

Preparing the Bony Bed: Socket Grafting with TCP Bone Graft, Innovations for Tomorrow's Radiant Smiles

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Abstract: After extraction of tooth the catabolic process of bone remodeling that takes place, eventually leading to quantitative as well as qualitative changes in the bone. These changes result in some amount of bone resorption at the site of tooth extraction. The clinical procedure that involves grafting bone substitutes into tooth extraction sockets is based on the rationale that the dimensional changes of the alveolar ridge that happen post tooth extraction can be reduced by addition of bone graft substitutes that provide a scaffold to the newly formed bone. Grafting at the site of tooth extraction is a must, when immediate implant is not feasible, because loss of bone not only affects future implant placement but also causes esthetic as well as functional issues is the replacement.

Keywords: Bone resorption, bone substitute, socket grafting, socket preservation

1. Introduction

Following a tooth extraction, there is a process of bone resorption that occurs, leading to a reduced amount of bone available for implant support, thereby making it unsuitable for implant placement as the altered height and width of the residual bone will cause esthetic issues and impaired healing.

During the first phase of bone remodeling post extraction of tooth, bundle bone is quickly resorbing and is replaced with woven bone leading to a large amount of reduction in bone height especially in the buccal aspect of the socket, as its crestal portion is comprised solely of bundle bone. The reason for this remodeling process is still not well understood. Disuse atrophy, decreased blood supply, and localized inflammation may be the reason behind bone resorption.

That being said, it is now known that bone remodeling is a complex process involving structural, functional, and physiologic factors and that surgical trauma from extraction induces microtrauma to surrounding bone, which accelerates bone remodeling.

Immediately after tooth extraction, the alveolar socket is filled by blood clot that is replaced by granulation tissue within 1 week. In socket healing the epithelium migrates over the granulation tissue to cover the healing socket. This happens because this inflammatory tissue is recognized as a connective tissue by the epithelial cells, therefore, cellular migration occurs over its surface. This is important when we examine guided bone regeneration applied to socket grafting. Starting from the apical and lateral residual bony walls, the granulation tissue is rapidly remodeled to provisional matrix. Mineralizing processes occur leading to the formation of

woven bone that eventually is replaced by mature lamellar bone. Alveolar preservation is proven to slow down socket wall collapse with the use of a bone substitute material.

Socket preservation is a well understood concept which is often done to maintain the extracted tooth's socket's dimensions and stop the bone from collapsing especially in the aesthetic zone. While Immediate implant placement has various advantages, we must take into consideration, factors such as its position, quality of the bone, buccal bone width, jumping distance, need for regenerative procedures and surgical technique.

Socket grafting is done to preserve the bone at the site where the implant will be placed at a later stage.

Within a tooth socket, there are five walls: mesial, distal, buccal, lingual, and apical. The call to graft the socket is based upon the number of remaining walls. While there is no consensus on the best bone grafting material and barrier membrane for all cases, various factors like clinicians' preference and skill as well as amount of osteoconductivity required for a particular case should be considered when selecting them.

Classification of bone grafts based on material groups:

Allograft - based bone graft involves allograft bone, used alone or in combination with other materials e. g., Grafton (Biohorizon, USA), Puros (Zimmer, USA)

Factor - based bone graft contain natural and recombinant growth factors, are used alone or in union with other materials such as transforming growth factor - beta (TGF - beta), platelet - derived growth factor (PDGF), fibroblast growth

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factors (FGF), and bone morphogenic protein (BMP). Cell - based bone grafts use cells to generate new tissue alone or are added onto a support matrix, for example, mesenchymal stem cells. Ceramic - based bone graft substitutes include calcium phosphate, calcium sulfate, and bioglass used alone or in combination. Polymer - based bone graft uses degradable and nondegradable polymers alone or in combination with other materials.

Most socket grafts available to us for clinical practice work well in socket grafting.

In the case when the socket is large and wide, clinicians should consider a staged approach.

Bone graft used in this case was Qualybone (Portugal). Granule size used 0.5 - 1.0mm.

This bone graft is a 100% synthetic porous ceramic. The main objective is to fill bony defects.

Because of its configuration in mesh format has a high porosity, facilitating the proliferation of bone cells into the empty spaces. This format offers an excellent mechanical strength.

It has Excellent characteristics of opacity, allowing the radiological monitoring during the bone regeneration.

Cell adhesion observed after 5 days

It also Facilitates an effective process of vascularization after intervention.

It Induces regeneration and bone growth by stimulating the proliferation and differentiation of osteoblasts. In many cases the requirement of membrane is not needed with this bone graft.

The TCP Qualybone is composed of 100% of tricalcium phosphate (BETA - TCP) and is absorbed between 1 and 6 months.

The Qualybone BCP is composed of 75% hydroxyapatite and 25% tricalcium phosphate (BETA - TCP) and is absorbed between 6 and 24 months.

2. Case Report

A female in her mid - fifties came to the dental office complaining of broken tooth and crown in the Left back lower teeth region and wished to get it removed and replaced.

On examination, lower left first molar and second molar were root canal treated and fractured under the bridge. Lower second premolar was also fractured. (Figure 1)



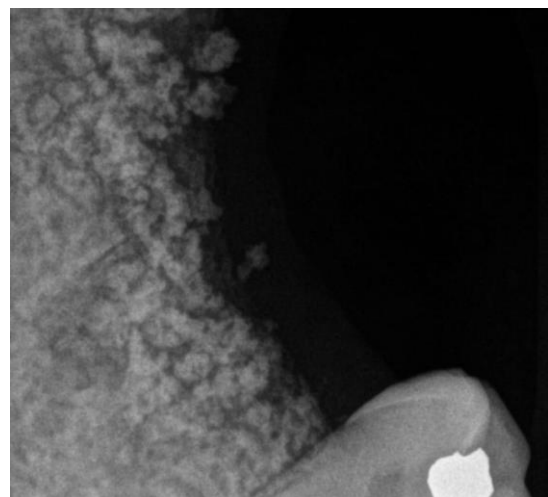
She had no relevant medical history and was medically fit for the surgical procedure.

After administration of local anesthesia (2% lidocaine with 1: 80, 000 epinephrine) flap was raised extending from 35 to 37 region using a 15C blade. This was followed by extraction of fractured teeth done in an atraumatic fashion by hemi sectioning the tooth. (Figure 2 and figure 3)



Qauly Bone tricalcium phosphate (Portugal) granule size 0.5 - 1.0mm 5cc was packed into the socket and Ossix Plus – (Datum Dental, Israel) collagen membrane 15mm X25mm was placed.

The wound was closed using 3 - 0 nylon sutures and haemostasias was achieved.
(Figure 4 Figure 5)



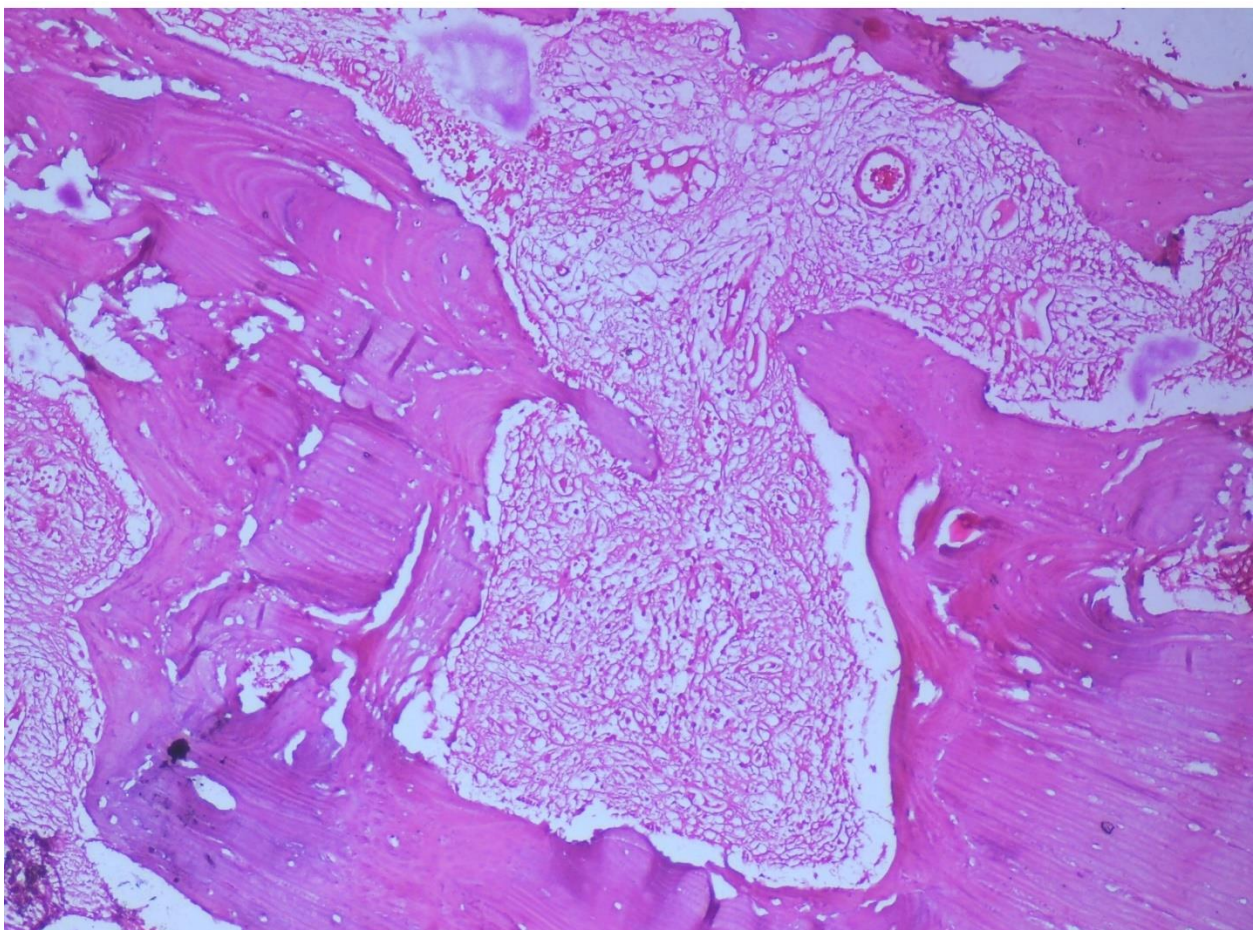
After 4 months, 2 trephine core biopsies were taken from the grafted sites and sent for histology. (Figure 6)

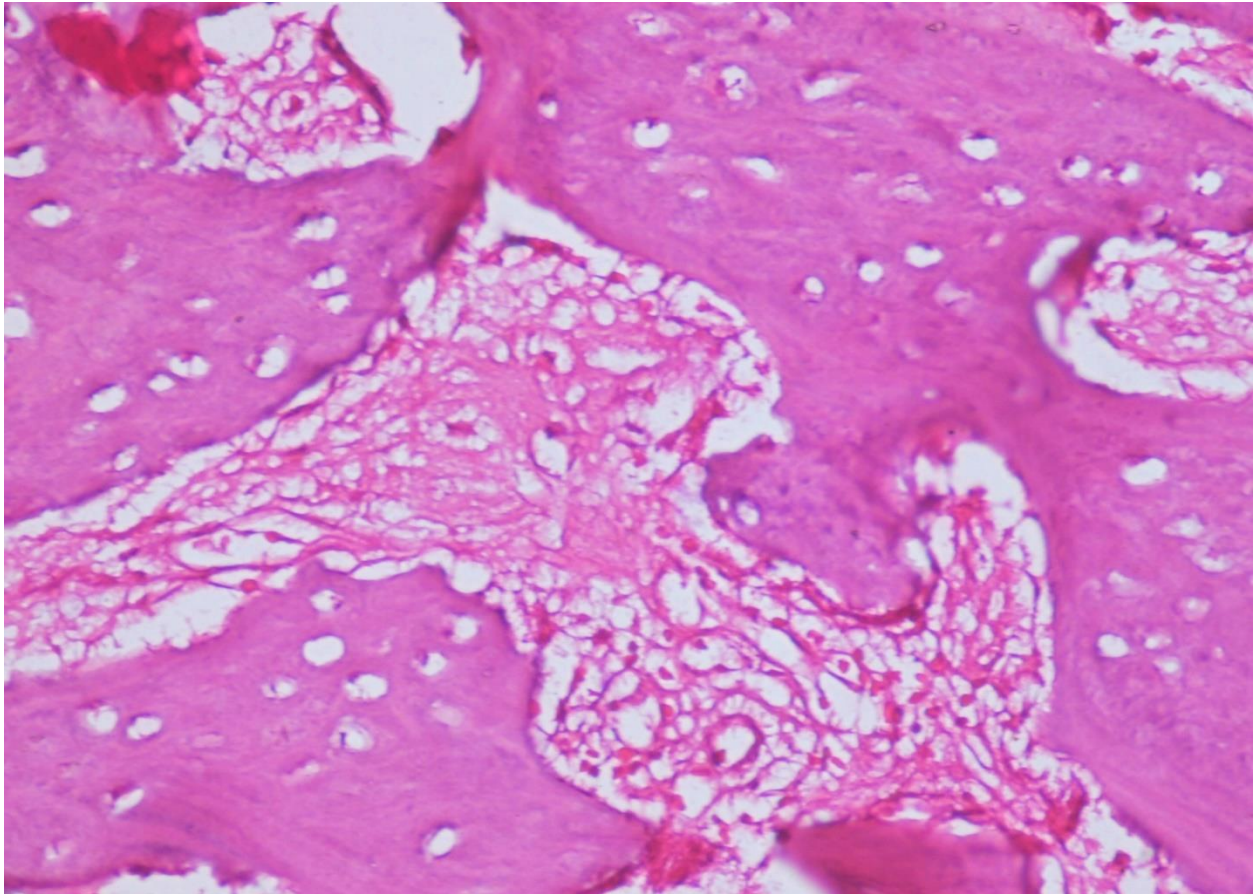


Histology report of the core obtained showed The H and E - stained sections obtained showed abundant areas of mature lamellar bone formation. The bony matrix was well supported with fibrovascular connective tissue with very mild chronic inflammatory infiltrate. The well - formed bony trabeculae were lined with plump cuboidal osteoblasts and showed embedded osteocytes within the osteocytic launae. The sections did not show any significant graft material

histologically with minimal host tissue response in terms of inflammation or foreign body reaction. The results showed that beta - TCP grafted sites showed well - formed mature bone formation, minimal host response and negligible graft material residues histologically.

(Figure 7 A and 7B)





After Biopsy was done, Bioner implants (Barcelona, Spain) DM 4/10 were placed in 34, 35, 36 region and the wound was closed using nylon 3 - 0 sutures in a two stage (submerged healing protocol).

3. Conclusion

The healing of an extraction socket involved a series of events including the formation of a coagulum that was replaced by a provisional connective tissue matrix, woven bone, and lamellar bone. During the healing process a hard tissue bridge is formed followed by cortical bone formation, which "closes" the socket.

Socket grafting provides Increased Stability and Longevity of Implants along with providing Improved Aesthetics even though it increases surgical time.

Various bone graft options are accessible for bone augmentation, and the selection of a specific type and technique depends on the unique characteristics of each case. The clinician's proficiency plays a crucial role in choosing the most suitable graft and technique, as what may be advantageous in one scenario may not be ideal in another. The decision involves careful consideration of the specific needs and conditions of the patient.

Utilizing alloplastic bone grafts offers several advantages. Firstly, there is an unlimited supply, eliminating concerns related to availability. Secondly, it simplifies the surgical procedure by eliminating the necessity for bone harvesting, reducing overall complexity. Additionally, there are no religious considerations, a contrast to Xenografts, making

alloplastic grafts more universally acceptable. Quality bone TCP has shown promising results in our clinical practice. It transforms into mature bone.

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