

## CASE REPORT

# Management of Inadequate Bone for Implant Placement in Esthetic Zone: A Case Series

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## ABSTRACT

**Introduction:** In the past, it was thought that presence of sufficient bone was mandatory for dental implants for primary stability. However, in the modern era, several techniques and a variety of materials are available for management of such cases.

**Aim:** Bone resorption followed by loss of teeth can lead to alveolar ridge defects, which can further impose problems in placement of dental implants. These defects can be in width or height of available bone. Vertical defects in alveolar ridge are quite difficult to manage for dental surgeons. This report describes several techniques for management of deficient bone in esthetic zone for implant placement.

**Case report:** In this case series, authors have discussed several techniques like ridge splitting and expansion, guided bone regeneration (GBR), block graft, and alveolar distraction osteogenesis (DO) for the management of alveolar defects. Through this case series, authors have tried to describe indications and contraindications of each procedure.

**Conclusion:** The choice of techniques depends upon the situation and clinician's choice. There are no specific guidelines for techniques to be used.

**Clinical significance:** This case series describes several techniques, which can be employed routinely in cases of deficient bone and will facilitate placement of implants.

**Keywords:** Block graft, Deficient bone, Distraction osteogenesis, Esthetic zone, Guided bone regeneration, Ridge splitting.

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## INTRODUCTION

Dental implants are routinely used in dental practice today for the treatment of total or partial edentulism.

Subsequent bone loss after tooth loss is often seen, which results in inadequate bone availability, hence affecting the prosthetically driven positioning of dental implants.<sup>1-3</sup> Edentulous alveolar ridges having bone of less than 5 mm in width are considered to require bone augmentation procedures so that the remaining bone thickness around the implant is at least 1 mm. This bone is required for long-term esthetic and function of implant. Insufficient bone can lead to following problems:

- A thin labial plate that resorbs eventually and leads to implant exposure.
- Grayish metal exposure can occur due to dehiscence of bone in labial aspect, which will compromise esthetics.
- Insufficient bone will lead to poor soft tissue and imperfect emergence profile.<sup>4</sup>

In this case series, we have discussed several treatment modalities for adequate placement of implants and prosthetic rehabilitation in atrophic ridges in esthetic zone.

## RIDGE SPLITTING AND EXPANSION

The "split-crest" technique consists of creating a split between the lingual and buccal cortical plates,<sup>5-8</sup> displacing the cortical bones and separating them from the spongy bone and creating a middle gap, which is occupied mostly by the inserted implants. Several materials, such as autologous bone graft, particulate bone graft, platelet-rich fibrin, etc., can be used to fill the unoccupied space.<sup>9</sup> The advantage of this technique is that, simultaneous placement of implant can be done and since graft is not required so cost is also reduced.<sup>10</sup> Viscoelasticity of bone facilitates its compression and manipulation. Compression of bone increases the density of bone and bone to implant contact, which leads to better osseointegration. In this case osteotome technique was used, which does not produce heat and viable bone-forming cells are not destroyed. Tactile sensitivity is also achieved with this technique.<sup>11</sup>

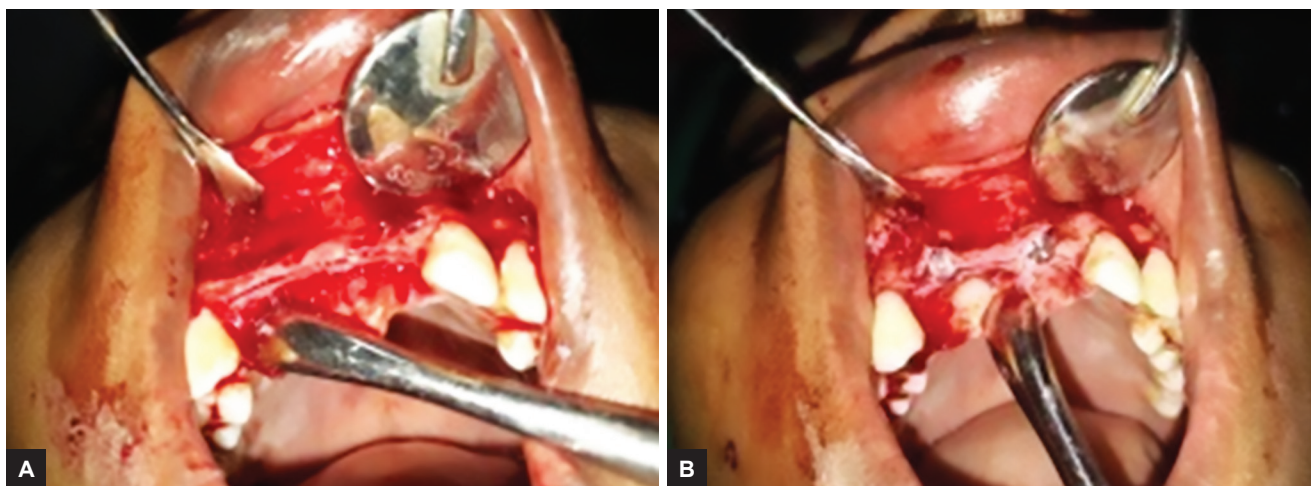
A 22-year-old female patient reported with a missing 11, 21, and 22. On radiological examination 3.5 mm of bone was found. Mucoperiosteal flap was elevated and split was created using Bard-Parker blade. Later the split was extended using osteotomes (Fig. 1A). Implants of 3.3 × 13 mm (Adin Touareg made in Israel) were placed in the same appointment (Fig. 1B).

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**Figs 1A and B:** (A) Split created. (B) Implants placed in the same visit

### GUIDED BONE REGENERATION

Guided bone regeneration technique utilizes barrier membranes with or without bone graft material. Success of this technique depends upon migration of osteogenic cells from the adjacent bone/bone marrow to the defect site and prevention of soft tissue forming cells.<sup>12,13</sup> To accomplish this, the osteogenesis rate from bony margins should exceed the fibrogenesis rate from surrounding soft tissue.<sup>14</sup> Four basic principles are required for GBR: (1) space maintenance, (2) stability of fibrin clot, (3) exclusion of epithelium cells, and (4) primary wound closure.<sup>15</sup> Autogenous bone, allografts, xenografts, and alloplasts are the materials that can be used for this. There are different mechanisms by which graft materials act, which depends upon their origin and composition. Autologous graft, which can be harvested from different sites of the patient, leads to *de novo* bone formation by osteogenesis, osteoconduction, and osteoinduction. Allografts harvested from human cadavers are not osteogenic. They act by osteoinduction and osteoconduction only. Xenografts/alloplasts are mainly osteoconductive. Membranes can be of either nonresorbable membranes [expanded polytetrafluoroethylene (PTFE), high-density PTFE, titanium-reinforced PTFE, titanium mesh] or resorbable membranes (collagen). The bioresorbable membranes do not require surgical exposure to remove membrane, are cost effective, and have decreased patient morbidity.<sup>16</sup>

In this case report, surgical site was exposed by reflecting a full thickness mucoperiosteal flap. Crestal and vertical releasing incisions were given. Mobility of flap was tested for a tension-free primary closure. Osteotomy for implant was made and Adin implant of 3.3 × 13 size was placed in 21. Upon placement of implant a fracture of labial plate was observed (Fig. 2A). This fracture plate was too thin. So GBR was planned. Xenograft (Cerabone Botiss Biomateri-

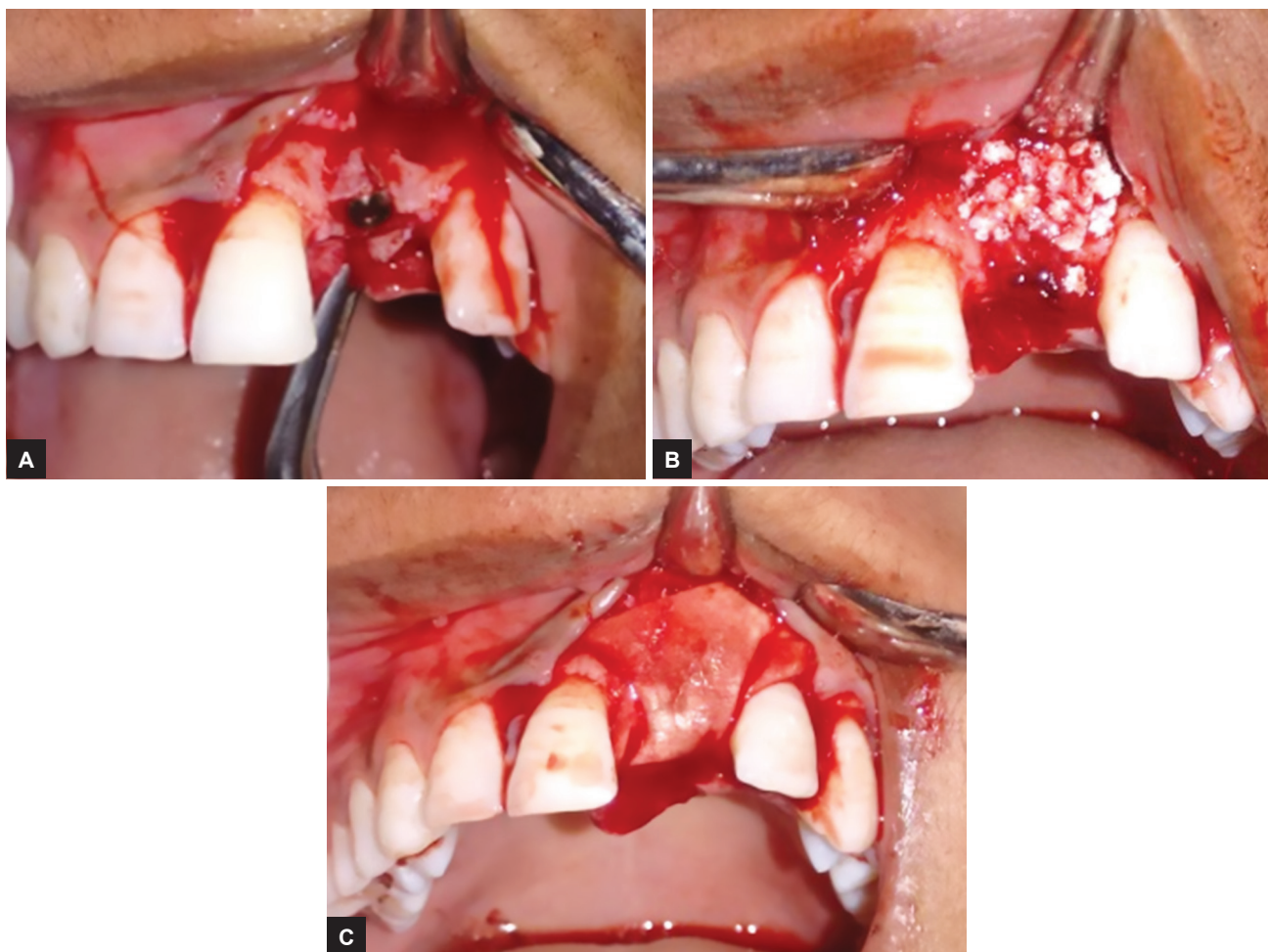
als) was mixed with patients' own blood and used to cover the fractured labial plate (Fig. 2B). A collagen membrane (PerioCol®-GTR EUCARE) was used to cover the graft (Fig. 2C). Finally, tensionless suture was done.

### BLOCK GRAFT

The use of autologous bone graft for management of alveolar ridge defect was first advocated in 1975.<sup>17</sup> It is still considered the gold standard of bone grafting. Its mechanism of action includes all the required properties of a graft material, which are osteoinduction, osteogenesis, and osteoconduction.<sup>18-20</sup> Possible donor sites can be calvaria, tibia iliac crest, etc, (extraoral sources)<sup>21</sup> or mandibular symphysis and ramus (intraoral).<sup>22-24</sup> Intraoral sources have an advantages of easy availability, no cutaneous scarring, and less morbidity. The mandible is preferred as donor site as it has several benefits, including better compact bone quality, easy access, minimal volume loss, shorter healing time, and embryological proximity.<sup>25</sup>

In this case report, full thickness flaps were raised for easy access to the alveolar ridge with a crestal incision and mesial and distal releasing incisions to achieve easy movement of the buccal flap. Exposure of the planned implant site permitted direct measurement of the available bone and amount of bone augmentation required (Fig. 3A).

Now, bone harvesting was initiated. Access to the mandible symphysis was gained through a horizontal incision deep in the vestibule, extending in intercannine region. A rectangular block was harvested depending upon the amount of bone required (Fig. 3B). Care was taken not to interfere with lower anterior roots. A round bur with copious amount of saline irrigation is used for preparation of recipient site to create multiple holes through the cortical bone to form communications with the marrow space. The harvested bone block was then trimmed and adjusted so



**Figs 2A to C:** (A) Intraoral image of the patient showing fractured labial plate after implant placement. (B) Xenograft placed covering fractured labial plate. (C) Collagen membrane covering the graft

that it could fit in to the recipient site, where it was firmly secured with the aid of titanium screws (Fig. 3C). Autogenous bone chips were then packed around the block to fill any gap. Collagen membrane (PerioCol) was used to protect the graft. Flap closure was done without tension. Extraoral pressure dressing was applied in chin region for 4 days to minimize postoperative swelling. A healing period of 6 months was ensured before implant placement.

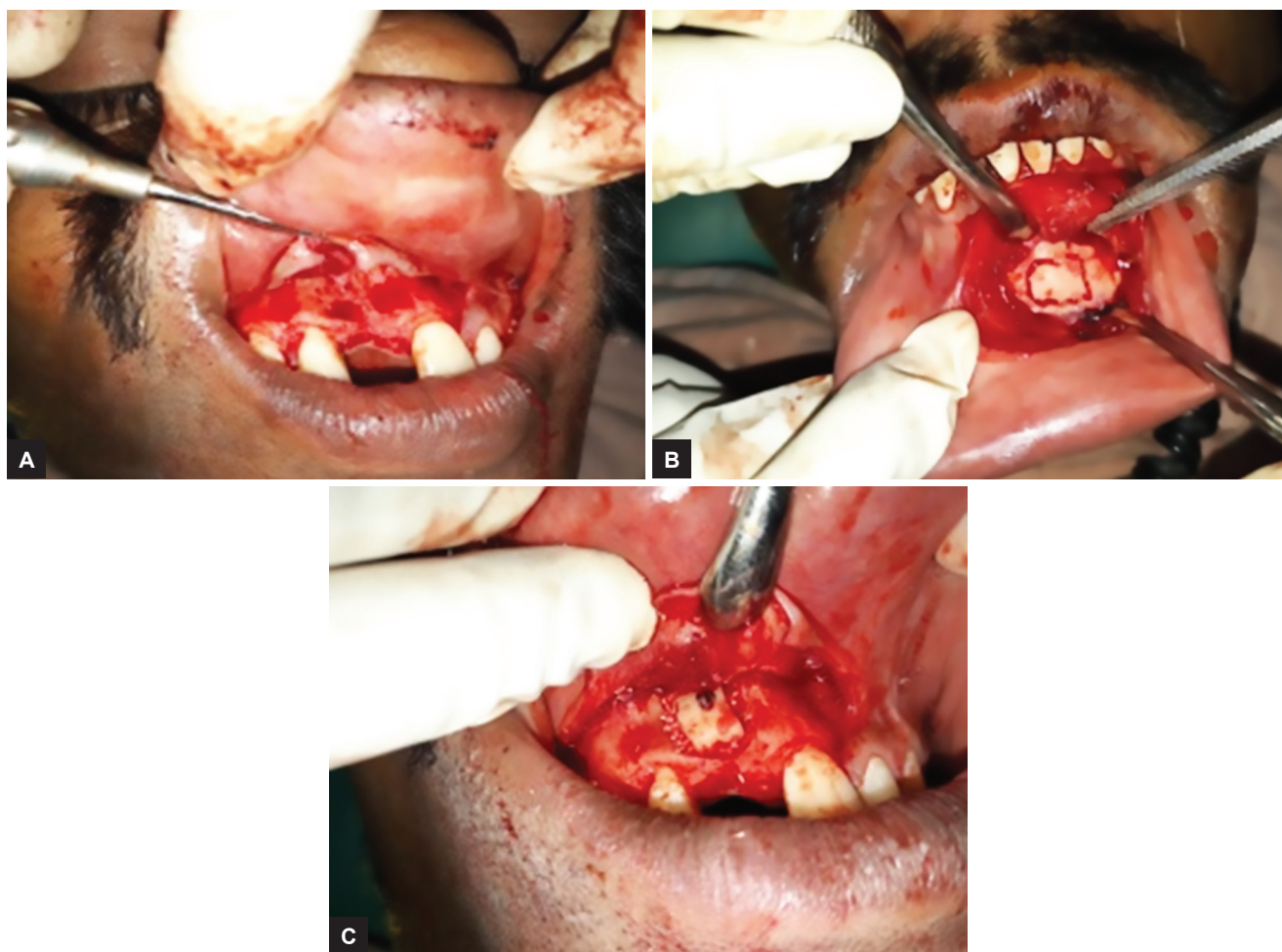
### DISTRACTION OSTEOGENESIS

Alveolar distraction is a bone regeneration technique that is done by progressively creating a separation between the bone fragments by osteotomy and slowly increasing it with the help of distractors (Fig. 4).<sup>26</sup> Recently, it is been used for horizontal or vertical bone augmentation. Distraction osteogenesis for alveolar deficiencies was first used by Chin and Toth<sup>27</sup> to correct vertical mandibular alveolar deficiency. Stable results are being obtained with alveolar DO in terms of both soft and hard tissue augmentation. Tension–stress effect on bone formation has been well explained by Ilizarov.<sup>28</sup> The results of Ilizarov’s

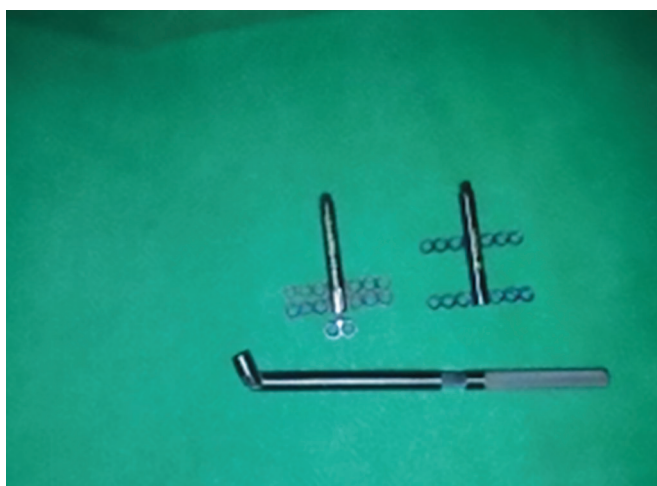
studies showed that latency period should be at least 5 days.<sup>29</sup> But in clinical practice it is seen that a latency of 7 days reduces the risk of exposure of bone to the oral environment, hence it is commonly used. Rate of distraction depends upon the type of device used. For vertical distraction usually a rate of 1 mm/24 hours and for horizontal/two-dimensional distraction a slower rate of less than 0.5 mm/24 hours is used. Too slow rate can lead to premature union and nonunion can result in case of too rapid rate. Before implantation, a consolidation period of 3 months for complete healing of distracted bone is important for implant integration and function.<sup>26</sup>

### CONCLUSION

Many techniques have been advocated for placement of implant in atrophic ridges. All have their advantages and disadvantages. No clear indication is provided for each augmentation technique, still leaving the clinician with the responsibility of final choice. Future studies should better describe the clinical situation before choosing the augmentation procedures.



**Figs 3A to C:** (A) Surgical exposure of the implant site showing deficient bone. (B) Mandibular symphysis (donor site) exposed. (C) Block graft stabilized with titanium screws



**Fig. 4:** Alveolar distractor with the key

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