Onlay Grafting with FDBA Block Bone for Reconstruction of Localized Maxillary Ridge Defect

Pranjali V Bawankar¹, Abhay P Kolte², Rajashri A Kolte³

Abstract

Aim: The aim of the present case was to evaluate the efficacy of freeze-dried bone allograft (FDBA) bone block in the augmentation of atrophied maxillary esthetic zone.

Background: The placement of endosseous dental implants is often hampered by unfavorable anatomy of the alveolar bone thereby making it difficult for the placement of implant in an optimal prosthetic position. The loss of width of the residual alveolar ridge necessitated measures which could refurbish the lost dimensions for adequate bone availability for the implant placement.

Case Description: Here we report the successful management of atrophic ridge condition in the maxillary anterior esthetic zone wherein the placement of implant was made possible by the placement of FDBA bone block allograft obtained from the tissue bank. The predictable osseointegration was achieved after placement of a regular platform implant and restoration of the complete esthetics, and the patient satisfaction was attained.

Conclusion: Allogenic bone blocks can serve as a good alternative for autogenous bone owing to its unlimited availability, reduced donor site morbidity, increased patient compliance, and decreased treatment time.

Clinical significance: Allogenic bone block confers an excellent alternative to autogenous bone blocks for the augmentation of atrophic maxillary ridges for the placement of endosseous implant.

Keywords: Onlay graft, Reconstruction, Ridge defect.


Background

Oral rehabilitation of patients with missing teeth with oral implants is a flourishing treatment modality since the last few years. Ridge atrophy may become an impediment for the implant placement at prosthetically correct position. Inadequate bone volume requires hard tissue reconstruction. Autogenous bone has been a gold standard over the years. Autogenous bone blocks can be routinely harvested from the intraoral sites such as retromolar, buccal shelf, and symphyseal region of the mandible, maxillary tuberosity, and extraoral sites such as tibia, fibula, iliac crest, and ribs. Nevertheless it has been associated with disadvantages such as donor site morbidity, increased discomfort and pain, limited amount of graft obtained, the need for general anesthesia, and hospitalization in case of extraoral grafts.

In the recent years, several alternatives have been investigated to surmount the reported disadvantages of autologous bone. Allogenic grafts obtained from individuals of the same species but with different genetic load have been extensively used and is becoming the block graft of choice for the clinicians. It is considered to be biocompatible with great applicability, exhibits good postoperative response without donor site morbidity, and is available in unlimited quantities. These can be obtained from living donors of the same species or from cadavers. The bone is processed and stored in tissue banks. Depending on the type of treatment, fresh frozen bone (FFB), freeze-dried bone, and demineralized freeze-dried bone can be obtained.

The present case report reveals the applicability and efficiency of freeze-dried bone allograft (FDBA) to augment a horizontally deficient maxillary anterior ridge for single dental implant placement.

Case Description

A 25-year-old female patient visited the Department of Periodontics and Implantology of our institute with the chief complaint of missing right central incisor which she wanted to be replaced probably with an implant. After recording a detailed case history, a comprehensive treatment was planned for the patient. A cone beam computed tomography (CBCT) scan was advised to determine the underlying osseous ridge contours and dimensions and density of the residual alveolar bone at the proposed implant site. CBCT scan revealed that there was only 1.3 mm bone width but adequate ridge height at the implant site which required horizontal bone augmentation (Fig. 1). The patient was explained about the present state, alternative treatment plans, and the proposed treatment plan. Consequently, a written informed consent was obtained from the patient. A staged treatment procedure was planned to reduce potential complications such as wound dehiscence and block graft fracture. The treatment was planned in the following stages:

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Horizontal ridge augmentation with FDBA block bone
- Stage I surgery 6 months later
- Stage II surgery 3 months later.

Surgical Procedure
Mid-crestal incision with bilateral oblique releasing incisions was given in the maxillary anterior region at the implant site and full thickness mucoperiosteal flap was raised. Intramarrow penetration was performed at the recipient site with 0.5-mm round bur (Fig. 2). Intramarrow penetration improves the blood supply to the graft from the trabecular bone blood vessels thereby accelerating revascularization. Surgical trauma also accelerates regional acceleratory phenomenon which results in 2-10 times faster healing.

The FDBA block graft was procured from the tissue bank of TATA Memorial Hospital, Mumbai. It was a corticocancellous bone block measuring 1 cm × 1 cm, which was trimmed to the required dimensions and care was taken to round off any sharp borders or edges (Fig. 3). Block graft was fixed to the recipient site with 1.6 mm diameter titanium self-tap screws. Two screws were used for the fixation of the block and to prevent microrotation of the graft which can result in compromised healing. The area between the block graft and recipient site and on the lateral aspects of the recipient site was filled with demineralised freeze dried bone allograft (DFDBA) and nanocrystalline hydroxyapatite synthetic graft material (Sybograf) of particle size 200–300 microns (Eucare Pharmaceuticals (P) Ltd, Chennai, India) (Fig. 4). PerioCol collagen membrane (Eucare Pharmaceuticals (P) Ltd, Chennai, India) for guided bone regeneration was placed over the grafted site. The flap was sutured using 3-0 mersilk (ETHICON) silk suture (Fig. 5). The patient was given postoperative instructions and medications. The patient was advised to rinse with 0.12% chlorhexidine gluconate for a period of 15 days. Oral hygiene instructions were reinforced.

Implant Placement and Prosthesis
Six months after the graft surgery, on evaluation by CBCT, it was revealed that 9.5 mm increase in bone width was obtained (Fig. 6). After raising a full thickness mucoperiosteal flap, however, it was observed that around 3 mm of the buccal cortex of the block graft was necrosed. The titanium self-tap screws were removed. The necrosed part was trimmed till fresh bleeding was observed. Subsequently, a 4.3 × 13 mm (regular platform [RP]) implant (Nobel Biocare Replace Select, Goteborg, Sweden) was placed with sequential drilling (Fig. 7). The immediate postoperative period was uneventful and the patient returned 3 months later for the definitive prosthesis. Periapical radiograph was taken which showed successful osseointegration. Then the healing abutment was placed using a minimally invasive (cross) incision for the exposure of implant cover screw. Fifteen days later, the impression was recorded and sent to the laboratory for the fabrication of metal–ceramic crown prosthesis. The metal try-in was performed (Fig. 8) and the appropriate shade was selected.
in the natural light. Later, bisque trial was done followed by final glazed metal ceramic crown cementation onto the implant (Fig. 9). The patient was recalled after 6, 12, and 18 months. The implant was seen to perform well in terms of function and esthetics with complete patient satisfaction.

**DISCUSSION**

Osseous grafting is an established treatment methodology for the management and augmentation of the deficient alveolar ridges. Successful bone regeneration requires a concurrent revascularization and substitution of the graft material with host bone. The pattern, rate, and quality of the new bone substitution are determined, in part, by complex reactions between the healing processes of the biological host and the nature of the graft material.

Three-dimensional outcome assessment of alveolar ridge augmentation procedures with CBCT scans makes the measuring process more accurate and reliable. The ideal bone graft should be (1) osteoinductive and conductive; (2) biomechanically stable; (3) disease free; and (4) contain minimal antigenic factors. All these features are found in autograft bone. The disadvantages of autografts incorporate the need for a separate incision for harvesting, increased operational time, and the possibility of donor site complications. Allogenic bone blocks have the advantage of containing growth factors and the original human scaffold. A major disadvantage is the risk of substantial graft volume decrease due to resorption.

The advantage of allogenic bone is its ready-to-use availability and unconstrained quantity. Recent review articles confirm high success rates of using allogenic bone blocks. Esser et al. regarded FDBA alloblocks to be effective for the reconstructive preimplant.
procedures in the alveolar ridge. The average rates of graft exposure, delayed wound healing and graft loss, and the degree of resorption and substitution were found to be similar to the results of autologous techniques. The use of allogenic block graft harvested from the same species represents a better alternative to the use of autogenous block bone. Allogenic grafts have proven to be successful in terms of integration with the host bone due to their osteoinductive potential. In addition, these grafts offer several benefits in comparison to autogenous grafts by means of reducing morbidity, discomfort, and operation time. A high heterogeneity among studies existed when examining the histologic behaviour of allografts; while Lumetti et al. reported minimal differences for allogenic blocks when compared to autogenous blocks, Spin-Neto et al. found major dissimilarities between them. For the allogenic bone block, large segments of necrotic bone with empty osteocytes lacunae and little osteoclastic activity and minimal number of blood vessels invading Haversian canals were found. In addition, no direct contact between remodelled and grafted bone was found. For autogenous block grafts, small areas of necrotic bone with the abundant presence of osteocytes were detected. No difference between the graft and host bone was noticed.

Bone autograft still remains the “gold standard” in the ridge augmentation procedures due to its osteogenic, osteoinductive, and osteoconductive properties. Allograft, on the contrary, only serves as an osteoconductive matrix for the new bone formation. Although clinical studies have proven the reliability of allografts, concerns about disease transmission remain and the risk of immune responses cannot be ruled out. A rigid fixation of the blocks is mandatory. A movement of 10–20 μm during the early stages of wound healing is enough to direct differentiation of mesenchymal cells into fibroblasts instead of osteoblasts, ultimately leading to failure of the allograft. To obtain the maximum stability of the graft, osteosynthesis screws should be screwed up to palatal cortical plate. Accuracy must also be taken into account during edge shaping to avoid soft tissue laceration. A study from Rothamel et al. showed that the pericardium membrane promoted the proliferation of human osteoblasts.

In the present case, we performed onlay grafting using FDBA allograft as it has sufficient rigidity as compared to DFDBA bone block which is more spongy and is difficult to fix with screws. Also, comparable results have been established with the autogenous bone coupled with unlimited availability for large defects. Bone augmentation can also be performed by bone spreading or ridge splitting technique which are predictable procedures but have mechanical limitation in cases with ridge width less than 3 mm. In this case, it was not possible to split the cortices because the bone width existing at the implant site was only 1.3 mm. Thus, onlay block grafting with FDBA bone was chosen and it offered predictable results and complete patient satisfaction.

**Conclusion**
This case report suggests the reliability of allogenic bone graft as the restoring material for maxillary ridge reconstruction. Successful bone regeneration can be achieved with FDBA bone block with increased predictability for implant placement in cases of deficient maxillary ridges. Allograft serves as a good alternative for ridge augmentation in the atrophic jaw for the implant placement. The overall morbidity is minimal and minimally invasive with adequate patient compliance.

**Clinical Significance**
The FDBA allogenic block bone owing to the virtue of adequate stiffness and less resorption rate confers a great alternative for the augmentation of atrophic anterior maxilla for successful implant placement in correct prosthetic position.

**References**


