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Original Research Article

Role of Platelet-Rich Plasma (PRP) as an Adjunct to Surgical Scar Revision: A Prospective Randomized Study

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Abstract

Background: Scar revision surgery is commonly performed to improve the appearance and function of mature scars. However, satisfactory healing is not always achieved, and some patients develop poor scar quality after surgery. Platelet-rich plasma (PRP), prepared from the patient's own blood, contains a high concentration of platelets and growth factors that may improve wound healing and scar maturation.

Objective: To compare the outcomes of surgical scar revision with intraoperative PRP application and surgical scar revision alone in terms of scar quality, wound healing, postoperative complications, and patient satisfaction.

Methods: This prospective randomized study included 60 patients with mature linear or post-traumatic scars. Patients were randomly divided into two equal groups. Group A underwent surgical scar revision with intraoperative PRP application, while Group B underwent surgical scar revision alone. All patients were followed for six months. Scar quality was assessed using the Vancouver Scar Scale (VSS) and the Patient and Observer Scar Assessment Scale (POSAS). Wound healing time, postoperative complications, and patient satisfaction were also evaluated.

Results: Both groups showed improvement after surgery. However, patients treated with PRP had better scar outcomes. The mean VSS score improved from 8.2 ±1.4 before surgery to 3.3 ±1.2 at six months in the PRP group, compared with 8.1 ±1.5to 5.0 ±1.4 in the control group. The average wound healing time was shorter in the PRP group (12.3 ±2.2 days) than in the control group (15.1 ±2.6 days). Patient satisfaction was higher in the PRP group (90%) compared with the control group (70%). Postoperative complications were fewer in the PRP group, and no PRP-related adverse effects were observed.

Conclusion: Intraoperative PRP application during surgical scar revision improved scar quality, promoted faster wound healing, and increased patient satisfaction without increasing complications. PRP appears to be a safe and useful adjunct in scar revision surgery.

Keywords: Platelet-rich plasma, PRP, Scar Revision, Wound Healing, Scar Assessment, Plastic Surgery.
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Introduction

Scar formation is a normal part of wound healing after trauma, burns, surgery, or skin infections. Although scars are unavoidable, some may become cosmetically unacceptable or cause functional problems such as pain, itching, contracture, and restricted movement. Scars over the face and other exposed parts of the body can also affect a person's confidence and quality of life.

Therefore, improving scar appearance and function is an important goal in plastic and reconstructive surgery [1,2]. Surgical scar revision is commonly performed to improve the appearance and function of mature scars. The procedure involves removal of the old scar and careful closure of the wound to reduce tension and achieve a better cosmetic result. Different surgical techniques, including fusiform excision, Z-plasty, W-plasty, geometric broken-line closure, local flaps, and serial excision, are selected according to the type, size, and location of the scar [3,4]. Despite careful surgical technique, the final scar outcome may vary because wound healing is influenced by several patient-related and biological factors.

Normal wound healing occurs in three overlapping phases: inflammation, proliferation, and remodeling. These stages involve coordinated

activity of inflammatory cells, fibroblasts, endothelial cells, keratinocytes, and various growth factors. Disturbance in any of these stages may lead to delayed healing, excessive fibrosis, hypertrophic scars, widened scars, or poor cosmetic results [5,6]. For this reason, therapies that improve tissue repair and support normal healing have received increasing attention.

Platelet-rich plasma (PRP) is an autologous blood product prepared by concentrating platelets from the patient's own blood. Activated platelets release several growth factors, including platelet-derived growth factor (PDGF), transforming growth factor-beta (TGF-β), vascular endothelial growth factor (VEGF), epidermal growth factor (EGF), fibroblast growth factor (FGF), and insulin-like growth factor (IGF). These growth factors promote angiogenesis, fibroblast proliferation, collagen formation, epithelialization, and tissue remodeling, which may improve wound healing and scar maturation [7–9].

PRP has been widely used in orthopaedics, plastic surgery, dermatology, maxillofacial surgery, sports medicine, and chronic wound management. Many studies have reported that PRP promotes healing in chronic ulcers, diabetic wounds, burns, tendon injuries, fat grafting, and aesthetic procedures. In India, PRP has also shown encouraging results in wound healing and reconstructive surgery because it is easy to prepare, safe, and uses the patient's own blood (10–16).

Recently, PRP has been used as an adjunct during scar revision surgery. It is believed to improve blood vessel formation, reduce inflammation, support balanced collagen deposition, and enhance scar remodeling. Clinical studies have reported improvements in scar thickness, pigmentation, vascularity, and pliability after PRP treatment. Some studies have also shown faster wound healing, fewer postoperative complications, and better patient satisfaction. However, the available evidence is still limited because different studies have used different PRP preparation methods, platelet concentrations, and scar assessment techniques [17–20].

Scar quality should be assessed using reliable and validated tools. The Vancouver Scar Scale (VSS) is widely used to evaluate scar vascularity, pigmentation, height, and pliability. The Patient and Observer Scar Assessment Scale (POSAS) provides additional information by including both the clinician's assessment and the patient's opinion regarding scar appearance and symptoms. Together, these scales provide a comprehensive assessment of treatment outcomes [21,22]. Although PRP is increasingly used in clinical practice, there are relatively few well-designed randomized studies evaluating its role in surgical scar revision, especially in the Indian population. Therefore, the present prospective randomized study was conducted to compare surgical scar revision with intraoperative PRP application and conventional scar revision alone. The study assessed scar quality using VSS and POSAS, wound healing time, postoperative complications, and patient satisfaction.

Materials and Methods

Study Design and Setting: This prospective randomized controlled study was conducted in the Department of Plastic and Reconstructive Surgery at PMCH, Patna after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants before enrolment.

Study Population: A total of 60 patients aged 18–60 years with mature linear, post-traumatic, post-surgical, or post-burn scars requiring surgical revision were included in the study.

Inclusion Criteria

- Age between 18 and 60 years.
- Mature linear, post-traumatic, post-surgical, or post-burn scars requiring revision surgery.
- Willingness to participate and provide written informed consent.

Exclusion Criteria

- Active wound infection.
- Hypertrophic scars or keloids.
- Uncontrolled diabetes mellitus.
- Coagulation disorders or platelet dysfunction.
- Pregnancy.
- Immunosuppressive disorders.
- Previous scar revision within the last six months.

Randomization and Intervention: Eligible patients were randomly assigned into two equal groups using a computer-generated randomization sequence.

- **Group A** (n = 30): Surgical scar revision with intraoperative application of autologous platelet-rich plasma (PRP).
- **Group B** (n = 30): Surgical scar revision alone.

PRP was prepared from the patient's own venous blood using the standard double-spin centrifugation method. After activation with calcium gluconate, it was evenly applied over the wound bed following complete scar excision and haemostasis.

The wound was then closed in layers. Patients in the control group underwent the same surgical procedure without PRP application. Both groups received identical postoperative care.

Follow-up and Outcome Measures: Patients were examined on postoperative days 7 and 14 and again at 1, 3, and 6 months.

The primary outcome was scar quality, assessed using the Vancouver Scar Scale (VSS) and the Patient and Observer Scar Assessment Scale (POSAS) [21,22].

Secondary Outcome Measures Included:

- Time to complete wound healing.
- Postoperative complications such as wound infection, seroma, hematoma, wound dehiscence, scar widening, and hypertrophic scar formation.
- PRP-related adverse events.
- Patient satisfaction at the end of six months.

Statistical Analysis: Data were analysed using IBM SPSS Statistics version 26.0. Continuous variables were expressed as mean ±standard deviation, while categorical variables were presented as frequencies and percentages. Comparisons between the two groups were performed using the independent Student's t-test or Mann–Whitney U test, as appropriate. Categorical variables were analysed using the Chi-square test or Fisher's exact test. Changes within each group were analysed using the paired t-test. A p value of less than 0.05 was considered statistically significant (23).

Results

Patient Characteristics: A total of 68 patients were screened for eligibility, of whom 60 met the inclusion criteria and were randomized equally into two groups. Thirty patients underwent surgical scar revision with intraoperative platelet-rich plasma (PRP) application (Group A), while the remaining 30 underwent surgical scar revision alone (Group B). All participants completed the six-month follow-up and were included in the final analysis.

The mean age of patients in Group A was 31.9 ± 9.1 years, compared with 33.4 ±8.7 years in Group B (p = 0.48). Males constituted the majority of the study population (63.3%). There were no statistically significant differences between the two groups with respect to age, sex distribution, scar duration, scar location, or scar etiology, indicating comparable baseline characteristics (Table 1).

Table 1: Baseline Demographic Characteristics

Variable	PRP Group (n=30)	Control Group (n=30)	p-value
Mean age (years)	31.9 ± 9.1	33.4 ± 8.7	0.48
Male	19 (63.3%)	19 (63.3%)	1.00
Female	11 (36.7%)	11 (36.7%)	
Mean scar duration (months)	18.4 ± 6.5	19.2 ± 7.1	0.67

There were no statistically significant differences in baseline characteristics between the two groups.

Scar Characteristics: Post-traumatic scars were the most common indication for surgical scar revision, followed by post-surgical and post-burn scars. The distribution of scar etiology was similar in both groups (Table 2).

Table 2: Etiology of Scars

Etiology	PRP Group	Control Group
Post-traumatic	15 (50.0%)	14 (46.7%)
Post-surgical	10 (33.3%)	11 (36.7%)
Post-burn	5 (16.7%)	5 (16.7%)

Vancouver Scar Scale (VSS): Both groups demonstrated significant improvement in scar quality during the six-month follow-up. However, patients treated with PRP showed a significantly greater reduction in the Vancouver Scar Scale (VSS) scores compared with the control group. The mean VSS score decreased from 8.2 ±1.4 preoperatively to 3.3 ±1.2 at six months in Group A, whereas it decreased from 8.1 ±1.5 to 5.0 ±1.4 in Group B. The difference between the groups at the final follow-up was statistically significant ($p < 0.001$) (Table 3, figure 1).

Table 3: Comparison of Vancouver Scar Scale Scores

Time	PRP Group	Control Group	p-value
Preoperative	8.2 ± 1.4	8.1 ± 1.5	0.81
3 Months	5.0 ± 1.3	6.3 ± 1.5	0.01
6 Months	3.3 ± 1.2	5.0 ± 1.4	<0.001

The mean reduction in VSS score was significantly greater in the PRP group.

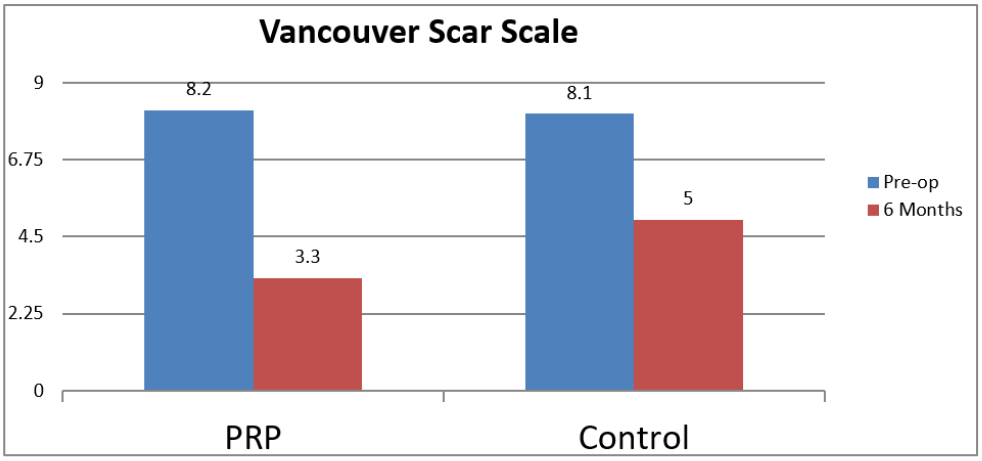

Figure 1: Comparison of Vancouver Scar Scale (VSS) scores before surgery and at 6 months in the PRP and control groups.

POSAS Scores: Similarly, Patient and Observer Scar Assessment Scale (POSAS) scores improved significantly in both groups throughout the follow-up period. Patients receiving PRP demonstrated lower observer and patient scores at six months, indicating superior scar appearance and greater patient-perceived improvement compared with the control group (Table 4).

Table 4: Mean POSAS Scores

Time	PRP Group	Control Group	p-value
Baseline	42.5 ± 5.2	41.8 ± 5.5	0.62
6 Months	19.4 ± 4.3	25.8 ± 5.0	<0.001

Wound Healing: The mean time required for complete wound healing was significantly shorter in the PRP group (12.3 ±2.2 days) than in the control group (15.1 ±2.6 days, $p < 0.001$), suggesting accelerated epithelialization following PRP application (Table 5, figure 2).

Table 5: Wound Healing

Variable	PRP Group	Control Group	p-value
Healing time (days)	12.3 ± 2.2	15.1 ± 2.6	0.002

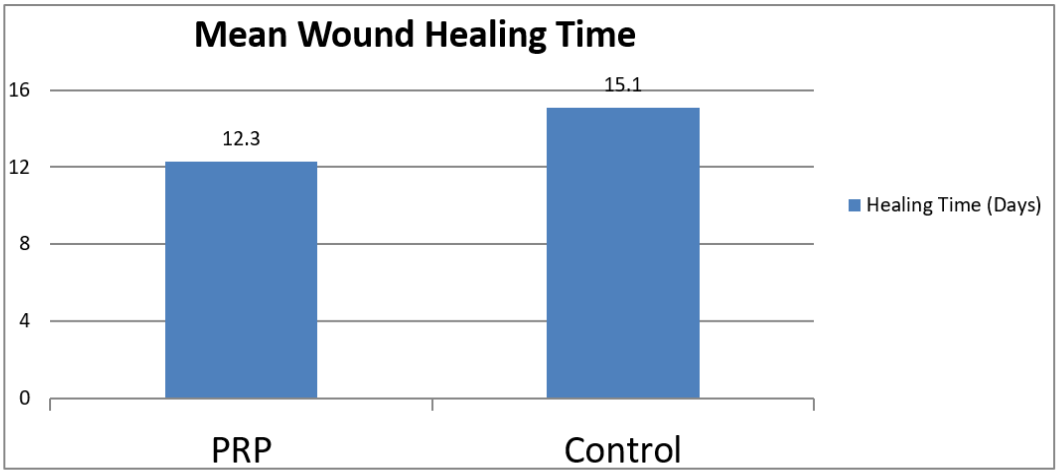

Figure 2: Comparison of mean wound healing time between the PRP and control groups.

Postoperative Complications: Postoperative complications were infrequent in both groups. Minor wound infection, seroma formation, wound dehiscence, and scar widening occurred less frequently in the PRP group; however, the overall difference in complication rates did not reach statistical significance ($p = 0.18$). No adverse reactions attributable to PRP administration were observed during the study period (Table 6).

Table 6: Postoperative Complications

Complication	PRP Group	Control Group
Wound infection	1 (3.3%)	3 (10.0%)
Wound dehiscence	1 (3.3%)	2 (6.7%)
Hematoma	0	1 (3.3%)
Hypertrophic scar	1 (3.3%)	4 (13.3%)

The difference in overall complication rates did not reach statistical significance (p = 0.18).

Patient Satisfaction: At the six-month follow-up, patient satisfaction was significantly higher among patients treated with PRP. Overall, 90%of patients in Group A reported being satisfied or very satisfied with the surgical outcome compared with 70% in Group B (p = 0.04) (Table 7, figure 3).

Table 7: Patient Satisfaction

Satisfaction Level	PRP Group	Control Group
Very satisfied	18 (60.0%)	9 (30.0%)
Satisfied	9 (30.0%)	12 (40.0%)
Neutral	2 (6.7%)	6 (20.0%)
Dissatisfied	1 (3.3%)	3 (10.0%)

Overall, 90% of patients in the PRP group were satisfied or very satisfied compared with 70% in the control group (p = 0.04).

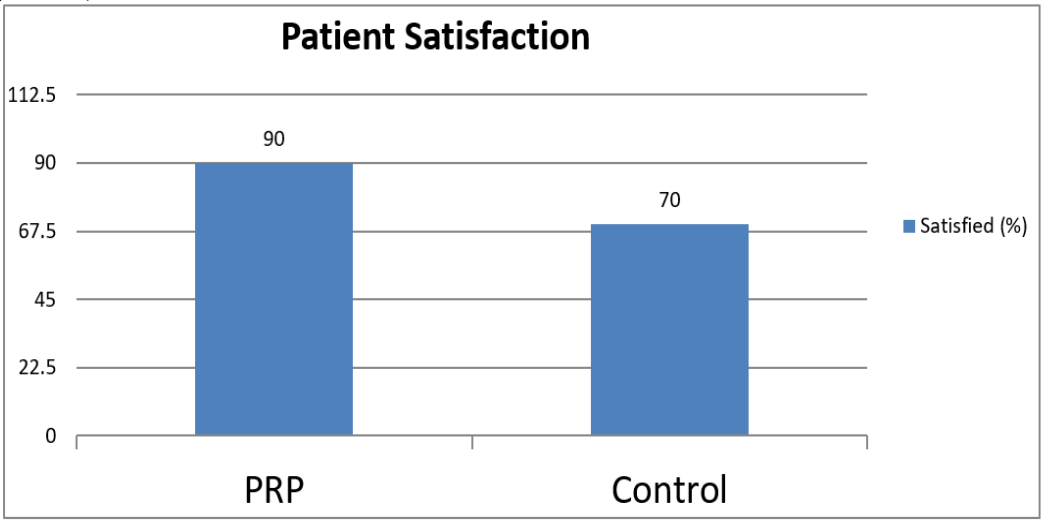

Figure 3: Comparison of patient satisfaction at 6 months between the two groups.

Discussion

The present study compared the effect of intraoperative platelet-rich plasma (PRP) with conventional surgical scar revision in patients with mature scars. The findings showed that adding PRP to scar revision surgery resulted in better scar quality, faster wound healing, and higher patient satisfaction. PRP was also found to be safe, as no treatment-related complications were observed.

The baseline characteristics of patients in both groups were similar with respect to age, sex, and scar type. This indicates that the two groups were comparable before treatment and that the postoperative differences were likely related to the intervention. Similar baseline findings have been reported in other studies evaluating PRP in reconstructive and aesthetic surgery [25,26]. In the present study, scar quality improved in both groups after surgery, but the improvement was significantly greater in patients who received PRP. The mean Vancouver Scar Scale (VSS) score was lower in the PRP group at six months, suggesting better scar maturation.

These findings are in agreement with Gentile et al. [17], who reported improved scar healing and better tissue quality after PRP application. Hausauer and Jones [19] also observed that PRP improved scar pliability and reduced scar thickness. Similar benefits have been reported in Indian studies, where PRP improved scar vascularity, pigmentation, and overall appearance [27,28].

The Patient and Observer Scar Assessment Scale (POSAS) scores also showed better improvement in the PRP group. Since POSAS includes both the clinician's assessment and the patient's opinion, it provides a more complete evaluation of scar outcome. Better POSAS scores in the PRP group indicate that the improvement was noticeable not only to clinicians but also to the patients. Comparable findings have been reported by Picard

et al. (18) and other recent studies on regenerative therapies for scar management [28,29].

A major finding of this study was the shorter wound healing time in patients treated with PRP. Healing occurred approximately three days earlier than in the control group. This may be explained by the release of growth factors such as PDGF, VEGF, TGF-β, EGF, FGF, and IGF, which promote angiogenesis, collagen synthesis, fibroblast activity, and epithelial regeneration (7–9). Similar improvements in wound healing have been reported in studies on chronic ulcers, burns, and reconstructive procedures, including reports from India [10,14,30].

Although postoperative complications were fewer in the PRP group, the difference was not statistically significant. Importantly, no adverse effects related to PRP were observed. Since PRP is prepared from the patient's own blood, the risk of allergic reactions or disease transmission is minimal. Previous systematic reviews have also reported that PRP is a safe treatment with a low complication rate [20,31].

Patient satisfaction was significantly higher in the PRP group. Most patients who received PRP reported satisfaction with both the appearance of the scar and the overall surgical outcome. Better cosmetic results and faster recovery are likely to have contributed to this finding. Similar improvements in patient satisfaction have been described by Gentile et al. [17] and recent Indian studies evaluating PRP in plastic and reconstructive surgery [27].

The beneficial effects of PRP are supported by its biological action. Activated platelets release several growth factors that regulate different stages of wound healing. These growth factors promote new blood vessel formation, collagen remodeling, fibroblast proliferation, and epithelial repair, resulting in better scar maturation and tissue healing [7–9,32,33].

The strengths of this study include its prospective randomized design, standardized surgical technique, uniform PRP preparation, and the use of validated scar assessment scales (VSS and POSAS). Complete follow-up of all participants also improved the reliability of the results. The study has a few limitations. It was conducted at a single centre with a relatively small sample size, and the follow-up period was limited to six months. In addition, platelet concentration was not measured for each PRP preparation, which may have influenced the biological response. Further multicentre studies with larger sample sizes, standardized PRP preparation methods, and longer follow-up are needed to confirm these findings.

Overall, the results of this study suggest that PRP is a useful adjunct to surgical scar revision. It improves scar quality, promotes faster wound healing, and increases patient satisfaction without increasing postoperative complications.

Conclusion

The findings of this study suggest that platelet-rich plasma (PRP) is a useful adjunct to surgical scar revision. Patients who received PRP showed better scar quality, faster wound healing, and higher satisfaction than those who underwent scar revision alone. No PRP-related adverse effects were observed during the study. These results indicate that PRP is a safe and effective option for improving postoperative scar outcomes.

Limitations

- Single-centre study.
- Relatively small sample size.
- Follow-up was limited to six months.
- Platelet concentration was not measured for each PRP preparation.

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