DOI: https://doi.org/10.53350/pjmhs2023173287

ORIGINAL ARTICLE

Platelet Rich Plasma PRP in Dental and Oral Surgery: Wound Healing to Bone Regeneration

SYED AKBAR ABBAS ZAIDI[1], BUSHRA ARAIN[2], NOSHEEN KHAWAR[3], SANA ADEEBA ISLAM[4], ALVINA ALI SHAIKH[5], SYED AIJAZ ALI ZAIDI[6]

[1]*Assistant Professor, Department of Dental Education, Bahria University Dental College, Karachi*
[2]*Assistant Professor, Oral Medicine Department, Isra Dental College, Isra University Hyderabad*
[3]*Assistant Professor, HOD Dental Materials Science, Fatima Jinnah Dental College, Karachi*
[4]*BDS, MSc (UK) Associate Professor, Department of Community & Preventive Dentistry, Incharge Department of Student Affairs Dentistry, Karachi Medical and Dental College, Karachi*
[5]*Assistant Professor, Oral Medicine Department, Isra Dental College, Isra University Hyderabad*
[6]*Assistant Professor, Oral Medicine Department, Baqai Dental College, Baqai University Karachi*
Corresponding author: Syed Akbar Abbas Zaidi, Email: akbarabbas_91@hotmail.com, Cell: +92 323 3326 3449

ABSTRACT

Background: The aim of this study to evaluate the outcome of the efficacy of the PRP use to promote wound healing and bone regeneration.

Study design: The study was cross sectional being conducted in the department of Dentistry, Bahria University Dental College, Karachi six months from June 2022 to November 2022.

Methods: A total number of the participants were 150. The male and female genders were both included who suffered dental surgery. The sample of blood was taken around 55cc by a trained medical expert. After that, blood will be centrifuged to separate the platelet-rich plasma from the remaining components of your blood. For the greatest results, your blood will often be spun two to three times.

Results: The age range was 20-60 years and > 61 years old, with an average of 51.1±12.5 years, which indicate highly significant tooth loss at above 61 years old age p<0.005**. The PRP treatment was showing significant improvement in the dental and oral postoperative treatment p<0.005. After postoperative analysis of the participants by the treatment of PRP, which show significant improvement CAL, gingival recession, repair bone defect, stop tooth extraction and root coverage show significant result <0.005** as compared to control group.

Conclusions: Following tooth extraction, the application of PRP in the alveolar socket can improve soft tissue healing and favorably affect bone regeneration. Root lengthening, apex closure, and dentin wall thickening were all higher, and they all encourage the rejuvenation of the pulp tissue and further root development.

Keywords: Platelet rich plasma, cytokine, growth factor and blood.

INTRODUCTION

Platelet-rich plasma (PRP) is a biological substance that is frequently employed in oral surgery, according to the profession of dentistry. Because cytokines and growth factors are included in platelet-based preparations, which help the healing process, these biomaterials have the potential to be used in dentistry.[1] PRP's efficacy in its many uses has grown, particularly in the healing of soft tissues after exodontia and in reducing the amount of analgesics required to relieve pain and the healing period as well as morbidity. In light of the previously stated, it is evident that PRP including fibrin has a high capacity for stimulating and regenerating the natural healing process of tissues at extraction sites. According to recent research, PRP can be used as an effective, affordable, and straightforward therapeutic support for extraction procedures. In addition to being beneficial for bone regeneration and tissue healing, the use of PRF in surgical operations for tooth extraction has also been found to significantly lower the risk of recovery delays for patients receiving oral bisphosphonate therapy.[2] Because of its ability to repair and regenerate itself, it plays a vital function in defense and survival by serving as a key barrier between the inner and exterior environments. A wound is characterized as a disruption of the normal anatomic structure and functional integrity of the skin. Multiple cell types, growth factors, cytokines, and chemokines interact throughout the coordinated, dynamic tissue repair process known as wound healing. The chronic inflammatory phase may halt if this system is disrupted, resulting in chronic, non-healing wounds or excessive granulation tissue production.[3] Despite substantial improvements in nutrition and medical treatment, there is a rising need to create new methods to speed up the healing of cutaneous wounds. The medical sector is moving quickly in the direction of the creation of low- or non-invasive procedures and faster therapies that can help patients have a better quality of life by reducing morbidity and achieving a strong functional recovery. These straightforward and economical methods have the ability to lower the expenses of general medical treatments that are already being used in the economy. A new, interdisciplinary area of biomedical study called "regenerative medicine" strives to repair, regenerate, and replace harmed tissues and cells. Due to its potential to promote and expedite tissue regeneration, platelet-rich plasma (PRP) is an endogenous therapeutic technique that is gaining popularity in regenerative medicine.[4]

Inflammation triggered by bacteria accumulations results in periodontitis, a complicated multifactorial inflammatory disease that is characterised by the loss of connective tissue and degradation of alveolar bone, cementum, periodontal ligament, and gingiva. Periodontal problems are brought on as a result of this. There are two types of periodontal defects: suprabony pocket and intrabony pocket. A pocket known as an intrabony pocket, also known as a vertical defect or angular defect, has a sulcus that is deeper and more apical than alveolar bone. A suprabony pocket, on the other hand, is one in which the alveolar bone is at the same level as or more coronal to the deepest point of the sulcus.[5, 6] Periodontitis can be treated surgically or non-surgically, but if inflammation persists despite non-surgical therapy, surgery is required. Open flap debridement (OFD), one of the most popular surgical procedures for periodontal pockets, tries to get rid of infection by removing inflamed tissues. The main goals of periodontal therapy are to restore lost periodontium, enhance periodontal health, lessen pocket depth, and produce healthy gingiva. Periodontal regeneration is generally understood to be the development of a new periodontium (bone, cementum, gingiva, and periodontal ligaments) on previously destroyed root surfaces in order to restore natural anatomy and function.[7, 8] Clinical indicators that can be used to assess the effectiveness of periodontal regeneration include probing depth (PD), clinical attachment loss (CAL), and bone height (BH). So better able to encourage healing of both soft and hard tissues. According to the study, the PRF's surroundings have an impact on how quickly growth factors are released. Growth factors such insulin-like growth factor (IGF), platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF), epidermal growth factor (EGF), and transforming growth

factor (TGF-) are found in PRF. Growth factors increase the proliferation and migration of periodontal fibroblasts, prevent periodontal fibroblast apoptosis, and promote angiogenesis, cell mitosis, osteogenesis, and the activation of growth factors. They also stimulate the mitogenic activity of periosteum cells to hasten bone healing. Growth factors stimulate and draw stem cells to the site of injury. The release of cytokines, which control platelet activation, proliferation, and leukocyte differentiation, is another function of the platelets.[9, 10] PRP does, however, have significant drawbacks, such as storage challenges since it cannot be stored after preparation and must be used as soon as possible after centrifugation. Because the amount of time between blood collection, centrifugation, and use greatly influences therapeutic outcomes, fast handling is necessary to get better therapeutic results. Therefore, the PRF membrane must be used right after after centrifugation because otherwise, it would shrink, dry up, and alter a PRF structural component. Leukocyte life will be significantly impacted, and their biological properties will change, as dehydration also causes a decrease in the amount of growth factor in PRF. The risk of membrane contamination from bacteria increases if PRF is kept in the refrigerator.[11]

METHODOLOGY

The study was cross sectional being conducted in the department of Dentistry, Bahria University Dental College, Karachi six months from June to December 2022. A total number of the participants were 150. The male and female genders were both included who suffered dental surgery. According to inclusion criteria; clinical attachment loss (CAL), participate at six month follow up after postoperative and complete documents. Exclusion criteria: teeth were exfoliated, physical and mental disability, lack of cooperation during follow up and systematic diseases. The sample of blood was taken around 55cc by a trained medical expert. After that, blood will be centrifuged to separate the platelet-rich plasma from the remaining components of your blood. For the greatest results, blood will often be spun two to three times. Once the PRP has been separated from the rest of the blood, your dentist will gather it and apply it where it is needed, either by applying it thickly directly to a wound or by injecting it into bone or tissue. Your dentist would likely numb the region before injecting if you are awake throughout the treatment. Your surgeon may use an ultrasound device in some surgical situations to make sure the injection is going in the appropriate place. Usually, a PRP process lasts for 30 minutes. The majority of patients have minimal to no recovery time following their PRP procedure. SPSS 21 was used to analyze the data. The data that was categorical will be presented as frequency and percentage. The p value was < 0.05, indicating that the variables had significantly changed.

RESULTS

The demographic data show a total number of the patients was N=150, and the last follow-up of these patients was available.

Table 1: Demographic parameters

Parameters	Total no of participants N=150(%)	P-value
Gender		<0.005**
Male	90(60%)	
Female	60(40%)	
Age		<0.005**
20-40y	50(33.3%)	
41-60y	70(47%)	
>61y	30(20%)	
Accident		0.113
Car	70(47%)	
Bike	80(53.3%)	
Smoker		<0.001**
Yes	80(53.3%)	
No	70(47%)	
PRP		<0.0001***
Yes	120(80%)	
No	30(20%)	

Mean ± SEM: ANOVA SPS 21 Test* p< 0.0; **p<0.0; ***p<0.00:

A total number of the participants was 150 which included both male 60% and female 40% which show statistically significant of tooth problem p<0.005**. The age range was 20-60 years and > 61 years old, with an average of 51.1±12.5 years, which indicate highly significant tooth loss at above 61 years old age p<0.005**. The participants was mostly smoker 53.3% had greater rate of dental issues which statistically significant changes <0.001** then non-smoker. The participants was used PRP 80% for the surgery which promote wound healing as well as bone regeneration, which show significant results <0.0001***. All surgery was done very well seen in Table 1.

Table 2: PRP use in dental and oral surgery

Parameters	Control group	PRP group	P-value
Probing depth (PD) mm	56.2±11.1	65.12±22.8	0.001**
Clinical attachment level (CAL)	57.1±13.3	62.11±23.5	0.001**
Gingival recession (GR)	53.4±14.4	63.16±21.7	0.001**
Bone defect	55.7±16.3	64.11±20.1	0.002**
Tooth extraction	55.3±15.9	63.10±20.2	0.0003***
Root coverage	58.1±14.2	61.19±21.6	0.005**
Alveolar ridge	53.3±11.4	62.15±22.4	0.008
Maxillary sinus	50.22±18.1	63.11±20.2	0.001**

Mean ± SEM: ANOVA SPS 21Test* p< 0.0; **p<0.0; ***p<0.00:

According to our interpretation, the PRP treatment was showing significant improvement in the dental and oral postoperative treatment p<0.005. Before treatment of PRP, increase the loss of teeth, pain and inflammation. After postoperative analysis of the participants by the treatment of PRP, which show significant improvement CAL, gingival recession, repair bone defect, stop tooth extraction and root coverage p<0.001**, 0.002**, 0.0003*** as compared to control group were seen in Table 2.

Table 3: PRP use in soft-bone tissue surgery

Parameters	Control group	PRP group	P-value
Reconstructive surgery of the jaw	55.22±13.4	61.11±10.3	0.0001***
Regeneration of Mandibular bone	56.21±12.5	62.12±11.1	0.0001***
Sinus lift	54.20±11.2	65.16±15.1	0.0001***

Mean ± SEM: ANOVA SPS 21 Test* p< 0.0; **p<0.0; ***p<0.00:

In our data analysis to found that, the PRP was show significant changes p<0.005*** after postoperative oral surgery. The regeneration of soft bones by the treatment of PRP was statistically significant P<0.0001*** as compared to control group were seen in Table 3.

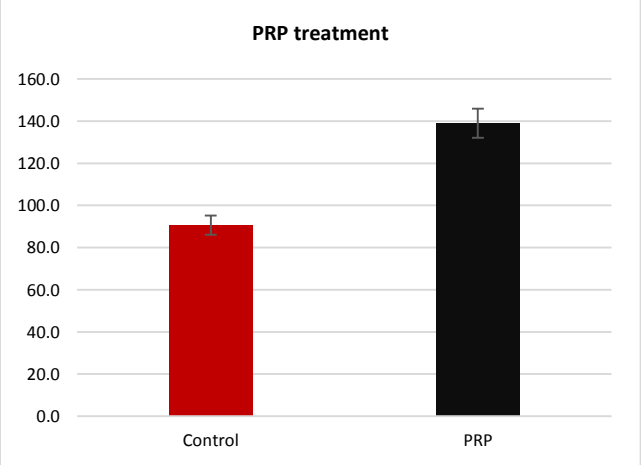

Figure 1: PRP treatment show significant result p<0.005** this means that to repair teeth socket, CAL, alveolar ridges, root coverage and help to regenerate bone.

DISCUSSION

Regenerative therapies are becoming more and more effective for treating various ailments. The paracrine action of trophic factors at considerable concentrations, which among other things stimulate endogenous progenitor cells to increase proliferation and repair, is what gives regenerative medicine treatments their important therapeutic advantages. PRP is an autologous plasma preparation with concentrated platelets that acts as a source and channel for growth factors. It has undergone substantial research for its potential use as a bioactive scaffold in tissue engineering and cell-based therapy. PRP's use in oral surgery and dentistry has steadily drawn the attention of regenerative dentists. Numerous research have examined the effectiveness of PRP as a therapy for treating various dental problems.[12, 13] Due to its capacity to produce a growth factors that promote healing and encourage stem cell multiplication and differentiation, as well as its capacity to serve as the ideal three-dimensional scaffold medium, PRP has found widespread use in many fields of dentistry. PRP has just come to light as a potential technique for encouraging cell development and differentiation of important tissues in the canal following disinfection, increasing endodontic regeneration. Revascularization, a minimally invasive method, is a successful treatment option for managing immature permanent teeth with reduced structural integrity.[14, 15]

In our study to found that, PRP comprises a variety of growth factors that can affect implant placement, wound healing, and reconstructive surgery for mandibular abnormalities. Following the implementation of PRP, notable improvements in the local environment are seen. According to research so far, the high concentration of growth factors produced in the alveolar socket following tooth extraction promotes tissue regeneration and guards against local problems. PRP is applied to soft tissue to accelerate angiogenesis, increase collagen content, and strengthen the early healing of wounds.[16] In addition, after the evacuation of impacted molars, PRP is a reliable method for stimulating bone regeneration at the distal surface of the mandibular second molar. Early stages of bone repair are said to benefit from PRP.[17]

In our study to found that the use of PRP Clinical attachment level (CAL) gain and probing depth reduction both showed a statistically significant advantage. These relatively recent findings reflect the more recent tendencies favoring more "personalized" therapy as regenerative techniques, despite the fact that few research have yet to fully explore their potential usefulness. As a result, PRF may be used as a therapeutic drug delivery system since it may be used as a three-dimensional matrix for the long-term distribution of tiny biomolecules.[18, 19] For residual pockets with deep intrabony defects more than 5mm, PRP is thought to be the preferred treatment. Given that blood clot appears to be a crucial component of periodontal regeneration, it is vital to first remark that human/animal histology research is still greatly needed in order to provide studies that compare PRF with conventional periodontal regenerative techniques. As a result, PRF functions similarly in that the fibrin scaffold can be placed into the periodontal pocket, where it works as a stable clot and results in large increases in platelets, leukocytes, and growth factors. Angiogenesis is a crucial component of tissue regeneration, and PRF releases a range of pro-angiogenic and pro-fibrotic substances that can hasten the repopulation of periodontal tissues.[20, 21]

CONCLUSIONS

Following tooth extraction, the application of PRP in the alveolar socket can improve soft tissue healing and favorably affect bone regeneration. Root lengthening, apex closure, and dentin wall thickening were all higher, and they all encourage the rejuvenation of the pulp tissue and further root development.

REFERENCES

1. Egierska, D., Perszke, M., Mazur, M., & Duś-Ilnicka, I. (2023). Platelet-rich plasma and platelet-rich fibrin in oral surgery: A narrative review. Dental and Medical Problems, 60(1), 177-186.
2. Araújo, A. M., de Mesquita, K. B. N., de Azevedo, M. W. C., Ribeiro, E. G. M., Brígido, K. G. R., & Brígido, J. A. (2023). Use of platelet-rich fibrin (PRF) in dental surgical procedures. Research, Society and Development, 12(2), e2512239811-e2512239811.
3. Kiaipour, Z., Shafiee, M., & Ansari, G. (2023). Role of Platelet Concentrates in Dental-Pulp Regeneration: A Systematic Review of Randomized Clinical Trials. Journal of Dentistry.
4. Wu, J., Piao, Y., Liu, Q., & Yang, X. (2021). Platelet-rich plasma-derived extracellular vesicles: A superior alternative in regenerative medicine?. Cell Proliferation, 54(12), e13123.
5. Wu, J., Piao, Y., Liu, Q., & Yang, X. (2021). Platelet-rich plasma-derived extracellular vesicles: A superior alternative in regenerative medicine?. Cell Proliferation, 54(12), e13123.
6. Knightly, N., Lee, C., O'Brien, L., Qayyum, T., Hurley, C., & Kelly, J. (2023). Role for platelet rich plasma as an adjuvant therapy in wound healing and burns. European Journal of Plastic Surgery, 1-10.
7. Tambeli, C. H. (2023). Platelet-rich plasma in pain management. In Nanotechnology and Regenerative Medicine (pp. 397-409). Academic Press.
8. Alshujaa, B., Talmaç, A. C., & Alsafadi, A. Autologous Platelet Concentrates: Their Generations, Forms, Preparation Protocols and Roles in Periodontal Regeneration. Eastern Journal Of Medicine, 28(2), 369-377.
9. Kusumadewi, W. W., Suseno, A., Lastianny, S. P., & Murdiastuti, K. Effect of Freeze-dried Homologous Platelet-rich Plasma Preparation and Sterilization Methods on Levels TGF-β.
10. He, Z., Liu, A., Yu, J., & Chen, X. (2022). Role of Platelet-Rich Plasma Gel in Promoting Wound Healing Based on Medical Images of Wounds. Contrast Media & Molecular Imaging, 2022.
11. Zhang, Y., Wang, X., Chen, J., Qian, D., Gao, P., Qin, T., ... & Yin, G. (2022). Exosomes derived from platelet-rich plasma administration in site mediate cartilage protection in subtalar osteoarthritis. Journal of Nanobiotechnology, 20(1), 1-22.
12. Fortunato, L., Bennardo, F., Buffone, C., & Giudice, A. (2020). Is the application of platelet concentrates effective in the prevention and treatment of medication-related osteonecrosis of the jaw? A systematic review. Journal of Cranio-Maxillofacial Surgery, 48(3), 268-285.
13. Xu, J., Gou, L., Zhang, P., Li, H., & Qiu, S. (2020). Platelet-rich plasma and regenerative dentistry. Australian dental journal, 65(2), 131-142.
14. Canellas, J. V. D. S., Medeiros, P. J. D., Figueredo, C. M. D. S., Fischer, R. G., & Ritto, F. G. (2019). Platelet-rich fibrin in oral surgical procedures: a systematic review and meta-analysis. International journal of oral and maxillofacial surgery, 48(3), 395-414.
15. Tabrizi, R., Arabion, H., & Karagah, T. (2018). Does platelet-rich fibrin increase the stability of implants in the posterior of the maxilla? A split-mouth randomized clinical trial. International journal of oral and maxillofacial surgery, 47(5), 672-675.
16. Mohan, S. P., Jaishangar, N., Devy, S., Narayanan, A., Cherian, D., & Madhavan, S. S. (2019). Platelet-rich plasma and platelet-rich fibrin in periodontal regeneration: a review. Journal of pharmacy & bioallied sciences, 11(Suppl 2), S126.
17. Feigin, K., & Shope, B. (2019). Use of platelet-rich plasma and platelet-rich fibrin in dentistry and oral surgery: introduction and review of the literature. Journal of veterinary dentistry, 36(2), 109-123.
18. Solakoglu, Ö., Heydecke, G., Amiri, N., & Anitua, E. (2020). The use of plasma rich in growth factors (PRGF) in guided tissue regeneration and guided bone regeneration. A review of histological, immunohistochemical, histomorphometrical, radiological and clinical results in humans. Annals of Anatomy-Anatomischer Anzeiger, 231, 151528.
19. Nibali, L., Koidou, V. P., Nieri, M., Barbato, L., Pagliaro, U., & Cairo, F. (2020). Regenerative surgery versus access flap for the treatment of intra-bony periodontal defects: A systematic review and meta-analysis. Journal of clinical periodontology, 47, 320-351.
20. Cecerska-Heryć, E., Goszka, M., Serwin, N., Roszak, M., Grygorcewicz, B., Heryć, R., & Dołęgowska, B. (2022). Applications of the regenerative capacity of platelets in modern medicine. Cytokine & Growth Factor Reviews, 64, 84-94.
21. Pietruszka, P., Chruścicka, I., Duś-Ilnicka, I., & Paradowska-Stolarz, A. (2021). Prp and prf—Subgroups and divisions when used in dentistry. Journal of Personalized Medicine, 11(10), 944.