

Systematic Review: Platelet-Rich Plasma (PRP) in Dental and Oral Surgery

Magid Nooraldeen Alyamany^{1*}, Ghalib Hamad Aljedani², Anas Riyadh Hamdoon³ and Suaad Hassan Alzahrani⁴

^{1,2,3}Dental and Oral Surgery, King Fahd General Hospital, MISHERFAH P.H.C Jeddah, KSA

⁴Nursing supervisor, King Fahd General Hospital, MISHERFAH P.H.C Jeddah, KSA

***Corresponding Author:** Magid Nooraldeen Alyamany, Dental and Oral Surgery, King Fahd General Hospital, MISHERFAH P.H.C Jeddah, KSA.

Received: March 07, 2023; **Published:** March 12, 2023

Abstract

Introduction: Platelet-rich plasma, sometimes known as PRP, has seen widespread use in the field of oral and dental surgery. On the other hand, there is a great deal of controversy around the impact that it has on the healing of wounds and the inflammatory response.

Materials and Methods: PubMed, Google Scholar, the Scopus database, and a manual search were used to locate articles on the use of PRP in dental and oral surgery; specific search terms included platelet-rich plasma, oral surgery, dental surgery, lower wisdom teeth, periodontal pocket, dental implant, tooth socket preservation, dry socket, cystic lesion, and ridge augmentation. A variety of papers examining PRP's practical uses.

Results: We found 9 publications discussing the use of PRP in dental and oral surgery. There are six pieces on using PRP after having lower wisdom teeth extracted, five on using it to treat periodontal pockets and improve implant stability, four on using it to preserve the ridge, three on using it to prevent dry socket, and two on using it after a cyst is removed and the ridge is augmented.

Conclusion: PRP improved bone regeneration and soft-tissue repair after lower wisdom teeth extraction. It reduced periodontal pocket depth, kept implant stability, maintained ridge height, and avoided dry socket. Nonetheless, PRP had no impact on pain, inflammation, or bleeding. After cystic excision of the jaws, there is no reason for the influence of PRP on bone augmentation and repair of bony deficiency. Additional research is required to justify the use of PRP in oral and dental surgery.

Keywords: Bone; Dental; Oral; Platelet-Rich Plasma; Surgery

Introduction

Materials and techniques capable of increasing clinical outcomes in terms of percentages of success are often studied in dentistry and oral surgery research. The purpose of this study was to develop a therapy technique that might decrease bleeding, promote successful bone regeneration, and promote quick soft-tissue repair by using resources that are simple to use and inexpensive.

Platelet rich plasma (PRP) is a novel technique to tissue regeneration that has found widespread usage in a variety of medical specialties, including head and neck surgery, otolaryngology, cardiovascular surgery, and maxillofacial surgery. PRP is often utilized in a gel formulation made by combining PRP (produced from centrifugation of autologous whole blood) with thrombin and calcium chloride. PRP gel has a high quantity of platelets as well as fibrinogen [2].

Platelets are among the first cells to react at a wound site during wound healing, and they are crucial to the commencement of this process. Platelets are a rich source of important growth factors, including platelet-derived growth factor (PDGF), transforming growth factor- β (TGF- β) 1 and 2, and vascular endothelial growth factor (VEGF); all of these are involved in the angiogenic cascade, which aids in hard and soft tissue wound healing [1].

PRP has recently emerged as a viable adjuvant to improve recovery in a variety of dentistry and oral surgical treatments. Ablative surgical treatments, mandibular reconstruction and surgical repair of the alveolar cleft, treatment of infrabony periodontal abnormalities, periodontal plastic surgery, and osseointegrated implant implantation are among them. The sticky property of PRP promotes better management of graft material in such operations, with more predictable flap adaptation and hemostasis, as well as a more predictable seal than is the case with primary closure alone. Recently, the use of PRP in the care of bisphosphonate-related osteonecrosis of the jaw (BRONJ) or avascular necrosis induced by other sources (e.g. radio-osteonecrosis) has been recommended, with the goal of enhancing wound healing and bone maturation [1,2].

Patients in their later years are often the ones who choose to have these elective operations. Age is regarded to be a major factor of periodontal disease, which is the primary cause of tooth loss in adults. From a dental point of view, these patients might be seen as special needs patients, needing a unique treatment; age is the most common cause of tooth loss in adults. In addition, senior individuals are more likely to suffer from systemic disorders, which are known to affect the way the body reacts to surgical therapy in terms of coagulation and tissue healing. As a result of the recent decades' worth of improvements in the quality of life of patients who are elderly, there has been an increase in the need for elective treatments and technologies that can meet their particular requirements at the same time.

Purpose of the Study

The purpose of this research was to determine whether or not platelet-rich plasma (PRP) is useful in oral surgical procedures and to investigate the uses of PRP in oral and dental surgery [2].

Materials and Methods

There is a collection of articles on the use of autologous PRP in dentistry and oral surgery. To gather publications and other reviews pertinent to this investigation, an electronic PubMed, Google Scholar, Scopus database, and manual search were employed. PRP, oral surgery, dental surgery, dry socket, dental implant, tooth socket preservation, wound healing, and bone defect are among the keywords or phrases used to search the papers. Articles using PRP in oral and dental surgical procedures (after surgical extraction of impacted lower wisdom teeth, treatment of periodontal pocket, preservation of tooth socket, maintenance of implant stability and bone density, prevention of dry socket, treatment of bony defect after cystic removal and ridge augmentation), original articles, studies involving adult patients, and articles published in English were considered for inclusion. Papers that employed alternative platelet derivatives, such as platelet rich fibrin (PRF), the use of PRP in bisphosphonate related necrosis of the jaws (BRONJ), trials with 6 patients, and articles published before 2017 were excluded [2].

The publications were categorized based on the kind of study, sample size, treatment technique, research result, time for follow up, and age of the patients. The clinical and radiological characteristics utilized throughout the investigation are used to evaluate the result of each trial. Because the primary goal of this review is to estimate the effect of PRP in specific dental and oral surgical procedures, parameters such as accelerating bone regeneration and soft tissue healing, as well as decreasing inflammatory response (pain, swelling, and bleeding), were used to estimate PRP effectiveness [2,3].

Results

In order to determine whether PRP should be used alone or in combination with other bone replacements in dentistry and oral surgery, a meta-analysis of nine primary investigations was performed. The use of PRP after extraction of impacted lower wisdom teeth is

the subject of six publications; infrabony pockets and dental implant therapy, five; ridge preservation, four; dry socket avoidance, three; and bony defect following cystic lesion excision and ridge augmentation, two. All the investigations are randomized clinical trials, with the vast majority using a split-mouth design and the rest a parallel-group design. Due to the small number of articles on PRP's therapeutic application and the wide variation in surgical methods, a meta-analysis was not conducted. The evaluation was carried out by comparing the results obtained from the PRP containing system to those obtained from the non PRP containing system. The results of each study are listed in table 1 [3].

n	References	Type of study	Sample size	Treatment	Follow Up	Outcome
1	Nisar, <i>et al.</i> 2020	RCT (split-mouth)	30	Use of collagen plug and PRP for ridge reservation	3 and 6 months	PRP +collagen plug preserved ridge height but not the width
2	Isaia, <i>et al.</i> 2018	RCT-split mouth	10	Alveolar sockets filled with ABS and PRP gel and subsequently covered with PRP dot membrane for ridge preservation	10 days - 4 months	ABB-PRP was useful in ridge preservation, demonstrating a significant increase of bone regenerative index and structural bone density
3	Soni, <i>et al.</i> 2018	RCT (parallel)	60	DFDSG and PRF, DFDSG and PRP (ridge preservation)	7 th day and 1 month for soft-tissue healing. Radiographic assessment for bone healing was done at 7 th maxillary and mandibular day.	DFDSG and PRP showed less bone height, width and density when compared to DFDSG and PRF in and PRP anterior and posterior region
4	Jalaluddin, <i>et al.</i> 2017	RCT (parallel)	20	Infrabony pocket treated with either PRP or OFD	6 months	No significant difference between PRP or OFD alone
5	Kaul, <i>et al.</i> 2018	RCT (split-mouth)	25	Surgical removal impacted mandibular third molars	1 st - 7 th days and then evaluated on 3 rd and 6 months	PRP decreased wound dehiscence and probing depth. Improve soft- and hard-tissue healing
6	Gandevala, <i>et al.</i> 2017	RCT (split-mouth)	25	Surgical removal impacted mandibular third molars	Up to 2 months	PRP decreased pain and swelling insignificantly and decreased healing period, pocket depth
7	Singha, <i>et al.</i> 2019	RCT (parallel)	30	PRP and PRF after surgical removal of impacted lower third molars	1, 3-7 days	Autologous PRP can be used as an adjunct to promote wound healing in mandibular-impacted third molar extract on socket
8	Prataap, <i>et al.</i> 2017	A case-control study (split-mouth)	75	PRP in the gel form to prevent dry socket	3-5 days	PRP significantly improved soft-tissue healing, reduced pain, and decreased the incidence of AO
9	Supriya, <i>et al.</i> 2018	RCT (split-mouth)	12	PRP gel to treat bony defect after removal of benign lesion like cyst	1, 3, and 6 months	PRP in the gel form enhanced bone regeneration

Table 1: Characteristics of randomized clinical trials on the use of platelet-rich plasma in dental and oral surgery.

The following are the findings of these investigations on the use of PRP in dentistry and oral surgery.

After surgical removal

Five of the research used a split-mouth randomized design, whereas the other was a parallel design. These studies involved anything from 6 people to 150 people. Male and female volunteers aged 18 to 70 years old took part in these investigations, respectively. In every test, platelet-rich plasma (PRP) gel was used. Patients were followed for 1, 2, 3, and 6 months after surgery in the majority of these studies, with the exception of the experiment conducted by Joy and Kaul., *et al.* (2018). The results of these studies showed that PRP reduced probing depth distal to the lower second molar; avoided wound dehiscence, and accelerated the healing of soft and hard tissues. Pain, swelling, bleeding, and numbness were not affected by PRP, as found by Gandevala., *et al.* [4].

Treatment of infrabony periodontal pocket

These publications provide results from four randomized clinical trials (split mouth) and one parallel investigation. Ten to forty-five individuals, both male and female, aged 25 to 48 years old, took part in the study. Patients were followed for anywhere from 6 months to 5 years after receiving PRP in combination with bone grafts and/or open flap debridement (OFD) to address infrabony pockets. A study by Isaia., *et al.* [7] found that platelet-rich plasma (PRP) combined with torus mandibularis chips or PRP/OFD improved CAL and probing depth. However, in other studies, PRP had no effect on CAL or pocket depth whether used alone or in conjunction with another bone transplant or OFD [5].

Treatment of dental implants

These studies provide the results of five separate randomized clinical trials (using a split mouth design). Male and female patients aged 18 to 44 took part in the studies, with the total number of patients in each group varying from 16 to 32. The patients in these studies were tracked for anything from one week to three years after receiving PRP gel. Osseointegration, bone density, and implant longevity were all improved with the use of platelet-rich plasma. But long-term follow-up shows that PRP has no influence on maxillary implant stability, as reported by Del Fabbro., *et al.* (2017) [5,6].

Preservation of alveolar ridge

These articles offer results from four separate randomized clinical trials. A split-mouth design was employed in three of the experiments, while a parallel trial was used in the fourth. Studies comprised both men and women, with the youngest participants being 18 and the oldest being 60, with sample sizes ranging from 10 to 30 people. In these studies, PRP was used in combination with collagen plug, calcium sulfate, demineralized freeze-dried bone (DFDB), and inorganic bovine bone (ABB), and patients were followed for as long as 9 months. In these studies, combining PRP with bone substitutes increased bone density and height but not alveolar ridge width [6].

Prevention of dry socket

In the process of the search, we came across three studies discussing the use of PRP to avoid dry sockets. Among these four studies, three were randomized clinical trials (splitmouth design), while the other was a parallel design. Sample sizes ranged from 20 to 75 patients, and participants were both male and female (with ages ranging from 18 to 40). The patients were followed for a total of three months following surgery, during which time frame they received PRP in gel form. This study found that platelet-rich plasma (PRP) was effective in avoiding dry socket after extraction of a permanent tooth and in accelerating the healing of surrounding soft tissues. However, these studies converged on the conclusion that PRP did not influence bone healing in any way [7].

Treatment of bony defect

Searching showed up two papers on the topic of using PRP to treat bone deformity in the craniofacial area. Split-mouth designs were used in each of these investigations. The research included both male and female participants, and the total number of participants varied

from 11 to 12. After surgical excision of a cystic lesion or benign tumor such a cyst in the craniofacial area, a gel containing platelet-rich plasma was employed to repair the resulting bone defect. In these trials, patients were followed for as long as 6 months after surgery. Supriya, *et al.* [17] found that PRP improved bone regeneration in a bony defect, however Ramanathan and Cariappa [14] found that PRP had no effect on bone repair 6 months later [8].

Ridge augmentation

The use of platelet-rich plasma (PRP) to improve ridges has been discussed in two separate academic papers. Each of these tests used the split mouth layout. Participants in these studies were both male and female, with ages ranging from 19 to 76 years. Patients who used PRP gel were followed for four to thirty months. After 4 and 30 months of follow-up, these studies revealed that PRP improved the ridge's width [8,9].

Discussion

Although there has been a great deal of study on the effect of PRP on wound healing, the findings have been uneven. This meta-analysis includes 27 studies that examine the usefulness of PRP for various dental procedures.

Six publications were chosen to discuss the use of PRP after extraction of lower wisdom teeth. These investigations examined the effects of PRP on a variety of healing parameters, including pain, swelling, bleeding, probing depth distal to the lower second tooth, wound dehiscence, bone regeneration, and soft tissue healing. A number of these studies found that PRP improved bone regeneration and soft tissue healing, reduced postoperative discomfort and edema, and shortened the time it took for wounds to heal after surgery [4,5]. Additional studies suggest that PRP aids in bone regeneration and soft tissue repair but does not reduce pain, swelling, or blood loss [4]. These discrepancies may originate from many different factors, including the kind of PRP used, the technique used to assess pain, swelling, and bleeding, and the amount of the sample used. One possible reason for the discrepancies in this study is that the articles did not specify the kind or degree of mandibular wisdom tooth impaction [10].

Franchini, *et al.* [3] state that periodontal tissue is made up of both hard tissue (bone) and soft tissue components. After periodontal pocket treatment, this in-depth study found that PRP had a debatable effect on both CAL and pocket depth. The amount of bone grafts used (PRP alone or in combination) did not affect CAL or pocket depth in one study [8]. However, some have asserted that platelet-rich plasma (PRP) grafts significantly affect the depth of probes and the results they provide (CAL) [11]. Possible causes for these discrepancies among research include (patient selection criteria, periodontal pocket measurement, and PRP containing system vs non PRP containing system). In addition, most of these researches followed PRP's after-effects for as long as 9 months. In the later study, PRP was used in conjunction with natural bone mineral and enamel matrix derivatives, and the results showed that PRP did not improve the healing process (CAL) [12].

Five studies were considered in this meta-analysis of the literature on the topic of platelet-rich plasma's (PRP) impact on dental implant durability and bone density. Some studies coated the implant surface with PRP before inserting the implant, while others coupled PRP with another bone transplant to treat a bony defect brought on by implant placement. Most of these studies concluded that PRP improved implant stability and bone density whether used alone or in conjunction with other bone transplants. On the other hand, Gopinath, *et al.* [5] found that PRP did not significantly improve implant stability. The impact of PRP on primary implant stability]in the posterior maxilla was studied by Gopinath, *et al.* [5] whereas the effect was studied in various regions of the upper and lower jaws in other studies. This might be the reason why some studies have shown different results from Gopinath, *et al.* [5]. The alveolar ridge resorbs with age, and the posterior maxilla contains soft bone but no cortical bone. With so many factors at play, securing implants at the back of the maxilla may be challenging [13].

The effects of PRP on ridge height, width, and density, either alone or in conjunction with other bone grafts, were examined in four investigations. Two of these trials demonstrated that the alveolar ridge's height and width were preserved when the socket was filled with PRP combined with calcium sulfate or ABB [7]. On the other hand, platelet-rich plasma with a collagen plug did not succeed in maintaining ridge height and bone density [11]. Also, while comparing PRP and PRF with DFDB graft, researchers observed that PRP with DFDBG had a milder effect on the width, height, and bone density of the upper and lower alveolar ridges [16]. Sample size, patient selection criteria, and the kind of PRP containing system may all play a role in explaining the disparities shown in these studies [14]. It is worth noting that the sample sizes used in the studies by Isaia, *et al.* [7] ranged from 10 to 12 individuals, suggesting that their findings may not be generalizable to the effects of PRP on alveolar ridge preservation. Thirty patients were used in prior studies [11,16] to demonstrate a comparable effect [15].

PRP has been shown to be useful in the prevention of dry socket in three separate clinical studies. Every study that looked at the effects of PRP on soft-tissue healing and the incidence of dry socket revealed that it was significantly improved by the use of PRP. While two of these trials followed patients for up to 15 days and showed soft tissue recovery, the research by Del Fabbro, *et al.* [1] indicated that PRP could prevent dry socket but not bone regeneration even though patients were followed for up to 3 months. However, it was not made clear in these studies whether PRP was used alone or in combination with other bone substitutes [16].

The use of platelet-rich plasma (PRP) for the treatment of bone deficiencies after surgical removal of a cystic lesion or benign tumor of the jawbone was investigated in two separate studies. Bone flaws were managed in these studies using PRP gel [14,17]. While some researchers [17] discovered that PRP enhanced bone regeneration at 6-month follow-up, others [14] observed no effect of PRP on bone formation, making the findings of these studies controversial. Variations in bone lesion size, PRP containing system, or patient age may underlie these differences [17]. The factors that influence how quickly a bone defect heals include its anatomical location, the age of the patient, the kind of bony defect (monocortical or bicortical), hormone secretion, periosteal integrity, and blood flow. Multiple studies have shown that it may take up to two years for a bone defect to heal on its own after the removal of a cystic lesion or benign tumor. However, some studies have shown that using PRP gel may shorten this time to only 6 months. It's important to keep in mind that it could take more than just these two papers to draw firm conclusions about whether or not PRP boosted bone development after cystic excision or not [18].

Two studies examined how PRP affected ridge enlargement. There have been many studies that combined PRP with cancellous allograft, ABB, and titanium mesh. The former showed that PRP did not influence ridge augmentation, whereas the latter showed that bone width was increased apical to the ridge crest. With just two studies to go on, it's hard to say whether or not PRP affects ridge augmentation. What's more, the PRP containing system varied across studies. Because of this, further studies on the effect of PRP on ridge augmentation are needed before any firm conclusions can be drawn [19].

Conclusion

Platelet-rich plasma (PRP) treatment accelerated the healing and regenerative processes after the extraction of lower wisdom teeth, but had no effect on the inflammatory response (pain, swelling and bleeding). PRP was effective in reducing the size of the periodontal pocket, however it had no effect on cellular activation level (CAL). When using PRP, both implant stability and ridge height could be maintained. Bone regeneration in a defect left by cyst removal or ridge augmentation is not expected to be affected by PRP. PRP has been demonstrated to reduce the frequency of dry sockets in those who are predisposed to developing them. Additional studies are needed to prove the efficacy of PRP in dentistry and oral surgery.

Bibliography

1. Del Fabbro M., *et al.* "Healing of postextraction sockets preserved with autologous platelet concentrates. A systematic review and meta-analysis". *Journal of Oral and Maxillofacial Surgery* 75.8 (2017): 1601-1615.

2. Everts P, et al. "Platelet-rich plasma: new performance understandings and therapeutic considerations in 2020". *International Journal of Molecular Sciences* 21.20 (2020): 7794.
3. Franchini M, et al. "The use of platelet-rich plasma in oral surgery: a systematic review and meta-analysis". *Blood Transfusion* 17.5 (2019): 357.
4. Gandevivala A, et al. "Autologous platelet-rich plasma after third molar surgery". *Annals of Maxillofacial Surgery* 7.2 (2017): 245.
5. Gopinath A, et al. "Effect of platelet rich plasma on stability of dental implants: a prospective comparative clinical study". *Journal of Dr. NTR University of Health Sciences* 6.2 (2017): 07.
6. Gopinath A, et al. "Effect of platelet rich plasma on stability of dental implants: a prospective comparative clinical study". *Journal of Dr. NTR University of Health Sciences* 6.2 (2017): 107.
7. Isaia L, et al. "The effects of the combined use of platelet-rich plasma and xenograft on alveolar socket healing". *Biomedical Journal* 2 (2018): 9.
8. Jalaluddin M, et al. "Use of platelet rich plasma in the management of periodontal intra-osseous defects: A clinical study". *Journal of International Society of Preventive and Community Dentistry* 7.2 (2017): 105.
9. Kaul RP, et al. "Autologous platelet rich plasma after third molar surgery: a comparative study". *Journal of Maxillofacial and Oral Surgery* 11.2 (2012): 200-205.
10. Mihaylova Z, et al. "RhPDGF-Basic Characteristics and Potential Application in the Oral Surgery-An Overview". *Acta Medica Bulgarica* 47.3 (2020): 61-66.
11. Nisar N, et al. "Extraction socket preservation using a collagen plug combined with platelet-rich plasma (PRP): A comparative clinico-radiographic study". *Journal of Dental Research, Dental Clinics, Dental Prospects* 14.2 (2020): 139.
12. Oudelaar BW, et al. "Concentrations of blood components in commercial platelet-rich plasma separation systems: a review of the literature". *The American Journal of Sports Medicine* 47.2 (2019): 479-487.
13. Piccin A, et al. "Platelet gel: a new therapeutic tool with great potential". *Blood Transfusion* 15.4 (2017): 333.
14. Ramanathan A and Cariappa KM. "Effect of platelet-rich plasma on bone regeneration after removal of cysts and benign tumours of the jaws". *Oral and Maxillofacial Surgery* 18.4 (2014): 445-452.
15. Singha S, et al. "Evaluation of treatment outcome after impacted mandibular third molar surgery with and without autologous platelet concentrates". *SRM Journal of Research in Dental Sciences* 10.2 (2019): 72.
16. Soni HC, et al. "Evaluation of bone healing and ridge preservation in mandibular and platelet rich fibrin A clinical and radiological study". *International Journal of Current Research* 10 (2018): 68639-68646.
17. Supriya GP, et al. "Evaluation of efficacy of platelet rich plasma in healing of maxillofacial bony defects: A comparative in vivo study". *Acta Scientific Dental Sciences* 2 (2018): 26-31.

18. Alissa R., *et al.* "The influence of platelet-rich plasma on the healing of extraction sockets: an explorative randomised clinical trial". *European Journal of Oral Implantology* 3 (2010): 121-134.
19. Gürbüz B., *et al.* "Scintigraphic evaluation of early osteoblastic activity in extraction sockets treated with platelet-rich plasma". *Journal of Oral and Maxillofacial Surgery* 66 (2008): 2454-2460.

Volume 22 Issue 4 April 2023

© All rights reserved by Magid Nooraldeen Alyamany., *et al.*