# State of the Art of Autologous Platelet Concentrates in Dentistry: A Narrative Review

Abstract

**Aim of the study**
Over the past 10 years, PRP and PRF have been widely used in dentistry, due to their growth factors and regenerative potentials and have expanded their use in many procedures with results that are now clinically and statistically significant. The initially described procedures included oral surgery, in general, from simple to complex extractions of included third molars. Today their use goes from periodontics to hard and soft tissue regenerative surgery, through oral wound healing up to implant therapy. The aim of this review is to evaluate the state of the art of autologous platelet concentrates in different branches of dentistry.

**Materials and methods**
A literature research was conducted through major scientific database without any restriction. Because of the large number of articles included and the wide range of methods and results among the studies found, it was not possible to report the results in the form of a systematic review or meta-analysis. Therefore, a narrative review was conducted.

**Results**
We obtained 2236 results, of which 1621 were published in the last 10 years. After the screening of titles and abstracts, non-topic entries were excluded, 323 reviews and systematic reviews were included, of which 320 passed the English language filter.

**Conclusions**
This review highlights the present state of the art of the use of autologous platelet concentrates in dentistry. According to several recent studies, there is an effective benefit in several clinical outcomes described in using prp or prf in different procedures, while in others further clinical studies are needed.

DOI

10.23805/JO.2024.679

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Keywords

**Platelet-rich fibrin, platelet-rich plasma, prf, prp, oral surgery, implantology.**

## INTRODUCTION

PRP is the plasmatic fraction containing platelets and leucocytes of the autologous non-coagulated blood. Although the evidence supporting the clinical use of PRP in dentistry is low, PRP is widely used in sportive medicine, orthopedics and dermatology (1). The beneficial activity of PRP is believed to be due to growth factors released by platelets accumulated in PRP, even if evidence is indirect and not completed. Despite the widespread use of PRP, the cellular and molecular mechanisms of its beneficial effects are not completely known.

The preparation of PRP involves collecting the patient's blood, the centrifugation process to separate platelets and plasma from red and white blood cells, and the measure of platelets concentration in a reduced plasma volume. Different centrifugation protocols and devices can influence the quality and composition of the PRP obtained. PRP contains a high concentration of platelets, which release growth factors and other bioactive molecules when activated. These growth factors include platelet-derived growth factor (PDGF), beta-transforming growth factor (TGF-β), vascular endothelial growth factor (VEGF), and many others, playing a crucial role in the modulation of tissue healing. The use of anticoagulants such as citrate in the preparation of PRP prevents coagulation during centrifugation (2). The addition of thrombin and CaCl2 to PRP activates platelets, causing the release of growth factors and the formation of a fibrin scaffold, providing a structure for tissue regeneration. Activated platelets release a variety of bioactive molecules, including cytokines, chemokines, and growth factors, affecting various biological processes such as inflammation, angiogenesis, and tissue regeneration. These molecules act on different target cells, including fibroblasts, endothelial cells, and inflammatory cells, to promote tissue healing. The fibrin-rich extracellular matrix (ECM) formed in activated PRP acts as a temporary scaffold supporting cell migration and proliferation, providing a reservoir of growth factors and modulating inflammation. The structure and composition of fibrin ECM can significantly affect the outcome of tissue healing. PRP can improve tissue healing through various mechanisms, including stimulation of cell proliferation, promotion of angiogenesis, modulation of the inflammatory response, and inhibition of apoptosis. These beneficial effects are mediated by growth factors and cytokines released from activated platelets and fibrin ECM.

Platelet-rich fibrin (PRF) is a second-generation technology (3). It is preceded by the platelet-rich plasma (PRP). Both PRF and PRP use autologous blood. Both PRF and PRP aim to use blood growth factors to promote the body's healing process. PRF is based on PRP by preserving the growth factors in a fibrin matrix and can take its effects in days or weeks after surgery. Unlike PRP, PRF is prepared without the use of anticoagulant factors, which are known to inhibit wound healing. Compared to PRP, PRF preparations tend to have a higher leukocyte concentration due to improvements in the centrifugation technique, a fibrin matrix that promotes healing and allows growth factors to be released gradually over time, and can be obtained in different forms that improve processability.

In general, there are 2 types of PRF: a solid one and a liquid one. Solid PRF is the initial form of PRF made by Choukroun et al. which improves PRP by preparing platelets concentrate without anticoagulation, having as a result a solid medium which allows slow release of growth factors (4). Choukroun used a high centrifugal force (708 g) in glass tubes to separate his blood products. This type of PRF had a dense fibrin structure. Ghanaati improved his technique in 2014 using a reduced centrifugation force (208 g) and plastic tubes that are less likely to activate a coagulation cascade to produce what he calls A-PRF (5). This dense nature of the clot is the main form of solid PRF used today. A-PRF has a higher concentration of leukocytes retained due to its slow centrifugation and a more porous fibrin matrix, which is better for a greater release of its content. The increasing porosity also allows a greater penetration of blood vessels during angiogenesis. These solid forms of PRF are malleable and can be shaped into pellets or cut into smaller pieces for bone grafting or pressed in a flat shape to be used as a membrane. The I-PRF is based on the concept of slow centrifugal force because it is prepared with a speed force of 60 g (higher rpm but for less time). The result is a non-coagulant suspension that can be manipulated like PRP but keeps the ability to form a slow-release matrix when applied into tissue. This form of PRF can be injected into deep tissue spaces, onto open wounds and mixed with other grafting materials, such as bone graft particles, to produce "sticky bone", which has a texture easier to handle.

The preparation time and cost for PRF are significantly lower because it does not require direct activation with additional factors such as bovine thrombin or extrinsic anticoagulants. Due to its fibrous structure, PRF retains a larger number of cytokines and growth factors within a supportive three-dimensional fibrin scaffold, which facilitates cell migration (6). In tissue, PRF dissolves more slowly than PRP, forming a solid fibrin matrix that is gradually remodeled similar to a natural blood clot. This allows platelets and cytokines to be effectively retained and released over time (6). The PRF scaffold provides a continuous slow release of growth factors and cytokines for up to 10 days, in contrast to PRP, which releases the majority of its growth factors within the first day. Consequently, migrating cells in proximity to PRF scaffolds are exposed to fibrin and growth factors throughout their entire growth cycle (7).

Once blood is collected (without anticoagulants), samples must be centrifuged immediately to prevent activation of the coagulation cascade. During centrifugation, fibrinogen is concentrated at the top of the collection tube until circulating thrombin transforms it into a fibrin network, resulting in a fibrin clot rich in platelets, trapped between an acellular plasma layer and erythrocytes (8). The solid fibrin clot is positioned between the supernatant and the reddish layer formed by red blood cells. This clot can then be immediately removed and condensed in a metal box to obtain a solid membrane or a cylindrical filler. The resulting exudate can be cut and used to hydrate graft materials if needed.

In oral surgery the most frequent applications are for example exodontic surgery, in which PRF can be used as an additive to graft biomaterials for filling the alveolus and in socket preservation techniques (9). It plays a role in third molar surgery to promote optimal healing processes and prevent the onset of alveolar osteitis. PRF has also been successfully used in the closing of oro-antral communications and in sinus augmentation procedures (10,11).

In implantology, the influence of autologous platelet concentrates (APC) on osteointegration processes was investigated (12). As regards the application of PRP and L-PRF on the surface of implants there seems to be a limited clinical benefit, on the other hand, the application of L-PRF membranes in the osteotomy site appears to give positive results in terms of early stability and marginal bone resorption, however no long-term positive effects have been observed. The limitations of this type of study are the inter-individual variability of each patients' unique plasma composition and also the great variability in the centrifugation protocols.

The purpose of this narrative review is to evaluate the state of the art of autologous platelet concentrates in different fields of interest in dentistry, highlighting clinical outcomes supported by significantly scientific studies and those still debated.

## MATERIALS AND METHODS

The aim of this review is to investigate all uses of autologous platelet concentrates in dentistry, to highlight the evidence of efficacy they have in some procedures and the ongoing debate that needs further investigation.

### Protocol and literature search

A literature research was conducted independently by two reviewers (A.A.; A.C.) through PubMed/MEDLINE, the COCHRANE library, Scopus, and Web of Science databases without any restriction. Only articles published until 29-07-2024 and written in English have been included. A combination of the following keywords was used for the electronic search: (PRF or PRP or Platelet Rich Plasma or Platelet Rich Fibrin) AND (Oral Surgery or Implantology).

References were exported and managed using Mendeley Reference Manager.

## RESULTS

We obtained 2236 results from our search. 1621 manuscripts were published in the last 10 years. Only reviews and systematic reviews were included from them, for a total number of 323 results, of which 320 passed the English language filter. After the screening of titles and abstracts, non-topic entries were excluded, but many articles that were obtained, concerne the use of platelet concentrates in oral surgery, regenerative surgery, periodontology, and implantology.

Due to the large number of articles included and the wide range of methods and results among the studies found, it was not possible to report the results in the form of a systematic review or meta-analysis.

On the other hand, the articles that were identified by the research procedure described above, were used as the basis for the present narrative review. This review is a narrative review, so it is not based on statistical analysis or bias reduction through confounding analysis.

## DISCUSSION

### PRP and PRF in Oral Surgery

Many studies have been done in the last two decades on the role and uses of autologous platelet concentrates in oral surgery (13,14). From early on, the presence of growth factors and cytokines within the first and second generation of platelet concentrates have shown promising results in their use in the field of oral surgery (15,16). Indeed, they have been used over time following extractions of dental elements, in particular of the lower third molar, in diabetic patients or those on anticoagulant therapy, in case of osteonecrosis of the jaws, or even in patients with osteitis or oro-antral communications (17). The results obtained are controversial, there are several studies that identify positive effects in the quality of wound healing and their regenerative potential, but the quality of the concentrates could have interindividual variability and depends on the healthy state of the subject (3,18). In the case of PRP, its efficacy could also depends on the mode and composition of preparation due to the protocol used (19).

### PRF after Third Molar Extraction

Third molar extraction is one of the most frequent surgical procedure in oral surgery. It is also one of the procedures that has major postoperative sequelae, all of which are related to the inflammatory state that is created after surgery. The major postoperative symptomatic manifestations are pain, swelling, difficulty in chewing, and a prolonged healing time of the site. The use of prf and its application in the post-extraction socket has been proposed by many authors as an aid in postoperative sequelae (20). Many of them agree that prf has a real efficacy in the reduction of postoperative pain and swelling, as well as in a better healing of the surgery site. Vitenson et al. in particular identify the application of A-PRF as the solution to a marked reduction in postoperative pain, when compared to L-PRF or natural healing of the socket (21). These results are also confirmed by Bao et al, who also identify a greater reduction especially on the days third and seventh after surgery (22). Many others also agree that prf does not have a regenerative capacity towards hard tissue, but further studies are needed to investigate this issue in more detail (23). According to some authors, postoperative complications such as osteitis would also be greatly reduced by the use of this platelet concentrate (24).

### PRF in Alveolar Osteitis

Alveolar osteitis is one of the complications related to dental avulsion. In particular, this occurs when there is no blood in the alveolus, thus no clot formation, and most frequently occurs after the avulsion of molars in the lower dental arch (25). This condition generates severe postoperative pain and discomfort that must be managed by the clinician. Several therapeutic options have been proposed for the management of alveolar osteitis, and it has been seen that, although there are no standard protocols identified, the use of PRF has a strong impact in reducing postoperative pain related to this complication (26,27). PRF also seems to have a role in the prevention of this complication when applied in the post-extraction socket, unlike the use of PRP, which does not seem to have a preventive role when compared to placebo (25).

### PRF in Oroantral Communication

Oroantral communication is another complication that can occur in oral surgery  when there is a pathological tract between the oral cavity and the sinus. It can results in various preexisting conditions, such as structural or anatomical, infective-inflammatory types or from traumatic origin. It is very important to manage this type of complication because chronic exposure of the maxillary sinus to the oral microbiota can cause infection and avoid the healing of the tract, especially when it has a diameter greater than 5 mm. Several techniques have been proposed, but the most commonly used is the coronally advanced flap, but this shows some disadvantages related to flap surgery and clinician experience (28). Among the various therapeutic alternatives, one stands out for its associated advantages, the use of PRF. Specifically, when used as a clot and a membrane at the same time, it creates a seal in the most apical portion of the gate and a barrier in the most coronal portion, at the flap level. It has been proposed in various techniques, such as the bilaminar or trilaminar one, but in general, the advantages of its use include the absence of a donor site, which was present using autologous grafts and the absence of displacement of the mucogingival junction,  that avoids the flap elevation and reduces post-operative pain (29,30).

### RF in Implant Therapy

The application of autologous platelet concentrates in regenerative and oral surgery has been studied for some time with various results (31). Studies involving the use of these concentrates in the field of implant therapy are all very recent, proving that it is a very current issue and the result of great clinical interest, as well as many studies have been done to understand what associations there may be between implant stability, osseointegration, and various factors (32). Most studies see the application of PRF at the implant site and evaluate implant stability frequency at various time points through resonance (33). Many studies agree that PRF has a power to accelerate the bone healing phase, promoting, especially in the first phase, the process of implant stability (34). In particular, at 1 and 4 weeks after implant placement most studies agree in identifying improved implant stability compared to the control group, then there are studies that extend this improvement in stability up to 6 weeks and 3-4 months after placement. PRP, on the other hand, does not seem to have a great role in improving implant stability (35,36). One study in particular sees possible benefits of its use in diseased patients compared with healthy patients, in whom it would not have much of a finding, but still concludes that it needs further clinical studies that land the results (37).

### PRF in management of MRONJ

Drugs to date described in the literature that can cause osteonecrosis of the jaws go far beyond those classically known as bisphosphonates (38,39). The use of autologous platelet concentrates in cases of medication-related osteonecrosis of the jaws, as in implant surgery, is not codified by standard protocols (40). Their use is divided depending on the application, which can be preventive, in patients undergoing dental extraction who are taking or have taken bisphosphonates or drugs that have antiresorptive or antiangiogenetic activity, or therapeutic, in patients who have already developed the adverse event (41). In the case of the first described use, the results are statistically significant in preventing the risk of drug-related adverse events, the same cannot be said for confirmed and stabilized cases of osteonecrosis of the jaws (42). However, it has also been showed that the results are variable and depend on the age of the patient, the time of the drug administration but above all it depends on the stage of the osteonecrosis (43).

### PRF in Oral lesions treatment

Oral lichen planus (OLP) represents a significant challenge in oral health, not only for its painful and distressing symptoms but also because of its therapeutic complexity. The variety of clinical manifestations—ranging from reticular lesions to ulcerative forms— needs a tailored approach and, at times, a multidisciplinary strategy for the effective management of the condition. Several therapeutic surgical strategies have been proposed against oral lesions (44).

Traditionally, the treatment of OLP has relied on corticosteroids and other pharmacological agents. However, the use of systemic corticosteroids can lead to a range of significant side effects, highlighting the urgent need for safer and less invasive alternatives. Recently, injectable platelet-rich fibrin (i-PRF) has emerged as a promising option. Although studies are limited, findings suggest that i-PRF not only alleviates pain and reduces lesion size but also enhances patient satisfaction, representing a potentially more acceptable treatment pathway with fewer side effects compared to corticosteroids (45).

In parallel, platelet-rich fibrin (PRF), utilized in the context of oncological surgery for oral carcinoma, has shown favorable outcomes. The meta-analysis conducted by Long et al. demonstrated that the application of PRF may promote tissue healing, reduce the risk of postoperative complications such as scarring, and improve the overall surgical treatment outcome (46).

The combination of innovative approaches such as i-PRF and PRF offers a new prospective to manage complex conditions such as OLP and to enhance the quality of life for patients, underscoring the importance of further research and clinical studies to validate these findings and optimize therapeutic strategies .

## PRP AND PRF IN PERIODONTOLOGY

### PRP and PRF in Periodontal Regeneration

Periodontal tissue regeneration encompasses a range of treatments and therapeutic techniques aimed at repairing and reconstructing the tissues that support the teeth, which are frequently compromised by periodontal diseases such as periodontitis. The objective of these procedures is to slow or halt the progression of periodontal disease and to restore damaged structures, including gums, bone, cementum, and periodontal ligament.

Infrabony periodontal defects are structural bone alterations that develop in the alveolar region of the maxillary or mandibular bone, in proximity to the roots of the teeth. The ultimate goal of periodontal therapy is not only to halt the progression of periodontal disease but also to regenerate the original architecture and function of the periodontal complex, which involves the formation of new cementum on the tooth root and new periodontal attachments between the newly formed bone and cementum. Various surgical techniques for the regeneration of periodontal tissues in infrabony defects are described in the literature.

Several studies have analyzed the efficacy of platelet concentrates either alone or in combination with other biomaterials in the treatment of intraosseous periodontal defects and furcation defects.

In terms of PPD and CAL, according to the review by Panda et al., platelet-rich fibrin (PRF) has a significant additive effect when used in conjunction with open flap debridement (OFD) (47). Platelet-rich plasma (PRP) also exhibits a significant additive effect when used alongside bone grafts. In contrast, PRP has been found ineffective when utilized in combination with guided tissue regeneration (GTR) procedures.

Additionally, according to Miron et al., the use of PRF results in statistically superior periodontal repair of intraosseous defects compared to OFD alone and can also be combined with regenerative biomaterials such as bone grafts or collagen barrier membranes to enhance periodontal regeneration of intraosseous defects (48). Despite the widespread use of PRF demonstrating reductions in PPD and CAL gains, there have been conducted histological studies to assess the regeneration of periodontal tissues.

These characteristics are also supported by the review conducted by Ye et al., who state that platelet-rich fibrin alone provides an effect comparable to the one of biomaterials alone and to that of platelet-rich fibrin combined with biomaterials (49). Conversely, the use of PRF in conjunction with biomaterials does not have any advantage over biomaterials alone. In contrast, according to Hou et al., PRP as an adjunct to the therapy of periodontal intraosseous defects has demonstrated clinically and statistically significant greater gains in clinical attachment level (CAL) and reductions in probing depth (PD) compared to biomaterials alone (50).

Hou et al. and Panda et al. agree that the addition of activated platelet concentrates did not prove beneficial in the GTR regenerative technique (47,50).

Furthermore, according to Cui et al., autologous platelet concentrate treatments have been associated with minimal pain and improved wound healing (51).

The management of periodontal furcation defects presents a significant challenge for clinicians due to the anatomy, accessibility, and complexity of healing. The regeneration of Class II furcation involvement, although feasible, is regarded as an unpredictable procedure, particularly concerning bone fill. This is attributed to the fact that furcation defects constitute lesions bounded by non-vascularized walls, which are unable to provide an adequate supply of cells and blood necessary for regeneration. Castro et al. and Skurska et al. agree that the use of Platelet Rich Fibrin (PRF) in addition to conventional open flap debridement (OFD) has demonstrated statistically significant advantages in terms of probing depth (PD), clinical attachment level (CAL), and bone fill, as supported by Miron et al. (48,52,53). There is no scientific evidence regarding the advantage of using PRF in conjunction with biomaterials compared to biomaterials alone; however, it appears to enhance soft tissue healing (52).

Several strategies and materials have been used over time against the damage caused by periodontal disease, especially because we know that the interaction between this condition and the oral microbiome turns out to be crucial (54–57). Recently, an innovative strategy for regenerative periodontal treatment has been proposed, which involves the simultaneous use of platelet-rich fibrin (PRF) (an anabolic agent) and 1% alendronate (ALN) (a catabolic agent). According to the data analyzed by Li et al., this combination of PRF and 1% ALN demonstrated a greater capacity for periodontal regeneration compared to PRF alone, with statistical significance (58).

## PRP and PRF in Periodontal Plastic Surgery

Recently, periodontal plastic surgery is often indicated for the correction of mucogingival defects. The use of free gingival grafts (FGG) and connective tissue grafts (CTG) harvested from the palate are among the most predictable procedures in periodontal and peri-implant plastic surgery. However, palatal harvesting causes significant discomfort in the palatal area for patients undergoing the procedure. For this reason, various surgical techniques and biomaterials have been introduced for the treatment of gingival recessions without the need for palatal harvesting of FGG and CTG.

According to the data analyzed by Miron et al., the use of Platelet-Rich Fibrin (PRF) in combination with the Coronally Advanced Flap (CAF) surgical technique may represent an effective treatment modality for gingival recessions that exhibit adequate baseline keratinized mucosa width (KMW) (59). This is supported by data indicating that the use of PRF in conjunction with CAF significantly improves the percentage of root coverage compared to CAF alone; however, it does not enhance KMW. Therefore, in cases with limited baseline KMW, the use of Connective Tissue Graft (CTG) may be preferred over PRF.

However, such data are contradicted by Chambrone et al., who demonstrated that PRF in combination with CAF did not yield statistically significant results in terms of root coverage percentage, increase in KMW, or reduction of recession width compared to CAF alone (60).

As highlighted by Panda et al., the data regarding its efficacy in covering gingival recessions do not show statistically significant results (61). This suggests that, although PRF may have some benefits, it is not universally effective for all cases of gingival recession.

However, reviews regarding its application at the palatal graft site indicate significant advantages. The use of Platelet-Rich Fibrin (PRF) in this context has been associated with a reduction in postoperative pain, which may translate into lower analgesic consumption by patients. Furthermore, PRF appears to promote enhanced and expedited wound healing, facilitating early re-epithelialization at the donor site (62,63). These factors render PRF a promising option in soft tissue management, particularly in surgical procedures where pain and healing are critical considerations (64,65).

It is important, however, to continue collecting and analyzing data to fully understand the efficacy of PRF in various clinical applications and to determine the contexts in which it may offer the greatest benefits.

## PRP and PRF in Sinus Floor Augmentation

The maxillary sinus floor elevation is a dental surgical procedure aimed at increasing the bone volume in the maxillary sinus area. This procedure is often necessary in preparation for dental implant placement in situations where the maxillary bone is insufficient due to bone loss, which can occur for various reasons, such as tooth extractions, periodontal disease, or trauma (66).

The use of platelet-rich plasma (PRP) in the context of maxillary sinus floor elevation represents an increasingly common practice in oral and maxillofacial surgery.

The approach for sinus elevation can be categorized into two types: the crestal approach, wherein access to the sinus is achieved from the maxillary bone crest, and the lateral approach, which involves accessing the sinus through the buccal maxillary bone. Furthermore, the procedure can be classified as "one-stage" when implant placement occurs simultaneously with the sinus elevation or "two-stage" when the implant placement takes place after the maxillary sinus elevation.

The issue of the efficacy of autologous platelet concentrates (APC) in the context of dental procedures and maxillofacial surgery is complex and characterized by studies with conflicting results.

The review by Gasparro et al. highlights that APC provides clinical benefits in the short term, demonstrating new bone formation without complications (67). However, the same authors emphasize that, in the long term, no significant improvements emerge in parameters such as bone density, volume, or height compared to the natural healing process.

In contrast, the research conducted by Quirynen et al. indicates that the use of L-PRF as a unique substitute in transcrestal approaches has led to high implant survival rates and reasonable vertical gain (68). This also appears to reduce postoperative pain and limit long-term bone resorption.

Ali et al. confirm the promising application of PRF in "one-stage" sinus lift procedures, suggesting it may accelerate the maturation of demineralized bone grafts (69). Conversely, Ortega-Mejia et al. found no significant additional effects of PRF on sinus augmentation in relation to bone heights and soft tissue percentages (70).

Finally, Valentini et al. caution against using APC alone in a two-stage approach, highlighting their insufficient resistance to the forces of sinus pneumatization (71). However, when combined with bone substitutes, they may accelerate bone formation, although without long-term advantages in new bone gain.

Several studies have reported that the use of these techniques does not seem to significantly influence survival rates or failure rates of implants, nor the occurrence of complications (72,73).

On the other hand, the application of L-PRF membranes in the treatment of perforations appears promising, demonstrating effectiveness as a viable option (71). L-PRF membranes may promote a favorable healing environment, contributing to a reduction in complications.

In addition, the use of Autologous Platelet Concentrate (APC) has shown positive results in the healing of soft tissues and in enhancing the quality of life of patients in the short postoperative period. This evidence suggests that, although PRP and PRF may not have direct effects on implant survival rates, techniques such as L-PRF membranes and APC can provide significant benefits in healing and postoperative comfort.

In summary, the implementation of PRF and APC can be considered recommended for the management of specific complications and for optimizing tissue healing, even though the results on implant success rates require further investigation to confirm long-term benefits.

### PRF in Alveolar Ridge Preservation

The process of bone resorption following the extraction of a dental element is a natural phenomenon that occurs due to the loss of supporting bone resulting from the absence of the root of the extracted tooth (74). This phenomenon can have various implications for oral health and the planning of potential future interventions, such as the placement of dental implants (75–77). For this reason, several surgical techniques have been described to manage and minimize such resorption.

The issue of using platelet concentrates, such as PRP (Platelet-Rich Plasma) and its derivatives, in oral surgery and alveolar ridge preservation is complex and yields variable results depending on the protocols employed for their preparation and application.

Quirynen et al. highlighted that the benefits of PRP in the context of alveolar ridge preservation are controversial, indicating that discrepancies in outcomes may arise from differences in PRP preparation methods (68). This has led to limited adoption of the technique in clinical contexts. In contrast, PRGF (Platelet-Rich Growth Factors) has shown potential in improving outcomes, although some studies have not found significant differences compared to healing achieved with a simple blood clot.

However, L-PRF (Leukocyte-Platelet Rich Fibrin) has demonstrated promising results, exhibiting a significant acceleration in soft tissue healing and a reduction in alveolar ridge resorption (78,79). Some studies have shown that the application of PRP or PRF at the tooth extraction site is associated with less horizontal and vertical bone loss during the early stages of healing, specifically within the 2-3 months following extraction (80,81). Nevertheless, it has been noted that an extended healing period may not confer additional benefits.

Additionally, histological analyses and the use of micro-CT have demonstrated that sockets filled with PRF or PRP exhibit superior quality new bone formation and significantly higher mineral density compared to natural clot (82). These findings are critical, as they suggest that the use of platelet concentrates not only promotes healing but may also enhance the quality of the newly formed bone tissue.

Furthermore, studies generally agree that the use of plasma concentrates, such as PRP and PRF, tends to accelerate healing and epithelization of soft tissues in extraction cavities, as well as reduce postoperative pain and discomfort, thereby mitigating the risk of post-extraction alveolitis . These evidences highlight their relevance in dental practice, despite variations in preparation protocols.

### Autologous Platelet Concentrates in Endodontics

APCs have also been used in the endodontic field. In particular, their use has been described in the management of apical lesions of dental elements, endo/periosteal lesion, endodontic surgery, and apical procedures (83,84). The results obtained describe a good quality of healing, which, however, is not quantified with standard criteria (85,86). Although therefore, the results are promising, further clinical studies and protocols are needed to be standardized to certify clinical and scientific reproducibility.

## CONCLUSIONS

This review substantially highlights all the areas of use of autologous platelet concentrates in dentistry described in the literature today. The state of the art shows greater scientific evidence, thanks to clinical trials conducted over the past 10 years, with absolutely

promising results.
They range from the surgical field to the oncological, infectious, regenerative, endodontic and implant fields. There is much scientific evidence reported in this study, however further investigations and clinical studies are necessary to create a standardization of protocols and clinical evaluation criteria to give greater reliability and predictability to their use.

## Author Contributions

Conceptualization, A.A.. B.S. and A.C.; methodology, A.A.; software, A.T.; validation, A.A., B.S. and A.C.; formal analysis, M.L.; investigation, A.C.; resources, A.T.; data curation, M.L.; writing—original draft preparation, A.A.; writing—review and editing, A.C., A.T.; visualization, B.S.; supervision, A.A.; project administration, A.A.; funding acquisition, A.A. All authors have read and agreed to the published version of the manuscript."

## Funding

This research received no external funding.

## Acknowledgments

Not Applicable.

## Conflicts of Interest

The authors declare no conflict of interest.

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