BULLETIN OF STOMATOLOGY AND MAXILLO-FACIAL SURGERY OF
Vol. 19, No. 2

DOI: 10.58240/1829006X-2023.19.2-145

FULL ARCH IMPLANT SUPPORTED FIXED PROSTHETIC REHABILITATION FOLLOWING MANDIBULAR RECONSTRUCTION WITH VASCULARIZED FIBULA BONE GRAFT

Gagan Sabharwal B.D.S, M.D.S, FCLP, FOI,[1]* Amitabh Singh M.B.B.S, M.S, MCh, DNB,[2]
Dr. Rashmi Taneja M.B.B.S, [3] Dr. Ravi S. Batra B.D.S, M.D.S,[4] Rajiv K. Chugh B.D.S, M.D.S [5]

1 Consultant Oral and Maxillofacial Surgeon, Fortis Memorial Research Institute, Gurgaon, Harayana
2 Consultant Plastic and Reconstructive Surgery, Fortis Memorial Research Institute, Gurgaon, Harayana
3 Diplomat American Board of Plastic Surgery, FCFS, Consultant Plastic, Reconstructive and Craniofacial Surgery, Fortis Flt. Lt. Rajan Dhall Hospital, New Delhi
4 Consultant Oral and Maxillofacial Surgeon, Fortis Memorial Research Institute, Gurgaon, Haraya
5 Professor, President Elect Indian Dental Association, Director, Dr. Chugh's Dental Centre, New Delhi, India

*Corresponding author: Dr. Gagan Sabharwal B.D.S, M.D.S, FCLP, FOI; Consultant Oral and Maxillofacial Surgeon, Fortis Memorial Research Institute, Gurgaon, Harayana;
e-mail: drgagansabharwal@gmail.com

Received: Feb. 26, 2023; **Accepted:** Mar. 27, 2023; **Published:** Apr. 15, 2023

Abstract

Dental rehabilitation with osseointegrated implants in reconstructed mandibles is a common procedure, lot of treatment and prosthetic options have been documented in literature. Full and complete rehabilitation of masticatory function may only be achieved by a final prosthetic restoration, leading to improvement of general well being. We herein report a case of full arch dental rehabilitation of vascularised fibula reconstructed mandible using 5 implants, multiunit abutment and an acrylic titanium hybrid screw retained denture. The hybrid denture helps in compensating the vertical and horizontal bone and soft tissue discrepancy and also allows easy retrievability for maintenance or repair and contributes to healthy peri-implant tissue.

Keywords: *Dental implants, mandible reconstruction, fibula bone graft, full arch rehabilitation, hybrid denture*

Introduction

Treatment of orofacial tumors commonly requires partial resection of the mandibular bone, soft tissue and muscle tissue leading to facial asymmetry, mandibular deviation, masticatory dysfunction, speech disturbances and swallowing difficulties as well as considerable aesthetic impairment.[1]

Immediate reconstruction of maxilla, mandible and adjoining soft tissues has been performed using vascularized fibula tissue transfer from past 3 to 4 decades and has proved to be a reliable morphofunctional reconstruction technique. Fibula free flap was first described by Taylor and colleagues in 1975,[2] and then Hidalgo[3] introduced it for mandibular reconstruction in 1989.

The fibula free flap offers an ideal reconstruction because it is a long, straight, strong, highly cortical bone that is expendable and includes a lengthy vascular pedicle with adequate calibre for anastomosis to recipient vessels in the head and neck. The donor site morbidity is minimal and a two-team approach

can be employed for ablative and reconstructive procedures. Osteotomies can be performed safely with reliable periosteal blood supply. The septocutaneous component offers flexibility in resurfacing external skin or internal lining separate from the bony reconstruction.[4] In addition to the esthetic and functional benefits osteocutaneous free flaps are a suitable substrate for endosseous implants to restore the dentition removed as part of tumor ablation.[5]

Nocini et al stated many advantages such as sufficient length of the bony segment, good vascularization, better quality of the bone, and a long vascular pedicle, which have been discussed earlier, but it is also associated with some disadvantages with regard to prosthetic rehabilitation with dental implants because of the height discrepancy between the native mandible and the transplanted fibula. They used distraction osteogenesis to increase the height of fibula in order to improve quantitative of bone and vertical mandibular deficiency[6] and others have used use of a double-barrel fibula flap graft[7] to increase the vertical discrepancy.

In this case report the author is challenging these clams, Distraction requires an additional surgery to place the distractor and another one to remove the it and it has been reported that the bridging of mandibular defects of >9.0 cm in length is very challenging with the double-barrel technique due to the limited fibula length.[7]

In this case report left mandibular ameloblastoma was resected and reconstructed using a free fibula bone graft, to compensate for the vertical discrepancy author is using, multi-unit abutments and an acrylic hybrid titanium screw retained prosthesis to rehabilitate the entire mandibular arch.

Multi-unit abutments

Multi-unit abutments are intended to be connectors between the dental implants and multiple implant screw-retained restorations. They are designed with a range of angle correction and are available for virtually all implant platforms. Multi-unit abutments provide a passive draw and positive uniform seat for all abutment sites. There are usually 3-4 angle correction options to choose from, ranging from straight - 0º to 45º. And also come in different gingival heights from 1mm to 6mm. The use of multi-unit abutments can overcome restorative challenges and is highly recommended when creating a full arch screw-retained implant restoration.

Case Report

A 48 years old female was referred to the dept of oral and maxillofacial surgery at Fortis Memorial Research Institute, Gurugram, India, with a swelling on the left lower posterior region since the last few years, the swelling was progressively increasing and was not associated with pain. She previously got an OPG, GБCT scan which suggestive of a multi locular lesion in the left lower body of the mandible extended from the left angle of the mandible up to the right mandibular canine (Figure 1 A, B).

Figure 1A. Pre op OPG

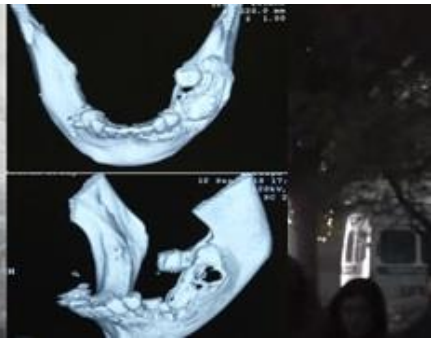

Figure 1B. GБCT scan

There was root resorption of the seen in 38, 34, 33, 32, 31, 41, 42. A incisional biopsy was performed, histopathological findings suggestive of a follicular Ameloblastoma.

The treatment plan was resection and reconstruction with free fibula bone graft followed by dental rehabilitation with dental implants.

Surgical procedure

Preoperative lower-leg Doppler ultrasonography was done evaluate the peroneal circulation before surgery. Under nasotracheal intubation, neck extended a left submandibular incision made, sub platysma dissection done, marginal mandibular vein identified and preserved the facial artery and vein ligated along with the external jugular vein, lower border of the mandible exposed, subperiosteal dissection done to expose the mandible body and the tumour (Figure 2A). A corticortomy of the buccal bone done in the angle and premolar region 1.5cm from the tumor margin. A 3.5mm reconstruction plate was adapted to the lower border of the mandible and secured with 3.5mm locking screws at the angle ramus and the right premolar region (Figure 2B).

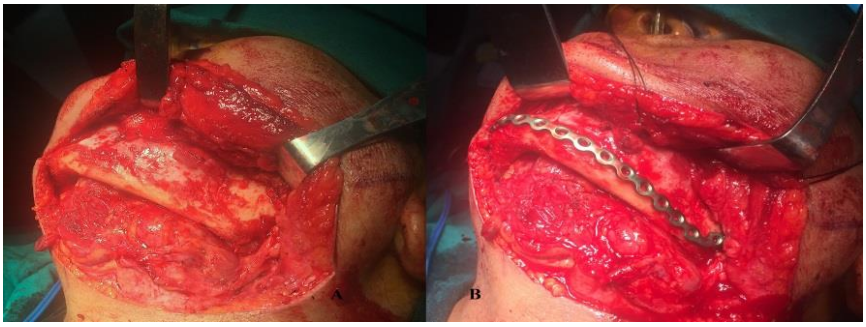

Figure 2A. Tumor exposed through sub mandibular incision

Figure 2B. Reconstruction plate adapted along the lower border of mandible before resection of tumor

Mandible osteotomy done and the tumor resected (Figure 3A, B, C).

The fibular flap was harvested at the same time as ablation of the diseased mandibular segment (Figure 4).

Figure 3A, B, C. Resected tumor specimen

Figure 4. Fibula harvested from right leg

Once harvested, the fibula was osteotomized to fit the contour of the mandibular defect and fixed to the residual mandible with the previous contoured and secured reconstruction plate with screws to maintain the inferior border of the mandible (Figure 5 A, B).

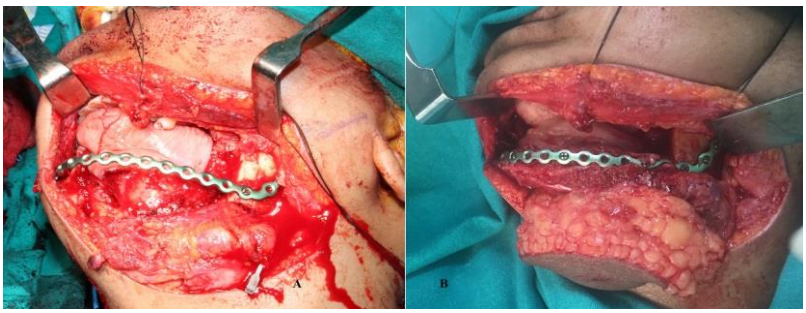

Figure 5A. Mandibular defect after tumor

Figure 5B. Resection fibula in situ

Microvascular anastomoses were performed of the peroneal vessels to the facial vessels using 9-0 ethilon. Skin paddles was placed along the submandibular incision to provide a sentinel monitor of bone viability.

Six months following reconstruction a crestal incision made right mandibular alveoloplasty done (Figure 6A, B), 4 implants were placed in the fibula and one tilted implant placed in the right 2nd premolar region of the mandible.

A 30-degree multi-unit abutment was placed on the tilted implant to correct the angulation and straight multi-unit abutments in the remaining implants were placed at the time of surgery (Figure 7A, B).

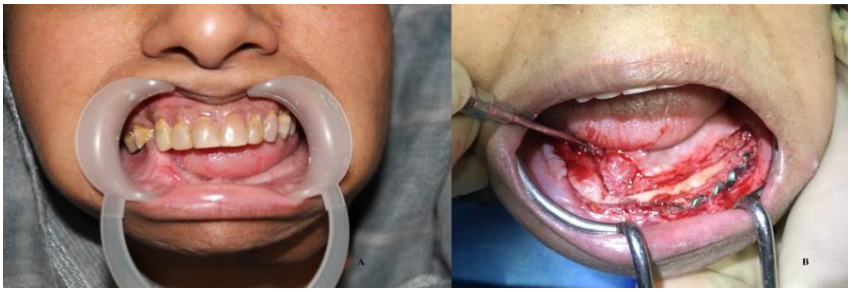

Figure 6A. Intraoral after 6 months of flap healing

Figure 6B. Crestal incision and exposed fibula

Figure 7A. Direction indicators placed to check the parallelism

Figure 7B. Multi-unit abutments placed (30-degree places in the right premolar tilted implant to maintain parallelism with the other straight implants)

Prosthetic procedure

Two months following soft tissue healing, impression made, (Figure 8 A, B, C), jaw relation, jig and teeth setting trial done and (Figure 9 A, B) a hybrid screw retained titanium acrylic denture delivered (Figure 9 C).

After the end of the prosthetic treatment, a GБCT scan showed good integration of the implants (Figure 10).

The denture improves both cosmetic and function (Figure 11 A, B).

Figure 8A. 2 Months after mucosal healing

Figure 8B. Prosthetic phase open tray impression coping

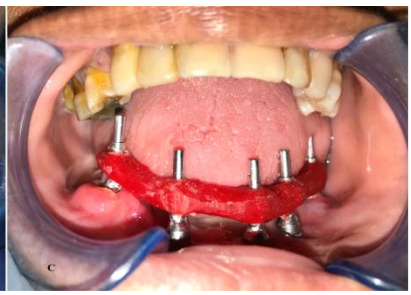

Figure 8C. Hybrid screw retained titanium acrylic denture delivered

Figure 9A. Jig trial, bite registration

Figure 9B. Teeth setting trial done

Figure 9C. Final prosthesis in situ

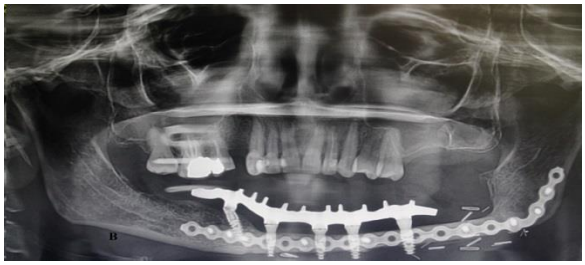

Figure 10. Post op OPG

Figure 11A. Front profile view, lip fullness seen after placement of the hybrid denture

Figure 11B. The denture improves both cosmetic and function

Discussion

Various reviews have shown that only about 15–25 % of patients who have been reconstructed end up with dental rehabilitation, the remainder of patients staying functionally crippled.[8] Reconstruction of segmental maxillary or mandibular defects can be reliably accomplished using osteocutaneous free flaps, most commonly the fibula. The osteocutaneous fibula free flap provides only bony and soft tissue covering of the defect, but does not re-establish the function (such as mastication) of these structures.[9] There is a patient need and demand for dental rehabilitation following resection and reconstruction of orofacial tumors. Full and complete rehabilitation of masticatory function may only be achieved by a final prosthetic restoration, leading to improvement of quality of life.

The benefits of implant-retained prosthesis have been recognized since several years. Dental implants may improve denture retention and stability without unnecessary loading of the vulnerable mucosa. Function, comfort, aesthetics, and eventually the quality of life can be improved.[10]

A previous cadaveric study revealed that the fibula bone has adequate width, thickness, and bone volume for dental implant placement that can withstand the biomechanical loads of mastication forces experienced throughout a lifetime.[13] In fact, a recent

retrospective study reported that the success rate of implants placed in fibula flaps was 92% with an average follow-up of 30 months.[11]

In this case report a two-stage mandibular reconstruction and rehabilitation approach was used. A screw retained implant supported titanium hybrid acrylic full arch prosthesis was placed on 5 implants following reconstruction of the mandible using a free fibula bone graft, the prosthesis was screwed on muti-unit abutments which were placed at the time of implant placement so that soft tissue was allowed to heal around them.

Currently, a one-piece abutment, which can be straight or angled, is commonly used. These definitive multi-unit abutment enable better hemidesmosomal adherence between the soft tissue and titanium and therefore might reduce bone resorption around the implants This "one abutment at one time" concept is especially advantageous in immediately restored implants for partial and full edentulous cases, whereas non removal of the multi-unit abutments placed at the time of surgery results in a statistically significant reduction in crestal bone resorption around the implants.[14]

Multi-unit abutments also enable an adequate parallelization, facilitating common insertion path for multi-unit, long-span, cross-arch restorations. When connecting several implants with a screw-retained implant restoration, there is a need for an interim part, a multi-unit abutment, to correct the differences in implant angles and to create a common path of insertion.[15]

The advantage of Screw-retained design of implant-based restorations allows for easy and nondestructive retrievability of the restoration for maintenance or repair procedures and contribution towards healthy peri-implant tissues. The added advantage of an acrylic hybrid denture is it compensates for vertical and horizontal discrepancy of the bone and soft tissue. Acrylic can be added to increase the fullness of the soft tissue on the face without drastically increasing the weight of the prosthesis.

Other techniques have been advocated for rehabilitation following reconstruction in the literature. Rohner et al shared their experience with prefabricated free flaps, which helped pave the way for the fibula jaw-in-a-day procedure. In this technique, implants and skin graft are placed on the fibula in situ and left there for 3 months for osseointegration. In a second-stage surgery, the fibula is harvested with the osseointegrated implants and an immediate provisional prosthesis is inserted.[16]

Levine et al reported on 4 patients for whom fibula free flap reconstruction with immediate dental implants and full dental rehabilitation was performed in 1 surgery. They coined the term 'jaw in a day' for the procedure which is an occlusion-driven reconstruction.[17]

Although further studies are needed to validate these findings, immediately placed implants appear to be safe at this time and serve as the rationale for the jaw-in-a-day procedure. The greatest and most obvious disadvantage of this technique is the loss of the investment in dental implants and the prosthesis should a flap failure occur.[17]

There are various treatment strategies to achieve different types of implant anchored prosthesis, and the treatment planning must be based on a cost-benefit analysis of the prosthesis for each patient.

We performed a delayed implant surgery as Insertion of implants into a fibula flap during one-stage reconstruction can compromise bone viability. The patient was explained the entire treatment plan in detail before the start of the treatment and also the pro and cons of immediate and delayed implant placement. The patient was comfortable in waiting for 6 months for rehabilitation following reconstruction. it was decided to go with a two-stage procedure.

The success of delayed loading when compared to immediate loading has been documented in the past delayed loading procedure guarantees that the implant is well protected during its incorporation in bone when the osseous interface has not been established properly, as evidenced from experimental and clinical studies.[18]

The primary objected was to get the patient disease free once the tumor was removed and reconstructed. We essentially treated the fibula-reconstructed mandible the same way as an edentulous mandible and followed all prosthetic steps as in a normal mandible rehabilitation.

Conflict of interest

The authors declare no conflict of interest.

Funding

This research received no external funding.

Institutional Review Board Statement

The study was conducted by the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee).

Informed Consent Statement

Informed consent was obtained from patient involved in the study.

Data Availability Statement

Not applicable.

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ԻՄՊԼԱՆՏՆԵՐԻՆ ՖԻՔՍՎԱԾ ԱՄԲՈՂՋԱԿԱՆ ՕՐԹՈՊԵԴԻԿ ՌԵԱԲԻԼԻՏԱՑԻԱ ՍՏՈՐԻՆ ԾՆՈՏԻ ՎԵՐԱԿԱՆԳՆՈՒՄԻՑ ՀԵՏՈ՝ ՕԳՏԱԳՈՐԾԵԼՈՎ ԱՆՈԹԱՎՈՐՎԱԾ ՖԻԲՈՒԼԱՅԻ ՈՍԿՐԱՅԻՆ ՓՈԽՊԱՏՎԱՍՏ

Գագան Սաբհարվալ,[1] Ամիտաբ Սինխ,[2] Ռաշմի Թանեջա,[3] Ռավի Ս. Բաթրա,[4] Ռաջիվ Չուղ [5]

[1] Բերանի և դիմածնոտային վիրաբույժի խորհրդատու, Ֆորտիսի Հետազոտական ինստիտուտ, Գուրգաոն, Հարյանա

[2] Պլաստիկ և վերականգնողական վիրաբուժության խորհրդատու, Ֆորտիսի Հետազոտական ինստիտուտ, Գուրգաոն, Հարյանա

[3] Պլաստիկ վիրաբուժության ամերիկյան խորհրդի անդամ, Խորհրդատու վիրաբուժություն, Ֆորտիսի Հետազոտական ինստիտուտ,Ռաջան Դհալի հիվանդանոց, Նյու Դելի

[4] Բերանի և դիմածնոտային վիրաբույժի խորհրդատու, Ֆորտիսի Հետազոտական ինստիտուտ, Գուրգաոն, Հարյանա

[5] Պրոֆեսոր, Հնդկական ատամնաբուժական ասոցիացիայի ընտրված նախագահ, տնօրեն, Դոկտոր Չուղի ատամնաբուժական կենտրոն, Նյու Դելի, Հնդկաստան

Ամփոփում

Վերականգնված ստորին ծնոտներում իմպլանտներով օրթոպեդիկ վերականգնումը սովորական պրոցեդուրա է, բուժման և պրոթեզավորման բազմաթիվ տարբերակներ փաստագրված են գրականության մեջ: Ծամող ֆունկցիայի ամբողջական վերականգնումը կարող է իրականացվել միայն վերջնական պրոթեզային վերականգնմամբ, ինչը կհանգեցնի ընդհանուր բարեկեցության բարելավմանը: Մենք ներկայացնում ենք 5 իմպլանտների և ակրիլային տիտանի հիբրիդային պտուտակով ամրացված պրոթեզի միջոցով անոթավորված ֆիբուլայի ոսկրային փոխպատվաստով վերականգնված ստորին ծնոտի ատամների ամբողջական վերականգնման դեպք: Հիբրիդային պրոթեզն օգնում է փոխհատուցել ոսկրերի և

փափուկ հյուսվածքների ուղղահայաց և հորիզոնական անհամապատասխանությունը, ինչպես նաև թույլ է տալիս հեշտ վերականգնում կատարել պահպանման կամ վերականգնման համար և նպաստում է առողջ պերիիմպլանտային հյուսվածքին:

Իմպլանտներին ֆիքսված ամբողջական օրթոպեդիկ պրոթեզը աջակցում է անոթային ոսկրային փոխպատվաստումով ստորին ծնոտի վերականգնմանը:

ОПИРАЮЩИЙ НА ИМПЛАНТОВ НЕСЪЕМНАЯ ПОЛНАЯ ОРТОПЕДИЧЕСКАЯ РЕАБИЛИТАЦИЯ ПОСЛЕ РЕКОНСТРУКЦИИ НИЖНЕЙ ЧЕЛЮСТИ С ИСПОЛЬЗОВАНИЕМ ВАСКУЛЯРИЗИРОВАННОГО КОСТНОГО ТРАНСПЛАНТАТА МАЛОБЕРЦОВОЙ КОСТИ

Гаган Сабхарвал,[1] Амитабх Сингх,[2] Рашми Танеджа,[3] Рави С. Батра,[4] Раджив К. Чуг [5]

[1] Консультант челюстно-лицевого хирурга, Исследовательский институт Fortis, Гургаон, Харьяна
[2] Консультант по пластической и реконструктивной хирургии, Исследовательский институт Fortis, Гургаон, Харьяна
[3] Член Американского совета пластической хирургии, консультант по хирургии, Исследовательский институт Fortis, больница Раджан Дхал, Нью-Дели
[4] Консультант челюстно-лицевой хирург, Научно-исследовательский институт Fortis, Гургаон, Харьяна
[5] Профессор, избранный президент Индийской стоматологической ассоциации, директор, д-р. Стоматологический центр Чуга, Нью-Дели, Индия

Резюме

Стоматологическая реабилитация с помощью остеоинтегрированных имплантатов в реконструированных нижних челюстях является распространенной процедурой, в литературе описано множество вариантов лечения и протезирования. Полная реабилитация жевательной функции может быть достигнута только при окончательном протезировании, что приводит к улучшению общего самочувствия. Здесь мы сообщаем о случае полной стоматологической реабилитации реконструированной васкуляризированной малоберцовой кости нижней челюсти с использованием 5 имплантатов, мультиюнитного абатмента и протеза с гибридной акриловой титановой винтовой фиксацией. Гибридный протез помогает компенсировать вертикальное и горизонтальное несоответствие костей и мягких тканей, а также позволяет легко извлекаться для обслуживания или ремонта и способствует здоровой ткани вокруг имплантата.

Sabharwal G, Singh A, Taneja R, Batra RS, Chugh RK. Full arch implant supported fixed prosthetic rehabilitation following mandibular reconstruction with vascularized fibula bone graft. *Bulletin of Stomatology and Maxillofacial Surgery*. 2023;19(2):145-153. doi: 10.58240/1829006X-2023.19.2-145