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Review Article

Bone Graft- Advances in Past and Present

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Abstract

Bone grafting is the well established procedures that promotes healing and regeneration of bone tissue. Throughout these years many progressions have been made in this field ranging from various grafts material to new techniques that improves the various regeneration procedures. This review article analyzes various techniques, materials and also headlining the new advancements in this field.

Keywords: Bone Grafts; Bone Regeneration; Therapy

Introduction

Health of periodontics is very important to maintain the proper functioning of teeth and their associating structures [1]. In periodontal therapy the recent idea is to slow the progression of the inflammatory diseases but also restoring lost supporting tissue thus preventing tooth loss [2].

Restoring or reformation of the tissues such as cementum, bone and pdl to their normal healthy functional stage is what periodontal regeneration means [3].

Bone graft is a dynamic phenomena and is considered as a viable tissue that facilitates bone formation and also promotes healing of the bone. Lots of studies say that after successful re-generative therapy, patients see better results in terms of things like decreased probing depth, higher levels of clinical attachment, and radio-graphic proof of bone fill [4]. What is bone grafting? It is a surgery where the bone that is lost or missing is replaced from patient's own tissue with material which can be natural, synthetic or artificial [5].

In past, bone grafts were viewed as simple strap lattice with success determined by how well they can handle the mechanical load but today at present they are also regarded as biological

entitles[3].Recent developments, including the implementation of gdr principles and the utilization of growth factors to improve healing, have led to an increase in the utilization of bone grafts and substitutes.

The three fundamental biological properties are

Osteoconduction: The bone graft material serves as a platform upon which the host cells can proliferate thus forming new bone [1].

Osteoinduction: The bone morphogenic proteins in the graft convert the surrounding cells to osteoblasts, which then form bone [6].

Oteogenesis: It refers to the process of development of new bone cells by the cells that are formed within the graft materials that have the potential to differentiate and bone formation [6].

Objectives of bone graft material

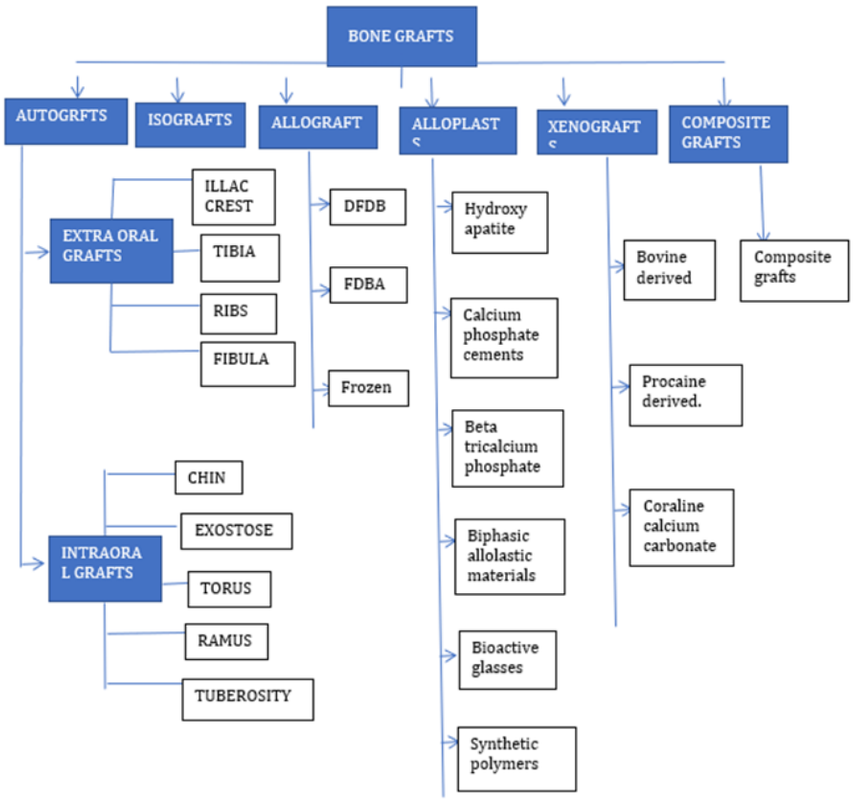
- Reduction of probing depth
- Clinical attachment gain
- Filling an osseous deficiency with bone
- Pdl, cementum and bone regeneration

In past bone grafting procedure was much disputed and doubtful. Some the recent advances include

- Accessibility of bone grafts has been significantly improved.
- Techniques have been enhanced to disinfect the damaged root surfaces.
- Growth factors are used that boost the healing process.
- Principles of guided tissue regeneration [7].

The ideal requirements for bone grafts as follows

- Biocompatible
- Predictability
- Structure should be similar to the bone
- Minimal 0perative hazard
- Accepted by patient
- Cost effective



Classification of bone grafts [8].

Autografts

Autologous bone graft or autogenous bone grafts are bone grafts acquired from same individual. These are obtained from intraoral sites and extra oral sites.

Intra oral sites include chin, exostoses, torus, ramus and maxillary tuberosity whereas extra-oral sites are iliac crest, tibia, ribs and fibula.

Correlating with other graft materials it is still regarded as criterion for grafting [9]. This material have the combination osteogenic, osteoinductive as well as osteoconductive properties [10]. Comparatively extraoral sites has more disadvantages than intra oral sites so they are less preferred [11]. Some of the disadvantages include postoperative infection, root resorbtion, sequestration, not cost effective due to need for hospitalization [11].

The most common type used in autogenous bone graft is cancellous bone that comprises of osteoblasts and progenitor cells with high osteogenic potential [12].

Here the advantages are that these are not involved in any immune responses, biocompatible and consists of osteoblasts and osteoprogenitor cells [11].

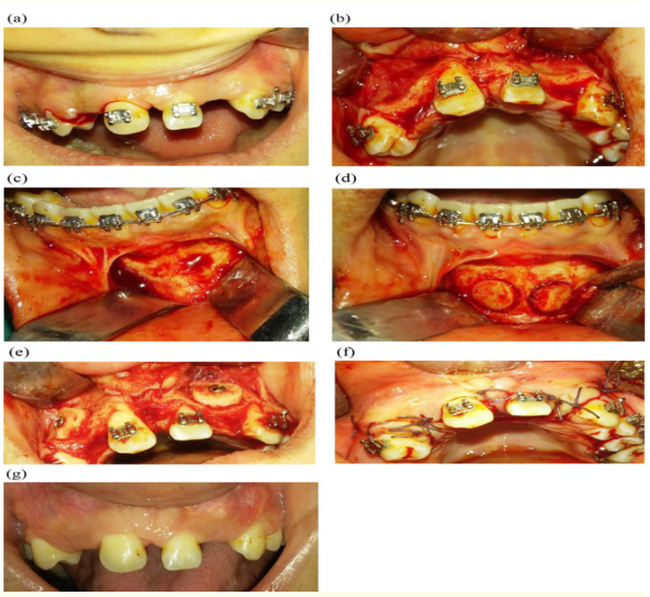


Figure 1

This example shows how autografts from mandibular symphysyeal can be used. Patient comes in with #6, #7, #9, and #11 missing. Trauma has caused regional loss of alveolar bone. Fixation screws were used to secure block grafts taken from the mental symphysis area on the receiver site.. Follow up visit was done for 6 month to observe the result [11].

Allografts

These are derived from different individuals but similar species. These are accessible in three different types that is used in periodontics

- Frozen
- Freeze dried
- Deminerlized freeze dried [3,12].

Due to bone inductive protiens, allografts leads to bone growth in nonorthotropic sites [13]. To strelize or devitalize these grafts they undergo the course of decalcification, deprotenization and freeze-drying [14].

Conclusievly, graft is immuno-competent, biocompatible,contains osteoblasts and osteoprogenitor cells promoting periodontal cell growth [11].

DFDBA

Demineralization of bone reveals bone morphogenic proteins that triggers bone formation, also forms attachment [11]. Demineralized allografts are more inductive than non-demineralized as the proteins have the ability that allows the host stem cells to form new bone cells called osteoblasts [7].

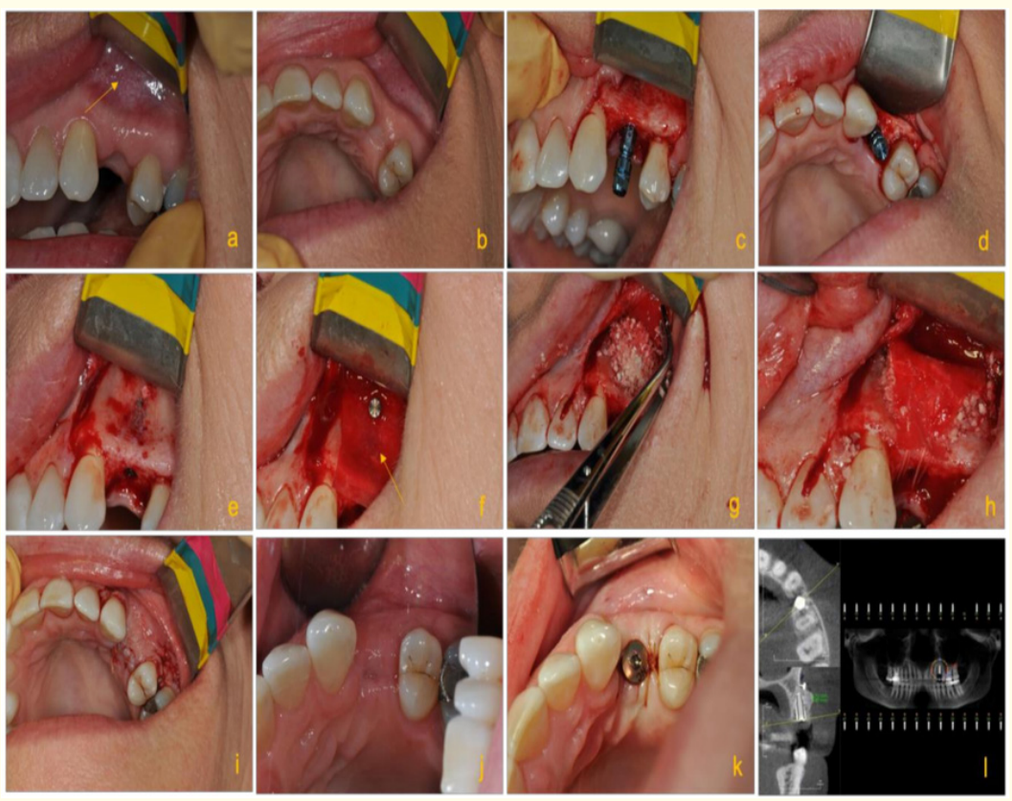


Figure 2

Clinical pictures showing pre- and post-op procedures of a patient with complete tooth loss treated with an fixture with GBR

- After the tooth was extracted at the edentulous site bone defect in the form of buccal concavity is seen in the apical aspect of 24
- The buccal concavity is seen in this occlusal view.
- The appropriate placement of the fixture.
- Proper bucco-palatal positioning of the fixture.
- Before the bone was put in the area should be decorticated and there should be absence of buccal bone at the apical portion of the fixture.
- Straumann Flex Membrane is placed that was secured and supported by tacks.
- Bone graft particles comprised of a combination of Allograft and Xenograft placed at the buccal bone defect.
- To prevent mobilization of the bone graft periostea sutures are given.
- The site is primarily closed
- Post-op is shown keeping intact primary closure.
- The fixture following the second stage and osseointegration test.

- Five months after the operation, a post-operative CBCT (conceal beam tomography) was obtained to demonstrate the final degree of bone healing before the second stage of the procedure and to ensure the fixture had undergone the necessary ossointegration checks. The postoperative CBCT revealed a gain of more than 5 mm in bone [11].

Xenografts

Having osteoconductive property they are derived from different species thus having lower risk of transmission of diseases.

It has two sources mainly: bovine derived and procaine derived.

The bovine derived xenografts are similar to human bone. This property of the material empower the incorporation with human bone very simply, Bio-Oss and osteograf/N are the examples [1,2].

Alloplast

These are synthetic bone substitute having similar biological properties of natural bone.

Having osteoconductive and biocompatible, these grafts eliminate the risk of transmission of diseases and also no requirement of using second surgical site [8]. To enhance the biological activity of these graft material, growth factors, strontium ions or aspirated bone marrow are incorporated into it.

Different kinds of materials used are as follows

- PMMA and polyhydroxyethyl-methacrylate (PHEMA) polymers.
- Demineralized dentin matrix
- Hydroxyapatite
- Calcium phosphate cement
- Beta- tricalcum phosphate
- Calciu sulfate
- Bioactive glasses
- Oily CaOH2 suspension

Advantages include [15]

- Esthetics
- Enhances tooth support and functions
- Progression of disease is reversed as it restores the lost periodontal tissues.

Disadvantages include [3].

- Duration of treatment and postoperative care are increased.
- Necessary to have two sites.

Conclusions

Success of periodontal therapy depends upon clinician skill and excellent biomaterials. Above all patients compliance and immune response play a very pivotal role in the management of periodontal disease.Use of bone grafts and bio materials proven to be very effective than the conventional treatments are autografts, allografts and xenografts. Various barrier membranes, growth factors etc also help in achieving good periodontal regeneration. Hence as the literature suggests bone substitutes definitely play a major role in periodontal regeneration with advanced skill and armamentarium.

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