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Amniotic Membrane: A Novel Approach in Dentistry

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INTRODUCTION

The degree of the disease's severity determines how much bone is destroyed. The idea of using foreign stem cells or encouraging indigenous stem cells to produce biological replacements and enhance tissue functions is at the heart of the emerging discipline of regenerative medicine. Amnion-derived cells have recently been found to possess the multipotent differential capacity. As a result, it has drawn interest as a potential source of stem cells for regenerative medicine.

According to certain theories, the amnion serves as a membrane sac that houses both the conceptus and the amniotic fluid, as suggested by its Greek name. It is a changeable biocontainer that gives the foetus a constrained place to move around in primates, including humans. The amnion is a metabolically active membrane that helps to regulate the balance of solutes and water in amniotic fluid. The placenta's innermost layer, known as the amniotic membrane or amnion, is made up of a thick foundation membrane and an avascular stromal matrix.

Two separate embryologically derived cell types that have certain stem cell-like traits are found in HAM. Human amnion mesenchymal stromal cells (hAMSCs), on the other hand, are derived from the embryonic mesoderm, whereas human amnion epithelial cells (hAECs) are. Both populations are multipotent for in vitro development into main mesodermal lineages and share a similar immunophenotype. The semiallogenic immune reaction to the foetus is suppressed by the amniotic membrane, which also secretes nutrients [1,2,3,4].

The amniotic membrane's ultrastructure reveals that it is a transparent, thin, avascular composite membrane made up of three main layers: an epithelial layer, a thick foundation membrane, and an avascular mesenchyme made of collagen. The lack of blood arteries and nerves in the amniotic membrane allows the necessary nutrients to diffuse straight from the underlying decidua or from the amniotic fluid [5].

A single layer of columnar, cuboidal, and flat cells that are in direct contact with the amniotic fluid makes up the amniotic epithelial cell layer. Amniotic Multipotent Stem Cells (AMSC) are extracted from this layer and kept in storage until they are needed to regenerate tissues. The amniotic mesoderm layer contains macrophages and mesenchymal cells that resemble fibroblasts. The amnion's basement membrane resembles the gingiva, conjunctiva, and other body regions' basement membranes in appearance.

HISTORY

The lining of the amniotic sac was intended to be used as a skin graft, as suggested by a fourth-year medical student, but Davis claimed that he was "unable to report satisfactory findings" in a 1910 Johns Hopkins publication.

"Material is well worth a trial," he said, "and if a technique (sic) is created by which favourable results can be produced, it may be of tremendous use"[6].

The usage of AMs has grown beyond the treatment of wounds to incorporate applications in a variety of fields and disease processes. . Examples from the modern era include orthopaedics for post-surgical wound dressing, dentistry as a matrix for gingival recession, gastroenterology for the removal of adhesions, and gynaecology for vaginal reconstruction. In-utero repair of myelomenigocele (spina bifida), a matrix for building blood vessels, improving fracture repair, and fixing cleft palate are a few intriguing potential applications in medical research .

The real membrane is frequently employed in these applications as a matrix for the growth of healthy tissue or as a defence against adhesions and scar tissue.

In the area of dentistry, it has also become more significant.

PROPERTIES OF AMNIOTIC MEMBRANE

The potential to expedite the inflammatory phase toward the proliferative phase, which is crucial for treating chronic wounds like periodontitis, is possessed by the Multi Potent Stem Cells (MPSC) located in the Amniotic Membrane.

The amniotic membrane's characteristics that speed up wound healing are :

- Immunomodulative and Immune Privilege Anti-Microbial (broad-spectrum against bacteria, fungi, protozoa, and viruses)
- Reduction of pain
- Anti-Scarring and Anti-inflammatory effects
- Tissue repair with enhanced bone remodeling, osteogenesis, and chondrogenesis.
- Accelerating fibrogenesis and angiogenesis
- Increased extracellular matrix deposition
- Potent source of mesenchymal stem cells

CLINICAL APPLICATION OF AMNIOTIC MEMEBRANE

There is a lengthy history of clinical uses for human amnion. A century ago, it was first described as a biological dressing to treat skin wounds. In order to reduce fluid, heat, and nutrient loss as well as wound infection, discomfort, and restricted mobility, a clean and closed wound must be achieved as quickly as possible while managing open wounds. Amniotic membranes are effectively employed as allografts to treat surgical, infectious, and traumatic wounds, pressure sores, open, non-healing ulcers, and skin burns [7,8].

An alternate method of managing oral cavity wounds, including those on the tongue, buccal mucosa, vestibule, palatal mucosa, and mouth floor; in the reconstruction of the bladder, vagina, and oral cavity; tympanoplasty; arthroplasty, etc. Due to the exposure of nerve fibres, its adhesiveness and tight contact with the wounded surface encourage hemostasis and effective pain relief.

Its favourable mechanical properties, which include permeability, stability, elasticity, flexibility, plasticity, and resorbability, as well as its good biocompatibility, make it a promising scaffolding material in tissue engineering for cell adhesion and the potential delivery of genetic materials and biomodulatory agents like growth factors. The amniotic membrane's ability to reduce swelling and prevent scarring has been demonstrated in studies on ulcers caused by the herpes simplex virus (HSV), varicella zoster virus-infected tissues, erythema multiforme major (Stevens-Johnson syndrome), and cervical necrotizing fasciitis.

CURRENT CLINICAL USES OF AMNIOTIC TISSUE IN DENTISTRY

Amniotic membranes have already been widely employed in ophthalmic, abdominal, and plastic surgery as biologic dressings. Amnion tissue has a laminin structure that is remarkably similar to native human tissue, such the oral mucosa. After speckled leukoplakia was removed, reconstruction of a buccal mucosal defect utilising HAM has been reported with a promising outcome[9].

Modern dental implant therapy advises having at least 1 mm of bone all around the implant fixture. The idea of site preservation is commonly used to accomplish this purpose. A new barrier for site preservation has recently been introduced: the resorbable amnion chorion membrane. Placental allografts are made of immune-privileged tissue, possess antibacterial and antimicrobial properties, reduce inflammation at the wound site, and provide a protein-enriched matrix to aid cell migration, in contrast to cadaveric allografts, xenografts, and alloplast barrier membranes.

The dehydrated amnion/chorion membrane allograft can also be ground into a fine powder that can be applied topically, combined with saline to make an injectable solution, or used topically as a topical gel. Amniotic membrane is now being used more frequently in clinical settings as an allograft material for the therapy of chronic and acute wounds, for the reduction of scar tissue, as a barrier membrane, and as a soft tissue regeneration graft. A great and efficient culture substrate[10] .

Another positive trait is the excellent revascularization of the amniotic membrane. The amniotic membrane had excellent wound coverage, making it a potential good grafting material. It improved post-operative function, wound healing, and aesthetics without any negative side effects. As it guarantees adequate reconstruction, postoperative function, and aesthetics, human amniotic membrane may be one of the solutions taken into consideration for the reconstruction of oral cavity deformities[11].

In operations to cover denuded root surfaces, amnion allograft may be an appropriate substitute for connective tissue graft and can lessen recession depth. Recently, the AM-based cell-culture technique was used to culture PDL-derived cells for periodontal tissue regeneration. These cells are thought to be able to multiply and may even be able to keep their PDL-like characteristics even when exposed to AM[12].

Sutures are not required since the processed, dehydrated allograft amnion can self-adhere. The surgery takes less time since it is less technically difficult. Processed dehydrated allograft amnion is a desirable alternative for multiple tooth surgeries and recession abnormalities, particularly in the posterior region, due to its capacity to self-adhere. For the treatment of Miller Class I and II recession defects that are shallow to moderate, processed dehydrated allograft amnion may be a useful substitute for autograft tissue.

Oronasal fistulas can be successfully repaired using the amniotic membrane, and membrane ruptures can be avoided by using the multilayer method and protective plates[13]. These amniotic membrane grafts are feasible and trustworthy for covering the raw surface when utilised in vestibuloplasty because they stop secondary contraction after the procedure and maintain the postoperative vestibular depth[14]. For vestibuloplasty, the amniotic membrane can make a good graft material since it speeds up healing and discourages relapse. It is a substance that is both reasonably priced and conveniently accessible and preserved[15].

CONCLUSION

Amnion membrane has significant advantages in terms of safety, logistics, and surgery. Amniotic membrane is currently demonstrating significant promise in a number of dental disciplines. The use of amniotic membranes as biologic dressings in ophthalmic, abdominal, and plastic surgery has already been widely practised in the medical profession. Collagen types I, IV, V, and VI, proteoglycans, laminin, and fibronectin are all abundant in amniotic membranes. Collagen possesses hemostatic qualities, is well tolerated by the body, is bioabsorbable, and promotes the migration of epithelial and autologous connective tissue along its surface.

Finally, it should be noted that amnion from discarded placentas can be a fascinating source of cells for regenerative medicine.

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