International Journal of Scientific Research in Dental and Medical Sciences

www.ijsrdms.com

Assessing the Effects of L-PRF on the Peri-implant Soft and Hard Tissue Parameters in Immediate Implants: A Randomised Controlled Trial

Navneet Kour[a,*], Surya Sharma[b]

[a] *Department of Periodontology and Implantology, BRS Dental College and Hospital, Panchkula, Haryana, India*
[b] *Doctor of Dental Surgery, Jammu, India*

ARTICLE INFO

Article history:
Received 25 August 2021
Received in revised form 07 October 2021
Accepted 20 October 2021
Available online 30 October 2021

Keywords:
Dental implants
Platelet-Rich fibrin
Randomized controlled trial

ABSTRACT

Background and aim: Platelet-rich fibrin is a healing biomaterial with greater potential for enhancing tissue and osseous healing and regeneration without inflammatory reactions and can be used alone or in combination with bone grafts to promote blood coagulation bone maturation and growth. Although the use of platelet-rich plasma in dentistry, enhancing peri-implant healing with immediate implants placement is not well authenticated. The main aim of this study is to assess the effect of Leukocyte-and Platelet-Rich Fibrin (L-PRF) on the peri-implant soft and hard tissue parameters in immediate implants.

Materials and methods: The split-mouth, randomized controlled trial on 10 systematically healthy subjects with adequate and maintainable oral hygiene. Subjects were enrolled, and sites were specified. On one site, atraumatic extraction was followed by immediate implant placement, while at another site, atraumatic extraction was done, followed by immediate implant placement with L-PRF application. Patients were recalled after 1, 3, and 6 months to evaluate various parameters, including tissue biotype, whether thick or thin, radiographic radiolucency (present or absent), modified plaque index, modified sulcus bleeding index, probing depth. The data was compiled and evaluated with an ANOVA test with a significant p-value of 0.05.

Results: Statistically significant values were observed in all the parameters evaluated after the surgical procedure at 1, 3, and 6-month intervals with immediate implant placement along with Leukocyte-and Platelet-Rich Fibrin (L-PRF) membrane in extraction sockets.

Conclusion: Within the study's limitation, it can be concluded that L-PRF can be used as a therapeutic adjuvant in clinical conditions of one-stage single tooth implant placements.

1. Introduction

Among various options available for rehabilitation, dental implants have become the choice of the day as they prove to be highly successful and predictable. Advancements in biomaterials and clinical techniques have allowed successful implant treatment procedures in various clinical situations. Traditionally dental implant placement techniques involve placing an implant in a completely healed edentulous area with subsequent restoration with the prosthesis. The extraction to implant placement usually takes several months to one year, compromising patients' comfort, function, and esthetics. Over the past few years, researchers have tried to minimize the treatment needs and the timing of implant placement. Schulte and Heimke in 1976 were the first to describe the immediate placement of dental implants in an extraction socket.[1] Immediate implant placement is a well-accepted protocol with various benefits of soft tissue esthetic preservation, reduced surgical time, with shorter treatment time.[2] Immediate implant placement works with an ideal three-dimensional implant positioning with hypothetical preservation of the alveolar bone of the extraction socket. Though accompanied with many benefits, high-level implant stabilities are not always achievable. To increase the success of immediate implants, the use of various modified surgical procedures, including flapless technique and augmentation procedures including bone grafts, bone substitutes as well as bone promoting molecules such as platelet-rich plasma, plasma-derived growth factors, and bone morphogenic proteins, have been used for bone preservation with their benefits and drawbacks.[3]

Many studies have been conducted using PRF, an autogenous graft material with promising results as a regenerative material, simple, inexpensive, and easy to prepare.[4] PRF comprises a solid interlinked fibrin matrix with a complex three-dimensional construction wherein platelets and leucocytes are gathered. Quite possibly, the best element of PRF is its adequacy in providing concentrated growth factors at the surgical site for the

* *Corresponding author. Navneet Kour*
E-mail address: mehtanavneet48@gmail.com
Department of Periodontology and Implantology, BRS Dental College and Hospital, Panchkula, Haryana, India
http://doi.org/10.30485/IJSRDMS.2021.301525.1186

incitement of the healing process.[5] PRF and leucocytes (L-PRF) contain an abundance of platelet aggregates, growth factors, and leucocytes within a strong fibrin matrix.[6] Although L-PRF has a role in soft tissue and hard tissue regeneration, minimal studies are present in the literature where its usage augments soft and hard tissue in immediate post-extraction implants placements. Therefore, the present study evaluated the hard and soft tissue outcomes of immediate implant placements with and without L-PRF.

2. Materials and methods

A randomized controlled split-mouth clinical trial was done on 10 patients aged 18 years and above. The study was conducted in a private clinic in the union territory of Jammu and Kashmir from October 2020 to June 2021. Systematically healthy, cooperative subject with good oral hygiene and no acute infections, patients with bilateral edentulous areas with sufficient bone volume or teeth indicated for extraction due to terminal periodontal disease, root fracture, or root resorption, and patients who were willing for the recall visits were included in the study. Patients with poor oral hygiene, current smokers, parafunctional habits, traumatic occlusion, malocclusion, periapical pathologies, and any systemic condition that can interfere with wound healing were excluded from the study. The patient signed a detailed informed consent before the enrollment. After selecting subjects and following proper covid protocols, the atraumatic surgical procedure was followed using aseptic techniques. In Site A: Atraumatic extractions with only stage 1 implant surgery done (right quadrant). Site B: atraumatic extraction followed by stage 1 implant surgery done with L-PRF placement (left quadrant). The areas were sutured, and patients were recalled after 10 days for suture removal. Follow-up of the patients was done after 1, 3, and 6 months to evaluate clinical and radiographic parameters. Second stage surgery was done after 3 months of the procedure.

Parameters to be assessed

1. Tissue Biotype, whether thick (2mm or more) or thin (less than 2mm), 2. Radiographic Radiolucency (present or absent), 3. Modified Plaque Index, 4. Modified Sulcus Bleeding Index, 5. Probing Depth.

Procedure followed

Before the subject's enrollment in the study, a short detailed explanation of the procedure was done with them, followed by obtaining signed informed consent. A detailed examination of the study patients, including both medical and dental history, was performed. After the oral examination and recording of the parameters, a blood sample was drawn from the patients from the antecubital fossa by venipuncture from which PRF was prepared. The patients were seated comfortably, and a local administration of 1:100,000 epinephrine was done.

Atraumatic extraction of the involved tooth was done, followed by careful socket debridement. Without raising any flap, implant site osteotomy was done with copious saline irrigation. Sequential site drilling was done until the full implant length; the final drilling was undersized to increase the initial stability needed for the early loading and proper osseointegration. Implants were placed manually and rotated clockwise till resistance for seating was achieved. Complete seating of the implant was carried so that the coronal part of the collar of the implant is below the crestal bone of the alveolar ridge. In site B, L-PRF was placed as a plug to fill the gap between the implant and wall of the socket, while in site A, implant placement was done alone without the placement of any L-PRF. Primary closure was done, and patients were recalled after 10 days for suture removal. A complete follow-up was done after 1, 3, and 6 months to evaluate radiographic and clinical parameters. After 3 months of undisturbed healing, a second stage surgery was done by exposing the implant and placing a gingival former, followed by early loading of implants.

Preparation of the L-PRF

venous blood of the patients was obtained from the antecubital fossa to prepare L-PRF before starting the surgical procedure. About 10 ml of blood was drawn under sterile conditions and collected in sterile evacuate tubes. The tube filled with blood was immediately centrifuged on manual mode at a rate of 2700 rpm for 12 minutes. After centrifugation, three layers were obtained: the uppermost being the poor acellular plasma, middle-the PRF clot and the bottom being RBC. The middle layer was transferred to a sterile dish while the rest was discarded. PRF membrane was compressed in a special toolbox for 1 minute, resulting in standardized membrane formation of constant thickness and size.

Statistical analysis

The clinical parameters evaluated and data prepared were transferred to an excel sheet and analyzed using SPSS version 20.0 Inc., Chicago, IL, USA. Descriptive analysis was performed using mean and standard deviation, while intergroup evaluation was done using the ANOVA test with a two-tailed p-value of 0.05.

3. Results

On the evaluation of both sites, without L-PRF and with L-PRF, the ANOVA test proved statistically significant results in cases of tissue biotype, peri-implant radiolucency, modified plaque index, sulcus bleeding index, and probing depth.

Table 1. Representing the general characteristics of the study patient.

Character		Frequency/ percentage	Mean±sd	Standard error
Age	20-30	2/20%	34.100±0.100	2.100
	31-40	7/70%		
	40-50	1/10%		
	Total	10/100%		
Gender	Male	9/90%	1.100±0.316	6.641
	Female	1/10%		
	Total	10/100%		

Out of 10 study patients, 90% (n=9) were males, while 10% (n=1) were female with a mean and standard deviation of 1.100±0.316. The age of the patients ranged from 20-50 years, who were systematically healthy, the mean and standard deviation was about 34.100±0.100.

Table 2. Representing the descriptive analysis of site without L-PRF and with L-PRF.

Parameter	Time duration	With PRF (Site A) Mean±SD	Without PRF(Site B) Mean±SD
Tissue biotype	baseline	1.600±0.548	1.600±0.548
	1 month	1.000±0.000	1.000±0.000
	3 month	1.000±0.000	2.000±0.000
	6 month	2.000±0.000	2.000±0.000
Peri-implant radiolucency	1 month	2.000±0.000	1.200±0.447
	3 month	1.800±0.447	1.200±0.447
	6 month	1.600±0.548	1.000±0.000
Plaque index	1 month	1.600±0.122	1.530±0.295
	3 month	0.780±0.110	0.900±0.354
	6 month	0.494±0.171	0.382±0.218
Sulcus bleeding index	1 month	1.200±0.837	1.400±0.548
	3 month	0.800±0.447	0.200±0.447
	6 month	0.400±0.548	0.000±0.000
Pocket depth	1 month	2.400±0.548	1.400±0.548
	3 month	2.200±0.447	0.400±0.548
	6 month	1.800±0.447	0.000±0.000

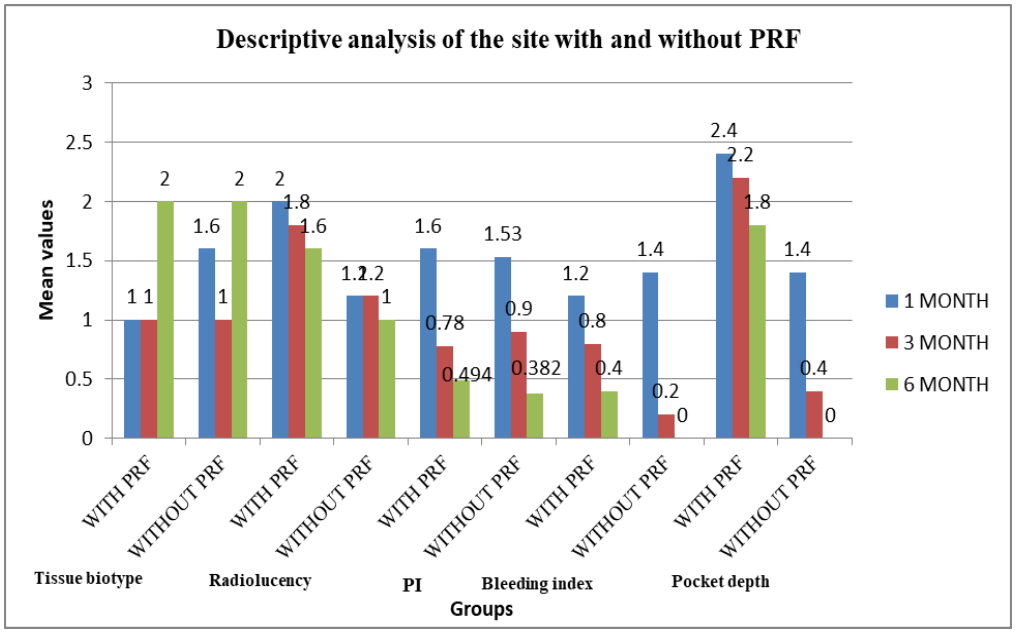

Fig. 1. Representing the mean and standard deviation of the two grouping systems.

Table 3. Representing the intersite comparison without l-prf and with L-PRF.

Parameter	Time duration	With PRF (Site A)			Without PRF(Site B)		
		Mean	SE	P-Value	Mean	SE	P-Value
Tissue biotype	Baseline-1 month	0.600	0.12	0.01*	0.600	0.12	0.00*
	Baseline-3 month	0.600		0.01*	0.400		0.00*
	Baseline-6 month	0.400		0.13	0.400		0.00*
	1 month-3 month	0.000		1.00	1.000		0.00*
	1 month-6 month	1.000		0.00*	1.000		0.00*
	3 month-6 month	1.000		0.00*	0.000		1.00
Peri-implant radiolucency	1 month-3 month	0.200	0.18	0.72	0.000	0.16	0.61
	1 month-6 month	0.400		0.30	0.200		0.05*
	3 month-6 month	0.200		0.72	0.200		0.05*
Plaque index	1 month-3 month	0.820	0.06	0.00*	0.630	0.13	0.01*
	1 month-6 month	1.106		-----	1.148		0.00*
	3 month-6 month	0.286		0.00*	0.518		0.04*
Sulcus bleeding index	1 month-3 month	0.400	0.28	0.59	1.200	0.18	0.05*
	1 month-6 month	0.800		0.15	1.400		0.00*
	3 month-6 month	0.400		0.59	0.200		0.72
Pocket depth	1 month-3 month	0.200	0.21	0.79	1.000	0.20	0.01*
	1 month-6 month	0.600		0.16	1.400		0.00*
	3 month-6 month	0.400		0.41	0.400		0.36

*statistically significant p-value (>0.05).

Table 2 represents the intersite comparison without PRF and with L-PRF. Tissue biotype with sites L-PRF showed statistically significant values (p=0.00) when compared from baseline to 1 month, 3 months and 6 months and 1 month to 3 months and 6 months. In the case of peri-implant radiolucency, statistically significant results were obtained compared from 1 month to 6 months and 3 months to 6 months (p=0.05). When plaque index was compared, statistically significant results were obtained from 1 month to 3 months and 6 months and 3 months to 6 months. Sulcus bleeding index and pocket depth represented statistically significant results when compared from 1 month to 3 months and 6 months (p>0.05). Thus, the results obtained represented many benefits from applying L-PRF along with immediate implant placement.

4. Discussion

Peri-implant bone quantity and quality affect osseointegration and the overlying soft tissue. Assessment of peri-implant radiolucency and tissue biotype becomes an integral part of evaluating the implant, forming the major indicator of peri-implant health.[7] Thus, for successful implant therapy, peri-implant bone preservation is one of the major factors along with the soft tissue, which can be protected and improved by coupling the regenerative capacity of the tissue with appropriate stimulus. Several growth factors are expressed during different phases of tissue healing which could serve as therapeutic agents, helping in peri-implant repair. PRF is one of the recent innovations with platelet concentrates as the therapeutic agent.[8] In our study, atraumatic extraction following atraumatic protocol was done to preserve as much of the buccal plate as possible, placing implants in the undersized osteotomy.[9] Some authors reported that the gap between the implant body and internal socket exceeding 2 mm usually lacks the potential to heal with predictable bone formation, and fibrous encapsulation was found.[10] However, Tarnow et al., in their study, reported a complete bone fill on the placement of implants in freshly extracted sockets even with the gaps of 4.2 mm between the implant and bone, hence not necessitating the importance of filling the gap.[11] Ragab O et al., in their study, evaluated that L-PRF did not increase implant stability during the first six months period.[1] Although no such parameters were evaluated in our study, there were no such mobility complaints on the follow-up visits by the patients, hence contradictory to our study.

One of the major characteristics of L-PRF is the period in which its growth factors exert their effect. A study conducted by Simonpiere et al. found that incorporating intrinsic platelets and leucocyte cytokine within the fibrin meshwork allows the progressive release over time. Vascular endothelial growth factors produced by leucocytes help in promoting

angiogenesis. A significant amount of platelet-derived growth factors and vascular endothelial growth factors are produced by activated fibrin.[12] This cascade of reactions involves the binding of secreted growth factors to transmembrane receptors usually present on the external surface of the flap, graft, or wound, which results in activation of the signal protein, which further initiates expression of normal gene sequences.[8] A low mean marginal radiolucency was observed in our study on the L-PRF site, which could be due to the expression of growth factors by PRF. Several studies conducted on PRF proved it to be an excellent biomaterial.[13] The subjects already discussed are a sinus lift, vertical and horizontal augmentations, healing of extraction wounds, periodontal defects, preservation grafting, cyst enucleation, endodontic surgeries, and gingival recessions. A limited number of studies have shown the effect of PRF on peri-implant hard and soft tissue. Bleeding on probing is the most common finding and was observed on both the sites with mild to moderate form. However, on follow-up on-site B, bleeding on probing was reduced from 1 to 3 months and 1 to 6 months with statistically significant values. The reduction in parameters observed in Site B compared to Site A indicated tissue stability around implants.

Limitations

The small sample size and few parameters observed became a substantial limitation in our study. Therefore many more studies with more clinical parameters and sample size are suggested.

5. Conclusion

In the light of the outcomes acquired from this examination, a synergistic effect and clinical viability of L-PRF on bone and soft tissue formation around immediately placed dental implants were seen. Consequently, the assessing information proved that using L-PRF in and around extraction sockets while immediate implant placements can affect the implant's stability and long-term provisionalization.

Conflict of Interest

The authors declared that there is no conflict of interest.

Acknowledgements

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

References

[1] Ragab O, Shoeib MA, El Nahass H. A comparative study of the effect of leukocytes and platelets-rich fibrin on the stability of immediate implants using early loading protocol. Cario dental journal. 2013;29(2):1-8.

[2] Chen CL, Chang CL, Lin SJ. Immediate implant placement and provisionalization with simultaneous guided bone regeneration in the esthetic zone. Journal of Dental Sciences. 2011;6(1):53-60. https://doi.org/10.1016/j.jds.2011.01.001.

[3] Diana C, Mohanty S, Chaudhary Z, Kumari S, Dabas J, Bodh R. Does platelet-rich fibrin have a role in osseointegration of immediate implants? A randomized, single-blind, controlled clinical trial. International journal of oral and maxillofacial surgery. 2018;47(9):1178-88. https://doi.org/10.1016/j.ijom.2018.01.001.

[4] Preeja C, Arun S. Platelet-rich fibrin: Its role in periodontal regeneration. The Saudi Journal for Dental Research. 2014;5(2):117-22. https://doi.org/10.1016/j.ksujds.2013.09.001.

[5] Boora P, Rathee M, Bhoria M. Effect of platelet rich fibrin (PRF) on peri-implant soft tissue and crestal bone in one-stage implant placement: a randomized controlled trial. Journal of clinical and diagnostic research: JCDR. 2015;9(4):ZC18. doi: 10.7860/JCDR/2015/12636.5788.

[6] Del Corso M, Dohan Ehrenfest DM. Immediate implantation and peri-implant Natural Bone Regeneration (NBR) in the severely resorbed posterior mandible using Leukocyte-and Platelet-Rich Fibrin (L-PRF): a 4-year follow-up. Poseido. 2013;1(2):109-116.

[7] Isler SC, Uraz A, Kaymaz O, Cetiner D. An evaluation of the relationship between peri-implant soft tissue biotype and the severity of peri-implantitis: a cross-sectional study. Int J Oral Maxillofac Implants. 2019;34(1):187-96.

[8] Dohan DM, Choukroun J, Diss A, Dohan SL, Dohan AJ, Mouhyi J, et al. Platelet-rich fibrin (PRF): a second-generation platelet concentrate. Part II: platelet-related biologic features. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2006;101(3):e45-50. https://doi.org/10.1016/j.tripleo.2005.07.009.

[9] Meltzer AM. Primary stability and initial bone-to-implant contact: The effects on immediate placement and restoration of dental implants. J Implant Reconstr Dent. 2009;1(1):35-41.

[10] Wilson Jr TG, Schenk R, Buser D, Cochran D. Implants placed in immediate extraction sites: a report of histologic and histometric analyses of human biopsies. International Journal of Oral & Maxillofacial Implants. 1998;13(3):333-341.

[11] Tarnow DP, Chu SJ. Human histologic verification of osseointegration of an immediate implant placed into a fresh extraction socket with excessive gap distance without primary flap closure, graft, or membrane: a case report. International Journal of Periodontics & Restorative Dentistry. 2011;31(5):515-521.

[12] Simonpieri A, Del Corso M, Sammartino G, Ehrenfest DM. The relevance of Choukroun's platelet-rich fibrin and metronidazole during complex maxillary rehabilitations using bone allograft. Part I: a new grafting protocol. Implant dentistry. 2009;18(2):102-11. doi: 10.1097/ID.0b013e318198cf00.

[13] Naik B, Karunakar P, Jayadev M, Marshal VR. Role of Platelet rich fibrin in wound healing: A critical review. Journal of conservative dentistry: JCD. 2013;16(4):284-293. doi: 10.4103/0972-0707.114344.

How to Cite this Article: Kour N, Sharma S. Assessing the Effects of L-PRF on the Peri-implant Soft and Hard Tissue Parameters in Immediate Implants: A Randomised Controlled Trial. International Journal of Scientific Research in Dental and Medical Sciences, 2021;3(4):156-160.
http://doi.org/10.30485/IJSRDMS.2021.301525.1186.