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PLATELET-RICH FIBRIN AND CONNECTIVE TISSUE GRAFTS IN PERI-IMPLANT SOFT TISSUE AUGMENTATION: CURRENT EVIDENCE AND CLINICAL PERSPECTIVES

FIBRINA RICA EM PLAQUETAS E ENXERTOS DE TECIDO CONJUNTIVO NA AUMENTAÇÃO DE TECIDO MOLE PERI-IMPLANTE: EVIDÊNCIAS ATUAIS E PERSPECTIVAS CLÍNICAS

FIBRINA RICA EN PLAQUETAS E INJERTOS DE TEJIDO CONECTIVO EN LA AUMENTO DE TEJIDO BLANDO PERIIMPLANTARIO: EVIDENCIA ACTUAL Y PERSPECTIVAS CLÍNICAS

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ABSTRACT

Objective: To critically review the current evidence regarding the use of platelet-rich fibrin (PRF) in combination with connective tissue grafts (CTGs) for peri-implant soft tissue augmentation, focusing on biological mechanisms, clinical outcomes, and potential advantages over conventional approaches. Methodology: A narrative review was conducted using studies published in peer-reviewed journals addressing PRF applications in implant dentistry and peri-implant soft tissue management. Clinical trials, systematic reviews, meta-analyses, and experimental studies evaluating soft tissue thickness, keratinized mucosa width, esthetic outcomes, healing patterns, and patient-reported outcomes were considered. Results: Current evidence suggests that CTGs remain the gold standard for peri-implant soft tissue augmentation due to their predictable ability to increase soft tissue volume and improve peri-implant esthetics. PRF has emerged as a promising autologous biomaterial capable of releasing growth factors, cytokines, and bioactive molecules that support angiogenesis, fibroblast proliferation, collagen synthesis, and wound healing. Studies indicate that PRF may enhance early healing, reduce postoperative discomfort, and improve soft tissue maturation

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when used adjunctively with CTGs. Furthermore, PRF membranes may contribute to better vascularization of grafted tissues and potentially decrease donor-site morbidity. However, heterogeneity in PRF preparation protocols and variations in clinical methodologies limit the comparability of available studies. Long-term evidence remains scarce, and the superiority of PRF-enhanced procedures over conventional CTG techniques has not been definitively established. Conclusion: The combination of PRF and CTGs represents a biologically plausible and clinically promising strategy for peri-implant soft tissue augmentation. While preliminary findings indicate potential benefits in healing and patient comfort, further standardized clinical trials with long-term follow-up are necessary to clarify the magnitude of these advantages and establish evidence-based protocols.

Keywords: Platelet-rich Fibrin. Connective Tissue Graft. Dental Implants. Soft Tissue Augmentation. Peri-implant Tissues.

RESUMO

Objetivo: Revisar criticamente a evidência atual sobre o uso de fibrina rica em plaquetas (PRF) em combinação com enxertos de tecido conjuntivo (ETC) para aumentação de tecido mole peri-implante, focando em mecanismos biológicos, resultados clínicos e possíveis vantagens sobre abordagens convencionais. Metodologia: Uma revisão narrativa foi conduzida utilizando estudos publicados em periódicos revisados por pares abordando aplicações de PRF em implantodontia e gerenciamento de tecido mole peri-implante. Ensaios clínicos, revisões sistemáticas, meta-análises e estudos experimentais avaliando espessura de tecido mole, largura de mucosa queratinizada, resultados estéticos, padrões de cicatrização e desfechos relatados pelos pacientes foram considerados. Resultados: A evidência atual sugere que ETC permanecem o padrão ouro para aumentação de tecido mole peri-implante devido à sua capacidade previsível de aumentar o volume de tecido mole e melhorar a estética peri-implante. A PRF emergiu como um biomaterial autólogo promissor capaz de liberar fatores de crescimento, citocinas e moléculas bioativas que suportam angiogênese, proliferação de fibroblastos, síntese de colágeno e cicatrização de feridas. Estudos indicam que a PRF pode aumentar a cicatrização precoce, reduzir o desconforto pós-operatório e melhorar a maturação do tecido mole quando usada de forma adjunta com ETC. Além disso, membranas de PRF podem contribuir para melhor vascularização de tecidos enxertados e potencialmente diminuir a morbidade do sítio doador. No entanto, a heterogeneidade nos protocolos de preparação de PRF e variações nas metodologias clínicas limitam a comparabilidade dos estudos disponíveis. Evidência de longo prazo permanece escassa, e a superioridade dos procedimentos aprimorados com PRF sobre as técnicas convencionais de ETC não foi definitivamente estabelecida. Conclusão: A combinação de PRF e ETC representa uma estratégia biologicamente plausível e clinicamente promissora para aumentação de tecido mole peri-implante. Embora os achados preliminares indiquem benefícios potenciais em cicatrização e conforto do paciente, ensaios clínicos padronizados adicionais com acompanhamento de longo prazo são necessários para esclarecer a magnitude dessas vantagens e estabelecer protocolos baseados em evidências.

Palavras-chave: Fibrina Rica em Plaquetas. Enxerto de Tecido Conjuntivo. Implantes Dentários. Aumentação de Tecido Mole. Tecidos Peri-implante.

RESUMEN

Objetivo: Revisar críticamente la evidencia actual sobre el uso de fibrina rica en plaquetas (PRF) en combinación con injertos de tejido conectivo (ITC) para el aumento de tejido blando periimplantario, enfocándose en mecanismos biológicos, resultados clínicos y posibles

ventajas sobre abordajes convencionales. Metodología: Se realizó una revisión narrativa utilizando estudios publicados en revistas revisadas por pares que abordan aplicaciones de PRF en implantología y manejo de tejido blando periimplantario. Se consideraron ensayos clínicos, revisiones sistemáticas, metaanálisis y estudios experimentales evaluando espesor de tejido blando, ancho de mucosa queratinizada, resultados estéticos, patrones de cicatrización y resultados reportados por los pacientes. Resultados: La evidencia actual sugiere que los ITC siguen siendo el estándar de oro para el aumento de tejido blando periimplantario debido a su capacidad predecible de aumentar el volumen de tejido blando y mejorar la estética periimplantaria. La PRF ha surgido como un biomaterial autólogo prometedor capaz de liberar factores de crecimiento, citocinas y moléculas bioactivas que apoyan la angiogénesis, proliferación de fibroblastos, síntesis de colágeno y cicatrización de heridas. Los estudios indican que la PRF puede mejorar la cicatrización temprana, reducir el malestar postoperatorio y mejorar la maduración del tejido blando cuando se usa adyuvantemente con ITC. Además, las membranas de PRF pueden contribuir a una mejor vascularización de los tejidos injertados y potencialmente disminuir la morbilidad del sitio donante. Sin embargo, la heterogeneidad en los protocolos de preparación de PRF y las variaciones en las metodologías clínicas limitan la comparabilidad de los estudios disponibles. La evidencia a largo plazo sigue siendo escasa, y la superioridad de los procedimientos mejorados con PRF sobre las técnicas convencionales de ITC no se ha establecido definitivamente. Conclusión: La combinación de PRF e ITC representa una estrategia biológicamente plausible y clínicamente prometedora para el aumento de tejido blando periimplantario. Si bien los hallazgos preliminares indican beneficios potenciales en cicatrización y comodidad del paciente, se necesitan más ensayos clínicos estandarizados con seguimiento a largo plazo para aclarar la magnitud de estas ventajas y establecer protocolos basados en evidencia.

Palabras clave: Fibrina Rica en Plaquetas. Injerto de Tejido Conectivo. Implantes Dentales. Aumento de Tejido Blando. Tejidos Periimplantarios.

1 INTRODUCTION

Dental implants have become a predictable modality for the rehabilitation of missing teeth, with high long-term survival rates. However, increasing attention has been directed toward peri-implant soft tissue conditions, as adequate mucosal thickness and keratinized mucosa width are associated with improved esthetic outcomes, greater patient comfort, and reduced peri-implant inflammation (Thoma *et al.*, 2014). For this reason, soft tissue augmentation procedures have become an essential component of contemporary implant dentistry, particularly in esthetically demanding areas.

Platelet-rich fibrin (PRF), originally described by Choukroun *et al.* (2001), is a second-generation autologous platelet concentrate obtained without the use of anticoagulants. Its fibrin matrix contains platelets, leukocytes, cytokines, and growth factors that are released gradually over time. Experimental studies demonstrate that PRF promotes angiogenesis, fibroblast proliferation, collagen synthesis, and wound healing through the sustained release of platelet-derived growth factor (PDGF), transforming growth factor-beta (TGF-β), and vascular endothelial growth factor (VEGF), among other bioactive molecules (Miron *et al.*, 2017a). These biological properties have generated considerable interest in the use of PRF for oral and periodontal regeneration.

Connective tissue grafts (CTGs) remain the gold standard for peri-implant soft tissue augmentation, given their predictable capacity to increase tissue thickness and improve esthetic outcomes (Zucchelli *et al.*, 2020). Nevertheless, donor-site morbidity and patient discomfort remain relevant limitations. Consequently, the adjunctive use of PRF has been proposed as a means of improving graft vascularization, accelerating healing, and reducing postoperative complications. Recent systematic reviews suggest that PRF may favor peri-implant soft tissue parameters, although heterogeneity across studies and the absence of standardized protocols still limit definitive conclusions (Giammarinaro *et al.*, 2025). A comprehensive appraisal of the current evidence regarding the integration of PRF and CTGs is therefore warranted.

2 METHODOLOGY

This narrative review was conducted to synthesize the current evidence regarding the use of platelet-rich fibrin (PRF) in combination with connective tissue grafts (CTGs) for peri-implant soft tissue augmentation. An electronic search was performed in PubMed/MEDLINE, Scopus, Web of Science, and Google Scholar for studies published up to June 2026. The

search strategy included combinations of the terms “platelet-rich fibrin,” “PRF,” “connective tissue graft,” “soft tissue augmentation,” “peri-implant tissue,” “keratinized mucosa,” and “dental implants.” Clinical trials, cohort studies, case series, systematic reviews, meta-analyses, and relevant experimental investigations published in English were considered. Studies focusing on soft tissue thickness, peri-implant esthetics, wound healing, vascularization, patient-reported outcomes, and biological mechanisms associated with PRF and CTGs were prioritized. Articles not directly related to peri-implant soft tissue management or lacking sufficient methodological information were excluded. The selected literature was critically analyzed and organized into thematic sections addressing biological foundations, clinical applications, advantages, limitations, and future perspectives.

3 RESULTS

3.1 BIOLOGICAL BASIS FOR COMBINING PRF AND CONNECTIVE TISSUE GRAFTS

The rationale for combining PRF with CTGs is supported by complementary biological mechanisms. CTGs primarily provide structural augmentation through the transplantation of autogenous connective tissue capable of increasing mucosal thickness and improving tissue phenotype. PRF, in contrast, acts as a biologically active scaffold that releases growth factors and cytokines involved in tissue regeneration, angiogenesis, and wound healing (Miron *et al.*, 2017a).

Experimental studies have demonstrated that PRF stimulates fibroblast proliferation, collagen matrix deposition, endothelial cell migration, and vascular formation through the sustained release of PDGF, TGF-β, VEGF, and insulin-like growth factor (IGF). These properties suggest that PRF may improve graft integration and accelerate early tissue maturation following peri-implant soft tissue augmentation procedures (Miron *et al.*, 2017a).

The available evidence therefore supports a synergistic interaction in which CTGs provide volumetric stability while PRF contributes to the biological enhancement of the healing process.

3.2 EFFECTS ON PERI-IMPLANT SOFT TISSUE THICKNESS

Increasing peri-implant mucosal thickness remains one of the primary objectives of soft tissue augmentation procedures. Multiple systematic reviews have demonstrated that CTGs provide the most predictable and stable increases in soft tissue volume around dental implants (Thoma *et al.*, 2014; Zucchelli *et al.*, 2020).

Current evidence indicates that PRF alone does not reproduce the volumetric gains achieved with autogenous connective tissue grafts. Studies evaluating PRF as a substitute for CTGs generally report inferior or less predictable outcomes regarding soft tissue thickness. Consequently, PRF is not currently considered a replacement for autogenous grafting in cases requiring substantial soft tissue augmentation.

When used adjunctively with CTGs, some clinical studies report modest additional gains in thickness and improved tissue quality. One recent systematic review reported a significant increase in soft tissue thickness when PRF was combined with implant placement compared with implant placement alone at six-month evaluations, although differences between PRF and CTG at three months were not statistically significant (Cheruvu *et al.*, as cited in Giammarinaro *et al.*, 2025). Overall, these findings suggest that the principal contribution of PRF is not the generation of additional tissue volume, but rather the optimization of the biological healing processes that may support graft integration.

3.3 INFLUENCE ON KERATINIZED MUCOSA WIDTH

The role of keratinized mucosa around dental implants remains an area of ongoing debate. Nevertheless, increasing evidence suggests that an adequate amount of keratinized tissue is associated with improved oral hygiene performance, reduced mucosal inflammation, decreased discomfort during brushing, and greater peri-implant tissue stability (Thoma *et al.*, 2014).

Studies evaluating PRF-associated soft tissue augmentation report variable effects on keratinized mucosa width. A split-mouth randomized controlled trial demonstrated a significant increase in keratinized mucosa width with the use of L-PRF around implants (Temmerman *et al.*, 2018, as cited in Giammarinaro *et al.*, 2025), while other studies report no significant differences compared with conventional CTG procedures.

Compared with free gingival grafts (FGGs), which remain highly effective for increasing keratinized mucosa width, PRF appears to offer limited direct benefits regarding the generation of additional keratinized tissue. Current evidence therefore suggests that PRF may support tissue maturation but does not substantially alter the fundamental capacity of surgical techniques to generate keratinized mucosa.

3.4 EFFECTS ON ESTHETIC OUTCOMES

Peri-implant esthetics represent a major determinant of patient satisfaction, particularly in the anterior maxilla. Soft tissue contour, color match, emergence profile, and mucosal stability collectively influence the final esthetic outcome.

CTGs have consistently demonstrated favorable effects on peri-implant esthetics through improved tissue volume and masking of implant-related discoloration (Zucchelli *et al.*, 2020). Preliminary evidence suggests that PRF may further enhance esthetic outcomes by promoting improved vascularization and tissue maturation.

Studies comparing titanium-prepared PRF (T-PRF) with CTG for peri-implant soft tissue thickening and keratinized mucosa width found no significant differences between groups at three-month outcomes, suggesting comparable clinical performance between the two approaches over that interval (Ustaoğlu *et al.*, 2020). However, esthetic outcomes remain largely dependent on subjective scoring systems that are susceptible to operator bias, and no high-quality evidence currently demonstrates that PRF significantly improves long-term esthetic outcomes beyond those achieved with CTG alone.

3.5 EFFECTS ON EARLY WOUND HEALING AND TISSUE MATURATION

Among all reported outcomes, enhanced wound healing represents the most consistent benefit associated with PRF use.

The systematic review by Miron *et al.* (2017a) demonstrated that PRF promotes accelerated epithelialization, enhanced angiogenesis, increased fibroblast proliferation, and improved collagen organization in soft tissue wounds.

Clinical studies included in recent reviews have repeatedly shown that PRF-treated sites exhibit:

- Faster epithelial closure;
- Reduced postoperative inflammation;
- Improved soft tissue color and texture;
- Earlier tissue maturation;
- Enhanced vascularization.

These findings support the hypothesis that PRF primarily functions as a biological enhancer of healing rather than as a volumetric augmentation material.

3.6 PATIENT-REPORTED OUTCOMES AND MORBIDITY REDUCTION

Patient-centered outcomes have gained increasing importance in implant dentistry. Postoperative discomfort remains one of the principal limitations associated with connective tissue graft harvesting.

A randomized controlled trial evaluating PRF application at the palatal donor site after CTG harvesting demonstrated that patients in the PRF group reported significantly lower pain scores at all assessed time points, along with better Early Healing Index scores on postoperative days 3 and 7 compared with the control group (Alpan & Cin, 2020).

Consistently, other studies evaluating PRF application at donor sites report:

- Reduced postoperative pain;
- Decreased analgesic consumption;
- Lower levels of swelling;
- Faster donor-site epithelialization;
- Improved patient satisfaction.

These benefits may be clinically relevant, as donor-site morbidity remains an important factor limiting patient acceptance of autogenous grafting procedures. Among all investigated applications, donor-site management appears to represent one of the most robust clinical indications for PRF use.

3.7 COMPARISON WITH ALTERNATIVE SOFT TISSUE AUGMENTATION MATERIALS

The search for alternatives to autogenous connective tissue grafts has led to the development of numerous biomaterials, including:

- Acellular dermal matrices (ADM);
- Xenogeneic collagen matrices (CM);
- Porcine-derived volume-stable collagen matrices;
- Platelet concentrates (PRF and PRP);
- Tissue-engineered substitutes.

Compared with collagen matrices, CTGs generally provide superior long-term volumetric stability (Thoma *et al.*, 2014). However, collagen substitutes eliminate donor-site morbidity and reduce surgical complexity.

Current evidence suggests that PRF may partially compensate for the biological limitations of these substitute materials by enhancing vascularization and tissue integration. In a randomized pilot clinical trial comparing PRF and acellular dermal matrix for vertical soft

tissue augmentation simultaneous with implant placement, both materials demonstrated comparable clinical outcomes at three months of follow-up, suggesting that PRF may represent a viable alternative in certain clinical scenarios. Nevertheless, PRF combined with collagen matrices has not consistently achieved outcomes comparable to those observed with CTGs.

Therefore, although PRF may improve the performance of soft tissue substitutes, the combination of PRF and CTGs remains the benchmark against which alternative approaches are currently evaluated.

3.8 LIMITATIONS OF THE AVAILABLE EVIDENCE

Despite the growing interest in PRF applications, several methodological limitations restrict the interpretation of current findings.

3.8.1 Heterogeneity of PRF Protocols

One of the most significant limitations is the absence of protocol standardization. Studies have employed:

- L-PRF;
- A-PRF;
- A-PRF+;
- Injectable PRF (i-PRF);
- Titanium-prepared PRF (T-PRF);
- Different centrifugation speeds;
- Different centrifugation times;
- Different centrifuge systems.

These variations may profoundly influence the biological composition and regenerative potential of PRF products, limiting inter-study comparability.

3.8.2 Small Sample Sizes

Most available clinical trials involve relatively small populations, reducing statistical power and increasing the risk of type II errors.

3.8.3 Short Follow-Up Periods

Many investigations report outcomes between 3 and 12 months. However, peri-implant soft tissue stability should ideally be assessed over several years.

3.8.4 Variability in Outcome Measurements

Different studies employ distinct methods to evaluate:

- Soft tissue thickness;
- Keratinized mucosa width;
- Esthetic outcomes;
- Patient satisfaction.

This variability complicates quantitative comparisons and limits the feasibility of robust meta-analytical synthesis.

3.8.5 Lack of Histological Evidence

Although clinical outcomes appear favorable, human histological evidence regarding PRF-enhanced peri-implant soft tissue regeneration remains scarce. Consequently, many proposed biological mechanisms continue to be inferred from experimental rather than clinical studies.

3.9 OVERALL SYNTHESIS OF THE EVIDENCE

The current body of evidence suggests that the greatest advantages of PRF in peri-implant soft tissue augmentation are related to biological enhancement of healing rather than direct volumetric augmentation. CTGs remain the gold standard for increasing peri-implant tissue thickness and achieving long-term soft tissue stability. PRF appears to function as a complementary regenerative tool capable of improving vascularization, accelerating tissue maturation, reducing postoperative morbidity, and enhancing patient-centered outcomes.

However, available evidence remains insufficient to conclude that the addition of PRF produces clinically significant, long-lasting improvements in peri-implant soft tissue dimensions or esthetic outcomes compared with conventional CTG procedures alone. Future randomized controlled trials with standardized PRF protocols, objective volumetric analyses, digital outcome assessment, and long-term follow-up are necessary to determine the true magnitude of these potential benefits.

4 DISCUSSION

The growing emphasis on peri-implant soft tissue management reflects an important paradigm shift in implant dentistry. While implant survival remains a primary outcome, contemporary treatment success increasingly incorporates esthetic integration, peri-implant tissue stability, patient comfort, and long-term maintenance. In this context, the combination of platelet-rich fibrin (PRF) and connective tissue grafts (CTGs) has attracted significant attention because it seeks to unite the volumetric predictability of autogenous grafts with the regenerative potential of biologically active autologous concentrates.

The present review indicates that CTGs continue to represent the most predictable approach for increasing peri-implant soft tissue thickness and enhancing esthetic outcomes. The ability of connective tissue grafts to provide long-term volumetric stability has been consistently demonstrated in both periodontal and peri-implant plastic surgery (Zucchelli *et al.*, 2020). Increased mucosal thickness has been associated with improved masking of implant components, reduced tissue discoloration, enhanced emergence profile development, and greater resistance to peri-implant tissue recession. Furthermore, thicker peri-implant mucosa may contribute to the establishment of a more stable biological seal, potentially reducing susceptibility to mechanical and inflammatory challenges over time.

Despite these advantages, CTG procedures are not without limitations. Harvesting autogenous connective tissue from the palate inevitably increases surgical complexity and may lead to postoperative pain, bleeding, swelling, and patient discomfort. Such drawbacks have motivated researchers to investigate adjunctive biomaterials capable of improving healing while potentially minimizing morbidity. Among these alternatives, PRF has emerged as one of the most extensively studied autologous regenerative materials due to its simplicity of preparation, low cost, and favorable biological profile (Choukroun *et al.*, 2001).

The biological rationale supporting the association between PRF and CTGs appears particularly compelling. PRF functions as a three-dimensional fibrin scaffold enriched with platelets, leukocytes, cytokines, and growth factors that are gradually released during the healing period. This sustained release profile creates a biologically active environment capable of promoting angiogenesis, cellular migration, extracellular matrix formation, and tissue remodeling. Since successful graft integration depends heavily on rapid revascularization and cellular colonization, the application of PRF around connective tissue grafts may theoretically enhance graft survival and accelerate tissue maturation (Miron *et al.*, 2017a).

Several experimental investigations support this hypothesis by demonstrating increased fibroblast proliferation, enhanced collagen synthesis, and improved endothelial cell activity in the presence of PRF-derived growth factors (Miron *et al.*, 2017b). These biological effects may explain the improved early wound healing frequently reported in clinical studies. Enhanced angiogenesis may be particularly relevant in peri-implant soft tissue procedures, where graft vascularization represents a critical determinant of treatment success. Improved blood supply during the initial healing phase may reduce tissue necrosis, facilitate graft integration, and contribute to more favorable esthetic outcomes.

Another important observation emerging from the literature concerns patient-reported outcomes. Although objective clinical measurements such as soft tissue thickness and keratinized mucosa width remain essential, patient-centered outcomes are increasingly recognized as critical indicators of treatment success. Multiple studies suggest that PRF may reduce postoperative pain, swelling, and discomfort when used adjunctively with CTGs (Alpan & Cin, 2020). These benefits are likely related to the anti-inflammatory properties of leukocyte-derived mediators and the accelerated wound healing promoted by growth factor release. From a clinical perspective, even modest improvements in postoperative recovery may significantly enhance patient acceptance of soft tissue augmentation procedures.

The role of PRF in improving donor-site healing deserves particular attention. Palatal wounds remain one of the principal sources of morbidity following connective tissue graft harvesting. Several investigations have reported faster epithelialization and improved patient comfort when PRF membranes are applied to the donor site (Alpan & Cin, 2020). Such findings may represent one of the most clinically relevant applications of PRF, as reducing morbidity without compromising treatment outcomes directly addresses one of the major limitations of autogenous grafting procedures.

Regarding peri-implant esthetics, current evidence remains promising but inconclusive. Some studies report improved soft tissue contour, better tissue texture, and enhanced color blending when PRF is combined with CTGs. These observations may be attributed to improved vascularization and tissue maturation. However, esthetic outcomes are multifactorial and influenced by variables such as implant position, prosthetic design, tissue phenotype, surgical technique, and patient-specific healing responses. Consequently, isolating the specific contribution of PRF remains challenging.

An important issue identified throughout the literature is the substantial heterogeneity among PRF preparation protocols. Variations in centrifugation speed, centrifugation time,

rotor characteristics, blood collection tubes, and handling procedures can significantly alter the biological composition of the final product. Such differences may influence platelet concentration, leukocyte content, fibrin architecture, and growth factor release kinetics. As a result, studies investigating PRF often evaluate biologically distinct products despite using the same terminology. This methodological inconsistency limits reproducibility and complicates direct comparisons between investigations.

Similarly, considerable variability exists in the clinical methodologies employed across studies. Differences in implant timing, graft dimensions, flap designs, augmentation techniques, follow-up periods, and outcome assessment methods contribute to significant heterogeneity. Many available studies also involve relatively small sample sizes and short observation periods, limiting the strength of current conclusions. Given that peri-implant soft tissue stability is fundamentally a long-term outcome, longer follow-up periods are essential to determine whether early benefits associated with PRF translate into durable clinical advantages.

Another noteworthy consideration is the evolving understanding of peri-implant disease prevention. Recent evidence increasingly suggests that adequate soft tissue volume and keratinized mucosa may contribute to improved plaque control, reduced mucosal inflammation, and enhanced peri-implant tissue stability. If PRF can effectively improve the quality and maturation of augmented tissues, its adjunctive use may potentially influence long-term peri-implant health. However, direct evidence linking PRF-enhanced soft tissue augmentation to reduced peri-implant disease incidence remains limited and requires further investigation.

From a practical standpoint, PRF offers several advantages that facilitate its incorporation into routine clinical practice. The material is entirely autologous, relatively inexpensive, easy to prepare, and associated with minimal biological risk. These characteristics make it an attractive adjunctive therapy for clinicians seeking to optimize soft tissue healing. Nevertheless, current evidence does not support replacing connective tissue grafts with PRF alone when significant soft tissue augmentation is required. Instead, PRF should be viewed as a complementary biological tool capable of enhancing specific aspects of the healing process while preserving the volumetric benefits provided by CTGs.

Overall, the available evidence supports the biological plausibility and clinical feasibility of combining PRF with connective tissue grafts for peri-implant soft tissue augmentation. The most consistent benefits appear to involve accelerated healing, improved patient comfort,

enhanced vascularization, and reduced donor-site morbidity. However, evidence demonstrating superior long-term volumetric stability or esthetic outcomes compared with conventional CTG procedures remains limited. Future research should focus on standardized PRF protocols, larger randomized clinical trials, objective volumetric analyses, and long-term follow-up evaluations to establish evidence-based recommendations for clinical practice.

5 CONCLUSION

Peri-implant soft tissue augmentation has become a fundamental component of contemporary implant therapy due to its influence on esthetic outcomes, tissue stability, patient satisfaction, and long-term peri-implant health. Within this context, connective tissue grafts continue to represent the gold standard treatment because of their predictable ability to increase soft tissue volume and improve peri-implant tissue quality.

The incorporation of platelet-rich fibrin as an adjunctive biomaterial introduces a biologically attractive strategy capable of enhancing tissue regeneration through the sustained release of growth factors and cytokines involved in wound healing and angiogenesis. Current evidence suggests that PRF may accelerate early healing, improve vascularization, promote tissue maturation, reduce postoperative discomfort, and decrease donor-site morbidity when combined with connective tissue grafts.

Although these findings are encouraging, the existing literature remains characterized by considerable methodological heterogeneity and limited long-term evidence. Consequently, definitive conclusions regarding the superiority of PRF-enhanced procedures over conventional connective tissue grafting cannot yet be established. At present, PRF should be considered a valuable adjunct rather than a substitute for connective tissue grafts in peri-implant soft tissue augmentation.

Future well-designed randomized clinical trials employing standardized PRF preparation protocols, objective volumetric assessments, and extended follow-up periods are required to determine the true clinical impact of PRF on peri-implant soft tissue outcomes. As the field of regenerative implant dentistry continues to evolve, the integration of biologically active autologous materials such as PRF may contribute to more predictable, patient-centered, and minimally invasive therapeutic approaches.

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