Harnessing Amniotic Membrane for Enhanced Healing of Facial Abrasion Wounds – A Clinical Comparative Study: Original Research

Dr. Shubham S Raut[1], Dr. B M Rudagi[2], Dr. Bhushan R Bhagat[3], Dr. Sejal Sachin Shah[4], Dr. Digvijay Shitole[5], Dr. Jayneel Raichura[6]

[1]Pg Student, Department of Oral and Maxillofacial Surgery, Dr D.Y. Patil Dental College & Hospital, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, India.

[2]Professor and HOD, Department of Oral and Maxillofacial Surgery, Dr D.Y. Patil Dental College & Hospital, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, India.

[3]PhD Scholar, Associate Professor, Department of Oral and Maxillofacial Surgery, Dr D.Y. Patil Dental College & Hospital, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, India.

[4]Assistant Professor, Department of Pediatric & Preventive Dentistry, Pandit Deendayal Upadhyay Dental College & Hospital, Kegaon, Solapur, India

[5]Pg Student, Department of Oral and Maxillofacial Surgery, Dr D.Y. Patil Dental College & Hospital, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, India

[6]Pg Student, Department of Oral and Maxillofacial Surgery, Dr D.Y. Patil Dental College & Hospital, Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, India

Corresponding author: Dr. B M Rudagi, Email: bm.rudagi@dpu.edu.in

Abstract

Introduction: Facial soft tissue injuries, though rarely life-threatening, are frequently encountered in emergency and surgical settings. These wounds vary from superficial abrasions to severe lacerations and require careful management to ensure both cosmetic and functional recovery. Proper healing depends on understanding wound biology and applying suitable treatment strategies. The use of biological dressings like the human amniotic membrane (hAM), known for its regenerative, anti-inflammatory, and angiogenic properties, is gaining attention. This study aimed to evaluate the efficacy of hAM in treating facial abrasion wounds.

Materials and Methods: This study was conducted on 30 patients. Participants were randomized into two groups: Group A (n=15) received amniotic membrane dressings, while Group B (n=15) received standard saline and betadine care. Parameters such as pigmentation, vascularity, pliability, scar height, pain, and aesthetics were evaluated over 10 weeks using the Vancouver Scar Scale.

Results: Both groups showed improvement, but Group A consistently demonstrated greater and statistically significant ($p < 0.05$) improvements in all parameters, including pain relief and aesthetic appearance.

Conclusion: Amniotic membrane dressings significantly improved facial wound healing outcomes compared to conventional methods, indicating its potential as an effective biological dressing in clinical practice. Research-based management for patients with facial abrasion wounds must be further verified by evidence-based scientific research.

Keywords: Facial abrasions, amniotic membrane, wound healing, Vancouver Scar Scale, biological dressings, evidence-based scientific research.

How to cite this article: Raut SS, Rudagi BM, Bhagat BR, Shah SS, Shitole D, Raichura J. Harnessing Amniotic Membrane for Enhanced Healing of Facial Abrasion Wounds – A Clinical Comparative Study: Original Research. Int J Drug Deliv Technol. 2026;16(17s): 534-541. DOI: 10.25258/ijddt.16.17s.63

Introduction: Soft tissue injuries, alone or with other trauma, are among the most common craniofacial emergencies managed by emergency department team and maxillofacial surgeons [1]. From simple scrapes to deep lacerations, soft tissue injuries demand meticulous care and expert handling. Effective wound management goes beyond immediate treatment—it's a holistic approach aimed at preventing complications, minimizing scarring, and ensuring full functional recovery [2]. A wound is any disruption in the skin's integrity, defined as a break in normal anatomy and function [3]. Wound healing is a complex process, and a deep understanding of its physiological, biochemical, cellular, and molecular foundations are essential for surgeons to make informed decisions and enhance recovery outcomes [4].

Facial injuries, though rarely life-threatening, reflect the force of trauma and can range from abrasions to avulsions, often caused by accidents, assaults, burns, bites, or other high-impact events [5]. Moreover, the visible nature of facial injuries and their impact on appearance often intensify the psychological distress experienced by trauma patients [6]. Managing acute facial soft-tissue trauma poses significant challenges for surgeons, with key goals being the preservation of both form and function. These injuries not only risk cosmetic deformities but can also impair nerve function, chewing, vision, and salivary flow [7].

Varieties of wound dressings are designed to retain moisture, promote skin regeneration, and protect against infections [8]. Traditional dressings like gauze are suitable for dry wounds, but modern dressings

with semi-permeable, absorbent layers are far more effective, speeding up tissue healing and promoting faster cell migration [9].

The human amniotic membrane (hAM), the innermost layer of fetal membranes forming the amniotic cavity, typically measures 0.02 to 0.5 mm in thickness. It comprises a single layer of epithelial cells, a basal lamina, and an avascular stroma made up of compact, mesenchymal, and spongy layers [10]. Robson and Krizek first evaluated the use of the human amniotic membrane as a temporary biological dressing in both experimental and clinical settings back in 1973 [11]. The primary way the amniotic membrane promotes wound healing is by attracting and supporting the integration of the body's own progenitor cells, enhancing new blood vessel formation and tissue repair. Additionally, it reduces local inflammation by releasing chemokines and cytokines that modulate immune responses, thereby benefiting all three stages of wound healing—inflammation, angiogenesis, and extracellular matrix remodelling [12]. Thus, the aim of this study was to assess and evaluate the efficacy of Amniotic Membrane on healing of facial wound abrasions.

Materials and Methods: This clinical study was conducted over the span of one year and involved 30 patients with eligible wound sites. Participants were randomly divided into two groups: Group A (Experimental Group, n=15), treated with Amniotic Membrane Dressing, and Group B (Control Group, n=15), managed through wound cleaning and debridement using normal saline and 10% betadine solution. Informed written consent was obtained from all participants, and the study was approved by the institutional ethics committee [DYPDCH/DPU/EC/582/117/2023].

Patients were selected for the study based on well-defined inclusion and exclusion criteria. The inclusion criteria encompassed individuals above 18 years of age presenting with fresh facial abrasion wounds who were willing to undergo treatment. Exclusion criteria ruled out patients with infected facial wounds, those with systemic conditions such as uncontrolled diabetes, uncontrolled hypertension, bleeding disorders, or a history of radiotherapy. Additionally, pregnant and lactating women were excluded from the study to ensure patient safety and study consistency.

Surgical Procedure: Patients who reported to the Department of Oral and Maxillofacial Surgery OPD and met the inclusion criteria were selected for the study. A detailed case history was recorded for each patient. Random allocation into experimental (Group A) and control (Group B) groups was carried out using the SNOSE (Sequentially Numbered, Opaque, Sealed Envelopes) method. Each patient was thoroughly informed about the procedure, including its benefits and potential risks.

For the surgical procedure, local anesthesia using 2% Lignocaine HCl (Hydrochloride) with 1:2,00,000 adrenaline was administered. The facial wounds were then debrided using 10% betadine, hydrogen peroxide, and normal saline. In the experimental group, the amniotic membrane (Received from Tata Memorial Hospital, Navi Mumbai) was applied to the wound and secured in place using 6-0 Ethilon sutures. Suturing was completed to ensure proper fixation of the membrane and wound closure. Patients were monitored at 2, 4, 6, 8, and 10 weeks, during which various parameters including pigmentation, vascularity, pliability, scar height, pain, discomfort, and aesthetic appearance were evaluated and recorded for both groups **(Fig.1 to Fig.6)**. Scar Healing Assessment was done using **Vancouver Scar Scale**.

Pigmentation was assessed by comparing it to the surrounding skin, with a score of 0 indicating normal pigmentation that closely matches nearby skin, 1 representing hypopigmentation, and 2 indicating hyperpigmentation.

Vascularity was evaluated based on the colour and blood flow in the scar tissue, with a score of 0 indicating normal vascularity, 1 representing a pink hue suggesting a slight increase in blood flow, 2 indicating a red colour reflecting a moderate rise in blood supply, and 3 denoting a purple appearance associated with a significant increase in local blood flow.

Pliability was assessed by examining the flexibility and resistance of the scar tissue. A score of 0 indicated normal pliability, while 1 denoted a supple texture with minimal resistance. A score of 2 reflected a yielding quality where the scar gave way under pressure, and 3 indicated firmness, showing rigidity and resistance to movement. Banding, scored as 4, described a rope-like texture that blanched upon stretching without limiting motion, whereas a score of 5 represented contracture, where scar shortening caused deformity and restricted movement.

The **height of the scar** was measured to assess its thickness. A score of 0 indicated a flat, normal scar, while a score of 1 represented a scar height of less than 2 mm. Scars measuring between 2 mm and 5 mm were given a score of 2, and those exceeding 5 mm in height were scored as 3.

Pain was evaluated using the Visual Analogue Scale, where a score of 0 indicated no pain, 5 represented moderate pain, and 10 reflected the worst pain imaginable.

Discomfort was assessed using the Verbal Rating Scale, where a score of 0 indicated the patient was comfortable, 1 reflected mild discomfort, 2 represented moderate discomfort, and 3 indicated severe discomfort.

The **aesthetic outcome** was evaluated by comparing the scar to the surrounding skin, with a score of 1

indicating a perfect match, 2 representing a slight mismatch, and 3 reflecting an obvious mismatch.

Statistical Analysis: Data were recorded in Microsoft Excel and tested for normal distribution using Kolmogorov-Smirnov and Shapiro-Wilk tests ($p > 0.05$). Descriptive statistics (mean ± SD) were calculated, and group comparisons between the amniotic membrane and control groups were analyzed using an unpaired t-test, with $p < 0.05$ considered statistically significant.

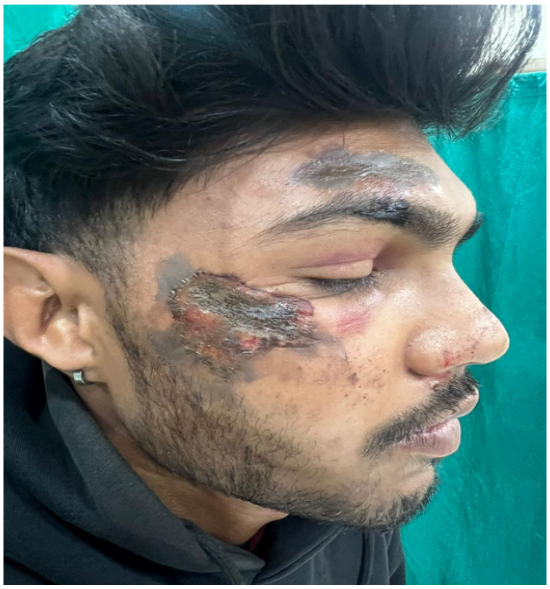

Figure 1- Illustrates a facial abrasion.

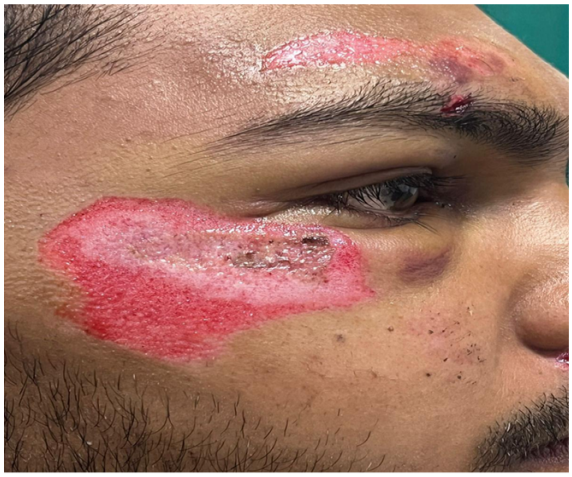

Figure 2- Illustrates the appearance of the facial abrasion following debridement

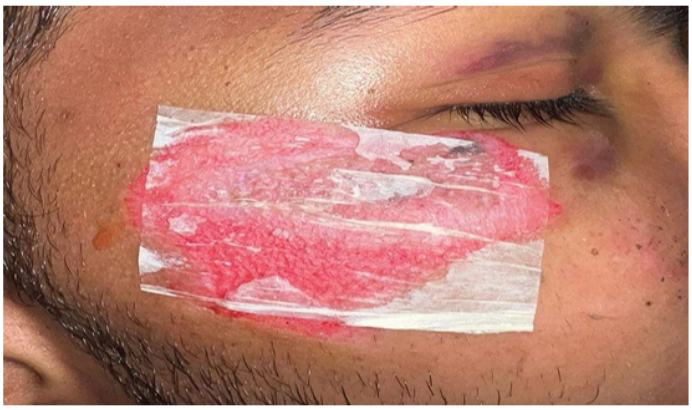

Figure 3- Illustrates the application of the amniotic membrane on an abrasion site.

Figure 4: Illustrates the suturing of the amniotic membrane using 6-0 Ethilon.

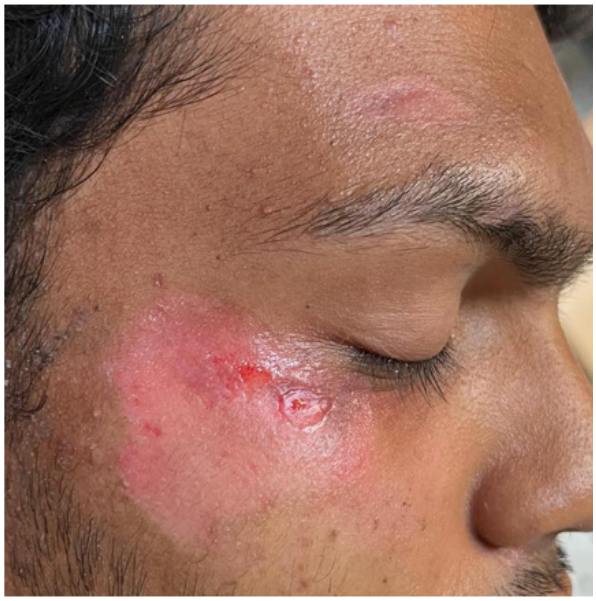

Figure 5- Illustrates the healing progress observed at the 6-week follow-up

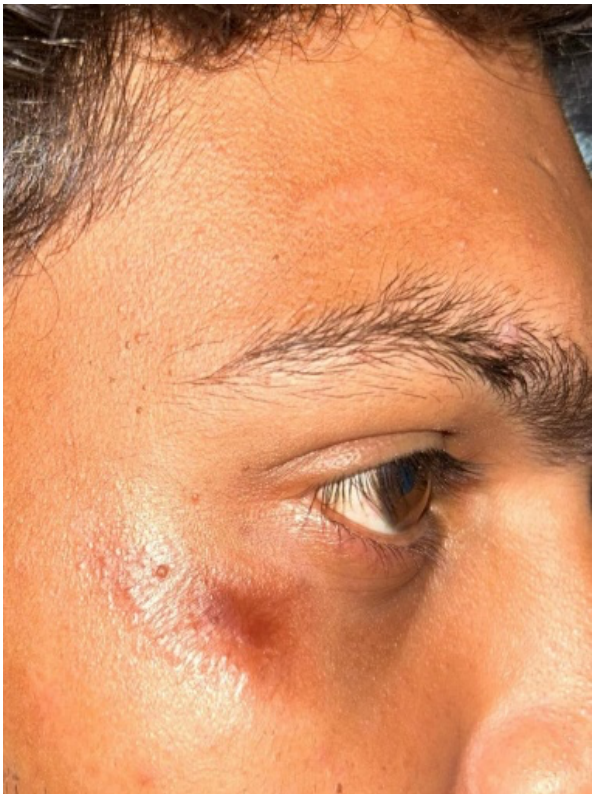

Figure 6- Depicts the follow-up image taken at the 10-week mark

Results: A total of 30 participants were enrolled for a 10-week observational period. **[Table.1]** depicts intragroup analysis for Group A (treatment group) revealed consistent and statistically significant improvements across various parameters.

Table.1: Intragroup Comparison of various parameters at 2,4,6,8and 10 weeks of **Group A**

Outcomes	Follow-Up	Mean ± SD	p- value
1. Pigmentation	2 Weeks	1.2±0.2	-----
	4 Weeks	0.6±0.3	0.04*
	6 Weeks	0.6±0.3	0.05
	8 Weeks	0.4±0.2	0.04*
	10 Weeks	0.3±0.1	0.04*
2. Vascularity	2 Weeks	1.5±0.9	----
	4 Weeks	1±0.6	0.04*
	6 Weeks	1±0.6	0.05
	8 Weeks	0.7±0.2	0.04*
	10 Weeks	0.4±0.1	0.04*
3. Pliability	2 Weeks	3.8±2.1	---
	4 Weeks	3.1±1.9	0.04*
	6 Weeks	2.6±1.5	0.03*
	8 Weeks	2.5±1.2	0.04*
	10 Weeks	2.2±1.1	0.03*
4. Height	2 Weeks	1.4±0.9	---
	4 Weeks	1.2±0.6	0.04*
	6 Weeks	0.9±0.6	0.03*
	8 Weeks	0.6±0.2	0.04*
	10 Weeks	0.5±0.1	0.02*
5. Pain	2 Weeks	0.6±0.9	---
	4 Weeks	0.4±0.6	0.04*
	6 Weeks	0.3±0.6	0.03*
	8 Weeks	0.2±0.1	0.04*
	10 Weeks	0.0±0.0	0.02*
6. Discomfort	2 Weeks	1.3±0.9	---
	4 Weeks	1±0.6	0.04*
	6 Weeks	0.9±0.6	0.03*
	8 Weeks	0.2±0.1	0.04*
	10 Weeks	0.0±0.0	0.02*
7. Aesthetic Outcome	2 Weeks	1.7±0.9	---
	4 Weeks	1.2±0.6	0.04*
	6 Weeks	1±0.6	0.03*
	8 Weeks	1±0.6	0.03*
	10 Weeks	1±0.6	0.03*

(***p-value < 0.05** indicates that the results are **statistically significant)**

Pigmentation scores steadily declined from 1.2 at week 2 to 0.3 at week 10 ($p < 0.05$). Similarly, vascularity scores reduced from 1.5 to 0.4 over the same period, showing a uniform trend of improvement. Pliability also showed a notable decrease from 3.8 to 2.2, indicating enhanced skin flexibility. The height of the treated area reduced from 1.4 to 0.5, maintaining a steady downward trajectory. Pain levels dropped from 0.6 to 0.0 by week 10, reflecting complete relief. Aesthetic outcomes

improved significantly, with scores decreasing from 1.7 to 1.0. All changes were statistically significant ($p < 0.05$), indicating the effectiveness of the treatment over the 10-week duration

[Table.2] presents the intragroup comparison of various parameters on Side B across 2, 4, 6, 8, and 10 weeks. A steady and statistically significant reduction in pigmentation was observed, with mean scores dropping from 1.7 to 0.6. Vascularity also showed a consistent decline from 1.6 to 1.1, while pliability improved markedly, with scores reducing from 3.5 to 1.3. The height of the scarred area decreased from 1.6 to 0.6, showing sustained improvement. Pain and discomfort followed a similar trend, with pain scores dropping from 1.2 to 0.3, and discomfort from 1.6 to 0.3. Aesthetic outcomes improved significantly, with a reduction in score from 2.1 to 1.2. Across all parameters, the rate of change was gradual and consistent, and each parameter's improvement was statistically significant ($p < 0.05$), confirming the effectiveness of the intervention on Side B over the 10-week period.

Table.2: Intragroup Comparison of various parameters at 2,4,6,8and 10 weeks of **Group B**

Outcomes	Follow-Up	Mean ± SD	p- value
1. Pigmentation	2 Weeks	1.7±1.1	-----
	4 Weeks	1.1±0.9	0.04*
	6 Weeks	0.8±0.6	0.03*
	8 Weeks	0.7±0.4	0.04*
	10 Weeks	0.6±0.5	0.04*
2. Vascularity	2 Weeks	1.6±1.3	----
	4 Weeks	1.3±0.9	0.04*
	6 Weeks	1.2±0.6	0.04*
	8 Weeks	1±0.7	0.04*
	10 Weeks	1.1±0.8	0.05
3. Pliability	2 Weeks	3.5±2.7	---
	4 Weeks	2.7±2.1	0.03*
	6 Weeks	2.1±1.6	0.02*
	8 Weeks	1.6±0.9	0.01*
	10 Weeks	1.3±0.8	0.04*
4. Height	2 Weeks	1.6±1.3	---
	4 Weeks	1.1±0.9	0.04*
	6 Weeks	0.7±0.6	0.04*
	8 Weeks	0.6±0.3	0.04*
	10 Weeks	0.6±0.4	0.05
5. Pain	2 Weeks	1.2±1.3	---
	4 Weeks	1.0±0.9	0.04*
	6 Weeks	0.9±0.6	0.04*
	8 Weeks	0.6±0.3	0.04*
	10 Weeks	0.3±0.4	0.05
6. Discomfort	2 Weeks	1.6±1.3	---
	4 Weeks	1.3±0.9	0.04*
	6 Weeks	1±0.6	0.04*
	8 Weeks	0.7±0.3	0.04*
	10 Weeks	0.3±0.4	0.05
7. Aesthetic Outcome	2 Weeks	2.1±1.3	---
	4 Weeks	1.9±1	0.04*
	6 Weeks	1.5±1.2	0.04*
	8 Weeks	1.3±0.9	0.04*
	10 Weeks	1.2±0.7	0.05

(***p-value < 0.05** indicates that the results are **statistically significant)**

Table. 3: Intergroup comparisons between **Group A and Group B** across various clinical parameters.

Outcomes	Follow-Up	Group A (Mean±SD)	Group B (Mean±SD)	p-value
1. Pigmentation	2 Weeks	1.2±0.2	1.7±1.1	0.01*
	4 Weeks	0.6±0.3	1.1±0.9	0.01*
	6 Weeks	0.6±0.3	0.8±0.6	0.01*
	8 Weeks	0.4±0.2	0.7±0.4	0.01*
	10 Weeks	0.3±0.1	0.6±0.5	0.01*
2.Vascularity	2 Weeks	1.5±0.9	1.6±1.3	0.01*
	4 Weeks	1±0.6	1.3±0.9	0.01*
	6 Weeks	1±0.6	1.2±0.6	0.01*
	8 Weeks	0.7±0.2	1±0.7	0.01*
	10 Weeks	0.4±0.1	1.1±0.8	0.01*
3.Pliability	2 Weeks	3.8±2.1	3.5±2.7	0.01*
	4 Weeks	3.1±1.9	2.7±2.1	0.01*
	6 Weeks	2.6±1.5	2.1±1.6	0.01*
	8 Weeks	2.5±1.2	1.6±0.9	0.01*
	10 Weeks	2.2±1.1	1.3±0.8	0.01*
4.Height	2 Weeks	1.4±0.9	1.6±1.3	0.01*
	4 Weeks	1.2±0.6	1.1±0.9	0.01*
	6 Weeks	0.9±0.6	0.7±0.6	0.01*
	8 Weeks	0.6±0.2	0.6±0.3	0.01*
	10 Weeks	0.5±0.1	0.6±0.4	0.01*
5.Pain	2 Weeks	0.6±0.9	1.2±1.3	0.01*
	4 Weeks	0.4±0.6	1.0±0.9	0.01*
	6 Weeks	0.3±0.6	0.9±0.6	0.01*
	8 Weeks	0.2±0.1	0.6±0.3	0.01*
	10 Weeks	0.0±0.0	0.3±0.4	0.01*

	8 Weeks			
	10 Weeks			
6.Discomfort	2 Weeks	1.3±0.9	1.6±1.3	0.01*
	4 Weeks	1±0.6	1.3±0.9	0.01*
	6 Weeks	0.9±0.6	1±0.6	0.01*
	8 Weeks	0.2±0.1	0.7±0.3	0.01*
	10 Weeks	0.0±0.0	0.3±0.4	0.01*
7.Aesthetic Outcome	2 Weeks	1.7±0.9	2.1±1.3	0.01*
	4 Weeks	1.2±0.6	1.9±1	0.01*
	6 Weeks	1±0.6	1.5±1.2	0.01*
	8 Weeks	1±0.6	1.3±0.9	0.01*
	10 Weeks	1±0.6	1.2±0.7	0.01*

(***p-value < 0.05** indicates that the results are **statistically significant)**

[Table.3] highlights the intergroup comparisons between Group A and Group B across various clinical parameters. Both groups exhibited statistically significant improvements over time; however, Group A consistently showed superior outcomes. In terms of pigmentation, vascularity, and pliability, Group A demonstrated greater reductions compared to Group B ($p < 0.05$). Similarly, a more substantial decrease in scar height was observed in Group A. Pain and discomfort levels were significantly reduced in both groups, but Group A again showed more pronounced improvements ($p < 0.05$). The aesthetic results followed the same trend, with Group A yielding better outcomes overall. These consistent findings confirm the enhanced effectiveness of the treatment used in Group A across all assessed parameters, supported by statistically significant differences throughout the study.

Discussion: The goal of using regenerative materials in clinical applications is to accelerate healing and restore damaged tissues due to surgery, trauma, disease, or infection. Over the past century, amniotic membranes have been used for various conditions, from skin transplants and burns to ophthalmic, periodontal, and wound healing applications [13-15]. It possesses biocompatibility, low immunogenicity, and favorable mechanical properties like stability, flexibility, and resorbability, along with promoting cell adhesion. Additionally, it offers anti-inflammatory, antifibrotic, and pain-relieving effects, and provides growth factors, cytokines, and stem cell-like properties [16].

This study evaluated the efficacy of Amniotic Membrane in promoting the healing of facial wound abrasions. In this study, intragroup analysis for both Group A (treatment group) and Group B demonstrated consistent, statistically significant improvements in all parameters, including pigmentation, vascularity, pliability, height, pain, and aesthetics, with all changes significant ($p < 0.05$) over 10 weeks. A study by Hassan SM et al. involving 10 keloid patients showed comparable outcomes, where surgical excision followed by amniotic membrane application led to statistically significant improvements in pliability, height, and total scores on the Vancouver Scar Scale. However, changes in pigmentation and vascularity were not statistically significant over the 3-month follow-up [17]. Kar IB et al. reported that by day 5, 79% of patients showed improved postoperative pain, with significant score improvement ($p < 0.001$), and after 6 months, 82% regained normal sensation while 18% experienced altered sensation [18]. Rai M et al. reported a Cervical necrotizing fasciitis CNF case with extensive postsurgical wound successfully managed using amniotic membrane dressings alone, resulting in complete healing within 4 weeks without the need for reconstructive surgery and minimal cosmetic or functional deformity at 6-month follow-up [19]. Velez I et al. found that surgical wounds treated with amniotic membrane showed significantly faster epithelialization, greater reduction in wound size, and less pain during the first 6 days post-op compared to controls, with both groups reaching similar outcomes by 3 months. Notably, no scarring occurred in the membrane group, while one case was observed in the control group [20].

In this study, although both groups demonstrated notable improvements, Group A consistently achieved superior results across all clinical parameters—pigmentation, vascularity, pliability, scar height, pain, and aesthetics—with statistically significant differences ($p < 0.05$). These findings align with the study conducted by Munoyath SK et al., which demonstrated that amnion dressings led to significantly better pliability and pigmentation outcomes by the third month, quicker granulation tissue formation (7 vs. 9 days), reduced pain levels, and earlier epithelialization within 48 hours—underscoring the enhanced healing potential of amnion [21]. Kumar Periyasamy I et al. reported that wounds treated with amnion membrane showed complete healing by the second week, while those treated with chorion membrane remained unhealed, indicating superior efficacy of the amnion membrane [22]. Boricha V et al. found that Human Amniotic Membrane dressings provided superior pain relief and wound healing in maxillofacial wounds while being

safe, effective, and comparable in operability to other methods, with no reported complications [23]. Zelen CM et al. demonstrated that adding dehydrated human amniotic membrane allografts (EpiFix) to standard care significantly improved healing rates and wound size reduction in diabetic foot ulcers compared to standard care alone, with 92% healing at 6 weeks versus only 8% in the control group [24].

The findings of this study suggested that AM is a highly effective wound dressing owing to its distinctive properties, easy accessibility, cost-efficiency, and storage convenience, while also reducing complications, accelerating healing, and improving patient comfort and tissue appearance. Research-based management for patients with facial abrasion wounds must be further verified by evidence-based scientific research [25].

Limitation: This study is limited by its small sample size and short follow-up duration, which may affect the generalizability and assessment of long-term outcomes. The lack of blinding and reliance on subjective outcome measures could introduce potential bias. Additionally, the focus on only abrasion-type facial wounds limits the applicability of findings to other wound types.

Conclusion: The application of Amniotic Membrane significantly enhanced healing in facial abrasion wounds compared to conventional treatment. Patients showed superior outcomes in pigmentation, vascularity, pliability, pain relief, and aesthetics. These findings highlight the membrane's regenerative, anti-inflammatory, and wound-modulating properties. Thus, Amniotic Membrane serves as a promising biological dressing for facial soft tissue injuries.

References

1. C M, Thilak G, Shetty P, Rai A, Gohil S. Management of Abrasions in Oral and Maxillofacial Surgery - A Review. NUJHS. 2016;6(3):41-44.
2. Pedaprolu AS, Rewale VM. Advances in soft tissue wound care: A comprehensive review of facial traumatic injuries. Multidiscip. Rev. (2024);7(7):e2024131.
3. Robson MC, Steed DL, Franz MG. Wound healing: biologic features and approaches to maximize healing trajectories. Curr Probl Surg. 2001 Feb;38(2):72-140.
4. Chhabra S, Chhabra N, Kaur A, Gupta N. Wound Healing Concepts in Clinical Practice of OMFS. J Maxillofac Oral Surg. 2017 Dec;16(4):403-423.
5. Bhattacharya V. Management of soft tissue wounds of the face. Indian J Plast Surg. 2012 Sep;45(3):436-43.
6. Choi J, Lorenz HP, Spain DA. Review of facial trauma management. J Trauma Acute Care Surg. 2020 Apr;88(4):e124-e130.
7. Patel KG, Sykes JM. Management of soft-tissue trauma to the face. Oper Tech Otolaryngo. 2008;19:90-97.
8. Ferraz MP. Wound Dressing Materials: Bridging Material Science and Clinical Practice. Appl. Sci. 2025;015:1725.
9. Brumberg V, Astrelina T, Malivanova T, Samoilov A. Modern Wound Dressings: Hydrogel Dressings. Biomedicines. 2021 Sep 16;9(9):1235.
10. Ramuta TZ, Kreft ME. Human Amniotic Membrane and Amniotic Membrane-Derived Cells: How Far Are We from Their Use in Regenerative and Reconstructive Urology? Cell Transplant. 2018 Jan;27(1):77-92.
11. Gruss JS, Jirsch DW. Human amniotic membrane: a versatile wound dressing. Can Med Assoc J. 1978 May 20;118(10):1237-46.
12. Pfister P, Wendel-Garcia PD, Meneau I, Vasella M, Watson JA, Bühler P, Rittirsch D, Lindenblatt N, Kim BS. Human amniotic membranes as an allogenic biological dressing for the treatment of burn wounds: Protocol for a randomized-controlled study. Contemp Clin Trials Commun. 2023 Sep 16;36:101209.
13. Ingraldi AL, Audet RG, Tabor AJ. The Preparation and Clinical Efficacy of Amnion-Derived Membranes: A Review. J Funct Biomater. 2023 Oct 20;14(10):531.
14. Kesting MR, Wolff KD, Nobis CP, Rohleder NH. Amniotic membrane in oral and maxillofacial surgery. Oral Maxillofac Surg. 2014 Jun;18(2):153-64.
15. Fairbairn NG, Randolph MA, Redmond RW. The clinical applications of human amnion in plastic surgery. J Plast Reconstr Aesthet Surg. 2014 May;67(5):662-75.
16. Fenelon M, Catros S, Meyer C, Fricain JC, Obert L, Auber F, Louvrier A, Gindraux F. Applications of Human Amniotic Membrane for Tissue Engineering. Membranes (Basel). 2021 May 25;11(6):387.
17. Hassan SM, Sabbagh A, Mahalawy A. Evaluation of Amniotic Membrane in treatment of Cervico-Facial Keloid Scars. Alexandria Dental Journal. 2019;44:120-124.
18. Kar IB, Singh AK, Mohapatra PC, Mohanty PK, Misra S. Repair of oral mucosal defects with cryopreserved human amniotic membrane grafts: prospective clinical study. Int J Oral Maxillofac Surg. 2014 Nov;43(11):1339-44.
19. Rai M, Ramaraj PN, Sharma A. Use of amniotic membrane as dressing in cervical necrotizing fasciitis. J Oral Maxillofac Surg. 2011 Apr;69(4):1125-8.

20. Velez I, Parker WB, Siegel MA, Hernandez M. Cryopreserved amniotic membrane for modulation of periodontal soft tissue healing: a pilot study. J Periodontol. 2010 Dec;81(12):1797-804.
21. Munoyath SK, Sathishwaran J, Prasad K. Efficacy of human amniotic membrane and collagen in maxillofacial soft tissue defects – A comparative clinical study. J. Oral Maxillofac. Surg. Med. Pathol. 2015;27(6);786-790.
22. 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 Apr 12;16(4):e58160.
23. 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 Jun;23(3):517-523.
24. Zelen CM, Serena TE, Denoziere G, Fetterolf DE. A prospective randomised comparative parallel study of amniotic membrane wound graft in the management of diabetic foot ulcers. Int Wound J. 2013 Oct;10(5):502-7.
25. Bhagat B, Bhagat S, Sachdev M, Pandey ND. Desideratum of corroboration-based management for temporomandibular joint disorders: pressing priority in oral surgery. J Korean Assoc Oral Maxillofac Surg. 2023 Feb 28;49(1):53-54. doi: 10.5125/jkaoms.2023.49.1.53. PMID: 36859376; PMCID: PMC9986000.