Guided Tissue Regeneration (GTR) and Simultaneous Endosseous Implant Placement Procedure: A Time-Savvy and Tech-Savvy Strategy

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Abstract

Dental Implantology has been considered as one of the most accepted treatment modalities for rehabilitation of missing teeth. The deficiency of the remaining supporting bone volume, though, is considered to be the primary concern in certain situations for avoiding implant placements. The solution to this problem lies in re-establishing the ridge volume consistent with the prosthetic design and with suitable load-bearing lamellar bone for long-term stability of the implant. The rehabilitation of large bone defects can be achieved with various types of grafting materials, natural or, synthetic. The use of autologous grafts exhibits the highest success rates amongst these and autogenous bone grafts are considered the gold standard because their osteogenic, osteoinductive and osteoconductive properties maximize the success of graft incorporation. The present case report describes the case of a 35 year old female patient who reported seeking treatment for her missing front tooth, right maxillary central incisor, which she had lost as a result of trauma at the age of 30 years. Clinical and radiographic examination revealed a severe vertical labial bone defect requiring vertical and horizontal bone augmentation. The amount of bone available was inadequate for an implant-supported prosthesis. Hence, vertical and horizontal bone augmentation with guided bone regeneration was planned in the region with simultaneous placement of the endosseous implant. The present case report, thus, demonstrates the successful use of vertical and horizontal bone augmentation procedure conducted with the help of Guided Tissue Regeneration (GTR) and simultaneous endosseous implant placement.

Keywords: Vertical and horizontal bone augmentation; Guided tissue regeneration (GTR); Dental implant therapy; Endosseous implants

Introduction

Dental Implantology has been considered as one of the most accepted treatment modalities for rehabilitation of missing teeth following trauma. The deficiency of the remaining supporting bone volume, though, is considered to be the primary concern in certain situations for avoiding implant placements [1]. The solution to this problem lies in re-establishing the ridge volume consistent with the prosthetic design and with suitable load-bearing lamellar bone for long-term stability of the implant [2]. Bone grafting techniques are widely used in the restoration of the atrophic maxillary bone prior to the placement of dental implants. Atrophy of the maxillary bone could occur following trauma and routine dental extractions as a result of resorption of the alveolar bone [3]. The rehabilitation of large bone defects can be achieved with various types of grafting materials, natural or, synthetic. The use of autologous grafts exhibit the highest success rates amongst these and autogenous bone grafts are considered the gold standard because their osteogenic, osteoinductive and osteoconductive properties maximize the success of graft incorporation [4,5]. Regardless of the donor site, though, approximately 4 to 6 months of healing period is required for the implants which is accomplished by using two-staged technique of implant placements. This technique uses autogenous bone grafts harvested at the time of surgery and is the most frequently used grafting technique because of its general clinical success and predictability in terms of implant site development. One of the important parameters for optimizing the bone regeneration is space maintenance; hence, collagen membranes are widely utilized during such procedures.

Case Presentation

A 35 year old female patient reported seeking treatment for her missing front tooth, her right
maxillary central incisor, which she had lost as a result of trauma at the age of 30 years. The patient was in good health with no positive medical history, good oral hygiene maintenance and a strong desire to replace her missing tooth with a permanent fixed prosthesis. Clinical (Figure 1) and radiographic examination revealed a severe vertical labial bone defect requiring vertical and horizontal bone augmentation. The amount of bone available was inadequate for an implant-supported prosthesis. Hence, vertical and horizontal bone augmentation with guided bone regeneration was planned in the region with simultaneous placement of the endosseous implant. An autograft from the chin was planned taking consent from the patient regarding creation of a second surgical site. Later, for esthetic purpose, soft tissue augmentation was planned for which the patient refused. The complete treatment procedure was explained to the patient and a duly signed consent was obtained.

**Surgical Procedure**

The corresponding surgical procedure was performed in sterile surgical conditions. Pre-operatively, the oral cavity was decontaminated using 0.2% chlorhexidine mouth rinse for 1 min. and the peri-oral area was disinfected with 5% povidone iodine solution. The site was anesthetized using 2% lignocaine with 1:80,000 adrenelines. A full thickness crestal incision, two crevicular incisions and vertical releasing incisions on the distal extent of the flap were made and a full thickness mucoperiosteal flap (Figure 2) was reflected. On refection of the flap, absence of the labial bone plate was observed with a deep vertical defect. A second surgical site in the lower labial sulcus was then, created to collect an autograft from the mandibular symphysis region (chin bone in interforaminal region). The area was adequately anesthetized using bilateral inferior alveolar nerve block and local infiltration with local anesthetic solution. A horizontal incision was made in the lower vestibule. The incision was directed in the apico-lingual direction toward the bone. Below this point, a full thickness mucoperiosteal flap (Figure 3) was reflected toward the base of the mandible keeping the most inferior aspect of the mentalis muscle intact. With the help of auto bone collector (HIOSSEN Implant System) (Figure 4), bone chips with adequate thickness were collected from the chin bone (Figure 5). The soft tissue superior to the initial access incision was elevated by few millimeters to reduce tension on the flap by edema and lip movement. The vestibular incision was then, sutured with non-resorbable sutures (Figure 6) using interrupted suturing techniques. The osteotomy site
for implant placement was, then, prepared. A standard 2 mm twist drill was used in the Myriad Equinox Implant System. A standard osteotomy was done with the pilot drill and twist drills along with direction indicators and depth gauges. A Myriad Equinox Implant, 5 mm in diameter and with 13 mm length (Figure 7) was placed at the site. Cover screw was placed. The labial defect was grafted using a combination of chin bone autograft and Hydroxyapatite graft (G-graft, Surgiwear, India) (Figure 8) with the autograft placed first and the allograft over it with the help of a syringe (Figure 9). The graft was secured in place with collagen membrane (Figure 10). Following this, the surgical site was closed with the flap and primary wound closure was obtained with interrupted sutures (Figure 11). An immediate post-operative radiograph was taken as baseline for future comparisons to assess bone healing (Figure 12).

**Post-Surgical Instructions and Oral Hygiene Care**

Post-surgical instructions were given to the patient. Chemical plaque control with 1% Chlorhexidine (CHX) (1 min mouth rinse 3 times a day) was instituted for 2 weeks along with Non-Steroidal
Anti-Inflammatory Drug (NSAID), Diclofenac 75 mg, 3 times a day for 3 days initially and then, si opus sit (as and when required) thereafter and antibiotic, Amoxicillin 500 mg, 3 times a day for 5 days. A weekly follow-up was done initially while the sutures were removed after 10 days following an uneventful healing. This was followed by a once every month follow-up till 6 months when the site was inspected radiographically (Figure 13) for adequate osseointegration and the second stage surgery was performed with placement of the healing abutment. A metal ceramic crown was, subsequently, fabricated and cemented.

Discussion

Implant placement requires an adequate quantity and quality of bone. The anatomic limitations of the residual alveolar ridge may make the insertion of dental implants difficult. Implants placed into the alveolar bone sites, previously augmented with graft material, have been associated with a high success rate [6,7]. The need for multiple surgeries with more procedural and post-procedural healing times, though, put serious disadvantage in such staged procedures of implant placements. Though not abundant, limited studies conducted in the recent past with few case reports reporting successful treatment outcomes have shown that predictable treatment outcomes could be achieved in cases where dental implant placement with simultaneous bone augmentation was done. The present case report demonstrates a similar case wherein the successful use of vertical and horizontal bone augmentation procedure conducted with the help of Guided Tissue Regeneration (GTR) and simultaneous endosseous implant placement was done.

Allografts and Alloplasts serve a space-maintenance role whereas fresh frozen transplants confer the risk of disease transmission. Autogenous bone grafts, thus, are still considered the gold standard, especially, when larger volumes of tissue restorations are required [8]. Iliac and Calvarial grafts have often been seen to possess varying rates of complications including increased risk of infections, mobility impairment and hernias [9-11]. On the contrary, autogenous chin bone ridge augmentation has been proposed to be a reliable alternative method for the management of severely defective socket bone tissues [12].

The bone tissue obtained by means of bone collectors as was done in the present case was already in a particulate state, thus, reducing the operation time and the probability of contamination since in the present case, there was no bone crusher used. Also, the use of barrier membrane has been proposed to be an efficient way of ensuring quality bone regeneration. In the present case, collagen membrane was utilized for effective guided bone regeneration without formation of fibrous tissue. The membrane must be cut and trimmed to adapt to the anatomy of the ridge and applied over the defect in order to cover the bone graft. Due to the hydrophilic properties of the collagen membrane, it is supposed to stick to the bone surface once wetted either with saline or, blood eliminating the need for fixation screws or, tactics for stabilization in most of the cases [13-15].

The usual protocol of implant placement in class II-IV socket involves bone augmentation and then, implant placement at an interval of about 3 to 4 months. However, in the present case, bone augmentation was done with simultaneous implant placement which saved the time for second invasive procedure. Also, bone collector used in the present study helped in conservative retrieval of the autograft. Thus, the surgical technique demonstrated here for obtaining particulate intra-oral autogenous bone material proved to be simple, efficient and safe. However, as autograft was used in the present study, morbidity of the second surgical site created for harvesting autograft was the major limitation.

Conclusion

Nevertheless, the use of autogenous bone grafts, also, presents considerable drawbacks including the need for creating a second surgical site, high morbidity at the donor site, limited quantity of bone that can be obtained, unpredictable quality of bone, blood loss, increased operative time and the possibility of infection at the donor site, seeing the advantages and the healing and regeneration potential with least chances of rejection of the graft material harvested mandate the need for further studies to be conducted ensuring the long-term follow-up in such cases.

References