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Mean Healing Time of Autologous PRP on Wounds in Terms of Split-Thickness Skin Graft Adhesion and Complications as Compared to Conventional Fixation Technique

Sadia Khan, Danish Almas, Asad Ashraf, Rimsha Irfan, Ali Muhammad

Abstract

Objective: To compare mean healing time and complication rates in patients undergoing Split thickness skin grafting with autologous PRP versus conventional fixation methods.

Study Design and Setting: Two groups comprising of 50 patients (Total 100) in each undergoing split thickness skin grafting were formed, Group A (PRP infiltration prior to STSG) and Group B (STSG with conventional fixation). Mean healing time and graft take were the primary outcomes; infection, seroma, hemorrhage, and graft loss were the secondary events.

Methodology: Non-probability consecutive sampling was used in a quasi-experimental study at PNS Shifa Hospital's Plastic Surgery Department. One hundred patients with open wounds aged 18 and 60 years were randomly divided into two groups by lottery method: Group B had STSG with conventional fixation, while Group A received autologous PRP infiltration prior to STSG. Mean healing time and graft take were the primary outcomes; infection, seroma, hemorrhage, and graft loss were secondary events.

Results: Mean healing time for Group A was 9.88 ± 1.56 days, substantially faster than that of Group B (mean 11.92 ± 2.68 days, $p < 0.001$). The PRP group's graft success rate was higher (85.17±9.83) than the control group (72.63±14.57). Group A experienced significant decrease in complications such infection, seroma, and haematoma.

Conclusion: In patients undergoing STSG, autologous PRP significantly reduced the healing period and increased graft success while lowering postoperative complications. It provides a biologically active substitute for traditional fixation techniques.

Key words: Autologous PRP, Conventional Fixation, Haematoma, Seroma, Split Thickness Skin Graft

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INTRODUCTION:

Skin grafting is the cornerstone of reconstructive surgery which provides long-lasting soft tissue coverage for severe injuries and other skin defects. Split-thickness skin grafting (STSG), although regularly performed, frequently leads to prolonged hospital stays and numerous dressing changes.[1] STSG is frequently used to treat challenging wounds such as burns, venous leg ulcers, and diabetic foot ulcers. Split skin grafting is the most popular treatment used in the area of plastic surgery to resurface wound beds. Hemostasis and the skin graft's adherence to the wound bed are two factors that affect the success of the procedure, while local vascularity and wound microbiology are also important. Although epinephrine soaks can be used to produce hemostasis on the wound bed before skin grafts are applied, this procedure has both systemic and local adverse effects. A skin transplant is typically quilted to the wound bed to minimize shearing and seroma beneath it, and it is secured to the wound borders using sutures, staplers, yano acrylate glue, or fibrin glue. However, the operational time and cost were increased by these strategies.

A Cochrane systematic review found that skin grafting may accelerate healing in venous leg ulcers when combined with the standard care.[2] The microbiological environment, local blood supply, and adhesion to the wound bed are some of the variables that affect graft success. Aiming to anchor the graft and avoid fluid buildup, traditional fixation techniques like sutures or staples can be expensive and time-consuming.[3] In wound healing, autologous platelet-rich plasma (PRP) has become a biologically active adjuvant. By providing nutrient-rich plasma straight to the wound bed, PRP improves graft anchoring, encourages inosculation, and significantly speeds up the healing process.[4] Growth factors such PDGF, IGF-1, EGF, VEGF, and TGF-â are released by platelets and promote angiogenesis, collagen production, and epithelial regeneration.[5] The use of autologous platelet-rich plasma (PRP) in several facets of tissue regeneration and wound healing has gained attention in recent years.[6] PRP, which is an autologous concentration of platelets in a tiny amount of plasma, is vital for tissue regeneration and repair because it contains a variety of growth factors and bioactive proteins. Among these are vascular endothelial growth factor (VEGF), platelet-derived growth factor (PDGF), transforming growth factor-â (TGF-â), and epidermal growth factor (EGF). PRP's potential to improve the graft's initial adherence due to its high fibrin content and the subsequent revascularization process due to its broad array of growth factors provides the theoretical foundation for its use in skin grafting. According to recent studies, PRP can improve haemostasis, decrease scarring, increase collagen synthesis, encourage angiogenesis, and speed up endothelial and epithelial regeneration .[7] PRP has logistical and financial benefits in addition to biological ones, especially in environments with limited resources. PRP is inexpensive and biocompatible because it is made from the patient's own blood, reducing the possibility of immunogenic reactions and the spread of infection.[8] Its preparation is relatively easy, and it doesn't require sophisticated infrastructure to be incorporated into standard surgical processes. Because of these characteristics, PRP is particularly useful in public hospitals and tertiary care facilities, where high patient volumes and budgetary constraints necessitate scalable, effective solutions.[9] When infilterated before traditional graft fixation, PRP acts as a biologically active enhancer to improve graft function and healing. Chronic wounds present serious obstacles to healing and rehabilitation, especially in burn and diabetic patients.[10] PRP may increase graft take, shorten healing times, and lower complication rates during STSG surgeries, which would ultimately result in less hospital stays and resource usage. Apart from its therapeutic value, PRP is in line with worldwide trends in regenerative and individualized medicine. Because it is autologous, it minimizes donor site morbidity and improves patient safety while supporting customized treatment plans.[11] Additionally, the incorporation of PRP into surgical workflows indicates a move away from mechanical fixation and toward biologically enriched techniques that maximize recovery. PRP stands out as a flexible, evidence-based solution that support current methods and enhances patient outcomes as surgical specialties use regenerative adjuncts more frequently.[12] There is a dearth of local data assessing PRP's function in surgical wound treatment, especially when split-thickness skin grafting (STSG) is involved, despite encouraging global data. To accurately reflect local patient demographics, clinical practices, and institutional capabilities, region-specific research are required. The purpose of this study is to provide regional data comparing traditional fixation with autologous PRP infiltration in STSG patients. The results could direct future clinical practice and aid in the integration of PRP into regular wound care protocols.

METHODOLOGY:

This Quasi experimental study was carried out from 15th may 2025 to 14th august 2025 in the Plastic Surgery Department of PNS Shifa Hospital in Karachi, Pakistan. Ethical approval was obtained from the institutional review board ethical with IRB No.BUHS-IRB #192/25. Patients who required split-thickness skin grafting (STSG) for soft tissue defects between 18 to 60 years age of both gender were included. Immunosuppressive treatment, bleeding problems, systemic infections, serious systemic diseases, and wounds exposing major arteries, nerves, or bone were all excluded.[16] These standards were chosen in light of earlier research assessing the safety of PRP and the results of wound healing.Non-probability consecutive sampling was utilised to recruit participants, and the lottery method was used to randomly allocate them to two groups. The sample size was calculated by using the mean±SD of complete healing time 37.9±14.3 in PRP/ thrombin gel group and 73.7±50.84[10] in control group using open Epi Software for taking the power of test = 80% and confidence interval 95%.[13] Previously published data comparing PRP and traditional fixation methods served as the basis for this computation.The study was open-label, and blinding was not possible because the patient and the operating surgeon could see the obvious differences in the intervention approaches. In compliance with ethical guidelines, all participants provided written informed permission prior to enrollment and group assignment.Clinical outcomes were assessed by impartial clinicians who were not involved in the intervention in order to reduce evaluation bias. Autologous platelet-rich plasma (PRP) was administered to the wound bed in Group A before grafting, whereas Group B got standard Split thickness skin graft (STSG) without PRP.

Autologous PRP was prepared in the outpatient department using two-step centrifugation technique.10-20ml of venous blood sample was drawn and transferred into sterile tubes containing anticoagulant . Tubes were placed in centrifuge machine for first cycle of spinning. Cycle was performed at 3000 rpm and spined for 10 minutes .This cycle separated

plasma and buffy coat from red blood cells resulted in distinct layering. Yellow coloured plasma was at upper half of tube , thin white coloured buffy coat was in middle and dark red coloured layer containing red blood cells was at the bottom of the tube. Plasma and buffy coat were collected in other sterile bottles containing anticoagulants and placed in centrifuge machine for second cycle. This time machine was set at 4000 rpm and spined for 5-7 minutes . This separated platelet rich plasma from platelet poor plasma. PRP could be seen by colour difference which was dark yellow coloured and at bottom of the tube. Upper Platelet poor plasma layer was discarded and platelet rich plasma was carefully aspirated using a syringe for infiltration into the wound. PRP was infiltrated into wound bed 15 minutes before split thickness skin grafting. A dermatome was used to harvest Split thickness skin grafts (STSG), which were then secured with staples or sutures. In addition to applying standard postoperative dressings, patients were observed for graft take and post operative complications. Successful graft take and mean healing time were primary outcomes while complications including infection, seroma development, and graft loss were secondary outcomes.

RESULTS:

A total of 100 patients were included, evenly divided between the PRP (n = 50) and Conventional (n = 50) groups. The overall a mean age of the study participants in current study was 36.2±1.1 years with the duration of diseases before treatment was 21.7±15.2, hospital stay in days was 6.9±2.4. Mean graft take was 78.9±14.6 beside the mean Healing time 10.9±2.4 days. Table 1. Male were 55 (55%) and female were 45 (45%). Out of 100 only 33 (33%) acquired the wound site infection, while 33 (33%) had Hematoma, and 46 (46%) had Seroma. Most common site of wound was left 11 (11%) and right foot 11 (11%). Table 2 and Figure 1. In current study autologous PRP significantly improved graft success and reduced post operative complications. The incidences of infection 10 (10%) were in PRP group while in conventional group it was 23 (23%) having the significant statistical association with p= 0.005. Length of hospital stay were categorized into two group detailing as stay of <=7 days and > 7 days for statistical analysis. 45 (45%) study participants of PRP groups had hospital stay of less than 7 days while only 27 (27%) in conventional group stayed in hospital for <= 7 dyas having the showed the significant statistical link with p= 0.001. Seroma and haematoma development were not associated with the groups. Table 3 and Figure 1. Additionally, the PRP group's healing period was substantially shorter than the Conventional group's, with a mean of 9.88 ± 1.56 days against 11.92 ± 2.68 days (p <.001), indicating a quicker recovery and lower morbidity. Importantly , the PRP group's mean graft take was greater (85.17 ± 9.83%) than the conventional group's (72.63 ± 14.57%), confirming PRP's ability to improve graft integration. Table: 04.

Table 1. Mean and standard deviation of quantitative variables

Variable	Mean±SD
Age (Years)	36.2±1.1
Duration of Disease (Days)	21.7±15.2
Hospital Stay (Days)	6.9±2.4
Healing time (Days)	10.9±2.4
Graft Take (Percent)	78.9±14.6

Table 2: Mean and standard deviation of quantitative variables

Variable	Percentages
Gender	
Male	55 (55%)
Female	45 (45%)
Infection	
Yes	33 (33%)
No	67 (67%)
Seroma	
Yes	46 (46%)
No	54 (54%)
Hematoma	
Yes	33 (33%)
No	67 (67%)
Hospital Stay	
<=7 Days	72 (72%)
>7 Days	28 (28%)
Wound Site	
Abdomen	3 (3%)
Back	4 (4%)
Left Arm	2 (2%)
Left Arm	1 (1%)
Left Axilla	4 (4 %)
Left Flank	1 (1%)
Left Foot	11 (11%)
Left Forearm	4 (4%)
Left Hand	5 (5%)
Left Leg	9 (9%)
Left Shoulder	1 (1%)
Left Sole	1 (1%)
Left Thigh	4 (4%)
Right Palm	1 (1%)
Right Arm	4 (4%)
Right Axilla	2 (2%)
Right Foot	11 (11%)
Right Forearm	6 (6%)
Right Hand	6 (6%)
Right Leg	8 (8%)
Right Palm	1 (1%)
Right Shoulder	2 (2%)
Right Thigh	3 (3%)
Scalp	4 (4%)

DISCUSSION:

This study shows that autologous PRP significantly improved graft success and reduced post operative complications. The incidences of infection (20% vs. 46%), seroma (36% vs. 56%), and haematoma (24% vs. 42%) were all lower with PRP than with traditional therapy. PRP's fibrin-rich composition, which produces an instant biological adhesive effect, is responsible for this rapid adherence. Similar results were shown by Kakudo et al, who reported improved skin graft adhesion when PRP was given to the wound bed prior to graft insertion. They suggested that PRP's fibrin aids in anchoring the graft to the wound bed and reduces micro-motion, which is harmful to graft take. Particularly useful in anatomically difficult areas where traditional dressings might not offer the best graft-recipient contact is this instant adherence.[14]

Table: 3. Association of complications and age with PRP and Conventional group

Variables	PRP group	Conventional Group	p-Value
Gender			
Male	27 (27%)	28 (28%)	0.5
Frmale	23 (23%)	22 (22%)	
Infection			
Yes	10 (10%)	23 (23%)	0.005*
No	40 (40%)	27 (27%)	
Seroma			
Yes	18 (18%)	28 (28%)	0.035
No	32 (32%)	22 (22%)	
Hematoma			
Yes	12 (12%)	21 (21%)	0.04
No	38 (38%)	29 (29%)	
Hospital Stay			
<=7 Days	45 (45%)	27 (27%)	0.001*
>7 Days	05 (05%)	23 (23%)	

Figure 1: Frequency of complications in both groups

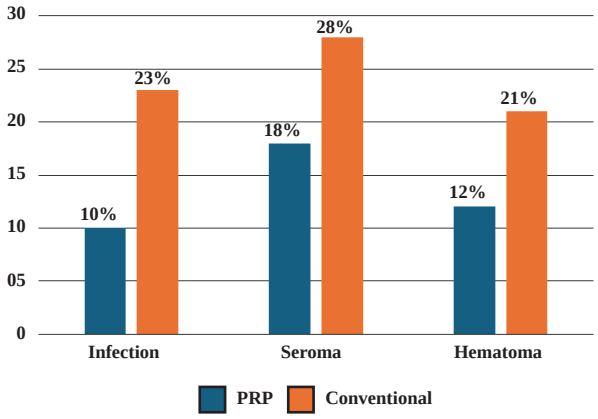

Table: 04. Association of two groups with Healing time and graft take comparison

Outcome	PRP Group (mean ± SD)	Conventional Group (mean ± SD)	p-Value
Healing time (days)	9.88 ±1.56	11.92±2.68	< .001
Graft take (%)	85.17 ±9.83	72.63±14.57	< .001
Duration of disease (days)	21.28±17.26	22.12±12.95	.785

According to the study conducted by Faizan Rahim et al at Sialkot concluded that autologous PRP treatment demonstrated superior efficacy in promoting graft adhesion compared to conventional fixation that are in line the results of current study. [15] Autologous platelet-rich plasma (PRP) is significantly more effective at healing wounds than conventional dressings, according to a different study by Shakoor, S. et al. PRP-treated wounds showed improved granulation tissue growth, quicker epithelialization, and improved patient satisfaction. PRP is a beneficial supplement to wound care since its physiologically active components aid in tissue regeneration. [16] Another study by Sara Mubeen et al. at the Mayo Hospital in Lahore found that microneedling with insulin is more effective in treating acne scars than microneedling with platelet-rich plasma. All skin types benefit from this combined procedure, which is affordable and causes less post-inflammatory hyperpigmentation. Additionally, because it doesn't require advanced abilities, doesn't require an IV line, and takes less time, this innovative combo method is convenient for both patients and doctors.[17]

The superior graft takes percentages observed in the PRP group 85% compared to conventional group 72%. highlight the sustained beneficial effects of PRP on graft survival. PRP influences wound healing in a number of ways, which can be linked to this increased graft take.[6] Growth factors including fibroblast growth factor (FGF) and VEGF in PRP encourage angiogenesis, which speeds up the graft's revascularization.[15] This guarantees proper oxygenation and nourishment, both of which are essential for graft survival.[17] Furthermore, fibroblasts, keratinocytes, and endothelial cells proliferate and migrate in response to growth factors like PDGF and EGF, which speeds up wound healing and graft integration.[18] Reduced scar formation has also been linked to the TGF-â found in PRP, which may improve cosmetic results.[19] Our results are consistent with several studies in the literature that have shown that using PRP can improve graft take rates and shorten healing times. In a related study, Maghsoudi et al. examined diabetic foot ulcers and found that using PRP improved graft take rates and sped up recovery.[20] Overwhelming inflammation can harm the graft, and reducing it helps increase graft success. These complex processes cooperate to improve graft take and reduce problems. These results not only confirm the biological effectiveness of PRP but also highlight its usefulness in surgical procedures. PRP provides a scalable option that improves graft results without requiring sophisticated equipment in high-volume public hospitals where cost

containment and quick recovery are crucial. PRP may have an impact on patient-reported outcomes like pain, mobility, and happiness in addition to its biological and logistical benefits.[21] Although pain scores and scar quality were not fully evaluated in this study, the observed decrease in hematoma and seroma production may indirectly improve patient comfort and cosmetic results. These outcomes along with PRP's affordability and simplicity of integration, are increasingly acknowledged as crucial endpoints in surgical recovery. Patients in the PRP group reported anecdotal evidence of less discomfort during dressing changes and an earlier return to walking, most likely as a result of quicker epithelialization and less inflammation. Although not explicitly measured in this study, these subjective benefits should be investigated further in subsequent studies utilizing validated patient-reported outcome measures (PROMs). Furthermore, PRP's function in regulating the local immune response may have outcomes that go beyond graft acceptance, possibly affecting tissue remodeling and long-term scar quality. PRP may lessen hypertrophic scarring and increase pliability in grafted areas, especially in burn victims, according to new researches. Future research may be able to quantify these impacts by using objective scar assessment instruments like the Vancouver Scar Scale. [5]

The results of this investigation support PRP's useful benefits in standard reconstructive procedures. Its function as a biologically active enhancer that improve conventional grafting techniques is supported by the statistically significant decrease in healing time and complication rates. Crucially, the PRP group's better graft take and lower infection rates point to a more stable wound environment that promotes early epithelialization. These results are particularly important in high-volume surgical facilities where reducing hospital stays and dressing frequency can alleviate resource shortages. PRP's viability in public hospitals is further supported by its autologous origin and ease of processing. Furthermore, cost-effectiveness studies contrasting PRP with negative pressure wound therapy or synthetic sealants would offer insightful information for institutional decision-making. PRP stands out as a physiologically active, patient-derived adjunct that bridges the gap between cost and effectiveness as the field of regenerative surgery develops, making it a viable contender for wider adoption in reconstructive protocols across a variety of clinical contexts. Because it is autologous, it lowers the danger of immunogenicity and fits nicely with the global movement toward regenerative, individualized treatment.[22] Additionally, using PRP into STSG regimens may enhance resource use, shorten hospital stays, and decrease the frequency of dressings. Biologically active adjuncts like PRP may become routine practice as wound care advances, particularly in situations where traditional fixation techniques are constrained by anatomical or financial limitations. Even at the end of the first week following surgery, Venter et al. and Pallua et al. found decreased complications and improved graft take rates with PRP administration.[23,24]

The much lower incidence of complications in the PRP group—such as graft infection, seroma, and hematoma formation—highlights and supports the clinical efficacy and preventative advantages of PRP against factors that usually endanger or compromise graft take. The haemostatic and anti-inflammatory properties of PRP, which together create a more stable and favourable environment for wound healing, are primarily responsible for this positive result. Thromboxane A2, a strong mediator that promotes strong platelet aggregation and causes vasoconstriction, is released by PRP's concentrated platelets. This significantly reduces intraoperative and postoperative bleeding as well as the risk of hematoma development.[25] Additionally, a variety of anti-inflammatory cytokines found in PRP actively modulate, regulate, and temper the wound bed's inflammatory response, limiting excessive inflammation that may otherwise hinder graft integration.[26] Crucially, immunosuppressive therapy—which is typically required in allogeneic or donor-derived applications to prevent immunological rejection—is eliminated by PRP's autologous origin, which is obtained exclusively from the patient's own biological material. Additionally, it streamlines the preparing process by avoiding the need for lengthy, labor-intensive, and resource-intensive donor screening procedures. Without adding any further immunological risk or regulatory complication, this intrinsic compatibility makes PRP a more versatile, adaptive, and widely applicable treatment alternative across a variety of clinical contexts. [27]

Although the outcomes of this study are promising, it is important to recognize a few limitations. The sample size was sufficient to show statistical significance in primary outcomes, but it restricts the findings' applicability to larger populations and a variety of clinical contexts including different health care systems and patient care models. Because the study was carried out at a single tertiary care facility, institutional biases pertaining to patient demographics, postoperative care procedures, and surgical technique may have been introduced. Although the study population's homogeneity reduces confounding from systemic disorders, it also limits its application to patients with more complicated medical profiles or comorbidities.

Conclusions about long-term efficacy or delayed problems were further limited by the study's lack of long-term follow-up and absence of standardized patient-reported outcome measures.Future studies should incorporate multicenter trials with bigger, more diverse populations, uniform PRP methods, and longer follow-up times in order to confirm and expand these findings. These investigations would improve external validity and offer a more thorough grasp of PRP's function in various surgical settings.

CONCLUSION:

This study found that in surgical reconstruction, autologous PRP greatly enhanced graft take and sped up wound healing. When compared to traditional fixation therapy, PRP was linked to a shorter hospital stay, a quicker healing period, and a lower risk of infection, seroma, and hemorrhage.

Furthermore, incorporating PRP into surgical procedures may lessen the requirement for systemic antibiotics, diminish the frequency of dressings, and reduce reliance on expensive synthetic sealants. In public hospitals, where large patient numbers and tight budgets necessitate scalable solutions, these operational benefits are especially beneficial. PRP is a useful addition to traditional grafting procedures since it lowers postoperative morbidity and resource consumption, supporting clinical quality and institutional sustainability.

Its capacity to lower problems and encourage early epithelialization may also result in better scar quality, less frequent dressings, and increased patient comfort. More multicenter trials with bigger sample numbers and longer follow-up times are highly advised in order to validate these results and look at long-term benefits across different patient groups. Future studies should also examine how PRP affects cosmetic results, patient satisfaction, and how effective it is in comparison to other biologic or synthetic graft enhancers. PRP stands out for its biological potency, ethical soundness, and economic viability as surgical specialties use regenerative adjuncts more frequently. Because of its autologous origin and ease of production, it can be widely used in a variety of therapeutic settings and is in line with global developments in personalized medicine. To fully characterize PRP's therapeutic spectrum and maximize its use in reconstructive surgery, future studies should examine its role in complex wound beds, irradiated tissues, and immunocompromised patients.

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Danish Almas: Supervisor and sample collection, Bench Work
Asad Ashraf: Data collection and literature review
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