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Amnion And Chorion Membrane In Periodontal Regeneration

Preethi Shankar, Ashok Kumar*, C. Burnice Nalina Kumari, Jaideep Mahendra, N.Ambalavanan

Meenakshi Academy of Higher Education and Research,

Faculty of Dentistry, Meenakshi Ammal Dental college and Hospital, Chennai, India.

Higher Education and Research, Chennai, India.

drburnice.perio@madch.edu.in

ABSTRACT

Periodontal regeneration is an age-old notion that is improving with the use of newer and modified barrier membranes to get better clinical results. The placental amnion and chorion membranes are examples of such membranes. It was first used because of its biocompatibility and capacity to facilitate wound healing.The membrane has been utilized in periodontology to help minimise probing pocket depth, boost clinical attachment levels, and stimulate bone formation as part of guided tissue regeneration and guided bone regeneration. These membranes are biologic membranes, which means they are bioresorbable and tissue compatible.Intrabony defects, guided bone regeneration, and root covering procedures have all been treated with it. The clinical implications, literature evaluation, and features of this membrane that make it unique and favourable for use in periodontal regeneration therapy will be reviewed and highlighted in this article.

Keywords: periodontal therapy, biologic membrane, amnion membrane, chorion membrane, periodontal regeneration

I.Introduction

Periodontitis is an inflammatory condition of the teeth's supporting tissues caused by individual germs or groups of microorganisms that leads to gradual deterioration of the periodontal ligament and alveolar bone, resulting in periodontal pockets, gingival recession, or both.[1] With the use of periodontal therapy, chronically irritated gingiva can be restored to a nearly healthy state.Surgical and non-surgical treatments are used depending on the severity of the periodontal disease. Surgical intervention is used in cases of severe periodontitis and a few cases of intermediate periodontitis that do not respond to non-surgical treatment.Periodontal therapy's primary goal is to recover damaged tissues by repair, regeneration, or new attachment.[2] By the growth and differentiation of newly created cells and intercellular substances, regeneration naturally renews the architecture of periodontium.The repair simply restores the normal sulcus on the previously damaged root surface at the same level as the periodontal pocket. It is preferable to restore the periodontal apparatus because it is generated through selective cell repopulation by regeneration.[1]

A variety of materials available in the market aid in periodontal regeneration such as the biologic resorbable membranes. The are advantageous as the promote periodontal regeneration due to following factors, low cost, ease of preparation and good biologic effects. Amnion and chorion are such biologic membranes.

II.History

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The amnion membrane, which is made up of a thick basement membrane and an avascular stromal matrix, is the placenta's innermost layer. The chorion forms the outer end of the sac, which encloses the foetus and is made up of several types of collagen and cell adhesion bioactive components.Over the years, human amniotic membrane and chorion membrane have been employed in a variety of surgical operations. The first documented use of foetal membrane for skin transplantation was in the medical field.[3]The membrane's ability to accelerate epithelialization and reduce pain when applied to burnt or ulcerated areas was investigated. Foetal membrane was also used to restore the ocular surface. As a result of its greater recognition, the amniotic membrane lowers scarring and inflammation while also improving wound healing. Its antibacterial characteristics help it act as a scaffold for proliferation and differentiation of cells in the membrane.The extracellular matrix and its components, such as growth factors, suggest that the membrane is a good biomaterial for tissue engineering since it can operate as a native scaffold. It is simple to obtain, process, and transport.[4]

III. Preparation

Fresh membrane is extracted from the placenta during delivery via vaginal or caesarean procedure. Robson and Krizekl devised a method for preparing fresh membranes, in which they cleaned the membrane in a 0.025 percent solution of sodium hypochlorite and kept it at 4°C in a sterile solution containing penicillin. Membranes remained sterile for up to 6 weeks, according to the researchers.[5]Various ways in which the amnion membrane has been used is as follows; as fresh membrane, dried membrane, frozen membrane; freeze dried irradiated membrane, stabilized amniotic membrane and cryopreserved membrane.[6]

IV. Preservation

For a long time, glycerol has been utilised as a cryoprotective agent. The amniotic membrane's interstitial water is extracted by its high osmotic pressure. The amniotic membrane is dried with 80 percent glycerol in this procedure, and it may then be stored at 4°C for a long period, however part of its biologic qualities are lost. This kind of preserved amnion is used to treat burns.[7]

V. Properties

Chorion has a thickness of three to four times that of amnion. The reticular layer, foundation membrane, and trophoblast layer make up the chorion. The interaction of the reticular layer with the spongy layer forms the majority of the chorion's thickness. Collagens I, III, IV, V, and VI make up the reticular network. Collagen IV, fibronectin and laminin attaches the trophoblasts to the reticular layer in the basement membrane.The trophoblast layer is made up of two to ten layers of trophoblasts that come into touch with the decidua.[8]

The amniotic membrane contains natural inhibitors of MMPs as well as hyaluronic acid, a higher molecular-weight glycosaminoglycan that binds CD44 to the stroma of the amniotic membrane.[9]The amnion exhibits analgesic, antiangiogenic, bacteriostatic, and low immunogenic characteristics.[10] It encourages re-epithelialization and helps to prevent

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scarring. Immunomodulatory cells from the foetal membranes may be implicated in the maintenance of foeto-maternal tolerance.Proteins such Activin A, IL-1 receptor antagonist (IL-1ra), and IL-10 are released by epithelial and mesenchymal amniotic cells and deposited in the amniotic membrane stroma.[11] The apoptosis-inducing genes fas ligand (Fas L), tumour necrosis factor (TNF), and TNF-related apoptosis-inducing ligand are all expressed in amniotic epithelial cells (TRAIL).It has been proven to be as effective as autologous skin transplants in reducing bacterial counts in open granulating rat wounds, but superior to allogenic and xenogenic skin grafts.[12] The amnion produces anti-angiogenic factors such as endostatin, thrombospondin 1 (TSP-1), and tissue inhibitor of metalloproteinases (TIMPs), but angiogenic factors such as vascular endothelial growth factor (VEGF) and fibroblast growth factor-basic (b FGF) have also been found in the amniotic membrane.[13]Antimicrobial activity can be seen in amnion and chorion membrane tissue. It generates -defensins, which are produced by epithelial cells and are an important element of the immune system. They keep microbial colonisation at bay on epithelial surfaces.[7]

VI. Mechanical Properties

A few features are required for the membrane to behave as a scaffold for progenitor cells to differentiate and proliferate following the application of a mechanical stimulus. Because it improves the stability of the scaffold and leads to uninterrupted healing, a scaffold must be sufficiently rigid throughout the place where new tissue is needed.They should also maintain their elasticity to keep the shear stresses of the surrounding tissue in check. Collagen and elastin from the extracellular matrix give stiffness and elasticity. The nature of the amniotic membrane is viscoelastic.[7]

By micronizing the dehydrated amnion/chorion membrane allograft, it can be used as an injectable solution or a topical gel. Amniotic membrane is being used to reduce scar tissue, as a barrier membrane, and as a soft tissue regeneration graft. As a culture substrate, they are extremely valuable and effective.[12]

VII. Composition of amnion and chorionmembrane and its role

Proteins such as fibronectin, laminin, proteoglycans, glycosaminoglycans, and collagen types IV, V, and VII make up the amnion membrane. It's a matrix that helps with wound healing, cellular migration, and proliferation. Amnion creates a physiologic "seal" with the host tissue early in its development, preventing bacterial contamination.Chorion membrane works as a barrier, preventing inflammatory cells from entering the wound. Tissue inhibitors of metalloproteinases found in chorion tissue reduce matrix metalloproteinases and transforming growth factor-β. Chemokines and cytokines can modulate inflammation by directly affecting T-cells, B-cells, and natural killer cells. As a result, these proteins in the chorion membrane inhibited inflammation and collagen degradation. By itself, IL-10 and IL-1 receptor antagonists expressed in chorion tissue reduce the inflammatory process.Histologically, the chorion membrane is made up of three layers: reticular, foundation membrane, and

trophoblasts. Collagen Types I, III, IV, V, VI, and VII, as well as proteoglycans, make up the reticular layer of the chorion membrane. The basement membrane contains collagen Type IV, fibronectin, and laminin.Laminin and laminin-5 were found in significant amounts across the barrier, which is important because of its strong affinity for binding gingival epithelial cells for better root adaptability.[13],[14]The laminin 5 protein found in amnion improves the cellular adhesion of gingival epithelial cells, type I, II, IV, V, and VI collagen, platelet derived growth factor (PGDF), fibroblast growth factor, and transforming growth factor.

VIII. Advantages

Placental barrier membranes have antibacterial and antifungal characteristics, minimise wound inflammation, and offer a protein-rich matrix that allows cells to migrate more easily.[15] The capacity of processed dehydrated placental membranes to self-adhere eliminates the necessity for sutures. It does, in fact, cut surgery time and is technically less difficult.When inserted, the membrane is dry and can soon hydrate with blood, allowing it to become malleable and conform to the shape of the underlying alveolar bone. Because the membrane is resorbable, no additional surgery is required. It also has good biocompatibility and mechanical features like permeability, stability, elasticity, flexibility, plasticity, and the ability to resorb. Its ability for delivery of biomodulator agents such as growth factors and genetic materials makes it a suitable scaffolding material in tissue engineering, as well as in cell adhesion. [7],[16]

IX. Limitations

The use of these membranes necessitates expertise. 2) Transmission of infection via placental membrane transplantation is a possibility. When using this membrane, safety precautions must be taken and safety regulations must be followed. 3) Because they are fragile membranes, they must be handled with care. 4) Hyperdry/cryopreserved membranes are costly.[17]5)The use of these membranes is technique-dependent.[18]

X. Clinical Uses of amnion and chorion membrane

In ocular, abdominal, and plastic surgery, amniotic membranes were employed as biologic dressings. Human oral mucosa and amnion tissue have nearly comparable laminin structures. The use of amniotic membrane to reconstruct a buccal mucosal defect following speckled leukoplakia excision has been reported with encouraging results.[19]

XI. Use of amnion and chorion membranes in periodontal therapy

Amniotic membrane is a semipermeable membrane with an immunotolerant structure that can guide tissue regeneration. It satisfies the mechanical idea of guided tissue regeneration (GTR), which is updated to include the biology concept of GTR. The biomechanical GTR membrane aids recovery by reducing postoperative scarring and associated loss of function, while also providing a rich source of nutrients.Another advantage is the excellent revascularization of the amniotic membrane. It has the potential to be an excellent grafting material. It improves wound healing, postoperative function, and aesthetics without causing any problems.[7]

Guided bone regeneration is a method for treating big bony defects that involves utilising a barrier membrane to encourage osteogenesis while inhibiting fibroblast cell multiplication. In-vivo rat tibia defects were treated using lyophilized multi-layered acellular human amnion membrane. It worked as a barrier against fibrous tissue infiltration and development, as well as stimulating bone growth.[20]

In dental implant therapy, an implant fixture requires 1mm of bone to surround it, and the site preservation approach is utilised to achieve this. As a site preservation barrier, a resorbable amnion chorion membrane has been introduced. Placental allografts contain immunoprivileged tissue, are antibacterial and antimicrobial, minimise wound inflammation, and provide a permanent solution.[21]

Intrabony deficiencies are repaired with amnion chorion membrane, demineralized freeze-dried bone allograft (DFDBA), and xenograft via directed tissue regeneration.[22] It gives you better root coverage, thicker tissue, and more connected gingival tissue. Provides great cosmetic results with minimal post-operative discomfort and side effects.Processed dehydrated allograft amnion is ideal for multiteeth surgeries and recession deformities due to its self-adhering nature. It can be utilised to treat shallow to moderate Miller's Class I and II recession defects as an alternative to autograft tissue.[7]

The goal of periodontal plastic surgery is to cover the exposed root surface. A recently developed resorbable amniotic membrane not only preserves the morphological and anatomical configuration of regenerated tissues, but it also improves gingival wound healing and provides a rich reservoir of stem cells. This amnion tissue-based allograft was recently introduced for periodontal plastic surgery.[23]

XIII. Conclusion

The antibacterial, biocompatible, and antiangiogenic qualities of the amnion and chorion membranes, to name a few, have made them popular in the field of periodontal regeneration in recent years. They've been used in the medical field for decades and are now finding their way into other areas of dentistry. Their surgical application has a number of benefits.They, like all inventions, have its drawbacks. However, changes could be made to them in the future to improve their clinical effectiveness.

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