CLINICAL CONSIDERATIONS AND APPLICATIONS OF MEMBRANES: A MINIREVIEW

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Abstract
Membranes have been widely used by Periodontist in managing periodontal defects, but the applications of membranes and their proper use is limited amongst other clinicians in dental practice. Even though some practioners tend to use GTR membranes for managing bone defects, membranes are not appropriately used. Membranes apart from use for recession coverage and routine periodontal procedures are being used for bone and socket augmentation along with use in implant surgeries. Some precautions have to be kept in mind to avoid post-operative complications and membranes must be used where indicated. Selection of membrane shape and size along with appropriate surgical technique contribute significantly to treatment outcomes.
Keywords: Guided Tissue Regeneration (GTR), Membranes, Regeneration.

Introduction

Periodontal regeneration is defined histologically as regeneration of tooth's supporting tissues, including alveolar bone, periodontal ligament and cementum over a previously diseased root surface.[1] Regeneration of the lost supporting structures is considered as the ideal objective of periodontal therapy. However, the nature of the gingival epithelium to rapidly proliferate and grow into the defect site prevents or retards the ongoing phenomenon and therefore minimizes the rate and amount of regeneration activity. [1]

Guided Tissue Regeneration membranes have been widely used in periodontics since long, but general practioners and other dentists are not acquainted with use of membranes in clinical practice. GTR membranes are significant where regeneration of tissues are desired and play a significant role in managing circumferential bony lesions, peri-apical defects, implant surgeries, bone augmentation, other bone defects and gingival recession.

Regeneration refers to reconstitution of a defect by its original tissues or cells,

Various regenerative therapies have been introduced to attain maximum regeneration of the lost supporting periodontal tissues that have resulted in a greater and more predictable regeneration of lost periodontal tissues. Currently, osseous grafting and guided tissue regeneration (GTR) are the two techniques with the most histological documentation of periodontal regeneration.[2-4]

Barrier membranes were introduced by Melcher (1976) with the concept of exclusion of gingival epithelium and connective tissue cells from occupying the wound area. This procedure allows cells with regenerative potential (periodontal ligament, bone cells and possibly cementoblasts) entry into the wound site first. [5]

In the procedure of guided tissue regeneration, membranes offer three advantages during wound healing. First, exclusion of the epithelium and gingival connective tissue from entering the defect area during healing,this prevents their interference with the healing and regenerative processs. Second, barrier membranes maintainsa space between the defect and the barrier, allowing the entry of regenerative cells fromthe periodontal ligament and alveolar bone. [6]

And,finally the barrier helps to stabilize the clot, which may enhance regeneration.

This article attempts to outline the clinical aspects of membranes and factors to be considered in clinical use of these membranes for general clinical practice.

GTR Membrane Types

The GTR membranes are divided into two main types, i.e., non-biodegradable membranes and biodegradable membranes.[7]These membranes are available in various shapes and sizes.Some of the commonly used membranes are expanded PTFE membranes, oxidized cellulose membranes, collagen membranes, polylactic acid and polyglycolic acid polymers, guidor, atrisorb etc.

Advantages of Biodegradable membranes over non-biodegradable membranes

Elimination of second surgery for barrier removal which may reduce operatory time and therefore may reduce total cost, reduce overall treatment morbidity, increase patient acceptance of GTR procedures and reduce risk of loss of regenerated attachment owing to re-entry surgery.

The biologically absorbable materials hold potential to be moretissue-friendly and integrated with host tissue, enhance tissue coverage,reduce barrier exposure and resist or prevent microbial colonization. [8]

Essential Criteria for barrier membranes

- Biocompatibility: the material should not elicit an immuneresponse.
- Cell-occlusiveness: the barrier membrane should exclude undesirable cell types from entering the secluded space adjacent to the root surface.

It is also considered advantageous that the material would allow the passage of nutrients and gases.

- Tissue integration: prevention of rapid epithelium down-growth on the outer surface of the material or encapsulation of the material and providing stability to the overlying flap.
- Space maintenance: the barrier material should be capable of creating and maintaining a space adjacent to the root surface. This will allow the in growth of tissue from the periodontal ligament.
- Good handling properties: the membrane should be available in a configuration which is easy to trim and place.[10]

Barrier membranes should have the following properties

- Nontoxic
- Easy and acceptable handling properties
- Malleable yet supports tissue
- Non antigenic
- Preserves and maintains space
- Ability to customize for unique situations
- Adherence to or ability to approximate the root surface
- Ability to adhere to the root or be stabilized against it
- Promotes tissue coverage and reduces barrier exposure rates
- Promotes flap attachment during surgery
- Reduces incidence of pocket or pouch formation between flap and barrier
- Resists bacterial seeding and contamination
- Promotes selective cell proliferation or migration within the defect
- Promotes natural or induced cellular filling of the defect by progenitor cells.[8]

Indications and Contraindications for GTR[9]

Indications

- Narrow two and three wall infrabony defects
- Circumscribed defects (apicoectomy)
- Bone augmentation (guided bone regeneration)
- Furcations
- Recession

Contraindications

- Any medical condition contraindicating surgery
- Infection at defect site
- Poor oral hygiene
- Smoking (heavy)
- Tooth mobility >1 mm
- Width of attached gingiva at defect site < 1 mm
- Thickness of attached gingiva at defect site <1 mm
- Circumferential defects
- Generalized horizontal bone loss
- Multiple defects. [10]

Clinical Applications of GTR

GTR procedures have been implied as a therapeutic modality for treating various periodontal defects including:

- Intrabony Defects[11]
- Furcations[12]
- Gingival Recession[13]
- Guided Bone Regeneration[14] (Socket Augmentation, Apicosectomy)
- Implant Surgeries[15]

Complications with GTR[16]

- Many complications such as bleeding, swelling, and pain are common to all periodontal surgical procedures.
- Complications that are unique to GTR include barrier exposure and infection around the barrier. Barriers may be exposed at the coronal aspect of the flap after suturing. This is undesirable but not always avoidable. Post-operative exposure of the barrier may occur at the incision or in an area of flap necrosis.
- Flap necrosis may occur because of poor flap management, excessive thinning of the flap, or protrusion of a sharp corner of the barrier through the flap.
- Post-operative infection, if there is any indication of infection, the barrier must be removed at the earliest possible opportunity. If there are no signs or symptoms of infection, the most common treatment is to maintain cleanliness of the flap, reinforce oral hygiene, and observe the area frequently.[6]

Factors Affecting Treatment Results[9]

Barrier- Independent Factors

- Poor plaque control
- Smoking
- Occlusion trauma
- Suboptimal tissue health
- Mechanical habits (e.g. aggressive tooth brushing)
- Overlying gingival tissue
- Inadequate zone of keratinized tissue
- Inadequate tissue thickness
- Surgical technique
- Improper incision placement (e.g. excessive loss of marginal tissue)
- Traumatic flap elevation and management
- Excessive surgical time (e.g. tissue or flap desiccation)
- Inadequate closure or suturing (failure to achieve and maintain primary closure)

Postsurgical factors

- Premature tissue challenge (inadequate gingiva)
- Plaque recolonization

- Mechanical insult
- Loss of wound stability (e.g. loose sutures, loss of early fibrin clot)

Barrier Dependent Factors

- Inadequate barrier adaptation
- Non-sterile technique (plaque or saliva contamination)
- Instability (movement) of barrier against root
- Premature exposure of barrier to oral environment and microbes
- Premature loss or degradation of barrier.[8]

Conclusion

Guided tissue regeneration membranes have been used extensively for the regeneration of periodontal tissues in various defects with successful histological and clinical evidence. Also GTR has been used with various other regenerative methods for achieving better regenerative outcomes.

Various studies are being conducted to introduce newer membranes with better manageable properties and in combination with various antibiotics for achieving better results.

With the introduction of various bio-active agents such as growth factors the use of GTR may be restrained in future. Moreover, the success of GTR procedures depends on proper case selection and post-operative care and skills of the clinician.

Even with the introduction of newer regenerative treatment modalities and agents, the use membranes still remain significant in regeneration owing to their property of isolating the wound defects and stabilization of blood clot, thus promising better predictability of treatment outcomes with better regenerative potential.

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