

Research Article



INTERNATIONAL RESEARCH JOURNAL OF PHARMACY

www.irjponline.com

ISSN 2230-8407 [LINKING]

RECONSTRUCTION OF SCALP DEFECTS WITH EXPOSED SKULL USING PLATELET-RICH GEL

Dr. Balaji Babu M.

Associate Professor, Department of Dermatology, Venkateswarra Medical College Hospital and Research Centre, Pondicherry

Email id: Santhii7299@gmail.com

How to cite: Balaji BM. Reconstruction of scalp defects with exposed skull using platelet-rich gel. International Research journal of Pharmacy. 2019;10:3:126-129.

DOI: 10.7897/2230-8407.100390

ABSTRACT

Background: It is difficult to treat exposed skull injuries clinically. Surgical methods are the primary means of treating exposed skull injuries. However, elderly patients who are contraindicated for anesthesia should not undergo these procedures.

Aim: The purpose of this study was to evaluate Platelet-Rich Gel's effectiveness as a non-surgical treatment option for exposed skull injuries.

Methods: During the specified study period, 24 individuals who came to the Institute with exposed skull injuries were evaluated in this study. Topical skin temperature, inflammatory markers, and VAS scores were used to evaluate the subjects before to surgery and three days following treatment. Additionally, each subject's hair growth, local scarring, wound healing duration, number of dressing changes, and platelet-rich gel length.

Results: The average wound area was 17.06 ± 5.47 cm². The platelet-rich gel had a length of 3.07 ± 0.07 cm and a platelet concentration increase of 2.41 ± 0.05 . Complete healing was observed in all 24 participants, requiring an average of 8.1 ± 1.8 dressing changes and a mean healing duration of 24.8 ± 5.6 days. Topical skin temperature, inflammatory indicators, and the visual analog scale score did not significantly change before or after the treatment. After 4–10 months after treatment, research participants underwent follow-up, which revealed minimal local scarring and sparse hair growth.

Conclusion: The current study comes to the conclusion that one-step platelet-rich gel preparation for scalp reconstruction is an efficient, safe, and straightforward non-surgical method with a number of benefits, such as little local scarring, painless treatment, and quick preparation.

Keywords: wound healing, scalp defects, skull exposure, traumas, and platelet-rich gel

INTRODUCTION

Skull exposes and scalp deformities are frequently linked to pressure ulcers and traumatic brain injuries. The scalp, which is located close to the skull, has less subcutaneous soft tissues than other areas of the body and is less mobile than the skin. According to earlier research, it becomes difficult to immediately close and stitch the wound when the diameter of the scalp flaws is greater than 2.5 cm. Additionally, clinical care becomes quite challenging, particularly in situations involving exposed skull trauma.¹ The scalp abnormalities paired with the skull's exposure can be managed in a number of ways.

According to earlier research, local flap transfer can be used to heal wounds when the scalp defect area is less than 20 cm², and a free anterolateral femoral flap can be used to cover bigger skull defects. Additionally, tissue dilators and skin-stretching devices have been shown in clinical investigations to be effective in treating scalp abnormalities.

However, these procedures need the induction of general anesthesia, which can be difficult for elderly patients with reduced anesthetic tolerance and impaired cardiopulmonary function. Furthermore, for the older participants, non-surgical therapy alternatives have proven to be the sole practical choice.²

Platelet-rich plasma, or PRP, has been utilized extensively in wound healing lately and has demonstrated exceptional clinical efficacy, making it an essential tool for treating skin abnormalities. Density gradient centrifugation and blood cell apheresis, a commonly used two-step procedure, are two clinical procedures for PRP preparation.³

However, the majority of the needy people and many nations throughout the world are unable to utilize these methods due to the related expense and complexity of the procedure each application. A simple and inexpensive one-step centrifugation procedure was used to create PRG (platelet-rich gel).⁴ The purpose of the current study was to evaluate Platelet-Rich Gel's effectiveness as a non-surgical treatment method for exposed skull injuries.

MATERIALS AND METHODS

The goal of the current clinical observational study was to evaluate Platelet-Rich Gel's effectiveness as a non-surgical treatment approach for exposed skull injuries. The study was conducted at Department of General Surgery provided the study participants. Prior to their involvement in the study, all participants provided written and verbal informed consent.

24 participants who arrived at the Institute with exposed head injuries within the designated study period were evaluated in this study. Subjects with scalp abnormalities and contemporaneous skull exposure due to trauma, the inability to directly heal the wound, and a wound edge distance greater than 2.5 cm met the study's inclusion criteria.

Pre-existing defective coagulation function, low platelet counts, malignant wounds, and exposure to titanium mesh wounds after cranioplasty were the study's exclusion criteria. To exclude out individuals with thrombocytopenia and aberrant coagulation, basic blood and coagulation functions were evaluated before to treatment.

A centrifuge tube containing coagulants was utilized to prepare autologous PRG. Five milliliters of blood were extracted into each tube, and the amount of blood needed was calculated based on the size and depth of the cut. After that, these tubes were centrifuged for five minutes at 1450 G in a low-speed centrifuge.

This divided the blood into three layers: the bottom layer contained red blood cells; the middle layer was a light-yellow gel that made up PRG; and the top layer was a translucent, light-yellow liquid that included acellular plasma. Tweezers were used to separate PRG and red blood cells. After PRG preparation, the platelet concentration and duration of PRG were measured.

In order to remove the inflammatory and necrotic granulation tissues from skull-exposed wounds and scalp defects, a part of the excised tissues was used for bacterial culture. After filling the wound with PRG, the surface was covered with Vaseline gauze to stop the growth factor-containing plasma from leaking out of the wound. For wound closure, the outermost layer was covered with hydrogel dressing, and PRG was changed every three days until the wound healed.

The duration of healing and the quantity of dressing changes required were noted. White blood cell (WBC) count, procalcitonin (PCT), C-reactive protein (CRP), topical skin temperature, and VAS ratings were measured both before and after three days of treatment. Hair growth and the development of local scars were evaluated at the follow-up appointments.

ANOVA, chi-square test, Fisher's exact test, Mann Whitney U test, and SPSS (Statistical Package for the Social Sciences) software version 24.0 (IBM Corp., Armonk, NY, USA) were used to statistically analyze the collected data. A p-value of less than 0.05 was used as the significance criterion.

RESULTS

The goal of the current clinical observational study was to evaluate Platelet-Rich Gel's effectiveness as a non-surgical treatment approach for exposed skull injuries. 24 participants who arrived at the Institute with exposed head injuries within the designated study period were evaluated in this study. Topical skin temperature, inflammatory markers, and VAS scores were used to evaluate the subjects before to surgery and three days following treatment. Additionally, each subject's hair growth, local scarring, wound healing duration, number of dressing changes, and platelet-rich gel length. The study included 20 men and 4 women, ages ranging from 41 to 84, with a mean age of 62.6.

Vehicle accidents accounted for 66.6% of the injuries, followed by falls from heights (25%) and being struck by heavy falling items (8%). The head and forehead were the sites of all the wounds, which ranged in size from 3 cm to 3 cm to 5 cm to 6 cm. The average wound size was 17.06 ± 5.47 cm². The platelet concentration increased by 2.41 ± 0.05 times and the length of the PRG produced for the investigation using one-step centrifugation was 307 ± 0.07 cm. With a mean of 8.1 ± 1.8 , the number of PRG replacements required to fully cure the skull abnormalities in 24 individuals ranged from 3 to 9.

The average wound healing duration was 24.8 ± 5.6 days, with a range of 15–31 days. The study's findings demonstrated that, with the exception of two individuals who passed away after their wounds healed from more serious injuries, every other participant was successfully monitored for four to ten months, with a mean follow-up period of 5.6 ± 1.7 months. The majority of the subjects had a minor local scar, no noticeable hair growth, thin hair, and normal skin color. None of the subjects reported wound exudation, edema, or local redness. Furthermore, none of the trial participants reported any localized skin pain, numbness, or discomfort.

There was no statistically significant difference between the mean values of topical skin temperature, procalcitonin, CRP, white blood cells, and VAS scores in study subjects before and after treatment, with p-values of 0.102, 0.816, 0.463, 0.271, and 0.218, respectively (Table 1).

DISCUSSION

24 participants who arrived at the Institute with exposed head injuries within the designated study period were evaluated in this study. Topical skin temperature, inflammatory markers, and VAS scores were used to evaluate the subjects before to surgery and three days following treatment.

Additionally, each subject's hair growth, local scarring, wound healing duration, number of dressing changes, and platelet-rich gel length. The study included 20 men and 4 women, ages ranging from 41 to 84, with a mean age of 62.6.

Vehicle accidents accounted for 66.6% of the injuries, followed by falls from heights (25%) and being struck by heavy falling items (8%). The head and forehead were the sites of all the wounds, which ranged in size from 3 cm to 3 cm to 5 cm to 6 cm. The average wound size was 17.06 ± 5.47 cm².

These findings were similar to those of earlier research by Miron RJ et al. (2017) and Rodriguez IA et al. (2014), in which participants with exposed scalp injuries and demographic information similar to this study were evaluated.

According to the study's findings, the platelet concentration increased by 2.41 ± 0.05 times and the PRG prepared for the investigation using one-step centrifugation had a length of 307 ± 0.07 cm. With a mean of 8.1 ± 1.8 , the number of PRG replacements required to fully cure the skull abnormalities in 24 individuals ranged from 3 to 9. The average wound healing duration was 24.8 ± 5.6 days, with a range of 15–31 days. These results were consistent with the one-step PRG results reported by Liu Q et al. in 2021 and Bhatnagar P et al. in 2022.

With the exception of two individuals who passed away after their wounds healed from more serious injuries, all other participants were successfully monitored for four to ten months, with an average follow-up time of 5.6 ± 1.7 months. The majority of the subjects had a minor local scar, no noticeable hair growth, thin hair, and normal skin color. None of the subjects reported wound exudation, edema, or local redness. Furthermore, none of the trial participants reported any localized skin pain, numbness, or discomfort.

These results were in line with the findings of Catanzano O et al.⁹ in 2021 and Sultana MJ et al.¹⁰ in 2022, where the authors likewise reported one-step PRG outcomes and complications similar to the current study. The mean values of topical skin temperature, procalcitonin, CRP, white blood cells, and VAS scores in study participants before and after treatment did not differ statistically significantly (p-values of 0.102, 0.816, 0.463, 0.271, and 0.218, respectively).

These findings were consistent with those of Smith OJ et al. (2021) and Pinto NR et al. (2018), who reported topical skin temperature, inflammatory markers, and VAS scores.

CONCLUSION

Considering its limitations, the present study concludes that one-step platelet rich gel preparation for reconstruction of the defects in the scalp is an effective, safe, and a simpler non-surgical technique that has various advantages including small local scars, painless management, and speedy preparation.

REFERENCES

1. Innocenti A, Menichini G, Innocenti M Major scalp defect reconstruction with free flap: analysis of the results. *Acta Biomed* 2022;92:e2021301.
2. Cherubino M, Taibi D, Scamoni S, Maggiulli F, Giovanna DD, Dibartolo R et al. A new algorithm for the surgical management of defects of the scalp. *ISRN Plast Surg* 2013;2013:916071.
3. Zhang QT, Xu L, Liu Y, Tang XY, Wang J, Deng YB et al Application of skin-stretching device for closing scalp defect. *J Craniofacial Surg* 2023;34:374–380.
4. Chen FF, Ju HB, Huang AF, Yi YJ, Cao YF, Xie W et al Treatment of large and complicated scalp defects with free flap transfer. *Biomed Res Int* 2020;2020:2748219.

5. Miron RJ, Fujioka-Kobayashi M, Bishara M, Zhang YF, Hernandez M, Choukroun J. Platelet-rich fibrin and soft tissue wound healing: a systematic review. *Tissue Eng Part B Rev* 2017;23:83–99.
6. Rodriguez IA, Growney Kalaf EA, Bowlin GL, Sell SA. Platelet-rich plasma in bone regeneration: engineering the delivery for improved clinical efficacy. *Biomed Res Int* 2014;2014:1–15.
7. Liu Q, Zhang N, Li ZN, He HM. Efficacy of autologous platelet-rich plasma gel in the treatment of refractory pressure injuries and its effect on wound healing time and patient quality of life. *Clinics* 2021;76:e2355.
8. Bhatnagar P, Law JX, Ng S-F. Delivery systems for platelet derived growth factors in wound healing: a review of recent developments and global patent landscape. *J Drug Deliv Sci Technol* 2022;71:103270.
9. Catanzano O, Quaglia F, Boateng JS. Wound dressings as growth factor delivery platforms for chronic wound healing. *Expert Opin Drug Deliv* 2021;18:737–759.
10. Sultana MJ, Akter MA, Yesmin N, Haque MA, Rahman M, Alam MM. Wound healing effects and antibacterial properties of heterologous platelet-rich plasma on staphylococcus aureus induced septic wounds in rabbits. *J Adv Vet Anim Res* 2022;9:481–489.
11. Smith OJ, Wicaksana A, Davidson D, Spratt D, Mosahebi A. An evaluation of the bacteriostatic effect of platelet-rich plasma. *Int Wound J* 2021;18:448–456.
12. Pinto NR, Ubilla M, Zamora Y, Del Rio V, Ehrenfest DMD, Quirynen M. Leucocyte- and platelet-rich fibrin (L-PRF) as a regenerative medicine strategy for the treatment of refractory leg ulcers: a prospective cohort study. *Platelets* 2018;29:468–475.

S. No		Topical skin temperature (°C)	Procalcitonin (ng/ml)	C-reactive protein (mg/L)	White blood cell (10g/L)	VAS
1.	Before treatment	36.87±0.25	0.096±0.02	10.51±2.02	8.35±1.08	2.98±0.58
2.	After treatment	36.71±0.22	0.092±0.01	9.95±1.33	7.78±1.03	3.31±0.63
3.	p-value	0.102	0.816	0.463	0.271	0.218

Table 1; Topical skin temperature, inflammatory markers, and VAS scores in study subjects before and after treatment