BONE GRAFTS IN PERIODONTICS - A Review

Thejeswar EP
Graduate Student
Saveetha dental college, Saveetha University,
Saveetha institute of medical and technical sciences

Dr.Sathish
Associate Professor
Faculty and practitioner Department of Periodontics
Saveetha dental college and hospitals

ABSTRACT:

AIM:
A systemic review on various bone grafts available in periodontics.
OBJECTIVE:
A systemic review on bone grafts which includes its classification, mechanism of action, and its techniques.
BACKGROUND:
Bone grafts are performed in order to replace the bone which is lost. There are four classifications which are Autogenous bone graft, Allograft, Xenografts, Alloplasts. The mechanism of action is usually Osteogenesis, Osteoinduction and Osteoconduction. The Autogenous bone graft can be cortical bone and cancellous bone. Therefore this review aims to discuss various bone drafting methods and techniques.
RESON:
To discuss various bone grafting methods.

KEYWORDS: Bone grafts, Allograft, Xenograft, Alloplast, Autogenous bone graft.

INTRODUCTION:

Bone replacement grafts are widely used to promote bone formation and periodontal regeneration. [1] Conventional surgical approaches, such as open flap debridement, provide critical access to evaluate and detoxify root surfaces as well as establish improved periodontal form and architecture; however, these surgical techniques offer only limited potential in restoring or reconstituting component periodontal tissues. [2, 3] Bone grafting materials function, in part, as structural scaffolds and matrices for attachment and proliferation of anchorage-dependent osteoblasts. Bone replacement grafts provide a structural framework for clot development, maturation, and remodelling that supports bone formation in osseous defects. [4] Bone grafting materials also exhibit a variable capacity to promote the coordinated formation of bone, cementum and periodontal ligament (PDL) when placed and retained in a periodontal defect. [5, 6] Bone grafting materials must possess the attributes of biocompatibility and osteoconductivity. Bone replacement grafts may also possess other properties that support osteogenesis. [7]. Ideal characteristics of a bone graft are: nontoxic, nonantigenic, resistant to infection, stimulate new attachment and be able to trigger osteogenesis, cementogenesis, and formation of a functional periodontal ligament. [8, 9]

CLASSIFICATION OF TISSUE GRAFTS AS FOLLOWS:

- **Autograft:** Tissue taken from one operative site and grafted in another operative site within the same individual.
- **Homograft/allograft:** Tissue taken from one operative site in one individual and grafted in the operative site in another individual of the same species.
- **Heterograft/xenograft:** Tissue is taken from one individual and grafted in the operative site of another individual of the different species.
- **Syngensio grafts:** Tissue graft removed from blood‑related relatives.
- **Orthotopic graft:** Tissue grafted into an anatomical site normally occupied by that tissue, for example, bone to bone and skin to skin.

MECHANISM OF BONE GRAFTING:

- Osteogenesis refers to the formation and development of new bone by cells contained in the graft.
- Osteoinduction is defined as a chemical process by which molecules contained in the graft convert the neighboring cells into osteoblasts, which, in turn, form bone.
- Osteoconduction is a physical effect by which the matrix of the graft forms a scaffold that favors outside cells to penetrate the graft and form new bone.
- Osteopromotion involves the enhancement of osteoinduction without the possession of osteoinductive properties.For example, enamel matrix derivative has been shown to enhance the osteoinductive effect.

SELECTION OF BONE GRAFT MATERIAL:

According to a study in 1977, [10] the considerations that govern the selection of a material are biologic acceptability, predictability,

clinical feasibility, minimal operative hazards, minimal postoperative sequelae, and patient acceptance. An ideal bone graft material should be easy to use and should provide desirable results with minimal complications. [11] Various bone graft materials have been used and tested in the field of medical science in the last few decades and many are still under trial, ensuring promising results and may put end to the search for a suitable bone graft material.

INDICATIONS FOR OSSEOUS GRAFTS:

1) Deep Intraosseous Defects - The deeper the defect, the greater amount of bone fill that can be expected; at the same time, the residual defect may be significant. It is the opinion of many clinicians that the greater the number of osseous walls and the greater the support and containment for the graft material, the greater will be the bone fill. [12] The degree of regeneration in an osseous defect of a given volume and morphology varies directly with the adequacy of the soft tissue cover and with the surface area of the vascularised bony walls lining the defect; it varies inversely with the root surface area. Therefore, a three-wall defect should heal with more bone fill than a two-wall or a one-wall lesion, and a one-wall defect should heal better than a furcation defect. [13]

2) Tooth Retention - The use of bone grafts may restore functional stability to such a degree as to obviate the need for extraction.

3) Support for Critical Teeth - Teeth severely weakened by a loss of alveolar support can benefit from the use of osseous grafts. This may be the case for an abutment tooth or those teeth that are critical for the preservation of arch integrity.

4) Bone Defects – Associated with Juvenile Periodontitis -These extensive lesions have been reported to respond very favorably to osseous grafting, especially when grafting is combined with an antibiotic, such as tetracycline.

5) Esthetics - The resection of shallow intraosseous defects in the anterior region of the mouth by osteoplasty/ostectomy followed by an apically positioned flap to eliminate the periodontal pocket will result in gingival recession and a long clinical crown. This may be esthetically unacceptable. The use of osseous grafts to reconstruct bone architecture allows placement of the gingival margin as close as possible to its original position. [14]

6) Furcation Defects - This indication applies mainly to class II furcation defects. Bone grafts, especially if used in conjunction with guided tissue regeneration, have proven to bet he therapeutic modality of choice for treating this type of lesion.

CLINICAL OBJECTIVES OF BONE GRAFTING FOR PERIODONTAL REGENERATION:

The objectives of bone grafting procedures for patients with periodontitis are as follows:

(1) Probing depth reduction.
(2) Clinical attachment gain.
(3) Bone fill of the osseous defect.
(4) Regeneration of new bone, cementum, and periodontal ligament.

ADVANTAGES OF BONE GRAFTS:

1. Regeneration of the attachment apparatus is possible. Reconstruction of lost bone, cementum, and periodontal ligament has been adequately documented with autogenous and allogeneic graft materials.
2. By reconstructing the periodontium, it is possible to reverse the disease process.
3. Increased tooth support, improved function, and enhanced esthetics are concomitant results of successful bone graft therapy.
4. Bone grafts have application for all categories of intraosseous defects and certain furcation defects. This is in contrast to other forms of regenerative therapy.
5. Idealistic therapeutic objectives may be achievable. With the advent of growth factors to augment the osteogenic potential of current or future graft materials, complete disease reversal is a realistic goal.

DISADVANTAGES OF BONE GRAFTS:

1. Bone graft therapy involves additional treatment time. Because of graft procurement and/or preparation, as well as placement, the time allotted to the surgical procedure must be lengthened.
2. Autografts require the removal of host donor tissue. Unless bone can be removed from within the primary surgical site, a secondary surgical site, either extraoral or intraoral, is necessary. The risks of any surgical procedure will apply here as well. In addition, the quantity of intraoral bone to fill multiple or deep defects is often lacking. Root resorption and ankylosis are problems encountered only with fresh iliac cancellous bone and marrow.
3. The availability and added expense of bone allografts are ongoing problems. Patients and clinicians fears of disease transfer can be ameliorated by reference to the scientific literature.
4. Additional post operative care is often necessary with bone graft therapy. [15] This can range from technical problems to management of soft tissue defects associated with wound healing.
5. Bone grafts take a long time to heal. As much as a 2-year postoperative interval may be necessary before there is a final radiographic resolution of the defect.
6. Bone graft adds greater expense to the therapy. [16] Economic considerations involve the cost of procurement or of the material itself, additional surgical treatment time, and postoperative maintenance treatment.

CONCLUSION:

Bone grafting is one of the most commonly used options to treat large bone defects in periodontal regenerative therapy. Although not all bone grafting materials support the formation of a new periodontal attachment apparatus, there is conclusive evidence that periodontal regeneration is achievable with bone replacement grafts in humans. [17] Autografts remain the gold standard since they provide osteogenic cells, osteoinductive growth factors, and an osteoconductive scaffold, all essential for new bone growth, but

carry the limitations of morbidity at the harvesting site and limited availability.

REFERENCES:

1. Sukumar S, Drízhal I. Bone grafts in periodontal therapy. ActaMedica (Hradec Kralove) 2008;51:203-7.
2. Glossary of Periodontic Terms. American academy of Periodontology;2001.
3. Elsalanty ME, Genecov DG. Bone grafts in craniofacial surgery.Craniomaxillofac Trauma Reconstr 2009;2:125-34.
4. Schallhorn RG, Hiatt WH, Boyce W. Iliac transplants in periodontal therapy. J Periodontol 1970;41:566-80.
5. Hyatt GW, Butler MC. The procurement, storage, and clinical use of bone homografts. Instr Course Lect 1957;14:343-73.
6. Carranza FA, Newman MG. Reconstructive Osseous Surgery. In:Clinical Periodontology. Philadelphia, USA: WB Saunders Company;1999;8:622-39.
7. Hegedus Z. The rebuilding of the alveolar process by bone transplantation. Dent Cosmos 1923; 65:736.
8. Nabers CL, O'Leary TJ. Autogenous bone transplants in the treatment of osseous defects. J Periodontol 1965;36:5-14.
9. Robinson E. Osseous coagulum for bone induction. J Periodontol1969;40:503-10.
10. Mellonig JT, Bowers GM, Cotton WR. Comparison of bone graft materials. Part II. New bone formation with autografts and allografts: A histological evaluation. J Periodontol 1981;52:297-302.
11. Meffert RM, Thomas JR, Hamilton KM, Brownstein CN.Hydroxylapatite as an alloplastic graft in the treatment of human periodontal osseous defects. J Periodontol 1985;56:63-73.
12. Yukna RA. HTR polymer grafts in human periodontal osseous defects.I 6-month clinical results. J Periodontol 1990;61:633-42.
13. Richardson CR, Mellonig JT, Brunsvold MA, McDonnell HT, Cochran DL. Clinical evaluation of Bio-Oss: A bovine-derived xenograft for the treatment of periodontal osseous defects in humans.J Clin Periodontol 1999;26:421-8.
14. Urist MR. Bone: Formation by autoinduction. Science 1965;150:893-9.
15. Araújo M, Linder E, Wennström J, Lindhe J. The influence of Bio-OssCollagen on the healing of an extraction socket: An experimental study in the dog. Int J Periodontics Restorative Dent 2008;28:123-35.
16.Chodroff, R.E. & Ammons, W.F. Periodontal repair and surgical debridement with and without cartilage allografts. J Clin. Periodontol 1984;11:295.
17.Alderman NE. Sterile plaster of Paris as an implant in the infrabony environment. A preliminary study.J Periodontol 1969; 40: 11.