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Review Article

Guided tissue regeneration- A review

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***ABSTRACT*:**
Guided tissue regeneration typically refers to ridge augmentation or bone regenerative procedures. The present article highlights the importance of guided tissue regeneration in treatment of periodontal diseases.

Key words: Guided tissue regeneration, Periodontal diseases, Ridge augmentation

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Introduction:

Guided tissue regeneration is procedures attempting to regenerate lost periodontal structures through differential tissue responses. Guided bone regeneration typically refers to ridge augmentation or bone regenerative procedures; guided tissue regeneration typically refers to regeneration of periodontal attachment. Barrier techniques, using materials such as expanded polytetrafluoroethylene, polyglactin, polylactic acid, calcium sulfate, and collagen, are employed in the hope of excluding epithelium and the gingival corium from the root or existing bone surface in the belief that they interfere with regeneration." Both of these concepts are under the umbrella term of regeneration, which in itself is defined as, "reproduction or reconstruction of a lost or injured part.[1]

The objective of tissue replacement is to recreate or regenerate the loss or damaged structure and to mimic as closely as possible the original form and function. The grafting material should be biocompatible to the host receiving the graft at the hard and soft tissue interfaces. The host tissue has a potential for damage and rejection of the graft. The clinician must determine the objective of the grafting material and the procedure for its application. The result will be determined by the classification of material used and the technique of the procedure. Regeneration is classified into guided bone regeneration (GBR) or guided tissue regeneration (GTR). Guided bone regeneration refers to an edentulous area, whereas Guided tissue regeneration refers to the regeneration of bone, periodontal ligament, and cementum around teeth. This article deals with the concept of Guided bone regeneration (GBR) and its applications.[2]

Egelberg pointed out in his review concerning the regeneration and repair of periodontal tissues that, from a therapeutic point of view, future research could be focused in the following three conceptual areas: 1) Methods to improve protection of the healing wound at the root surface (e.g., the coronally repositioned flap). Such methods may obviate the need for attempts at preventing the oral epithelium from early access to this interface. 2) Methods to enhance the adhesion and maturation of the coagulum at the root surface (e.g., the root conditioning method). These methods will need to stimulate, or at least allow for subsequent repopulation, of the root surface by periodontal ligament cells. 3) Methods of achieving repopulation of the root surface by cells originating in the periodontal ligament.3

Different types of membrane materials have been developed concomitant with expansion of the concept of membrane barrier techniques, and their clinical applications.[4]

I. Non-resorbable membranes
a. Cellulose filters
b. Expanded polytetrafluoroethylene membranes
II. Resorbable materials and devices
a. Collagen membranes

b. Polylactic acid
c. Polyglycolic acid and polylactic acid
d. Synthetic liquid polymer Polyglactin
e. Calcium sulfate
f. Acellular dermal allografts
g. Oxidized cellulose mesh

Non-resorbable membranes

Recently, physical barriers like occlusive membranes have been interposed between the connective tissue of the periodontal flap and the curetted root surface. The purpose of this physical barrier is to deflect the gingival connective tissue and the apically migrating oral epithelium away from the root surface and create a protected space over the defect that allows cells from the remaining periodontal ligament to selectively repopulate the root surface.[5]

Membranes made of ePTFE are composed of a matrix of polytetrafluoroethylene (PTFE) nodes and fibrils in a microstructure that vary in porosity, which addresses the clinical and biologic requirements of its intended applications.

Titanium-reinforced ePTFE membranes were designed to increase the tent like effect, which is an advantage when the defect morphology does not create an adequate space. The creation and maintenance of a space have been recognized as important requirements for achieving regeneration.[6]

Resorbable materials and devices

GTR is based on the concept that damaged biological tissues are for the most part capable of self-reconstitution if provided with appropriate support. It is desirable for the auxiliary materials to disappear at the end of wound healing or in the course of healing. From this point of view, biodegradable polymers may be best suited to support healing of damaged biological tissues by providing an appropriate scaffold or guidance.

Collagen is a physiologically metabolized macromolecule of the periodontal connective tissue that has two different properties: chemotactic and hemostatic. This material is also a weak immunogen and may act as a scaffold for migrating cells. Collagen possesses several characteristics that make it suitable barrier material, including favourable effects on coagulation and wound healing. Advantages of the use of collagen membranes are minimal postoperative complications, a good healing rate and no incidence of material dehiscence, tissue perforation and sensitivity.[7]

Polylactic acid is a bioresorbable matrix barrier composed of a blend of polylactic acid that was softened with citric acid for malleability and to facilitate clinical handling (Guidor) was first resorbable barrier to be approved by the Food and Drug Administration (FDA) for membrane barrier techniques.

Occlusive membranes, such as a Teflon membrane, serve as a barrier between the gingival connective tissue and the tooth root to create a protected space over the defect. It has been suggested that such a synthetic space may facilitate the migration of periodontal ligament and bone forming cells onto root surfaces, encouraging regeneration of the components of the supporting periodontal tissues rather than nonspecific connective tissue repair.

Recent advances in the development of GTR

Advances in the science and technology of nanomaterials have led to increased enthusiasm for approaches such as electrospinning.[8]

Designed membranes for zone-dependent bioactivity

In recent years, many research groups have tried to design and develop GTR/GBR periodontal membranes with the requisite features and properties by combining natural and synthetic polymers. These studies prepared GTR/GBR membranes using film casting, dynamic filtration and e-spinning of synthetic (e.g., PCL) and/or natural (e.g., collagen, chitosan) polymers. The membranes have been prepared with or without therapeutic drugs, growth factors, and/or calcium phosphate particles.

Electrospinning (e-spinning) for membranes

Formhals first introduced electrospinning or e-spinning in 1938. Recently, numerous research groups have explored its use to generate fibrous scaffolds for tissue regeneration. A typical electrospinning apparatus includes a polymer solution/melt in a syringe, charged through a high voltage supply, and a grounded plate positioned at a predetermined distance from the tip of the needle.

Designing functional surface layers for interface tissues

Membranes for GTR/GBR applications capable of promoting faster bone growth as well as impeding the infiltration of epithelial tissue into the defect and bacterial colonization would be unique and highly effective when implanted in vivo. Clinically, the oral administration of antibiotics as an adjunctive treatment for periodontal diseases has been helpful in reducing and/or eliminating the presence of pathogens in the gingival fluid and periodontal pocket.[9]

Bioactive calcium phosphate incorporation

Techniques such as co-electrospinning of HA nanoparticles, electrospraying of HA suspensions and biomimetic growth of HA from simulated body fluids have been frequently employed for fabricating fibrous composites of polymer and HA with improved bioactivity, leading to greater adhesion and proliferation of osteoblasts or mesenchymal stem cells. Co-electrospinning of HA and collagen with polymers has made possible the fabrication of membranes with improved mechanical properties.[10]

Conclusion

Guided Tissue Regeneration is a surgical technique employed by many clinicians. It is capable of regenerating the loss or damaged structure and mimic as closely as possible the original form and function.

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