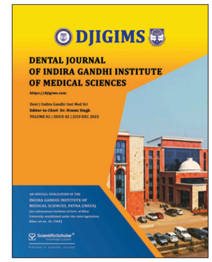
ScientificScholar®
Knowledge is power
Publisher of Scientific Journals

https://djigims.com

Dental Journal of Indira Gandhi Institute of Medical Sciences

Article in Press



Review Article

Rebuilding Smiles and Renewing Lives: Regenerative Innovations in OMFS

Indra Kumar Periyasamy[1], Priyadharshini G[1]

[1]Department of Oral and Maxillofacial Surgery, Vivekanandha Dental College for Women, Ellayampalayam, Tiruchengode, Tamil Nadu, India

***Corresponding author:**
Dr. Indra Kumar Periyasamy, Department of Oral and Maxillofacial Surgery, Vivekanandha Dental College for Women, Ellayampalayam, Tamil Nadu, India.

kumarjeeth@yahoo.com

Received: 08 October 2024
Accepted: 30 November 2024
Epub Ahead of Print: 24 February 2025
Published: ***

DOI
10.25259/DJIGIMS_33_2024

Quick Response Code

ABSTRACT

Wounds, such as abrasions and lacerations, involve disruptions in soft tissue that trigger the body's healing process, including inflammation, tissue regeneration, and remodeling. Abrasions affect the skin's surface and heal quickly with minimal scarring. while lacerations are deeper, requiring more extensive tissue repair. Human amniotic membrane (HAM) has emerged as an effective biological dressing for both wound types, promoting faster healing through growth factors, anti-inflammatory properties, and a supportive extracellular matrix. HAM's antimicrobial effects further enhance its role in wound management by reducing infection risks. Compared to Type I fish collagen membrane, HAM offers faster tissue regeneration, better pain relief, and fewer complications, making it a superior option for managing soft tissue wounds, especially in maxillofacial cases.

Keywords: Human amniotic membrane, Type I fish collagen membrane, Dressing, Maxillofacial wounds, Soft tissue

INTRODUCTION

This study aims to compare the effectiveness of human amniotic membrane (HAM) and Type I fish collagen membrane as dressing materials in the treatment of maxillofacial wounds, with a focus on their role in promoting soft tissue regeneration, reducing healing time and minimizing complications, particularly in cases of abrasions and lacerations.

DISCUSSION

A wound is any disruption of the skin and underlying tissues caused by trauma, disease, or surgery. Wounds are commonly categorized based on their depth and the type of tissue involved.[1] In particular, abrasions and lacerations represent different types of soft tissue injuries that require distinct healing processes.[2,3] Abrasions are superficial wounds that affect only the epidermis and sometimes the upper dermis, generally caused by friction or scraping.[2] Lacerations, however, are deeper injuries that cut through the skin and sometimes involve underlying tissues such as muscles, nerves, or blood vessels.[3] These different types of wounds trigger a biological response that aims to restore tissue integrity and function.[1] The body's natural healing process for wounds involves four key stages: hemostasis, inflammation, proliferation, and remodeling.[1]

In the case of abrasions, the healing process is relatively straightforward, involving rapid re-epithelialization. Keratinocytes, the primary cells in the epidermis, migrate across the wound surface to restore the skin barrier. Since abrasions only affect the outermost layer of the skin, collagen synthesis is minimal, and there is usually little to no scarring involved. The inflammation phase in abrasions is typically brief, with limited involvement of immune cells, and the wound closes within 7–10 days.[2]

Lacerations, by contrast, involve a more complex healing process due to the deeper tissue damage. In lacerations, the inflammatory phase is prolonged and more intense because of the involvement of deeper tissues, including the dermis and possibly subcutaneous layers. The formation of granulation tissue is critical in this phase, which provides a scaffold for new tissue growth. This is followed by angiogenesis (formation of new blood vessels), fibroblast proliferation, and extensive collagen deposition to close the wound. Lacerations require more time to heal than abrasions, and the risk of scarring is higher due to the deeper tissue involvement and the longer duration of inflammation.[3]

To promote the regeneration of soft tissue in both types of wounds, various biological substitutes and wound dressings have been explored.[4] Traditionally, autologous skin grafts have been the gold standard for covering large or complex wounds. However, skin grafts have significant limitations, such as limited availability of donor tissue, the risk of donor site morbidity, potential immune reactions, and scarring. Due to these limitations, attention has shifted towards alternative wound coverage materials, including synthetic grafts, porcine xenografts, artificial skin, and biological membranes like HAM.[4,5]

In the context of soft tissue regeneration, the HAM has emerged as a promising material for wound coverage, especially in maxillofacial surgery, where both abrasions and lacerations are common. HAM is a biological tissue derived from the innermost layer of the placenta, and it is rich in a variety of growth factors, extracellular matrix proteins, and antimicrobial peptides.[6] HAM has been used successfully in many clinical settings, including the treatment of chronic wounds, burns, and surgical defects, owing to its ability to promote tissue regeneration, modulate inflammation, and provide a scaffold for new tissue growth.[7]

This study compared the efficacy of Type I fish collagen membrane and HAM as dressing materials for maxillofacial wounds, which often involve both abrasions and lacerations.[5] Both membranes were applied directly to the wounds and secured with sutures. The results demonstrated that both materials facilitated effective wound healing with no adverse effects. However, HAM exhibited superior outcomes in terms of promoting faster granulation tissue formation, pain relief, and the rapid removal of necrotic tissue.[5]

The enhanced healing observed with HAM is primarily attributed to its unique biological composition, which includes a range of growth factors such as epidermal growth factor (EGF), fibroblast growth factor (FGF), transforming growth factor-beta (TGF-β) and vascular endothelial growth factor (VEGF). These growth factors play a critical role in stimulating fibroblast proliferation, angiogenesis, and collagen synthesis, which are essential for soft tissue regeneration, particularly in lacerations where deeper tissue repair is needed.[7] For abrasions, these growth factors accelerate keratinocyte migration and re-epithelialization, allowing for rapid closure of the wound. Additionally, HAM's extracellular matrix (ECM), which includes proteins such as collagen, fibronectin, and laminin, serves as an optimal scaffold that supports cellular growth and organized tissue repair.[7]

Another significant advantage of HAM is its anti-inflammatory properties, which are crucial for controlling the local inflammatory response in wounds. Cytokines such as Interleukin-10 (IL-10) and Interleukin-1 receptor antagonist (IL-1Ra) present in HAM help reduce excessive inflammation at the wound site.[7,8] This is particularly beneficial in lacerations, where prolonged or excessive inflammation can impair healing and lead to the formation of scars. By modulating the inflammatory response, HAM promotes more efficient and organized tissue repair, minimizing scar formation and improving the overall quality of the regenerated tissue.[5]

Furthermore, HAM has inherent antimicrobial properties due to the presence of defensins, lysozyme, and other antimicrobial peptides. These peptides provide protection against bacterial infections, which is a common complication in both abrasions and lacerations. The antimicrobial effects of HAM reduce the need for systemic antibiotics, which is particularly advantageous in wound management. Moreover, the preservation techniques used for HAM, such as cryopreservation, lyophilization, and glycerol preservation, ensure that its bioactive properties, including its antiviral and antibacterial benefits, are maintained over time.[5]

Compared to Type I fish collagen membrane, HAM offers numerous benefits in terms of soft tissue regeneration. It facilitates faster recovery, enhances tissue regeneration, reduces pain, minimizes scarring, and lowers the risk of postoperative complications.[9] Additionally, HAM is highly biocompatible and has low immunogenicity, making it suitable for use in a wide range of patients, including those with hypersensitivity or immune-related issues.[9] The ability of HAM to deliver a combination of growth-promoting, anti-inflammatory, antimicrobial, and immunomodulatory effects makes it an ideal material for wound coverage and soft tissue regeneration.[7,10]

CONCLUSION

In conclusion, HAM is a superior wound dressing material for managing both abrasions and lacerations, as it promotes rapid and organized soft tissue regeneration. Its multifaceted benefits, including the stimulation of fibroblast proliferation, angiogenesis, and collagen synthesis, combined with its anti-inflammatory and antimicrobial properties, make it an invaluable tool in modern wound care. The use of HAM in maxillofacial wounds offers a holistic approach to wound healing, ensuring faster recovery, improved tissue quality, and enhanced patient outcomes. Given its low risk of immune reactions and its broad applicability, HAM has emerged as a preferred option in clinical practice for the regeneration of soft tissue in a variety of wounds, from superficial abrasions to complex lacerations. As research continues to uncover new aspects of its regenerative potential, HAM is poised to play an even more significant role in the future of regenerative medicine and wound care.

Ethical approval

Institutional Review Board approval is not required.

Declaration of patient consent

Patient's consent not required as there are no patients in this study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of AI-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

REFERENCES

1. Chhabra S, Chhabra N, Kaur A, Gupta N. Wound healing concepts in clinical practice of OMFS. J Maxillofac Oral Surg 2017;16:403–23.
2. C MM, Thilak G, Shetty P, Rai AJ, Gohil SM. Management of abrasions in oral and maxillofacial surgery – a review. J Health Allied Sci NU 2020;6:41–4. Available from: http://dx.doi.org/10.1055/s-0040-1708661
3. Park KH, Song JM, Hwang DS, Kim YD, Shin SH, Kim UK, *et al*. A clinical study of emergency room visits for oral and maxillofacial lacerations. J Korean Assoc Oral Maxillofac Surg 2015;41:246–50.
4. Jazayeri HE, Tahriri M, Razavi M, Khoshroo K, Fahimipour F, Dashtimoghadam E, *et al*. A current overview of materials and strategies for potential use in maxillofacial tissue regeneration. Mater Sci Eng C Mater Biol Appl 2017;70:913–29.
5. Boricha V, Pai KD, Rai M, Asodariya MR. Efficacy of Type-1 Fish collagen membrane v/s human amniotic membrane as a surgical dressing material in maxillofacial wounds: A comparative study. J Maxillofac Oral Surg 2024;23:517–23.
6. Rastogi S, Modi M, Sathian B. The efficacy of collagen membrane as a biodegradable wound dressing material for surgical defects of oral mucosa: A prospective study. J Oral Maxillofac Surg 2009;67:1600–6.
7. Kumar Periyasamy I, Mehthaf A, Elangovan GP, D V, Vijaykumar G, Elumalai A. Efficacy of amniotic and chorionic membrane in facial wound healing: A comparative study. Cureus 2024;16:e58160.
8. Jafari H, Lista A, Siekapen MM, Ghaffari-Bohlouli P, Nie L, Alimoradi H, *et al*. Fish collagen: Extraction, characterization, and applications for biomaterials engineering. Polymers (Basel) 2020;12:2230.
9. Mohammadi AA, Seyed Jafari SM, Kiasat M, Tavakkolian AR, Imani MT, Ayaz M, *et al*. Effect of fresh human amniotic membrane dressing on graft take in patients with chronic burn wounds compared with conventional methods. Burns 2013;39:349–53.
10. Khademi B, Bahranifard H, Azarpira N, Behboodi E. Clinical application of amniotic membrane as a biologic dressing in oral cavity and pharyngeal defects after tumor resection. Arch Iran Med 2013;16:503–6.

How to cite this article: Periyasamy IK, G P. Rebuilding Smiles and Renewing Lives: Regenerative Innovations in OMFS. Dent J Indira Gandhi Int Med Sci. doi: 10.25259/DJIGIMS_33_2024