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Bone Grafts in Dentistry: A Review

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Abstract:

This article aims to shed light on the types of bone grafts available, their mechanisms of action, and their uses in dentistry.

Materials: Bone grafts are used as a filler and form a scaffold to allow bone formation and promote healing of the wounds. These grafts are bioresorbable and don't have any antigen- antibody reaction. They act as mineral reservoirs which induce new bone formation. The main goals of osseous replacement are the maintenance of contour, elimination of dead space, and reduction of the chances of postoperative infection. This in turn aids in proper and efficient bony and soft tissue healing. Bone grafting is a procedure that helps to replace this missing bone with bio materials from patient's own body- an artificial, synthetic, or natural substitute. As natural bone grows, the graft material gets completely replaced by it. This means that the region gets fully integrated with new bone.
Conclusion: The most common use of bone grafting is in dental implants. Generally, bone grafts are either utilized in block or particulated, to be able to adapt it better to a defect. Besides the most use of bone grafting in dental implants, this procedure is employed to fuse joints to stop movement, repair broken bones that have bone loss, and repair broken bone that has not yet healed.

Keywords: bone graft, ridge augmentation, implants, autograft, allograft, xenograft

Introduction:

Bone grafts are used as a filler and form a scaffold to allow bone formation and promote healing of the wounds. These grafts are bioresorbable and don't have any antigen-antibody reaction. They act as mineral reservoirs which induce new bone formation.
Alveolar ridge defects develop as a result of congenital malformations, trauma, surgery, or sometimes even infections.[1] The main goals of osseous replacement are the maintenance of contour, elimination of dead space, and reduction of the chances of postoperative infection. This in turn aids in proper and efficient bony and soft tissue healing.

Bone grafting is a procedure that helps to replace this missing bone with bio materials from patient's own body- an artificial, synthetic, or natural substitute.[3] As natural bone grows, the graft material gets completely replaced by it. This means that the region gets fully integrated with new bone.

Classification of Bone Graft Materials by Composition(Bauer, 2000):

A. Autograft
   1. Aspirated bone marrow or processed osteogeniccells
   2. Cancellous bone
   3. Nonvascularized corticalbone
   4. Vascularizedbone

B. Allograft:
   1. Graft anatomy
      a. Cortical
      b. Cancellous
      c. Osteochondral
   2. Graft processing
      a. Fresh
      b. Frozen
      c. Freeze-dried
      d. Demineralized
   3. Graft sterilization
      a. Sterilely processed
      b. Irradiated
      c. Ethyleneoxide
   4. Handling Properties:
      a. Powder
      b. Particulate
      c. Gel
      d. Paste orputty
      e. Chips
      f. Strips orblocks
      g. Massive

C. Synthetic skeletalmaterials
      a. Osteoconductive blocks orgranules
      b. Osteoconductivecements
      c. Osteoinductiveproteins
      d. Composites

The biologic mechanisms that provide a rationale for bone grafting are osteoconduction, osteoinduction, and osteogenesis.[2]

Osteoconduction:

When bone graft material serves as a scaffold for new bone growth, which is perpetuated by the native bone. Osteoblasts from the margin of defect that is being grafted, utilize the bone graft material as a framework upon which to spread and generate new bone.[1] The bare basic of a bone graft must be
osteoconduction.
Osteoinduction:
Involves stimulation of osteoprogenitor cells to differentiate into osteoblasts and then begins formation of new bone.[2] A bone graft material that is
osteoconductive and osteoinductive will serve as a scaffold for already existing osteoblasts but will also trigger the formation of new osteoblasts, thus, promoting faster integration of the graft.

Osteopromotion:
This involves enhancement of osteoinduction without possession of osteoinductive properties. For example, enamel matrix derivative enhances the osteoinductive effect of demineralized freeze-dried bone allograft (DFDBA), but will not stimulate bone growth alone.[2]

Osteogenesis:

It occurs when vital osteoblasts originating from bone graft material contributes to the growth of new bone along with bone formation.

TYPES OF GRAFTS:

Autograft:

Autologous or autogenous bone graft involves utilizing bone obtained from same individual who is to receive the graft. Bone can be harvested from nonessential bones, such as from iliac crest, mandibular symphysis, the coronoid process etc. There is less risk of graft rejection as the graft originates from the patient's body. It can be termed to be osteoinductive and osteogenic, as well asosteoconductive.

Disadvantage of autologous grafts is the additional surgical site required, which leads to another potential location for postoperative pain and complications.[3]

Allograft:

Allograft is derived from humans. The difference is that allograft is harvested from a different individual than the one receiving the graft.

Synthetic Variants:

Artificial bone can be created from ceramics such as calcium phosphates (e.g., HA and tricalcium phosphate. [5]

Xenografts:

Xenografts are bone grafts from a species other than humans. Alloplastic Grafts:

Alloplastic grafts may be made from hydroxyapatite. Tricalcium phosphate is now being used in combination with hydroxyapatite and thus giving effect of both, osteoconduction and resorbability.

Uses:

The most common use of bone grafting is in dental implants. Generally, bone grafts are either utilized in block or particulated, to be able to adapt it better to a defect. The periosteum and arteria nutricia are generally removed with piece of bone so that the graft will remain alive and grow when transplanted into new host site.

Besides the most use of bone grafting in dental implants, this procedure is employed to fuse joints to stop movement, repair broken bones that have bone loss, and repair broken bone that has not yet healed.[9]

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