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Research Article

Use of PRP for Split Thickness Skin Graft Donor Sites to Reduce Pain and Promote Faster Healing Rates: A Randomized Controlled Trial

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Received: July 24, 2020; **Published:** October 31, 2020

Abstract

Introduction: Platelet Rich Plasma has been vastly utilised in the medical field due to its property to heal the wounds and the multitude of growth factors it contains. Traditionally, donor sites are left to heal with a primary dressing which would otherwise be opened as the wound heals. Various methods of donor site management have been described such as collagen dressings, hydrocolloid, alginate, hydrofiber, silicone dressing, or paraffin gauze. However, it is often encountered that there is a delay in the healing process and accompanied by pain at donor site. Furthermore, in a relatively small population of patients who have a tendency to hypertrophic scar formation, this becomes a challenge for the plastic surgeon. It not only leads to unsightly scars but also additional problems of dryness and itching. This study primarily throws light on the usage of Autologous PRP over Split thickness Skin Graft donor sites to augment healing and reduce pain.

Materials and Methods: The 100 patients enrolled in this study between 2018 - 2019 were divided into two groups of 50 each on a randomized basis, one of which was subjected to use of Autologous PRP, which was topically applied at the donor site and the other control group where the wound was traditionally dressed. Pain scales were measured in the immediate postoperative period as well as at the time of first dressing. Dressing was opened on the 14th postoperative day and observed for healing.

Results: Patients with the PRP group showed statistically significant faster healing at the 14th postoperative day, as compared to the control group which required continuing dressing 3 - 4 weeks. We also measured pain scale in the postoperative period and at the time of first dressing, which was significantly less in the PRP group. Its worthy to mention that a few of the patients who has hypertrophic scars previously, did not develop after the application of PRP.

Conclusion: Application of PRP is a safe, cost effective, easy method to achieve faster healing in graft donor site areas, which is more often than not bothersome to the patients undergoing split thickness grafts. It also reduces the postoperative pain at the donor site. We recommend its use more frequently in managing donor site for Split thickness skin grafts.

Keywords: *PRP; Donor Site; Pain; Skin Grafts; Wound Healing*

Introduction

Split thickness skin graft is a widely accepted technique to cover large defects. However, it is often encountered that there is a delay in healing process, which may lead to hypertrophic scar formation. Autologous PRP has been used in various treatment modalities in the field of plastic surgery for its healing, adhesive and hemostatic properties owing to the growth factors that are released. Platelet-rich plasma (PRP) is an autologous product that concentrates a large number of platelets in a small volume of plasma [1]. PRP also provides an immediate surgical hemostatic agent that is biocompatible, safe, and effective. The platelet comprises granules which are released when PRP is applied to the surface. These granules have properties which:

- Accelerates endothelial, epithelial and epidermal regeneration,

- Stimulates angiogenesis,
- Enhances collagen synthesis,
- Promotes soft tissue healing,
- Decreases dermal scarring,
- Enhances the hemostatic response to injury.

The application of autologous Platelet-Rich Plasma (PRP) to STSG application sites has been recently described and theorised to help in faster healing and treatment of hypertrophic scars. In this study we have demonstrated how application of PRP aids in donor site healing. We have also shown that it reduces pain in the immediate postoperative period.

Materials and Methods

The study was performed in the Department of Plastic, Reconstructive and Burns Surgery, SMS Hospital, Jaipur between 2018 - 2020.

100 patients were taken into the study with written and informed consent which were randomly divided into two groups of 50 each in cases and controls. All the patients gave consent to be a part of this trial.

The patients in the cases group were subjected to use of PRP at the donor site followed by paraffin gauze dressing. In the patients of the control group, the donor site was managed simply by paraffin gauze dressing.

Intraoperatively, fentanyl in a dose of 1 ug/kg was given as a pain medication and postoperatively no pain medication was administered until the patient complained of pain. If he did complain of pain a rescue drug Inj. Diclofenac in a dose 1 mg/kg was given.

Inclusion criteria:

- All patients which required harvesting of split thickness skin graft.
- S. Albumin above 2.5 g/dl.

Exclusion criteria:

- Active infection
- Age > 70 years
- Pus, discharge
- Immunocompromised patients
- Exposed ligaments/bone/cartilage
- Underlying comorbidities uncontrolled hypertension, uncontrolled diabetes and renal disorders.
- Uncooperative patients

- Drug abuse.

Our method of preparing PRP

- Patients venous sample was taken.
- Blood collected in 10 ml ACD vials.
- The vials were spun for 5 minutes at 1500 rpm (Soft Spin) after which the supernatant was spun at 3500 rpm (Hard Spin) for 15 minutes.
- PRP is spread as a thin film over the area using a syringe with a 24 gauge needle.
- 5 ml for 100 square cm was used.

Post-operative care

Dressing was opened on the 14th Postoperative day to assess for healing and pain by an independent observer who did not know which group the patient belonged to.

Next follow up was done on the 21st day.

Primary goal

- Donor site healing on 14th post-operative day.
- Pain scale in the postoperative period at 6, 10 and 16 hours and on the 14th day at the time of dressing.

Results

Healing on 14th day

The wound healing was assessed by an independent observer at the time of the first dressing. It was observed that the patients in the PRP group had significantly higher fasted wound healing rates as compared to the controlled group. A paired T Test was applied to assess this where in a p value of < 0.005 was obtained. Table 1 and figure 1 depicts wound healing in both the groups.

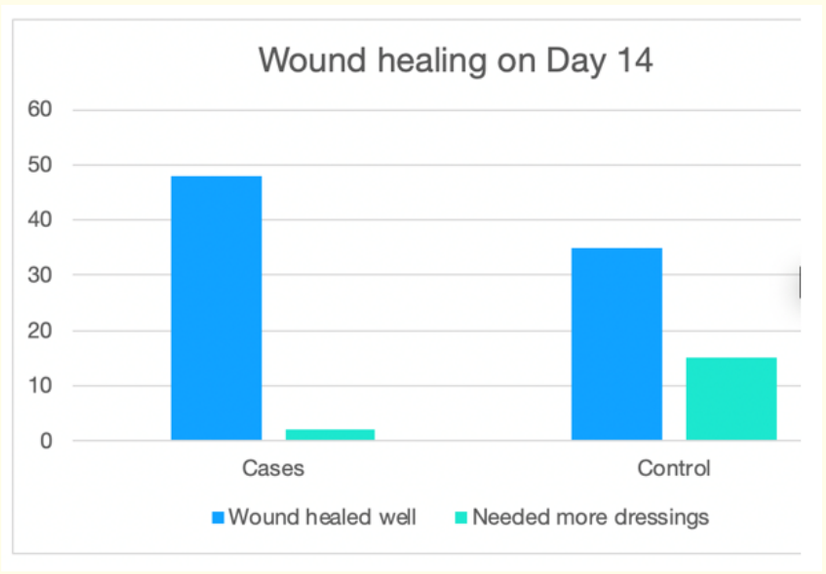

Figure 1: *Wound healing in cases and controls.*

	Wound healed well	Needed more dressings
Cases	48	2
Control	35	15

Table 1: *Wound healing in cases and controls.*

Pain scale by VAS at 6 hours

The Mean VAS Score was also significantly lower with a p value <0.05 at 6 hours in the Cases group. At 10hours and 16 hours the VAS Score was similar because of the rescue drug being given to patients who complained of pain. The Pain scores were significantly less at the time of first dressing with a p value < 0.045. Table 2 depicts Mean VAS Scores in two groups.

	Mean VAS at 6 hours	Mean VAS at 10 hours	Mean VAS at 16 hours	Pain at first dressing
Cases	2	2	3	3
Control	6	4	4	6

Table 2: *Mean VAS Scores in two groups.*

Cost of PRP

The overall cost of PRP is only 100 - 200 Rupees.

Observation in hypertrophic scar patients

5 of our patients in the PRP group had hypertrophic Scars in previously graft do not sites. All of them had undergone skin grafting at least an year back. These patients were followed for 1 year and we observed that these patients did not develop hypertrophic scars in the follow-up.

3 patients in the control group who were found to have hypertrophic scar developed hypertrophy in the donor sire at 1 year follow up.

Discussion

PRP is defined as a biological product derived from patients own blood with the concentration of platelets above the baseline [2].

PRP has been known to have many benefits which helps early vascularisation by delivering these growth factors and increasing collagen synthesis. There are other benefits like reduced hematoma, infection, cost.

Donor site care with dressing material should provide optimum healing, be cost effective and should prevent complications such as pain, infection, discomfort and scarring. It is often encountered that patients feel more pain at the donor site as compared to the recipient wound bed [3-5].

There have been a variety of dressings that are available in the clinical practice. However, there is no single dressing that is devoid of complications or can address to all the necessary problems with donor sites. This has led to variations in choice of dressing or topical agents used by health care professionals [6-8].

Use of PRP has been studied by many researchers and has been published, to name a few here:

- Gibran., *et al*. conducted a study on forty post burn patients in which they used PRP as a wound adhesive for fixing of grafts over wound beds comparing it to traditional methods like sutures and staples [9].
- Schade and Roukis found PRP enhances wound healing time by releasing the growth factors it contains [10].
- Kakudo., *et al*. published a study which proved that PRP helps in revealed that PRP epithelialization and angiogenesis of graft donor sites [11].

In a recent study, Wanden-Berghe., *et al*. found accelerated wound healing in chronic wound beds by PRP activated by calcium chloride [12].

There are many other studies that have been conducted which demonstrates that PRP aids healing and reduces pain providing growth factors to the local site. In that view this study was conducted to overcome these problems at graft donor sites.

Preparing PRP

Although a lot has been written about methods of preparing PRP, there is still a confusion over terminology to classify and describe the different variations of platelet concentrations.

There are several commercial devices available, which make preparation of PRP simple and easy. However, they add to the costs of treatment. They are usually able to achieve a concentration of 2 - 5 times above baseline. Higher Platelet count above this has not shown to cause any additional benefits contrary to the assumption. In fact in one of the studies, a concentration of PRP above 2.5 has been shown to be detrimental [4]. Marx proposed that platelet count of 10 lakh/ml in 5 mL of PRP, as a working definition of PRP, based on the scientific proof of bone and soft tissue healing enhancement [13]. Rughetti., *et al*. [14] studied the relationship between the concentration of platelets in platelet gel and changes in the functional activity of human endothelial cells. The authors found that the stimulation for proliferation of endothelial cells peak at 1.25×10^6 and angiogenesis at 1.5×10^6 platelets/mL, respectively. This signifies the fact that a PRP platelet count 1 million/mL has become the working definition for therapeutic PRP and also reasons out the criticism on not getting the expected best results of PRP, which might be due to lower concentrations of platelets.

There are various methods to prepare PRP. The following paragraph describes our institutional method.

After taking the venous sample in ACD tubes there are two cycles of centrifugation. The first spin step is performed at constant acceleration to separate RBCs from the remaining whole blood volume. After the first spin step, the whole blood separates into three layers: an upper layer that contains mostly platelets and WBC, an intermediate thin layer that is known as the buffy coat and that is rich in WBCs, and a bottom layer that consists mostly of RBCs. For the production of PRP the upper layer and superficial buffy coat are transferred to an empty sterile tube. The second spin step is then performed. The RPM for a second spin should be just adequate to aid in formation of soft pellets (erythrocyte-platelet) at the bottom of the tube. The upper portion of the volume that is composed mostly of PPP (platelet-poor plasma) is removed. Pellets are homogenized in the lower $1/3^{rd}$ (5 ml of plasma) to create the PRP (Platelet-Rich Plasma).

The platelet concentrations have been classified into Low with a count of 0.5 x million/µl, Intermediate having 0.5 - 3 x million/µl and High with 3 - 5 x million/µl.

We have been able to achieve high concentration of platelets by our technique of preparation.

We observed that the problem of prolonged dressings and donor site pain for which there was no definite solution. Keeping that in mind and with the proven properties of PRP, this study was conducted. It has been observed that there was significantly faster healing

rates and that the donor site in most of the cases had healed when the dressing was opened on day 14. Previous studies correlate regular application of PRP with pain reduction during gauze changes [15-20]. We observed that our study showed lower pain scales at 6 hours.

We also followed up 8 patients (5 in PRP group and 3 in Control group) who had history of hypertrophic scar formation in donor sites. It was observed that patients in PRP group did not develop Hypertrophy in donor sites as compared to the control group where hypertrophy occurred at the end of 1st year. Although no statistical analysis was done on these patients we found it worthy enough for its mention and that a study could be done to prove thus hypothesis.

Conclusion

Application of PRP is a safe, cost effective, easy method to promote faster healing in donor site areas from where split thickness skin grafts have harvested. It also reduces the postoperative pain at the donor site. We recommend its use more frequently in managing donor site for split thickness skin grafts.

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Volume 11 Issue 11 November 2020