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Reducing split-thickness skin grafting donor site agony; faster healing and decreased pain-role of platelet-rich plasma

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Abstract:

INTRODUCTION: The split-thickness skin graft harvested donor site is associated with prolonged healing, discomfort, and pain. Platelet-rich plasma (PRP) contains platelet-derived growth factors and has been widely used in chronic wounds and skin graft donor sites. PRP application is known to accelerate wound epithelialization rates, and also reduce postoperative wound site pain.

MATERIALS AND METHODS: We assessed 20 patients admitted to our hospital service who underwent split-thickness skin grafting (STSGs) with proximal half of the donor site treated with PRP. The dressing was conducted on postoperative day 7, 14, and 21. The donor site healing was assessed with serial photographs and donor site pain measured by numerical rating scale.

RESULTS: Complete healing of wounds (epithelialization) was present in 12 (60%) patients dressed with PRP. Pain on opening dressing was an average of 3.5 in PRP dressed wounds and 6.35 in control wounds. Patients dressed without PRP, none of them had complete epithelialization. All patients had partial healing and were less than the donor site dressed with PRP. Based on these results, skin graft donor site with PRP showed accelerated healing and reduced pain and discomfort compared to control without PRP.

CONCLUSION: PRP is a beneficial adjunct for reducing donor site pain and increased healing of donor site following STSG harvest.

Keywords:

Platelet-rich plasma, skin graft donor site dressing, skin grafting

Introduction

The split-thickness skin grafting (STSG) is performed daily in plastic surgery and is an indispensable part of many plastic surgery procedures. It is required for the coverage of secondary defects during flap harvest, posttraumatic, and postburn raw area.

These transplantations result in donor sites, generally on a smooth area of skin, such as the thigh. The donor site in STSG is managed with paraffin gauze dressing. Studies have shown that as many as half of all donor sites show signs of infection and that patients often experience pain at the donor site.[1,2] Problems with the leakage of blood and fluid are also common. Infection, pain, and leakage are factors that can complicate and slow the rate of healing and result in a hypertrophic scar and either hypo- or hyper-pigmentation. Factors that have a deleterious effect on wound healing are smoking, being underweight or overweight, taking steroids, and having autoimmune diseases.[3] Patients in whom healing is delayed are often subjected to cumbersome

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and costly wound care procedures. Delayed healing of the donor site can result in a prolonged hospital stay and may cause the patient more problems than the original injury or disease.

A donor site should, under optimal conditions, be healed within 7–21 days.[4] The ideal dressing should help quick reepithelialization without infection, inhibit leakage, and be painless, adjustable for different sites, easy to use, and cost-effective. Currently, it is recommended that we use dressings that provide a moist environment.[5]

Autologous platelet-rich plasma (PRP), is used in many specialties for the treatment of chronic neuropathic wounds,[6] maxillofacial bone defects[7] and cosmetic,[8] spinal,[9] and reconstructive surgery.[10]

In this study, we used autologous PRP to treat soft-tissue wounds created by STSG harvest.

This study aims to preliminarily assess if treating these wounds with topical PRP mitigates patient pain following an STSG harvest from the thigh and to access the potential of PRP to accelerate the soft-tissue wound healing and epithelialization of a split-thickness skin graft donor site.

Materials and Methods

This prospective randomized clinical study was conducted between April 2016 and September 2016 in our hospital and was approved by the local ethics committee. The study included 20 patients aged between 18 and 80 years, requiring STSG in excess of 10 cm × 10 cm and the donor site was located on the thigh. All patients requiring STSG <10 cm × 10 cm, diabetic, and immunocompromised patients were excluded from the study.

Preparation of platelet-rich plasma

1. 10 mL EDTA (lavender-top) tube sample is to be drawn by direct venipuncture
2. Mixed gently during and after blood collection by slowly inverting the vacutainer
3. The tube was centrifuged at 1250 × *g* (2200 rpm) at 15°C–24°C for 15 min
4. After the spin, three distinct layers can be observed:
   - Bottom layer: Red blood cells (accounting for 50%–80% of the total volume)
   - Middle layer: Very thin band of white blood cells (also called "buffy coat")
   - Top layer: Straw-colored PRP.
5. The supernatant was removed and retained in a separate test tube
6. Two-thirds of the PRP were transferred into a new sterile plastic tube using a transfer pipette without disturbing the buffy coat layer, to avoid contamination
7. Mixed very gently by inverting the tube slowly
8. The tube was centrifuged at 1615 × *g* (2500 rpm) at 15°C–24°C for 10 min with brake off
9. The supernatant was removed and retained in a separate test tube
10. PRP was transferred into a new sterile plastic tube using a transfer pipette (1.0–2.0 ml).[11]

Methods

STSG was harvested from thigh with powered dermatome and of uniform thickness by the same surgeon in all the patients. PRP was sprayed on proximal of donor site and covered with petroleum gauze dressing was conducted. Distal half of wounds were dressed with only petroleum gauze dressing with no PRP. Both the areas were then dressed with sterile gauze pad and bandage.

The dressing was changed on day 7, 14, and 21. After the dressing had been carefully removed, a digital photograph was taken. The photograph was assessed by a plastic surgeon, who was unaware of which treatment had been used. The donor site was considered healed when 98% or more of the total area had reepithelialized, and the donor site required only a protective dressing.

The patients were asked to estimate the pain in the donor site at rest and during dressing changes using a numerical rating scale (NRS), where 0 indicated no pain and 10 the worst pain ever experienced. The NRS has been tested for reliability and validity.[12]

Results

A total of 20 patients were included in the study with STSG donor site in excess of 10 cm × 10 cm. Twelve patients were male and 8 were female. In all the patients, donor site was located on the thigh.

The first dressing of the STSG donor site was conducted on day 7.

Partial healing of donor site was present in both PRP dressed wounds and control wounds in all the patients. In all the patients, the healing area was more in PRP dressed wounds. Accelerated healing was present in PRP dressed wound in comparison to wounds dressed without PRP.

The pain was assessed by NRS and was an average of 6.5 in PRP dressed wounds and average of 8.4 in wounds not dressed with PRP. The patients dressed with PRP had decreased pain in comparison to control wounds without PRP.

The second dressing was conducted on day 14.

Complete healing of wounds (epithelialization) was present in 12 (60%) patients dressed with PRP. In eight patients dressed with PRP, partial healing was present, but it had increased the areas of epithelialization when compared to control group. The patients dressed without PRP, none of them had complete epithelialization. All patients had partial healing and were less than the donor site dressed with PRP.

Pain on opening dressing was an average of 3.5 in PRP dressed wounds and 6.35 in control wounds. Patients dressed with PRP had decreased pain on rest and during dressing changes.

The third dressing was conducted on day 21.

STSG donor site dressed with PRP had complete healing by day 21 in 19 (95%) patients and partially in one patient.

The donor site dressed without PRP healed completely in 11 (55%) patients and partially in 9 patients.

The pain was an average of 2 in PRP dressed wounds and 4.2 in control groups. The pain gradually decreased by day 21 in both wounds PRP dressed and control.

Discussion

Platelets contribute toward hemostasis at sites of vascular injury, and they contain a large number of growth factors and cytokines that play key roles in inflammation and tissue repair.[13] These characteristics of platelets have led to the idea of using platelets as therapeutic tools to promote wound healing. PRP used is an autologous PRP and 10 ml blood is extracted and centrifuged to prepare 3–5 ml PRP. There is no risk of any cross infection as autologous blood is used.

The extraction of PRP begins with any peripheral venous access. The extraction of platelet concentrate from patient blood occurs through plasmapheresis, whereby PRP is concentrated to 300% of normal blood levels. Kazakos *et al*. have shown the role of PRP in acute trauma wound healing. The wound healing was significantly faster in PRP dressed wounds in comparison to conventional dressing methods.[14]

PRP contains different growth factors such as platelet-derived growth factor (PDGF)-AB, transforming growth factor beta-1 (TGF-β), and vascular endothelial growth factor.[15] These growth factors are thought to be responsible for the observed increased rate of epithelialization and pain reduction at wound sites. Graft donor sites, especially those of the dorsal thigh, are often a primary source of discomfort postoperatively.

Kakudo *et al*. proved that PRP promotes fibroblast growth and induced epithelialization and neovascularization at split-thickness skin graft donor sites[16] which are consistent with our study. It was suggested that growth factor released by platelets contained in PRP promoted vascular regeneration and cell growth, leading to wound healing. In this study, during all dressing changes donor site dressed with PRP showed accelerated healing as compared to control wounds.

Kakudo *et al*. have studied that regular application of PRP is associated with pain reduction during gauze changes[16] which are consistent with our study.

Patients experienced less pain at rest and on opening dressing during a change of dressings.

Danielsen *et al*. stated that the epithelialization of donor wounds or the interstices of autografts was not significantly influenced by platelet-rich fibrin treatment.[17]

Miller *et al*. stated that PRP may provide some degree of STSG donor site pain relief. By reducing donor site pain, PRP may also have the potential to reduce analgesic usage postoperatively and shorten hospital stay.[18]

Conclusion

PRP added topically to a deepithelialized wound accelerates the early phase of wound healing, presumably by the release of PDGF and TGF-β, as well as a fibrin-rich base that provides an early revascularization and a framework for epithelial migration. Clinically, these biologic events gain an earlier epithelialization promoting faster healing and less pain reducing patients agony associated with STSG donor site.

Long-term follow-up will be required for assessing the effects of PRP on pigmentation and scarring.

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Conflicts of interest
There are no conflicts of interest.

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