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Anterior Implant Placement with Block Graft for Ridge Augmentation in a Young Patient with Severe Bone Deficiency: A Clinical Case Report

Dr. Gaurang Mistry[1], Dr. Ashwini Kini[2], Dr. Kunal Mehta[3], Dr. Sapna Singh[4], Dr. Rasha Ansari[5], Dr. Yash Gujar[6]

[1]Dean & HOD and PG guide, Department of Prosthodontics, D.Y. Patil Deemed to be University, School of Dentistry, Navi Mumbai.

[2]Professor and PG guide, Department of Prosthodontics, D.Y. Patil Deemed to be University, School of Dentistry, Navi Mumbai.

[3]Associate Professor, Department of Prosthodontics, D.Y. Patil Deemed to be University, School of Dentistry, Navi Mumbai.

[4]Postgraduate student, Department of Prosthodontics, D.Y. Patil Deemed to be University, School of Dentistry, Navi Mumbai.

[5]Lecturer, Department of Prosthodontics, D.Y. Patil Deemed to be University, School of Dentistry, Navi Mumbai.

[6]Postgraduate student, Department of Prosthodontics, D.Y. Patil Deemed to be University, School of Dentistry, Navi Mumbai.

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ABSTRACT

The present case report describes the successful rehabilitation of a young patient with a missing anterior tooth and severe bone resorption using a combination of block grafting and dental implant placement. A young adult male had a missing maxillary central incisor for 12 years, leading to significant bone loss in the region. A block graft was harvested from the mandibular symphysis and used for ridge augmentation, followed by implant placement with immediate loading of a temporary crown. The graft successfully restored both vertical and horizontal dimensions of the ridge, creating an optimal environment for implant osseointegration. A final prosthesis was placed after a healing period of three months, providing both functional and esthetic restoration. The case report highlights the effectiveness of autogenous block grafting combined with guided bone regeneration as a reliable and predictable method for managing severe bone deficiency in implant dentistry.

Keywords: *bone augmentation; dental implant; block graft; autogenous graft; guided bone regeneration*

1. INTRODUCTION

Dental implants have revolutionized the field of prosthodontics by offering a highly predictable and effective solution for the restoration of missing teeth. The success of dental implants, however, is closely linked to the quantity and quality of the available bone at the implant site. In patients with significant bone loss, particularly in cases of long-term edentulism or traumatic bone resorption, implant placement can become challenging due to the inability to achieve sufficient primary stability for the implant.[1] This problem is particularly evident in the anterior region of the jaw, where both functional restoration and aesthetic outcomes are paramount.

To address these challenges, bone augmentation techniques have gained widespread use. These methods are essential in implant dentistry for restoring sufficient bone volume in areas with significant resorption, ensuring the proper support for implant placement. Techniques such as guided bone regeneration (GBR), sinus lifts, and bone grafting, including both autogenous and allogenic grafts, are commonly employed to enhance bone dimensions and facilitate successful osseointegration.[2]

The block graft technique involves harvesting bone from a donor siteand transplanting it to the implant site to augment deficient bone.[3] This method is preferred for its ability to restore both the vertical and horizontal dimensions of the alveolar ridge, creating an ideal environment for implant placement. Autogenous bone grafts have osteogenic, osteoinductive, and osteoconductive properties.[4] Therefore, they are considered the gold standard for bone regeneration, ensuring better integration and reduced risk of rejection.[5]

The present case report details the autogenous bone graft-based clinical management of a young adult who presented severe bone resorption in place of a prolonged missing maxillary central incisor.

2. CASE REPORT

Patient Presentation and Diagnosis

A 22-year-old male presented to the Department of Prosthodontics at DY Patil University School of Dentistry with amissing maxillary right central incisor. The patient reported that the tooth had been missing for 12 years. On intraoral examination, the site of the missing tooth exhibited a severe loss of buccolingual width and height of the alveolar ridge, making implant placement a challenge. Radiographic analysis, including a CBCT scan, confirmed the presence of a saucer-shaped defect in the labial aspect of the ridge, with insufficient bone volume for immediate implant placement (Figure 1).

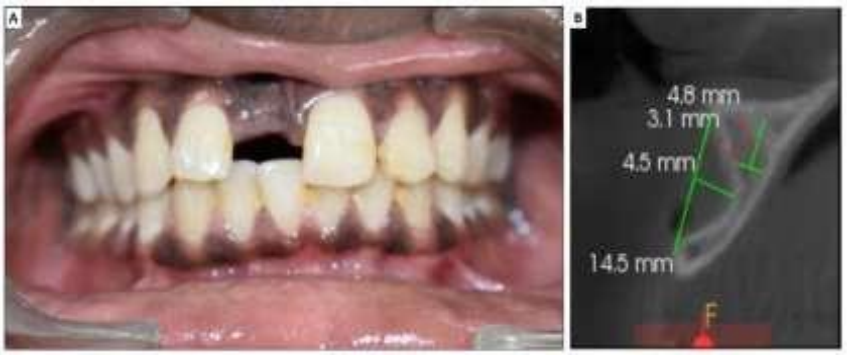

Figure 1: A) Missing central incisor with severely resorbed ridge; B) CBCT showing insufficient bone

The clinical diagnosis was severe alveolar ridge deficiency due to long-term edentulism in the anterior maxilla, compounded by the loss of both vertical and horizontal bone dimensions. Given the patient's young age and aesthetic concerns, a comprehensive treatment plan was devised to restore both function and aesthetics.

Treatment Planning and Approach

A multidisciplinary approach was undertaken to address the patient's functional and aesthetic needs. The primary goal of treatment was to restore the missing tooth with a dental implant while addressing the significant bone deficiency in the anterior maxilla. The treatment plan was divided into two stages: bone augmentation followed by implant placement and prosthetic restoration.

Bone Augmentation with Block Grafting: The first stage of treatment focused on augmenting the deficient bone in the implant site. A block graft procedure was planned to increase both the buccolingual and vertical dimensions of the ridge. An autogenous bone graft was harvested from the mandibular symphysis, a site chosen for its high success rate and minimal morbidity (Figure 2). This region provides a reliable source of bone due to its intramembranous origin, which tends to resorb less and offers better integration potential compared to other donor sites.

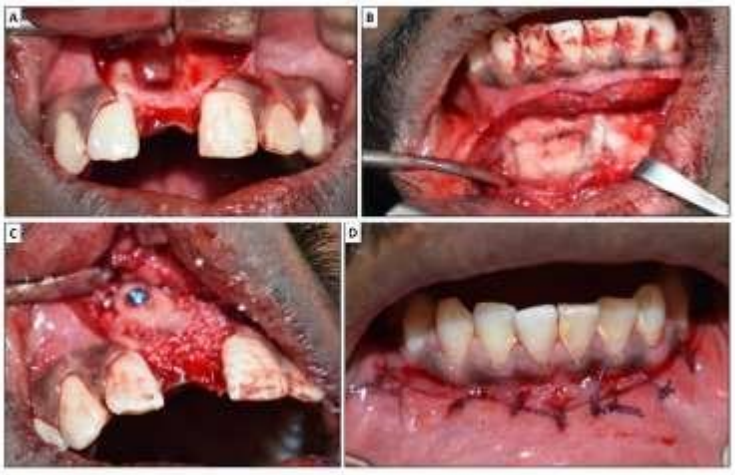

Figure 2: A) Flap reflection at implant site; B) Flap reflection at donor site; C) Insertion of combined graft; D) Suturing of donor site

The harvested block graft was then secured onto the buccal aspect of the implant site using fixation screws, with additional allograft material and a titanium mesh used to support GBR. The GBR technique helps in directing bone growth towards the implant site, ensuring the desired shape and volume of the augmented ridge. The grafted site was then sutured, and the patient was instructed on post-operative care, including avoiding any direct trauma to the area.

Implant Placement and Immediate Loading: After a healing period of approximately four months, a follow-up CBCT scan was performed to assess the success of the graft and the volume of bone achieved. The scan revealed that the graft had integrated well and that adequate bone volume had been restored in both the buccolingual and vertical dimensions. With sufficient bone present for implant placement, the decision was made to proceed with the placement of a 4.5 x 13 mm dental implant.

The implant was placed following standard surgical protocols, with care taken to ensure proper alignment and positioning for optimal functional and aesthetic outcomes. To reduce the risk of excessive loading during the healing phase, a temporary bis-GMA composite resin crown was immediately placed over the implant on a temporary abutment (Figure 3). The crown was carefully relieved of any centric or eccentric contacts to avoid undue stress on the implant during the osseointegration phase. A three-month healing period was observed before moving on to the definitive prosthetic restoration.

Figure 3: A) Enhanced buccolingual width noted after four months; B) Placement of implant; C) Post-placement radiograph; D) Immediate loading with composite resin temporary crown

Prosthetic Rehabilitation

After the healing period, the patient underwent the final stage of treatment, which involved the fabrication and placement of the definitive prosthesis. Initially, a PMMA trial crown was fabricated to assess the esthetics, function, and fit of the restoration. This was followed by a bisque trial to fine-tune the contours and occlusion.Given the patient's desire for improved esthetics, a customized smile design was created, taking into consideration the mesiodistal gap left by the missing tooth. The patient had grade 1 fluorosis, which was factored into the treatment planning for the final restoration. A veneer option was discussed; however, due to financial constraints, the patient opted for a more conservative approach with a fixed prosthesis. After trial evaluations, the final restoration was placed (Figure 4), and the patient was satisfied with both the functional and aesthetic outcome.

Figure 4: A) Pre-operative smile in frontal profile; B) PMMA trial crown fabricated for esthetic evaluation; C) Final definitive prosthesis; D) Post-operative smile

Post-Operative Care and Follow-Up

The patient was closely monitored throughout the entire treatment process. Post-operative follow-up appointments were scheduled to assess the healing of both the graft and implant site. During these visits, the patient was educated about oral hygiene practices to ensure the long-term success of the implant and prosthesis. Additionally, routine radiographic evaluations were performed to monitor the osseointegration process and confirm the stability of the implant.At the final follow-up appointment, the implant and prosthesis were functioning well, with no signs of complications. The patient reported increased confidence and satisfaction with the aesthetic outcome, and there were no issues with the implant site or adjacent teeth.

3. DISCUSSION

The restoration of a missing anterior tooth in a young patient with severe bone deficiency requires a thoughtful approach that balances both functional and aesthetic considerations. Dental implant therapy remains the gold standard for tooth replacement, but its success is heavily dependent on the available bone.[1] In cases of significant bone resorption, as seen in this patient, the use of bone augmentation techniques is necessary to create a stable foundation for implant placement.[2] Various treatment options were considered in this case, including the use of fixed partial dentures (FPD), Maryland bridges, and dental implants with bone augmentation. While FPDs and Maryland bridges are conservative options, they do not address the underlying bone deficiency and may require altering adjacent healthy teeth. These options also tend to have limitations in long-term durability and esthetic outcomes, particularly in the anterior maxilla, where both function and appearance are crucial.[6]

The decision to proceed with dental implant placement, supplemented by bone augmentation using a block graft, was made due to the need for a permanent and functional restoration that would also address the significant bone loss. Bone augmentation techniques, such as block grafting, offer several advantages over other methods, particularly in cases of severe bone deficiency.[2] The use of an autogenous bone graft from the mandibular symphysis was particularly beneficial in this case, as it provided a reliable and stable source of bone that integrated well with the recipient site. Autogenous grafts are considered the gold standard due to their osteoinductive, osteogenic, and osteoconductive properties, which promote bone growth and regeneration at the implant site.[4,5]

The mandibular symphysis, being an intramembranous bone, resorbs less compared to endochondral bone and supports faster vascular development, which facilitates quicker healing and graft integration.[7,8] These factors made it an ideal donor site for the graft, ensuring that the augmented area would support the dental implant. Furthermore, the combination of block

grafting with GBR provided additional stability and ensured that the bone formed in the desired shape and volume, which is critical in the anterior maxilla. The GBR technique, which utilized titanium mesh and allografts, helped guide bone healing and protected the graft, ensuring that the implant site was prepared adequately for the implant placement.

The immediate loading of the implant with a temporary crown helped in soft tissue contouring during the healing phase.[9] This technique allowed for the development of an optimal emergence profile, which is particularly important in the esthetically critical anterior region. The use of a temporary bis-GMA resin crown on a temporary abutment ensured that the implant was not subjected to undue stress during the osseointegration process while allowing for proper soft tissue adaptation around the implant. After a three-month healing period, the final restoration was completed, and the patient was satisfied with both the functional and aesthetic results.

Block grafting offers several significant advantages over other bone grafting techniques. Its ability to restore both vertical and horizontal ridge dimensions makes it particularly suitable for augmenting the anterior maxilla, where bone loss can lead to significant esthetic concerns. The autogenous bone harvested from the mandibular symphysis provides a stable foundation for the implant and integrates well with the surrounding bone, reducing the risk of graft rejection or failure. Furthermore, the use of block grafting in combination with GBR significantly enhances the predictability of implant placement, as it ensures the creation of an ideal site for implant osseointegration.[3]

Alternative bone grafting methods, such as particulate bone grafts or synthetic substitutes, could have been considered in this case. However, these options often resorb more quickly and do not provide the same structural integrity as block grafts, particularly in cases of severe bone loss. The use of synthetic graft materials may be beneficial in certain scenarios but generally lacks the biological properties that autogenous bone offers.[10] While these alternatives may be more cost-effective or less invasive, they are not as reliable for achieving the desired bone volume and stability in cases where substantial bone regeneration is needed.

4. CONCLUSION:

The present case demonstrates the successful integration of a block graft technique with dental implant placement in the anterior maxilla of a young patient with severe bone deficiency. The use of an autogenous block graft from the mandibular symphysis, combined with guided bone regeneration, provided a reliable and biologically favorable foundation for implant integration. This approach not only addressed the significant bone loss but also ensured both functional and aesthetic restoration in the esthetically critical anterior region. The predictable outcomes of this technique underscore the importance of personalized treatment planning and the role of advanced bone augmentation procedures in achieving long-term implant success, even in complex cases of severe bone deficiency

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