

Review Article

Amniotic Membrane: A Membrane with Magical Healing Powers – A Brief Review

Sukhmeet kaur¹, Preetika Bansal², Pardeep Bansal³, Harvinder Singh⁴

¹Assistant professor, ²Associate professor, Department of Periodontics, ³Prof and Head, Department of Prosthodontics, Dasmesh Institute of Research and Dental Sciences, Faridkot, Punjab, India, ⁴Principal, Prof & Head, Institute of Dental Sciences, Jammu, India

ABSTRACT:

Amnion allograft has been used in the field of medicine from several years. The amnion membrane lines the amniotic sac which is necessary for the protection and development of an embryo and is composed of three major layers: A single epithelial layer, a thick basement membrane and an avascular mesenchyme. Amnion membrane (AM) contains various growth factors, stem cells which help in regeneration of lost tissues and accelerated wound healing. Recently, this multipurpose tissue gained importance in the field of dentistry due to presence of various inherent factors which helps in tissue regeneration. In this review article various properties & uses of the amnion membrane in various dental fields are discussed.

Key Words: Amnion membrane, tissue regeneration, wound healing, growth factors, stem cells.

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Corresponding Author: Dr. Pardeep Bansal, Prof and Head, Department of Prosthodontics, Dasmesh Institute of Research and Dental Sciences, Faridkot, Punjab, India

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INTRODUCTION

Human amniotic membrane has been used successfully in medical field for over 70 years. First use of fetal membrane as a skin substitute was reported by Davis in 1910.¹ Applications of amnion membrane in the medical field include burns (chemical and thermal), correction of conjunctival defects, epithelial defects, neurotrophic ulcers, diabetic neurovascular ulcers, postoperative wounds and postsurgical wound dehiscence and bullous keratopathy.² In the field of dentistry, amnion membrane has gained importance day by day because of various beneficial properties like it reduces scarring and inflammation, enhances wound healing, serves as a scaffold for tissue regeneration, has antimicrobial properties and can be easily procured, processed, stored and transported.³ Regenerative medicine is an emerging era based on the concept to regenerate the lost tissue either by transplanting exogenous or stimulating endogenous stem cells and also improve functions. The amniotic epithelial cells are multipotent cells which have ability to differentiate into other cellular elements which have the capabilities to stimulate the repair of injured

tissues. After parturition the amniotic membrane (AM) is usually discarded, can be processed, stored and used for further clinical applications in tissue engineering, cell transplantation therapy and periodontal regeneration. In this review article various uses of this membrane in dentistry are discussed along with its inherent properties which play an important role in tissue regeneration.

COMPOSITION OF HUMAN AMNIOTIC MEMBRANE

The human placenta is a very important and complex organ which is essentially required for the growth and development of the fetus during gestational period and it starts developing within a few days after fertilization. Thickness of the organ is about 10-15µm and has two fetal membranes (the inner amniotic membrane and the outer chorion).⁴ The amnion membrane encloses the amniotic fluid and fetus, highly flexible membrane and can easily be separated from outer chorion layer. The AM is thin, transparent membrane 0.02 and 0.5 millimetres which includes around 6–8 layers of cells and composed of three layers: single layer of epithelial cells, a basement

membrane and an avascular connective tissue consisting collagen.⁵ The epithelial cells are flat, columnar and cubical in shape which directly contacts the amniotic fluid. The epithelial cells secrete collagen (type III and IV) and non collagenous glycoproteins (laminins, nidogen, fibronectin and vitronectin) which involves in transmission and interaction of signals at cell surface receptors. The amniotic mesenchymal stem cells are isolated and stored for tissue regeneration. The amniotic membrane contains no lymphatics, nerves or muscles.⁶ Both the epithelial and mesenchymal cells express pluripotency and source of stem cells. Thick basement layer of AM consists of collagen (type IV and VII), non collagenous proteins like fibronectin, laminin 1 and 5 and growth factor [keratinocyte growth factor, transforming growth factor-beta, basic-fibroblast growth factor and epidermal derived growth factor] which accelerates healing and promote tissue regeneration.⁷ Laminin-5 in the amnion membrane is effective in angiogenesis in the early phases of wound healing, epithelial cell adhesion and invasive growth of fibroblasts.⁸ The basement membrane of AM contains a large amount of heparan sulfate that is one of the major proteoglycan present in the gingiva.

APPLICATIONS OF AMNIOTIC MEMBRANE IN DENTISTRY

The use of AM in general surgery has been started from a long period by Davis in 1910 as skin substitutes for the treatment of open wounds. Later on the usage of this membrane was increased and used for treatment of ulcers, burn and repair of conjunctiva defects. Dino et al in 1965 demonstrated that the AM could be easily sterilized, stored, separated from the chorion and safely used in various treatments.⁹ From that period of time a lot of researches have started to understand its regenerative potential. AM is also used as a carrier for local delivery of various drugs like antibiotic and antiviral drugs.¹⁰ Its use in dentistry is increasing with time due to its several biological and mechanical properties. AM is a good dressing material because it accelerates vascularization, reepithelialization, and helps in formation of granulation tissue. This fetal membrane is being used in the reconstruction of the oral cavity, vagina, bladder, and in arthroplasty tympanoplasty. AM has an antiinflammatory and antiscarring property which decreases necrosis and rapid healing of ulcers with varicella zoster virus-infected tissues, erythema multiforme major, herpes simplex virus.¹¹ AM has been tried as an interpositional material to prevent fibrosis and reankylosis in the reconstruction of TMJ ankylosis.¹² AM may be used as alternative treatment to treat the wounds of the oral cavity like the buccal mucosa, tongue, floor of the mouth vestibule and palatal mucosa. Sham E and Sultana (2011)¹³ and Arai et al (2011)¹⁴ showed that the AM could be used for the intra oral repair of mucosa. In vestibuloplasty, amniotic membrane can be used to maintain the postoperative vestibular depth and promoting healing as well as preventing secondary

contraction after vestibuloplasty. So this membrane can be a favorable graft material for vestibuloplasty. Sikkerimath BC et al in 2012 compared the vestibular sulcus depth in vestibuloplasty using Clark's technique with and without amnion as graft material and concluded that the AM is a viable and reliable option which maintains postoperative vestibular depth and promotes early healing.¹⁵ AM is also used in conjunction with bioactive materials in the treatment of furcation defects.¹⁶ Holtzclaw and Toscano in 2013 used AM in the treatment of periodontal intrabony defects as a barrier membrane for regeneration and found that reduction in probing depths and gain in clinical attachment levels in localized moderate to severe chronic periodontitis cases.¹⁷ In periodontics, amnion allograft is used to cover denuded root surfaces and can reduce recession depth and this membrane might be a suitable alternative to connective tissue graft. In 2013 Singh H and Singh H presented a case report on bioactive AM for the treatment of isolated gingival recession and showed significant root coverage with uneventful healing.¹⁸ Shetty SS et al in 2014 compared usage of Platelet-rich Fibrin (PrF) and amniotic membrane in treatment of Miller's class I recession and found more stable results with the amnion membrane.¹⁹ AM has been successfully used for the repair of oronasal fistula. In 2015, Holtzclaw D presented case series and reported the use of amnion-chorion for the repair of sinus membrane perforation. These case series suggested that amnion-chorion barriers should be considered as a potential treatment option in the treatment of perforated Schneiderian membranes during sinus augmentation.²⁰ Amnion-chorion membranes are also effective in alveolar ridge preservation. Hassan M et al in 2017 conducted clinical study to compare the effectiveness of these membranes in ridge preservation and concluded that these membranes are equally effective in ridge preservation when compared with dense poly tetra fluoro ethylene membranes (dPTFE) and aids in reduction of post operative pain and results in better quality of bone for implant placement.²¹ Due to the presence of various inherent properties, the use of amniotic membrane is expanding with wide range of applications in various treatments in dentistry.

CONCLUSION

Amnion membranes are rich source of collagen and proteoglycans which have many biological properties including promoting cell adhesion, growth and differentiation of various cells and involved in many cellular processes including blood clotting, tissue repair, cell migration and adhesion. An important property of amniotic membrane is its resistance to various proteolytic factors due to the presence of interstitial collagens which makes this membrane suitable for tissue regeneration as a barrier membrane. These diverse properties make them a unique potential biomaterial for use in medicine and dentistry. But still more clinical researches are needed to conduct to know its enormous potential and further applications in the field of dentistry.

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