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Case Report

Design–computer-aided manufacturing guided implant-supported prosthesis in a fibular graft reconstructed mandible: A 7-year follow-up of a case

Alka Gupta[1], Deepak Agrawal[2], Deshraj Jain[1], Unnati Gedam[1], Amit Varma[2]

Departments of [1]Prosthodontics, Crown and Bridge and Implantology and [2]Oral and Maxillofacial Surgery, Government College of Dentistry, Indore, Madhya Pradesh, India

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Address for correspondence:
Dr. Unnati Gedam, Government College of Dentistry, 1, Sardar Patel Marg, Opposite M.Y. Hospital, Indore, Madhya Pradesh, India.
E-mail: udgedam1994@gmail.com

ABSTRACT

Reconstruction of functional occlusion in case of a large surgical defect of the mandible involving partial mandibulectomy remains a significant challenge to the maxillofacial surgeon and prosthodontist. Removable appliances and the conventional implant-supported prosthesis are precluded in this case due to the absence of normal anatomical contours of the bone. In recent years, due to the advancement of technology, bone graft reconstruction with computer-guided rehabilitation of the functional occlusion has been advocated to reverse the debilitating effects of the hemimandibulectomy defect. This clinical report describes the prosthodontic management of fibular graft reconstructed mandible by computer-aided design–computer-aided manufacturing guided implant-supported prosthesis.

Key Words: Case report, computer-aided design–computer-aided manufacturing, dental prosthesis, implant supported, mandibular reconstruction

INTRODUCTION

The mandible is the most common site for odontogenic tumors which often requires the resection of a large portion of the mandible. If mandibular continuity is not restored during surgical closure of wound, the remaining mandibular segment will retrude and deviate toward the surgical site at the vertical dimensions of rest.[1] The mandible is a single bone that creates peripheral boundaries of the floor of the mouth, speech, swallowing, mastication, and respiration. One of the most challenging and demanding maxillofacial endeavors is the construction of a functional dental prosthesis for an edentulous patient who has undergone a mandibular resection.

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There are few cases reports that present a long-term follow-up of these cases and discuss their challenges and complications. This case report describes prosthodontic management of fibular graft reconstructed mandible by computer-aided design–computer-aided manufacturing (CAD-CAM) guided implant-supported prosthesis.

CASE REPORT

Case presentation

A 14-year-old female reported to the Postgraduate Department of Prosthodontics, Government College of

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Dentistry, Indore, Madhya Pradesh, for rehabilitation after having surgery for a tumor. The patient had a chief complaint of difficulty in chewing food due to deviation of the jaw and missing teeth. She wanted the replacement of teeth.

Detailed history revealed that the patient had a history of swelling on the right side of the face which was later diagnosed as odontogenic myxoma of the right side mandible involving its inferior border, and thus, right side hemimandibulectomy was performed in the year 2016. The maxillofacial surgeon at Government College of Dentistry Indore, Madhya Pradesh, performed hemimandibulectomy of right side up to left canine and performed an immediate reconstruction with free fibula graft. The bone segment was placed and contoured to depict the contour of the mandible. The graft was fixed to the mandible with reconstruction plates.

Extraoral examination revealed facial asymmetry, deviation of the lower third of the face toward the right, and reduced mouth opening [Figure 1]. Intraoral examination revealed loosely attached bulky surgically grafted flap seen on the resected side, missing teeth 31–33 and 41–47. The maxillary arch was intact [Figure 2]. After detailed extraoral and intraoral examination, the patient was advised for orthopantomogram (OPG). The radiograph revealed a reconstructed mandible with fibular graft and placement of reconstruction plates. After reconstruction of the mandible by vascularized bone graft, sufficient time for a healing period was given for about 9 months. Subsequently, the implant-supported fixed prosthesis was planned as the treatment of choice.

The prosthodontic management was done which includes the following steps:

Step no. 1: Diagnostic impressions were made using rubber base impression material (Flexceed, Vinyl Polysiloxane, Indore, Madhya Pradesh). Both the impressions were sent to DIO Navi laboratory for fabrication of record base having CBCT radio marker. Jaw relation was established using a record base having radiopaque markers and verified the correct seating of record base using the software.

Step no. 2: Surgical planning of implant placement was carried out considering bone availability, the number of implants, size of implant, and position of the implant. According to the jaw relation established, CAD-CAM planning of implant placement was

Figure 1: Extraoral image before prosthetic rehabilitation.

Figure 2: Intraoral clinical situation after surgery and before prosthetic rehabilitation.

decided at positions 33, 42, 45, and 46. All the four implants planned were 4.5 mm × 7 mm and with a sleeve offset of 12 mm except for the implant planned in position 45 which had a sleeve offset of 10.5 mm [Figure 3].

Step no. 3: According to the planned implant position, a surgical stent was fabricated using Dio Navi software and rechecked in the patient's mouth [Figure 4].

Step no. 4: Surgical procedure for implant placement was carried out with the help of a prefabricated stent following strict protocols of implant system for drilling sequence. All four implants were placed sequentially, and an orthopantomogram was taken to confirm the position of the implants. Cover screws were placed. The patient was left for a healing period of 6 months [Figure 5].

Step no. 5: The patient was recalled after 6 months and evaluated. OPG was taken and integration of the implant to the bone seemed satisfactory. Second stage

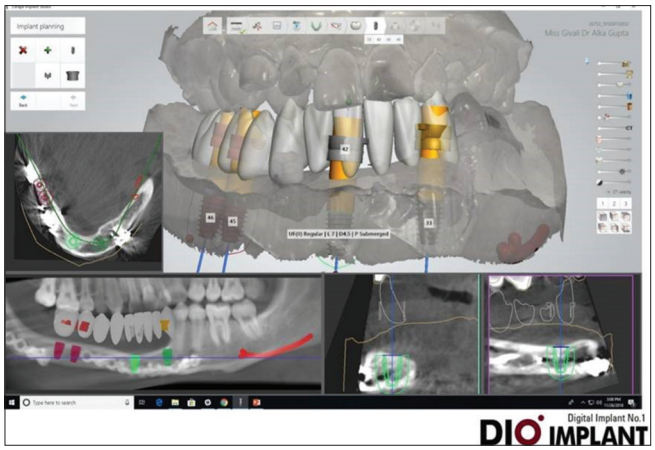

Figure 3: Computer-aided design–computer-aided manufacturing planning for implants placement at positions 33, 42, 45, and 46.

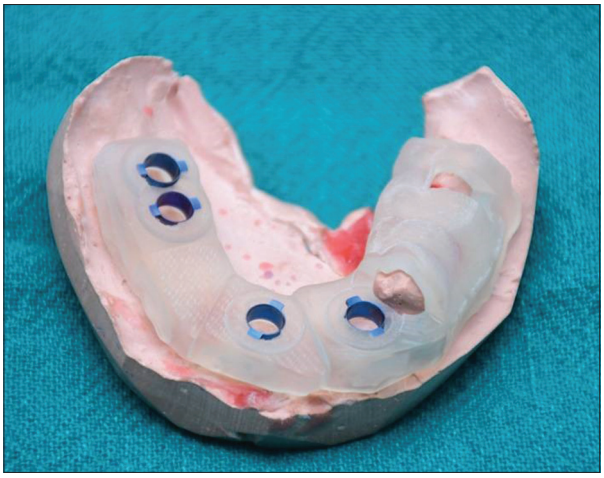

Figure 4: Prefabricated surgical stent sent by the laboratory.

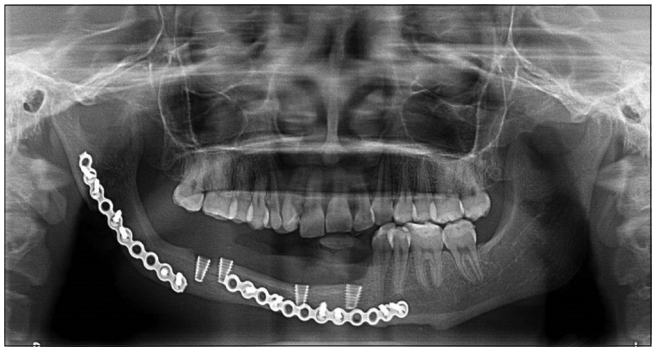

Figure 5: Panoramic radiograph after implant placement.

surgery was done, and healing caps were placed. OPG was again taken to confirm the position of the healing caps.

Step no. 6: While making impressions for prosthesis, as there was fibular grafting done at the time of alveolar reconstruction which led to flabby tissue with no vestibular depth, this would lead to difficulty in managing oral hygiene around the implants. Debulking and soft-tissue grafting were considered an option to increase the vestibular depth and attached the gingival collar around the implants. A partial-thickness incision was given on the palate bilaterally using a 15-C blade to increase the free gingival graft. Guided tissue regeneration was placed, and a free gingival graft was sutured using 5-0 resorbable vicryl sutures to stabilize the graft. The patient was given a Hawley's retainer in the mouth to cover the donor maxillary site. The patient was recalled after 3 weeks for the final impression.

Step no. 7: The final impression was made using splinted open tray impression technique. The open tray impression copings were attached to the implants. Complete seating of the impression copings was verified through OPG. The impression coping was stabilized with the floss and then splinted with pattern resin (Luxatemp, Indore, Madhya Pradesh) [Figure 6]. After the complete set of the pattern resin, the impression tray was checked for proper passage of the impression copings. Once the tray was verified, a pick-up impression was made with rubber base impression material (Flexceed, Vinyl Polysiloxane, Indore, Madhya Pradesh) [Figure 7].

Step no. 8: Verification of implant position by reseating the splinted open tray impression copings intraorally was done and sent back to the laboratory for fabrication of screw-retained metal-ceramic prosthesis.

Step no. 9: After confirming the implant position, temporization was planned. A wax trial was done, and a putty index was made for the fabrication of provisional restorations. Tooth-colored autopolymerizing resin (DPI, Cold Cure acrylic resin, Indore, Madhya Pradesh) was mixed and placed in the putty index. Provisional restoration was thus fabricated using indirect technique and placed in the patient's mouth [Figure 8].

Step no. 10: The definitive prosthesis was fabricated of metal-ceramic and checked in the patient's mouth. Occlusal adjustments were done to achieve implant-protected occlusion, and the final screw-retained prosthesis was delivered to the patient [Figures 9 and 10].

DISCUSSION

Rehabilitation of the defect with dental implants has changed the way that reconstructive surgeon

Figure 6: Splinting of impression copings with dental floss and pattern resin.

Figure 7: Impression made with open tray impression technique using addition silicone impression material.

Figure 8: Provisional restoration *in situ.*

Figure 9: Definitive prosthesis.

approaches the intraoral soft tissues. The prosthodontic rehabilitation of the reconstructed area restores form, function, comfort, and esthetics of the debilitated patients.

There are several documented advantages of using a free fibular microvascular flap for mandibular reconstruction.[2,3] The literature also reports an excellent potential prognosis for implant-supported prostheses with the long-term survival and success rates of implants placed in reconstructed jaws ranging from 86% to 99%.[4-7]

The implant-supported fixed restoration is often considered the treatment of choice for patients following jaw resection/reconstruction. Here, we have completely digitalized the whole treatment process using Dio Navi Implant System. The digital implant system increases the accuracy of the implant treatment and enabled 3D simulation that is used for the patient counsel process. These implants can withstand the highest load because the crown is designed first in consideration of occlusion and stress diversion, followed by fixture placement.[8]

Over a period of 2 years, the patient reported great comfort and ability to function with the prosthetic reconstruction. The patient accepted the prosthesis easily. The patient reported the ability to eat most of the normal to near-normal diet. The fixed prosthesis helped in psychological comfort which in turn had a positive impact on the patient's confidence level.

The reconstructed mandible acted as a stable platform for tongue mobility. Thus, the patient showed excellent speech quality postoperatively. Postoperatively, there was a significant change in the patient's profile, facial proportions, and symmetry. Over a 2-year follow-up period, there was no detectable distortion to the outcome achieved. Radiographically, the grafted

Figure 10: Postoperative.

bone did not show any significant change and was uniformly stable. These outcomes had a significant effect from a quality of life standpoint.

CONCLUSION

The CAD-CAM system is initially expensive, but it provides precision work and patient comfort. The use of fibular flaps to restore lower jaw defects after tumor ablation is a viable procedure with good long-term results. This case report showed that implant treatment is beneficial in improving patients masticatory efficiency and providing satisfactory quality of life. Thus, prosthodontists and reconstructive surgeons should work together to achieve the best possible outcomes for patients requiring mandibular resection and reconstruction.

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Department of Plastic Surgery, MY Hospital Indore Madhya Pradesh, Department of Periodontology, Government College of Dentistry, Indore, Madhya Pradesh.

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Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or non-financial in this article.

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