Case Report

Corticobasal Implant Supported Fixed Prosthetic Rehabilitation of a Fibula-Reconstructed Mandible after Segmental Mandibulectomy with 3-year Follow-Up

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KEY WORDS

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ABSTRACT

Reconstruction of the mandible after surgical resection poses a significant challenge for oral and maxillofacial surgeons. The utilisation of a fibula free flap in mandibular reconstruction, combined with the installation of corticobasal implants, promotes osseointegration and offers promising dental rehabilitation. This report illustrates a 48-year-old male patient who presented with a successfully reconstructed mandible using a fibula free flap after hemi-mandibulectomy. Further treatment sequences were planned for the placement of nine corticobasal implants supported by a fixed prosthesis after 6 months of mandible reconstruction. A 3-year follow-up revealed a 100% survival rate, with no fractures, implant loss, or bone graft complications, and a stable prosthesis, resulting in satisfactory oral function. A combination of fibula free flap and corticobasal implants after segmental mandibulectomy delivers successful dental rehabilitation with better aesthetic and functional outcomes and high survival rates.

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Introduction

Segmental resection of the mandible implies loss of an entire segment of the bone, causing facial disfigurement, impaired oral function such as difficulty in swallowing, mastication, and speech, leading to deterioration of self-esteem and overall quality of life [1-2]. Mandibular defect reconstruction varies based on the existing defect size, the amount of hard and soft tissue loss, and defect extension [3]. The options for reconstruction of the mandible remain plenty in the literature. However, the gold standard method in mandible reconstruction is the fibula free flap, first described by Taylor *et al.* in 1975 [2].

The benefits of the fibula free flap are that it provides sufficient bone volume and an adequate skin flap pedicle for reconstruction of oral defects, a wider bone diameter paves the way for implant placement, and implant-supported removable or fixed prosthesis [4]. Despite limitations, the fibula free flap has proven to demonstrate a high success rate, better osseointegration, and successful dental rehabilitation [5]. Corticobasal implants are referred to as single-piece implants, which has a small diameter and a small penetrating tip with a smooth surface, isoelastic properties, the fibula bone has a longer vascularised pedicle, which can feasibly contour with the recipient bone, the voluminous cortical nature of the fibula bone supports better anchorage during implant insertion, the fibula bone offers better primary implant stability and high survival rates when implanted in a fibula bone-supported prosthesis [6-7].

This case report presents a corticobasal implant-supported fixed prosthetic rehabilitation of a fibula reconstructed mandible following segmental mandibulectomy, with a 3-year follow-up.

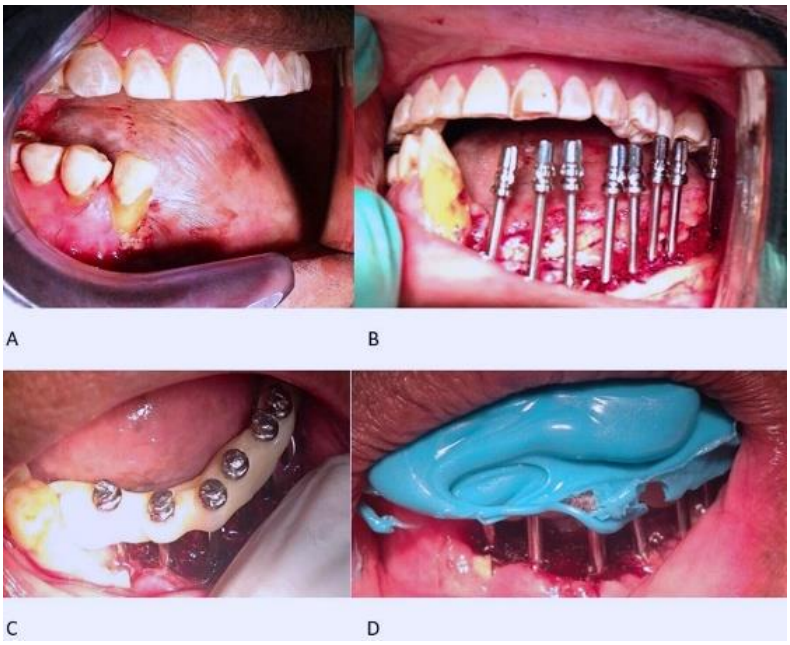

Figure 1: Intraoperative images, **a:** Clinical image showing reconstruction of mandible on the left side using fibula bone graft after segmental mandibulectomy, **b:** Clinical image showing placement of nine corticobasal implants secured with basal screws, **c:** A composite splint was constructed to engage all the basal implants below the level of abutments to prevent undercuts while making impression, **d:** The impression was made using condensation silicone light body impression material covering the abutment of the implant and the composite splint on the same day after the completion of implant insertion

Case Presentation

A 48-year-old male reported to our outpatient department for partial fixed dental rehabilitation. Previous history revealed that he was diagnosed with squamous cell carcinoma of the mandible, for which he had undergone segmental mandibulectomy on the left side. Following surgical resection, the mandible on his left side was reconstructed with a fibula free flap secured with titanium screws. An intraoral screening revealed adequate inter-arch space and complete soft-tissue healing (Figure 1a). Further treatments for dental rehabilitation were planned, including a corticobasal implant-supported fixed prosthesis, after 6 months of mandible reconstruction.

Surgical procedure

The surgical methods for corticobasal implant placement were performed under a sterile aseptic environment. Intraoral betadine irrigation was done before the surgery. Local anaesthesia (2% lidocaine hydrochloride) was administered with adrenaline (1 in 80,000 concentration) along the vestibule and mandibular crest. The implants chosen for placement varied according to the available width and length of the bone. A flapless technique was employed, and nine corticobasal implants with basal screws were carefully placed away from the site where screws were used to stabilise the fibula bone (Figure 1b). The implant placement was challenging due to the length of the chosen implants and the limited inter-arch clearance, which made insertion difficult. Postoperative instructions and medications included an antibiotic (Cefixime tablet, 200mg, twice daily) and analgesics (Ketorolac tablet, 10mg, twice daily) for three days.

Prosthetic Loading

A composite splint was constructed to engage all the basal implants below the level of the abutments, ensuring that the polished surface of the implants beneath the abutments was exposed. This, in turn, prevents undercuts while making an impression (Figure 1c). The exposed area acts as a self-cleanser, preventing food accumulation around the polished implant surface, thereby minimising the risk of postoperative peri-implantitis. The impression was made using condensation silicone light body impression material covering the abutment of the implant and the composite splint on the same day after the completion of implant insertion (Figure 1d). On the third day, after implant placement, the patient was delivered a milled acrylic semi-permanent prosthesis (Figure 2). The acrylic prosthesis was then analysed for high points using 40µ articulating paper, which was

Figure 2: The patient was delivered with a milled acrylic semi-permanent prosthesis after implant placement

sequentially reduced to achieve an end-on occlusion.

Postoperative follow-up

The patient was initially evaluated at the 1st, 3rd, and 6th postoperative months, as well as at 3 years (Figure 3). During the 1st and 3rd postoperative months, the patient reported no complaints, and no signs of infection or inflammation were evident at the implant site. At the 6th postoperative month, the patient reported being satisfied with the aesthetics, phonetics, and comfortable masticatory efficiency. At the 3-year follow-up, the patient demonstrated a 100% implant survival rate, with no adverse events at the site of implant placement. The patient reported being satisfied with the treatment and routine oral function (Figure 4).

Discussion

Management of patients with segmental mandibulectomy for dental rehabilitation presents a clinical challenge for the oral and maxillofacial surgeons. The choice of fibula bone in mandible defect reconstruction remains a promising and gold-standard grafting material, as it provides a biomechanical advantage in bearing maximum masticatory loads [8]. Klesper *et al*. [9] through their cadaveric study, emphasized that a fibula graft would be a suitable option for reconstructing long-span defects, providing sufficient width and adequate volume of bone for implant insertion. The present case report describes the placement of a corticobasal implant-supported prosthesis on a fibula free flap reconstructed mandible, with successful outcomes in terms of masticatory function and implant stability over 3 years.

The timing of implant placement after mandible reconstruction correlates with the success of treatment. Owing to rapid prosthetic rehabilitation in an early reconstructed mandible with a fibula free flap, the possibilities of implant failures are high due to improper positioning of the implant and greater susceptibility to recurrence of tumor [10]. Hence, delayed placement of the implant would be the best viable treatment option with no recurrence. Although numerous studies on immediate implant placement with fibula bone graft have proven to show better implant primary stability [11], Ariga *et al*. [2] followed a delayed protocol of implant loading and Lland *et al*. [12] reported with 88% with immediate implant placement and 97% with delayed implant placement which had a positive association with our case report where a delayed implant placement was planned after resection and reconstruction of mandible using fibula bone graft.

The success of the chosen implant treatment in a reconstructed mandible may be attributed to the flapless technique employed during implant insertion and the

Figure 3: Postoperative orthopantamograph (OPG) showing placement of corticobasal implants with acrylic prosthesis ensuring adequate stability and correct positioning of the implants

Figure 4: Orthopantamograph (OPG) showing adequate stability of corticobasal implants with acrylic prosthesis evaluated at 3-year follow-up

use of a thin implant drilling tip, which minimizes blood interruption at the time of implant insertion [13]. Moreover, the surface characteristics of the implants, being smooth, minimised the adherence of plaque to the implant surface and susceptibility to cause adverse effects around the implants. In the present case report, a composite splint was fabricated to engage all the implants below the level of abutments, and the supporting metal framework ensures that the masticatory load is eliminated, preventing overload to the implants.

The outcomes of implant success and survival rates are controversial, with studies documented in the literature [14-20]. Tahmasebi *et al*. [14] and Navarro Cuellar *et al*. [15] reported a 95% survival rate of implants using a fibula free flap, assisted by virtual surgical planning, and 92.6% using the standard surgical technique. Lazarov *et al*. [16] reported a 97.5% survival rate with 4 years of oral function. Awadalkreem *et al*. [17] reported a 100% implant survival rate in marginal mandibulectomy patients without bone grafting. Whereas Burgess *et al*. [18] and Sozzi *et al*. [19] reported survival rates of 92% and 98%, respectively, with follow-up periods of 30 months and 7.8 years after implant loading. Navarro Cuellar *et al*. [15] and Huang *et al*. [20] determined that a successful implant-supported prosthesis with a fibula free flap, which had a similar correlation with our case report. In the present report, the patient evaluated at the postoperative months (1^{st}, 3^{rd}, and 6^{th}) showed no evidence of infection or inflammation at the site of implant. At the 3-year follow-up, the patients had satisfactory aesthetic, phonetic, and masticatory function, with 100 % survival of the osseointegrated implants.

Postoperative long-term maintenance of the surrounding implant health remains crucial for the osseointegrated reconstruction of a fibular mandible. In a study by Ariga *et al*. [2], 80% of patients reported chewing difficulties, while 20% showed no functional deficits with the dental prosthesis. While Leung and Cheung [21] reported dental prosthesis instability in 28.6% of patients, Gosai *et al*. [22] experienced a 3.2% rate of failures, with manageable complications such as pain, mobility issues, abutment neck fractures, loosening of the prosthesis, and relining, with no significant complications of peri-implantitis. Our case report elicited no significant complications during the 3-year follow-up.

The present case report had a few limitations: the mouth opening was restricted after mandible resection and subsequent reconstruction with a fibula free flap; hence, a short, stable occlusion was achieved only up to the premolar region, and a full-arch dental rehabilitation was not attained. The patient was only reviewed for a period of 3 years. A follow-up of more than 5 years would help to better assess the functional outcomes and complications if they arise. Due to limited mouth opening, the manual impression technique was performed since the digital impression method was not favourable.

Informed consent

Informed consent was obtained from the patient

Conclusion

A combination of corticobasal implant-supported prosthetic dental rehabilitation in a reconstructed fibular mandible after segmental mandibulectomy results in better osseointegration, excellent peri-implant health, and masticatory function, with a high success rate and no significant complications up to 3 years of follow-up.

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Author's Contributions

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Satheesh Chandran: Conceptualization, Investigation, Methodology

Karthik Kattur Premkumar: Data curation, Validation, Supervision

George Samyo Stephenson: Data curation, Validation, Supervision

Balamurugan Rajendran: Formal analysis, Supervision, Writing and Review

All authors have read and approved the draft.

Conflict of interest

None

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