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Wound Healing Tissue Graft Using Prf Incorporated Pla Membrane

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ABSTRACT

Introduction: Poly lactic acid (PLA) is a biocompatible and biodegradable polymer that has been extensively used in tissue engineering and medical devices. Platelet rich fibrin (PRF) is a fibrin matrix in which platelet cytokines, growth factors, and cells are trapped and may be released after a certain time and that can serve as a resorbable membrane. Platelet-rich fibrin (PRF) incorporated into a poly(lactic acid) (PLA) membrane is a potential approach for wound healing and tissue grafting.
Materials and methods: This procedure is done by mixing 6% alginate with 3% poly lactic acid and then dissolving it in 100ml of water. And then, freshly platelet rich fibrin is collected from whole blood. These both solutions are mixed together and blended for 3 hours to form a homogenous membrane.
Results and discussion: PLA based composites development is one of the
strategic methods for different problems related diseases. Blending of PLA membrane with PRF may provide balanced physical and biological properties. Platelets, which contain growth factors, play major roles in cell migration, proliferation, differentiation and angiogenesis and are associated with the tissue regeneration process. It can be used as a major method in fabrication of wound healing faster compared to other methods available.
Conclusion: This study concludes that the synthesized PLA with PRF membrane is effective in accelerating wound healing.

Keywords: platelet rich fibrin, poly lactic acid, wound healing

INTRODUCTION

Poly Lactic Acid (PLA), a biodegradable and bioactive polymer, has emerged as a transformative material at the forefront of diverse industries, from packaging to biomedical applications (1). Sourced from renewable reservoirs like corn starch or sugarcane, PLA exemplifies sustainability in polymer science (2). Its biocompatibility has propelled it into the realms of medicine and tissue engineering, where it contributes to the development of medical devices, sutures, and intricate scaffolds for regenerative purposes. PLA stands as a beacon of innovation, offering a viable alternative to traditional plastics and demonstrating the potential for a more sustainable future (3)
Platelet-Rich Fibrin (PRF) emerges as a dynamic player in the realm of regenerative medicine, captivating attention for its unique biological composition and therapeutic potential (4). Derived from a patient's blood, PRF is a concentration of platelets and fibrin, enriched with growth factor (5). This autologous elixir becomes a powerful tool in tissue healing, promoting cell proliferation and tissue regeneration (6). PRF, with its rich concentration synergizes with the structural support provided by PLA (7). This alliance capitalizes on the regenerative potential of PRF, fostering an environment conducive to accelerated tissue healing (8).
Wound healing is a complex biological process that the body undergoes to repair damaged or injured tissue (9). It involves a series of coordinated events and cellular responses aimed at restoring the structural and functional integrity of the affected area (10). The process generally consists of three overlapping phases: inflammation, proliferation, and remodeling (11). Wound healing is crucial for maintaining the body's integrity and functionality, and disruptions to this process can lead to complications (12).
PLA complements PRF by offering a stable scaffold for cellular activity and tissue regeneration. This alliance of PRF and PLA holds promise across various medical applications, from wound healing to the development of advanced biomaterials (13).
To fabricate wound healing tissue graft using PRF incorporated PLA membrane.
The aim of this study is to fabricate wound healing tissue graft using PRF incorporated PLA membrane.

MATERIALS AND METHODS

This procedure is done by mixing 6% alginate with 3% poly lactic acid and then dissolving it in 100ml of water. And then, freshly platelet rich fibrin is collected from whole blood. These both solutions are mixed together and blended for 3 hours to form a homogenous membrane.

RESULTS AND DISCUSSION

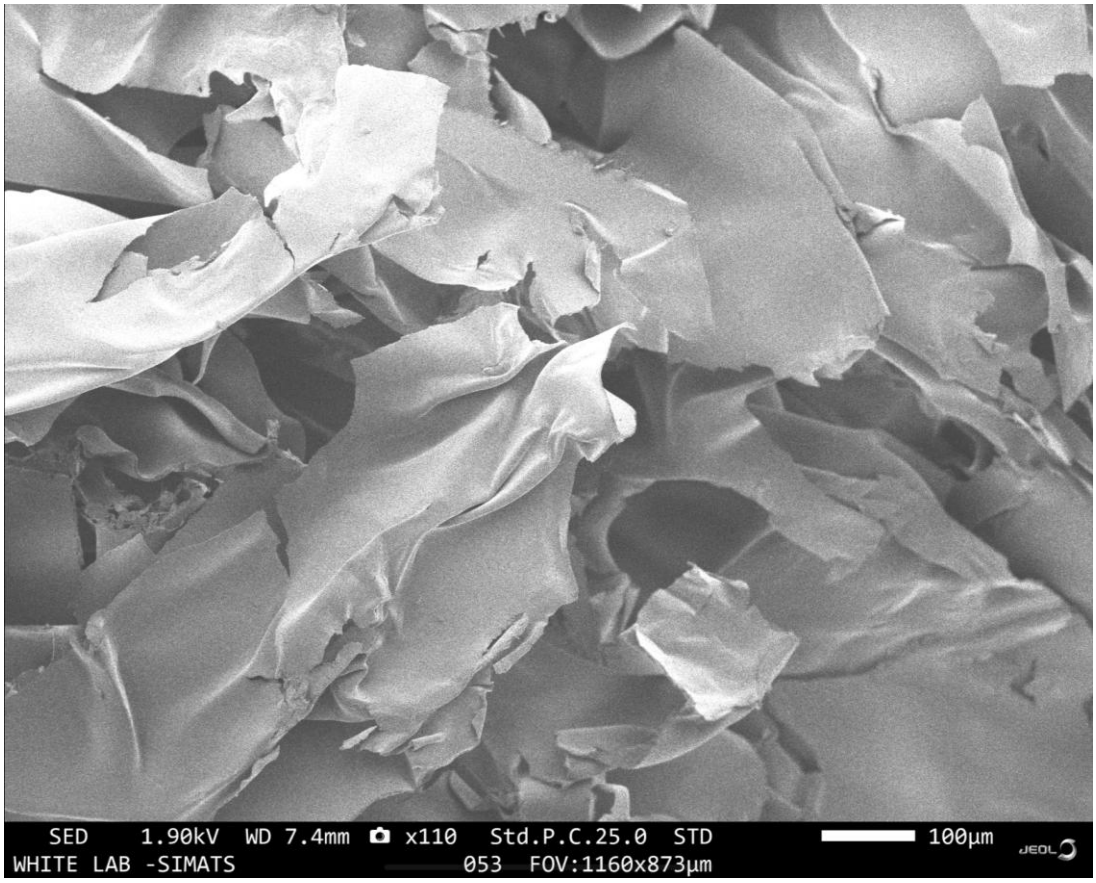

Fig.1. SEM- Membrane is porous, flexible, sheet like morphology

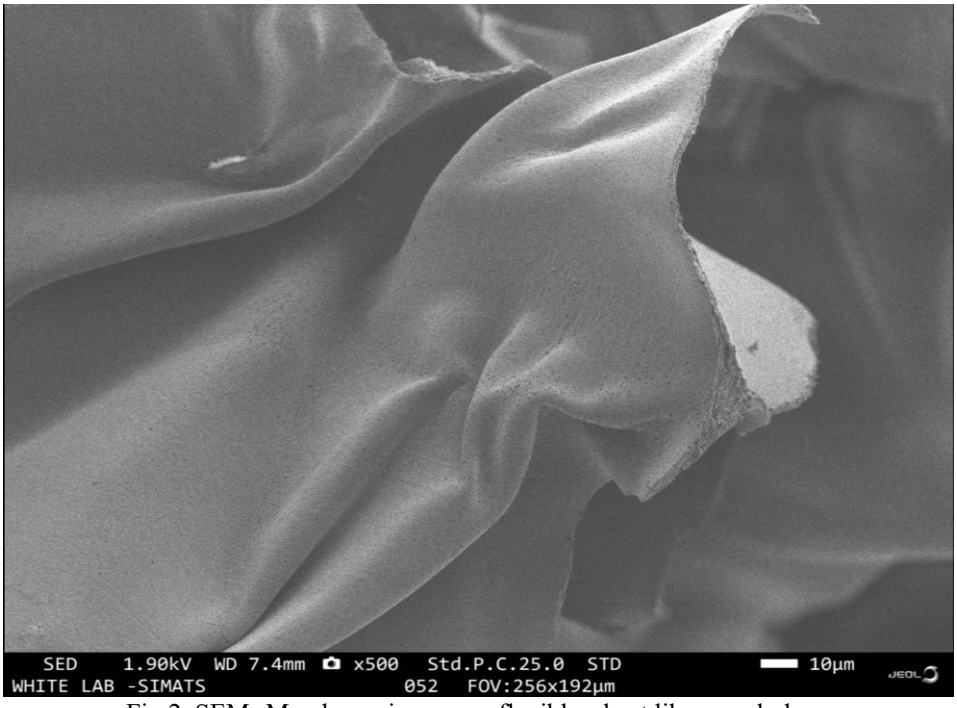

Fig.2. SEM- Membrane is porous, flexible, sheet like morphology

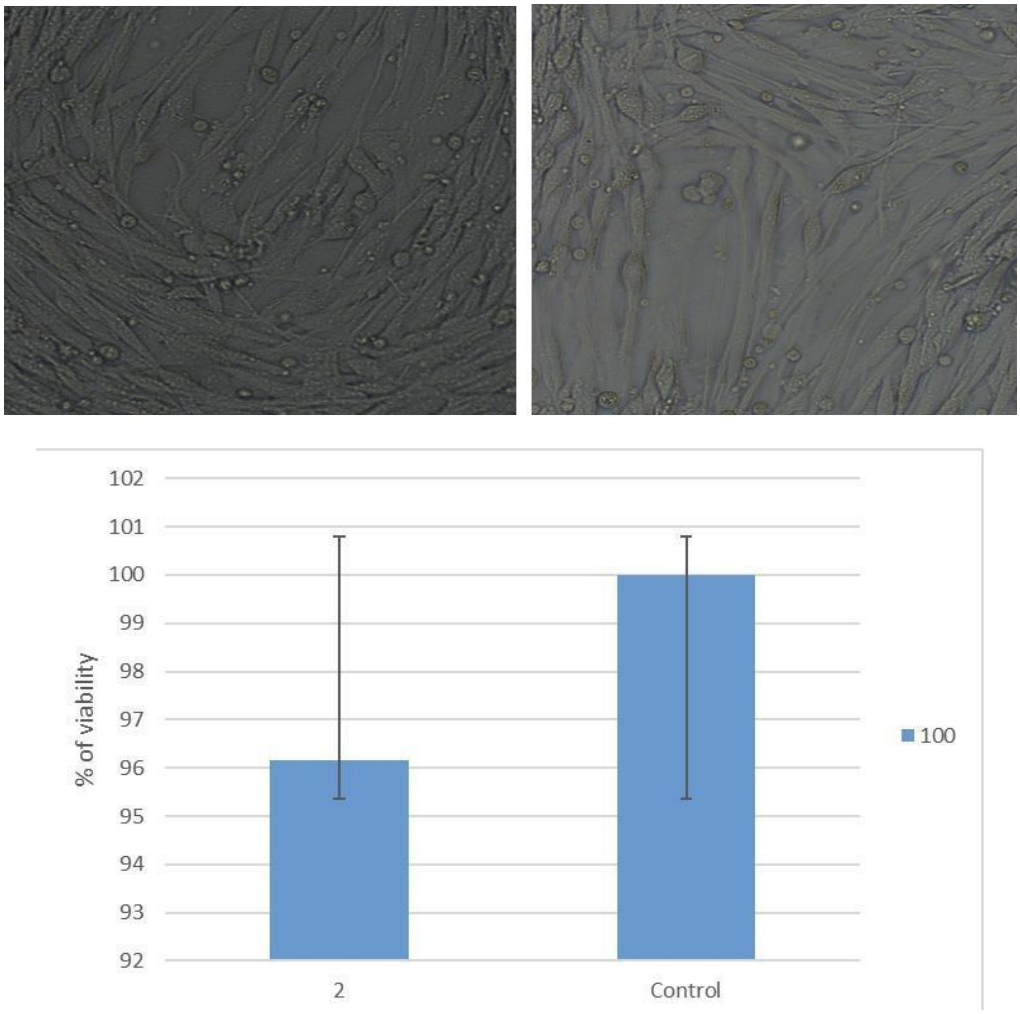

Fig. 3. Cell attachment and proliferation - Better cell attachment and proliferation is observed with a high viable rate of fibroblast cells.

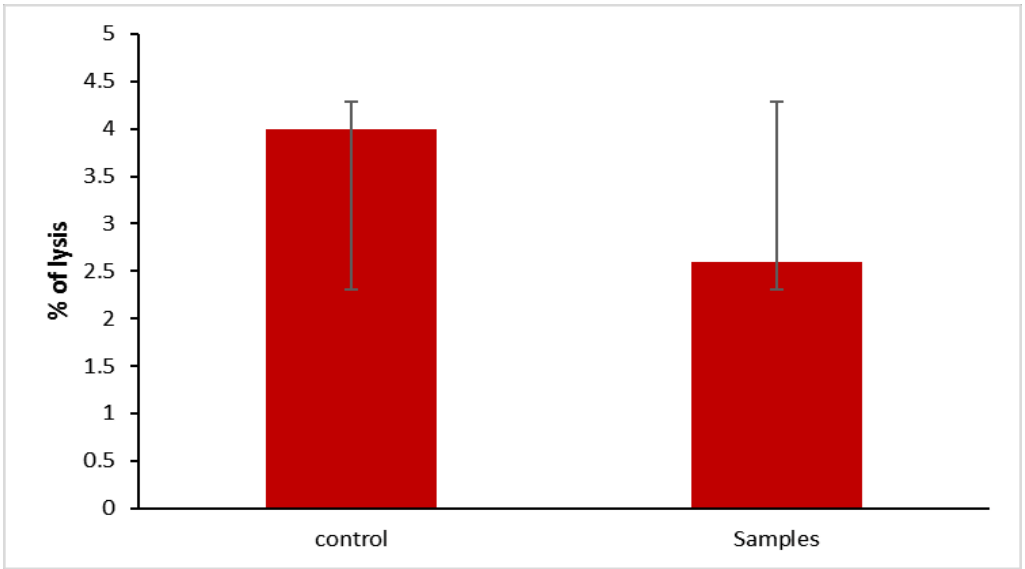

Fig. 4. Hemocompatibility- As per ASTEM standard, less than 2% lysis of RBC occurred which confirms the material is Haemocompatible.

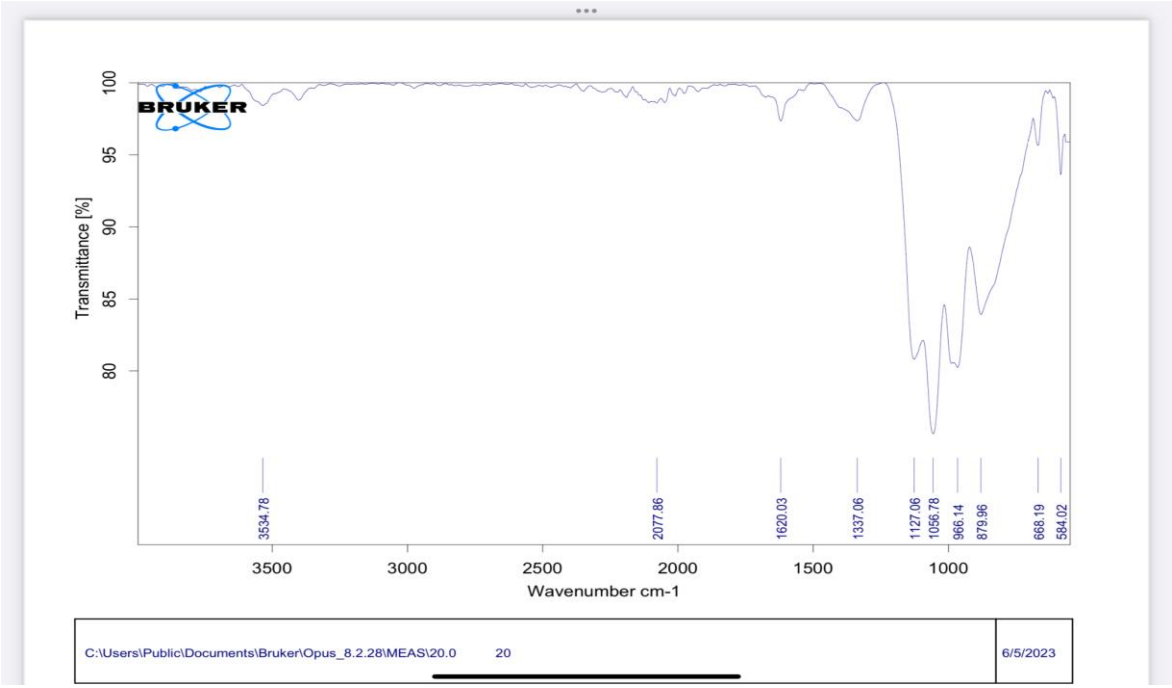

Fig. 5. FTIR- It confirms the presence of function groups such as hydroxyl group, carbonate group, and amide groups.

The usage of PRF therapeutically has increased attention of clinicians worldwide as it is of natural origin and has significantly accelerated the process of tissue healing and regeneration (14). All of the known clinical applications of PRF highlight an accelerated tissue cicatrization due to the development of effective neovascularization, accelerated wound closing with fast cicatricial tissue remodeling, and nearly total absence of infectious events (15).

PRF is an adjunct to the natural healing process and has the following effects:the fibrin clot acts as a support through its mechanical properties which involve the protection of graft materials and also acts as a biological connector between the bone particles, in addition to this the fibrin network is engaged in cellular migration, mainly for the endothelial cells necessary for the neoangiogenesis, vascularization, and survival of the graft (13).

In an article stated by F. Fahimpour, to develop collagen membrane which is 3-D bilayer reinforcing with nano beta-tricalcium-phosphate (nβ-TCP) particles and to evaluate its bone regeneration in combination with leukocyte-platelet-rich fibrin (L-PRF). The Mechanical properties have been improved, with 89 % porosity (pore size ~100 μm) in the bilayer-collagen/nβ-TCP membrane. This bilayer design also enhances the proliferation and ALP activity (16).

In this study, by M. Ansarizadeh, lyophilized advanced platelet rich fibrin (A-PRF) was used in combination with collagen-chitosan membrane for the first time to combine advantages of both collagen and A-PRF membranes. Cell viability of mesenchymal stem cells (MSCs) was improved by both increasing chitosan/collagen (chit/col) weight ratio and A-PRF concentration. Moreover, as chit/col weight ratio increased from 0 to 4 and A-PRF concentration decreased from 5 to 0, degradation rate of the membranes decreased from 90 to 20% after four weeks incubation (10).

In an article by Balaram Naik stated that PRF can be used to promote wound healing, bone regeneration, graft stabilization, wound sealing, and hemostasis. Because the fibrin matrix is better organized, it is able to more efficiently direct stem cell migration and the healing program (17).

CONCLUSION

This study concludes that the synthesised PLA with PRF membrane is effective in accelerating wound healing. The therapeutic use of PRF for accelerating tissue healing and regeneration has increasingly grabbed the attention of clinicians worldwide because this is of natural origin, PRF technology is readily available;easy to prepare; can be produced immediately and widely applicable in dentistry,and with virtually no risk of a rejection reaction (foreign body response). The three-dimensional architecture of fibrin provides the PRF membrane with great density, elasticity, flexibility, and strength that are excellently suited for handling, manipulation, and suturing. Further studies will be necessary to determine platelet concentrates and its features, only a perfect understanding of its components will enable us to get significant clinical results and further use it as a natural method for fabrication of accelerated wound healing.

REFERENCES

1. Ren J. Biodegradable Poly (Lactic Acid): Synthesis, Modification, Processing and Applications. Springer Science & Business Media; 2011. 302 p.
2. Sin LT, Tueen BS. Polylactic Acid: A Practical Guide for the Processing, Manufacturing, and Applications of PLA.

William Andrew; 2019. 422 p.
3. Jiménez A, Peltzer M, Ruseckaite R. Poly(lactic acid) Science and Technology: Processing, Properties, Additives and Applications. Royal Society of Chemistry; 2014. 374 p.
4. Miron RJ, Choukroun J. Platelet Rich Fibrin in Regenerative Dentistry: Biological Background and Clinical Indications. John Wiley & Sons; 2017. 286 p.
5. Easley EL. The Use of Platelet Rich Fibrin in Pulpal and Periodontal Regeneration. 2016. 106 p.
6. Polak D, Falcoff D, Chachartchi T, Asher R, Assad R. Sustainability and Release Pattern of Growth Factors from Bone Grafts Prepared with Platelet-Rich Fibrin. Int J Oral Maxillofac Implants. 2023 Nov 8;0(0):1–15.
7. Visser LC. The Use of Platelet-rich Fibrin Matrices to Enhance Growth Factor Delivery for Connective Tissue Healing. 2010. 280 p.
8. Anbu RT, Suresh V, Gounder R, Kannan A. Comparison of the Efficacy of Three Different Bone Regeneration Materials: An Animal Study. Eur J Dent. 2019 Feb;13(1):22–8.
9. Pla LC. Enhanced Fibroblast Apoptosis and Impaired Wound Healing in Type 2 Diabetes is Mediated by TNF Dysregulation. 2007. 172 p.
10. Cheng B, Fu X. The Role of Stem Cell on Wound Healing After Revascularization-Healing Following Revascularization-Unlocking Skin Potential. Int J Low Extrem Wounds. 2023 Oct 29;15347346231210709.
11. Boateng J. Therapeutic Dressings and Wound Healing Applications. John Wiley & Sons; 2020. 444 p.
12. Thomas S. Wound Management and Dressings. 1990. 238 p.
13. Ding Y, Cui L, Zhao Q, Zhang W, Sun H, Zheng L. Platelet-Rich Fibrin Accelerates Skin Wound Healing in Diabetic Mice. Ann Plast Surg. 2017 Sep;79(3):e15–9.
14. Andia I, Maffulli N. Blood-Derived Products for Tissue Repair/Regeneration. MDPI; 2019. 178 p.
15. Choi SY, Kim S, Park KM. Initial Healing Effects of Platelet-Rich Plasma (PRP) Gel and Platelet-Rich Fibrin (PRF) in the Deep Corneal Wound in Rabbits. Bioengineering (Basel) [Internet]. 2022 Aug 20;9(8). Available from: http://dx.doi.org/10.3390/bioengineering9080405
16. Nares S. Advances in Periodontal Surgery: A Clinical Guide to Techniques and Interdisciplinary Approaches. Springer; 2019. 252 p.
17. Zhang B, Zhang J, Kuang L, Yao X, Wang Y, Shang H. Ultraviolet light C in promoting rapid healing of delayed wound union: A case report. Int J Surg Case Rep. 2023 Nov;112:108949.