Dental Research Journal

Case Report

Minimal guided bone regeneration procedure for immediate implant placement in the esthetic zone

Nettemu Sunil Kumar[1], Nettem Sowmya[1], Dhoom Singh Mehta[2], Pendyala Siva Kumar[3]

[1]Department of Periodontology, Faculty of Dentistry, Melaka-Manipal Medical College, Jalan Batu Hampar, Bukit Baru, Melaka, [3]Department of Oral and Maxillofacial Surgery, Aimst University, Kedah, Malaysia, [2]Department of Periodontology, Bapuji Dental College and Hospital, Davangere, Karnataka, India

Received: August 2012
Accepted: November 2012

Address for correspondence:
Dr. Nettem Sowmya, Department of Periodontology, Faculty of Dentistry, Melaka-Manipal Medical College, Jalan Batu Hampar, Bukit Baru, Melaka, Malaysia.
E-mail: drsowmyark@gmail.com

ABSTRACT

The anterior maxilla presents a challenging milieu interior for ideal placement of implants because of the compromised bone quality. With the advent of intraoral bone harvesting and augmentation techniques, immediate implant placement into fresh extraction sockets have become more predictable. Immediate implant placement has numerous advantages compared to the delayed procedure including superior esthetic and functional outcomes, maintenance of soft and hard tissue integrity and increased patient compliance. This case report exhibits immediate implant placement in the maxillary esthetic zone by combining a minimal invasive autogenous block bone graft harvest technique for ensuring successful osseointegration of the implant at the extraction site.

Key Words: Anterior maxilla, autogenous bone, immediate implant

INTRODUCTION

Increasing esthetic concerns coupled with awareness about latest advancements in the field of fixed replacements for edentulism in patients has opened the doors for implant-based restorations. Over the years, implants placed immediately after tooth extractions have shown high percentages of clinical success.[1] When the implants are placed into fresh extraction sockets, the peri-implant soft and hard tissue morphologies are maintained leading to an ideal pink component around the final restoration. Immediate implantation also helps provide a functional and esthetic prosthesis for the patients within a shorter time frame. However, the anterior maxilla presents a challenging environment for implant placement due to the quality of bone in the region, comprised mainly of a porous crestal layer of cortical bone and fine trabecular bone underneath.

This case report highlights the immediate implant placement in the anterior maxilla using a variant minimal guided bone regeneration procedure.

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CASE REPORT

A 28-year-old male patient reported to the Department of Periodontology and Oral Implantology with a chief complaint of a fractured crown in relation to root canal treated maxillary left central incisor. The patient had undergone root canal treatment of the tooth 3 years back and had received fixed bridge prosthesis in relation to the bilateral maxillary central incisor regions. The patient reported that the prosthesis got avulsed and the crown portion of the maxillary left central incisor was fractured following the biting into a hard food substance. The patient also reported the previous dental treatment to be unsatisfactory in terms of the final esthetic and functional outcomes of the prosthesis. Patient expressed preference for a single crown prosthesis and considered his previous bridge prosthesis, a failure in simulating the natural tooth appearance. There were no other relevant dental

and medical histories. The patient was a teetotaler and his family history was non-contributory, whereby the confounding environmental and genetic risk factors were deemed absent. Intraoral examination revealed a fractured root canal treated maxillary left central incisor. The right maxillary central incisor had undergone tooth preparation as a part of the previous bridge prosthesis. Oral hygiene maintenance was satisfactory and on examination, the gingival and periodontal status of the patient also appeared to be apparently healthy.

The patient was explained in detail about the various treatment modalities available, the advantages and disadvantages of each type of therapy as well as the cost factor related to each therapeutic mode. Taking into consideration the esthetic and functional demands in the anterior esthetic region and the patient's request for an implant-based fixed prosthetic rehabilitation, the final treatment plan was formulated. An atraumatic extraction of the fractured, root canal treated maxillary left central incisor and an immediate implant placement was decided upon as the final treatment plan for the patient. A written informed consent was obtained from the patient prior to commencement of the surgical procedure.

Surgical procedure

The surgical site was anesthetized by local administration of 2% lignocaine hydrochloride (LOX, Neon Laboratories Ltd., Mumbai, India) with 1:200,000 adrenaline. A modified crestal incision was made beyond the palatal surface of the tooth. The conventional mid-crestal incision was placed just apical to the palatal margin of the fractured tooth. This incision was then continued with the oblique releasing incisions placed along the mesial line angles of the maxillary right central and left lateral incisors, extending beyond the mucogingival junction to obtain a tension-free flap with a broad base. This type of envelope flap design with two releasing incisions is called the four corner flap. This mucoperiosteal flap was reflected and the fractured tooth exposed sufficient enough to facilitate atraumatic and careful extraction [Figure 1]. The tooth was extracted by conventional forceps technique and the socket was thoroughly curetted for complete removal of infected granulation tissue, if any. The socket was flushed with sterile isotonic saline solution and osteotomy site preparation was performed for receiving the implant. A self-threaded titanium implant (4.2 mm × 10 mm, Lifecare Devices Pvt. Ltd, Chennai, India) was inserted at the extraction socket and adequate primary stability was accomplished from the residual alveolar bone. However, a small amount of space was present at the palatal and proximal surfaces of the implant in the cervical aspect [Figure 2]. Autogenous bone harvesting was decided upon and the patient was explained in detail regarding the procedure. A second written informed consent was obtained from the patient prior to proceeding with the bone harvesting procedure.

Autogenous block bone graft harvest using "minimum button-hole" technique

Autogenous block bone graft was harvested according to the "minimum button-hole" technique described by Kumar *et al*. in 2011.[2] A minimal vestibular incision was placed apical to the roots of mandibular left incisors. Soft tissue attachments were carefully relieved using a periosteal elevator until mandibular symphysis bone in the size of a "button-hole" was exposed. An 11 mm diameter cylindrical autogenous block bone was harvested using a round trephine bur [Figure 3]. Next, the block bone graft was crushed into bone chips using a bone rongeur.

The bone chips were carefully packed around the palatal and proximal aspects of the implant [Figure 4]. A bio-resorbable collagen membrane (Healiguide, Advanced Biotech Products, Chennai, India) was adapted over the implant site to establish complete coverage and protection of the implant and bone graft material [Figure 5]. The recipient and donor sites were sutured using an absorbable suture material (4-0 Vicryl, Ethicon, Inc., Johnson and Johnson, Somerville, NJ, USA).

Post-operative care

A prescription of 8 mg of betamethasone was given jointly with 2 g/day of amoxicillin for 10 days. The patient was advised to rinse with warm salt water rinses for the initial 15 days to promote wound healing. The patient was also instructed in the use of chlorhexidine gluconate 0.12% (Peridex, Zila Pharmaceuticals, Phoenix, AZ, USA) as part of home care regime. The patient experienced very minimal post-operative discomfort and no complications were reported.

In order to protect the recipient site and eliminate undue stress and forces from acting upon the surgical area, the placement of a temporary prosthesis was avoided with a mutual consent obtained from the patient. This ensured an undisturbed interior milieu

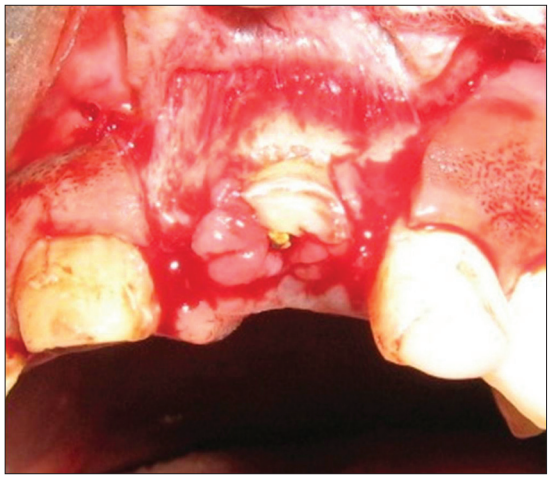

Figure 1: Mucoperiosteal flap reflected to expose the fractured root canal treated tooth. Note the gutta percha filling material protruding outside

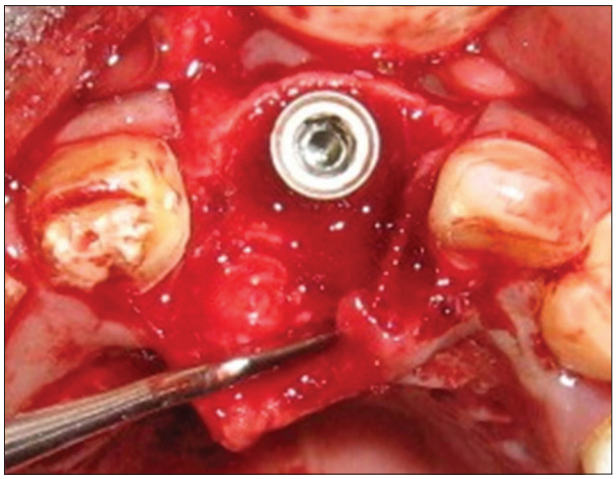

Figure 2: Space present at the palatal and proximal surfaces of the implant in the cervical aspect

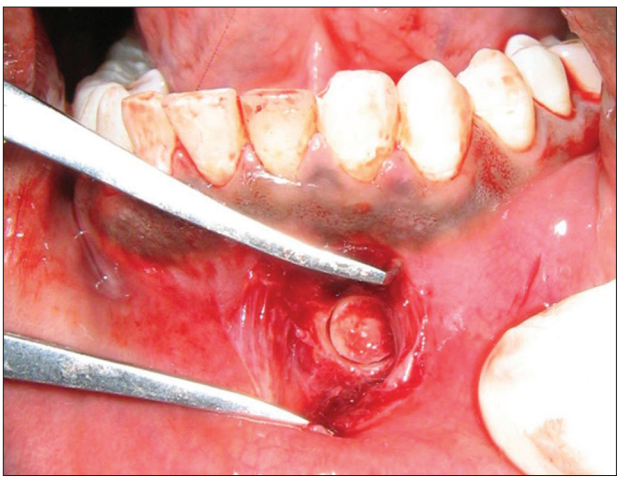

Figure 3: Cylindrical autogenous block bone harvested from mandibular symphysis region using round trephine bur

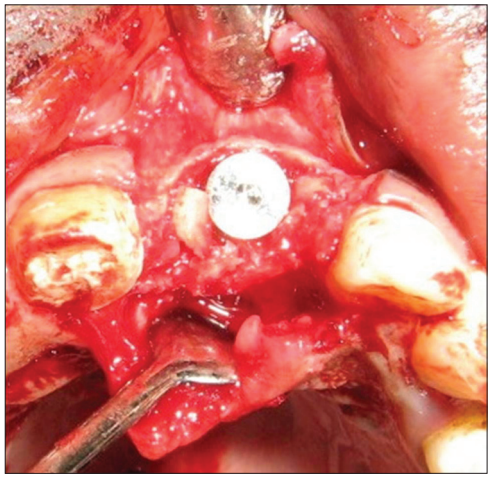

Figure 4: Bone chips packed around the palatal and proximal surfaces of the implant

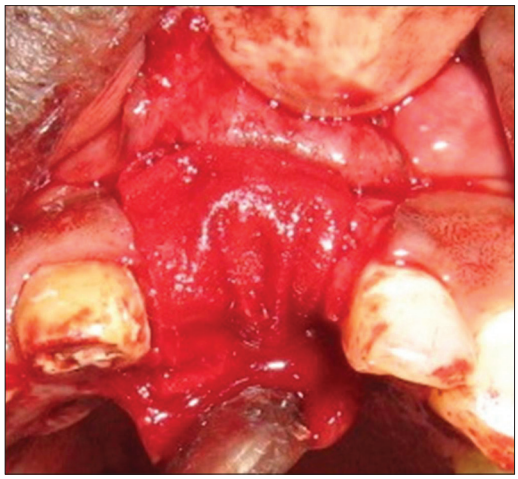

Figure 5: A bio-resorbable collagen membrane adapted over the implant site

facilitating appropriate healing of surgical site. Six months post-operatively, the recipient and donor surgical sites exhibited excellent wound healing with adequate amount of interdental papilla present at the recipient site around the implant fixture [Figure 6]. A second phase surgery was performed to uncover the implant, and the final fixed prosthesis involving two separate crowns were delivered in relation to both the maxillary central incisors [Figure 7]. The separate crown suprastructures were fabricated keeping in mind the patient's request and preferences. The patient was extremely satisfied with the final outcome of the restoration, fulfilling both esthetics and functional needs.

DISCUSSION

Autogenous bone is considered the "gold standard" in guided bone regeneration due to its osteogenic, osteoinductive and osteoconductive properties. The absence of antigenic property associated with the use

Figure 6: Six months post-operative intraoral clinical view of the implant surgical site

Figure 7: Post-operative clinical photograph after prosthesis placement

of an autogenous bone makes it the superior choice in hard tissue augmentation procedures. Additional benefits include the ease of availability of desired bone quantity as well as the affordability of the procedure. Hence, it can be safely concluded that, except for fresh autogenous bone, bone replacement grafts do not provide the cellular elements necessary for osteogenesis nor can they reliably be considered truly osteoinductive, but instead are mostly osteoconductive providing a scaffold for bone ingrowth.[3] Numerous studies have established that the autogenous bone graft in particulate form has been shown to provide better outcomes compared to block grafts, and therefore, may be the preferred choice.[2,4,5]

Also, the advantages of intraoral graft material in contrast to extraoral graft are multiple. With the advent of simple, minimally invasive techniques for harvesting extraoral bone grafts using biopsy needle penetration techniques, the extraoral autogenous bone graft can also be easily obtained for guided bone regeneration procedures with minimal post-operative complications and patient discomforts. However, it has been shown that in the facial skeleton, membranous bone, such as that grafted from the mandible, undergo less resorption than endochondral bone, such as the ileac crest.[6,7] The intraoral bone graft materials undergo rapid integration, allowing an early reentry for implant or prosthesis placement.[8-11] An optimal bone density is also maintained for enhancing implant stability due to the cortical nature of the graft.[12] Also, if the graft volume is sufficient for the planned reconstruction, intraoral mandibular bone is the ideal choice.[13,14] Many studies have reported 87-100% of success rates with intraoral bone graft harvest techniques with success defined as sufficient bone for implant placement.[13,15-17] For this patient, the mandibular symphysis region was preferred over the ramus region for harvesting intraoral autogenous bone graft material. The reason for this choice is the ease of availability of rich cortico-cancellous nature of bone in comparison to the cortical bone of mandibular ramus.[12] The cortico-cancellous bone harvested from the symphyseal region facilitates faster vascular in-growth resulting in rapid integration and less potential resorption during healing. Also, the main limitations of the ramus area is the difficulty in access and the potential risks of damage to the vital structures like inferior alveolar nerve, buccal nerve as well as trismus and chances of mandibular fracture.[12]

In this particular patient, the treatment plan was modified to the use of a bone trephine involved "minimal button-hole" technique of bone harvest due to several reasons. A higher amount of bone material was required to fill the mesial and distal proximal surfaces as well as the palatal aspect around the implant, and the desired particle sizes can be obtained by reducing an autogenous block bone harvested using the bone trephine method. Larger particle size of bone material has the potential to endure osteoclastic resorption in comparison to the smaller particle sizes, which undergoes rapid resorption and gets removed from the site. The present technique also has the advantage of harvesting cortico-cancellous bone material. The other advantages of the "minimum button-hole" technique for guided bone regeneration are the negligible morbidity associated with the second surgical site, the avoidance of redundant exposure of a large area of bone at the donor site and the high level of patient compliance due to minimal post-operative discomfort and complications.

Immediate implants placement into fresh extraction sites heal predictably.[18] These findings are similar with the cases reported by Evian *et al*. in 1994.[19] Implant placement into fresh extraction sites help to maintain intact peri-implant mucosal and papillary morphologies. The chances of residual ridge atrophy and soft tissue recession is minimal.[20-22] The functional stability and esthetic outcomes of immediate implants prove that this treatment option must be considered in the treatment planning for patients requiring extraction of teeth with hopeless prognosis.[15,23]

CONCLUSION

This case report solely aims at presenting a simple, minimally invasive autogenous bone graft harvest technique for use by the clinicians in their daily practice. The graft obtained by this method can be utilized in the block form as well as crushed to be used in particulate form of desired size, depending on the clinical scenario. We recommend that more case series utilizing the same technique of guided bone regeneration is performed in the future with histological and radiologic evaluation of pre-operative and post-operative results in bone gain and levels of the interdental papillae.

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How to cite this article: Kumar NS, Sowmya N, Mehta DS, Kumar PS. Minimal guided bone regeneration procedure for immediate implant placement in the esthetic zone. Dent Res J 2013;10:98-102.

Source of Support: Nil. **Conflict of Interest:** None declared.