Original Article

Comparison of Soft Tissue Healing in Immediate Implant Placement in Fresh Extraction Socket with and without the Use of Platelet-Rich Fibrin

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ABSTRACT

Objective: To compare soft tissue healing in immediate implant placement in fresh extraction socket with and without the use of platelet-rich fibrin (PRF) by evaluating cover screw exposure on 7th post-operative day and pink esthetic score on 3rd and 6th post-operative month.

Methodology: This quasi-experimental study was conducted at the Department of Oral & Maxillofacial Surgery, Armed Forces Institute of Dentistry, Rawalpindi over 10 months from June 2022 to March 2023 after ethical approval. Total 60 patients aged 18-60 years with maxillary or mandibular teeth indicated for extraction without active infection and with adequate gingival architecture and bone volume were included. Thirty participants were included in intervention and control groups. Written informed consent and demographic details were acquired from patients and recorded. Participants were non-randomly allocated via non-probability convenience sampling to receive immediate implant placement with or without PRF based on the availability of intervention material and clinical scheduling. Follow-up evaluations were done on the 7th post-operative day for presence or absence of cover screw exposure and at 3 and 6 months for mean pink esthetic scores (PES). Data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 27.

Results: The mean age of the participants was 37.97±13.37 years. The sample consisted of 27(45%) males and 33(55%) females. Among the PRF intervention group (n=30), 4(13.3%) had cover screw exposure on the 7th post-operative day, while 26(86.7%) did not. While for the control group, the presence and absence of cover screw exposure was 15(50%). Participants who received PRF treatment demonstrated significantly higher mean PES scores at both the 3rd month (11.73 ± 1.143) and the 6th month (10.93 ± 0.907), compared to 9.17 ± 0.747 and 8.90 ± 0.845, respectively, in those without PRF. A statistically significant difference between the mean PES of the groups ($p < 0.001$) was observed between study groups.

Conclusion: The mean PES of the intervention (PRF) group in post extraction immediate implant placement was significantly higher than the control group at 3rd & 6th month follow-up, indicating better soft tissue healing with PRF use. Platelet-rich fibrin-treated group also demonstrated significantly lesser occurrence of cover screw exposure on 7th post-operative day highlighting the beneficial impacts of PRF adjunct in immediate implant placement.

Keywords: *Immediate dental implant loading. Platelet-rich fibrin. Bone regeneration. Tooth extraction.*

INTRODUCTION

In recent years, immediate implant loading following tooth extraction has gained considerable attention in dental implantology due to its potential advantages in reducing treatment time and preserving alveolar bone dimensions.[1] This approach involves placing a dental implant into the extraction socket immediately after tooth removal, which can streamline the treatment process and enhance patient satisfaction.[2] However, the success of immediate implant placement depends significantly on the preservation of soft tissue integrity and optimal healing around the implant site.[3]

Platelet-rich fibrin (PRF), a second-generation platelet concentrate, has emerged as a promising adjunct in various dental procedures, including immediate implant placement.[4] Platelet-rich fibrin is derived from the patient's own blood and contains a high concentration of platelets, leukocytes, and growth factors that promote wound healing and tissue regeneration.[5] Its application in immediate implant procedures aims to enhance soft tissue healing, stabilize the blood clot, and facilitate faster integration of the implant into the surrounding bone.[6]

The effectiveness of PRF in enhancing soft tissue healing around immediately placed implants has been a subject of growing interest among researchers and clinicians. Several studies have investigated its impact on parameters such as gingival biotype preservation, reduction in post-operative complications, and improvement in aesthetic outcomes. The pink esthetic score (PES) is a widely accepted tool to evaluate the soft tissue parameters around an implant, including the morphology and anatomy of the papilla, the level of attachment of facial mucosa and its curvature along with the color & texture of soft tissue.[7] Immediate implant placement in the anterior maxilla is challenging due to aesthetic demands and the risk of soft and hard tissue loss. The aesthetic success of implant-

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supported prostheses depends on factors like implant positioning, soft tissue manipulation, prosthesis type, and individual patient characteristics such as bone & soft tissue quality. Bone loss after extraction, particularly involving the buccal wall, often leads to gingival structure compromise, thereby reducing the aesthetic outcome. Studies indicate up to a 50% reduction in alveolar width within six months post-extraction, with a greater loss if the buccal wall is involved.[8] Cover screws can be spontaneously exposed post-implant due to overlying gingival tissue perforation and may lead to bone loss. Its early detection can prevent future complications.[9] Platelet-rich fibrin accelerates the healing of bone and gum tissues, promotes tissue regeneration, supports vascularization, hence reducing the need for bone grafts, thereby making it a valuable adjunct in immediate implant placements.[10]

This study aims to evaluate the efficacy of PRF in enhancing soft tissue healing in immediate implant placement, addressing the need for improved aesthetic outcomes in the anterior maxilla. It seeks to provide new insights into PRF's benefits in minimizing bone and soft tissue loss, particularly in the Pakistani population where such data is limited. This research will fill existing gaps by offering evidence-based recommendations, contributing to the global understanding of PRF's role in dental implantology, and potentially setting new standards for clinical practice in Pakistan.

METHODOLOGY

This quasi-experimental study was conducted at the Department of Oral & Maxillofacial Surgery, Armed Forces Institute of Dentistry, Rawalpindi over a duration of 10 months from June 2022 to March 2023. The ethical approval of the study was obtained from the Institutional Review Board (Letter No. 918/Trg, 13-05-2022). The sample size calculation was done using 95% confidence level, 80% power, and the difference between two means (PES) of 1.17 units with a standard deviation of 0.52.[11] A minimum of 30 participants were enrolled in both groups (control and intervention). The patients were recruited using non-probability convenience sampling technique. Informed written consent was obtained from all participants. Patients aged between 18 and 60 years, with maxillary or mandibular teeth indicated for extraction (without active infection), adequate gingival architecture, and sufficient bone volume were included. Edentulous patients, those undergoing chemotherapy or radiotherapy, patients with systemic diseases such as diabetes, smokers, or with poor oral hygiene were excluded from the study. Patients were non-randomly assigned to one of two groups based on the availability of intervention materials and clinical scheduling. The control group (n=30) received immediate implant placement following minimally traumatic extraction without the placement of platelet-rich fibrin. The intervention group (n=30) received immediate implant placement following minimally traumatic extraction with PRF placed in situ.

Clinical outcomes assessed were presence or absence of cover screw exposure, and mean PES. A 0-1-2 scoring system was used to assign PES, where 0 indicated the lowest and 2 was the highest score for each of the following seven parameters: distal papilla, mesial papilla, level of soft tissue at mid-labial area, alveolar process deficiency and soft tissue color, contour and texture. The maximum possible score was 14.[12]. Follow-up evaluations were performed on the 7th post-operative day for presence or absence of cover screw exposure, and at 3rd and 6th months post-operatively for mean PES.

STATISTICAL ANALYSIS

Data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 27. Quantitative variables, such as age and PES were expressed as mean±standard deviation. Qualitative variables such as gender and cover screw exposure were expressed as frequencies and percentages. Fisher's exact test was used to compare presence or absence of cover screw exposure between the groups. Independent sample t-test was used to compare the mean PES between control and intervention groups. Effect modifiers, like age were stratified and post-stratification independent sample t-test was applied. A p-value of ≤0.05 was considered significant.

RESULTS

The mean age of the participants was 37.97±13.37 years. The sample consisted of 27(45%) males and 33(55%) females. Table 1 summarizes the descriptive statistics regarding cover screw exposure on the 7th post-operative day for both groups. Only 4(13.3%) patients in the intervention group experienced cover screw exposure on the 7th day post-operative day as compared to 15(50%) in the control group. These results were statistically significant (p=0.005).

Table 2 presents the comparison of mean pink esthetic scores at 3rd and 6th month follow-up between the two groups. Participants treated with PRF demonstrated significantly higher scores at both the 3rd month (11.73±1.143) and 6th month follow-up (10.93±0.907) as compared to those without PRF

(9.17±0.747 and 8.90±0.845 at 3rd and 6th months respectively) (p=0.001).

Table 3 compares the mean PES at 3rd and 6th month follow-up between two age groups. In both age groups, participants treated with PRF showed significantly higher PES compared to those without PRF treatment at 3rd and 6th months (p=0.001).

DISCUSSION

Soft tissue healing in immediate implant placement within fresh extraction sockets is crucial for successful outcomes. Utilizing PRF enhances this process by promoting faster regeneration and improved tissue quality compared to procedures without PRF. This approach not only supports rapid healing but also enhances long-term stability and integration of the implant in the surrounding tissues, highlighting PRF's role as a valuable adjunct in contemporary implant dentistry.[13]

Our study revealed a mean age of participants of 37.97±13.37 years with 27(45%) males & 33(55%) females. In contrast to our findings, Zaidi et al. observed a mean age of 51.1±12.5 years among patients in Karachi. The study demonstrated a statistically significant prevalence of dental issues among participants older than 61 years, including 40% females and 60% males. Comparing these demographics underscores the broad demographic variability in dental health studies, highlighting both the consistency and variability in age and gender distribution across different research contexts.[14]

Our results showed that the frequency of cover screw exposure on 7th post-operative day was significantly more in the control group (50%) without PRF as compared to the PRF intervention group (13.3%). Similar to our findings, Ali et al. reported that 30% patients had cover screw exposure at 3 months follow-up in the control group, whereas it was not seen in any patient in the PRF-treated group.[15]

Table 1: Comparison of Cover Screw Exposure between Control and Intervention Groups

Cover Screw Exposure On 7th Post-Operative Day	Intervention Group (n=30)	Control group (n=30)	Total	p-value
Yes	4(13.3%)	15(50%)	19(31.7%)	0.005*
No	26 (86.7%)	15(50%)	41(68.3%)	
Total	30(100%)	30(100%)	60(100%)	

**Significant p-value*

Table 2: Comparison of Mean Pink Esthetic Score between Two Groups

Pink Esthetic Score (PES)	Intervention Group Mean±SD	Control Group Mean±SD	p-value
3rd Month Follow-Up	11.73±1.143	9.17±0.747	0.001*
6th Month Follow-Up	10.93±0.907	8.90±0.845	0.001*

**Significant p-value*

Table 3: Comparison of Mean Pink Esthetic Scores between Two Age Groups

Age Groups (Years)	Pink Esthetic Score	Groups	(n)	Mean±SD	p-value
<40	**3rd Month Follow-up**	**Intervention Group**	14	11.93±0.997	0.001*
		Control Group	13	9.00±0.816	
	6th Month Follow-up	**Intervention Group**	14	11.00±0.877	0.001*
		Control Group	13	8.92±0.862	
≥40	**3rd Month Follow-up**	**Intervention Group**	16	11.56±1.263	0.001*
		Control Group	17	9.29±0.686	
	6th Month Follow-up	**Intervention Group**	16	10.88±0.957	0.001*
		Control Group	17	8.88±0.857	

**Significant p-value*

Cover screw exposure can occur due to many reasons including the type of screw, the patient's anatomy, and the technique of the implantologist. Early cover screw exposure can lead to bone loss. Guney et al. reported that cover screw morphology influences epithelial maturation and inflammatory response of the peri-implant soft tissue.[16] Fang et al. reported that PRF enhances soft and hard tissue healing even in infected post-extraction implant sockets.[9] Sharma et al. also compared soft and hard tissue changes around dental implants with and without PRF. It was observed that radiographic crestal bone loss was significantly lesser in the PRF group as compared to the control group.[17] The findings of a meta-analysis also revealed that PRF-treated patients exhibited superior bone healing outcomes post-dental implantation.[18]

Our study revealed that patients treated with PRF had significantly higher PES at both 3rd (11.73±1.143) and 6th month follow-ups (10.93±0.907) as compared to those without PRF (9.17±0.747 and 8.90±0.845 at 3rd and 6th months, respectively). Aldosari et al. reported that the pink and white esthetic scores offer standardized methods for assessing peri-implant soft tissue and the use of platelet-rich fibrin in immediate implant procedures increases pink esthetic score.[19] Sharafuddin et al. conducted a randomized controlled trial (RCT) on patients undergoing immediate dental implant placements at various sites, with and without PRF & connective tissue graft (CTG). They reported that CTG and PRF augmentation enhanced tissue biotype and peri-implant keratinized tissue width. At 3rd month post-operation, the test group, with CTG and PRF had higher pink esthetic scores (12.17±1.72) than the control group (10.67±1.37). These results align closely with our findings, suggesting consistent trends in the aesthetic outcomes of PRF use in dental implant surgeries over time.[20] Kamal et al. compared PRF and subepithelial CTG for soft tissue augmentation around dental implants in an RCT in Egypt. Contrary to our findings, they found that mean PES at 6th month follow-up was significantly higher in the subepithelial CTG group (12.50±1.05) as compared to the PRF group (11.33±0.52).[11] Ahmed El Komi et al. emphasized the stability benefits of injectable PRF over platelet-rich plasma. They observed increased PRF's efficacy in enhancing soft tissue quality post-implantation.[21] Additionally, Ali et al. observed improved soft tissue healing in test groups receiving PRF as compared to control. Platelet-rich fibrin enhances the release of growth factors, supports angiogenesis and decreased chance of implant exposure to micro-organisms of the oral cavity.[15] Chandana et al. studied the impact of PRF on rebound soft tissue in immediate implant placement. Their results also showed significantly better soft tissue thickness and healing in PRF as compared to control.[22]

CONCLUSION

The mean PES of the intervention (PRF) group in post-extraction immediate implant placement was significantly higher than the control group at 3rd & 6th month follow-ups, indicating better soft tissue healing with PRF use. Platelet-rich fibrin-treated group also demonstrated significantly lesser occurrence of cover screw exposure on 7th post-operative day, highlighting the beneficial impacts of PRF adjunct in immediate implant placement.

LIMITATIONS & RECOMMENDATIONS

This study was limited by its single-center design and relatively small sample size. Future research should explore larger cohorts and multicenter studies to further validate these findings. It is recommended that platelet-rich fibrin should be considered a valuable therapeutic adjunct in enhancing soft tissue healing and esthetic results in dental implantology.

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Authors' Contributions:
T.M: Data acquisition and analysis.
B.P: Conceptualization, study design, and drafting of the manuscript.
M.A: Data analysis, interpretation, and critical revision of the article.
M.N.K: Data analysis and revision for intellectual content.
A.N: Data acquisition and manuscript drafting.
N.T: Final revision for approval and contribution to data analysis.

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