



Applications of platelet- and leukocyte-rich fibrin (L-PRF) in Oral and Maxillofacial Surgery

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REVIEW ARTICLE

ABSTRACT

Introduction: Oral and maxillofacial surgery plays a crucial role in the reconstruction and restoration of facial structures, seeking to improve both aesthetics and function. The use of platelet-rich fibrin (L-PRF) represents a notable advance, accelerating healing and improving surgical outcomes. **Materials and Methods:** This review covers 710 studies from various electronic databases (PubMed, Scopus, Web of Science, Science Direct and Google Scholar). The aim is to thoroughly investigate the applications of platelet- and leukocyte-rich fibrin (L-PRF) in Oral and Maxillofacial Surgery and Traumatology. **Results:** The analysis reveals that L-PRF stands out as an effective autologous therapy in oral and maxillofacial surgery. Its application shows remarkable potential for accelerating the healing process, contributing significantly to the effectiveness of procedures. **Discussion:** L-PRF has emerged as an excellent choice in oral and maxillofacial surgery and traumatology, improving both the aesthetic and functional aspects of facial reconstructions. This highlights the relevance of this autologous therapy and its benefits in surgical practice. **Conclusion:** The applications of platelet and leukocyte-rich fibrin (L-PRF) in Oral and Maxillofacial Surgery and Traumatology are fundamental and promising. This advance represents not only a means of accelerating healing, but also a significant contribution to better aesthetic and functional results in surgical procedures in this area.

Keywords: Platelet-Rich Fibrin, Wound Healing, Oral Surgical Procedures, Molar and Dentistry

Aplicações da fibrina rica em plaquetas e leucócitos (L-PRF) na cirurgia oral e maxilofacial

RESUMO

Introdução: A cirurgia bucomaxilofacial desempenha um papel crucial na reconstrução e restauração de estruturas faciais, buscando melhorar tanto a estética quanto a função. A utilização da fibrina rica em plaquetas (L-PRF) representa um avanço notável, acelerando a cicatrização e aprimorando os resultados cirúrgicos. **Materiais e Métodos:** Esta revisão abrange 710 estudos provenientes de diversas bases de dados eletrônicas (PubMed, Scopus, Web of Science, Science Direct e Google Scholar). O objetivo é investigar minuciosamente as aplicações da fibrina rica em plaquetas e leucócitos (L-PRF) na Cirurgia e Traumatologia Bucocomaxilofacial. **Resultados:** A análise revela que o L-PRF destaca-se como uma terapia autóloga eficaz na cirurgia bucomaxilofacial. Sua aplicação demonstra notável potencial para acelerar o processo cicatrizador, contribuindo significativamente para a efetividade dos procedimentos. **Discussão:** O L-PRF emerge como uma escolha excelente na esfera da cirurgia e traumatologia bucomaxilofacial, melhorando tanto os aspectos estéticos quanto funcionais nas reconstruções faciais. Destacando a relevância dessa terapia autóloga e seus benefícios na prática cirúrgica. **Conclusão:** As aplicações da fibrina rica em plaquetas e leucócitos (L-PRF) na Cirurgia e Traumatologia Bucocomaxilofacial são fundamentais e promissoras. Este avanço representa não apenas um meio de acelerar a cicatrização, mas também uma contribuição significativa para melhores resultados estéticos e funcionais em procedimentos cirúrgicos nesta área.

Palavras-chave: Fibrina Rica em Plaquetas, cicatrização, Procedimentos Cirúrgicos Buciais, Dente Molar e odontologia

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INTRODUCTION

Oral and Maxillofacial Surgery is an area of great importance in dentistry, encompassing an extensive variety of surgical procedures involving the oral cavity, face, skull and maxillofacial structures. Its main focus is on the diagnosis and treatment of various conditions, disorders and injuries that impact the oral and maxillofacial region. In this context, oral and maxillofacial surgery plays a fundamental role not only in relieving pathological conditions, but also in improving function and aesthetics through the reconstruction and restoration of facial structures ¹.

However, in order to carry out these procedures effectively, it is essential to have advanced technologies. Among these technologies is platelet-rich fibrin, a valuable tool that contributes significantly to optimizing the effectiveness of treatments. The incorporation of platelet-rich fibrin into oral and maxillofacial surgical practice represents a notable advance, promoting not only faster healing, but also improving aesthetic and functional results.

Platelet-rich fibrin (PRF) is a technology that precedes platelet-rich plasma (PRP). The latter is obtained by centrifuging whole blood, eliminating red blood cells and resulting in a suspension rich in white blood cells and plasma components, considered crucial for stimulating healing. Both PRF and PRP use autologous blood, aiming to take advantage of blood growth factors to promote the body's natural healing process. PRF, based on PRP, preserves the growth factors in a fibrin matrix, allowing their effects to manifest over days or weeks after the surgical procedure ².

The body's self-repair process goes through three distinct phases: inflammatory, proliferative and remodeling ³. The initial and acute inflammatory phase is an inflammatory response to the injury, where the blood acts as a carrier of inflammatory cells to the affected site. In addition to the role of phagocytes in cleaning the wound, white blood cells and platelets release crucial cell mediators such as TGF β 1, PDGF, VEGF, IGF1, coordinating cell migration, proliferation and differentiation during this intricate process ².

Platelet concentrates represent highly concentrated suspensions of growth factors present in platelets, playing a crucial role as bioactive surgical additives when applied locally to stimulate the healing process. Both platelet-rich plasma (PRP) and

platelet-rich fibrin concentrate (PRF) use supraphysiological doses of autologous growth factors, originating from patients' own blood, to significantly accelerate tissue regeneration. This versatility is not limited to regenerative dentistry, but extends to various medical areas, including maxillofacial surgery, orthopedic surgery and aesthetic medicine ⁴.

Platelet and leukocyte-rich fibrin (L-PRF) demonstrates a wide range of applications in Oral and Maxillofacial Surgery and Traumatology, offering substantial benefits in various procedures. One of the notable areas is bone regeneration, where L-PRF stimulates the regeneration process in grafts, maxillary sinus lift, improves the integration of dental implants, treatment of cystic and tumor lesions. In addition, it plays a crucial role in the healing of post-surgical wounds, significantly reducing recovery time and promoting the formation of quality scar tissue. L-PRF also excels in the treatment of cystic and tumor lesions, facilitating the surgical approach and promoting tissue regeneration. In orthognathic surgery procedures, it contributes to post-surgical stability and optimizes healing in corrections of facial deformities. In complex extractions, L-PRF reduces the risk of post-extraction complications, such as alveolitis, by promoting efficient healing ^{5 7}

The main objective of this review is to carry out a comprehensive evaluation of the main applications of platelet and leukocyte-rich fibrin (L-PRF) in the field of oral and maxillofacial surgery and trauma.

METHODOLOGY

This study is a comprehensive literature review whose purpose is to thoroughly investigate the applications of platelet and leukocyte-rich fibrin (L-PRF) in Oral and Maxillofacial Surgery and Traumatology. In order to obtain up-to-date and significant data, we searched five databases: PubMed, Science Direct, Scopus, Web of Science and Google Scholar (for gray literature), including articles published in the last five years.

The searches were meticulously conducted using strategic combinations of descriptors and alternative terms extracted from the Health Sciences Descriptors (DeSC) and Medical Subject Headings (MeSH), as shown in Chart 1. Among the terms explored were "platelet-rich fibrin," "Leukocyte and Platelet Rich Fibrin (L-PRF)," "Traumatology," "Therapeutic Uses," "Oral Surgery," and "Dentistry."

Chart 1: Search strategies used in the databases

Database	Search strategy	Results
Web of Science	("statistics and numerical data"[Subheading] OR ("statistics"[All Fields] AND "numerical"[All Fields] AND "data"[All Fields]) OR "statistics and numerical data"[All Fields] OR "use"[All Fields]) AND ("platelet-rich fibrin"[MeSH Terms] OR ("platelet-rich"[All Fields] AND "fibrin"[All Fields]) OR "platelet-rich fibrin"[All Fields] OR ("platelet"[All Fields] AND "rich"[All Fields] AND "fibrin"[All Fields]) OR "platelet rich fibrin"[All Fields]) AND (("fibrin"[MeSH Terms] OR "fibrin"[All Fields]) AND rich in[Author] AND ("blood platelets"[MeSH Terms] OR ("blood"[All Fields] AND "platelets"[All Fields]) OR "blood platelets"[All Fields] OR "platelets"[All Fields]) AND ("leukocytes"[MeSH Terms] OR "leukocytes"[All Fields])) AND ("dentistry"[MeSH Terms] OR "dentistry"[All Fields]) OR ("statistics and numerical data"[Subheading] OR ("statistics"[All Fields] AND "numerical"[All Fields] AND "data"[All Fields]) OR "statistics and numerical data"[All Fields] OR "use"[All Fields]) AND (("fibrin"[MeSH Terms] OR "fibrin"[All Fields]) AND rich in[Author] AND ("blood platelets"[MeSH Terms] OR ("blood"[All Fields] AND "platelets"[All Fields]) OR "blood platelets"[All Fields] OR "platelets"[All Fields]) AND ("leukocytes"[MeSH Terms] OR "leukocytes"[All Fields])) AND ("oral surgical procedures"[MeSH Terms] OR ("oral"[All Fields] AND "surgical"[All Fields] AND "procedures"[All Fields]) OR "oral surgical procedures"[All Fields]) AND ("molar"[MeSH Terms] OR "molar"[All Fields]) AND ("dentistry"[MeSH Terms] OR "dentistry"[All Fields])	n=218
Scopus		n= 209
Science Direct		n= 104
PubMed		n= 79
Google Scholar		n= 100
Total		n= 710

Source: Authors (2023)

After the initial stage of obtaining all the articles related to the use of L-PRF in dentistry, we implemented strict exclusion criteria, starting by reading the titles. We then moved on to a detailed analysis of the abstracts in order to identify the articles that most closely aligned with the pre-established criteria and then selected them for full reading. This careful approach aims to ensure not only the relevance but also the quality of the studies included in the review, making a substantial contribution to advancing knowledge in the field.

2.1 - INCLUSION AND EXCLUSION CRITERIA OF THE STUDY

The articles selected for this review were mainly designed as clinical trials, systematic reviews with or without meta-analysis, and had to have been published in the last five years, specifically focusing on the use of platelet and leukocyte-rich fibrin (L-PRF) in dentistry. To ensure the quality and relevance of the studies included, the inclusion criteria included a rigorous analysis of the title and abstract, identifying relevant studies, and the inclusion of articles from reliable sources, in English and Portuguese, with accessible full text.

On the other hand, the exclusion criteria were carefully applied to ensure the accuracy and integrity of the review. Articles that had no direct relevance to the scope of the literature review, those written in languages other than those cited (English and Portuguese), those published before 2018 and those that were not fully available in the databases searched were excluded. This rigorous process of inclusion and exclusion aims to ensure the robustness and reliability of the studies incorporated, contributing to the validity and applicability of the results of this review.

RESULTS

Figure 1 shows the flowchart for selecting the studies. A total of 710 studies were identified through electronic databases (PubMed, Scopus, Web of Science, Science Direct and Google Scholar). After removing duplicates, the titles and abstracts of 574 articles were analyzed. Subsequently, 54 articles were included for full-text eligibility, but 43 of these were excluded according to the predetermined exclusion criteria.

Figure 1. PRISMA flowchart

Records identified ⇨ Science Direct: 104 Additional records

Records after

Screening	Screened records (n= 574)	Deleted records (n= 520)
Eligibility	Articles with full text evaluated (n= 54)	Full-text articles excluded: narrative reviews, animal studies, case reports/case series, cohort studies, integrative reviews (n= 43)
Included	Articles included (n= 11)	

Source: Authors (2023)

The data extracted is in line with the objective of this review and is presented in Table 1, containing: authors, year of publication, title, objective and the applications of (L-PRF) in the field of Oral and Maxillofacial Surgery and Traumatology.

Table 2. Summary description of the characteristics of the included studies

Authors/year	Title	Objective	What are the applications of (L-PRF) in the field of Oral and Maxillofacial Surgery and Traumatology?
Salgado-Peralvo <i>et al.</i> , (2022) ⁸	Treatment of oroantral communication with Platelet-Rich Fibrin: A systematic review	To analyze cases of the use of Platelet Rich Fibrin (PRF) to treat Oroantral Communication and Oroantral Fistula, suggesting PRF as an alternative to reduce postoperative morbidity and costs.	PRF can be used in CTBMF alone to treat OACs/OAFs of up to 5 mm; however, for larger defects, it is recommended to combine it with two- or three-laminar techniques.
Al- Maawi <i>et al.</i> , (2021) ⁹	Efficacy of platelet-rich fibrin in promoting the	To evaluate the influence of PRF on tooth preservation in patients with	PRF has shown efficacy in reducing post-operative pain, accelerating soft tissue

	healing of extraction sockets: a systematic review	recently extracted teeth. And to analyze the effectiveness of PRF in preventing pain and regenerating soft tissue and bone.	healing and preventing dimensional bone loss, indicating substantial benefits in surgical procedures.
Snopek <i>et al.</i> , (2022) ¹⁰	Application of platelet-rich fibrin after surgical extraction of the mandibular third molar: A systematic review and meta-analysis	To analyze double-blind randomized clinical trials (RCTs) to assess whether the use of platelet-rich fibrin (PRF) has benefits in reducing postoperative complications after lower third molar removal surgery.	The application of PRF has shown advantages in reducing alveolar osteitis after lower third molar surgery. However, the influence of PRF on postoperative pain levels, edema and wound healing remains ambiguous, with a meta-analysis showing no significant impact on pain levels.
Millard <i>et al.</i> , (2018) ¹¹	Efficacy of Platelet-Rich Fibrin in Bone Regeneration of the Jaws: A Systematic Review	To analyze the effects of platelet-rich fibrin (PRF) in jaw bone regeneration procedures.	The use of PRF has been shown to improve the local conditions of grafts and soft tissues, resulting in a reduction in healing time and associated symptoms.
Ramos <i>et al.</i> , (2022) ¹²	Do the new protocols of platelet-rich fibrin centrifugation allow better control of postoperative complications and healing after surgery of impacted lower third molar? A systematic review and meta-analysis	To analyze the impact of platelet-rich fibrin (PRF) and new centrifugation protocols, advanced platelet-rich fibrin (A-PRF) and leukocyte platelet-rich fibrin (L-PRF), on recovery after extraction of impacted lower third molars.	The use of L-PRF and A-PRF improves pain and edema control compared to standard PRF, with no impact on trismus. Both PRF and L-PRF protocols show improvements in soft tissue healing, although not in a statistically significant way, and may contribute to an improved probing depth after third molar surgery.
Xiang <i>et al.</i> , (2019) ¹³	Impact of platelet-rich fibrin on mandibular third molar surgery recovery: a systematic review and meta-analysis	This study aims to evaluate the efficacy and safety of platelet-rich fibrin (PRF) in patients undergoing bilateral lower third molar extraction, looking at post-operative complications, pain control, swelling reduction and the incidence of adverse events.	The local use of PRF during the removal of lower third molars proved effective in preventing post-operative complications.
Dragonas <i>et al.</i> , (2019) ¹⁴	Effects of leukocyte-platelet-rich fibrin (L-PRF) in different intraoral bone grafting procedures: a systematic review	To analyze the effects of leukocyte- and platelet-rich fibrin (L-PRF) on bone regeneration, soft tissue healing and postoperative complications in ridge preservation and augmentation procedures, as well as maxillary sinus augmentation.	The use of L-PRF in post-extraction alveoli showed modest benefits in reducing alveolar ridge remodeling and post-operative pain, compared to natural healing. However, in maxillary sinus augmentation procedures, there were no clear advantages, and the evaluation on ridge augmentation was limited.
Powell <i>et al.</i> , (2022) ¹⁵	The application of leukocyte- and platelet-rich fibrin (L-PRF) in maxillary sinus augmentation	To evaluate how the application of fibrin rich in leukocytes and platelets influences bone healing in maxillary sinus augmentation.	L-PRF shows potential benefits in bone regeneration when used in maxillary sinus augmentation.

Shah & Cairns, (2018) ¹⁶	Autologous Platelet Concentrates to improve post extraction outcomes	To determine whether the use of APCs reduces complications and improves the quality of life of patients after tooth extraction.	The use of platelet-rich plasma (PRP), platelet-rich fibrin (PRF) and plasma rich in growth factors (PRGF) after tooth extraction shows significant benefits, including improved soft tissue healing, increased probing depth, increased bone density and reduced swelling and trismus.
De Angelis <i>et al.</i> , (2019) ¹⁷	Hard and Soft Tissue Evaluation of Different Socket Preservation Procedures Using Leukocyte and Platelet-Rich Fibrin: A Retrospective Clinical and Volumetric Analysis	To compare the clinical and radiographic results of different ridge preservation procedures based on the use of leukocyte- and platelet-rich fibrin (L-PRF).	The use of L-PRF resulted in less post-operative discomfort and pain, as well as promoting improved post-operative progress and more effective healing for patients.
Liu, Liu & Luo, (2023) ¹⁸	The role and mechanism of platelet-rich fibrin in alveolar bone regeneration	Provide a comprehensive summary of recent PRF applications in the field of dentistry	PRF plays a role in regulating the expression of osteogenic genes, releasing various growth factors and activating signaling pathways. These actions are responsible for stimulating angiogenesis, ensuring proper cell organization and facilitating bone formation.

Source: Authors (2023)

DISCUSSION

Among the results obtained, it is notable that a significant majority of studies corroborate the view that PRF is a truly outstanding option in the field of oral and maxillofacial surgery and traumatology. This autologous therapy has emerged as an excellent choice, significantly enhancing the effectiveness of the healing process. In addition, its ability to reduce both the intensity of post-operative pain and edema stands out, thus providing a more comfortable experience for patients. Furthermore, PRF is recognized for its stimulating role in angiogenesis and the formation of soft and hard tissues, further expanding its beneficial scope in surgical and recovery contexts.

4.1 TREATMENT OF BUCOSINUSAL COMMUNICATION (OACS/OAFs) UP TO 5 MM:

Bucosinusal communications (OACs) and oroantral fistulas (OAFs) are common complications in oral and maxillofacial surgery. OAC, an abnormality between the

maxillary sinus and the oral cavity, facilitates infection of the maxillary sinus mucosa. Its incidence, between 0.5% and 13%, is influenced by factors such as maxillary sinus anatomy, bone resorption after tooth loss, cysts, tumors, osteomyelitis, trauma, implant surgeries, sinus augmentation, radiation, orthognathic surgeries and enucleation of cysts/tumors, which can result in oral and maxillofacial communication.

There are various therapeutic options for treating OACs/OAFs, such as a buccal advancement flap, buccal fat pad rotation, gingival or connective tissue graft, distant autogenous flaps (tongue flap, auricular/septal cartilage, temporal muscle flap), combined with regenerative techniques such as monocortical bone grafts, hydroxyapatite blocks or collagen membranes. Tooth transplantation, interseptal alveolectomy, biostimulation with laser light, among others, have also been described. The approach can be intraoral or combined with an endoscopic approach. However, these techniques have disadvantages, leading some authors to consider Platelet Rich Fibrin (PRF) as a viable alternative.

Platelet Rich Fibrin (PRF) is effective when used alone to treat OACs/OAFs of up to 5 mm. This approach not only proves to be effective therapeutically, but also stands out for minimizing post-operative morbidity compared to other techniques. An additional relevant aspect is PRF's ability to preserve the position of the mucogingival junction, thus contributing to more favorable clinical results and a smoother recovery for patients ⁸.

4.2 - REDUCING POST-OPERATIVE PAIN, ACCELERATING SOFT TISSUE HEALING AND PREVENTING DIMENSIONAL BONE LOSS

During the repair process, the body goes through the inflammatory, proliferative and remodeling stages. In the initial phase, there is an acute inflammatory response to the injury, with the blood carrying inflammatory cells to the affected site. In addition to the phagocytes that clean the wound, white blood cells and platelets release cell mediators such as TGFB1, PDGF, VEGF, IGF1, which trigger cell migration, proliferation and differentiation in the healing process ².

PRF is formed by dividing autologous blood into components that promote the wound healing process and components that do not. The components that promote

wound healing are suspended in a fibrin matrix for preservation and slow release as the wound heals. Ideally, the red blood cells are extracted during centrifugation and what is kept are the white blood cells, platelets and fibrin. By volume, these ingredients for wound healing are found at levels much higher than physiological. The fibrin matrix is PRF's main advantage over PRP. It acts as a three-dimensional structure for leukocytes and platelets and their release products. The matrix allows for the delayed release of its contents so that the beneficial effects of wound healing are present for a longer period of time.

Platelet Rich Fibrin (PRF) and Leucocyte-Platelet Rich Fibrin (L-PRF) have emerged as key players in surgical interventions, playing a fundamental role in promoting a significant reduction in post-operative pain. These therapies, through the autologous concentration of platelets and leukocytes, not only act effectively in accelerating the soft tissue healing process, but also stand out for their remarkable ability to prevent bone dimensional loss. By exploiting the rich growth factors present in the patient's own blood, these innovative approaches not only show substantial clinical benefits, but also prove crucial for a more efficient surgical recovery and a more comfortable and optimized post-operative experience ^{8, 11 13, 16, 17}.

4.3 - LOCAL APPLICATION OF PRF IN THE POST-OPERATIVE PERIOD

The local application of Platelet Rich Fibrin (PRF) in the post-operative period has been highlighted as an effective strategy for promoting tissue regeneration and optimizing results after surgical procedures. The direct use of PRF at the site of the intervention contributes to a more favorable biological response, taking advantage of the benefits of autologous growth factors present in the patient's own blood. This approach aims not only to accelerate tissue healing, but also to minimize post-surgical complications, reduce pain and promote faster and more efficient recovery. The localized application of PRF in the post-operative period thus represents a valuable tool in the search for better results and in promoting a more optimized post-surgical experience for patients ¹³.

4.4- STIMULATION OF BONE REGENERATION

Stimulation of bone regeneration is a crucial concept in the field of regenerative medicine and orthopedic surgery. Various techniques and approaches are employed to promote the growth and repair of bone tissue, with Platelet Rich Fibrin (PRF) being a notable option. The application of PRF, which is rich in growth factors and regenerative cells, actively stimulates the biological processes that favor bone formation. This strategy not only accelerates healing, but also contributes to improving the quality of the regenerated bone. Stimulation of bone regeneration, with the support of PRF and other innovative techniques, represents a significant advance in the search for effective solutions in procedures related to bone reconstruction and repair^{15, 18}.

CONCLUSION

In summary, the applications of platelet and leukocyte-rich fibrin (L-PRF) in oral and maxillofacial surgery and trauma are fundamental and promising. The ability of L-PRF to stimulate tissue regeneration, reduce post-operative pain, minimize complications and promote efficient recovery highlights this technique as a valuable ally in surgical procedures in the oral and maxillofacial region. Whether it's preserving the alveolar ridge, preventing complications after tooth extraction or supporting the healing of soft and hard tissues, L-PRF has emerged as an effective and versatile approach, helping to improve clinical results and the patient experience in this specific context. These applications, backed by scientific evidence, reinforce the potential positive impact of L-PRF on the optimization of surgical procedures and the ongoing search for innovative therapeutic approaches in Oral and Maxillofacial Surgery and Traumatology.

However, it is imperative to emphasize the pressing need for further research aimed at deepening our understanding of this subject. Further research could explore specific aspects, such as optimizing application protocols, evaluating long-term results and direct comparison with other therapeutic modalities. The continuous improvement of knowledge in this field will not only consolidate the efficacy of L-PRF, but will also outline more precise and personalized guidelines for its application, thus raising the standard of care in Oral and Maxillofacial Surgery and Traumatology.

CONFLICTS OF INTEREST



The authors declare no conflicts of interest.

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