

Review Article

Efficacy of injectable platelet-rich fibrin (i-PRF) in gingival recession coverage: a narrative review

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ABSTRACT

Gingival recession presents significant esthetic, functional, and structural challenges in periodontology. While subepithelial connective tissue grafts (SCTGs) remain the gold standard for root coverage, their application is limited by donor site morbidity and tissue availability. This systematic review comprehensively evaluates the biological profile and clinical efficacy of injectable platelet-rich fibrin (i-PRF) as a primary or adjunctive therapy for gingival recession coverage. By analyzing the synergistic effects of i-PRF with connective tissue grafts, collagen membranes, free gingival grafts, and standalone semisurgical methodologies, this review demonstrates that i-PRF significantly enhances keratinized tissue width and thickness, accelerates neo-angiogenesis, and provides predictable root coverage while minimizing postoperative morbidity.

Keywords: i-PRF, Periodontal plastic surgery, Recession coverage

INTRODUCTION

Gingival recession, defined as the apical migration of the gingival margin toward the cemento-enamel junction, leads to the exposure of root surfaces, causing dentinal hypersensitivity, impaired esthetics, and increased susceptibility to root caries.^{1,2} The etiology of gingival recession is highly multifactorial, associated with anatomical predispositions such as a thin periodontal phenotype, aberrant frenal attachments, and prominent roots, alongside iatrogenic or environmental factors like traumatic toothbrushing and periodontal disease.³⁻⁵

The primary objective of periodontal plastic surgery is to achieve predictable, long-term root coverage and soft tissue augmentation.⁶ Historically, subepithelial connective tissue grafts (SCTGs) and coronally advanced flaps (CAF) have been considered the gold standard for treating Miller Class I and II (or Cairo RT1) recessions due

to their functional and cosmetic predictability.^{6,7} However, the use of autogenous grafts invariably requires a second surgical donor site, most commonly the palate, which severely restricts the volume of available tissue and significantly increases postoperative patient morbidity, pain, and surgical time.^{7,8}

To circumvent the limitations of autogenous tissue harvesting, autologous platelet concentrates (APCs) have gained immense traction in regenerative dentistry. First-generation platelet-rich plasma (PRP) utilized anticoagulants, which inadvertently inhibited the natural clotting cascade required for optimal tissue healing.⁹ The subsequent development of Platelet-Rich Fibrin (PRF) completely eschewed anticoagulants, allowing for the formation of a natural, three-dimensional fibrin matrix that acts as a scaffold for tissue repopulation.¹⁰⁻¹² Recent advancements in centrifugation technology have led to the isolation of an entirely liquid, injectable formulation of

PRF (i-PRF), which bypasses early encapsulation to deliver a highly concentrated, dynamic hydrogel of regenerative cells directly into the periodontal microenvironment.^{13,14} This review critically synthesizes the current literature to establish the clinical efficacy of i-PRF in the management of gingival recessions.

Biological profile and the "Slow Speed Concept"

The remarkable regenerative capabilities of i-PRF are fundamentally governed by its preparation protocol, characterized by the "slow speed concept".¹⁵ High-speed centrifugation forces, commonly used in early PRF protocols, inadvertently push the majority of regenerative platelets and leukocytes into the dense red blood cell layer, excluding them from the usable biomaterial.¹⁶ By systematically reducing both the relative centrifugal force (RCF) and the centrifugation time such as operating at 700 rpm (60g) for 3 minutes or 300 RCF for 5 minutes i-PRF is successfully isolated as a liquid concentrate rich in viable cells.¹⁷⁻²⁰

Because i-PRF is not subjected to anticoagulants, it initiates a natural coagulation cascade shortly after injection (typically within 15–20 minutes), transforming into a "dynamic hydrogel" inside the host tissue.²¹ This dynamic gel traps leukocytes and platelets, facilitating the sustained, slow release of supra-physiological levels of growth factors over a period exceeding 10 days.^{22,23}

Key bioactive molecules inherent to i-PRF include: Vascular Endothelial Growth Factor (VEGF): A primary catalyst for accelerated angiogenesis, essential for restoring blood supply to avascular graft materials and denuded root surfaces.²⁴ Platelet-Derived Growth Factor (PDGF): A potent mitogen that drives cellular recruitment, mesenchymal stem cell migration, and early tissue regeneration.²⁵ Transforming Growth Factor-Beta 1 (TGF- β 1): Critical for stimulating fibroblast proliferation, extracellular matrix synthesis, and the deposition of type I collagen.²⁵

Additionally, the enriched presence of leukocytes in i-PRF directs immune regulation, exerts anti-infectious/antibacterial properties, and crucially directs tissue remodeling, rendering i-PRF an unparalleled biological adjunct in periodontal plastic surgery.²⁶

CLINICAL EFFICACY OF I-PRF IN ROOT COVERAGE

Synergistic application with connective tissue grafts (CTG)

While CTG remains the gold standard, the integration of i-PRF profoundly elevates its biological integration and clinical success. In a randomized controlled trial by Mahmoud et al. focusing on the treatment of Cairo class I (RT1) gingival recessions via the tunnel technique, CTGs were immersed in i-PRF prior to placement.²⁷ The

adjunctive use of i-PRF resulted in statistically superior improvements in Keratinized Tissue Height (KTH), Mean Root Coverage (MRC), and significant reductions in Recession Depth (RD) when compared to CTG therapy alone at 6 months.²⁷ Crucially, this study provided molecular validation for the visual clinical success: immunohistochemical analysis demonstrated that CTGs immersed in i-PRF expressed significantly higher levels of VEGF A and TGF β 1.²⁷ This molecular upregulation confirms that i-PRF directly stimulates accelerated neo-angiogenesis and fibrogenesis at the cellular level, overcoming the inherently poor vascular supply of denuded root surfaces and expediting the integration of the graft.

Combination with collagen membranes (CM) and the VISTA technique

The use of resorbable collagen membranes (CM) mitigates the need for autogenous donor tissue by acting as a semipermeable barrier that prevents epithelial downgrowth while encouraging connective tissue regeneration.^{28,29} However, collagen alone lacks intrinsic cellular bioactivity. By pairing CM with i-PRF, clinicians can transform an inert scaffold into a highly bioactive matrix.

A highly robust split-mouth randomized controlled clinical trial by Patra et al. evaluated this combination using the minimally invasive Vestibular Incision Subperiosteal Tunnel Access (VISTA) technique.³⁰ The VISTA approach avoids papillary reflection and minimizes marginal tissue trauma, ensuring unhampered blood supply. In the test group, collagen membranes were soaked in i-PRF for 10 minutes prior to subperiosteal placement, and additional i-PRF was injected directly into the local periodontal ligament and facial gingiva.

The trial reported remarkable, statistically significant superiorities for the i-PRF + CM group across multiple critical parameters at the 6-month follow-up include; Recession depth (RD): Reduced to 0.9 ± 0.64 mm in the test group versus 1.3 ± 0.57 mm in the control group ($p=0.04$).

Recession width (RW): Shrunk to 1.65 ± 1.04 mm compared to 2.55 ± 0.75 mm in the control ($p=0.001$).

Keratinized tissue width (KTW) and thickness (KTT): Both showed massive gains. KTT measured 2.46 ± 0.25 mm in the i-PRF group versus 1.91 ± 0.16 mm in the control ($p=0.001$), indicating profound soft tissue volumization.

Percentage of root coverage: The i-PRF enriched sites achieved a 67% overall root coverage rate at 6 months, dramatically outperforming the 53.95% coverage observed with collagen membranes alone.

The authors attributed this success to i-PRF acting as a chemoattractant, enriching the membrane with regenerative cells and heavily stimulating localized wound

healing through mesial and distal periodontal ligament injections.

Papilla augmentation and integration with free gingival grafts (FGG)

The reconstruction of the interdental papilla (the "black triangle" defect) is notoriously one of the most unpredictable and challenging procedures in periodontics due to the incredibly restricted and complex avascular anatomy of the interdental space.^{31,32} Because free grafts struggle to survive in this zone, i-PRF presents an elegant alternative.

Oswal et al documented a complex case of Miller class III gingival recession complicated by severe interdental papilla loss.³³ Following initial vestibuloplasty and an FGG to increase the base of attached gingiva, the papilla reconstruction was driven entirely by i-PRF. Commencing 3 months post-FGG, i-PRF was injected directly into the connective tissue of the interdental papilla using a one-point injection technique, repeated for a total of 6 sessions at 15-day intervals. This sustained administration of liquid growth factors profoundly stimulated the local tissues, resulting in an improvement of the papilla index score (PIS) to a level 3, completely harmonizing the interproximal embrasure space without the need for invasive secondary grafting.

Novel semi-surgical and standalone applications in thin periodontal phenotypes

Patients possessing a thin periodontal phenotype (gingival thickness <0.8 mm) are at severe risk for progressive gingival recession, and classical periodontal plastic surgery in these areas often yields unpredictable outcomes or flap dehiscence.^{5,34} Taking advantage of the unique liquid nature of i-PRF, Alan et al investigated a completely graft-free, semi-surgical approach to thicken the gingiva and cover recession defects.³⁵

Utilizing the VISTA technique to carefully elevate the periosteum and create a subperiosteal pocket, the investigators allowed a natural blood clot to stabilize for 30 minutes, followed by direct i-PRF injections into the newly created space. Crucially, this i-PRF application was repeated in 4 sessions at 10-day intervals to sustain the angiogenic and histo-conductive microenvironment. The results of this 6-month prospective study shifted paradigms regarding non-grafted recession coverage include; Gingival thickness (GT): A statistically significant increase in GT was observed in 92.5% of the treated regions, with 44.9% achieving the highly desirable thick phenotype (≥ 0.8 mm).

Recession defect resolution: In the active gingival recession sites, 83.3% experienced a significant reduction in defect size, with 60% of these areas achieving complete (100%) root coverage.

This methodology proves that by continually saturating a minimally invasive subperiosteal envelope with i-PRF, clinicians can induce profound histoconduction and tissue volumization using entirely autogenous, liquid biologic material, bypassing the need for solid grafts entirely.

The integration of i-PRF into periodontal plastic surgery marks a profound biological leap over traditional mucogingival techniques. The limitation of early solid PRF membranes was their inability to be injected or deeply integrated into complex anatomical defects without physically displacing the flap. By utilizing hydrophobic centrifugation environments and low-speed separation, i-PRF maintains a transient liquid state that perfectly permeates structural scaffolds (like collagen membranes and CTGs) before transitioning into a dynamic hydrogel.^{14,29}

The data consistently illustrate that i-PRF exerts a synergistic effect. When combined with CTGs or CMs, it effectively nullifies the primary cause of graft failure avascular necrosis by instantly bathing the site in VEGF and PDGF, sparking early and aggressive neo-angiogenesis.^{22,27} As demonstrated by Patra et al the structural lattice of a collagen membrane paired with the cellular hyperactivity of i-PRF generates massive improvements in keratinized tissue thickness (2.46 mm vs 1.91 mm) and vastly superior root coverage (67% vs 54%).

Furthermore, the advent of repetitive i-PRF injection protocols (as utilized by Oswal et al. for papillae and Alan et al. for thin phenotypes) represents a new frontier in "semisurgical" periodontics. Periodontists can now bio-modulate the local tissue environment post-operatively. By re-injecting the site at 10-to-15 day intervals, the local tissue is continuously saturated with TGF- β 1 and leukocytes, forcing the continuous synthesis of collagen and the thickening of the lamina propria without reopening the surgical flap.³⁶

CONCLUSION

Based on our extensive review of the clinical and histological evidence, injectable Platelet-Rich Fibrin (i-PRF) represents a highly predictable, biologically superior, and minimally invasive modality for the treatment of gingival recession. Prepared via the "slow speed concept," i-PRF retains exceptionally high concentrations of leukocytes and regenerative growth factors. Whether deployed as an active soak for autogenous connective tissue grafts, integrated as a chemoattractant into resorbable collagen membranes, or injected iteratively in standalone semisurgical tunneling procedures, i-PRF aggressively promotes rapid angiogenesis, massively improves keratinized tissue thickness, and statistically maximizes the percentage of overall root coverage. It stands as a vital autologous adjunct to minimize patient morbidity while achieving optimal esthetic and structural periodontal regeneration.

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REFERENCES

- Rodas MAR, de Paula BL, Pazmiño VFC, Lot Vieira FFDS, Santiago Junior JF, Silveira EMV. Platelet-rich fibrin in coverage of gingival recession: a systematic review and meta-analysis. *Eur J Dent.* 2020;14(2):315-26.
- Marschner F, Lechte C, Kanzow P, Hráský V, Pfister W. Systematic review and meta-analysis on prevalence and risk factors for gingival recession. *J Dent.* 2025;155:105645.
- Mythri S, Arunkumar SM, Hegde S, Rajesh SK, Munaz M, Ashwin D. Etiology and occurrence of gingival recession: an epidemiological study. *J Indian Soc Periodontol.* 2015;19(6):671-5.
- Löe H, Anerud A, Boysen H. The natural history of periodontal disease in man: prevalence, severity, and extent of gingival recession. *J Periodontol.* 1992;63(6):489-95.
- Manchala SR, Vandana KL, Mandalapu NB, Mannem S, Dwarakanath CD. Epidemiology of gingival recession and risk indicators in dental hospital population of Bhimavaram. *J Int Soc Prev Community Dent.* 2012;2(2):69-74.
- Chambrone L, Salinas Ortega MA, Sukekava F, Rotundo R, Kalemaj Z, Buti J, et al. Root coverage procedures for treating localised and multiple recession-type defects. *Cochrane Database Syst Rev.* 2018;10(10):CD007161.
- Green E, Lari E, Klokkevold PR. Autogenous soft tissue grafting for the treatment of gingival recession. *J Calif Dent Assoc.* 2018;46(10):625-37.
- Stefanini M, Marzadori M, Aroca S, Felice P, Sangiorgi M, Zucchelli G. Decision making in root-coverage procedures for the esthetic outcome. *Periodontol 2000.* 2018;77(1):54-64.
- Calciolari E, Dourou M, Akcali A, Donos N. Differences between first- and second-generation autologous platelet concentrates. *Periodontol 2000.* 2025;97(1):52-73.
- Pavlovic V, Ciric M, Jovanovic V, Trandafilovic M, Stojanovic P. Platelet-rich fibrin: basics of biological actions and protocol modifications. *Open Med (Wars).* 2021;16(1):446-54.
- Dohan DM, Choukroun J, Diss A, Dohan SL, Dohan AJ, Mouhyi J, et al. 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(3):e37-44.
- Narayanaswamy R, Patro BP, Jeyaraman N, Gangadaran P, Rajendran RL, Nallakumarasamy A, et al. Evolution and clinical advances of platelet-rich fibrin in musculoskeletal regeneration. *Bioengineering (Basel).* 2023;10(1):58.
- Miron RJ, Gruber R, Farshidfar N, Sculean A, Zhang Y. Ten years of injectable platelet-rich fibrin. *Periodontol 2000.* 2024;94(1):92-113.
- Miron RJ, Chai J, Fujioka-Kobayashi M, Sculean A, Zhang Y. Evaluation of 24 protocols for the production of platelet-rich fibrin. *BMC Oral Health.* 2020;20(1):310.
- Shirbhate U, Bajaj P, Wanjari M, Patil M. Role of injectable platelet-rich fibrin in the management of soft and hard tissue periodontal regeneration in dentistry: protocol for a systematic review. *JMIR Res Protoc.* 2025;14:e65137.
- Bunyatratchata O, Nimlamool W, Sangin S. The impact of centrifugation devices and collection tubes on fibrin characteristics and growth factor release under high- and low-speed protocols. *Dent J (Basel).* 2025;13(10):476.
- Idris MI, Burhan AS, Hajeer MY, Sultan K, Nawaya FR. Efficacy of the injectable platelet-rich fibrin (i-PRF) in gingival phenotype modification: a systematic review and meta-analysis of randomized controlled trials. *BMC Oral Health.* 2024;24(1):1331.
- Wend S, Kubesch A, Orłowska A, Al-Maawi S, Zender N, Dias A, et al. Reduction of the relative centrifugal force influences cell number and growth factor release within injectable PRF-based matrices. *J Mater Sci Mater Med.* 2017;28(12):188.
- Uyeda FH, Quilles Vargas G, Matias Malavazi L, Tiemi Macedo T, Paim de Abreu Paulo Gomes A, Rocha Bueno M, et al. Platelet-rich fibrin obtained from different protocols affects the formation of the in vitro multispecies subgingival biofilm associated with periodontitis. *J Oral Microbiol.* 2025;17(1):2445598.
- Gollapudi M, Bajaj P, Oza RR. Injectable platelet-rich fibrin—a revolution in periodontal regeneration. *Cureus.* 2022;14(8):e28647.
- Costa FR, de Souza SAL, Martins RA, Costa BR, Pires L, de Macedo AP, et al. The role of injectable platelet-rich fibrin in orthopedics: where do we stand? *Curr Issues Mol Biol.* 2025;47(4):239.
- Alsabri GA, van der Horst F, Alkaabi SA, Alavi SA, Forouzanfar T, Helder MN. Evaluating growth-factor release in leukocyte- and platelet-rich fibrin, advanced platelet-rich fibrin, and injectable platelet-rich fibrin protocols: a narrative review. *Growth Factors.* 2024;42(4):216-228.
- Pall E, Roman A, Olah D, Beteg FI, Cenariu M, Spînu M. Enhanced bioactive potential of functionalized injectable platelet-rich plasma. *Molecules.* 2023;28(4):1943.
- Jia K, You J, Zhu Y, Li M, Chen S, Ren S, et al. Platelet-rich fibrin as an autologous biomaterial for bone regeneration: mechanisms, applications, optimization. *Front Bioeng Biotechnol.* 2024;12:1286035.
- Lodyga M, Hinz B. TGF- β 1—a truly transforming growth factor in fibrosis and immunity. *Semin Cell Dev Biol.* 2020;101:123-39.
- Tsang NCW, Acharya A, Pelekos G. In vitro evaluation of the antibacterial properties and cellular

- response of liquid-leukocyte platelet-rich fibrin products on barrier membranes: a pilot study. *Dent J (Basel)*. 2025;13(6):228.
27. 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;15(3):e35761.
 28. Abtahi S, Chen X, Shahabi S, Nasiri N. Resorbable membranes for guided bone regeneration: critical features, potentials, and limitations. *ACS Mater Au*. 2023;3(5):394-417.
 29. Zhou Z, Yun J, Li J, Chen Y, Duan T, Wang L, et al. Comparison of the efficacy of different biodegradable membranes in guided bone/tissue regeneration: a systematic review and network meta-analysis. *Biomed Mater*. 2023;18(3).
 30. Patra L, Raj SC, Katti N, Mohanty D, Pradhan SS, Tabassum S, et al. Comparative evaluation of effect of injectable platelet-rich fibrin with collagen membrane compared with collagen membrane alone for gingival recession coverage. *World J Exp Med*. 2022;12(4):68-91.
 31. Barakat SO. Interdental papilla recession and reconstruction of the lost triangle: a review of the current literature. *Front Dent Med*. 2025;5:1537452.
 32. Patel M, Guni A, Nibali L, Garcia-Sanchez R. Interdental papilla reconstruction: a systematic review. *Clin Oral Investig*. 2024;28(1):101.
 33. Oswal PU, Kour P. Free gingival graft along with i-PRF for recession coverage and interdental papilla augmentation: a case report. *IOSR J Dent Med Sci*. 2020;19(6 Ser 9):22-7.
 34. Zhao H, Zhang L, Li H, Hicawy A, Shen Y, Liu H. Gingival phenotype determination: cutoff values, relationship between gingival and alveolar crest bone thickness at different landmarks. *J Dent Sci*. 2023;18(4):1544-52.
 35. Alan R, Ercan E, Firatli Y, Firatli E, Tunali M. Innovative i-PRF semisurgical method for gingival augmentation and root coverage in thin periodontal phenotypes: a preliminary study. *Quintessence Int*. 2023;54(9):734-43.
 36. Mancini L, Romandini M, Fratini A, Americo LM, Panda S, Marchetti E. Biomaterials for periodontal and peri-implant regeneration. *Materials (Basel)*. 2021;14(12):3319.

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