such patients requires careful planning and execution. The prosthetic rehabilitation of mandibular defects owing to tumor resection is challenging, especially when the patient has undergone subsequent radiotherapy. Here our 60-year-old male patient was diagnosed with squamous cell carcinoma on the lower left mandibular region in which treatment included excision of the lower left mandible along with modified radical neck dissection followed by radiation. In the elderly and completely edentulous patients, these problems are exacerbated, since the patients usually have a severely atrophied mandible, inadequate vestibule¹, and a complicated medical situation, making them poor candidates for major reconstructive treatment². Hence, there is an increased need for a less invasive procedure with fewer complications that can still provide a stable and retentive prosthesis.

With advances in the development of dental implants and the introduction of different implant designs and systems,

including Corticobasal® implants, bone grafting procedures may no longer be obligatory^{3,4}. The initial stability of these implants is achieved through anchoring into the cortical / basal bone, which makes this implant design advantageous for treating patients with maxillo-facial defects^{3,4}.

Prosthetic rehabilitation of resected cases after radiotherapy demands thorough understanding of the biomechanics of the jaw, its associated structure with post-radiation changes at bone level. Single-piece Corticobasal® implantology is the most predictable method for the functional correction of such cases improving the lifestyle and survival of such patients¹.

Case Presentation

A 60-year-old male patient reported to the Department of Prosthodontics with a chief complaint of difficulty in mastication, impaired speech, and compromised facial esthetics following previous oncologic surgery. The patient had a significant medical history of oral malignancy for which he underwent partial resection of the mandible and marginal maxillectomy on the left side. This was followed by adjunctive radiotherapy as

part of the comprehensive cancer management protocol.

On extraoral examination, facial asymmetry was evident, with deviation of the mandible toward the left (resected) side during both rest and functional movements. This deviation was caused by unbalanced (unilateral) muscle forces, mainly caused by the medial pterygoids. The deviation was more pronounced on mouth opening and closure, attributed to the unilateral loss of muscles of mastication and associated neuromuscular imbalance. Mild soft tissue contraction and fibrosis were also observed on the affected side, likely secondary to radiation therapy.

Intraoral examination revealed a partially dentate maxillary arch with teeth present from 17 to 23. The remaining teeth appeared periodontally stable with no significant mobility or active pathology. The mandibular arch was completely edentulous, with significant ridge resorption noted, particularly on the resected left side. The right mandibular ridge exhibited comparatively better bone volume and density, making it a favorable site for implant placement¹, Figs. 2 and 3a-3c.

The mucosa over the edentulous ridge appeared healthy but exhibited signs of radiation-induced changes such as reduced elasticity and mild dryness. Mouth opening was slightly restricted, suggesting early radiation-induced fibrosis. Occlusal analysis indicated an absence of stable intercuspation due to mandibular deviation and lack of opposing dentition in the lower arch.

Radiographic evaluation, including an orthopantomogram (OPG) and cone beam computed tomography (CBCT), revealed adequate cortical bone availability in the right mandibular region, while the left side showed compromised bone architecture due to surgical resection. No signs of residual pathology or recurrence were observed. Bone quality in the right mandible was assessed to be favorable for cortical engagement, Fig. 1. Considering the patient's history of radiation therapy, compromised anatomy, and need for early functional rehabilitation, a multidisciplinary team comprising prosthodontists, oral surgeons, and radiologists formulated a comprehensive treatment plan. The plan aimed to improve function and esthetics using a fixed prosthesis with retrievability,

supported by screw-retained Corticobasal® implants placed in the available dense cortical bone of the right mandible.

Under strict aseptic conditions and appropriate antibiotic prophylaxis, a total of six Corticobasal® screw-retained implants were strategically inserted in the right mandibular region, engaging the cortical bone for enhanced primary stability, Figs. 4 and 5. Immediate loading protocol was considered based on high insertion torque and implant stability. A screw-retained fixed prosthesis was fabricated to ensure retrievability and ease of maintenance.

Post-operative healing was uneventful, with no signs of infection, implant mobility, or soft tissue complications. The patient was placed on a regular follow-up schedule with strict oral hygiene instructions and periodic evaluation.

At the 6-month follow-up, clinical and radiographic assessment demonstrated excellent peri-implant soft tissue health, absence of inflammation, and increased bone-implant contact. The prosthesis remained stable and functionally efficient, with improved mastication, speech, and facial symmetry.

The patient reported high satisfaction with the treatment outcome, indicating a significant improvement in overall quality of life.

Diagnostic Evaluation and Treatment Plan

Before surgery, the patient's complete blood profile was done along with the proper history of any medication and hba1c levels were measured as well.

Day 1: Surgical Placement and Immediate Digital Workflow

Under strict aseptic conditions and appropriate antibiotic prophylaxis, local anesthesia was administered. A flapless, minimally invasive approach was preferred to preserve the periosteal blood supply, which is especially critical in irradiated tissues with compromised vascularity³, Figs. 4a and 4b.

A total of six single-piece multiunit BECES® implants (Manufacturer: Simpladent® GmbH, Dorfplatz 11, 8737 Gommiswald, Switzerland) were placed in the right mandibular region. The implants were anchored in the available second cortical bone including engagement of the lingual and caudal cortices, to achieve bi-

cortical stabilization. High insertion torque (typically >35-45 Ncm) was achieved in all implants, confirming excellent primary stability – an essential prerequisite for immediate loading⁴, Fig. 5. The correct use of the adequate IF[®] Method is one of the critical prerequisites for the success. Here, implants were placed using IF[®] Methods 1a, 1b, 1c, Method 2 in anterior mandible and Method 5a in posterior mandible¹⁶. Access to the posterior mandible was very difficult because of reduced mouth opening and in anterior region, the operator had to literally hold the mandible and perform IF[®] Method 2 because of the deviation caused by the resection of medial pterygoid and muscles of the mastication on the opposite side.

Following implant placement, single-piece multiunit implants were connected, and implant alignment was corrected to achieve a common path of insertion. Care was taken to minimize cantilever forces and ensure optimal load distribution.

A digital intraoral scan was then performed using scan bodies for MU implants and the protocol feasible for Exocad processing. This way we capture the exact three-dimensional position of

the implants and the surrounding soft tissues. The use of a digital workflow (as per the IF[®] digital protocol) allowed for enhanced precision, reduced chair-side time, and immediate transfer of data for prosthesis fabrication.

Day 2: Framework Fabrication and Metal Try-In

Based on the digital impressions, a CAD-CAM fabricated metal framework was designed and milled. The framework was created to provide rigid splinting of all six implants, which is critical in immediate functional loading cases to distribute occlusal forces evenly and prevent micro-movement at the bone-implant interface, Figs. 6a-6b and 7.

During the metal try-in appointment, the framework was evaluated for:

- Passive fit (to avoid stress at the implant interface)
- Marginal accuracy
- Occlusal clearance
- Arch form and prosthetic space

Any discrepancies were corrected chair-side to ensure a precise and passive framework fit. Proper jaw relations and occlusal scheme were verified,

with emphasis on achieving a strategic occlusion or lingualized occlusion with shallow group function, Fig. 8. There is no centric on such patients, thus the need to have wide platform of occlusal surfaces.

Day 3: Definitive Prosthesis Delivery

On the third day, the definitive screw-retained fixed prosthesis was delivered, Figs. 9a-9c. The prosthesis was designed to provide:

- Cross-arch stabilization (as much as possible)
- Reduced occlusal table width
- Controlled occlusal contacts to minimize overload

Occlusion was carefully adjusted to ensure:

- Light centric contacts
- Elimination of premature contacts
- Reduced lateral interferences, particularly considering the mandibular deviation

The prosthesis was fixed and torqued according to manufacturer specifications, and screw access channels were sealed with composite resin.

Biomechanical Considerations in Immediate Loading

Immediate loading was made possible due to:

- High primary stability achieved through cortical engagement
- Splinting of implants with a rigid framework
- Strategic implant distribution minimizing cantilever forces
- Favorable bone quality in the basal cortical region

In irradiated patients, Corticobasal® implants offer a distinct advantage as they rely on cortical bone, which is less affected by radiation-induced changes compared to cancellous bone and not affected by crystal bone resorption that is common in post radiation bone.

Post-Operative Care and Follow-Up

The patient was instructed on maintaining meticulous oral hygiene and was advised to follow a soft diet during the initial healing phase to reduce functional loading.

Regular follow-ups were scheduled to monitor:

- Soft tissue healing
- Implant stability
- Prosthetic function

At the 6-month follow-up, the patient exhibited excellent peri-implant tissue health, stable osseointegration, and satisfactory functional outcomes, validating the success of the immediate loading protocol.



Fig. 1a



Fig. 1b

Figs. 1a-1c: Pre-operative radiographic images

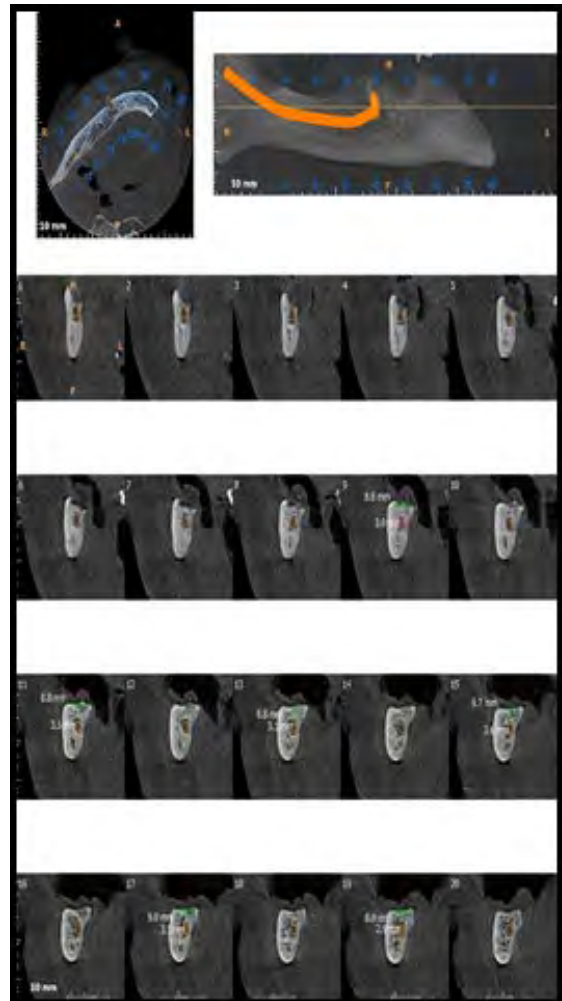


Fig. 1c



Fig. 2: Pre-operative clinical image



Fig. 3a



Fig. 3b



Fig. 3c

Fig. 3a-3c: Pre-operative clinical images



Fig. 4a



Fig. 4b

Figs. 4a-4b: Implant placement



Fig. 5: Radiographic image after implant placement



Fig. 6a



Fig. 6b

Figs. 6a-6b: Metal try-in on model



Fig. 7: Metal try-in in the oral cavity



Fig. 8: Final prostheses requiring prosthetic and masticatory adjustments

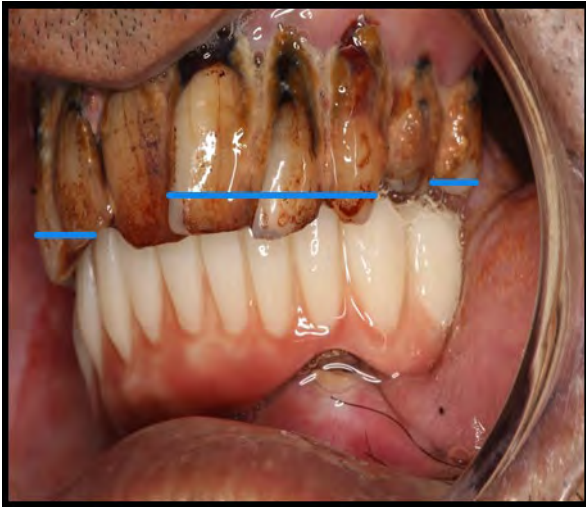


Fig. 9a



Fig. 9b



Fig. 9c

Figs. 9a-9c: Intraoral images of prostheses, Fig. 9b shows the approximate amount of necessary vertical reduction of the vestibular cusps of upper frontal teeth in order to avoid a distal forced bite and an anterior pattern of chewing. This adjustment can be done after the cementation in order to allow an unlimited (non-blocked) pattern of mastication. It might be necessary to shorten the lower frontal teeth as well in order to avoid an anterior pattern of chewing.

Discussion

Despite the advancement in implant surfaces and textures, it has been scientifically proven that a smooth surface is better than a rough surface for implants, from a biological point of view. The surface texture of the endosseous surface of implants is considered a crucial determinant for biofilm and infection formation. As the rough surface of the implant is exposed to the oral cavity, it may permit the adherence of plaque biofilm. Moreover, the detachment or peeling of the surface coating under occlusal forces may aggravate the situation. Thus, the result of this study was in line with previous observations³⁻⁶. The excellent results obtained in the present study might be related to the smooth polished surface and the thin mucosal penetration diameter of the implants, which permit quick peri-implant soft tissue healing and result in a decrease or even elimination of both soft tissue inflammation and infection. This trend was in agreement with the observations reported by Ihde et al.^{3,7,8}, Lazarov⁹, Ahmad et al.¹⁰, and Osman et al.⁶. The concept of **Strategic Implant**® emphasizes the utilization of basal cortical bone rather than alveolar bone for

implant anchorage. This approach eliminates the need for bone grafting and allows immediate functional rehabilitation even in compromised situations. Gaur et al.¹¹ demonstrated that immediate loading protocols, when combined with proper implant design and cortical engagement, result in favorable clinical outcomes with reduced treatment time and improved patient satisfaction. The present case aligns with this philosophy, where rapid prosthetic rehabilitation was achieved within three days.

Immediate loading of implants has been extensively studied and is dependent on achieving high primary stability and minimizing micro motion at the bone-implant interface. (Bi)cortical engagement, as achieved in basal implantology, plays a crucial role in this regard. Studies have shown that engagement of dense cortical bone significantly enhances primary stability, thereby allowing early or immediate functional loading with high success rates¹².

The work by Patel et al.¹³ highlights the advantages of Corticobasal® implants in atrophied and resorbed ridges. Their clinical studies suggest that conventional implants are often limited in such cases,

whereas basal implants provide a viable, simple and effective alternative by utilizing the stable basal bone, which is less prone to resorption and radiation-induced damage. This is particularly relevant in the present case, where the patient had undergone radiation therapy, making conventional implant placement less predictable.

A retrospective study involving immediate functional loading protocols reported high survival rates over extended follow-up periods, reinforcing the predictability of this approach when proper case selection and biomechanical principles are followed. The present case showed no complications and excellent peri-implant health at six months and over an observation period of twelve years and longer further supporting these findings^{14,15}.

Here we have modified the occlusion by widening the occlusal plane at premolars region. This was done to counteract the deviation caused by dissection of sternocleidomastoid muscle and muscles of mastication that are primarily medial pterygoid anterior belly of digastric and masseter, on the opposite site, which was operated for hemimandibulectomy

because of cancer. This case and our solution demonstrate that rigid rules for prosthetics and surgery, as set up by many universities, are outdated or at least not applicable for a number of cases.

Here we were not able to follow the exact rule of supporting polygon, but as per the demand of the case, we tried to create occlusion balance with creating tripod situation for occlusion itself and little ridge support from the prosthesis on the opposite balancing site.

However, due to the unwillingness of the patient, upper arch teeth were not replaced with implants. That was one of the primary reasons for using screw-retained Corticobasal® implants for the lower arch for future perspective.

We would like to point out that not too many conclusions can be taken from this case as we only have a short-term follow-up of this case. Avoiding a deep overbite by the upper teeth would have made this case safer for sure.

Conclusion

In immediate functional loading, Corticobasal® implants with screw-retained retrievable prosthesis are really helpful in resorbed jaws and resected cases. The treatment plan allows major changes in the quality of patient's life with retrievability as an added advantage to consider if so. Otherwise, there is no such difference in outcomes of the single-piece cement-retained Corticobasal® implants and screw-retained single-piece Corticobasal® implants.

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