How to Cite:
Gagandeep, Singh, R. J., & Thind, B. K. (2021). Injectable platelet-rich fibrin (albumin gel and liquid platelet-rich fibrin). *International Journal of Health Sciences*, *5*(S2), 269–273. https://doi.org/10.53730/ijhs.v5nS2.5770

Injectable platelet-rich fibrin (albumin gel and liquid platelet-rich fibrin)

Gagandeep
Reader-Department of Periodontics and Implantology, Desh Bhagat Dental College and Hospital, Amloh road, Mandi Gobindgarh

Rupinder Jyot Singh
Post-Graduation student-Department of Periodontics and Implantology, Desh Bhagat Dental College and Hospital, Amloh road, Mandi Gobindgarh

BirSukhman Kaur Thind
Post-Graduation student-Department of Periodontics and Implantology, Desh Bhagat Dental College and Hospital, Amloh road, Mandi Gobindgarh

***Abstract*---**This article provides review on Injectable Platelet-Rich Fibrin (Albumin Gel and Liquid Platelet-Rich Fibrin). The current findings suggest that AlbPRF has regeneration characteristics that are caused by the slow and steady release of growth factors contained in liquid PRF via albumin gel breakdown. Future research is needed to thoroughly define the degrading features of Alb-PRF in vivo and to investigate potential therapeutic uses in other domains of medicine. Platelet concentrates are easy to apply in clinical practice and offer potential benefits including rapid wound healing and bone regeneration, and can therefore be considered to be new therapeutic adjuvants. In dental implant surgery they are used in bone reconstruction prior or concomitant to implant procedures, and also for dental extraction socket preservation.

***Keywords*---**aesthetics, AlbPRF, injectable platelet plasma, PRF.

Introduction

Wound healing is initiated by clot formation, followed by proliferative stage which comprises of epithelialization, angiogenesis, granulation tissue formation, collagen deposition and finally collagen maturation and contraction.[1] This involves adherence and aggregation of platelets favoring formation of thrombin and fibrin. Platelets contain biologically active proteins, binding of these proteins within a developing fibrin mesh or to the extracellular matrix can create

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2021.
***Corresponding author**: Gagandeep.*
Manuscript submitted: 18 Sept 2021, Manuscript revised: 9 Nov 2021, Accepted for publication: 12 Dec 2021

chemotactic gradients favoring recruitment of stem cells, stimulating cell migration, differentiation, and promoting repair. Thus, use of autologous platelet concentrates is a promising application in the field of periodontal regeneration and can be used in clinical situations requiring rapid healing.[2]

Macrophage activation are hallmarks of inflammatory osteolysis and may be targeted by the local application of liquid platelet-rich fibrin (PRF). Liquid PRF is produced by a hard spin of blood in the absence of clot activators and anticoagulants, thereby generating an upper platelet-poor plasma (PPP) layer, a cell-rich buffy coat layer (BC; termed concentrated-PRF or C-PRF), and the remaining red clot (RC) layer. Heating PPP has been shown to generate an albumin gel (Alb-gel) that when mixed back with C-PRF generates Alb-PRF having extended working properties when implanted in vivo. Evidence has demonstrated that traditional solid PRF holds a potent anti-inflammatory capacity.

History of Alb-PRF

One of the most significant disadvantages of PRF has been it's low in vivo turnover rate. The ability to act as a true barrier is limited, in regenerative dentistry because it is associated with a typical 10-14-day resorption period in vivo. 19 Kawase et al. presented an intriguing attempt to use the heat-compression technique with PRF membranes for guide tissue regeneration (GTR) treatment. The heat-compressed PRF was observed for at least 3 weeks postimplantation in vivo, whereas the control PRF membranes, were completely resorbed within 2 weeks. 19 Furthermore, in facial aesthetics and plastic surgery, a novel technique was developed in which platelet-poor plasma (PPP) containing roughly 60 percent albumin is heated at 75 degrees Celsius for 10 minutes to allow for the denaturation and breaking of many of the weak linkages or bonds (e.g. electrovalent bonds like H2) within its protein molecule 20 in the aftermath, the proteins are redeployed into a highly compact protein-packed structure with prolonged resorption characteristics lasting up to 4–6 months. 20,21. However, despite the longer-lasting heat-treated PRF/PPP, a poorer regeneration capacity is to be predicted, because no cells/growth factors in the heat-treated PRF/PPP can withstand the denaturation process (thermal heating). For these reasons, a technique known as Alb-PRF involves reintroducing the platelet-rich layer from the buffy coat into heated PPP (albumin gel) after cooling.

What is platelet rich fibrin (ALB-PRF)?

Alb-PRF is a novel injectable regenerative composite that consists of autologous albumin gel and concentrated platelet rich fibrin (Alb-PRF). Alb-PRF is the latest development in the field of natural regenerative composites. The Albumin and Fibrin provide natural scaffold for leukocytes, platelets as well as newly formed tissue cells. It also contains vascular endothelial growth factor (VEGF), Platelet-Derived Growth factor (PDGF) and Transforming Growth Factor – Beta (TGF-B). These factors provide necessary micro-environment for healing and regeneration of injured tissues.

Alb-PRF characteristics

Alb-PRF is the latest functional matrix that overcomes limitations of its predecessors. It shows many characteristics of ideal biomaterial for repair, regeneration, or facial aesthetics. Here are some important characteristics:
It is injectable which allows physicians to minimize access trauma to affected tissue. No need for complicated manufacturing. Alb-PRF can be prepared in the clinic and does not need to be manufactured. It can be used as a bioactive, natural filler – Alb-PRF forms "sticky" gel that can be used as a 100% natural filler and it does not easily leak out from the injury site. Biodegradable scaffold – Alb-PRF gel creates a natural scaffold allowing absorption of water that is necessary for proliferation of new cells. It is does not block the space for newly formed tissue.

100% Natural Composite – Alb-PRF does not contain any foreign substances or artificial components. That eliminates issues of toxicity or adverse immune reaction. Cyto-compatibility – Alb-PRF is friendly to your own cells. Albumin and fibrin have a long track record of being used in cell cultures. Bioactive composite – Alb-PRF is bioactive. It contains significant amounts of white blood cells as well as platelets. This reduces the risk of bacterial contamination and development of infection. Extended resorption properties – Albumin portion of the composite is processed in such a way that its structure is re-organized into a more dense structure. This extends resorption for up-to 4-6 months. Highest concentration of growth factors – biologic characterization of Alb-PRF shows that Alb-PRF has 10-15 times greater concentrations of platelets and leukocytes than the latest generation of PRF (aka i-PRF). Sustained release of growth factors – Alb-PRF contains the highest level of growth factors. In addition, these factors have been released from the material over a period of several weeks. Alb-PRF composite represents a functional matrix that is almost exactly mimicking and supplementing the body's natural response to the injury. Alb-PRF maintains a normal environment and same relative proportion of cells that naturally aggregate at the site of injury.

Conclusion

The current findings suggest that AlbPRF has regeneration characteristics that are caused by the slow and steady release of growth factors contained in liquid PRF via albumin gel breakdown. Future research is needed to thoroughly define the degrading features of Alb-PRF in vivo and to investigate potential therapeutic uses in other domains of medicine. Platelet concentrates are easy to apply in clinical practice and offer potential benefits including rapid wound healing and bone regeneration, and can therefore be considered to be new therapeutic adjuvants. In dental implant surgery they are used in bone reconstruction prior or concomitant to implant procedures, and also for dental extraction socket preservation. Their use result in enhanced bone graft density and maturation. Limitations include its faster resorption properties (~2 weeks). Interestingly, recent studies have demonstrated that by heating a liquid platelet-poor plasma (PPP) layer, the resorption properties of heated albumin (albumin gel) can be extended from 2 weeks to greater than 4 months (e-PRF).

References

1. Agrawal M, Agrawal V. Platelet rich fibrin and its applications in dentistry - A review article. Natl J Med Dent Res 2014;2:51-8.
2. Chandran P, Sivadas A. Platelet-rich fibrin: Its role in periodontal regeneration. Saudi J Dent Res 2014;5:117-22.
3. Prakash S, Thakur A. Platelet concentrates: Past, present and future. J Maxillofac Oral Surg 2011;10:45-9. 4. Sunitha Raja V, Munirathnam Naidu E. Platelet-rich fibrin: Evolution of a second-generation platelet concentrate. Indian J Dent Res 2008;19:42-6
4. Dohan D.M., Choukroun J., Diss A., Dohan S.L., Dohan A.J., Mouhyi J., Gogly B. Platelet-rich fibrin (PRF): A second-generation platelet concentrate. Part I: Technological concepts and evolution. Oral. Surg. Oral. Med. Oral. Pathol. Oral. Radiol. Endod. 2006;101:37–44. doi: 10.1016/j.tripleo.2005.07.008. [PubMed] [CrossRef] [Google Scholar]
5. Strauss F.J., Stahli A., Gruber R. The use of platelet-rich fibrin to enhance the outcomes of implant therapy: A systematic review. Clin. Oral Implants Res. 2018;29(Suppl. 18):6–19. doi: 10.1111/clr.13275. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
6. Karimi K., Rockwell H. The Benefits of Platelet-Rich Fibrin. Facial Plast. Surg. Clin. N. Am. 2019;27:331–340. doi: 10.1016/j.fsc.2019.03.005. [PubMed] [CrossRef] [Google Scholar]
7. Fujioka-Kobayashi M., Kono M., Katagiri H., Schaller B., Zhang Y., Sculean A., Miron R.J. Histological comparison of Platelet rich fibrin clots prepared by fixed-angle versus horizontal centrifugation. Platelets. 2020:1–7. doi: 10.1080/09537104.2020.1754382. [PubMed] [CrossRef] [Google Scholar]
8. Kawase T., Tanaka T. An updated proposal for terminology and classification of platelet-rich fibrin. Regen. Ther. 2017;7:80–81. doi: 10.1016/j.reth.2017.10.002. [PMC free article] [PubMed] [CrossRef] [Google Scholar]
9. Dohan DM, Choukroun J, Diss A, Dohan SL, Dohan AJ, Mouhyi J, et al. Platelet-rich fibrin (PRF): a second-generation platelet concentrate. Part II: platelet-related biologic features. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2006;101(3):e45–50.
10. Miron RJ, Fujioka-Kobayashi M, Hernandez M, Kandalam U, Zhang Y, Ghanaati S, et al. Injectable platelet rich fibrin (i- PRF): opportunities in regenerative dentistry? Clin Oral Investig. 2017;21(8):2619–27.
11. Kawase T, Kamiya M, Kobayashi M, Tanaka T, Okuda K, Wolff LF, et al. The heat-compression technique for the conversion of platelet- rich fibrin preparation to a barrier membrane with a reduced rate of biodegradation. J Biomed Mater Res B Appl Biomater. 2015;103:825– 31. doi:10.1002/jbm.b.33262.
12. Mourão C, Gheno E, Lourenço ES, Barbosa RDL, Kurtzman GM,
13. Javid K, et al. Characterization of a new membrane from concentrated growth factors associated with denaturized Albumin (Alb-CGF) for clinical applications: A preliminary study. Int J Growth Factors Stem Cells Dent. 2018;1:64.
14. Jung SY, Kim HY, Oh HJ, Choi E, Cho MS, Kim HS. Feasibility of autologous plasma gel for tonsil-derived stem cell therapeutics in hypoparathyroidism. Sci Rep. 2018;8:11896.

15. Doghaim NN, El-Tatawy RA, Neinaa YME. Assessment of the efficacy and safety of platelet poor plasma gel as autologous dermal filler for facial rejuvenation. J Cosmet Dermatol. 2019;18:1271–1279.
16. Fujioka-Kobayashi M, Schaller B, Mourão C, Zhang Y, Sculean A, Miron RJ. Biological characterization of an injectable platelet- rich fibrin mixture consisting of autologous albumin gel and liquid platelet-rich fibrin (Alb-PRF). Platelets. 2021;32(1):74–81.