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PRP vs PRF: A Systematic Review of their Efficacy in Socket Preservation

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KEYWORDS

alveolar ridge, bone healing, platelet rich fibrin, platelet rich plasma, regeneration, socket

ABSTRACT:

Introduction- Extraction of a tooth frequently leads to bone loss in the alveolar ridge, which can make the installation of dental implants more challenging. Platelet-rich fibrin (PRF) and Platelet rich plasma (PRP) serves as an adjunct to bone grafting in alveolar ridge preservation to enhance bone regeneration. The present systemic review was done to check the efficacy of PRP vs PRF in socket preservation.

Material And Methods- Systematic review was designed and performed following the preferred reporting items of the PRISMA statement. PubMed, Cochrane Central Register of Controlled Trials, and EBSCO, google scholar databases were searched. All the randomized clinical trials using PRP and PRF for bone regeneration in alveolar ridge preservation were selected. Data extracted was organized and results were analyzed on the basis of primary and secondary outcome.

Results- There was a statistically significant difference in bone density outcome found in the P-PRP group. The sockets treated with L-PRP exhibited greater bone density compared to the control sockets. A total of 66.6% of the studies demonstrated a significant reduction in postoperative pain with the use of PRF, particularly within the first 1-3 days following tooth extraction. The socket fill was considerably higher in the PRF group compared to spontaneous wound healing in 85% of the investigations.

Conclusion- According to the analysed studies, Platelet-Rich Fibrin (PRF) has been found to be more efficacious than Platelet-Rich Plasma (PRP) during the initial healing phase, which lasts for 2-3 months after tooth extraction. The existing data does not provide sufficient evidence to make any conclusions on the long-term success of implants in sockets treated with PRF or its combination with biomaterials.

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Introduction

Tooth extraction not only results in the loss of a functional dental unit, but also leads to significant changes in the structure of the surrounding hard and soft tissues. These changes can have important implications for the future prosthetic rehabilitation of the empty tooth socket, including the placement of a dental implant in a position that is both functional and aesthetically pleasing.[1] The dimensional changes of the alveolar process (or alveolar ridge) after tooth extraction have been extensively studied in humans using various clinical, cast model, and radiographic examinations.[2,3] The surgical treatment known as "socket preservation" is performed to maintain the alveolar ridge after tooth extraction, with the goal of reducing or eliminating the need for future augmentation surgeries for implant-prosthetic rehabilitations. The primary component of the suggested socket preservation procedures is the utilization of bone or bone replacement grafts, either with or without membranes. Another method for socket preservation primarily aims to improve the healing of the alveolar socket by utilizing biological mediators. Platelets possess numerous roles beyond their primary role in hemostasis. Activated platelets secrete growth factors and cytokines, including fibrinogen, basic fibroblast growth factor, fibronectin, angiopoietin-2, insulin-like growth factor-I, platelet-derived growth factor, transforming growth factor-β1 (TGF-β1), and vascular endothelial growth factor. These substances are crucial for the healing of both soft and hard tissues.[4,5]Platelet-rich plasma (PRP) and platelet concentrate were introduced to the area of dentistry in the 1990s.[6] Subsequently, alternative procedures for preparing PRP have been established. Typically, blood that has been treated with anticoagulants is first centrifuged gently to separate the plasma portion from the red blood cells. The plasma fraction undergoes a second centrifugation process to separate the platelets from the platelet poor plasma (PPP). The leukocyte-containing platelet pellet is suspended in a smaller volume of platelet-poor plasma (PPP) and then activated using thrombin and calcium. By employing this dual centrifugation technique, platelets undergo a substantial enrichment of around 2 to 5 times compared to regular blood.[7] Choukroun et al. were the first to produce PRF, which stands for platelet-rich fibrin, as a second-generation platelet derivative for use in oral and maxillofacial surgery. Platelet-rich fibrin is created by centrifuging blood without the use of anticoagulants or bovine-derived thrombin. This method has several benefits, such as simpler preparation and the absence of chemical manipulation, compared to PRP.[8] Platelet products have recently been investigated for several clinical uses in oral and maxillofacial surgery.[9] The aim of the present study was to review systematically the available scientific literature to evaluate the efficacy of PRP versus PRF in socket preservation.

Material and Methods

The search approach employed in this systematic review was derived on the PRISMA guidelines (Preferred Reporting Items for Systematic reviews and Meta-Analyses).[10] The formulation of clinical questions followed the PICO framework, which is commonly used in evidence-based practice.[11] The question was: 'What is the impact of PRP and PRF on alveolar socket preservation? A literature search was done in the National Library of Medicine's MEDLINE/PubMed database, the Cochrane Central Register of Controlled Trials, and the ClinicalTrials.gov website. The authors utilized a search string that was constructed specifically for this purpose: ('PRP' OR 'platelet rich plasma' OR 'PRF' OR 'platelet rich fibrin' OR 'PRGF' OR 'plasma rich in growth factors') AND ('extraction socket' OR 'tooth extraction' OR 'alveolar socket' OR 'socket preservation' OR 'socket'). There were no limitations on the use of any language. This study includes all randomized controlled trials and controlled clinical trials that evaluated the effectiveness of platelet concentrates in promoting the repair and regeneration of hard and soft tissues in patients who underwent tooth extraction. The study only included subjects who did not have any systemic disorders and were not taking any medications that could impair platelet and bone functioning. No age or patient limit was taken into account. Only studies that compared a test group utilizing platelet concentrates with a control group that did not use platelet concentrates were included. Any form of platelet concentrate was taken into account, excluding those that were utilized in conjunction with other biomaterials. Inclusion criteria required studies to have a minimum follow-up duration of 2 months for hard tissue healing and 3 weeks for soft

Journal of Chemical Health Risks

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tissue healing. Excluded from the analysis were preclinical studies, case reports, case series, retrospective studies, letters to the editor, technical reports, narrative reviews, and studies that involved the excision of impacted third molars or prompt implantation of implants. In addition, conference abstracts were excluded from consideration. All complete text studies were thoroughly examined and analyzed to determine their eligibility based on the inclusion and exclusion criteria. The diversity of the main findings of the studies analyzed in this review was assessed based on various factors, including study design, study population, tooth type, reason for extraction, extraction method and intervention, outcomes, evaluation method, evaluation time, results, and conclusions. The methodological quality of each study was evaluated based on the criteria proposed by Van van Weijden et al.[12], with certain adjustments. The assessment of bias was determined by evaluating the extent to which each study matched the established quality criteria. An examination of the chosen studies, including information on the vertical and horizontal dimensions of the data. Data was gathered on alterations in both the soft and hard tissues, as well as the values of bone fill. Mean and median values, together with their corresponding standard deviations or errors, were reported whenever they were available. Additional data, such as surgical problems, recovery, and analysis of tissues that had recently developed were also gathered. Nevertheless, as a result of the diverse nature of studies quantitative analysis followed by a meta-analysis was not conducted to analyze the data across studies. Feasible and solely a descriptive analysis were conducted.

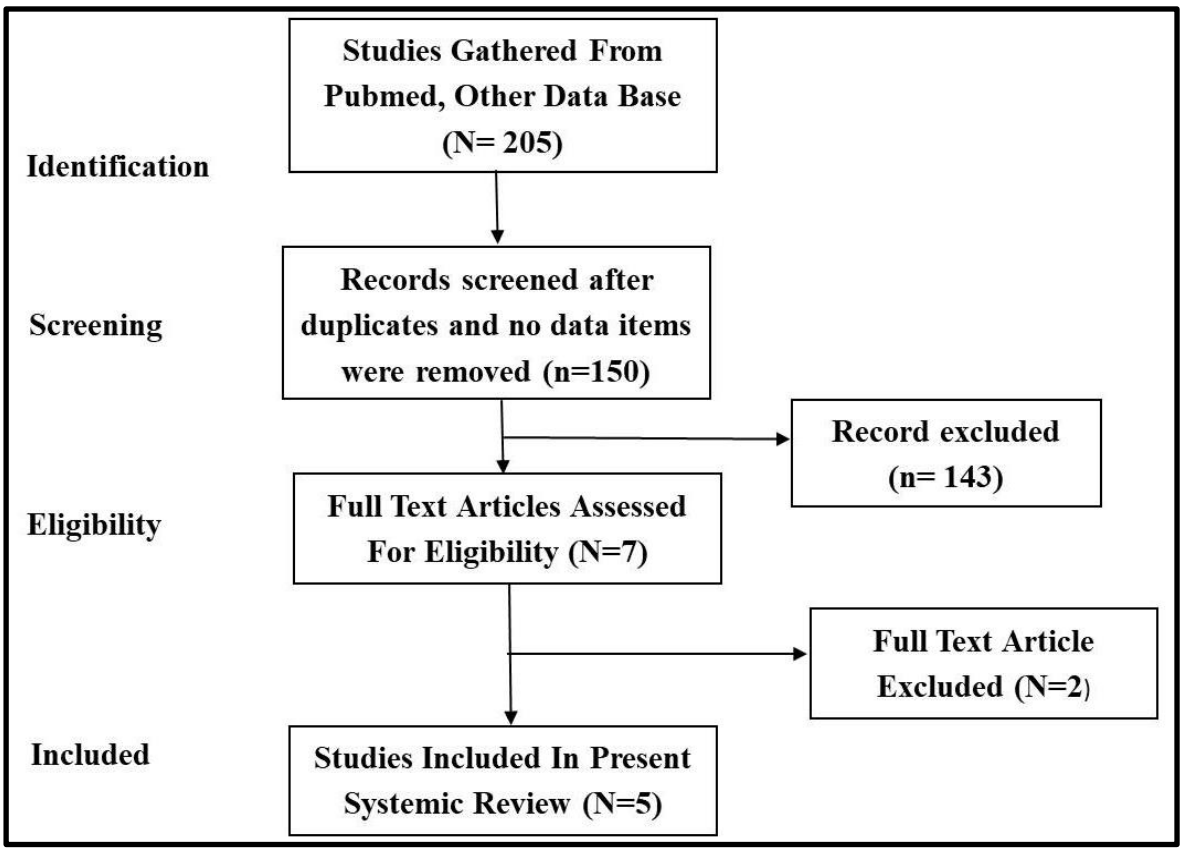

Figure 1- Flow diagram (PRISMA format) of the screening and selection process

Journal of Chemical Health Risks

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JCHR (2024) 14(4), 308-315 | ISSN:2251-6727

Results

After the initial search, a total of 205 items were identified in MEDLINE/PubMed, and in other sources. After eliminating duplicates and items with missing data, there were 150 remaining records. Following the evaluation of titles and abstracts based on the predetermined criteria for inclusion and exclusion, a total of 143 articles were deemed irrelevant and so removed. Consequently, only 7 researches met the necessary requirements and were retained for further analysis. One report was removed following a thorough assessment of the whole text due to the additional use of a bone transplant in the experimental groups. After completing the process, this systematic review includes a total of 5 studies that were published between 2010 and 2016 (fig. 1). The rationale for the inclusion and exclusion criteria is provided in table 1.

Table 1: Inclusion and exclusion criteria for studies

Inclusion Criteria	Exclusion Criteria
Study design: interventional studies either randomized controlled clinical trials (RCT) & nonrandomized controlled clinical trials (CCT) Population: Patients with some missing teeth There are no limitations regarding the age or quantity of patients. Individuals in good health Procedure: Alveolar socket preservation utilizing autologous plasma concentrate Comparison: no biomaterial in the control group; only clot in the socket Outcome: qualitative and /or quantitative changes of soft and hard tissues. Follow-up duration: at least 2 months for hard tissue healing, 3 weeks for soft tissue healing	Research on the excision of impacted third molars Research studies have investigated the use of platelet concentrates in conjunction with bone transplants, biomaterials, or rapid implant implantation. Other forms of study design, including observational studies, technical reports, conference papers, pre-clinical investigations, and reviews

The examination of the included studies revealed high heterogeneity in terms of aim, design and protocol, results obtained, and conclusion reached. The main characteristics of selected studies like study design, type of wound healing and the different methods used in the selected studies to prepare platelet concentrates as reported in table 2.

Table 2: Main characteristics of selected studies

Study	Design	flap	Type of platelet concentrate	Anti coagulant solution	Activator	Type of healing

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(4), 308-315 | ISSN:2251-6727

Alissa et al., 2010 [13]	RCT	Flap	PRP	citrate dextrose	Autologus thrombin	I intention
Suttapreyasri and Leepong 2013 [14]	RCT	Flapless	PRF	None	None	II intention
Hauser et al. 2013 [15]	RCT	Flap and flapless group	PRF	None	None	II intention
Marenzi et al. 2015 [16]	RCT	Flapless	PRF	None	None	II intention
Temmerman et al. 2016 [17]	RCT	Flapless	L-PRF	None	None	II intention

Meta-analysis of data among the studies was not possible because of the substantial variation in design and in data presentation even if similar outcomes were measured (such as radiographic alveolar height, bone fill, and pain).

Discussion

In the past decade, there has been a growing interest in the use of blood concentrates in oral and regenerative medicine. These concentrates have been used for various purposes, such as promoting wound healing and regenerating bone and soft tissue. Several recent reviews have examined the clinical evidence comparing platelet-rich plasma (PRP) and platelet-rich fibrin (PRF) in different fields, including oral and maxillofacial surgery and orthopedics.[18] However, many of these reviews have analyzed multiple indications and used broad inclusion criteria, making it difficult to draw specific conclusions about the use of platelet concentrates for specific indications. Furthermore, these reviews have often focused on general bone regeneration, which is important for implantology, but little is known about the effects of PRF on specific parameters of socket preservation, such as soft tissue regeneration and pain.[19] The present systemic review compared the use of PRP vs PRF in socket preservation after extraction. We conducted a systematic review that focused solely on randomized controlled trials. These trials compared the use of various types of platelet concentrates in a postextraction alveolar socket with a control site that was allowed to heal naturally. We excluded all other types of studies from our analysis. Unlike previous reviews, we chose to exclude studies involving impacted third molars, as these extractions often involve the removal of socket walls through osteotomy. We also excluded studies that investigated the combined use of platelet concentrates and bone grafts, focusing solely on the influence of platelet concentrates on the healing process. In contrast to prior reviews, this study only included research with individuals who were in good health and not taking any medication that could potentially affect platelets or bone metabolism. This was done to minimize the influence of other factors and make it easier to interpret the results. Various techniques have been suggested for the preparation of platelet concentrates. Among the studies analyzed, one utilized platelet-rich plasma (PRP) and four utilized platelet-rich fibrin (PRF). However, it is challenging to definitively determine which technique is more effective than the other. There are several factors that can affect the viability and activity of platelets in tissues. These include the type of cell separator used, the method of centrifugation, the amount of blood collected before surgery, the initial concentration of platelets in the collected blood, the amount of platelet concentrate obtained, the final increase in platelet concentration, and the type of blood anticoagulant and platelet activator used.[4,20] Preparations such as Platelet-Rich Plasma (PRP) or Platelet-Rich Fibrin (PRF) consist of a solution with a relatively high concentration of white blood cells. The quality and quantity of cells in

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(4), 308-315 | ISSN:2251-6727

PRP can be influenced by factors such as centrifugation speed and time, as well as the type of anti-clotting and activation agents employed. These parameters are of little importance in the preparation of PRF, as natural clotting takes place during centrifugation, and there is no need to add anti-clotting agents, thrombin, or calcium hydrochloride to alter the biochemical properties of blood.
PRF is the most easily prepared plasma concentration.[21] Recent studies have compared the release of growth factors from various platelet concentrate families in terms of their concentration. Unfortunately, conclusive data cannot be presented.[4] In a study conducted in 2012, it was found that the release of growth factors was significantly higher in L-PRF compared to PRGF. However, it is not feasible to definitively state that one technique is superior to the other, as both product families have the ability to positively effect tissue healing.[22] The authors conducted a recent study to assess the release of growth factors over time from PRP, PRF, and an updated technique for PRF known as advanced-PRF (A-PRF).[23] The findings suggest that PRP has the benefit of releasing considerably larger quantities of proteins at earlier time intervals, while PRF demonstrates a consistent and gradual release of growth factors over a span of 10 days. Subsequently, the revised version of PRF, known as A-PRF, exhibited a substantial increase in the overall amounts of growth factors in comparison to the conventional PRF.[23] The platelet concentration in various platelet concentrates may impact their impact on tissues.[24] A study determined that the ideal platelet concentration for enhancing tissue repair/regeneration is 1,000,000 PLT/µl. Unfortunately, there is a lack of information regarding this particular element, and only a small number of efforts have been made to establish a standard for platelet count and its correlation with clinical outcomes.[4] The findings from our study provide evidence suggesting that using autologous platelet concentrates after tooth extraction can speed up the healing of soft tissues and lessen postoperative discomfort. However, the data about the repair of hard tissues is still uncertain. The most recent research have given promising results in the evaluation of hard tissues using advanced technologies like cone beam computed tomography, which provide more trustworthy and accurate assessments. Because there is currently a lack of comparison data on the various types of platelet preparations used for socket preservation, we can say that using the PRF involves lower risks than the PRP due to absence of bovine thrombin and anticoagulants and better efficiency for cell migration and proliferation but it is not possible to provide a recommendation on this issue. The lack of universally recognized criteria for the manufacturing of platelet concentrates greatly hinders the reliability of the existing evidence concerning their biological impacts. In addition, there is a scarcity of comprehensive information regarding the protocols used to prepare platelet concentrates. Conducting additional research that precisely examines the relationship between platelet count and growth factor concentration in these preparations, as well as their impact on biological consequences, will greatly contribute to our knowledge of the varied clinical outcomes observed thus far.

Conclusion

Platelet-Rich Fibrin (PRF) has been proven to be more effective than Platelet-Rich Plasma (PRP) during the early healing phase, which occurs between two and three months after tooth extraction. The currently available data does not give sufficient information to draw any conclusions regarding the success of socket preservation that have been treated with PRF or the combination of PRF and biomaterials over the long term.

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Journal of Chemical Health Risks

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JCHR (2024) 14(4), 308-315 | ISSN:2251-6727

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