Rehabilitation using implants in free fibula flap of a patient with ameloblastoma: Case report with 4-year follow-up

ABSTRACT

Ameloblastoma is a locally invasive odontogenic tumor of the jaw. It can advance to large size resulting in facial deformity, loose teeth, and in severe cases pathologic fracture of the jaws. As ameloblastoma shows local invasiveness and tendency for recurrence, radical surgery which includes marginal resection or segmental resection are preferred. This clinical report describes the prosthetic rehabilitation of a patient affected by extensive mandibular ameloblastoma. Enbloc resection of the tumor and reconstruction by fibula-free flap was done. After initial healing for about 18 months, five endosseous implants were placed and implant-supported fixed hybrid prosthesis using computer-aided design and computer-aided manufacturing milled titanium framework was fabricated. Surgical and prostodontic challenges are discussed. Osseointegrated implants provide a new perspective of treatment to enhance the quality of life of patients resected for oral tumors.

Keywords: Ameloblastoma, fibula free flap, implant-supported prosthesis, segmental mandibulectomy

INTRODUCTION

Ameloblastoma is a locally invasive odontogenic tumor of the jaw and constitutes 1% of all tumors found in the oral cavity and about 9%–11% of odontogenic tumors. Almost 80% of ameloblastomas occur in the mandible, most often in the molar ramus region. The multicystic/solid ameloblastoma is the most common type, comprising 91% of all the ameloblastomas. The tumor arises from remnants of the dental lamina and odontogenic epithelium. It has a peak incidence in the third and fourth decades of life and equal gender predilection 1:1. The World Health Organization 2005 classification for the head-and-neck tumors documented four different growth variants of ameloblastoma: peripheral, unicystic, solid/multicystic, and desmoplastic.

Mandibular ameloblastoma can advance to large size, which causes the facial deformity, loose teeth, malocclusion, and in severe cases, cause pathologic fractures. Radiographically, ameloblastoma presents as unilocular or multilocular radiolucent lesion. It results in the expansion of the cortical plates, which leads to a honeycomb or soap bubble appearance on a panoramic X-ray. Histologically, solid or multicystic ameloblastoma shows both cystic and solid features. The follicular and plexiform patterns are most common. The epithelial nests consist of a core of loosely arranged angular cells. As ameloblastoma shows local invasiveness and tendency for recurrence, radical surgery, which includes marginal resection, segmental resection with or without disarticulation are preferred. A recent case report describes the prosthetic rehabilitation of a patient affected by extensive mandibular ameloblastoma. Enbloc resection of the tumor and reconstruction by fibula-free flap was done. After initial healing for about 18 months, five endosseous implants were placed and implant-supported fixed hybrid prosthesis using computer-aided design and computer-aided manufacturing milled titanium framework was fabricated. Surgical and prostodontic challenges are discussed. Osseointegrated implants provide a new perspective of treatment to enhance the quality of life of patients resected for oral tumors. This clinical report describes the prosthetic rehabilitation of a patient affected by extensive mandibular ameloblastoma. Enbloc resection of the tumor and reconstruction by fibula-free flap was done. After initial healing for about 18 months, five endosseous implants were placed and implant-supported fixed hybrid prosthesis using computer-aided design and computer-aided manufacturing milled titanium framework was fabricated. Surgical and prostodontic challenges are discussed. Osseointegrated implants provide a new perspective of treatment to enhance the quality of life of patients resected for oral tumors.

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meta-analysis discovered 15 times greater chances of recurrence with conservative treatment as compared to resective treatment. A segmental resection with a 1–2 cm margin has therefore been favored for the solid or multicystic-type ameloblastoma.\[7\]

The use of fibula-free flap for mandibular reconstruction was propagated by Hidalgo and has become the treatment of choice.\[8\]–\[9\] Sumi et al.\[10\] have validated the use of implants in fibular bone graft. The authors conducted a histological study of the titanium-implant interface with the bone in a retrieved human fibular graft.

Successful mandibular reconstruction with dental implants placed in fibula had been shown by several authors. Attia et al.\[11\] showed the cumulative implant survival rate as 81% in fibula-free flap. They found the survival rate of the 34 fibula flaps transplanted after surgical reconstruction to be 97%. They concluded that implant placement into fibula-free flap results in predictable rehabilitation and excellent clinical outcomes. Sozzi et al.\[12\] have determined the dental implant and prostheses success rate in fibula free flap and found implant survival rate to be 98% and prosthesis success rate to be 100%. Kumar et al.\[13\] had studied the effect of implant-supported overdenture on the quality of life in patients who had undergone mandibular reconstruction with fibula-free flap. They found that implant-supported overdenture improved the quality of life.

Surgical scar and reduced vestibular depth after wide resection, make rehabilitation with removable prosthesis difficult. Implant-retained fixed prosthesis provides a better option to aid in improved mastication and speech. Smolka et al.\[14\] in their study comprising of 56 patients, have found the implant success rate to be 92% as compared to the prosthetic success rate of only 42.9%. The common reasons put-forth by the authors were poor patient compliance (30.4%), recurrence of tumor (14.3%), and factors related to surgery- (10.8%), which included failed implant as well as unfavorable maxillomandibular relationship. They opined that if the prosthesis function result is not optimum, the high implant osseointegration rate has no significance.

The primary objective of this case report is to describe the rehabilitation of a patient who has undergone segmental resection of the mandible followed by fibula free flap. Implant-supported fixed hybrid prosthesis using computer-aided design/computer-aided manufacturing (CAD-CAM) milled titanium framework was fabricated.

CASE REPORT

A male patient aged 31-year with a left facial swelling reported to the Department of Oral and Maxillofacial surgery. On clinical examination, extraoral swelling on the left side body of the mandible crossing the midline with buccolingual expansion was evident. Swelling was bony hard in texture, with an area of fluctuation felt over the left side body region. On a panoramic radiograph, multilocular radiolucent areas were observed in the left angle, ramus, and posterior body of the mandible crossing the midline and extending up to the right first premolar region. An incisional biopsy was performed, and it was diagnosed as multicystic ameloblastoma.

Segmental resection of the mandible extending from left side angle to right side second premolar was performed, and microvascular reconstruction with a fibula free flap was done. A single osteotomy of the fibula in the symphysis region was done which makes it class II of mandibular defects according to the classification proposed by Iizuka et al.\[15\] The patient was under constant follow-up with periodic radiographic evaluation [Figure 1a and b]. After adequate healing for about 18 months from the initial reconstructive surgery was achieved, prosthetic rehabilitation for the patient was planned. Considering the vestibular depth, alveolar ridge height, and soft tissue drape over the reconstructed mandible, a decision was made to rehabilitate with implant-supported fixed hybrid prosthesis for better function, stability, and esthetics. This type of prosthesis replaces not only teeth but also soft tissue. The antagonistic arch had the full complement of teeth present, and occlusion was stable with posterior stops on the right side.

Before stage 1 of implant surgery, interosseous miniplante fixation screws were removed for proper placement of dental implants. Five endosseous implants were inserted with an implant surgical stent at the positions determined with preoperative simulation. (Osstem Implant Co.). After measuring the available bone in the panoramic radiograph, the dimension of three implants was decided to be 10 mm×4 mm, and two implants were 10 mm×3.5 mm [Figure 2]. Primary

Figure 1: (a) Intraoral photograph after reconstruction. (b) Panoramic radiograph after fibula free flap reconstruction
stability of more than 15 N torque was attained for all implants. Relative parallelism was achieved for all the implants.

Five months after the placement of implants, healing abutments were placed after removing the cover screws. (Osstem Implant Co.). At this stage, no mobility, pain, or bone loss was detected. This showed good osseointegration of implants. In the next appointment, impression posts were seated on the implants, and an implant level impression was made with polyvinyl siloxane impression material (Affinis, Coltene) [Figure 3a and b] using a custom-made resin impression tray. The laboratory analogs (Osstem Implant Co.) were placed into the impression posts, and the impression was painted with a silicone gingival mask (Gingitech, Ivoclar) to simulate the gingiva and then poured with type IV dental stone (Kalrock, Kalabhai Karson) to make the definitive cast. The maxillomandibular relationship was recorded with the use of wax occlusal rim to mount the casts in a semi-adjustable articulator (Hanau Wide-Vue; Water Pik Inc.).

A verification jig was fabricated by the laboratory to confirm the accuracy of the impression and cast. Verification jig trial was done, small discrepancies were noted, so the jig was cut vertically and joined in the patient’s mouth using pattern resin (GC Corp). For the definitive prosthesis, five custom abutments along with titanium framework were milled by CAD-CAM. The clinical trial of the framework was done for accuracy and passiveness.\[16,17\] Framework was milled for screw-retained prosthesis with screw access holes to facilitate retrieval of the prosthesis for long-term maintenance.

Arrangement of artificial teeth was done on mandibular denture base, and the final trial of waxed-up denture was done to assess esthetics, speech, labial fullness, and occlusion. Processing was done with heat-processed acrylic resin (Trevalon, Dentsply). Finished and polished prosthesis was placed, and tightening of screws was done up to 30 Ncm tightening torque [Figure 4a and b]. Occlusal prematuraties were checked and corrected. The patient was instructed regarding the maintenance of hygiene. The patient was recalled for follow-up after 1 month. The patient had been followed for 4 years following insertion of the prosthesis; the patient was able to maintain good oral hygiene and plaque control. A panoramic radiograph was done, which showed no evidence of bone loss around implants [Figure 5].

**DISCUSSION**

The combined use of fibula-free flap and dental implants placed in the flap has improved the reconstruction opportunities in maxillofacial pathological cases and is being very useful in conditions, such as ablative jaw surgeries,
osteoradionecrosis, severe atrophy of jawbones. As compared to the conventional prosthesis in the defect area, improved performance has been noted by the use of implant-retained prosthesis. Fibula-free flap has several advantages over other grafts being used for reconstruction purposes. The length of the fibula enables multiple osteotomies to be done and gives a similar shape to that of the mandible. It has adequate height and width for implant placement. Lesser rates of donor site morbidity and adequate vascularity due to the periosteal blood supply.

lizuka et al. had given a classification according to the type of mandibular defects and the number of osteotomies required. They suggested that Class I defects required no osteotomy of the fibula, Class II required one osteotomy, Class III required two osteotomies, and Class IV required multiple (more than two) osteotomies. Class IV is a special modification of Class III pertinent for females with small chins. Rehabilitative treatment provided to patients with Class I defects was either through an implant-supported fixed prosthesis or removable prosthesis in cases where abutment teeth were sufficient in number. In the rest of the defect classes (Classes II-IV), the authors advocated a bar-supported removable denture with two to four dental implants.

Whenever delayed implant placement is favored, it should be undertaken at least 6 months after placement of the graft, with completion of bone remodeling and muscle healing. It gives good knowledge about vascularization of the graft, assessing the interest and need for prosthesis of the patient, and deciding the most favorable sites for implant placement.

CONCLUSION

Implant-supported fixed hybrid prosthesis using CAD-CAM milled titanium framework was fabricated for prosthetic rehabilitation of a patient who underwent mandibullectomy and reconstruction with fibula-free flap. Osseointegrated implants provide a new perspective of treatment to enhance the quality of life of patients resected for oral tumors. The patient was under follow-up for 4 years and showed satisfactory results.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the legal guardian has given his consent for images and other clinical information to be reported in the journal. The guardian understands that names and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Conflicts of interest
There are no conflicts of interest.

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