Localized Reconstruction of the Posterior Mandibular Ridge Using the Split-Ridge Technique: A Case Report.

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Abstract

Mandibular ridge reconstruction presents various challenges to surgeons. Obviously, the presence of the inferior alveolar canal complicates implant placement in the posterior mandibular areas. In addition, skeletal deformities, namely resorption, occur as a result of loss of mandibular posterior teeth. Various techniques have been proposed in order to augment the posterior mandibular segments, including the ramus and/or chin autogenous block bone graft approach guided bone regeneration or a split ridge osteotomy. Misch, Pikos and Block et al., have reported ramus and chin autogenous block bone grafts to be predictable in augmenting the posterior edentulous mandibular alveolar ridge, both in horizontal and vertical dimensions. However, such procedures are technique sensitive with the success highly dependent on the fixation and immobility of the block segment. Using a bone autograft and a protective barrier, Buser et al. reported on a technique for local augmentation of deficient ridges. The authors stated that space maintenance and primary closure were critical determinants of success for such procedures. Scipioni et al. introduced the ridge split osteotomy as an alternative method which allows for conservation of the cortical plate, determined to be crucial to the success of implant placement. The ridge split osteotomy technique requires careful planning. The initial osteotomy must result in a buccal residual ridge width of 3 mm and lingual cortical plate of no less than 1 mm prior to displacement of the facial cortical bone. Violation of anatomical structures such as inferior alveolar nerve and mental foramen are additional considerations. The main challenge with the split ridge osteotomy is the potential risk for fracture and displacement of the facial cortical bone. This case report presents the technique and instrumentation to perform a piezoelectric hinge assisted alveolar ridge split osteotomy followed by placement of a two dental implants.

KEY WORDS: Mandibular ridge split, bone augmentation, dental implants

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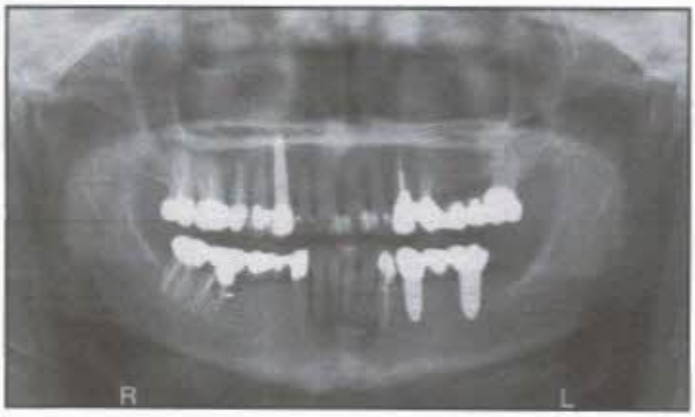

Figure 1: Panoramic radiographic view prior to surgery.

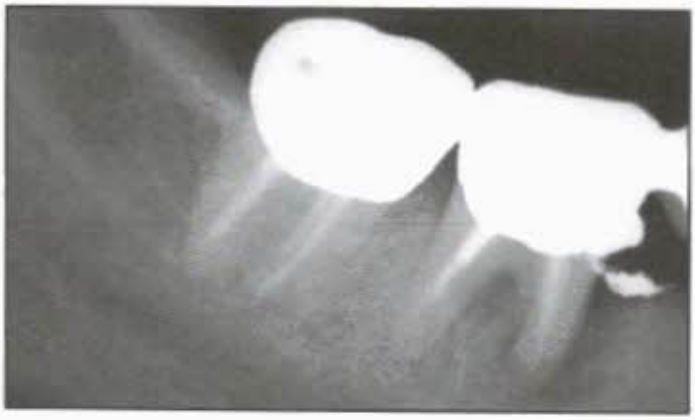

Figure 2: Periapical Radiograph of the lower right area.

INTRODUCTION

Mandibular ridge reconstruction presents various challenges to surgeons. Obviously, the presence of the inferior alveolar canal complicates implant placement in the posterior mandibular areas. In addition, skeletal deformities, namely resorption, occur as a result of loss of mandibular posterior teeth.[1,2] Various techniques[3] have been proposed in order to augment the posterior mandibular segments, including the ramus and/or chin autogenous block bone graft approach,[4,5] guided bone regeneration[6,7,8] or a split ridge osteotomy.[9,10,11,12] Misch,[4] Pikos[5] and Block et al.,[9] have reported ramus and chin autogenous block bone grafts to be predictable in augmenting the posterior edentulous mandibular alveolar ridge, both in horizontal and vertical dimensions. However, such procedures are technique sensitive with the success highly dependent on the fixation and immobility of the block segment. Using a bone autograft and a protective barrier, Buser et al.[7,8] reported on a technique for local augmentation of deficient ridges. The authors stated that space maintenance and primary closure were critical determinants of success for such procedures. Scipioni et al.[11,12] introduced the ridge split osteotomy as an alternative method which allows for conservation of the cortical plate, determined to be crucial to the success of implant placement.[13,14] The ridge split osteotomy technique requires careful planning. The initial ostoeotomy must result in a buccal residual ridge width of 3 mm and lingual cortical plate of no less than 1 mm prior to displacement of the facial cortical bone.[11,12] Violation of anatomical structures such as inferior alveolar nerve and mental foramen are additional considerations. The main challenge with the split ridge osteotomy is the potential risk for fracture and displacement of the facial cortical bone.

This case report presents the technique and instrumentation to perform a piezoelectric hinge assisted alveolar ridge split osteotomy[15] followed by placement of two dental implants.

CASE REPORT AND SURGICAL TECHNIQUE

A healthy 64 year-old female presented to the Graduate Periodontics Clinic at the University of Missouri Kansas City for implant placement. The patient had a fixed partial denture extending from

Figure 3: Clinical view of the lower right area after sectioning the fixed partial denture.

Figure 4: Dissection and release of the mylohyoid muscle.

teeth #28 to #31 that replaced missing teeth #29 and #30. Teeth #29 and #30 had been missing for over ten years. Tooth #31 exhibited recurrent caries extending into the furcal area and a periapical radiolucency involving the mesial root. The patient's medical history was unremarkable.

A panoramic and a periapical radiograph confirmed our findings (Figs. 1 & 2). Clinically, the edentulous ridge presented as a Seibert[16] Class I (horizontally deficient). The treatment plan included sectioning the fixed denture, extraction of #31, reconstruction of the resorbed ridge prior to placement of two implants. The two implants were intended to support a fixed prosthesis extending from tooth #29 to tooth #31. Following a detailed explanation, the patient signed an informed consent for the necessary surgery and restorations and possible publication of a case report, including photographs and radiographs.

Three carpules of 2% Lidocaine with 1:100,000 epinephrine and one carpule of 0.5 % Marcaine with 1:200,000 epinephrine were administrated to obtain a field block of the inferior alveolar, local buccal and mental nerves. The fixed partial denture was sectioned (Fig. 3) distal of teeth #28 and #31 and delivered without complications. A full-thickness mucoperiosteal flap was reflected, exposing the edentulous bony ridge and confirming the underlying bone deformity (Seibert Class I). The ridge presented a horizontal dimension of 3 mm in the premolar region and 5 mm in the tooth #30 area. Following exposure of the edentulous ridge, the mylohyoid muscle was carefully dissected and released, thereby allowing passive displacement of the lingual flap (Fig. 4). The mental foramen and inferior alveolar canals were identified to prevent inadvertent violation of their nerve and vascular tissues during the osteotomy procedure. Using a NSK VarioSurg® piezo-electric unit (NSK, America Corp., Schaumberg, IL) fitted with an SG2R titanium nitride coated 0.5 mm blade and copious amounts of sterile water, a midline crestal ridge osteotomy was performed, cutting 10 mm into the alveolus.[17] This initial cut started within the mesial aspect of the extraction socket of tooth #31 and extend to within 2 mm of the distal aspect of tooth #28 (Fig. 5). Starting at the most mesial extension of the midline crestal ridge incision, using an SG1 blade, a 10 mm vertical cut was extended apically. This cut passed

Figure 5: Initial split osteotomies.

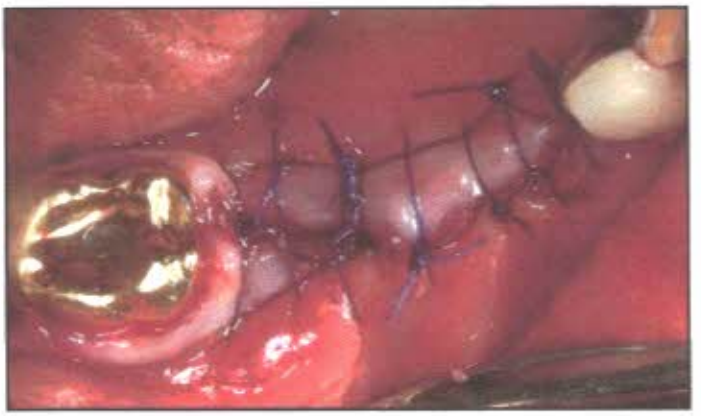

Figure 6: Primary closure of the reconstructed ridge.

through the facial cortical bone. A distal vertical cut was not necessary as the extraction socket allowed facial displacement of the facial cortical bone. Apically, 10 mm from the alveolar crest, the facial cortical bone was weakened by placing a horizontal cut with a #2 round bur. This bur cut penetrated to a depth of approximately 1.5 mm such that the facial cortical bone was not free but was flexible. Using bone spreaders and osteotomes, the facial cortical bone was gently moved facially. Puros allograft,® hydrated in sterile water, was used to preserve the socket of tooth #31 and fill the space created within the alveolar ridge. The grafted area was then covered with Puros Copios® Pericardium membrane (Zimmer Dental, Carlsbad, CA). Primary closure was attained using Vicryl™ 4-0 sutures (Ethicon, Inc, Somerville, NJ) using a horizontal mattress suture, two interrupted sutures and a continuous interlocking suture (Fig. 6). The patient was prescribed Amoxicillin 875 mg, b.i.d. for 7 days, a Medrol dose pack, Vicodin 5/500, and a 0.12% chlorhexidine rinse. The patient was given written and oral instructions and seen at 10 days, 1 month, and 3 months post-surgery (Fig. 8).

POST-TREATMENT RESULTS

Following a 4-month healing period, the site was re-entered and measurements were taken. The initial measurement of a 3 mm in the premolar area increased to 8 mm and that in the molar area (#30) doubled to 10 mm (Figs. 7 & 8). Osteotomies were prepared to receive two screw-form implants. RP Nobel Replace Select® implants were placed in sites corresponding to teeth #29 and #31, 4.3 mm and 5.0 mm diameters, respectively (Nobel Biocare USA, LLC, Yorba Linda, CA). Type II bone density was evident when placing the implants.

CONCLUSION

This single case report demonstrates that the techniques presented by Scipioni et al.[11,12] and Holtzclaw et al.[15] are viable approaches. The technique allows for substantial gains in horizontal dimension of the edentulous posterior mandibular alveolar ridge without morbidity to a secondary site. Maintaining the original cortical bone plate and the increase in the lateral dimension allowed for adequate placement of implants. ●

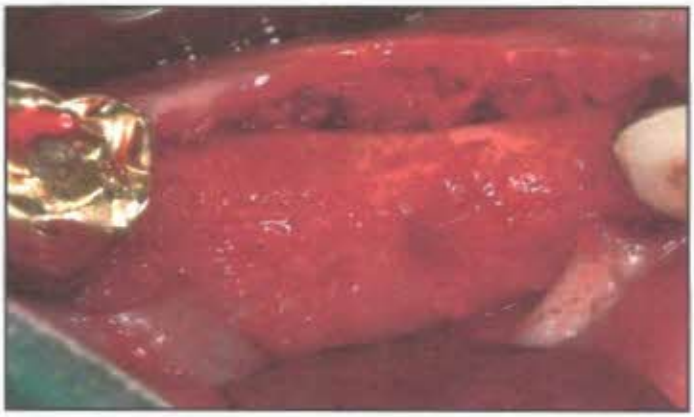

Figure 7: Re-entry, 4 months post healing.

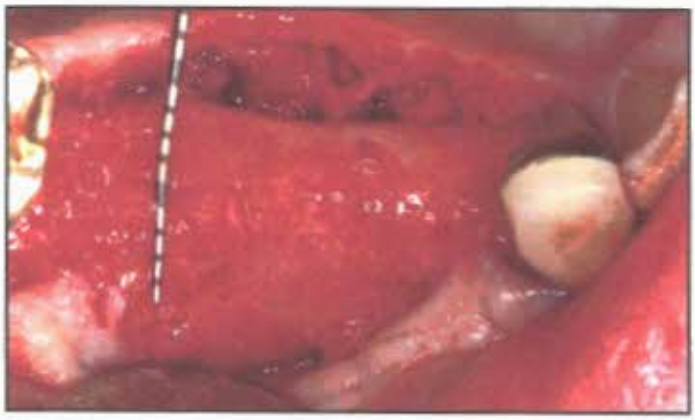

Figure 8: Width of the reconstructed ridge.

Figure 9: Implants in place.

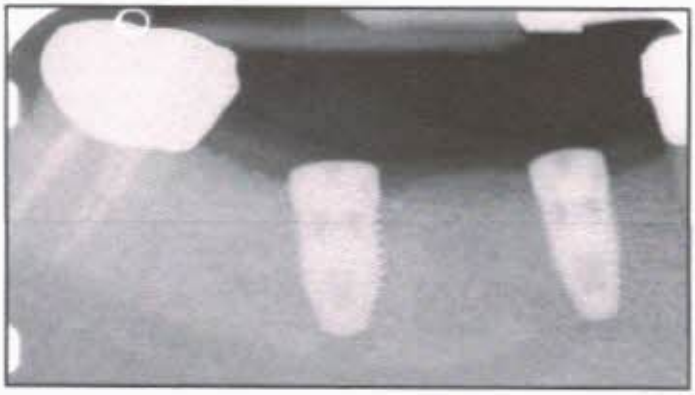

Figure 10: Periapical radiograph after implant placement.

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Disclosure
The authors report no conflicts of interest with anything mentioned in this article.

References

1. Flanagan D. A comparison of facial and lingual cortical thickness in edentulous maxillary and mandibular sites measured on computerized tomograms. J Oral Impl 2008; 34: 256-258.
2. Schwartz-Dabney CL, Dechow PC. Edentulation alters material properties of cortical bone in the human mandible. J Dent Res 2002; 81: 613-617.
3. McAllister BS, Haghighat K. Bone augmentation techniques. J Periodontol 2007; 78: 377-396.
4. Misch CM. Ridge Augmentation using mandibular ramus bone grafts for the placement of dental implants. Presentation of a technique. Pract Periodont Esthetic Dent 1996; 8: 127-135.
5. Pikos, MA. Block autografts for localized ridge augmentation: part II. The posterior mandible. Implant Dent 2000; 9: 67-75.
6. Block MS, Degen M. Horizontal ridge augmentation using human mineralized particulate bone: Preliminary results. J Oral Maxillofac Surg 2004; 62 (Suppl. 2): 67-72.
7. Buser D, Dula K, Hess D, Hirt HP, Belser UC. Localized ridge augmentation with autografts and a barrier membrane. Periodontol 2000 1999; 19: 151-163.
8. Buser D, Dula K, Hirt HP, Schenk RK. Lateral ridge augmentation using autografts and barrier membranes: a clinical study with 40 partially edentulous patients. J Oral Maxillofacial Surgery 1996; 54: 420-432.
9. Block MS, Haggerty CJ. Interpositional osteotomy for posterior mandible ridge augmentation. J Oral Maxillofac Surg 2009;67 (Suppl. 11): 31-39.
10. Coatom GW, Mariotti A. The segmental ridge split procedure. J Periodontol 2003; 74: 767-770.
11. Scipioni A, Bruschi GB, Calesini G. The edentulous ridge expansion technique: A five year Study. Int J Peridontics Restor Dent 1994;14:451-459.
12. Scipioni A, Calesini G, Micarelli C, Coppe S, Scipioni L. Morphogenic bone splitting: description of an original technique and its application in esthetically significant areas. Int J Prosthodont 2008;21:389-397.
13. Merheb J, Van Assche N, Coucke W, Jacobs R, Naert I, Quirynen M. Relationship between cortical bone thickness or computerized tomography-derived bone density values and implant stability. Clin Oral Implant Res 2010; 21: 612-617.
14. Miyamoto I, Tsuboi Y, Wada E, Suwa H, Iizuka T. Influence of cortical bone thickness and implant length on implant stability at the time of surgery-clinical, prospective, biomechanical and imaging study. Bone 2005; 37: 776-780.
15. Holtzclaw DJ, Toscano NJ, Rosen PS. Reconstruction of posterior mandibular alveolar ridge deficiencies with the piezoelectric hinge assisted ridge split technique: a retrospective observational report. J Periodontol 2010; 81: 1580-1588.
16. Seibert JS. Reconstruction of deformed partially edentulous ridges using full thickness onlay grafts: Part I - technique and wound healing. Compend Contin Educ Dent 1983; 4: 437-453.
17. Vercalotti T. Piezoelectric surgery in implantology: a case report- a new piezoelectric ridge expansion technique. J Periodontica Restorative Dent 2000; 20: 358-365.