CASE REPORT

Staged ridge-split evaluated using cone beam computed tomography and peri-implant plastic surgery in the mandibular arch

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ABSTRACT

Lack of sufficient bone to place an implant at a functionally and an esthetically appropriate position is a common problem, especially in the mandibular posterior region. Narrow edentulous alveolar ridges <5 mm wide require bone augmentation before implant placement to establish a bony wall of at least 1 mm around the endosseous implant. Various surgical widening techniques are available, including lateral augmentation with or without guided bone regeneration, ridge-split technique and horizontal distraction osteogenesis. The ridge-split technique aims at creating a new implant bed by longitudinal osteotomy of the alveolar bone. The buccal cortex is repositioned laterally by greenstick fracture, and the space between the buccal and lingual cortices is filled with a graft material. Peri-implant plastic surgery focuses on harmonizing peri-implant structures by means of hard- and soft-tissue engineering and includes bone structure enhancement, soft-tissue enhancement, precision in implant placement and improves quality of the prosthetic restoration. The rationale for the peri-implant plastic surgery approach goes well beyond pure esthetics as it creates peri-implant keratinized mucosa and interimplant soft-tissue height in order to avoid food impaction, interimplant airflow, and speech problems. This case report demonstrates a staged ridge-split technique evaluated with cone beam computed tomography using a piezosurgical unit and a surgical technique to restore a papilla-like tissue at the time of the second-stage implant surgery.

Key words
Alveolar ridge, cone beam computed tomography, grafting, peri-implant plastic surgery, piezosurgery, ridge-split

INTRODUCTION

Implant therapy success is no longer a measure of implant survival alone, but is gauged by its long-term functional and esthetic survival. Implant placement should be prosthetically driven with correct three-dimensional positioning to allow optimal support and stability of surrounding hard- and soft-tissues.[1]

Lack of sufficient bone to place an implant at a functionally and an esthetically appropriate position is a common problem, especially in the mandibular posterior region. Edentulous alveolar ridges <5 mm in width require augmentation before or at the time of implant placement to establish a bony wall of at least 1 mm around the endosseous implant.[2,3]

Various surgical widening techniques have been described, including lateral augmentation[4,5] with or without guided bone regeneration,[6,7] ridge-split technique[8] and horizontal distraction osteogenesis.[9] The ridge-split technique creates a new implant bed by longitudinal osteotomy of the alveolar bone. The buccal cortex is repositioned laterally by causing a greenstick fracture and the space between the two cortices is filled with graft material.[10,11]

Peri-implant plastic surgery harmonizes peri-implant structures by means of hard-tissue and soft-tissue manipulation. Along with esthetics, peri-implant plastic surgery is also important for creating peri-implant keratinized mucosa and interimplant soft-tissue height in order to avoid food impaction, interimplant airflow, and speech problems.[12]

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This case report demonstrates a staged ridge-split technique using a piezo surgical unit and a surgical technique to restore a papilla-like tissue at the time of the second-stage implant surgery.

CASE REPORT

A 56-year-old female presented with a chief complaint of missing teeth in the lower right back region and inability to chew food from that side of the mouth. The missing teeth were extracted 5 years back due to dental caries and were never replaced. Cone-beam computed tomography (CBCT), and diagnostic model revealed inadequate bone width for ideal implant placement [Figure 1].

A staged ridge-split followed by implant placement, peri-implant plastic surgery, and prosthetic rehabilitation was planned.

Surgical technique

Stage 1: [Figure 2] Crestal and intracrevicular incisions were made around the buccal aspect of teeth, adjacent to the edentulous space to raise a mucoperiosteal flap, exposing the buccal aspect of the mandible. Care was taken to keep the lingual periosteum attached to the bony surface. Using a piezosurgical device, a crestal corticotomy cut was made in the alveolar ridge. On the mesial and distal ends of the corticotomy, vertical cuts were made on the buccal cortex. The length of the vertical cut was determined according to the height of the implants to be placed. The vertical cuts were connected to each other at their caudal ends with a horizontal corticotomy. All corticotomies were 3–4 mm in depth making sure only the cortical bone was affected without significantly affecting the cancellous bone. The mucoperiosteal flap was repositioned and sutured. Suture removal was done after a week.

Stage 2: This was carried out 6 weeks after stage 1. It included splitting of the ridge and lateral mobilization of the pedicled buccal bone. A crestal and intracrevicular incision was performed around the lingual aspect of adjacent teeth to raise a full thickness mucoperiosteal flap. Buccal periosteum was kept attached to the buccal cortical plate to maintain the vascular supply to the previously pedicled bone. Gradual lateralization of the buccal segment was performed using a series of chisels in the increasing order, causing a greenstick fracture at the base of the buccal cortex until a gap of around 5 mm was established between the bony plates [Figure 3]. The space between the cortices was filled with hydroxyapaptite synthetic graft material (Bio-Oss, Geistlich Pharmaceuticals, Wolhausen, Switzerland) [Figure 4].

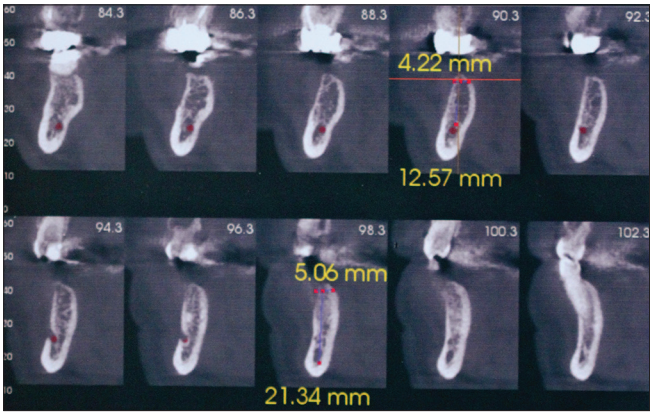

Figure 1: Preoperative cone beam computed tomography

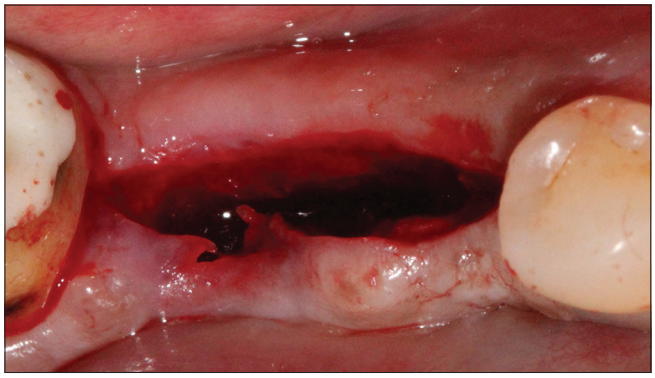

Figure 3: 5-mm gap between the cortical plates

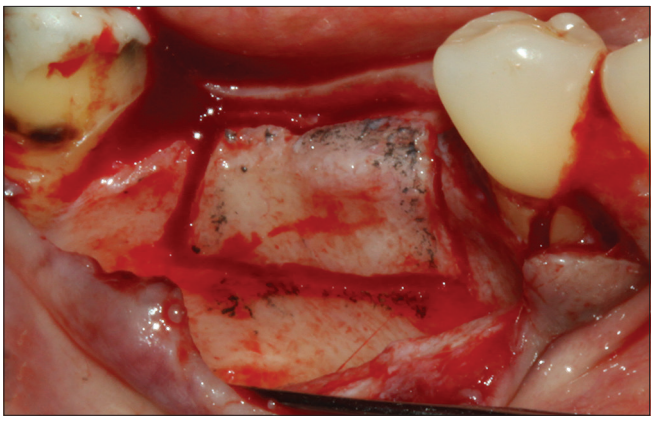

Figure 2: Stage 1 corticotomy

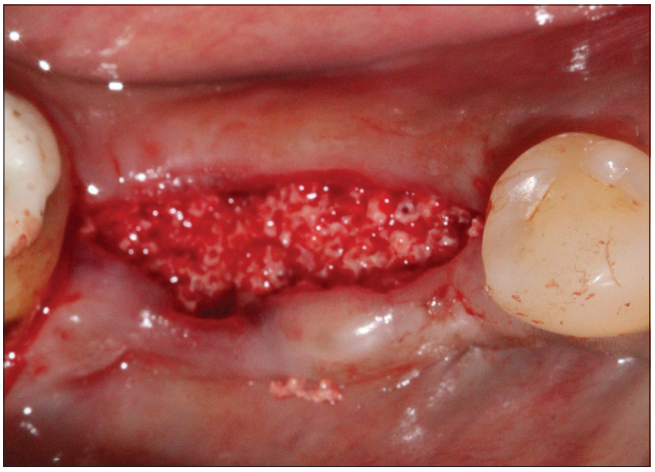

Figure 4: Gap filled with graft material

The flap was repositioned and tension free sutures were given using an absorbable suture material (4–0 Vicryl, Ethicon, Inc., Johnson and Johnson, Somerville, NJ, USA). The sutures were removed 1-week postsurgical.

Implant insertion

Implants were placed 12 weeks later. A CBCT was made to confirm the increase in ridge width [Figure 5]. Conventional implant osteotomies were performed, and implants (Biohorizons, Birmingham, AL, USA) were placed in the preplanned positions using a surgical stent [Figure 6].

Peri-implant plastic surgery and prosthetic loading

The submerged implants were allowed to heal for 12 weeks, after which they were uncovered. In the peri-implant plastic surgery, the attached masticatory mucosa is displaced bucally, thereby increasing the tissue volume on the buccal aspect of the implants. A paracrestal incision [Figure 7] toward the lingual aspect was made to raise a mucoperiosteal flap and gingival formers were attached [Figure 8]. Semilunar incisions were made in the flap at each implant. The first one started distal to the most mesial implant. The tissue was then rotated towards the tongue to create a papilla between the implant and the tooth and between the two implants [Figure 9]. Mattress sutures were given to keep the tissues in place [Figure 10].

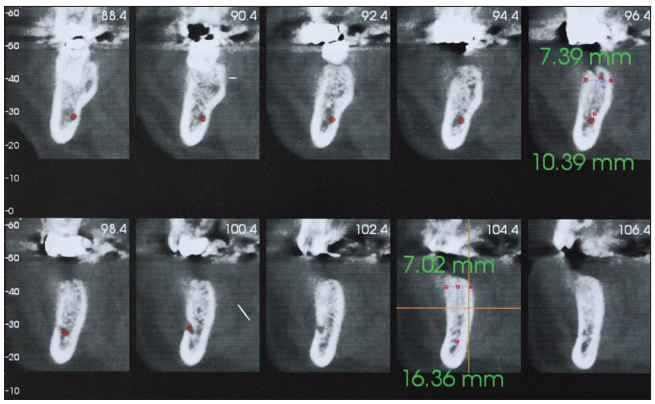

Figure 5: Postoperative cone beam computed tomography

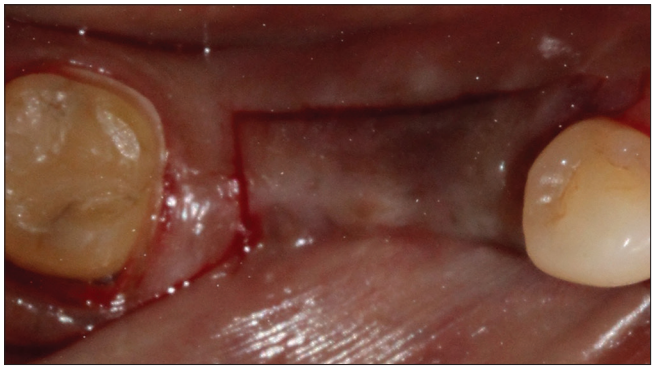

Figure 7: Paracrestal incision

Two weeks after the plastic surgery it was seen that bulky keratinized tissue and papilla was regenerated [Figure 11]. At this stage, conventional closed tray impression was made and prosthesis was fabricated keeping the occlusal considerations in mind [Figure 12].

DISCUSSION

Various studies have shown that successful osseointegration can be achieved using the two-stage ridge-split technique in narrow alveolar ridges.[13-16] In the mandible, the risk of fracture of the osteotomized segment is high because mandibular bone has less flexibility due to the thicker cortical plates. Thus, widening of the alveolar crest by ridge-split osteotomy should be combined with vertical cuts and a horizontal osteotomy connecting its caudal ends.[10] The apical horizontal osteotomy is the most difficult to control as complete transection of the buccal plate needs to be avoided and is also the most crucial cut as it acts as a hinge for lateral positioning of the fractured segment of bone.[17] Basal greenstick fracture of the segments during widening with osteotomes is difficult to control. Hence, a staged approach to the ridge-split in the posterior mandible was undertaken.

One of the problems in ridge-splitting, using the conventional osteotome technique is the trauma and

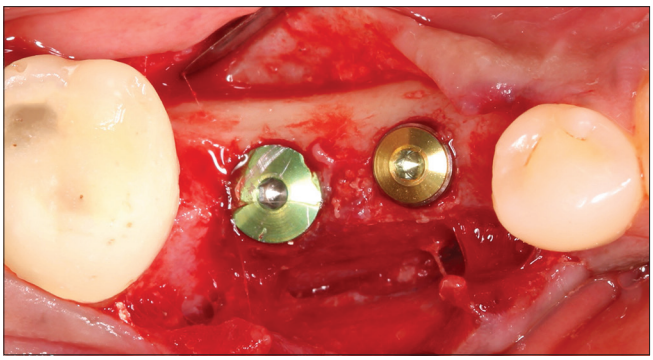

Figure 6: Implant insertion

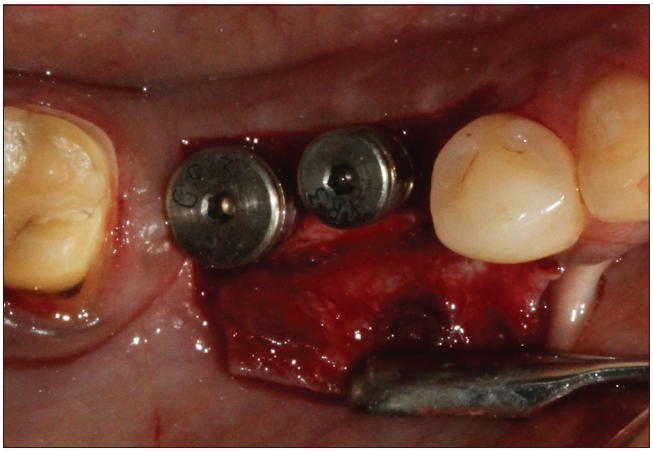

Figure 8: Mucoperiosteal flap raised and gingival formers attached

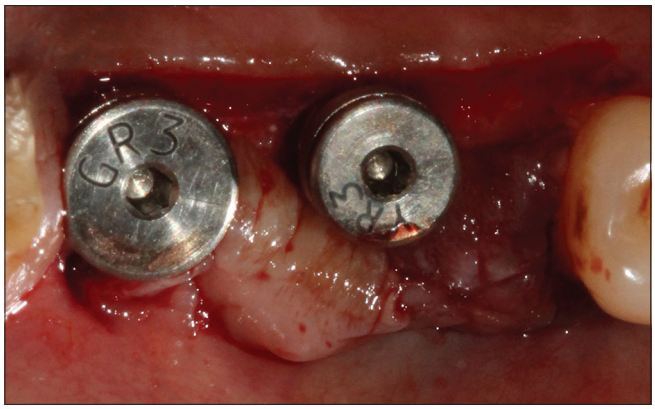

Figure 9: Semilunar incisions made in the flap at each implant and the tissue was then rotated towards the tongue to create a papilla between the implant and the tooth and between the two implants

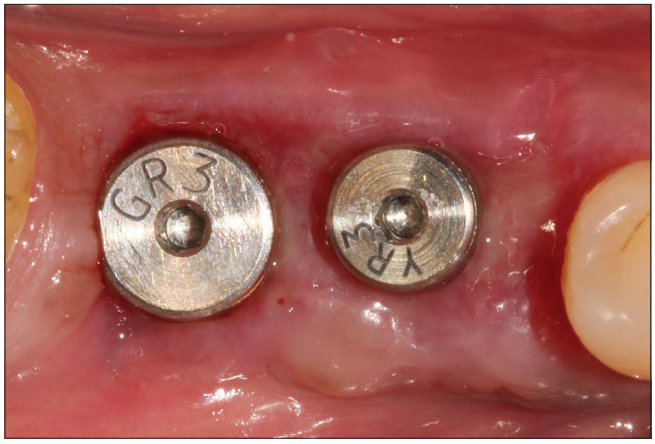

Figure 11: Bulky keratinized tissue and papilla was regenerated

eventual fracture of the cortex during separation, causing total detachment and interruption of the vascular supply, ultimately leading to bone necrosis and implant failure. Piezosurgery limits hard-tissue destruction[18] and avoids damage to fine anatomic structures. It also maintains a clear surgical site due to its cavitation effect created by irrigation and oscillation of the tip.[19]

Manipulation of the soft-tissue adjacent to the implants enables proper peri-implant tissue healing and can result in a soft-tissue architecture similar to the healthy gingival anatomy around the teeth.[20]

CONCLUSION

Rehabilitation of narrow alveolar ridges with implants placed in three-dimensionally correct positions can successfully be achieved by increasing ridge width using the two-stage ridge-split surgical protocol. Piezosurgery makes the procedure predictable and convenient to perform. The papilla regeneration technique provides enough keratinized tissue in the buccal aspect giving the prosthesis a natural emergence profile and also helps in maintaining adequate hygiene around the implants.

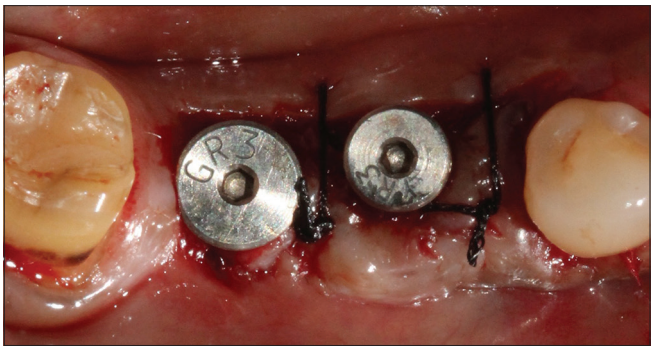

Figure 10: Mattress sutures hold the tissue in place

Figure 12: Final prosthesis

REFERENCES

1. Buser D, Martin W, Belser UC. Optimizing esthetics for implant restorations in the anterior maxilla: Anatomic and surgical considerations. Int J Oral Maxillofac Implants 2004;19 Suppl: 43-61.
2. Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants: A review and proposed criteria of success. Int J Oral Maxillofac Implants 1986;1:11-25.
3. Shulman LB. Surgical considerations in implant dentistry. J Dent Educ 1988;52:712-20.
4. Andersson B, Odman P, Widmark G, Waas A. Anterior tooth replacement with implants in patients with a narrow alveolar ridge form. A clinical study using guided tissue regeneration. Clin Oral Implants Res 1993;4:90-8.
5. De Boever AL, De Boever JA. A one-stage approach for nonsubmerged implants using a xenograft in narrow ridges: Report on seven cases. Int J Periodontics Restorative Dent 2003;23:169-75.
6. Bedrossian E, Tawfilis A, Alijanian A. Veneer grafting: A technique for augmentation of the resorbed alveolus prior to implant placement. A clinical report. Int J Oral Maxillofac Implants 2000;15:853-8.
7. Cordaro L, Amadé DS, Cordaro M. Clinical results of alveolar ridge augmentation with mandibular block bone grafts in partially edentulous patients prior to implant placement. Clin Oral Implants Res 2002;13:103-11.
8. Simion M, Baldoni M, Zaffe D. Jawbone enlargement using immediate implant placement associated with a split-crest technique and guided tissue regeneration. Int J Periodontics Restorative Dent 1992;12:462-73.
9. Takahashi T, Funaki K, Shintani H, Haruoka T. Use of horizontal alveolar distraction osteogenesis for implant placement in a narrow alveolar ridge: A case report. Int J Oral Maxillofac Implants 2004;19:291-4.
10. Engelke WG, Diederichs CG, Jacobs HG, Deckwer I. Alveolar

reconstruction with splitting osteotomy and microfixation of implants. Int J Oral Maxillofac Implants 1997;12:310-8.
11. Duncan JM, Westwood RM. Ridge widening for the thin maxilla: A clinical report. Int J Oral Maxillofac Implants 1997;12:224-7.
12. Palacci P, Nowzari H. Soft tissue enhancement around dental implants. Periodontol 2000 2008;47:113-32.
13. Summers RB. A new concept in maxillary implant surgery: The osteotome technique. Compendium 1994;15:152.
14. Scipioni A, Bruschi GB, Calesini G. The edentulous ridge expansion technique: A five-year study. Int J Periodontics Restorative Dent 1994;14:451-9.
15. Summers RB. The osteotome technique: Part 2 – The ridge expansion osteotomy (REO) procedure. Compendium 1994;15:422-6.
16. Summers RB. The osteotome technique: Part 3 – Less invasive methods of elevating the sinus floor. Compendium 1994;15:698-704.
17. 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;81:1580-6.
18. Vercellotti T. Technological characteristics and clinical indications of piezoelectric bone surgery. Minerva Stomatol 2004;53:207-14.
19. Schlee M, Steigmann M, Bratu E, Garg AK. Piezosurgery: Basics and possibilities. Implant Dent 2006;15:334-40.
20. Hertel RC, Blijdorp PA, Baker DL. A preventive mucosal flap technique for use in implantology. Int J Oral Maxillofac Implants 1993;8:452-8.

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