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REVIEW ARTICLE

Bone regeneration with PRP and PRF: Comparative analysis of their effectiveness in dentistry and orthopedic surgery

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ABSTRACT

Introduction: guided bone regeneration constitutes a therapeutic cornerstone in dentistry and orthopedic surgery, where autologous platelet concentrates have gained relevance.
Objective: to evaluate the clinical effectiveness of platelet-rich plasma and platelet-rich fibrin in guided bone regeneration procedures in dentistry.
Methods: a descriptive and qualitative bibliographic review of scientific literature published between 2019 and 2024 was conducted across different databases. The design of a search algorithm enabled the identification of sources addressing the topic, and their selection according to inclusion and exclusion criteria allowed the retrieval of the necessary literature for an adequate analysis of the subject.
Development: the analyzed evidence shows that both platelet concentrates promote healing and bone regeneration. Platelet-rich plasma stands out for its ease of preparation and usefulness in complex wounds, improving postoperative recovery. In contrast, platelet-rich fibrin presents advantages in the quality and stability of regenerated tissue, attributable to its three-dimensional matrix and sustained release of growth factors. Likewise, emerging approaches, such as autologous blood clots derived from alveolar bone, were identified, broadening the available therapeutic alternatives.
Conclusions: platelet-rich plasma and platelet-rich fibrin are effective tools in guided bone regeneration. Nevertheless, platelet-rich fibrin demonstrates greater consistency in regenerative quality. Further studies are required to standardize protocols, optimize clinical indications, and consolidate comparative evidence.

Keywords: Platelet-Rich Fibrin; Dentistry; Platelet-Rich Plasma; Orthopedic Procedures; Bone Regeneration; Guided Tissue Regeneration.

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INTRODUCTION

Guided bone regeneration (GBR) is a highly important technique in dentistry, playing a vital role in implantology and periodontal surgery. This procedure involves the use of biomaterials to stimulate and guide new bone growth in areas affected by bone loss. Among the most prominent GBR approaches are the use of platelet-rich plasma (PRP) and platelet-rich fibrin (PRF). Both techniques utilize autologous blood derivatives but differ in preparation method, composition, and mechanism of action—factors that may influence their clinical effectiveness.[1]

PRP is obtained by centrifuging the patient's blood to concentrate platelets, which release essential growth factors for tissue healing and regeneration.[2] In contrast, PRF is prepared without anticoagulants, resulting in a three-dimensional fibrin matrix that enables more sustained release of growth factors.[3]

The rationale for comparing these two techniques stems from the growing demand for more effective and predictable bone regeneration treatments, as well as the interest in optimizing clinical outcomes for patients requiring dental rehabilitation. Current literature presents varied results regarding the effectiveness of PRP and PRF. Some studies suggest that PRF may offer advantages in terms of bone regeneration quality and healing time due to its more stable structure and prolonged growth factor release.[4] However, other works highlight the ease of preparation and application of PRP, as well as its effectiveness in specific clinical contexts.[5] This contrast in findings underscores the need for a critical and systematic evaluation of both methods. Accordingly, this review was conducted with the objective of evaluating the clinical effectiveness of platelet-rich plasma and platelet-rich fibrin in guided bone regeneration procedures in dentistry.

METHODS

This study was developed as a systematic bibliographic review, conducted in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, with the aim of identifying, analyzing, and synthesizing the available scientific evidence on the effectiveness of platelet-rich plasma (PRP) and platelet-rich fibrin (PRF) in bone regeneration within dentistry. The literature search was carried out between March 2023 and July 2024 and included publications from 2019 to 2024 to ensure the currency and relevance of the findings.

Information sources included internationally recognized scientific databases known for their rigor and coverage in health sciences: PubMed/MEDLINE, ScienceDirect, SciELO, Google Scholar, and Elsevier. Additionally, reference lists of selected articles were manually reviewed to identify potentially relevant secondary studies. Grey literature not indexed in scientific databases—such as theses or institutional reports—was excluded to ensure methodological quality of the analyzed evidence.

The search strategy was structured using controlled descriptors and free-text terms related to the research topic, combined through Boolean operators. Searches were limited to articles published in English, Spanish, and Portuguese—languages deemed relevant for the analysis. Specific term combinations were used to maximize retrieval of relevant results. The most effective search string included:
("PRF"[All Fields] AND ("pharmacol res perspect"[Journal] OR "prp"[All Fields]) AND ("dental health services"[MeSH Terms] OR ("dental"[All Fields] AND "health"[All Fields] AND

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"services"[All Fields]) OR "dental health services"[All Fields] OR "dental"[All Fields] OR "dentally"[All Fields] OR "dentals"[All Fields])) AND (2019:2024[pdat])

Inclusion criteria encompassed original studies, systematic reviews, clinical trials, observational studies, and case reports that directly addressed the use of PRP and/or PRF in dental bone regeneration, published within the defined timeframe and with full-text availability. Excluded were duplicate articles, publications outside the temporal range, studies unrelated to dentistry, investigations lacking relevant comparisons or sufficient information, and non-indexed documents.

The selection process was carried out in three phases: title screening, abstract review, and full-text assessment. Initially, 807 records were identified; after duplicate removal and application of eligibility criteria, 16 articles were selected for final analysis. This process was documented using a PRISMA flow diagram detailing each selection stage (Fig. 1).

For data extraction and analysis, a standardized matrix was designed to capture variables including author, publication year, study type, sample size, intervention type, main results, and conclusions. Findings were synthesized through descriptive qualitative analysis; no meta-analysis was performed due to methodological heterogeneity among included studies.

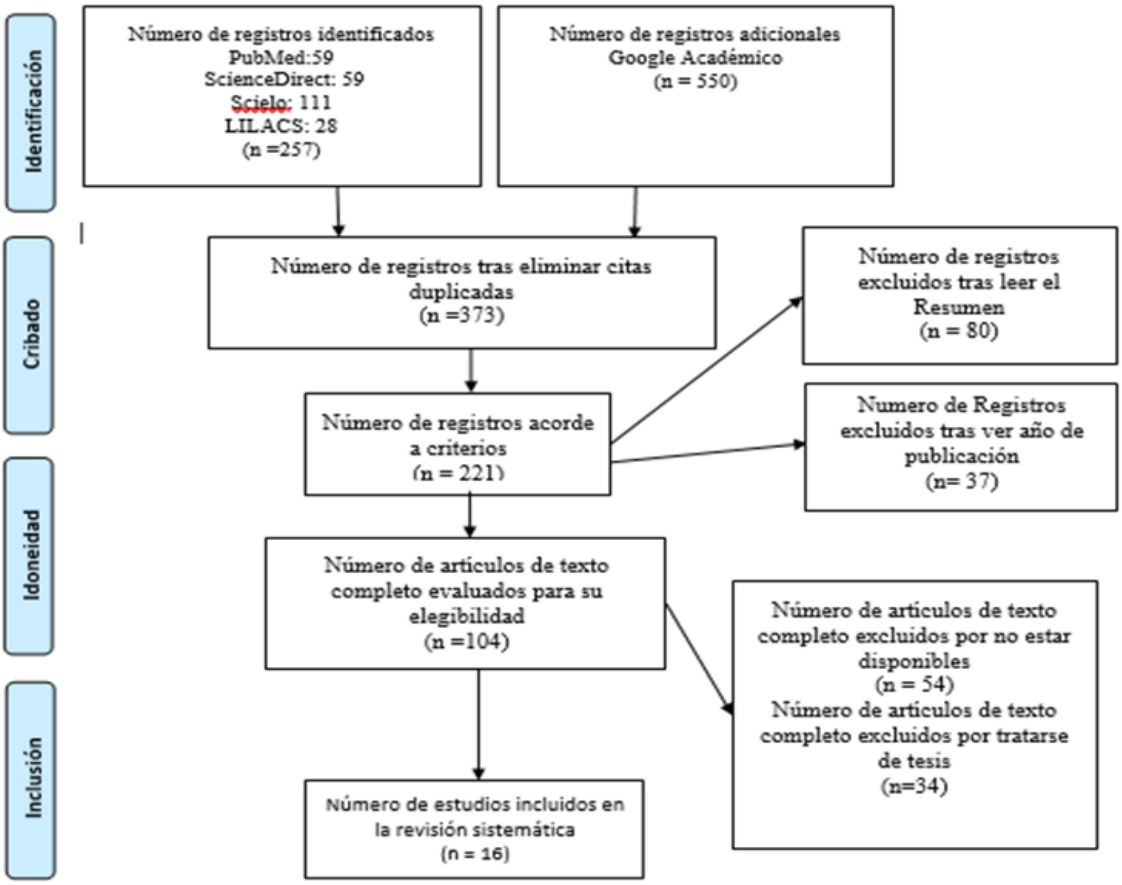

Fig. 1. PRISMA Flow Diagram.

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DEVELOPMENT

From a total of 373 articles identified in indexed journals, exclusion criteria based on publication year, keywords, and scientific validity were applied, resulting in a final selection of 16 articles that met the established search parameters. Table 1 presents a synthesis of the results from the selected studies.

Table 1. Synthesis of obtained results.

Source	Study Type (Comparison)	Main Results	Conclusions
Zwittnig et al.,(2022)[1]	Systematic review (PRF in oral surgery and implantology)	Significant improvement in bone regeneration and soft tissue healing; reduction in postoperative complications.	PRF is highly effective in oral surgery and implantology, enhancing regeneration and reducing complications.
Prakash (2023)[3]	Case report (PRF in marginal gingival recession)	Significant root coverage with good color match and sensitivity relief; stable results at 6 months and 1 year postoperatively.	PRF is an effective autologous biomaterial for root coverage procedures, promoting healing and tissue regeneration.
González et al.,(2020)[4]	Case report (PRF vs. PRP in peri-implant defects)	PRF showed faster and more effective bone regeneration compared to PRP; PRP was easier to handle; no significant complications with either method.	PRF is more effective than PRP for bone regeneration around dental implants, though PRP remains a viable alternative.
Bettin-Yánez et al.,(2021)[5]	Case report (PRF in aggressive periodontitis)	Reduced probing depth, improved clinical attachment level, and radiographic bone fill.	PRF is effective in guided tissue regeneration for aggressive periodontitis.
Anarthe et al.,(2019)[6]	Case report (PRF in bone defects)	Probing depth reduced from 6 mm to 3 mm; clinical attachment gain from 7 mm to 3 mm; significant intraosseous bone formation.	PRF is simple and cost-effective for periodontal tissue regeneration.
Brizuela et al.,(2020)[7]	Case report (PRP + MSCs in pulp necrosis)	Reduction in apical lesion size; dentin bridge formation in the middle third of the root canal; blood perfusion detected in the treated tooth.	PRP combined with MSCs shows promising results in regenerating necrotic pulp tissue and healing apical periodontitis.
Cruz Molina et al.,(2020)[8]	Literature review (PRF vs. PRP in bone regeneration)	PRF demonstrated superior bone regeneration quality; PRP was easier to prepare and apply; low complication rates for both methods.	PRF is preferred for bone regeneration due to its superior regenerative quality.
Giacon et al.,(2021)[9]	Case report (HBOT + A-PRF in implants)	Significant reduction in implant failure rates; enhanced bone regeneration around implants; improved soft tissue healing.	The combination of HBOT and A-PRF yields better outcomes in bone regeneration and implant success.

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Kaur et al.,(2023)[10]	Case series (PRP in radicular cysts)	Significant cyst size reduction; improved surgical site healing; enhanced bone regeneration.	PRP augmentation shows promise in managing radicular cysts by promoting healing and bone regeneration.
Lafuente-Ibáñez de Mendoza et al.,(2021)[11]	Case report (PRP in ciliated surgical cysts)	Histopathological analysis confirmed pseudostratified ciliated epithelium; PRP treatment associated with observed changes in cystic epithelial lining.	PRP may play a role in respiratory metaplasia in ciliated surgical cysts, highlighting the need for careful clinical consideration.
Mansour et al.,(2023)[12]	Case report (i-PRF in orthograde retreatment)	Significant reduction in periapical lesions after three years; improved soft tissue healing.	i-PRF proved effective in reducing periapical lesions and enhancing soft tissue healing.
Seco-Calvo et al.,(2022)[13]	Case report (PRP in non-healing surgical wounds)	Successful wound closure; pain reduction; improved patient quality of life.	PRP is effective in healing non-healing surgical wounds and improving patient quality of life.
Sisto (2022)[14]	Case report (PRP in endoperiodontal lesions)	Significant clinical and radiographic improvement; reduced tooth mobility and periodontal pocket depth.	PRP is effective in treating endoperiodontal lesions, improving both dental stability and periodontal health.
Xu et al.,(2021)[15]	Clinical study (PRP in periodontally accelerated osteogenic orthodontics)	Accelerated tooth movement; improved bone regeneration and soft tissue healing.	PRP is beneficial in accelerated orthodontics, enhancing both tooth movement and bone regeneration.

The review of these 14 studies suggests that, although both PRP and PRF are effective for guided bone regeneration, PRF appears to offer significant advantages in terms of bone regeneration quality, healing time, and lower incidence of complications. PRF's three-dimensional fibrin matrix and its capacity for sustained growth factor release may explain its superiority over PRP.

Several studies emphasized that PRF provides better bone stability and more efficient integration in regenerative procedures—critical factors for the long-term success of dental implants and other interventions. Additionally, the lower rate of postoperative complications and improved patient experience make PRF a preferred choice in clinical practice. However, PRP remains a viable alternative due to its ease of preparation and application. The decision between PRP and PRF should consider not only clinical effectiveness but also logistical and economic factors specific to each case.

The discussion on the effectiveness of platelet concentrates in dental and periodontal tissue regeneration reveals both consistencies and discrepancies among the reviewed studies. Mansour et al.,[12] reported notable reduction in periapical lesions and improved soft tissue healing using i-PRF in orthograde retreatments, highlighting i-PRF's efficacy in endodontic contexts.

This finding is supported by Seco-Calvo et al. ,[13] who observed successful healing of a non-healing surgical wound with PRP, demonstrating PRP's ability to improve quality of life in challenging wound cases.

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Consistent with these results, Sisto,[14] reported significant clinical and radiographic improvements in endoperiodontal lesion treatment with PRP, noting reduced tooth mobility and periodontal pocket depth. These findings align with Xu et al.,[15] who found that PRP in periodontally accelerated osteogenic orthodontics not only accelerated tooth movement but also enhanced bone regeneration and soft tissue healing.

Conversely, Zwittnig et al.,[1] in their systematic review on PRF use in oral surgery and implantology, concluded that PRF significantly improves bone regeneration and soft tissue healing while reducing postoperative complications. This is consistent with Prakash's[3] report of significant root coverage and sensitivity relief in a marginal gingival recession case using PRF, with stable outcomes at 6 months and 1 year postoperatively. Other authors further emphasize that PRF is an effective autologous biomaterial for root coverage procedures, promoting healing and tissue regeneration.[7,9]

However, Wu,[16] offers a different perspective by evaluating the use of autologous blood clots harvested directly from maxillary alveolar bone in regenerative endodontics. The author found this method effective in resolving periapical lesions and thickening root canal walls, suggesting that such clots may serve as a viable alternative to traditional PRP and PRF. Although Wu underscores the need for further clinical trials to confirm this approach's viability, the study highlights the potential to simplify regenerative endodontic procedures by eliminating the need for peripheral blood-derived PRP or PRF.

In summary, the reviewed studies agree on the efficacy of PRP and PRF in enhancing tissue healing and bone regeneration across various dental applications. While some authors highlight PRP's effectiveness in diverse clinical contexts,[12,13,14] others—such as Prakash,[3] and Zwittnig et al.,[1]—emphasize PRF's superiority in regeneration and healing. The introduction of alternative approaches like Wu's,[16] alveolar bone-derived autologous clot suggests room for further innovation. Overall, both PRP and PRF are valuable tools in modern dentistry, capable of significantly improving clinical outcomes across a range of therapeutic scenarios—though additional research is needed to optimize their use and explore novel alternatives.

CONCLUSIONS

This review demonstrates that PRP and PRF are highly effective in tissue regeneration and wound healing in dentistry. PRP is particularly effective in managing difficult-to-heal wounds and improving patient quality of life. In contrast, PRF has shown superiority in bone regeneration and soft tissue healing. Furthermore, innovative approaches—such as autologous blood clots harvested from alveolar bone—suggest viable and potentially simpler alternatives. Long-term studies are needed to optimize these treatments and explore new options that could further enhance clinical outcomes.

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