Case Report

Assessment of Oral Health-Related Quality of Life for Complex Mandibular Defects Rehabilitated with Computer-guided Implant Restoration

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Abstract

The individuals who have been afflicted with mandibular defects involving soft and hard tissue loss are subjected to functional ,psychological and social consequences. Rehabilitation is of prime importance in restoring self confidence and improving the quality of life. Complex mandibular defects can be successfully rehabilitated with the three dimensional (3D) computerized diagnostic technique (Simplant-Dentsply sirona implant). one of the important tools for measuring the oral health status by scale knows as oral health impact profile (OHIP). OHIP is a scale particularly designed to measure the quality of life and its influence pertaining to functional and psychological aspects. This report describes the prosthetic rehabilitation posttraumatic mandibular defect with 3D SimPlant software and stereolithography. With the application of computer-aided design/computer-aided manufacturing technology, guided implant prosthesis could definitely improve masticatory performance and esthetics, thereby enhancing oral health-related quality of life.

Keywords: *Computer-aided design/computer-aided manufacturing, customized abutment (UCLA), rapid prototyping, SimPlant, stereolithography*

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Introduction

Rehabilitation of maxillofacial structures becomes a more challenging task because of the complex anatomy and the defects involving various vital structures. Mandibular defects mainly due to trauma often results in strong impact on functional, psychological, and aesthetic well being of the individuals. The ultimate goals of rehabilitation are mainly to restore maxillomandibular relationship, occlusion, function, and esthetics.

There are numerous treatment modalities available for restoring mandibular defects. Routine treatment options for mandibular defects include the use of conventional tooth/tissue-supported prosthesis and implant-retained/supported prosthesis. Meanwhile, with conventional prosthodontic rehabilitation, patients regain some mastication ability; they gain the most favorable masticatory outcomes with implant-retained prosthodontic treatment. Removable dental prosthesis may not be the suitable treatment option due to the insufficient keratinized tissue, poor tissue tolerance and the presence of skin graft. Dental implants[5] are considered to be a predictable treatment for restoring mandibular defects. Accurate preoperative planning of implant size and location and designing of restorations are successfully possible only with advanced computer-aided design/computer-aided manufacturing (CAD/CAM) technology.[6]

The primary goal of rehabilitation of these defects is to enhance the quality of life. Quality of life[7] has become the focus of attention during recent years in maxillofacial defects; patient's psychological well-being and the patients' vitality are increasingly contributing to the evaluation of therapeutical success.

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The oral health impact profile[8] (OHIP) is a specifically designed scale to assess the impact of oral health on psychological well-being and quality of life. This clinical report describes the assessment of oral health-related quality of life (OHRQoL) for complex mandibular defects rehabilitated with computer-guided implant restoration.

Case Report

A young male patient aged 23 years reported to the Department of Prosthodontics and Crown and Bridge of Vinayaka Mission's Sankarachariyar Dental College, Salem, Tamil Nadu, India, with a right-side defect of his mandible.

The patient met with a road traffic accident roughly about 4 years back and had been treated with various surgeries to correct the mandibular defects. Informed consent was obtained. Thorough clinical and radiographic examination revealed extensive buccal and lingual soft-tissue loss and alveolar bone loss of mandibular right-sided region [Figure 1a and b]. The right-sided central incisors, lateral incisors, canine, premolars, and 1st molar were missing. All other remaining teeth in the mandibular arch were clinically healthy.

The patient was thoroughly evaluated, and appropriate treatment modalities were recommended. Due to the inadequate keratinized tissue and lack of soft- and hard-tissue support and patient's desires, removable dental prosthesis may not be the ideal solution. In spite of significant bone loss, considering dental implants to be the ideal treatment option, implant-supported fixed dental prosthesis was planned with three implants. A treatment was planned with Simplant guided surgery (Densply- Sirona implants) for determining the position and size of endosseous root form implants (BioHorizons implant system) [Figures 2 and 3].

Maxillary and mandibular alginate (irreversible hydrocolloid) impressions were made and poured with type IV die stone for fabrication of surgical guide's template. The planned implant size in region of 1st molar, premolar, and canine was 4.6/9 mm, 3.8/10.5 mm, and 3.8/10.5 mm, respectively. Based on the planned implant size, 3-resin model surgical guide templates were designed and fabricated with stereolithography [Figure 4]. The patient was comfortably seated and inferior alveolar nerve block was administered at the site of implant placement. The implants were guided with tooth supported surgical guides [Figure 5] and three endosseous implants were placed in molar, premolar and canine region. The cover screw were then placed on the implants and surgical site were sutured with 3-0 silk, simple interrupted sutures [Figure 6 and 7]. Final implant positions were evaluated

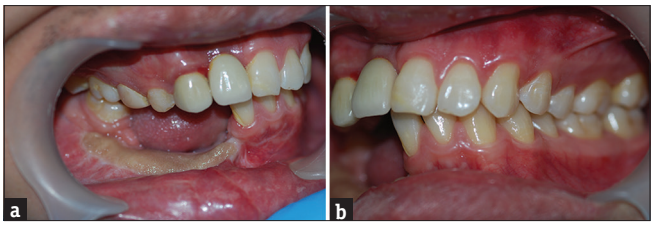

Figure 1: Pretreatment intraoral condition of the right mandibular continuity defects (a, right lateral view and b, left lateral view)

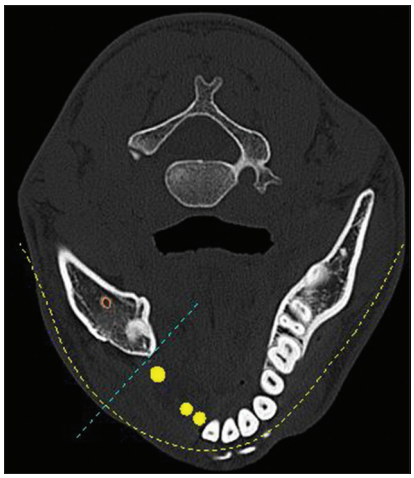

Figure 2: Planning and positioning of implants using Simplant software

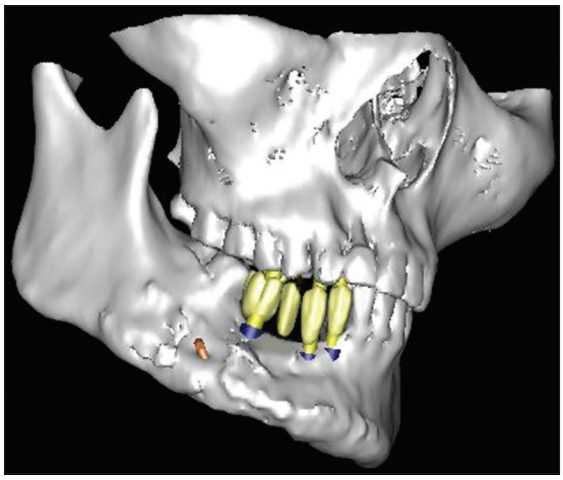

Figure 3: Planning and designing of restoration using Simplant software

with panoramic radiograph [Figure 8]. The patient was recalled after 5 months for placement of gingival healing abutments [Figure 9]. Final impressions were made with polyvinyl siloxane (putty-wash) impression technique 10 days after placement of healing abutment [Figure 10]. Basic maxillomandibular relationship is maintained in continuity defect, and the records were obtained using the bite block and bite registration material. The master casts were then transferred to a semi-adjustable articulator (Hanau Wide-Vue). Since the vertical height of defect was >15 mm in length, customized abutments [Figure

11] (UCLA) were planned and definitive prostheses were fabricated. Four-unit metal ceramic restorations (FP-3) were cemented, and follow-up instructions were provided [Figure 12a and b]. Postoral hygiene maintenance instructions were given.

OHRQoL was assessed for a period of 2 weeks and 3 months of prosthesis function using obturator functioning scale and OHIP. Significant improvement was observed in functional, physical, psychological, and social subscales of OHIP.

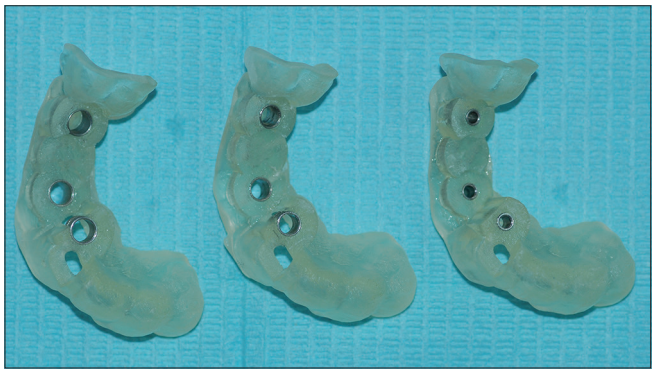

Figure 4: Resin-based surgical guides fabricated by stereolithography technology

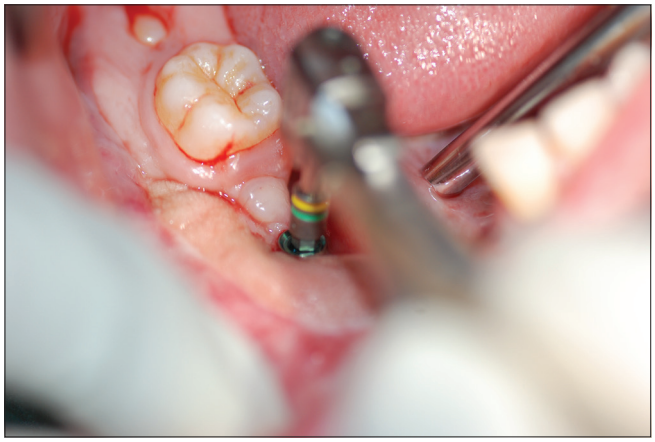

Figure 6: Placement of endosseous implant by surgical guide sequences

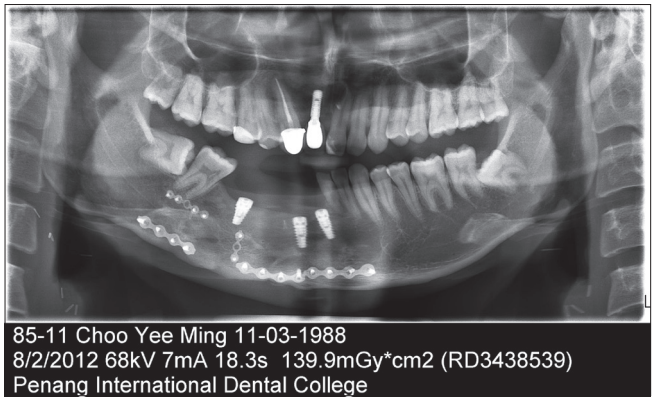

Figure 8: Panoramic radiograph of endosseous implants after placement

No clinical complications were observed during the 2-year follow-up period.

Discussion

Rehabilitation of mandibular defects is challenging due to the complex anatomy and the defects involving various vital structures.[9] The primary aim of restoration is mainly to restore function, occlusal relationship, and appearance.[10,11]

Figure 5: Position of tooth-supported surgical guides

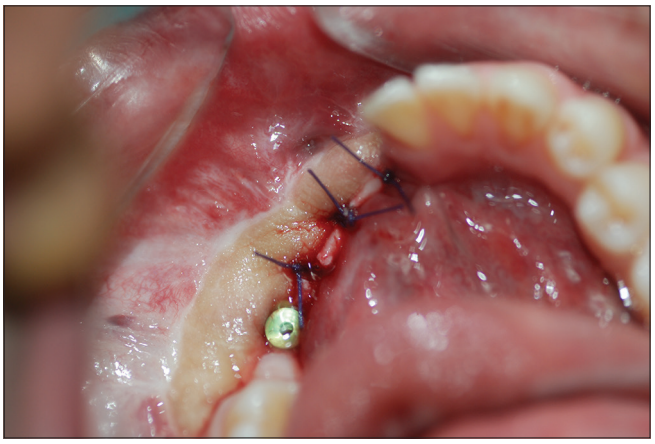

Figure 7: Implant placement with cover screw

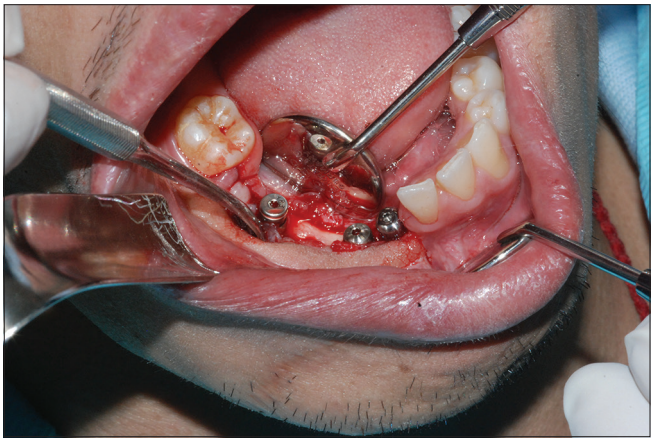

Figure 9: Healing abutment placement

Figure 10: Position of ball abutment for impression making

Figure 11: Customized UCLA abutment

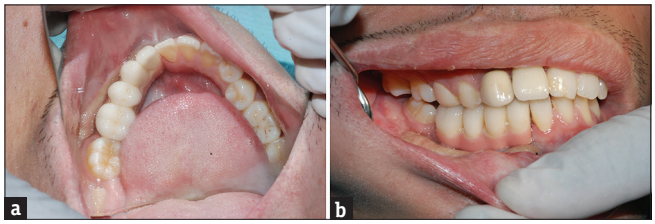

Figure 12: Final restoration in place (a, occlusal view and b, right lateral view)

Results are promising with advanced diagnostic technology by precise preoperative planning and designing of patient-specific implant location and restorations preoperatively and thereby exhibiting excellent esthetic and functional outcomes.[12-14]

This case report provides a simple method for rehabilitation of complex three-dimensional (3D) structures with advanced computerized technology. The use of rapid prototyping 3D stereolithography models[15,16] has revolutionized the way of reconstruction for planning of complex craniofacial structures.

To fabricate a customized stereolithographic drill guide,[17,18] the cone-beam computed tomography (CBCT) with Simplant, a software to easy facilitate, is very helpful. The planned surgical drill guide helps in accurate placement of implant which is otherwise a very difficult and cumbersome procedure.[19] The treatment outcome becomes more predictable for both the patient and the clinician. Prosthetically driven implantology is possible only with 3D Implant planning with Simplant software in complex mandibulectomy patients.[20,21]

With the CBCT, the anatomical structures which are close to the site such as teeth, sinus, nerves, and arteries can be assessed accurately and planned, and even the best soft-tissue thickness can be measured and planned accordingly with Simplant guide.[22] The treatment plan with Simplant indirectly helps in the OHRQoL of the patients because it simplifies the procedure, thereby minimizing the complications and surgical abuse.

John *et al*. characterized the index OHRQoL. OHIP is a self-administered instrument and a specifically designed scale to measure the impact of oral health on psychological well-being and quality of life.

In this clinical procedure, there was a significant improvement in OHRQoL after rehabilitation with implant-supported mandibular prosthesis.

Conclusion

The important aspect in rehabilitation of complex mandibular defects involves careful, thorough evaluation of the patient's anatomy to describe the full extent of the existing or proposed defect.

Advances in technologies can be very useful when formulating a plan and design of the implant restoration for mandibular defects.

CAD/CAM systems have been used for restoring complex mandibular defects with implant-supported fixed restorations because they facilitate the accurate position of endosseous implants and design of fixed restorations.

Clinical applications

CAD/CAM technology is applied in creating a successful implant-supported restoration in complex mandibular defects with respect to masticatory ability, structural balance, occlusal equilibrium, and esthetics. Thereby, it helps improve the quality of life of patients.

Declaration of patient consent

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

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Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Cantor R, Curtis TA. Prosthetic management of edentulous mandibulectomy patients. I. Anatomic, physiologic, and psychologic considerations. J Prosthet Dent 1971;25:446-57.s
2. Beumer J 3rd, Marunick MT, Curtis TA, Roumanas E. Acquired defects of the mandible: Etiology, treatment, and rehabilitation. Maxillofacial Rehabilitation: Prosthodontic and Surgical Considerations. St. Louis: Ishiyaku Euro America; 1996. p. 113-224.
3. Jacob RF. Prosthodontic rehabilitation of the mandibulectomy patient. In: Taylor TD, editor. Clinical Maxillofacial Prosthetics. Chicago: Quintessence; 2000. p. 171-88.
4. Schrott AR, Jimenez M, Hwang JW, Fiorellini J, Weber HP. Five-year evaluation of the influence of keratinized mucosa on peri-implant soft-tissue health and stability around implants supporting full-arch mandibular fixed prostheses. Clin Oral Implants Res 2009;20:1170-7.
5. Adell R, Eriksson B, Lekholm U, Brånemark PI, Jemt T. Long-term follow-up study of osseointegrated implants in the treatment of totally edentulous jaws. Int J Oral Maxillofac Implants 1990;5:347-59.
6. Reshad M, Cascione D, Aalam AA. Fabrication of the mandibular implant-supported fixed restoration using CAD/CAM technology: A clinical report. J Prosthet Dent 2009;102:271-8.
7. Landes CA. Zygoma implant-supported midfacial prosthetic rehabilitation: A 4-year follow-up study including assessment of quality of life. Clin Oral Implants Res 2005;16:313-25.
8. Allen PF, Locker D. Do item weights matter? An assessment using the oral health impact profile. Community Dent Health 1997;14:133-8.
9. Cecchinato D, Marino M, Lindhe J. Bone loss at implants and teeth in the same segment of the dentition in partially dentate subjects. Clin Oral Implants Res 2017;28:626-30.
10. Marunick M, Mathes B, Klein B. Masticatory function in hemimandibulectomy patients. J Oral Rehab 1992;19:289-95.
11. Aramany M, Myers E. Dental occlusion and arch relationship in segmental resection of the mandible. In: Sisson GA, Tardy ME, editors. Plastic and Reconstructive Surgery of the Face and Neck. Proceedings of the Second International Symposium. New York: Grune and Stratton Inc.; 1974.
12. Bazrafshan N, Darby I. Retrospective success and survival rates of dental implants placed with simultaneous bone augmentation in partially edentulous patients. Clin Oral Implants Res 2014;25:768-73.
13. Benic GI, Thoma DS, Muñoz F, Sanz Martin I, Jung RE, Hämmerle CH, *et al.* Guided bone regeneration of peri-implant defects with particulated and block xenogenic bone substitutes. Clin Oral Implants Res 2016;27:567-76.
14. Borges T, Lima T, Carvalho A, Dourado C, Carvalho V. The influence of customized abutments and custom metal abutments on the presence of the interproximal papilla at implants inserted in single-unit gaps: A 1-year prospective clinical study. Clin Oral Implants Res 2014;25:1222-7.
15. Biyani R, Ali M, Belles D, Powers JM. Effect of metal extension of crown in the screw access channel of a posterior implant abutment on the retention of cement retained prosthesis. J Oral Implantol 2015;41:537-41.
16. Tepper OM, Sorice S, Hershman GN, Saadeh P, Levine JP, Hirsch D, *et al.* Use of virtual 3-dimensional surgery in post-traumatic craniomaxillofacial reconstruction. J Oral Maxillofac Surg 2011;69:733-41.
17. Saad A, Winters R, Wise MW, Dupin CL, St. Hilaire H. Virtual surgical planning in complex composite maxillofacial reconstruction. Plast Reconstr Surg 2013;132:626-33.
18. Wen X, Gao S, Feng J, Li S, Gao R, Zhang G, *et al.* Chest-wall reconstruction with a customized titanium-alloy prosthesis fabricated by 3D printing and rapid prototyping. J Cardiothorac Surg 2018;13:4.
19. Cho HR, Roh TS, Shim KW, Kim YO, Lew DH, Yun IS, *et al.* Skull reconstruction with custom made three-dimensional titanium implant. Arch Craniofac Surg 2015;16:11-6.
20. Lara-Mendes ST, Barbosa CF, Santa-Rosa CC, Machado VC. Guided endodontic access in maxillary molars using cone-beam computed tomography and computer-aided design/Computer-aided manufacturing system: A case report. J Endod 2018. pii: S0099-2399(18) 30088-8.
21. Zheng SN, Yao QQ, Mao FY, Zheng PF, Tian SC, Li JY, *et al.* Application of 3D printing rapid prototyping-assisted percutaneous fixation in the treatment of intertrochanteric fracture. Exp Ther Med 2017;14:3644-50.
22. Cha JH, Lee YH, Ruy WC, Roe Y, Moon MH, Jung SG, *et al.* Application of rapid prototyping technique and intraoperative navigation system for the repair and reconstruction of orbital wall fractures. Arch Craniofac Surg 2016;17:146-53.