

Dental Implant Placement Procedure with Simultaneous Bone Augmentation: A Case Report and Literature Review

Sahu S¹, Gupta S², Govindraj S³, Rajambigai MA³, Ranganathan K⁴, Shelvan S⁵, Nayyar AS⁶

¹Department of Oral and Maxillofacial Surgery, HiTech Dental College and Hospital, Bhubaneswar, Odisha, ²Department of Conservative Dentistry and Endodontics, Sudha Rustagi College of Dental Science and Research, Faridabad, Haryana, ³Department of Prosthodontics and Crown and Bridge, Rajas Dental College and Hospital, Tirunelveli, ⁴Department of Prosthodontics and Crown and Bridge, Rajah Muthiah Dental College and Hospital, Annamalai University, Annamalai Nagar, ⁵Department of Periodontology and Implantology, Ragas Dental College and Hospital, Chennai, Tamil Nadu, ⁶Department of Oral Medicine and Radiology, Postgraduate Research Institute, Saraswati Dhanwantari Dental College and Hospital, Parbhani, Maharashtra, India

ABSTRACT

Bone grafting techniques often constitute the mainstay of treatment used in the restoration of the atrophic maxillary bone before the placement of dental implants. Bone grafting can be achieved with various types of grafting materials; natural or synthetic, though, autogenous bone grafts are still considered the gold standard because of their osteogenic, osteoinductive and osteoconductive properties. The present case report describes the case of a 35-year-old female patient who presented with missing right maxillary central incisor secondary to trauma. Clinical and radiographic examination revealed a severe bone defect requiring a bone augmentation procedure. Hence, guided bone regeneration of the maxillary defect was planned with simultaneous placement of endosseous implant. The present case report, thus, demonstrates the successful use of vertical and horizontal bone augmentation procedures conducted with the help of guided tissue regeneration and simultaneous endosseous implant placement.

Key words: Dental implant therapy, endosseous implants, guided tissue regeneration, vertical and horizontal bone augmentation procedures

How to cite this article: Sahu S, Gupta S, Govindraj S, Rajambigai MA, Ranganathan K, Shelvan S, *et al.* Dental implant placement procedure with simultaneous bone augmentation: A case report and literature review. *Niger J Health Sci* 2018;18:72-6.

INTRODUCTION

Dental implantology has been considered one of the most accepted treatment modalities for the rehabilitation of edentulous spans of the alveolar bones after the loss of teeth. The resorption of alveolar bone that ensues after the loss of teeth due to a lack of masticatory load is the primary concern in this regard.¹ The solution to this problem is by re-establishing the ridge volume consistent with the prosthetic treatment procedure required to restore the missing teeth. The amount of remaining bone along with the quality of the bone remaining decides the long-term stability of the implants placed.² Atrophy of the maxillary bone may be caused by trauma, malignant diseases, oral infections, congenital absence of teeth or the tridimensional alveolar ridge resorption process

subsequent to following routine dental extractions. Bone grafting is an important procedure required in such situations for the rehabilitation of larger bone defects before the final placement of implants to restore function after the prosthetic rehabilitation of edentulous alveolar spans of the alveolar ridges.³ Bone grafting is accomplished with various types of grafting materials, which may be natural or synthetic, though, autogenous bone grafts are still considered the gold standard because of their osteogenic, osteoinductive and osteoconductive properties. Furthermore, autologous bone grafts exhibit the highest success rates compared to other bone substitutes.^{4,5} The technique used in the present case used autogenous bone blocks harvested at the time of surgery and is the most frequently used grafting technique because of its general clinical success and predictability in terms of

Submitted: 12-Sep-2019 Revised: 04-Jul-2020
Accepted: 30-Sep-2020 Published: 23-Mar-2022

Access this article online

Quick Response Code:



Website:
www.chs-journal.com

DOI:
10.4103/njhs.njhs_19_19

Address for correspondence: Dr. Nayyar AS,

Department of Oral Medicine and Radiology, Postgraduate Research Institute, Saraswati-Dhanwantari Dental College and Hospital, Parbhani, Maharashtra, India.

E-Mail: singhabhishekndls@gmail.com

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

the desired goals of the treatment. Furthermore, one of the important considerations for optimising bone regeneration in such techniques is space maintenance, for which collagen membranes are widely utilised during such procedures. The present case report, thus, demonstrates the successful use of vertical and horizontal bone augmentation procedures conducted with the help of guided tissue regeneration (GTR) and simultaneous endosseous implant placement.

CASE REPORT

The present case report describes the case of a 35-year-old female patient who presented with missing right maxillary central incisor, secondary to trauma. The patient was in good health with no significant medical history. Clinical [Figure 1] and radiographic examination revealed a severe bone defect requiring a bone augmentation procedure. The amount of bone available was inadequate for an implant-supported prosthesis. Hence, guided bone regeneration of the maxillary defect was planned with simultaneous placement of endosseous implant, while an autograft from the chin was planned, taking consent from the patient regarding creation of a second surgical site.



Figure 1: Pre-operative view of the defect

Surgical procedure

The complete surgical procedure was performed in sterile surgical conditions. Pre-operatively, the oral cavity was decontaminated using 0.2% chlorhexidine (CHX) mouthrinse for 1 min, and the peri-oral area was disinfected with 5% povidone-iodine solution. The site was anaesthetised using 2% lignocaine with 1:80,000 adrenaline. A full-thickness crestal incision, two crevicular incisions and a vertical releasing incision on the distal extent of the flap were made, and a full-thickness mucoperiosteal flap [Figure 2] was reflected. On reflection of the flap, the absence of the labial bone plate was observed with a deep vertical defect. A second surgical site in the lower labial sulcus was then created to collect an autograft from the mandibular symphysis region (chin bone in interforaminal region). The area was adequately anaesthetised using bilateral inferior alveolar nerve block and local infiltration with a local anaesthetic solution. A horizontal incision was made in the lower vestibule. The incision was directed in the apico-lingual direction towards the bone. Below this point, a full-thickness mucoperiosteal flap was reflected towards the base of the mandible keeping the most inferior aspect of the mentalis muscle intact. With the help of auto bone collector (HIOSEN Implant System), bone chips with adequate



Figure 2: Flap reflection (from the labial side of the defect)



Figure 3: Collection of autograft from the second surgical site using bone collector

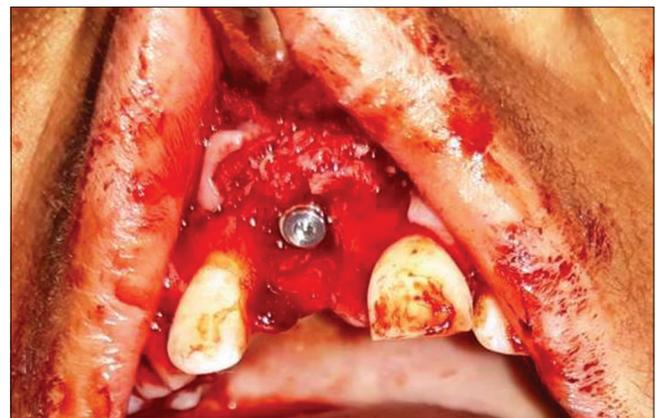


Figure 4: Implant placed at the primary surgical site with defect

thickness were collected from the chin bone [Figure 3]. The soft tissue superior to the initial access incision was elevated by few millimetres to reduce tension on the flap by oedema and lip movement. The vestibular incision was then sutured with non-resorbable sutures using interrupted suturing techniques. The osteotomy site for implant placement was then prepared. A standard 2 mm twist drill was used in the Myriad Equinox Implant System. A standard osteotomy was done with the pilot drill and twist drills along with direction indicators and depth gauges. A Myriad Equinox Implant (mm × mm) [Figure 4] was placed at the site. The cover screw was placed. The labial defect was grafted using a combination of chin autograft and hydroxyapatite graft (G-graft, Surgiwear, India). The graft was secured in place with a collagen membrane. Following this, the surgical site was closed with the flap, and primary wound closure was obtained with interrupted sutures. An immediate post-operative radiograph was taken as baseline for future comparisons to assess bone healing [Figure 5].

Post-surgical instructions and oral hygiene care

Post-surgical instructions were given to the patient. Chemical plaque control with 1% CHX (1 min mouthrinse 3 times a day) was instituted for 2 weeks along with amoxicillin 500 mg, 3 times a day for 5 days in addition to diclofenac 50 mg, 3 times a day for 3 days initially and then, on an as and when required basis thereafter. A weekly follow-up was done initially, while the sutures were removed after 10 days following an uneventful healing. This was followed by a once every month follow-up till 6 months when the site was inspected radiographically [Figure 6] for osseointegration, and the second stage surgery was performed with placement of the healing abutment. A metal–ceramic crown was, subsequently, fabricated and cemented.

DISCUSSION

The amount of residual alveolar bone as well as the quality of the remaining bone is the prime deciding factor for a successful implant-based treatment procedure. The anatomic

limitations of the residual alveolar bone may make the insertion of dental implants difficult in certain situations with severe ridge resorption. Implants placed into the alveolar bone sites, previously augmented with bone grafting procedures, have been associated with high success rates.^{6,7} The need for multiple surgeries with more procedural and post-procedural healing times, however, put a serious disadvantage in such staged procedures of implant placements.⁸⁻¹¹ Although not abundant, few case reports have reported successful treatment outcomes in cases where dental implant placement procedure was accomplished with simultaneous bone augmentation.¹²⁻¹⁶ The present case report demonstrates a similar case wherein the successful use of vertical and horizontal bone augmentation procedure was planned with GTR and simultaneous endosseous implant placement.

Autogenous bone blocks are considered the gold standard amongst the various grafting options available as far as the grafting materials are considered, especially when larger volumes of tissue restorations are required.¹⁷ Furthermore, iliac and calvarial autogenous bone grafts have often been seen to be associated with numerous complications including increased risk of post-surgical infections at the sites where such surgeries are performed apart from mobility impairment and hernias.¹⁸⁻²⁰ Autogenous chin grafts, on the contrary, have been proposed to be a reliable alternative for the management of severely defective socket bone tissues and thus used in the present case.²¹

The bone tissue obtained by means of bone collectors as was done in the present case was already in a particulate state, thus reducing the operation time and the probability of contamination since, in the present case, there was no bone crusher used. Furthermore, the use of the barrier membrane has been proposed to be an efficient way of preventing surface resorption. In the present case, collagen membrane was utilised for an effective guided bone regeneration (GTR) procedure. A plethora of *in vitro* studies on cell-scaffold interactions and tissue synthesis as well as *in vivo* studies have revealed the excellent biological performance of collagen in GTR procedures in the past.²²⁻²⁸ Furthermore, due to the hydrophilic properties of the collagen membranes, they are supposed to



Figure 5: Immediate post-operative radiograph



Figure 6: Post-operative radiograph taken at 6-month follow-up visit

stick to the bone surface once wetted either with saline or blood, further eliminating the need for fixation screws or tacks for stabilisation in most of the cases.^{29,30}

The usual protocol of conventional implant placement procedures, though, requires two surgical procedures: first, for bone augmentation and the second, for implant placement at an interval of about 3–4 months; however, in the present case, bone augmentation was done with simultaneous implant placement which saved the time for second invasive procedure. Furthermore, the bone collector used in the present study helped in conservative retrieval of the autograft. Thus, the surgical technique demonstrated here for obtaining particulate intra-oral autogenous bone material proved to be simple, efficient and safe. However, as autograft was used in the present study, morbidity of the second surgical site created for harvesting autograft was the major limitation.

CONCLUSION

Although the use of autogenous bone grafts presents considerable drawbacks including the need for creating a second surgical site for taking the bone, a limited quantity of the bone that can be obtained as well as unpredictable quality of the bone obtained, however, seeing the advantages and the healing and regeneration potential with least chances of rejection of the graft harvested mandate the need for further studies to be conducted ensuring long-term follow-ups in such cases to see the possible clinical outcomes and possible failures and the reasons behind to improve the technique for future cases.

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.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Andersson B, Odman P, Carlsson GE. A study of 184 consecutive patients referred for single-tooth replacement. *Clin Oral Implants Res* 1995;6:232-7.
- Buser D, Dahlin C, Schenk RK. *Guided Bone Regeneration in Implant Dentistry*. London, UK: Quintessence Publishing Company Inc.; 1995.
- Pereira E, Messias A, Dias R, Judas F, Salvoni A, Guerra F. Horizontal resorption of fresh-frozen corticocancellous bone blocks in the reconstruction of the atrophic maxilla at 5 months. *Clin Implant Dent Relat Res* 2015;17:e444-58.
- Zétola AL, Verbicaro T, Littieri S, Larson R, Giovanini AF, Deliberador TM. Recombinant human bone morphogenetic protein Type 2 in the reconstruction of atrophic maxilla: Case report with long-term follow-up. *J Indian Soc Periodontol* 2014;18:781-5.
- Albrektsson T, Johansson C. Osteoinduction, osteoconduction and osseointegration. *Eur Spine J* 2001;10:S96-101.
- Carinci F, Danza M. Clinical outcome of implants inserted in piezo split alveolar ridges: A pilot study. *Perspect Clin Dent* 2011;29-30.
- Franco M, Tropina E, de Santis B, Viscioni A, Rigo L, Guidi R, *et al.* A 2-year follow-up study on standard length implants inserted into alveolar bone sites augmented with homografts. *Stomatologija* 2008;10:127-32.
- Engquist B, Astrand P, Anzén B, Dahlgren S, Engquist E, Feldmann H, *et al.* Simplified methods of implant treatment in the edentulous lower jaw. A controlled prospective study. Part I: One-stage versus two-stage surgery. *Clin Implant Dent Relat Res* 2002;4:93-103.
- Esposito M, Grusovin MG, Polyzos IP, Felice P, Worthington HV. Timing of implant placement after tooth extraction: Immediate, immediate-delayed or delayed implants? A cochrane systematic review. *Eur J Oral Implantol* 2010;3:189-205.
- Engquist B, Astrand P, Anzén B, Dahlgren S, Engquist E, Feldmann H, *et al.* Simplified methods of implant treatment in the edentulous lower jaw: A 3-year follow-up report of a controlled prospective study of one-stage versus two-stage surgery and early loading. *Clin Implant Dent Relat Res* 2005;7:95-104.
- Koh RU, Rudek I, Wang HL. Immediate implant placement: Positives and negatives. *Implant Dent* 2010;19:98-108.
- Buser D, Chappuis V, Bornstein MM, Wittneben JG, Frei M, Belsler UC. Long-term stability of contour augmentation with early implant placement following single tooth extraction in the esthetic zone: A prospective, cross-sectional study in 41 patients with a 5- to 9-year follow-up. *J Periodontol* 2013;84:1517-27.
- 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.
- Boronat A, Carrillo C, Penarrocha M, Penarrocha M. Dental implants placed simultaneously with bone grafts in horizontal defects: A clinical retrospective study with 37 patients. *Int J Oral Maxillofac Implants* 2010;25:189-96.
- Buser D, Chappuis V, Kuchler U, Bornstein MM, Wittneben JG, Buser R, *et al.* Long-term stability of early implant placement with contour augmentation. *J Dent Res* 2013;92:S176-82.
- D'Avenia F, Miron R. Vertical bone augmentation of the posterior mandible with simultaneous implant placement utilizing atelo-collagen-derived bone grafts and membranes. *Periodontics Prosthodont* 2018;4:3.
- Hollinger JO, Brekke J, Gruskin E, Lee D. Role of bone substitutes. *Clin Orthop Relat Res* 1996;324:55-65.
- Nkenke E, Neukam FW. Autogenous bone harvesting and grafting in advanced jaw resorption: Morbidity, resorption and implant survival. *Eur J Oral Implantol* 2014;7:S203-17.
- Dasmah A, Thor A, Ekestubbe A, Sennerby L, Rasmusson L. Particulate vs. block bone grafts: Three-dimensional changes in graft volume after reconstruction of the atrophic maxilla, a 2-year radiographic follow-up. *J Craniomaxillofac Surg* 2012;40:654-9.
- Cuellar CN, Caicoya SJ, Sanz JJ, Cuellar IN, Muela CM, Vila CN. Mandibular reconstruction with iliac crest free flap, nasolabial flap, and osseointegrated implants. *J Oral Maxillofac Surg* 2014;72:1226.
- Omara M, Abdelwahed N, Ahmed M, Hindy M. Simultaneous implant placement with ridge augmentation using an autogenous bone ring transplant. *Int J Oral Maxillofac Surg* 2016;45:535-44.
- Hämmerle CH, Karring T. Guided bone regeneration at oral implant sites. *Periodontol* 2000 1998;17:151-75.
- Buser D, Dula K, Belsler U, Hirt HP, Berthold H. Localized ridge augmentation using guided bone regeneration. 1. Surgical procedure in the maxilla. *Int J Periodontics Restorative Dent* 1993;13:29-45.
- Hermann JS, Buser D. Guided bone regeneration for dental implants. *Curr Opin Periodontol* 1996;3:168-77.
- Yeh HC, Hsu KW. Guided bone regeneration for fenestration defects in dental implants. *Chang Gung Med J* 2003;26:684-9.
- Dimitriou R, Mataliotakis GI, Calori GM, Giannoudis PV. The role of barrier membranes for guided bone regeneration and restoration of large bone defects: Current experimental and clinical evidence. *BMC Med* 2012;10:81.
- Moses O, Pitaru S, Artzi Z, Nemcovsky CE. Healing of dehiscence-type defects in implants placed together with different barrier membranes: A comparative clinical study. *Clin Oral Implants Res* 2005;16:210-9.

28. Elshahat A, Inoue N, Marti G, Safe I, Manson P, Vanderkolk C. Guided bone regeneration at the donor site of iliac bone grafts for future use as autogenous grafts. *Plast Reconstr Surg* 2005;116:1068-75.
29. Geesink RG, Hoefnagels NH, Bulstra SK. Osteogenic activity of OP-1 bone morphogenetic protein (BMP-7) in a human fibular defect. *J Bone Joint Surg Br* 1999;81:710-8.
30. Heckman JD, Ehler W, Brooks BP, Aufdemorte TB, Lohmann CH, Morgan T, *et al.* Bone morphogenetic protein but not transforming growth factor-beta enhances bone formation in canine diaphyseal nonunions implanted with a biodegradable composite polymer. *J Bone Joint Surg Am* 1999;81:1717-39.