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REVIEW ARTICLE

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Platelet-Rich Fibrin in Periodontal Regeneration

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Abstract

Background: Periodontal disease is multifactorial regarding potential etiological factors and modifiers of achieved therapeutic effects. The treatment of this disease has been a challenge for periodontists for years. In recent years, new methods have begun to be implemented to regenerate periodontal tissue. One of these methods is platelet-rich plasma therapy in regenerating periodontal tissue. This study aimed to assess the potential benefits of platelet-rich fibrin (PRF) in periodontal regeneration.

Material and Methods: An electronic literature search was conducted using the National Library of Medicine, PubMed/MEDLINE, and the Scopus database, covering articles published from 2000 to 2023. Keywords used included "platelet-rich fibrin (PRF)," "PRF in periodontology," "PRF on gingival recession," and "PRF in infrabony pocket." The articles were selected based on title and abstract, focusing on clinical applications of PRF in periodontology. Inclusion criteria encompassed case reports, case series, original research, review papers, and both in vitro and in vivo studies, including animal studies and controlled clinical trials.

Conclusion: The use of PRF in the treatment of periodontal diseases, especially advanced platelet-rich fibrin, offers additional benefits in periodontal regeneration. Simplicity in the preparation, minor interventions, cost efficiency, and favorable clinical results have made this treatment method attractive for the regeneration of gingival recessions and the treatment of bone defects. The relatively small volume of PRF obtained from a single blood sample and the dependence on accurate handling and preparation are limitations that must be considered.(**International Journal of Biomedicine. 2025;15(1):31-36.**)

Keywords: platelet-rich fibrin • periodontal disease • gingival recession

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Abbreviations

A-PRF, advanced platelet-rich fibrin; **CTG**, connective tissue graft; **DFDBA**, demineralized freeze-dried bone allograft; **L-PRF**, leukocyte- and platelet-rich fibrin; **OFD**, open flap debridement; **PRF**, platelet-rich fibrin; **PRP**, platelet-rich plasma; **SCTG**, subepithelial connective tissue graft.

Introduction

Periodontal disease is a complex, multifactorial disease characterized by the loss of connective tissue attachment with the destruction of periodontal tissues. The aim of periodontal therapy is to eliminate the inflammatory process, prevent the progression of periodontal disease, and regenerate the lost periodontal tissues. Periodontal regeneration is a complex multifactorial process involving biological events like cell adhesion, migration, proliferation, and differentiation in an orchestrated sequence.[1]

Periodontal regenerative procedures include soft tissue grafts, bone grafts, root biomodifications, guided tissue regeneration, and combinations of these procedures. The current perspective is that regenerative periodontal therapies can only restore a fraction of the original tissue volume [2] and

have a limited potential for complete periodontal restoration.[3] Often, tissues in the oral cavity are complex with bordering mineralized and soft tissue components, both of which harbor unique progenitor populations residing within specialized extracellular matrix frameworks.[4,5]

Mimicking such complex environments using chemically homogenous scaffolds and uniform stem cell populations is often challenging. Instead, recent approaches favor complex natural scaffolds that allow for repopulation with the patient's own cells, thereby producing an autologous tissue-engineered organ.[6]

One such complex natural scaffold ideally suited for autologous tissue regeneration is platelet-rich fibrin (PRF), a second-generation platelet concentrate developed as an improvement over the earlier introduced platelet-rich plasma (PRP) to aid tissue repair and regeneration.[7]

Platelets play a key role in wound healing, and hence, wound healing after periodontal treatment can be accelerated by the use of platelet concentrates. The wound healing process initiated by the formation of blood clots and after tissue injury in periodontal surgery causes adherence and aggregation of platelets, favoring the formation of thrombin and fibrin.[8]

The main aim of this review was to briefly describe the novel platelet concentrate PRF and its potential role in periodontal regeneration.

Material and Methods

An electronic literature search was conducted using the National Library of Medicine, PubMed/MEDLINE, and the Scopus database, covering articles published from 2000 to 2023. Keywords used included "PRF," "PRF in periodontology," "PRF on gingival recession," and "PRF in infrabony pocket." The articles were selected based on title and abstract, focusing on clinical applications of PRF in periodontology. Inclusion criteria encompassed case reports, case series, original research, review papers, and both in vitro and in vivo studies, including animal studies and controlled clinical trials.

Topics

Biological Aspects

Platelet-rich fibrin (PRF), classified as a leukocyte- and platelet-rich fibrin (L-PRF), often named Choukroun's PRF after its inventor, to avoid any confusion with other techniques using similar names such as Vivostat PRF (Vivolution, Alleroed, Denmark), a pure platelet-rich plasma (PRP) or Fibrine PRF (Cascade Medical, Wayne, NJ) matrix (without leukocyte).[9,10] Platelet-rich fibrin (PRF) belongs to the second-generation platelet concentrate, collecting on a single fibrin membrane containing constituents of blood samples favorable for healing and immunity.[11,12]

Platelet Concentrate Evolution

Kingsley in 1954 first used the term PRP to earmark thrombocyte concentrate during experiments related to blood coagulation.[13] In 1970, fibrin glue was introduced by Matras, which improved the healing of skin wounds in rat models. Fibrin glue was made by polymerizing fibrinogen with thrombin and calcium. However, due to the low concentration of fibrinogen in donor plasma, the quality and stability of fibrin glue were suboptimal.[14] Simultaneously, Choukroun et al., in 2000, developed another form of platelet concentrate in France, which was labeled as PRF, based on the strong fibrin gel polymerization found in this preparation. It was stamped as a "second-generation" platelet concentrate because it was obviously different from other PRPs. This proved an important milestone in the evolution of terminology.[7]

In 2009, Dohan Ehrenfest et al.[15] proposed the first classification of platelet concentrate. The authors classified the different platelet concentrates into four categories, depending on their leucocyte and fibrin content: "pure platelet-rich plasma (P-PRP), such as cell separator PRP, Vivostat PRF or Anitua's PRGF; leucocyte- and platelet-rich plasma (L-PRP), such as Curasan, Regen, Plateltex, SmartPReP, PCCS, Magellan or GPS PRP; pure plaletet-rich fibrin (P-PRF), such as Fibrinet; and leucocyte- and platelet-rich fibrin (L-PRF), such as Choukroun's PRF." A major advantage of PRF is that it has a simple preparation protocol.

Choukroun,[16] in 2014, introduced an advanced PRF called A-PRF (claimed to contain more monocytes).

Protocol of Preparation

The initial protocol for PRF production, introduced by Choukroun et al. in 2001, requires 10 mL of blood sample to be collected without anticoagulant in glass-coated plastic tubes, which is immediately subject to centrifugation at 2,700 rpm (around 400 g) for 12 min. The obtained PRF is usually termed Choukroun's PRF or leukocyte- and platelet-rich fibrin (L-PRF). However, the PRF protocol underwent several modifications in the last few years. These protocols led to the formation of various products with different biology and potential uses.[17]

Since it is well-known that high centrifugal forces shift cells to the bottom of the tube, it was proposed that decreased centrifugation speed may prevent cell loss and increase leukocyte number in the PRF matrix. Advanced PRF (A-PRF) was provided using a reduced centrifugal force of 1,500 rpm (230 g) for 14 min and glass-based vacuum tubes. The obtained A-PRF is richer in the total number of viable cells compared to the L-PRF. Among them, an increase in the number of neutrophils, lymphocytes, and platelets was observed.[18]

Production of A-PRF may also be obtained using the same centrifugation time (14 min) but with a centrifugation speed of 1,300 rpm (200 g), as was suggested later.[19]

Recent research provided a new protocol for a liquid variation of PRF called injectable PRF (i-PRF). This injectable form of PRF is produced by using blood without anticoagulant and centrifuged at 700 rpm (60 g) for 3 min in plastic tubes without any coatings.[20] Plastic tubes used in this protocol do not effectively activate the coagulation process since they possess hydrophobic surfaces.[21]

Advantages and Disadvantages in the Use of PRF

Some advantages are reported in the literature related to the use of PRF, such as the following: its preparation is

a simplified and efficient technique, with centrifugation in a single step, free and openly accessible for all clinicians.[22,23] Platelet-rich fibrin is obtained by an autologous blood sample,[24] and blood manipulation is minimized.[25] It does not require the addition of external thrombin because polymerization is a natural process without any risk of suffering from an immunological reaction.[25]

Platelet-rich fibrin has a natural fibrin framework with growth factors that may keep their activity relatively long and stimulate tissue regeneration effectively. Used as a membrane, it avoids a donor-site surgical procedure and results in a reduction in patient discomfort during the early wound-healing period.[26] The studies of platelet-rich fibrin present it to be more efficient and with less controversies on its final clinical results when compared to platelet-rich plasma.[27]

Platelet-rich fibrin may present some disadvantages: The final amount available is low because it is autologous blood.[28] The success of the PRF protocol depends directly on the handling, mainly related to blood collection time and its transference for the centrifuge.[29] A glass-coated tube is needed to achieve clot polymerization.[23]

Use of PRF in Gingival Recession

Gingival recession or soft tissue recession is defined as the displacement of the gingival margin apical to the cement-enamel junction (CEJ) of a tooth or the platform of a dental implant.[30,31]

This condition is associated with the loss of periodontal tissues, including gingiva, periodontal ligament, root cementum, and bone at dental sites, as well as the loss of mucosa and bone around dental implants. It has been suggested that the term 'periodontal recession' rather than 'gingival recession' would represent a more accurate definition of this condition at teeth.[32]

In the context of gingival recession therapy, the regenerative capacity of advanced platelet-rich fibrin (A-PRF) is applied to stimulate the growth of gingival tissues, promoting more proper wound healing and the restoration of a healthful periodontium.[32-35]

Clinical efficacy of subepithelial connective tissue graft and A-PRF in treating gingival recession was performed by Anegundi et al.[36] in 17 patients. The authors compared and evaluated subepithelial connective tissue graft (SCTG) and advanced platelet-rich fibrin (A-PRF) membrane-based root coverage in the treatment of gingival recession type 1 (RT1). Their study results suggested that both SCTG and A-PRF can be used in treating gingival recessions. However, SCTG was better for achieving root coverage and increasing keratinized tissue width.

Abu-Ta'a[37] compared the clinical outcomes of advanced platelet-rich fibrin (A-PRF) and connective tissue graft (CTG) in treating marginal tissue recessions. His study demonstrates that A-PRF and CTG effectively manage gingival recession defects. However, connective tissue graft resulted in better clinical outcomes in terms of reduction in recession height and width.

Tadepalli et al. compared the clinical efficacy of leukocyte platelet-rich fibrin (L-PRF) and advanced platelet-rich fibrin (A-PRF) in combination with coronally advanced flap (CAF) in the treatment of gingival recession defects. Based on the findings of this study, both L-PRF and A-PRF may be suggested as viable treatment options for managing gingival recession in the maxilla.[38]

Use of PRF for the Treatment of Periodontal Intrabony Defects

True and complete periodontal regeneration is complex since it involves a complex interaction of epithelium, gingival connective tissue, periodontal ligament, and alveolar bone. True periodontal regeneration should also include Sharpey's fibers spanning from the cementum through the periodontal ligament (PDL) and into the alveolar bundle bone. Many attempts utilizing various strategies, including bone grafts, barrier membranes, and biologic agents, have been proposed, yet to date, complete periodontal regeneration remains very challenging and unpredictable.[39] One strategy proposed several years ago to regenerate intrabony defects was platelet concentrates.[40]

In a study by Agarwal et al.,[41] 60 interproximal infrabony defects in 30 healthy, non-smoker patients diagnosed with chronic periodontitis were randomly assigned to PRF/demineralized freeze-dried bone allograft (DFDBA) group or the DFDBA/saline group. Compared with baseline, 12-month results indicated that both treatment modalities significantly changed all clinical and radiographic parameters. However, a combination of PRF and DFDBA was more effective than DFDBA with saline for treating infrabony periodontal defects.

Platelet-rich fibrin can be used with open flap debridement (OFD) to treat infrabony defects. In a study by Ajwani et al.,[42] the clinical efficacy of open flap debridement with or without platelet-rich fibrin in the treatment of intrabony defects was evaluated. It was found that adjunctive use of platelet-rich fibrin with open flap debridement significantly improves defect fill compared to v alone. Platelet-rich fibrin has consistently been showing regenerative potential; it is a simple, easy, and inexpensive biomaterial compared with bone grafts.

The same results were shown by Sharma & Pradeep.[43] Fifty-six intrabony defects were treated with either autologous platelet-rich fibrin with open flap debridement or open flap debridement alone. The researchers found more significant probing depth reduction, periodontal attachment level gain, and bone fill at sites treated with platelet-rich fibrin with conventional open flap debridement compared to conventionalopen flap debridement alone.

In a study by Martande et al.,[44] the combined efficacy of platelet-rich fibrin and 1.2% atorvastatin gel with open flap debridement in the treatment of intrabony defects in individuals with chronic periodontitis showed similar improvements in clinical parameters with a greater percentage of radiographic defect depth reduction compared with platelet-rich fibrin alone.

Autologous platelet-rich fibrin combined with bioactive glass was found to be more effective in gaining clinical attachment levels, reducing probing pocket depth, and achieving greater bone fill compared to treatment with bioactive glass alone in periodontal intrabony defects.[45]

Conclusion

The use of platelet-rich fibrin in the treatment of periodontal diseases, especially advanced platelet-rich fibrin, offers additional benefits in periodontal regeneration. Simplicity in the preparation, minor interventions, cost efficiency, and favorable clinical results have made this treatment method attractive for the regeneration of gingival recessions and the treatment of bone defects. Current studies, in vitro and in vivo, have confirmed safe and encouraging results related to using platelet-rich fibrin alone or in a mixture with other biomaterials. PRF treatment has several indications and advantages for periodontal tissue regeneration. It has been shown to improve and promote natural support for tissue healing. Although platelet-rich fibrin has shown favorable clinical results, challenges still exist in the efficiency of its application and in ensuring consistent and predictable results in different clinical situations. The relatively small volume of platelet-rich fibrin obtained from a single blood sample and the dependence on accurate handling and preparation are limitations that must be considered.

Competing Interests

The authors declare that they have no competing interests.

References

1. The potential role of growth and differentiation factors in periodontal regeneration. J Periodontol. 1996 May;67(5):545-53. PMID: 8724716.
2. Greenwell H; Committee on Research, Science and Therapy. American Academy of Periodontology. Position paper: Guidelines for periodontal therapy. J Periodontol. 2001 Nov;72(11):1624-8. doi: 10.1902/jop.2001.72.11.1624. PMID: 11759876.
3. Sander L, Karring T. Healing of periodontal lesions in monkeys following the guided tissue regeneration procedure. A histological study. J Clin Periodontol. 1995 Apr;22(4):332-7. doi: 10.1111/j.1600-051x.1995.tb00156.x. PMID: 7622641.
4. Dangaria SJ, Ito Y, Walker C, Druzinsky R, Luan X, Diekwisch TG. Extracellular matrix-mediated differentiation of periodontal progenitor cells. Differentiation. 2009 Sep-Oct;78(2-3):79-90. doi: 10.1016/j.diff.2009.03.005. Epub 2009 May 9. PMID: 19433344; PMCID: PMC2744845.
5. Dangaria SJ, Ito Y, Luan X, Diekwisch TG. Successful periodontal ligament regeneration by periodontal progenitor preseeding on natural tooth root surfaces. Stem Cells Dev. 2011 Oct;20(10):1659-68. doi: 10.1089/scd.2010.0431. Epub 2011 Mar 9. PMID: 21250830; PMCID: PMC3210028.
6. Hollander A, Macchiarini P, Gordijn B, Birchall M. The first stem cell-based tissue-engineered organ replacement: implications for regenerative medicine and society. Regen Med. 2009 Mar;4(2):147-8. doi: 10.2217/17460751.4.2.147. Retraction in: Regen Med. 2024 Nov;19(11):579. doi: 10.1080/17576180.2024.2413823. PMID: 19317632.
7. Choukroun J, Adda F, Schoeffer C, Vervelle A. PRF: An opportunity in perio-implantology. Implantodontie. 2000;42:55–62. [In French].
8. Chandran P, Sivadas A. Platelet-rich fibrin: Its role in periodontal regeneration. The Saudi Journal for Dental Research. 2014;5(2):117–122. doi:10.1016/j.ksujds.2013.09.001
9. Del Corso M, Sammartino G, Dohan Ehrenfest DM. Choukroun's platelet-rich fibrin membranes in periodontal surgery: Understanding the biomaterial or believing in the magic of growth factors? (letter to the editor) J Periodontol 2009; 80: 1694–1697; author reply 1697-1699.
10. Dohan Ehrenfest DM, Diss A, Odin G, Doglioli P, Hippolyte MP, Charrier JB. In vitro effects of Choukroun's PRF (platelet-rich fibrin) on human gingival fibroblasts, dermal prekeratinocytes, preadipocytes, and maxillofacial osteoblasts in primary cultures. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2009 Sep;108(3):341-52. doi: 10.1016/j.tripleo.2009.04.020. Epub 2009 Jul 9. PMID: 19589702.
11. Dohn D, Donsimoni J-M, Navarro G, Gaultier F. Platelet concentrates. Part I: Technologies. Implantodontie.2003;12:5–16.
12. Choukroun J, Diss A, Simonpieri A, Girard MO, Schoeffler C, Dohan SL, Dohan AJ, Mouhyi J, Dohan DM. Platelet-rich fibrin (PRF): a second-generation platelet concentrate. Part IV: clinical effects on tissue healing. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2006 Mar;101(3):e56-60. doi: 10.1016/j.tripleo.2005.07.011. PMID: 16504852.
13. KINGSLEY CS. Blood coagulation; evidence of an antagonist to factor VI in platelet-rich human plasma. Nature. 1954 Apr 17;173(4407):723-4. doi: 10.1038/173723a0. PMID: 13165629.
14. Matras H. Die Wirkungen verschiedener Fibrinpräparate auf Kontinuitätstrennungen der Rattenhaut [Effect of various fibrin preparations on reimplantations in the rat skin]. Osterr Z Stomatol. 1970 Sep;67(9):338-59. German. PMID: 4917644.
15. Dohan Ehrenfest DM, Rasmusson L, Albrektsson T. Classification of platelet concentrates: from pure platelet-rich plasma (P-PRP) to leucocyte- and platelet-rich fibrin (L-PRF). Trends Biotechnol. 2009 Mar;27(3):158-67. doi: 10.1016/j.tibtech.2008.11.009. Epub 2009 Jan 31. PMID: 19187989.
16. Choukroun J. Advanced PRF and i-PRF: Platelet concentrate or blood concentrate? J Periodontal Med Clin Pract. 2014;1:3.
17. Dohan Ehrenfest DM, Rasmusson L, Albrektsson T. Classification of platelet concentrates: from pure platelet-rich plasma (P-PRP) to leucocyte- and platelet-rich fibrin (L-PRF). Trends Biotechnol. 2009 Mar;27(3):158-67. doi: 10.1016/j.tibtech.2008.11.009. Epub 2009 Jan 31. PMID: 19187989.
18. Ghanaati S, Booms P, Orlowska A, Kubesch A, Lorenz J, Rutkowski J, Landes C, Sader R, Kirkpatrick C, Choukroun J. Advanced platelet-rich fibrin: a new concept for cell-based tissue engineering by means of inflammatory cells. J Oral Implantol. 2014 Dec;40(6):679-89. doi: 10.1563/aaid-joi-D-14-00138. PMID: 24945603.
19. Fujioka-Kobayashi M, Miron RJ, Hernandez M,

Kandalam U, Zhang Y, Choukroun J. Optimized Platelet-Rich Fibrin With the Low-Speed Concept: Growth Factor Release, Biocompatibility, and Cellular Response. J Periodontol. 2017 Jan;88(1):112-121. doi: 10.1902/jop.2016.160443. Epub 2016 Sep 2. PMID: 27587367.

20. Mourão CF, Valiense H, Melo ER, Mourão NB, Maia MD. Obtention of injectable platelets rich-fibrin (i-PRF) and its polymerization with bone graft: technical note. Rev Col Bras Cir. 2015 Nov-Dec;42(6):421-3. English, Portuguese. doi: 10.1590/0100-69912015006013. PMID: 26814997.

21. Bowen RA, Remaley AT. Interferences from blood collection tube components on clinical chemistry assays. Biochem Med (Zagreb). 2014 Feb 15;24(1):31-44. doi: 10.11613/BM.2014.006. PMID: 24627713; PMCID: PMC3936985.

22. Simonpieri A, Del Corso M, Vervelle A, Jimbo R, Inchingolo F, Sammartino G, Dohan Ehrenfest DM. Current knowledge and perspectives for the use of platelet-rich plasma (PRP) and platelet-rich fibrin (PRF) in oral and maxillofacial surgery part 2: Bone graft, implant and reconstructive surgery. Curr Pharm Biotechnol. 2012 Jun;13(7):1231-56. doi: 10.2174/138920112800624472. PMID: 21740370.

23. Dohan DM, Del Corso M, Charrier J-B. Cyto-toxicity analyses of Choukroun's platelet-rich fibrin (PRF) on a wide range of human cells: The answer to a commercial controversy. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2007;103:587–593

24. Choukroun J, Diss A, Simonpieri A, Girard MO, Schoeffler C, Dohan SL, Dohan AJ, Mouhyi J, Dohan DM. Platelet-rich fibrin (PRF): a second-generation platelet concentrate. Part IV: clinical effects on tissue healing. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2006 Mar;101(3):e56-60. doi: 10.1016/j.tripleo.2005.07.011. PMID: 16504852.

25. Kang YH, Jeon SH, Park JY, Chung JH, Choung YH, Choung HW, Kim ES, Choung PH. Platelet-rich fibrin is a Bioscaffold and reservoir of growth factors for tissue regeneration. Tissue Eng Part A. 2011 Feb;17(3-4):349-59. doi: 10.1089/ten.TEA.2010.0327. Epub 2010 Dec 31. PMID: 20799908.

26. Wu CL, Lee SS, Tsai CH, Lu KH, Zhao JH, Chang YC. Platelet-rich fibrin increases cell attachment, proliferation and collagen-related protein expression of human osteoblasts. Aust Dent J. 2012 Jun;57(2):207-12. doi: 10.1111/j.1834-7819.2012.01686.x. PMID: 22624763.

27. Anegundi RV, Shenoy SB, Chandran T, Pampani P. Clinical efficacy of subepithelial connective tissue graft and A-PRF in the treatment of gingival recession. Quintessence Int. 2023 Feb 10;54(2):134-141. doi: 10.3290/j.qi.b3512389. PMID: 36421044.

28. Simonpieri A, Del Corso M, Vervelle A, Jimbo R, Inchingolo F, Sammartino G, Dohan Ehrenfest DM. Current knowledge and perspectives for the use of platelet-rich plasma (PRP) and platelet-rich fibrin (PRF) in oral and maxillofacial surgery part 2: Bone graft, implant and reconstructive surgery. Curr Pharm Biotechnol. 2012 Jun;13(7):1231-56. doi: 10.2174/138920112800624472. PMID: 21740370.

29. Choukroun J, Diss A, Simonpieri A, Girard MO, Schoeffler C, Dohan SL, Dohan AJ, Mouhyi J, Dohan DM. Platelet-rich fibrin (PRF): a second-generation platelet concentrate. Part IV: clinical effects on tissue healing. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2006 Mar;101(3):e56-60. doi: 10.1016/j.tripleo.2005.07.011. PMID: 16504852.

30. Pini Prato G. Mucogingival deformities. Ann Periodontol. 1999 Dec;4(1):98-101. doi: 10.1902/annals.1999.4.1.98. PMID: 10863381.

31. AAP's Glossary of Periodontal Terms. Available from: https://members.perio.org/libraries/glossary?ssopc=1. Accessed 6 December 2019.

32. Starzyńska A, Kaczoruk-Wieremczuk M, Lopez MA, Passarelli PC, Adamska P. The Growth Factors in Advanced Platelet-Rich Fibrin (A-PRF) Reduce Postoperative Complications after Mandibular Third Molar Odontectomy. Int J Environ Res Public Health. 2021 Dec 18;18(24):13343. doi: 10.3390/ijerph182413343. PMID: 34948953; PMCID: PMC8702191.

33. Tadepalli A, Chekurthi S, Kavassery Balasubramanian S, Parthasarathy H, Ponnaiyan D. Comparative Evaluation of Clinical Efficacy of Leukocyte-Rich Platelet-Rich Fibrin with Advanced Platelet-Rich Fibrin in Management of Gingival Recession Defects: A Randomized Controlled Trial. Med Princ Pract. 2022;31(4):376-383. doi: 10.1159/000525560. Epub 2022 Jun 21. PMID: 35728577; PMCID: PMC9485915.

34. Ghanaati S, Booms P, Orlowska A, Kubesch A, Lorenz J, Rutkowski J, Landes C, Sader R, Kirkpatrick C, Choukroun J. Advanced platelet-rich fibrin: a new concept for cell-based tissue engineering by means of inflammatory cells. J Oral Implantol. 2014 Dec;40(6):679-89. doi: 10.1563/aaid-joi-D-14-00138. PMID: 24945603.

35. Öngöz Dede F, Bozkurt Doğan Ş, Çelen K, Çelen S, Deveci ET, Seyhan Cezairli N. Comparison of the clinical efficacy of concentrated growth factor and advanced platelet-rich fibrin in the treatment of type I multiple gingival recessions: a controlled randomized clinical trial. Clin Oral Investig. 2023 Feb;27(2):645-657. doi: 10.1007/s00784-022-04775-5. Epub 2022 Nov 19. PMID: 36401070.

36. Anegundi RV, Shenoy SB, Chandran T, Pampani P. Clinical efficacy of subepithelial connective tissue graft and A-PRF in the treatment of gingival recession. Quintessence Int. 2023 Feb 10;54(2):134-141. doi: 10.3290/j.qi.b3512389. PMID: 36421044.

37. Abu-Ta'a M. Advanced Platelet-Rich Fibrin and Connective Tissue Graft for Treating Marginal Tissue Recessions: A Randomized, Controlled Split-Mouth Study. Cureus. 2023 Mar 4;15(3):e35761. doi: 10.7759/cureus.35761. PMID: 36879584; PMCID: PMC9985511.

38. Tadepalli A, Chekurthi S, Kavassery Balasubramanian S, Parthasarathy H, Ponnaiyan D. Comparative Evaluation of Clinical Efficacy of Leukocyte-Rich Platelet-Rich Fibrin with Advanced Platelet-Rich Fibrin in Management of Gingival Recession Defects: A Randomized Controlled Trial. Med Princ Pract. 2022;31(4):376-383. doi: 10.1159/000525560. Epub 2022 Jun 21. PMID: 35728577; PMCID: PMC9485915.

39. Bosshardt DD, Sculean A. Does periodontal tissue regeneration really work? Periodontol 2000. 2009;51:208-19. doi: 10.1111/j.1600-0757.2009.00317.x. PMID: 19878476.

40. Miron RJ, Zucchelli G, Pikos MA, Salama M, Lee S, Guillemette V, Fujioka-Kobayashi M, Bishara M, Zhang Y, Wang HL, Chandad F, Nacopoulos C, Simonpieri A, Aalam AA, Felice P, Sammartino G, Ghanaati S, Hernandez MA, Choukroun J. Use of platelet-rich fibrin in regenerative dentistry: a systematic review. Clin Oral Investig. 2017 Jul;21(6):1913-1927. doi: 10.1007/s00784-017-2133-z. Epub 2017 May 27. PMID: 28551729.
41. Agarwal A, Gupta ND, Jain A. Platelet rich fibrin combined with decalcified freeze-dried bone allograft for the treatment of human intrabony periodontal defects: a randomized split mouth clinical trail. Acta Odontol Scand. 2016;74(1):36-43. doi: 10.3109/00016357.2015.1035672. Epub 2015 May 14. PMID: 25972081.
42. Ajwani H, Shetty S, Gopalakrishnan D, Kathariya R, Kulloli A, Dolas RS, Pradeep AR. Comparative evaluation of platelet-rich fibrin biomaterial and open flap debridement in the treatment of two and three wall intrabony defects. J Int Oral Health. 2015 Apr;7(4):32-7. PMID: 25954068; PMCID: PMC4409793.
43. Sharma A, Pradeep AR. Treatment of 3-wall intrabony defects in patients with chronic periodontitis with autologous platelet-rich fibrin: a randomized controlled clinical trial. J Periodontol. 2011 Dec;82(12):1705-12. doi: 10.1902/jop.2011.110075. Epub 2011 Apr 5. PMID: 21513477.
44. Martande SS, Kumari M, Pradeep AR, Singh SP, Suke DK, Guruprasad CN. Platelet-Rich Fibrin Combined With 1.2% Atorvastatin for Treatment of Intrabony Defects in Chronic Periodontitis: A Randomized Controlled Clinical Trial. J Periodontol. 2016 Sep;87(9):1039-46. doi: 10.1902/jop.2016.150306. Epub 2016 Jun 13. PMID: 27294433.
45. Bodhare GH, Kolte AP, Kolte RA, Shirke PY. Clinical and radiographic evaluation and comparison of bioactive bone alloplast morsels when used alone and in combination with platelet-rich fibrin in the treatment of periodontal intrabony defects-A randomized controlled trial. J Periodontol. 2019 Jun;90(6):584-594. doi: 10.1002/JPER.18-0416. Epub 2018 Dec 14. PMID: 30488952.

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