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Case Report
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Functional Outcomes with Implant-Prosthetic Rehabilitation Following Simultaneous Mandibulectomy and Mandibular Reconstruction by Fibula Graft

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Abstract

Aim: To evaluate the clinical outcomes and success rates of dental implant placement in vascularized fibula bone grafts used for the reconstruction of mandibular defects.

Methods: The present study aimed at investigating the clinical treatments outcomes a 21patients (12 males and 9 females, the age was 28-63), who underwent surgical reconstruction of post-oncologic lower jaw defects with the micro vascular fibular graft and further dental implantation between 2012-2018. The mandible was resected for ameloblastoma of the mandible 13 cases, eosinophilic granuloma of the mandible in 2 case, odontogenic keratocysts of the mandible in 5 cases and low differentiation osteosarcoma in of the mandible 1 cases. Flap raising and tumour resection were always carried out simultaneously. After 5-6 months reconstruction of mandibular defects 134 implants were inserted within fibula flaps. The implants were evaluated with measures of Resonance Frequency Analysis (RFA) during the follow-up periods using Osstell Mentor at time of implant placement, after 3 months. The functional load on dental implants was performed with ISQ values above 65. Dental prosthetic rehabilitation was performed after 3-4 months of submerged healing. Postoperative clinical and radiographic controls were made regularly, the criteria for implant success were assessed.

Results: The postoperative evolution of the patients was favorable, with the integration of the fibula vascularized grafts. No intra-operative or immediate post-operative complications were noted and no flap failure occurred. Free fibula flap transfer was successful in all cases. In all 21 patients, fibula flaps provided adequate bone stock for implant placement. The mean RFA recordings of all 134 implants were 65 ISQ at implant placement respectively 73 ISQ after 3 months. Implants placed in the reconstructed areas were demonstrated to integrate normally. Of the 134 implants placed in these 21 patients, 4 failed to osseointegrate. Overall, graft success rate was 100% and implant success rate was 97%.

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Introduction

The treatment of jaw bone defects that result from traumatic or resective loss is one of the most actual problems in reconstructive maxillofacial surgery. The mandibular resection resulting from treatment of malignant tumors, aggressive odontogenic tumors, or trauma can cause extensive composite defects including bone, oral lining mucosa, muscles, and teeth, with a significant decrease in the patient quality of life. These defects often compromise the mastication, deglutition, speech and facial aesthetics [1]. There are various methods available for reconstruction of mandibular defects: non vascularized bone grafts, titanium reconstructive splints or microsurgical techniques that allow the use of vascularized bone. Every reconstructive technique must satisfy the following key objectives: (1) obliteration of the defect; (2) restoration of function; particularly speech and mastication; (3) structural support for reconstruction of external facial features; and (4) aesthetic reconstruction of these external facial features [2]. Fibula is the most common donor site in both the vascularized and non-vascularized groups. Simple anatomy and accessibility of the fibula caused the popularity of this transplant in reconstructions of the lower jaw [3-5]. The bone is available with enough length to reconstruct any mandible defect. A 22 to 25 centimeters segment of fibula bone may be harvested in the adult patient, permitting reconstruction of near-total mandibular

Figure 1: Clinical appearance.

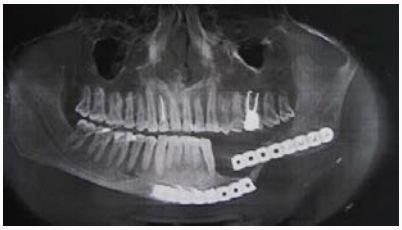

Figure 2: X-rays of the patient.

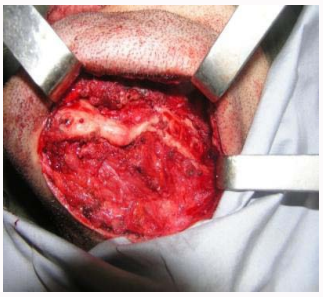

Figure 3: Intraoperative view. After preparing the recipient site.

Figure 4,5: Design of fibula bone and skin island contour at harvest site.

Figure 6: Intraoperative photograph during harvesting the free fibula flap.

Figure 7: Harvested vascularized fibular graft.

Figure 8: Titanium plate for fixation.

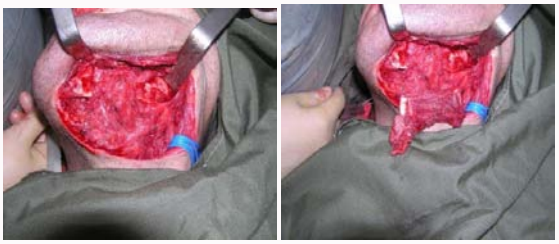

Figure 9, 10: Intraoperative view. Shaping and adjustment of the graft to the recipient site.

defects with a single flap. During harvest, distally at least 5 cm of fibula should be left to prevent angle instability. It characteristics such as the thick and long cortical bony component (average width is 2.5 cm 3 cm, thickness approximately 1.5 cm) provide a good rigidity to withstand physiological stress during mastication. The peroneal artery and vein are usually of good quality and caliber and ideal for microsurgical anastomosis. Using a vascularized fibula bone grafts for single stage reconstruction of defects in the mandible, after resections of tumors, provides the conditions for a full rehabilitation of patients and good aesthetic results. Restoration of oral functions requires not only reconstruction of the mandibular defect, but also dental rehabilitation. The use of dental implants after transplantation of the fibula graft to restore the jaw is one of the most prospective directions in solving this problem. Dental implants allow evenly distribute the chewing load on the lower jaw and prevent the resorption of the graft [6-9]. This case report presents a combination of surgical and prosthetic solutions applied to a case of oral implant rehabilitation in post-oncologic reconstructed mandible.

Case Presentation

The 30-year-old male patient complained of pain and swelling on the lateral mandible.

History of illness

- Was operated for osteogenic sarcoma of the lower jaw (Stage T4N0 M0)
- the bone defect was replaced twice with free bone grafts from iliac crest
- failure of the fixation and substitution of the bone defect

Figure 11,12: Fixation of the graft and imposition of the vascular anastomosis with a/v facialis.

Figure 13: Intraoral view of 6 abutments in place before prosthetic reconstruction, peri-implant soft tissues show a healthy status.

Treatment plan

- Stage I - segmentar resection of the lower jaw.
- Stage II - harvesting of the fibular graft.
- Stage III - shaping of the fibular graft and fixation of the graft on lower jaw with the reconstruction plate.
- Stage IV - insertion of 4 dental implants 5 months after the surgery.
- Stage V - prosthetic reconstruction 3 months after implant surgery.

Two teams were involved in the surgery- microsurgery team and oromaxillofacial surgeon team. Oromaxillofacial surgeons performed the neck dissection and segmentar resection of the lower jaw, the microsurgery team performed the flap dissection, the receptor vessels dissection, and vascular anastomosis. After assessing the size of the defect, the free fibular flap was harvested from the donor site following standard protocols. The fibula was exposed and the required length of fibula bone was harvested with a sufficient length of vascular pedicle to facilitate the vascular anastomosis with the recipient vessels. After segmentar resection of the lower jaw shaping and adjustment of the graft to the recipient site and attached to the remaining mandibular segments by fixation with titanium plate. Recipient vessels were the facial artery and vein, with which an anastomosis of the end-to-end type was applied. The donor site and recipient site was closed with usual technique. The patient not received postoperative radiation therapy or chemotherapy. Postoperative clinical and radiographic controls were made regularly, using serial orthopantomograms and CT scan. After 5 months of healing, 4 dental implants were placed in the reconstructed mandible. To assess the degree of osseointegration and determine the timing of the functional load of dental implants installed in free vascularized bone autografts, a Resonance-Frequency Analysis (RFA) of the stability of implants using Osstell Mentor (Osstell instrument, Integration Diagnostics AB, Gothenburg, Sweden) at time of implant placement, after 3 months. After a healing period of 3 months second stage surgery was performed. Upon uncover and on clinical and radiographic evaluation, all implants were osseointegrated, abutments were placed. The mean RFA recordings of all 4 implants were 72 ISQ after 3 months. Dental prosthetic rehabilitation was undertaken with a ceramometal implant- fixed prostheses. The patient was reviewed at 3, 6- and 12- month interval. All the implants were stable and in good function with no post-operative complications. The patient had good masticatory efficiency 3 year post-operative follow-up. The esthetic and functional outcomes of the case restituted an acceptable quality of life to the patient.

Figure 14: Clinical appearance after prosthetic rehabilitation with ceramometal implant-fixed prostheses.

Figure 15: 6 months follow up of final prosthesis restoration. Radiographic control.

Figure 16,17: Clinical appearance after 6 months.

Conclusion

The reconstruction of mandibular defects following ablation for tumors with fibula-free flaps has been demonstrated to be a reliable technique with good long-term results. Implants placed in the reconstructed areas were demonstrated to integrate normally, with success and survival rates comparable to those obtained in case of implants placed in native bone. The long-term survival and success rates of implants placed in the reconstructed areas may guarantee an excellent prognosis of implant-supported prostheses. Frequency-resonance analysis method could serve as a noninvasive diagnostic tool for detecting implant stability during healing stages and subsequent routine follow ups. The method of resonance-frequency analysis allows us to determine the timing of the beginning of the prosthetic stage in each specific case.

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