CASE REPORT

Inverted bone block for a mandibular lateral ridge augmentation: A case report

Raed AlRowis[1], Sherif Said[2], Razan Alaqeely[3], Sultan Albeshri[4], Gary Greenstein[5]

Abstract

The purpose of this report is to describe an original technique for bone grafting using an inverted autogenous bone block taken from the same edentulous site that was to be implanted. A 54-year-old female presented for replacement of a missing lower premolar. Clinical and radiographical assessments revealed a deficiency in the width of the alveolar ridge. It was decided to expand the edentate area using an inverted bone block. The graft was harvested from the same edentate site that was to be implanted. The crestal bone width after nine months of healing was increased, and an implant was placed. An autogenous inverted bone block can be used as a bone grafting procedure to augment some bone-deficient sites prior to dental implantations. This novel technique provides an autogenous bone without the complexity of having a second surgical site. This technique can be used in specific situations when there is proper bone anatomy.

Keywords: Alveolar bone loss, Alveolar ridge augmentation, Dental implants, Bone block.

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Introduction

Bone augmentation procedures are often needed before dental implantations to restore alveolar ridges that have undergone alveolar bone resorption following teeth extractions.[1] Multiple methods are in use to regenerate deficient alveolar ridges: autogenous bone blocks, xenogeneic and alloplastic bone blocks, and guided bone regeneration (GBR) with particulate bone material. Each procedure has advantages and disadvantages.[2,3] Autogenous block grafts are the only graft material that provide osteoconductive, osteoinductive, and osteogenic properties and are considered the gold standard for bone augmentation.[4] However, they require a second surgical site to harvest a bone block, which can result in morbidity issues (e.g., discomfort, oedema, infection).

To avoid problems that may be associated with obtaining a bone block from a secondary site, it was hypothesized that in certain situations it may be possible to reduce the number of surgical sites by harvesting an autogenous bone graft from a deficient edentate area and using it to augment the same ridge before dental implantation. This paper discusses a unique approach that employs an inverted mandibular bone block from an edentate area. The block was rotated so that its base was located coronally to increase the alveolar ridge width prior to implant insertion.

Case Report

A 54-year-old African American female was referred in September 2016 to the Dental Implant Clinic, Boston University Henry M. Goldman School of Dental Medicine, Boston, MA, United States, for replacement of a missing mandibular left premolar, which was lost 10 years ago due to caries. Clinically, there was a buccal plate deficiency corresponding to a Seibert Class I ridge defect (Figure 1-a).[5] Cone-beam computerised-tomography (CBCT) demonstrated bone loss in the coronal one-third of the ridge. The bone width at the crest was 5mm bucco-lingually (Figure 1-b) with increasing bone thickness apically (Figure1-c). The distance from the alveolar crest to the inferior alveolar nerve was 16mm.

It was planned to place an implant in two stages: bone augmentation, followed by dental implantation after adequate healing. Considering the CBCT findings with respect to alveolar topography, a novel approach was discussed with the patient and her consent was taken. It was decided to use the wider apical bone of the edentate ridge to augment the coronal aspect of the thinner alveolar crest.

Surgical technique: After administering local anaesthesia with Lidocaine (1/100,000, 2%), a horizontal mid-crestal incision across the edentate area was made. Two vertical-releasing incisions on the buccal were made, one tooth width to the adjacent sides of the edentate area, and a full thickness mucoperiosteal flap was raised. A crestal

[1,3,4]Department of Periodontics and Community Dentistry, College of Dentistry,King Saud University, Riyadh, Saudi Arabia; [2]Department of Periodontology, Boston University, Boston, USA; [5]Department of Periodontology, Columbia University, New York, USA.
Correspondence: Razan Alaqeely. e-mail: raqeely@ksu.edu.sa
ORCID ID: 0000-0001-6461-4552

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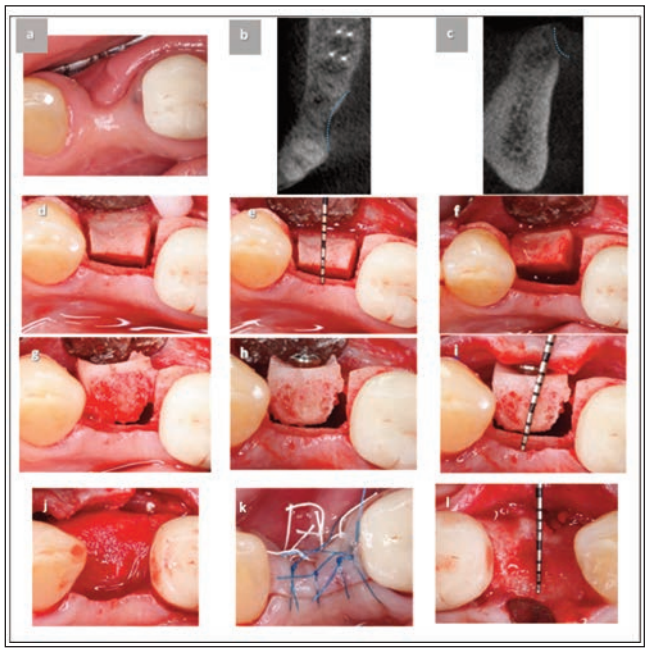

Figure-1: a) Occlusal view of missing #34. There is clinically insufficient buccolingual width; b) occlusal view showing the buccolingual width and the buccal defect; c) cross-section obtained from CBCT, note buccal bone deficiency; d) area of the missing tooth (#34) after osteotomy cuts at the crest and vertically; e) the block after ostectomy and before mobilization; f) the block graft after mobilisation; g) the block graft was inverted and positioned in the same place; h) fixation screw used to stabilise the bone block into its final position; i) measurement of width; j) coverage of the bone block with the xenograft and barrier membrane; k) tension-free closure of the site; l) measurement at re-entry.

horizontal osseous cut (Figure1-d) was made using a piezoelectric osteotomy PS1 tip (Piezotome ACTEON®, Acteon Group, UK). Vertical osseous cuts were made 1.5mm away from the adjacent teeth (#'s 19, 22) using a thin diamond bur extending 11mm in an apical direction. When creating the horizontal and vertical osteotomies, the tips and the diamond were angled toward the lingual cortical plate to create a wide base for the bone block.

Ridge split tips CS1 and CS2 (Piezotome ACTEON®, Acteon Group, UK) were used to deepen the cuts. Osteotomes were employed to widen the cuts and create green-stick fractures of the block (Figure 1-e). Next, the bone block was mobilised (Figure 1-f) and vertically rotated 180 degrees and placed back into the same area (Figure 1-g). The inverted bone graft was 11mm long, 7mm wide and 7 mm thick at its base.

To avoid block dislodgment, a 12mm-long fixation screw (TruTACK, ACE Surgical Supplies, Brockton, MA) was inserted passively to stabilise the inverted bone block (Figure 1-h). Figure 1-i shows the width of bone after fixation of the inverted block. The gap between the graft and native bone was filled with xenograft (Nu-oss®, ACE Surgical Supply, USA) and covered with resorbable collagen membrane (ACE RCM6®, ACE Surgical Supply, USA) (Figure

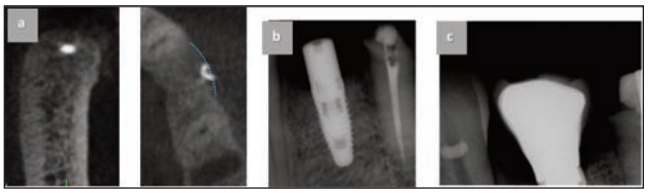

Figure-2: a) cross-sectional and occlusal images on the day of re-entry. Increased bone width with uniform thickness; b) Implant placed with a healing abutment; c)crown placed after four months of healing.

1-j). It has been reported that xenograft chips work as well as allograft particles in combination with an autogenous bone block.[6] After releasing the flap, tension-free closure was achieved and single interrupted sutures were placed in the crestal and vertical incisions (Figure 1-k) using 4/0 cytoplast (Cytoplast™, Osteogenics, Lubbok, TX, USA)and 6/0 Prolene photo-sutures (Prolene™, Ethicon Inc., Somerville, NJ, USA). Post-operatively, the patient was prescribed an antibiotic (Augmentin 1g, bid for seven days), Dexamethasone (5mg, single dose) and Ibuprofen (400mg, as needed for pain).

After nine months (Figure 1-l), re-entry with a full thickness mucoperiosteal flap was performed to remove the fixation screw and place a dental implant. The bone width at the crest was 7.5 mm (Figure 2-a). A 3.5mm wide and 10mm long PMC Nobel implant (Replace Select Tapered PMC, NobelReplace®, Switzerland) was inserted ensuring 2 mm of bone on the buccal and lingual sides of the implant. (Figure 2-b). The 2 mm thickness of bone buccal and lingual to the implant was desired to inhibit post-surgical bone resorption buccolingually and vertically.[7] The implant was restored after four months with a screw-retained crown (Figure 2-c).

Discussion

This case report demonstrates a mandibular ridge augmentation using an autogenous inverted bone block. The novelty of this technique was that there was only one surgical site, and an autogenous bone graft was harvested. This has not been previously reported in the dental literature. Inversion of the bone block yielded an autogenous block with a large quantity of cancellous bone, and thus, enhanced vascular supply.[2] This procedure avoided garnering a graft from an additional intraoral site, thereby reducing the possibility of infection, increased discomfort, and oedema.

The inverted block lost around 0.5mm of its horizontal width after nine months with no vertical bone loss. The width decreased by 6.25%.[8] The expected resorption after horizontal block grafting ranges from 6.12% to 10.28%. The low resorption rate of the bone block can possibly be explained by two factors: coverage with a membrane and nature of the bone. In this regard, a recent systematic

review reported that membrane coverage of a bone block graft decreased the rate of bone resorption.[9] Others reported that cortical bone takes longer to revascularise than cancellous bone.[2] In this case, inverting the bone block from the same edentulous site retained a large quantity of cancellous bone and probably facilitated quicker revascularisation of the block resulting in minimal bone resorption.[8]

Post-operatively, after the block procedure, the patient had an uneventful recovery with minor oedema. She did not complain of paraesthesia or demonstrate any signs of neuropathy. Upon flap elevation to place an implant, the bone block seemed fully integrated with the adjacent bone.

The authors are aware that the ridge could have been augmented using other methods, such as guided bone regeneration with a particulate graft. The concept of using an inverted bone block graft to augment a ridge was a proof of principal procedure. Successful horizontal augmentation with an inverted bone block demonstrates an additional method to augment a deficient ridge. In our opinion, there may be situations where crest of the ridge is so thin that an inverted bone block may provide a more predictable result than a particulate graft with a membrane. The option of using an inverted block might be limited to the posterior mandible after careful assessment of the available bone and the vital structures.

Conclusion

This novel technique provides an autogenous bone graft without the complexity of having a second surgical site. This technique can be used in specific situations when there is proper bone anatomy.

Consent: The patient provided written, informed consent for the publication of the case report.

Disclaimer: The first author was visiting the Department of Periodontology and Community Dentistry, Boston University, Boston, USA, when the case was seen.

Conflict of interest: None.

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References

1. Starch-Jensen T, Deluiz D, Deb S, Bruun NH, Tinoco EMB. Harvesting of Autogenous Bone Graft from the Ascending Mandibular Ramus Compared with the Chin Region: a Systematic Review and Meta-Analysis Focusing on Complications and Donor Site Morbidity. J Oral Maxillofac Res 2020;11:e1. doi: 10.5037/jomr.2020.11301.
2. McKenna GJ, Gjengedal H, Harkin J, Holland N, Moore C, Srinivasan M. Effect of autogenous bone graft site on dental implant survival and donor site complications: a systematic review and meta-analysis. J Evid Based Dent Pract 2022;22:e101731. doi: 10.1016/j.jebdp.2022.101731.
3. Sanz-Sánchez I, Sanz-Martín I, Ortiz-Vigón A, Molina A, Sanz M. Complications in bone-grafting procedures: Classification and management. Periodontol 2000 2022;88:86-102. doi: 10.1111/prd.12413.
4. Wang SH, Shen YW, Fuh LJ, Peng SL, Tsai MT, Huang HL, et al. Relationship between Cortical Bone Thickness and Cancellous Bone Density at Dental Implant Sites in the Jawbone. Diagnostics (Basel) 2020;10:710. doi: 10.3390/diagnostics10090710.
5. Seibert JS. Reconstruction of deformed, partially edentulous ridges, using full thickness onlay grafts. Part I. Technique and wound healing. Compend Contin Educ Dent (Lawrenceville) 1983;4:437-53.
6. Leonida A, Favero G, Caccianiga P, Ceraulo S, Rodella LF, Rezzani R, et al. Concentrated Growth Factors (CGF) Combined with Melatonin in Guided Bone Regeneration (GBR): A Case Report. Diagnostics (Basel) 2022;12:1257. doi: 10.3390/diagnostics12051257.
7. Hartlev J, Schou S, Isidor F, Nørholt SE. A clinical and radiographic study of implants placed in autogenous bone grafts covered by either a platelet-rich fibrin membrane or deproteinised bovine bone mineral and a collagen membrane: a pilot randomised controlled clinical trial with a 2-year follow-up. Int J Implant Dent 2021;7:8. doi: 10.1186/s40729-021-00289-z.
8. Aloy-Prósper A, Carramolino-Cuéllar E, Peñarrocha-Oltra D, Soto-Peñaloza D, Peñarrocha-Diago M. Intraoral onlay block bone grafts versus cortical tenting technique on alveolar ridge augmentations: a systematic review. Med Oral Patol Oral Cir Bucal 2022;27:e181-e90. doi: 10.4317/medoral.25169.
9. Zaki J, Alnawawy M, Yussif N, Elkhadem A. The Effect of Membrane Coverage on the Resorption of Autogenous Intraoral Block Grafts in Horizontal Ridge Augmentation: A Systematic Review of Literature and Meta-Analysis: Inevitability or an Iatrogenic Vulnerability? J Evid Based Dent Pract 2018;18:275-89. doi: 10.1016/j.jebdp.2017.11.001.

Author Contribution:
RA: Design and writing.
SS: Conception of study.
RA: Data interpretation and writing.
SA: Data analysis.
GG: Guidance and writing.