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The Role of Platelet-Rich Products in Soft Tissue Repair after Extraction of Wisdom Teeth: A Review

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ABSTRACT

Introduction: The extraction of the third molar, commonly known as wisdom tooth extraction, is one of the most frequent clinical procedures. This surgery can lead to several postoperative complications such as pain, trismus, swelling, dry socket and damage to soft and hard tissues, significantly impacting the patient's quality of life. Platelet-Rich Plasma (PRP) and Platelet-Rich Fibrin (PRF) have been proposed as an effective treatment to mitigate these complications and enhance tissue repair. This study aims to review the role of PRP and PRF in soft tissue repair following wisdom tooth extraction between 2015 and 2023.

Materials and Methods: This research reviewed the role of PRP and PRF in soft tissue repair after wisdom tooth extraction. Articles from Scopus, PubMed, Elsevier, and SID databases were selected and reviewed based on inclusion and exclusion criteria, focusing on publications from 2015 to 2023. The search was conducted using keywords such as "impacted wisdom teeth," "soft tissue," "hard tissue," "repair," "PRP" and "PRF."

Results: Nineteen relevant studies were identified, with no studies conducted in 2023. The studies from this period were primarily meta-analyses with varying degrees of relevance to the study topic. The distribution of the studies reviewed is as follows: three studies in 2022, four studies in 2021, three studies in 2020, one study in 2019, one study in 2018, one study in 2017, two studies in 2016, and four studies in 2015. These studies collectively suggest that PRP and PRF are beneficial in reducing postoperative complications and enhancing the repair of soft tissue damaged during wisdom tooth surgery.

Conclusion: PRP and PRF effectively reduce postoperative complications and promote the restoration of soft tissues damaged by wisdom tooth extraction. Therefore, in cases of soft tissue damage and periodontal conditions in patients undergoing wisdom tooth surgery, PRP and PRF can be a valuable treatment option for tissue repair.

Keywords: Impacted wisdom teeth; Soft tissue; Hard tissue; Repair; Platelet-rich plasma (PRP); Platelet-rich fibrin (PRF).

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Introduction

The wisdom tooth refers to the last tooth to erupt in each jaw arch, and if it is not placed in the dental arch at the expected time, it is called an impacted tooth. The most common impacted teeth are the upper and lower third molars. As a general rule, all impacted teeth should be extracted unless there are specific contraindications to extraction [1]. Surgical extraction of the third molar is one of the most common clinical procedures performed by surgeons [2]. This surgery is associated with the possibility of several complications after the operation, including pain, trismus, swelling, and dry socket (alveolar osteitis, AO) [3]. The prevalence of wisdom teeth in the lower jaw is 17.5%, and in the upper jaw, it is 21.9% [4]. Not removing these teeth from the jaw can lead to complications, including resorption of the roots of adjacent teeth, damage to the periodontal tissues, decay in adjacent teeth, and the development of cysts and tumors. Considering these potential issues, it appears that the most effective treatment method in such cases is to extract the teeth [5].

Socket repair of an avulsed tooth is a coordinated process of biochemical, physiological, cellular, and molecular reactions involving various cell types, growth factors, hormones, cytokines, and other proteins. This process aims to regenerate tissue and restore function after surgery. Following tissue damage, after hemostasis and cessation of bleeding, the repair process begins, which includes three interwoven stages: inflammation, fibroblastic activity, and regeneration. These stages overlap in terms of time [6]. Platelets are responsible for several vital activities, including blood coagulation, inflammation, antimicrobial defense, and wound healing. Although the initial focus of platelets is on coagulation, it is known that platelets carry growth factors, immune system messengers, enzymes, and other biologically active compounds involved in various aspects of tissue repair [7].

Platelets are involved in both hemostasis and the initiation of the wound healing process. These two processes are inseparable, as the tissue repair process begins concurrently with the completion of hemostasis [8]. Platelet-Rich Plasma (PRP) is obtained through the centrifugation of the patient's blood. It contains a physiological concentration of platelets that release growth factors. PRP is a biological approach to improve healing by releasing growth factors directly into the wound. In surgery, PRP has yielded beneficial results, including reduced bleeding, improved soft tissue repair and bone regeneration, and numerous applications in treating musculoskeletal injuries. Animal and laboratory studies have demonstrated that PRP creates a local environment rich in growth factors and other cytokines for tissue regeneration, positively affecting the migration and proliferation of all cell types. Recently, expanding research on the effects of PRP regeneration on various tissues, such as bone, cartilage, tendon, and muscle, especially in traumatic injuries, has led to its increased use in plastic surgeries [9].

Studies conducted on humans using PRP in oral and dental surgeries, such as tooth extraction, periodontal surgery, and implant surgery, have shown promising results [10,11]. Research on the effects of PRP in improving wound healing in oral and maxillofacial surgery has yielded varied results, with most studies focusing on graft healing and dental implants [12]. PRP, which contains growth factors, can help prevent the development of periodontal defects caused by third molar extraction and also aid in their repair. During tooth extraction, bone formation typically takes approximately 16 weeks; however, there may be insufficient bone volume for reconstruction in the long term. PRP has been developed as an effective method to improve bone formation [13].

Platelet-Rich Fibrin (PRF) is prepared by a one-step centrifugation without applying any anticoagulants. PRF consists of platelets, leukocytes, and their subgroups embedded in a fibrin matrix with plasma proteins. The first protocol of PRF was called leukocyte-rich platelet-rich fibrin (L-PRF), mainly because it contains more leukocytes compared to the first-generation blood concentrates, PRP. PRF is the most extensively studied type of platelet concentrate for accelerating wound healing, particularly in promoting soft tissue migration. PRF can reduce inflammation of the periodontal tissues, preserve the alveolar site, and repair alveolar bone defects, thereby enhancing bone regeneration. L-PRF promotes rapid neo-angiogenesis and stimulates bone regeneration by releasing growth factors and providing good clot stability [14,15]. Considering the complications that can occur after wisdom tooth surgery, which significantly affect the patient's quality of life, as well as the effectiveness and efficiency of PRP and PRF, the purpose of this study is to review the role of PRP and PRF in soft tissue repair following wisdom tooth extraction from 2015 to 2023.

Materials and Methods

This research examined the results obtained from existing articles on the subject of a review of the role of

PRP and PRF in soft tissue repair after the extraction of impacted wisdom teeth. In this way, the articles available in the Scopus, PubMed, Elsevier and SID websites with similar topics in the 8 years from 2015 to 2023 were selected and reviewed based on the entry and exit criteria, and the articles were received by searching for wisdom teeth, soft tissue, repair, PRP and PRF keywords. The inclusion criteria for the study were: studies written in English, clinical studies, case-control studies, and review studies, conducted between 2015 and 2023, and articles with full-text availability. Exclusion criteria for the study were: systematic review studies and studies not indexed in the specified scientific databases. After searching the articles and reading the title and abstract, the necessary information (author, year of publication, type of study, number of patients, investigated parameter, type of treatment, conclusion) was obtained from the reviewed articles and the results were interpreted and compared.

Results

Based on the search strategy and inclusion criteria, 19 studies with the most similarity to the subject were identified, out of which no study had been conducted in 2023. The studies reviewed in this period were meta-analyses with low similarity to the subject of the study. Also, 3 studies in 2022, 4 studies in 2021, 3 studies in 2020, 1 study in 2019, 1 study in 2018, 1 study in 2017, 2 studies in 2016, and 4 studies in 2015 were reviewed. They had discussed the issue (Table 1).

Table 1. Summary of reviewed articles and relevant parameters.

Row	author	year	Type of Study	Number of Patients	Investigated Parameters	Method	Findings
1	Rengarajoo et al. (54)	2022	Clinical trial	15	Swelling, trismus, pocket depth, soft tissue healing, bone formation	Platelet rich plasma	Soft tissue healing, measured as the change of periodontal pocket depth, showed significant reduction, suggesting the benefit of LPRP for soft tissue healing. However, bone regeneration and reduction of post-operative sequelae showed no improvement even after quantification and repeated LPRP application.
2	Sargaiyan (55) et al.	2022	Clinical trial	15	Pain, soft tissue healing, bone density	Platelet rich plasma	Bone and soft tissue healing may be aided by platelet-rich plasma (PRP).
3	Osagie (56) et al.	2022	Clinical trial	50	Preoperative and postoperative swelling, degree of mouth opening and pain	Comparative efficacy of platelet-rich fibrin (PRF) to platelet-rich plasma (PRP)	PRF was more effective in reducing postoperative pain compared to PRP. Furthermore, the study shows that platelet concentrates positively modulate post-inflammatory sequelae of impacted M3 surgery.
4	Verma (57)et al.	2021	Clinical trial	20	Pain, swelling, trismus	platelet-rich fibrin (PRF) and platelet-rich plasma (PRP)	Platelet-rich fibrin and platelet-rich plasma both worked well in reducing post operative pain, swelling and trismus. Authors did not notice any significant difference with PRF and PRP. Both of the studied materials seem to have almost equal potential in osseous healing
5	Ahmed (58)et al.	2021	Clinical trial	96	Soft tissue healing and inflammation	Platelet rich plasma	Platelet rich plasma showed better outcomes in terms of soft tissue healing and control of inflammation after surgical extraction of mandibular molar teeth.

Row	author	year	Type of Study	Number of Patients	Investigated Parameters	Method	Findings
6	Hanif (59)et al.	2021	Clinical trial	130	Mouth opening and pain after tooth extraction	Platelet rich plasma	Platelet Rich Plasma is effective to lessen trismus and pain after surgical removal of mandibular third molar teeth.
7	Al-Noaman (60)et al.	2021	Clinical trial	-	Wound healing and inflammatory response	Platelet rich plasma	PRP enhanced bone regeneration and soft-tissue healing after lower wisdom tooth surgery. It decreased the depth of periodontal pocket, maintained implant stability, preserved ridge height and prevented dry socket. However, PRP had no effect on pain, swelling, and bleeding. There is no justification for the impact of PRP on bone augmentation and healing of bony defect after cystic removal of the jaws. More studies should be carried out to support the usage of PRP in oral and dental surgery
8	Bhujbal (61)et al.	2020	Clinical trial	20	Swelling, wound, soft tissue, bone density	Platelet rich plasma and Platelet rich fibrin	Results showed a significant improvement in the soft tissue wound healing and increase in bone density in PRF site than PRP site. There was significant reduction of the swelling found on the ١st and ٣rd day at PRF site as compared to the PRP site. Although the postoperative pain scores were less in PRF site, this was not statistically significant among the two groups
9	Aftab (62)et al.	2020	Clinical trial	100	Pain, swelling, mouth opening	Autologous PRP gel	The use of simple, cost- effective method of autologous PRP gel may be beneficial to enhance the wound healing process and promotes bone regeneration.
10	Kumar (63)et al.	2019	Clinical trial	100	Pain, swelling, trismus, soft tissue healing, pocket	Platelet rich plasma	The use of PRP application increases the bone density, healing process, and improvement in the pain and swelling, and there was a definite reduction in trismus and periodontal probing depth after the impacted mandibular wisdom teeth extraction

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Row	author	year	Type of Study	Number of Patients	Investigated Parameters	Method	Findings
11	Jonathan (64) et al.	2019	Clinical trial	15	Post-operative pain, swelling, trismus, pocket depth	Lyophilized platelet-rich plasma	Soft tissue healing, measured as the change of periodontal pocket depth, showed significant reduction, suggesting the benefit of LPRP for soft tissue healing. However, bone regeneration and reduction of post-operative sequelae showed no improvement even after quantification and repeated LPRP application.
12	Bhujbal (65)et al.	2018	Clinical trial	20	Soft tissue healing, pain, swelling, bone density	Platelet rich plasma	The results showed an improvement in wound healing and swelling and an increase in the bone density at PRP site. The growth factors in PRP would improve the hard and soft tissue healing ۳ months after molar surgery.
13	Gandevivala (66)et al.	2017	Clinical trial	25	Pain, swelling, wound healing, periodontal probing depth	Autologous platelet rich plasma	The use of PRP lessens the severity of immediate postoperative sequelae and decreases preoperative pocket depth.
14	Doiphode (67)et al.	2016	Clinical trial	30	Wound healing, bone regeneration	Platelet rich plasma and platelet rich fibrin	This study indicates a definite improvement in the periodontal health distal to second molar after third molar surgery in cases treated with PRF as compared to the PRP group and control group. Hence, PRP and PRF can be incorporated as an adjunct to promote wound healing and osseous regeneration in mandibular third molar extraction sites.
15	Dutta (68)et al.	2016	Clinical trial	40	Pain, swelling, dry socket, soft tissue healing	Platelet rich plasma, platelet rich fibrin and hydroxyapatite	PRP and PRF are better graft materials than HA regarding pain, swelling, dry socket, and soft tissue healing. Bone regeneration is induced promptly by HA as compared to other graft materials.
16	Dutta (69)et al.	2015	Clinical trial	60	Soft tissue healing, bone regeneration	Platelet rich plasma	Autologous PRP is biocompatible and has significant improved soft tissue healing, bone regeneration and increase in bone density in extraction sockets.

Row	author	year	Type of Study	Number of Patients	Investigated Parameters	Method	Findings
17	Yelamali (70) et al.	2015	Clinical trial	20	Socket healing	Platelet rich plasma and platelet rich fibrin	PRF is significantly better in promoting soft tissue healing and also faster regeneration of bone after third molar extraction, in comparison with PRP. This could be attributed to simpler preparation protocols of PRF over PRP and the ability of PRF to release growth factors in a controlled way.
18	Gawai (71)et al.	2015	Clinical trial	5	Soft tissue healing and bone regeneration	Platelet rich plasma	PRP enhanced the osteogenic response in initial bone healing at 1 month duration but there was no added benefit in late bone healing at 4 months period compared in both intervention and control groups. However, PRP significantly improved the soft tissue healing in PRP treated sites compared to control group.
19	Nathani (72)et al.	2015	Clinical trial	10	Post operative pain and soft tissue healing	Platelet rich plasma and synthetic graft material	The platelet rich plasma is a better graft material than synthetic graft material in terms of soft tissue and bone healing. However, a more elaborate study with a larger number of clinical cases is very much essential to be more conclusive regarding the efficacy of both the materials.

Discussion

In most cases, wisdom tooth surgery creates problems and complications for the patient, which creates the need for repeated visits to treat and solve these problems. Common complications after wisdom tooth surgery include swelling, pain, bleeding, dry mouth, damage to soft tissue and periodontal structure and jaw bone. In studies conducted on human samples, the effect of PRP and PRF in oral and dental surgeries such as tooth extraction, periodontal surgeries and implant surgeries was promising. However, although many studies have investigated the effect of using PRP and PRF in various treatments and dental practices, but few studies have investigated the effect of PRP and PRF on soft tissue repair after the extraction of wisdom teeth. Collecting the latest achievements in this regard, reviewed the role of PRP and PRF in soft tissue repair after wisdom tooth extraction. Platelet-derived growth factors in PRP and PRF, as mitogens, play a key role in angiogenesis and tissue repair. Since the introduction of PRP for maxillofacial use in 1997 by Withman, no single protocol has demonstrated significant, reproducible results. In a recent meta-analysis, limited evidence was found regarding the effects of PRP on bone repair, and the scientific evidence for PRP improving third molar cavities was also weak; therefore, further research is needed to fully identify its indications and efficacy in patients [16]. However, another study found improvement in bone and soft tissue after tooth extraction in patients [17]. In this review, 19 studies were identified that investigated the effect of PRP and PRF on soft tissue repair following third molar surgery. Also, other complications, including swelling, trismus, pocket depth and bone formation, were among the cases that were investigated in the studies. In most studies, there is a consensus that PRP and PRF resulted in soft tissue repair [18-31]. However, in some studies,

although the soft tissue repair was more pronounced in the PRP and PRF group, no significant difference was observed between the two groups receiving PRP and PRF injections and the control group. In a study by Sargaiyan et al., most patients experience healing without the need for intervention, and PRP can only be effective in accelerating the healing of damaged soft tissue. But regarding pain caused by surgery, a positive effect of PRP injection was observed. Perhaps the reason for the lack of significant difference between the two investigated groups in the study of Sargaiyan et al. is due to the high periodontal health in the investigated patients in both groups and also the genetics of the patients is an effective factor in the restoration of soft tissue damaged by wisdom tooth surgery [32].

Another reason for the low effectiveness of PRP in soft tissue repair in some studies could be due to the nature of PRP and its effectiveness. In several studies, the effect of using PRP and PRF in soft tissue repair has been investigated [21,25,27,29,33,34]. They expressed the therapeutic effect of PRF in terms of soft tissue repair, pain, swelling, bleeding and bone formation far more than PRP. Osagie et al. stated in their study that PRF was more effective than PRP in reducing preoperative and postoperative swelling, the degree of mouth opening, and postoperative pain. In addition, this study demonstrated that platelet concentrate had a positive effect on reducing the inflammatory sequelae of latent brain surgery [33]. Bhujbal and colleagues also stated in their study that there was a significant improvement in soft tissue wound healing and an increase in bone density in the PRF site compared to PRP and a significant reduction in swelling on the first and third day in the PRF site compared to the PRP site.

Although postoperative pain scores were lower at the PRF site, it was not statistically significant between the two groups [21]. Doiphode et al. also observed a better therapeutic effect in the PRF group than PRP and control [27]. Dutta et al. also stated in their study, Yelamali et al. third molars were significantly better compared to PRP [28,29]. One of the reasons for the better effect of PRF compared to PRP may be due to the differences in their structure and production methods. The reason that the effect of PRF was greater than PRP may be due to the nature of PRF and the concentration of platelets in it compared to PRP. In comparisons made for the effect of PRP and PRF on tissue regeneration, it was stated that the effect of PRF on tissue regeneration is far greater than that of PRP [35,36]. It can also be attributed to the presence of leukocytes in PRF, as noted in several studies [35,37,38]. As Yelamali et al. stated in their research, the better effect of PRF compared to PRP may be due to the simpler preparation protocols of PRF compared to PRP and the ability of PRF to release growth factors in a controlled manner [29]. However, in some studies, no significant difference was observed between soft tissue repair in two PRF and PRP groups [34,27]. Verma et al. stated in their research that platelet-rich fibrin and platelet-rich plasma are both effective in reducing postoperative pain, swelling, and trismus, and no significant difference was observed. Both studied substances seem to have almost equal potential in bone and soft tissue healing [34]. Also, Dutta et al. in their study, which compared platelet-rich plasma (PRP), platelet-rich fibrin (PRF), and hydroxyapatite (HA) in soft tissue healing after wisdom tooth surgery, stated that PRP and PRF are better graft materials than HA in terms of pain, swelling, dry socket, and soft tissue healing. However, in comparison to other graft materials, bone regeneration is rapidly induced by HA [36].

Nevertheless, a more precise study with a larger number of clinical cases is necessary to determine the definitive effectiveness of graft materials. The genetic makeup of individuals can significantly impact the healing of soft tissues following surgery, which could explain the variability in study results. Additionally, factors such as the technician's skill and the extent of the injury are not measurable and were not addressed in previous studies. However, the therapeutic effect of PRP and PRF may vary in patients with different surgical conditions and levels of soft tissue damage. Therefore, based on the results of a single study, it is not possible to conclusively confirm or refute the effect of PRP on soft tissue healing.

A comprehensive assessment of study results is necessary to make an informed decision regarding the use or non-use of PRP. Out of 19 studies reviewed, 18 studies indicated that PRP and PRF are effective in soft tissue healing and reducing other complications following wisdom tooth surgery. Only one study did not find a significant difference between the two groups under study. Still, even in this study, the soft tissue healing effect in the PRP group was greater than in the control group. Thus, based on a consensus, PRP and PRF can be considered effective in soft tissue healing. It should also be noted that the use of PRP and PRF should be based on the surgeon's discretion, careful assessment of the extent of the injury, the individual's periodontal disease history, and the type of surgery being performed. Hence, the necessity of using PRP and PRF in all patients is not obligatory, but its benefits should be

utilized when needed.

Conclusion

PRP leads to reduction of complications after surgery and restoration of soft tissue damaged by wisdom tooth surgery; therefore, in case of damage to soft tissue and periodontal condition in patients undergoing wisdom tooth surgery, this method can be used to restore soft tissue.

Conflict of Interest

There is no conflict of interest to declare.

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