

CASE REPORT

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Immediate implant placement using autogenous bone graft with autologous platelet-rich fibrin (A-PRF) for severe vertical bone loss: A case report

Arvind UD, Akash Chakravarthy, Geyasri Vinnakota, Ravi UD

ABSTRACT

Introduction: Dental implants have become the treatment of option for replacing missing teeth. But dental implant placement needs adequate available bone for primary stability to attain successful osseointegration. In patients with inadequate bone volume, various bone augmentation procedures are available for facilitating implant placement. The mandibular ramus acts as an admirable source of autogenous bone for alveolar ridge augmentation procedures.

Case Report: In the present case report a female patient with Siebert class III defect with respect to 46 was managed by implant placement along with autogenous bone grafting keeping in mind about the crown root ratio which could be a post-complication in anticipation.

Conclusion: Thus, this article describes a case report of reconstruction of extensive vertical bone defect, using intraoral ramus block bone graft and autogenous A-PRF

for implant site augmentation presented admirable results.

Keywords: A-PRF, Bone graft, Bone loss, Implant

How to cite this article

Arvind UD, Chakravarthy A, Vinnakota G, Ravi UD. Immediate implant placement using autogenous bone graft with autologous platelet-rich fibrin (A-PRF) for severe vertical bone loss: A case report. Int J Case Rep Images 2022;13(2):13–21.

Article ID: 101319Z01AU2022

doi: 10.5348/101319Z01AU2022CR

Arvind UD¹, Akash Chakravarthy², Geyasri Vinnakota³, Ravi UD⁴

Affiliations: ¹Oral & Maxillofacial Surgeon & Implantologist, Reader, Department of Oral & Maxillofacial Surgery, HKE's S. Nijalingappa Institute of Dental Sciences, Gulbarga, Karnataka, India; ²Oral & Maxillofacial Surgeon & Implantologist, Managing Director, Saritha Dental Clinic, Sainikpuri, Hyderabad, India; ³Periodontist & Oral Implantologist, Private practitioner, Saritha Dental Clinic, Sainikpuri, Hyderabad, India; ⁴Prosthodontist, Senior Lecturer, Department of Prosthodontics, HKE's S. Nijalingappa Institute of Dental Sciences, Gulbarga, Karnataka, India.

Corresponding Author: Arvind UD, Oral & Maxillofacial Surgeon & Implantologist, Reader, Department of Oral & Maxillofacial Surgery, HKE's S. Nijalingappa Institute of Dental Sciences, Gulbarga, Karnataka, India; Email: dr.arvind.ud@gmail.com

Received: 11 February 2022

Accepted: 04 May 2022

Published: 14 July 2022

INTRODUCTION

Missing teeth is a very common problem; therefore, the use of dental implants has also become common practice these days. The effective outcome of any implant procedure depends upon a succession of patient and procedure dependent parameters, which includes general health conditions, biocompatibility of the implant material, the implant surface features, the surgical procedure, and the quality and quantity of the bone available [1]. Local bone quality and quantity can influence the primary stability, which is one of the main factors affecting the implant survival rates [2–4].

Alveolar ridge defect refers to the loss of buccal or labial cortical bone and medullary bone or sometimes both [5]. There are different types of classifications of the alveolar ridge deficiencies proposed by Lekholm and Zarb (1985), Misch and Judy (1985), Allen (1985), and Seibert (1983) classification is the most widely used for ridge defects [6]. According to Seibert classification ridge defects are

categorized into 3 classes: Class I—buccolingual defect, Class II—apicocoronal defect, Class III—a combination of both [7].

Dental implants placement needs to have adequate available bone in terms of height and width, i.e., bone volume. But in case of patients who have inadequate bone volume a pre-implant surgery is required which is termed as bone augmentation. Several methods have been suggested for the reconstruction of bone defects before (two stage procedure), or at the time of implant placement (one stage procedure), using various materials and techniques. When carried out prior to implant placement, this needs an additional surgical episode and then the area is left to heal for a period of time before the implants are placed [8]. Several materials are available to improve for bone topography. Types of bone grafting materials available are autogenous bone, allografts, and alloplasts. They can act through three different mechanisms: osteogenesis, osteoinduction, osteoconduction [9]. Osteogenesis is the development and formation of bone from cells derived from either the host or the graft [10]. Osteoinduction means the primitive, undifferentiated, and pluripotent cells are somehow stimulated to develop into the bone-forming cells and also it is the process by which osteogenesis is induced [11]. Osteoconduction is the process of bone growth on the surface of bounded graft and provides the capability to allow new cell colonization, bone in-growth, and blood vessel formation (vascularization). It also acts as scaffold and permits the formation of new bone [12]. Autogenous grafts are biologically compatible as they are obtained from the same individual and provide a scaffold into which new bone may grow [13]. They are considered as gold standard as they retain the viability of cells and do not induce any immunological response in the patient. These grafts heal by osteogenesis as they contain live osteoblasts and osteoprogenitor stem cells [14].

Autogenous bone can be obtained from the calvarium [15], tibia [16], and iliac crest [17]. The disadvantage of corticocancellous block grafts is that they are associated with significant resorption [18–20]. In addition to patient expense, patient morbidity, altered ambulation, difficulty in procuring the donor material, and need for hospitalization were the limiting factors [21, 22] together with the fact that dental implants do not require large amounts of bone, the use of intraoral block bone grafts from intraoral sources have come forward, especially the mandibular symphysis [23–28] and ramus [29, 30].

Properties of various types of bone graft sources [31] (Table 1)

While the benefits of intraoral donor sites are conventional surgical access, proximity of donor and recipient sites, which reduces operative and anesthesia time, patient discomfort, and less morbidity, making

Table 1: Properties of various types of bone graft sources

	Osteoconductive	Osteoinductive	Osteogenic
Alloplast	+	–	–
Xenograft	+	–	–
Allograft	+	+/-	–
Autograft	+	+	+

it ideal for outpatient compared to extraoral location [14]. Autogenous bone forms the rigid scaffold which supports teeth and implants [9]. Another convenient and economical approach to procure growth factors at the surgical site is the use of autologous platelet-rich fibrin (A-PRF). Autologous platelet-rich fibrin is basically a concentrate of growth factors that promote wound healing and regeneration [32]. Choukran demonstrated that A-PRF has higher amounts of platelets and growth factors and more mechanical properties compared to PRF due to lower speed of centrifugation [33]. The motive of this article is to describe reconstruction of extensive bone deficiency, using intraoral block bone grafts and autogenous A-PRF for implant site augmentation.

CASE REPORT

A 26-year-old female patient reported with chief complaint of missing tooth. On examination, missing tooth along with Siebert class III defect with respective to 46 was found. Treatment planning was done accordingly which was explained to the patient in prior and the consent was taken for the same. Management of Siebert class III defect and missing tooth was planned by implant placement along with autogenous bone grafting keeping in mind about the crown root ratio which could be a post-complication in anticipation (Figure 1A and B).

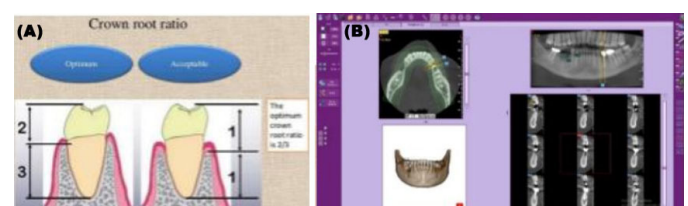


Figure 1: (A) Optimum & acceptable crown root ratio. (B) CBCT showing vertical bone loss leading to an unacceptable crown root ratio.

Pre-surgical procedure

Initially, oral prophylaxis was performed and careful instructions regarding oral hygiene measures were given. The patient reviewed after 4–6 weeks of Phase I therapy for a detailed evaluation and pre-operative records (Figures 2–4) were taken, routine blood investigations were done.



Figure 2: Intraoral occlusal view.



Figure 3: Pre-operative OPG.



Figure 4: Interocclusal clearance.

Surgical procedures

Patient preparation

Pre-procedural rinse with 0.12% (15 mL) chlorhexidine mouthwash was done for few minutes. Perioral skin area was scrubbed vigorously with povidone-iodine (antiseptic solution) using the sterile gauze.

Preparation of donor site

Under local anesthesia in the ramus region by inferior alveolar nerve block/buccal nerve block (block and infiltration using 2% Lidocaine with 1:80,000 epinephrine), incision was made with a Bard Parker blade # 15 apical to the mucogingival line and full thickness flap was reflected to expose the ramus region. Using piezoelectric hand piece an outline at a 45° angle to the bone surface was placed such that the block comes out easily, followed by osteotomy deepening into the marrow space (Figure 5). Tactile sense, as well as bleeding from the outline form indicated penetration into the marrow space. Once this communication was completed, surgical osteotome was tapped into the outline with a mallet. If osteotome refuses to advance, it was probable that the marrow space has not been reached. After tactile purchase has been achieved around the entire periphery with the osteotome, it was used as a lever to elevate the graft. This movement was employed at a variety of sites until block became mobile. After elevating the graft from the donor site, it was stored in the saline.

Preparation of recipient site

The bone block and the recipient site were modified (Figure 6) to fit as closely as possible at the recipient site. The graft had to be immobilized, and it should offer adequate blood supply to maximize its success. The holes



Figure 5: Harvesting ramus bone.



Figure 6: Shaping the ramus graft.

for the bone block fixation screw were prepared with a spiral drill. One titanium screw of diameter 1.5 mm is used to stabilize the bone block graft at recipient site (Figure 7).

Implant selection and placement

Implant diameter choice and placement was prosthetically driven to get the most out of function. Based on the anatomic site analysis, the implant size of 4.2*13 mm was selected. The osteotomy site was prepared through the autogenous block graft placed with standard spiral drills sequentially with copious irrigation (Figure 8). The implant was placed equicrestal. Cover screw placed on the implant fixture. Titanium screw which is used for stabilizing block graft was removed. Particulate bone graft which is obtained from milling bone after shaping the block graft was placed at recipient site (Figure 9). For preparation of A-PRF, around 20 mL of whole venous blood is collected and transferred into two sterile glass tubes without any coagulant. The tubes are then placed in a centrifuge machine at 1500 rpm for 14 minutes. The fibrin clots were carefully retrieved from glass tubes after centrifugation. These fibrin clots were shifted to PRF box, where membranes were prepared (Figure 10). Prepared A-PRF membranes were



Figure 9: Bone mill used to get particulate graft.

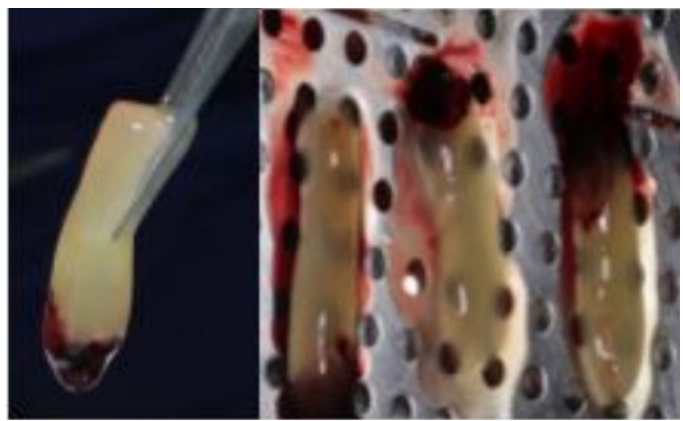


Figure 10: Autologous PRF membranes.

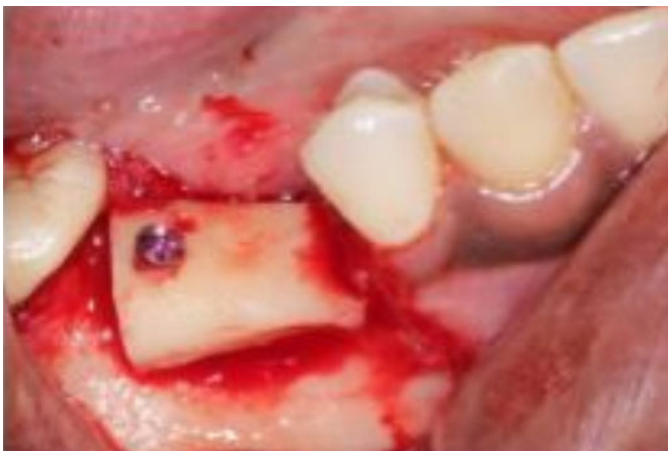


Figure 7: Autogenous block graft stabilized.



Figure 8: Implant placement.

placed at the surgical site for better healing (Figure 11). As the bone graft used is autogenous bone, i.e., corticocancellous bone from the ramus of the mandible. The cortical portion of corticocancellous bone is faced superior and cancellous part is faced toward alveolar bone. Immediate post-operative orthopantomography (OPG) was taken (Figure 12). The mucoperiosteal flap was repositioned for suturing with vicryl sutures material (Figure 13).

Post-operative instructions

Patients were advised about oral hygiene maintenance instructions and not to chew on implant site for two weeks till complete healing. Antibiotic therapy and chlorhexidine mouth rinses were continued for five days, and Paracetamol 500 mg was prescribed.

The six months post-operative clinical and radiographic examination showed increase in alveolar width at grafted region. After thorough examination screw retained final prosthesis was delivered to the patient (Figures 14–16).



Figure 11: A-PRF membranes placed at surgical site.



Figure 15: Occlusion.

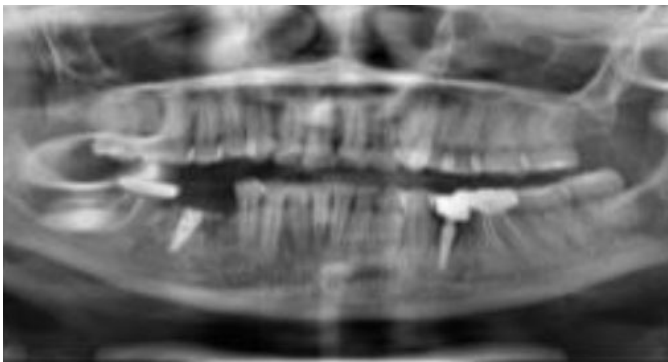


Figure 12: Post-operative OPG.

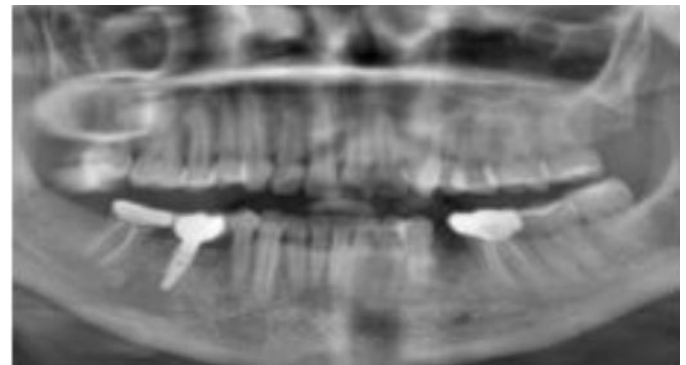


Figure 16: Post-operative OPG after six months.



Figure 13: Vicryl sutures placed.



Figure 14: Final prosthesis.

DISCUSSION

Implant dentistry has advanced to a stage that it has become a key part of dental surgery. It is the first treatment option for rehabilitation of aesthetic as well as functional tooth loss. Alveolar ridge defects are frequently encountered due to resorption following extraction of teeth for which implant placement becomes challenging to the clinician. Alveolar defects can also compromise the treatment of implant restorations which increases crown to implant ratio (CIR). A study by Cáceres La Torre et al. (2012) [34] evaluated the influence of the crown-to-implant ratio on crestal bone loss around dental implants. Their results showed that factors such as crown-to-implant ratio, design and location of implant, design of restoration, type of antagonist, loading time might influence peri-implant crestal bone loss. As specified by a consensus conference, the optimum prosthesis height is considered to be 8–12 mm that includes 3 mm soft tissue covering the implant collar along with the biological width, 2 mm porcelain thickness and 5 mm as average abutment height [35]. Many studies considered that maintenance of CIR can prevent the fracture from forces which increases the crown height while the others described some technical and biological complications based on their research. These technical complications such as loosening of the screw, crown de-cementation, food accumulation in the

interdental spaces and occlusal strain. And the biological problems include peri-implantitis, formation of deep pockets, poor oral hygiene, pain, swelling, bleeding gums, and transient paresthesia [36]. Hence, alveolar ridge augmentation provides sufficient bone for implant placement and prosthesis. In the present case report localized Siebert class III alveolar defect was planned to restore by autogenous block bone graft & autologous A-PRF membrane with simultaneous implant placement in a single go. Autogenous grafts such as mandibular ramus, mandibular symphysis, maxillary tuberosity, and intraoral exostoses are considered as “gold standard” for improving intraoral osseous volume facilitating implant placement [37]. The mandibular ramus is a useful cortical graft that provides primarily dense cortical bone along with high concentration of bone morphogenetic proteins [38]. In addition, the mandibular ramus is also associated with less post-operative complications, when compared to the symphysis region [29, 39–42]. In the current case report ramus region was selected in need to gain vertical height and volume which is hard-hitting to attain. The reports of Clavero and Lundgren (2003) [43], Silva et al. (2006) [44], Raghoobar et al. (2007) [45], and Andersson (2008) [46] also supported harvesting from ramus bone. According to the studies by Proussaefs et al. (2002) [28] and Von Arx and Buser (2006) [47] the ramus is considered the site of choice when block grafts are needed for horizontal or vertical augmentation, which is also in concurrence with the present case report.

Along with autogenous block bone graft autogenous A-PRF membrane is placed at the recipient site. In a comparative study by Kobayashi et al., it was found that A-PRF released the highest total growth factors up to 10 days. Autologous platelet-rich fibrin shows better results in terms of soft and hard tissue healing potential [33]. Therefore, A-PRF membrane helps in wound healing and protects the surgical site. A study by Hartlev et al. (2021) [48] concluded that lateral ridge augmentation using mandibular ramus bone graft along with PRF is a more predictable and successful technique, whereas in our case report alveolar ridge augmentation done using ramus bone graft in association with autologous PRF showed likely outcome. In the present case report, the implant placement was done at the same time along with onlay grafting in order to avoid second surgery for placing implant. The success rate of implants placed in regenerated ridges of onlay graft also seem to be range around 72.8–97% after follow-up periods ranging from six months to ten years, which is in accordance with our case report showing sufficient bone gain in both height and volume [14].

CONCLUSION

The present case report entitles successful reconstruction of both horizontal and vertical alveolar ridge defect using ramus bone block along with

autogenous particulate bone graft and autologous PRF at the site of single implant placement which showed major advantages as we could avoid second stage for implant placement, patient comfort, and sufficient bone gain and with lesser complications.

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Author Contributions

Arvind UD – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Akash Chakravarthy – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Geyasri Vinnakota – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related

to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Ravi UD – Conception of the work, Design of the work, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Guarantor of Submission

The corresponding author is the guarantor of submission.

Source of Support

None.

Consent Statement

Written informed consent was obtained from the patient for publication of this article.

Conflict of Interest

Authors declare no conflict of interest.

Data Availability

All relevant data are within the paper and its Supporting Information files.

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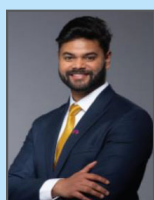
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ABOUT THE AUTHORS

Article citation: Arvind UD, Chakravarthy A, Vinnakota G, Ravi UD. Immediate implant placement using autogenous bone graft with autologous platelet-rich fibrin (A-PRF) for severe vertical bone loss: A case report. Int J Case Rep Images 2022;13(2):13–21.



Arvind UD, Oral & maxillofacial surgeon is a Reader, Department of Oral & Maxillofacial Surgery, HKE's S. Nijalingappa institute of dental sciences, Gulbarga, Karnataka, India. He earned the undergraduate degree from NTR University, Andhra Pradesh and postgraduate degree from NTR University, Andhra Pradesh. He has published 7 articles in national and international academic journals. His research interests include dental implants, orthognathic surgeries, trauma management, and bone regeneration. Email: dr.arvind.ud@gmail.com



Akash Chakravarthy, Oral & maxillofacial surgeon is a Managing Director of Saritha Dental Clinic, Hyderabad, India. He earned the undergraduate degree from Sri Ramachandra University, Chennai and postgraduate degree form Saveetha University, Chennai. He has published 3 articles in national and international academic journals. His research interests include dental implants, orthognathic surgeries, trauma management, and bone regeneration. Email: drakashchakravarthy@gmail.com



Geyasri Vinnakota, Periodontist & Oral Implantologist, is working as a private practitioner at Saritha Dental Clinic, Hyderabad, India. She earned the undergraduate degree from NTR University, Andhra Pradesh and postgraduate degree from Rajasthan University, Rajasthan. She has published 2 articles in national and international academic journals. Her research interests include dental implants and periodontal surgeries.
Email: vinnakota.geyasri10j@gmail.com



Ravi UD, Senior Lecturer, Department of Prosthodontics, HKE's S. Nijalingappa Institute of Dental Sciences, Gulbarga, Karnataka. He earned the undergraduate degree from NTR University, Andhra Pradesh and postgraduate degree from Ayush and Health Science University, Chhattisgarh, India. He has published 3 articles in national and international academic journals. His research interests include dental implants and maxillofacial prosthesis, and bone regeneration.
Email: raviuttara@gmail.com

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