10.5005/jp-journals-10012-1167

CASE REPORT

Guided Bone Regeneration using a Combination of Novel Biomaterial and Type I Collagen for Isolated Ridge Defect to facilitate Delayed Implant Therapy: A Solitary Case Report

[1]Rashmi Paramashivaiah, [2]Pabbati K Vardhan, [3]Munivenkatappa L Venkatesh

ABSTRACT

Introduction: Ridge augmentation has attained a key role in implant placement to recreate the natural contour of the hard and soft tissues that may have been lost as a consequence of extraction. Ridge augmentation procedures require bone to be regenerated outside the existing bony walls or housing and are therefore often considered to be one of the most challenging surgical procedures.

Materials and methods: In the current case, a Seibert's class III defect was treated, followed by implant placement after 6 months. The bony deficit was managed with guided bone regeneration (GBR) techniques utilizing bone grafting material and membrane. Second surgery and the subsequent morbidity involved in the removal of nonresorbable membranes were tackled with the use of resorbable collagen membranes. Different bone graft materials are used routinely in combination with these membranes to facilitate space maintenance and to prevent membrane collapse. Particulate xenograft was used, as it restores the natural tissue architecture for placement of implant at a later stage. At the time of implant placement, the ridge was found to have the required dimensions.

Conclusion: Ridge augmentation using a combination of membrane and xenograft for Seibert's class III ridge defect is a predictable treatment option. It improves the restorative aspect of implant placement in compromised areas.

Keywords: Biomaterial, Collagen, Guided bone regeneration, Implant, Osseointegration, Ridge augmentation.

How to cite this article: Paramashivaiah R, Vardhan PK, Venkatesh ML. Guided Bone Regeneration using a Combination of Novel Biomaterial and Type I Collagen for Isolated Ridge Defect to facilitate Delayed Implant Therapy: A Solitary Case Report. Int J Oral Implantol Clin Res 2017;8(2&3):45-49.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Implants are becoming an increasingly feasible treatment option for single or multiple edentulous areas. But an ideal ridge to place implants is often lacking. The inevitable hard tissue reaction after surgical removal of tooth is the resorption of alveolar ridge which, if excessive, can lead to restorative complications.

The alveolar ridge loses its vertical component by 1.5 to 2 mm on average and horizontal component is reduced by less than or half of the original width in a time span ranging from 0.5 to 1 year during the healing of extraction socket.[1-5] The major dimensional changes occur during the immediate three months following extraction 2 and this insidious process can continue gradually over time, with as much as 11% of loss of bone volume additionally in the ensuing 5 years.[6,7]

As stated in a longitudinal study, there is approximately 40% bone height loss and 60% bone width loss following couple or more years of tooth extraction.[8] In advanced periodontitis patient, the resorption is often severe encompassing both the facial and the lingual bony plates. There is even a loss of attachment in the interproximal area which may necessitate procedures to reconstruct the same.

For dental implants to succeed, a triad of factors, namely a proper restoratively driven implant, good amount of bone surrounding the implant, and a healthy peri-implant soft tissue for proper oral hygiene maintenance are essential. Prior to treating a deficient ridge, it is essential to categorize it so as to take a decision regarding the available options for restoring it. Among the various systems of classification, the following are more commonly followed in the recent times.

Classification of Soft/hard Tissue Ridge Defects by Seibert[9]

Seibert[9] classified the dimensional loss of alveolar ridge into three groups:

- *Class I:* Loss of alveolar ridge in the buccolingual direction with no change in the vertical height.
- *Class II:* Loss of height of alveolar bone in the vertical direction with no change in the width.
- *Class III:* Combination of residual ridge loss in the horizontal and vertical direction leading to an atrophied ridge.

[1]Reader, [2]Postgraduate Student, [3]Professor and Head

[1-3]Department of Periodontology, Krishnadevaraya College of Dental Sciences and Hospital, Bengaluru, Karnataka, India

Corresponding Author: Rashmi Paramashivaiah, Reader Department of Periodontology, Krishnadevaraya College of Dental Sciences and Hospital, Bengaluru, Karnataka, India, Phone: +919900925844, e-mail: rashparams2005@yahoo.co.in

Cologne's Classification of Alveolar Ridge Defect[10]

Part 1: Defect orientation
- H: Horizontal component
- V: Vertical: Combination of horizontal and vertical
- S/+S: Sinus region.

Part 2: Need for restoring the defect
- Low: Less than 4 mm
- Medium: 4 to 8 mm
- High: More than 8 mm

Part 3: Region of defect needed to be reconstructed
- i: Internal, where the inner side of defect contour requires reconstruction
- e: External, the outer surface of defect requires reconstruction

The alveolar ridge deficit can be countered by various techniques, namely GBR, block bone grafting, distraction osteogenesis, and ridge split technique with sandwich osteotomy.[11] Among the above techniques, GBR with adjunctive bone grafts is noninvasive and has a reasonable amount of success.

The GBR is an elective procedure that utilizes a biological membrane as a barrier alone or in combination with a regenerative bone substitutes. Bone regeneration by GBR is based on the principle of exclusive migration of the osteogenic cells which have the potential to be pluripotent than the other cells which impede the bone formation (e.g., epithelial cells and fibroblasts) like the periosteal osteoblasts or osteoblasts from the surrounding and/or bone marrow into the defective bone site.[12-15] For the defect regeneration to occur, the rate of bone regeneration from adjacent bony margins inward should supersede the fibroblast growth rate from the adjacent soft tissue.[16] The effectiveness of augmentation of residual ridge is often difficult to predict in a clinical set-up.

The four principles for successful GBR which are essential are: excluding the epithelium and connective tissue, maintenance of space, stabilizing the initial fibrin clot, and closure of the wound (primary).[17] The procedures for ridge augmentation can be carried out at various treatment times and can be either simultaneous or staged.

When the approach is staged, the ridge augmentation procedures are carried out at the initial surgery and the implant is placed 2 to 6 months later.[18] On the contrary, both ridge augmentation and implant placement are done at the same time in the simultaneous approach.[19]

CASE REPORT

Patient and Residual Ridge Regeneration

A 50-year-old healthy male subject came to the Department of Periodontology with the presentation of missing left upper back tooth as a chief complaint.

After completing a comprehensive examination of the periodontium and a radiographic investigation, it was diagnosed to be a case of generalized severe chronic periodontitis; 23 was missing and on eliciting the history, it was found to have been extracted due to hypermobility in a private clinic. All the treatment options to replace the missing 23 were explained in detail to the patient.

It was decided to place an implant, but the residual ridge was found to be deficient belonging to Seibert's class III category of ridge defects (Figs 1 and 2). After administering local anesthesia, an incision was placed on the crestal region of alveolar ridge with a # 15 blade and a full thickness flap was elevated buccally. On reflection, the horizontal and vertical loss of bone was revealed. Adequate amount of Cerabone (Xenograft, Natural Bovine bone) graft was filled into the defect.

A palatal pouch was created and a resorbable membrane (Healiguide, type I collagen) was placed after trimming along with the graft (Fig. 3). The membrane

Fig. 1: Preoperative view

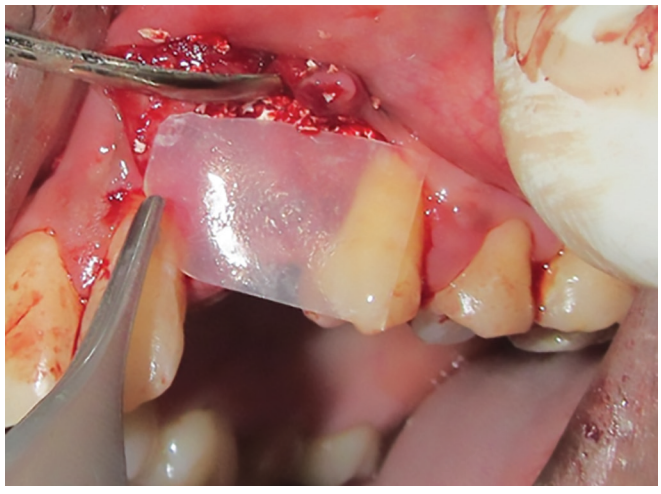

Fig. 2: Preoperative radiograph

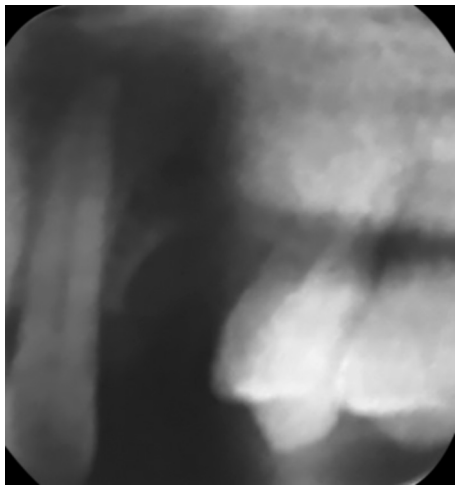

Fig. 3: Surgical procedure

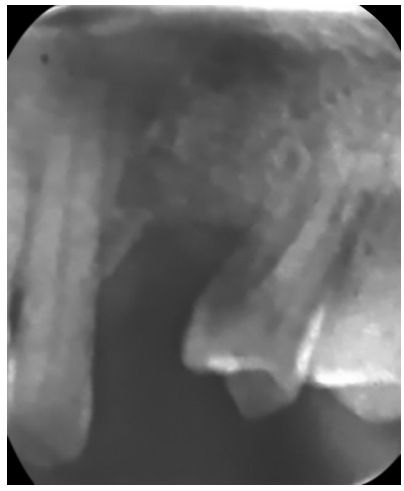

Fig. 4: Three months postoperative view

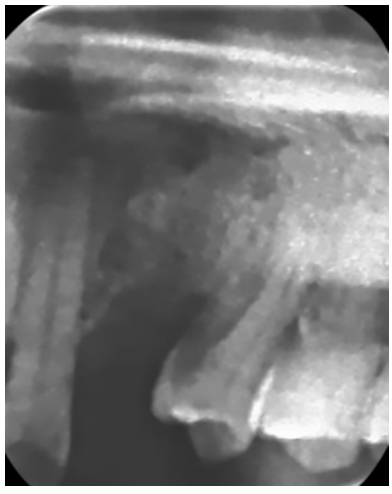

Fig. 5: Six months postoperative view

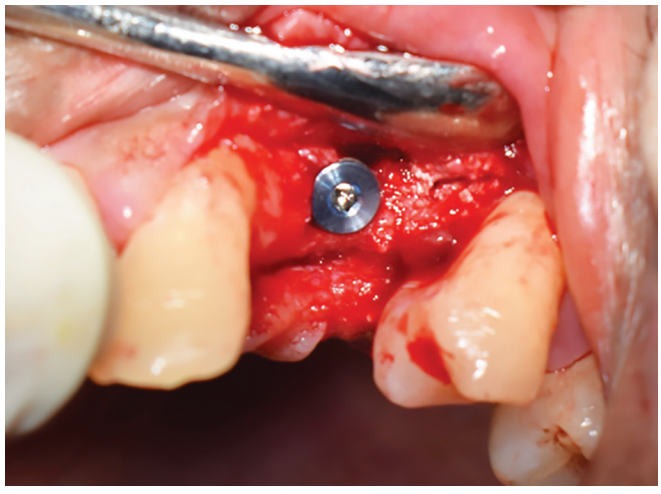

Fig. 6: Placement of the implant

was stabilized with periosteal suture using 3-0 (Vicryl, Ethicon, Johnson and Johnson, Sint-Stevens Woluwe, Belgium). Supracrestally interrupted direct loop suture was placed using 3-0 silk (Ethicon, Johnson and Johnson, Sint-Stevens Woluwe, Belgium). Postoperative care comprised of 0.12% antimicrobial rinse of chlorhexidine gluconate for a period of 15 days and thrice a day, systemic antimicrobial therapy, namely amoxicillin about 1 gm and 2 times a day for a total of 6 days, and a nonsteroidal anti-inflammatory drug for pain control (600 mg b.i.d.) for 5 days.

Suture removal was done on the 14th postoperative day. Radiographically, the case was assessed after 3 and 6 months wherein a good amount of bone formation could be appreciated (Figs 4 and 5). After 6 months of GBR, a detailed surgical plan was drawn for implant placement under a delayed protocol. The entire procedure was explained in detail to the patient. Both verbal consent and a written signed consent were procured from the subject.

After infiltration of 2% lignocaine local anesthesia, a subcrestal incision was placed along with sulcular incisions in the region of 22 and 24. A mucoperiosteal flap was used to expose the edentulous area and elevated buccally. An initial pilot drill was used, followed by sequential drilling at 900 rotations per minute (RPM) with adequate cooling.

The drilling was stopped to one size less than the planned implant diameter. A 3.3 × 11.5 mm size tapered screw-shaped implant (Tuff TT, RBM surface, Norris) was placed (Fig. 6). A primary stability of 35 N/cm^2 was achieved. Since there was a slight thread exposure, it was decided to place a regenerative graft (DM Bone, combination of hydroxyapatite and tricalcium phosphate).

Interrupted direct loop sutures were placed with 3-0 silk (Ethicon, Johnson and Johnson, Sint-Stevens Woluwe, Belgium). A postoperative radionuclide ventriculogram was procured (Fig. 7). Postoperative care was aimed at controlling the swelling, pain, and infection. It comprised of 0.12% chlorhexidine gluconate as rinse for 15 days t.i.d.; amoxicillin was administered systemically for 6 days in the dosage of 1 gm two times daily and ibuprofen for the pain control for 5 days 600 mg b.i.d.

Fig. 7: Postimplant radiograph

The patient was recalled after a week for a review. On the 14th day, sutures were removed. Follow-up radiographs and clinical photographs were obtained.

RESULTS AND DISCUSSION

Among the plethora of ridge augmentation techniques, the common hurdles encountered are the complexity of the treatment, cost factor involved, and patient acceptance of the same. These hurdles can be overcome by doing the GBR which is comparatively simpler and has a better feasibility.

A vast amount of evidence is available on the predictability of GBR for regeneration of residual alveolar ridge; however, it is challenging to do the same in severely atrophied ridge having both deficit horizontally and vertically. In this case report, a Seibert's class III ridge defect in relation to 23 was filled with a xenograft and a primary coverage was obtained with a type I collagen membrane.

Primary closure could be obtained after suturing the flap. After 6 months, on radiographic examination, the amount of bone formed was more than adequate for placement of implant. The different steps in implant placement and the time taken for the entire procedure were explained in detail to the patient. The patient was willing and cooperative for the same.

In the current case report, a bovine type I collagen membrane was used as a protective cover over a osteoconductive regenerative material which promoted and stabilized the initial clot formed in the healing site and also prevented the interference inflammatory response in the later stage of bone regeneration when the filling material starts to degrade.

Type I collagen promotes angiogenesis with an accelerated ingrowth, increased proliferation, and maturation of the endothelial cells leading to an enhanced bone regeneration.[20]

CONCLUSION

The augmentation of alveolar ridge prior to the implant placement thus improves the net bone volume and height. This procedure is not surgically technique-sensitive and hence, can be attempted easily.

Even though it is a single edentulous area, a fair conclusion can be drawn that GBR is quite effective as a ridge augmentation procedure. A deficient ridge need not necessarily be a road block for implant-supported prosthesis. Thus, with proper planning, a severely atrophied ridge defect can be restored with GBR, followed by successful implant placement contributing to a comprehensive therapeutic goal.

INTERNET SOURCES

<1%—https://www.scribd.com/doc/95768678/Healing-of-Extraction-Socket

4%—http://pisotupurapem.ml/6781387/2194960/b5d1e-guided-bone-regeneration-1b809e5d1e

3%—http://europepmc.org/articles/PMC4040931

3%—https://www.hindawi.com/journals/crid/2017/9370693/

<1%—https://www.scribd.com/doc/164131183/Implant-Dentistry-A-Rapidly-Evolving-Practice

1%—https://www.slideshare.net/AbbasiBegum1/diagnosis-and-tretment-planning-in-fpd

1%—http://www.thejpd.org/article/S0022-3913(05)80042-3/pdf

1%—https://www.slideshare.net/DrDarshanaaArunachal/soft-tissue-ridge-augmentation

1%—https://www.bdizedi.org/bdiz/web.nsf/gfx/guidelines_Konsensus-Leitfaden-2013_engl.pdf/$file/guidelines_Konsensus-Leitfaden-2013_engl.pdf

1%—https://prezi.com/rgnflpgpvpm6/outline/

1%—https://pocketdentistry.com/surgical-techniques-for-augmentation-in-the-horizontally-and-vertically-compromised-alveolus/

<1%—http://www.dentalxp.com/implant-articles.aspx

1%—https://www.sciencedirect.com/science/article/pii/S1526054204900085

1%—http://www.joponline.org/doi/pdf/10.1902/jop.2009.080309

1%—https://link.springer.com/content/pdf/10.1007%2Fs00520-009-0688-1.pdf

4%—https://www.iti.org/public/services/download/2040

<1%—http://dentistrytoday.com/periodontics?format=feed&type=rss

<1%—https://pocketdentistry.com/1-examination-and-diagnosis-2/

REFERENCES

1. Cardaropoli G, Araujo M, Lindhe J. Dynamics of bone tissue formation in tooth extraction sites: an experimental study in dogs. J Clin Periodontol 2003 Sep;30(9):809-818.
2. Schropp L, Wenzel A, Kostopoulos L, Karring T. Bone healing and soft tissue contour changes following single-tooth extraction: a clinical and radiographic 12-month prospective study. Int J Periodontics Restorative Dent 2003 Aug;23(4):313-323.
3. Lekovic V, Kenney EB, Weinlaender M, Han T, Klokkevold P, Nedic M, Orsini M. A bone regenerative approach to alveolar ridge maintenance following tooth extraction. Report of 10 cases. J Periodontol 1997 Jun;68(6):563-570.
4. Lekovic V, Klokkevold PR, Kenney EB, Dimitrijelic B, Nedic M, Weinlaender M. Histologic evaluation of guided tissue regeneration using 4 barrier membranes: a comparative furcation study in dogs. J Periodontol 1998 Jan;69(1):54-61.
5. Lekovic V, Camargo PM, Klokkevold PR, Weinlaender M, Kenney EB, Dimitrijevic B, Nedic M. Preservation of alveolar bone in extraction sockets using bioabsorbable membranes. J Periodontol 1998 Sep;69(9):1044-1049.
6. Nemcovsky CE, Serfaty V. Alveolar ridge preservation following extraction of maxillary anterior teeth. Report on 23 consecutive cases. J Periodontol 1996 Apr;67(4):390-395.
7. Artzi Z, Nemcovsky CE. The application of deproteinized bovine bone mineral for ridge preservation prior to implantation. Clinical and histological observations in a case report. J Periodontol 1998 Sep;69(9):1062-1067.
8. Ashman A. Ridge preservation: important buzzwords in dentistry. Gen Dent 2000 May-Jun;48(3):304-312.
9. Seibert JS. Reconstruction of deformed partially edentulous ridges, using full thickness onlay grafts. Part I. Technique and wound healing. Compend Contin Educ Dent 1983 Sep-Oct;4(5):437-453.
10. BDIZ EDI. Cologne's classification of alveolar ridge defects. Germany: BDIZ EDI; 2013. [cited 2013 Feb]. Available from: https://www.bdizedi.org/bdiz/web.nsf/gfx/guidelines_Konsensus-Leitfaden-2013_engl.pdf/$file/guidelines_Konsensus-Leitfaden-2013_engl.pdf.
11. McAllister BS, Haghighat K. Bone augmentation techniques. J Periodontol 2007 Mar;78(3):377-396.
12. Dahlin C, Linde A, Gottlow J, Nyman S. Healing of bone defects by guided tissue regeneration. Plastic Reconstr Surg 1988 May;81(5):672-676.
13. Dahlin C, Sennerby L, Lekholm U, Linde A, Nyman S. Generation of new bone around titanium implants using a membrane technique: an experimental study in rabbits. Int J Oral Maxillofac Implants 1989 Spring;4(1):19-25.
14. Becker W, Becker BE. Guided tissue regeneration for implants placed into extraction sockets and for implant dehiscences: surgical techniques and case report. Int J Periodontics Restorative Dent 1990;10(5):376-391.
15. Becker W, Becker BE, Handlesman M, Celletti R, Ochsenbein C, Hardwick R, Langer B. Bone formation at dehisced dental implant sites treated with implant augmentation material: a pilot study in dogs. Int J Periodontics Restorative Dent 1990;10(2):92-101.
16. Gher ME, Quintero G, Assad D, Monaco E, Richardson AC. Bone grafting and guided bone regeneration for immediate dental implants in humans. J Periodontol 1994 Sep;65(9):881-891.
17. Wang HL, Boyapati L. "PASS" principles for predictable bone regeneration. Implant Dent 2006 Mar;15(1):8-17.
18. von Arx T, Buser D. Horizontal ridge augmentation using autogenous block grafts and the guided bone regeneration technique with collagen membranes: a clinical study with 42 patients. Clin Oral Implants Res 2006 Aug;17(4):359-366.
19. Buser D, Bornstein MM, Weber HP, Grutter L, Schmid B, Belser UC. Early implant placement with simultaneous guided bone regeneration following single-tooth extraction in the esthetic zone: a cross-sectional, retrospective study in 45 subjects with a 2- to 4-year follow-up. J Periodontol 2008 Sep;79(9):1773-1781.
20. Twardowski T, Fertala A, Orgel JP, San Antonio JD. Type I collagen and collagen mimetics as angiogenesis promoting superpolymers. Curr Pharm Des 2007 Dec;13(35):3608-3621.