DOI: https://doi.org/10.53350/pjmhs22166866

ORIGINAL ARTICLE

Results of Split Thickness Skin Grafts after Scalp Rotation Flap Surgeries: A Cross-Sectional Study

HASSAN KASHIF[1], SHAZIA MANZOOR[2], MAHAK ALI[3], AIMAN NASEEM[4], SABA KIRAN[5], SYED AAQIL SHAH[6]
[1]Consultant Plastic Surgeon, Department of Plastic Surgery, Shaheed Mohtarma Benazir Bhutto Institute of Trauma (SMBBIT) Karachi Pakistan.
[2]Resident Year 4, Department of Plastic Surgery, Patel Hospital Karachi Pakistan.
[3,4,5]Resident Medical officer, Department of Plastic Surgery,Shaheed Mohtarma Benazir Bhutto Institute of Trauma (SMBBIT) Karachi Pakistan.
[6]Consultant Plastic Surgeon, Plastic & Burn Surgery Department, Patel Hospital Karachi Pakistan.
Corresponding author: Hassan Kashif, Email:drhassankashif@gmail.com

ABSTRACT

Aim: To assess outcome of Split thickness skin grafts after scalp rotation flap Surgeries.
Study design: A cross-sectional study
Place and Duration: This study was conducted at Patel Hospital Karachi Pakistan fromFebruary 2021 to February 2022.
Methodology: This study aimed to assess clinical features, patient demographics, results, and long-term follow-up to identify its effectiveness in other procedures. A total of 15 individuals were incorporated in the present study, those who had combination scalp reconstruction and cranioplasty with anSplit thickness skin graftsfor local donor site covering. Before surgery, five patients (33.3 %) were classified as having "high complexity" scalp abnormalities. Six (40 %) patients were large, while 9 (60 %) were medium size. The remaining grafts were inset over bare Calvarial bone, while 10 (66.7%) were inset over vascularized muscle or pericranium.
Results: The authors observed that all Split thickness skin grafts in this group were successful 93.3 % of the time (14/15). Due to poor take, grafts failed were observed in 1 patient. Because of the excellent success rate in this series, no patient risk factors were observed to be associated with transplant failure. Furthermore, whether the graft resided over bone or vascularized muscle/pericranium did not affect the success rate.
Conclusion: Cranioplasty poses a challenge to surgeons. Split thickness skin Grafting has shown more promising results with simple techniques than other multifaceted reconstructive methods.
Keywords: Calvarial bone, Cranioplasty, Split thickness skin grafts ,Percranium, Skin grafts

INTRODUCTION

Reconstructing primary Split thickness skin graft is challenging due to restricted scalp mobility, scalp structure, and low vascularity of the calvaria for surgeons. (1) Skin grafts can be harvested to restore a defect that would typically take weeks to months to mend by secondary intention, depending on the anatomical position of the skin lesion and if tension-free skin repair cannot be performed. (2) Tissue expansion, primary closure, local flaps, skin grafting, and microvascular free tissue transfer have all been used to treat the wound. (3) Each of these reconstructive procedures has its own set of limits and drawbacks. Achieving effective cranioplasty with tailored cranial implants requires a stable scalp closure with low to no stress. (4) Regrettably, surgeons are frequently confronted with unanticipated scalp dehiscence after cranioplasty, followed by subsequent hardware infections due to wound disruption. (5) As a result, more people opt for the more complicated alternative of free tissue transfer, which comes with a higher risk of morbidity and requires more possessions. In addition, closure of scalp employing neighbouring tissue transferal showed better results with enhanced esthetic effects, together with tertiary referrals with injured and vascular-compromised scalps. (6) However, scalp closure during concurrent cranioplasty may be inadequate for specific patients due to local tissue rearrangement. Furthermore, obtaining a long-term sustainable scalp closure in cancer patients who received radiation therapy and re-operation with considerable scalp atrophy is considerably more difficult. (7)

The calvarium is repaired using various materials, each with its own set of benefits and drawbacks in terms of cost, aesthetics, biocompatibility, implant strength, and complication rate. (8) Split-thickness skin grafts (STSGs), biological materials, phased tissue expansion, healing by secondary intention, and free tissue transfer is a few strategies used to treat scalp deficit during cranioplasty. Regardless, the best method of covering should result in a long-lasting scalp closure with little to no strain and an attractive appearance. Furthermore, the optimum procedure requires the least operational time and is associated with the slightest degree of morbidity. Split-thickness skin grafts (STSG) combine the epidermis with a thin layer of the dermis, whereas full-thickness skin grafts combine the epidermis with the entire dermis thickness. (9)STSGs are now preferred over FTSCs, but more surgeon education and skill with harvesting equipment may assist in raising the proportion in the future. Previous studies have evaluated that STSG used for muscle, pericranium, and calvarium are safe and dependable in attaining these objectives with minimum complication risk. A simple method for overcoming co-existing scalp scarcities following a complex nearby tissue transplant, STSGs are used to treat local donor abnormalities in the present study to assess the efficiency of the method during and after cranioplasty.

METHODOLOGY

Approval was taken from the hospital's ethical review board before conducting the research. A total of 15 patients were incorporated in the study who followed the surgical process of Split thickness skin grafts as described by Wolff et al. (2019). (10) The data was examined concerning demographic and socioeconomic information comprising age at surgery, gender, cigarette consumption, etc. Bone flap, purulence, or foreign material exposure were identified in the chart as signs of pre-reconstruction wound breakdown or infection, as characterized by purulence, bone flap osteomyelitis, or foreign body exposure. Defects were categorized as medium and large concerning cutaneous components. Radiation therapy was used before and after the final reconstructive process, and neurosurgical procedure histories were documented. Flap-related complications were categorized as a fractional loss of the flap utilized for reconstruction or wound breakdown due to the flap's adequacy. Likewise, implant-related complications include infection or exposure to an implant utilized at the initial reconstruction or during a staged surgery. These studies were carried out using Microsoft Excel 2010's conventional statistical capabilities. Data were expressed in mean and percentages.

RESULTS

The present study incorporated 15 patients who experienced scalp reconstruction via theSplit thickness skin grafts technique. The follow-up period for the patients was one year. Out of the 8 were females, and 7 were males. The mean age of the patient observed was 52.3 years. Overall, ten patients had experienced more than five surgeries and received radiation therapies before reconstruction of the scalp. Tumors in 9(60%) patients were the

most prevalent underlying cause that required surgery and the second prevalent cause was trauma (13.4%), as shown in **Table 1.**

We categorized our patient cohort as "medium-sized" flaws between 9 and 50 cm2 and lesions >50 cm2 as "large-sized" defects, comparable to how previous investigators classified scalp abnormalities based on size. With this categorization, 6 (40%) of the participants were present with large-sized scalp deformities, and 9 (60%) had defects of the scalp with medium size. The remaining 5 (33.3 %) grafts were put on bare cranial bone, and 10 (66.7 %) graft beds were made up of intact muscle/pericranium, as described in **Table 2.**

Table 3 summarizes the final Split thickness skin grafts take findings. At follow-up, graft take was 100 percent in 12 (81.82%) of the 15 patients. One patient (14.2 %) had a graft take of 95 percent, while another (14.2 %) had a graft take off roughly 90 percent. The remaining 5-10% of exposed bone after secondary intention healing was unremarkable in the latter individuals. Split thickness skin grafts covered in this series had an overall success percentage of 93.3 % in this investigation. Due to necrosis, before the reconstructive stage, a patient who was radiated lost 50% of his transplant. Out of seven patients, five (71.42 %) who had radiation therapy before reconstruction had 100% graft take, whereas one patient (14.2 %) achieved 95% graft take. In the present study, a high rate of graft take was observed. No risk factors for radiation therapy, co-morbidities, cranial defect, previous neuro-cranial surgeries, and infections were found to correlate with the graft's failure significantly. Additionally, the graft was inserted over cranial bone or vascularized pericranium/muscle had little effect on the success rate. In addition, the size of the Split thickness skin grafts had no bearing on its success or failure.

Table 1: Prospective patient characteristics

Variables	Value	% (n=15)
Duration of follow-up, years	1	
High complexity scalp (previous surgeries >5)	5	33.34
Preconstruction recipient site radiotherapy	7	46.64
Relevant medical history for each patient		
No relevant medical history	11	73.4
Anticoagulant therapy	2	13.4
Diabetes mellitus	1	6.7
Smoking	1	6.7
Initial pathology		
Trauma	2	13.4
Tumour	9	60
Functional neurosurgery	1	6.7
Infection	1	6.7
Arteriovenous malfunction	1	6.7
Cerebral aneurysm	1	6.7

Table 2: Scalp/Skull Defect Characteristics

Variables	Value	% (n=15)
Defect type		
Soft tissue defect	4	26.67
Hard time defect	11	73.3
Recipient defect size		
Medium (≥ 9 cm^2)	9	60.00
Large (≥ 50 cm^2)	6	40.00
Graft recipient size substrate		
Over bone	5	33.3
Over muscle/pericranium	10	66.7

Table 3: Graft Success Rate

Variable	Value	%
Overall take (n=33)	12	81.82
100 percent	1	6.7
95 percent	1	6.7
90 percent	1	6.7
Failure (< 90%)		46.67
Graft take in the radiated scalp (n=7)	5	71.42
100 percent	1	14.2
95 percent	1	14.2
Failure (<90%)		

DISCUSSION

According to reconstructive and neuroplastic surgery, patients who have had a cranioplasty should have tension-free scalp cessations. Local fasciocutaneous flaps, necessary for cranial implant protection of long-term and incisional healing, can be used to accomplish this. (11) Simultaneously, various approaches of varying complexity have been described by others in comparable situations. Graded tissue enlargement, repair by secondary intent with daily change of dressing, free tissue transferal local/regional scalp flaps, and STSGs are some practical approaches. (12) Each of the strategies listed above has benefits and drawbacks. In addition, numerous case reports have described Integra's usefulness in treating Split thickness skin grafts for cranial abnormalities when cranioplasty and free flap surgery aren't feasible. Integra was successfully included in four case reports when placed directly on the dura. (13)

Successful repair of significant scalp defects has been achieved with the staged tissue expansion technique; However, this process necessitates multiple clinical appointments; before the second (delayed) procedure, the patient may experience discomfort and needs a lengthy gap time, resulting in improper scalp thinning (pressure/stretch), and carries a significant risk of infection, all of which are particularly concerning when alloplastic cranial implants are to be used secondary. (14) Healing with secondary intention is also an extensive process that necessitates the use of time-consuming wound care resources and the danger of scarring/tension, infection contamination, and imminent implant failure. Wang et al. (2019) reported a complication rate of 16.5% in scalp reconstruction with the staged tissue expansion method. (15) Tissue growth can impose pressure on the underlying dura/brain in the event of pre-existing cranial anomalies. (16, 17)

In the context of cranioplasty reconstruction, free tissue transfer is typically recognized as the optimal approach to restoration for large-scale scalp covering. Several case series have shown that therapy is effective with minimal complication rates. On the other hand, free tissue transfers need a prompt commitment, necessitate a labour-intensive procedure, have a substantial operative risk of failure, and require considerably extended postoperative observations and ICU stay. Furthermore, it frequently results in a cosmetically deforming, defined, large flap region with mismatched colour, alopecia, and frequent demands of surgery revision. Due to reports of poor wound healing and complications, skin transplantation for scalp lesions of medium/large size has been widely contested in previous articles. This complication rate appears inconsistent according to our present experience; thus, they were investigated further. Graft failure was observed in just 1/15 patients in our group of medium/largeSplit thickness skin grafts with simultaneous cranioplasty (6.7 %). This complication incidence is equivalent to lesions of similar size treated with free tissue transfer. A similar study observed that the graft failure rate was 6% with medium to large Split thickness skin grafts .(10) Similarly, some writers have expressly opposed repair with Split thickness skin grafts over burred bone due to poor results. (18, 19) The present study has observed promising results with Split thickness skin grafts andFTSGs. Furthermore, before skin grafting, the 2-step techniques frequently allude to and need a preliminary stage for forming granulation tissue in the wound. (20)Split thickness skin grafts is more aesthetic, more resistant to accidental harm, and can even encourage hair follicle development in some cases. (21) The use of skin grafts for fault coverage in patients who received irradiation following neighbouring tissue transfer has provided satisfactory outcomes. (22) We observed in our study that 5 out of 7 had 100% graft taken following radiation therapy; graft failure was observed in only one patient. These findings show that in individuals with numerous disorders for whom protracted anesthesia is judged inadequate, Split thickness skin grafts are a safe choice for masking local abnormalities following scalp radiation therapy.

Because grafts are seen to be unattractive and untrustworthy for full-thickness scalp lesions, medium- to large-sized scalp failures are usually best treated with a free flap, independent of surgical ability. (23)Split thickness skin graftsoffer several benefits, including reduced healing contraction, a more pleasing cosmetic appearance, and thicker, trauma-resistant skin. (24) In the present study, bulkiness was observed to be far more visually inferior in the immediate smooth contour ofSplit thickness skin grafts. However, the weakness of our study was its limited sample size and duration of the study. Long-term studies and comparisons are required to enlighten the pros and cons of implementing better techniques.

CONCLUSION

Split thickness skin grafts is an excellent alternative for cranioplasty, as long as the surgeon chooses the right donor location. In the current investigation, a preliminary series of neurosurgical patients with medium- to large-sized scalp lesions were successfully treated with Split thickness skin grafts (muscle, bare Calvarial bone, and pericranium). It is a necessary approach for the neuroplastic surgeon in contrast to prior research that has indicated mixed effectiveness with skin grafting. Even in the challenging cranioplasty patient group, full-thickness skin grafts provide constant dependability and outstanding cosmetic outcomes when used correctly.

Funding source: None

Conflict of interest: None

Permission: The ethical review committee approved the study of the institute.

REFERENCES

1. Lin SJ, Hanasono MM, Skoracki RJ. Scalp and calvarial reconstruction. Seminars in plastic surgery. 2008;22(4):281-93.
2. Sun L, Patel AJ. Outcomes of split vs full-thickness skin grafts in scalp reconstruction in outpatient local anaesthetic theatre. Scars, burns & healing. 2021;7:20595131211056542.
3. Sokoya M, Inman J, Ducic Y. Scalp and Forehead Reconstruction. Seminars in plastic surgery. 2018;32(2):90-4.
4. Park EK, Lim JY, Yun IS, Kim JS, Woo SH, Kim DS, et al. cranioplasty Enhanced by Three-Dimensional Printing: Custom-Made Three-Dimensional-Printed Titanium Implants for Skull Defects. The Journal of craniofacial surgery. 2016;27(4):943-9.
5. Albano NJ, Afifi AM, Iskandar BJ, Koueik J. Functional and Cosmetic Management of Post-Craniotomy Pain. Surgical Treatment of Chronic Headaches and Migraines: Springer; 2020. p. 147-66.
6. Leedy JE, Janis JE, Rohrich RJ. Reconstruction of acquired scalp defects: an algorithmic approach. Plastic and reconstructive surgery. 2005;116(4):54e-72e.
7. Janus JR, Peck BW, Tombers NM, Price DL, Moore EJ. Complications after oncologic scalp reconstruction: a 139-patient series and treatment algorithm. The Laryngoscope. 2015;125(3):582-8.
8. Qasmi SA, Ghaffar A, Hussain Z, Mushtaq J. Early autologous cranioplasty after decompressive hemi-craniectomy for severe traumatic brain injury. JPMA The Journal of the Pakistan Medical Association. 2015;65(12):1325-9.
9. Adams DC, Ramsey ML. Grafts in dermatologic surgery: review and update on full- and split-thickness skin grafts, free cartilage grafts, and composite grafts. Dermatologic surgery : official publication for American Society for Dermatologic Surgery [et al]. 2005;31(8 Pt 2):1055-67.
10. Wolff AY, Santiago GF, Belzberg M, Manson PN, Huang J, Brem H, et al. Full-Thickness Skin Grafting for Local Defect Coverage Following Scalp Adjacent Tissue Transfer in the Setting of Cranioplasty. The Journal of craniofacial surgery. 2019;30(1):115-9.
11. Gordon CR, Fisher M, Liauw J, Lina I, Puvanesarajah V, Susarla S, et al. Multidisciplinary approach for improved outcomes in secondary cranial reconstruction: introducing the pericranial-Onlay cranioplasty technique. Neurosurgery. 2014;10 Suppl 2:179-89; discussion 89-90.
12. Sunil NP, Ahmed F, Jash PK, Gupta M, Suba S. Study on Surgical Management of Post Burn Hand Deformities. Journal of clinical and diagnostic research : JCDR. 2015;9(8):PC06-10.
13. de Haas LEM, Gardien KLM, van Trier AJM, Vloemans A, Buis DR. The Use of Integra in Extensive Full-Thickness Scalp Burn Involving the Skull in a Child. The Journal of craniofacial surgery. 2019;30(3):888-90.
14. Nguyen LL, Naunheim MR, Hevelone ND, Diaz-Siso JR, Hogan JP, Bueno EM, et al. Cost analysis of conventional face reconstruction versus face transplantation for large tissue defects. Plastic and reconstructive surgery. 2015;135(1):260-7.
15. Wang HD, Ibrahim Z, Quan A, Bai J, Ostrander BT, Redett RJ. Pediatric Tissue Expansion: Predictors of Premature Expander Removal in a Single Surgeon's Experience with 472 Expanders. Plastic and reconstructive surgery. 2020;145(3):755-62.
16. Kurland DB, Khaladj-Ghom A, Stokum JA, Carusillo B, Karimi JK, Gerzanich V, et al. Complications Associated with Decompressive Craniectomy: A Systematic Review. Neurocritical care. 2015;23(2):292-304.
17. Iaccarino C, Kolias AG, Roumy LG, Fountas K, Adeleye AO. Cranioplasty Following Decompressive Craniectomy. Frontiers in neurology. 2019;10:1357.
18. Akan M, Karaca M, Eker G, Karanfil H, Akoz T. Is polymethylmethacrylate reliable and practical in full-thickness cranial defect reconstructions? The Journal of craniofacial surgery. 2011;22(4):1236-9.
19. Koenen W, Goerdt S, Faulhaber J. Removal of the outer table of the skull for reconstruction of full-thickness scalp defects with a dermal regeneration template. Dermatologic surgery : official publication for American Society for Dermatologic Surgery [et al]. 2008;34(3):357-63.
20. Desai SC, Sand JP, Sharon JD, Branham G, Nussenbaum B. Scalp reconstruction: an algorithmic approach and systematic review. JAMA facial plastic surgery. 2015;17(1):56-66.
21. Goodarzi P, Falahzadeh K, Nematizadeh M, Farazandeh P, Payab M, Larijani B, et al. Tissue Engineered Skin Substitutes. Advances in experimental medicine and biology. 2018;1107:143-88.
22. Lal ST, Banipal RP, Bhatti DJ. Tolerance of skin grafts to postoperative radiotherapy. International journal of applied & basic medical research. 2015;5(3):187-9.
23. Hoffmann JF. Tissue expansion in the head and neck. Facial plastic surgery clinics of North America. 2005;13(2):315-24, vii.
24. Ramsey ML, Walker B, Patel BC. Full Thickness Skin Grafts. StatPearls. Treasure Island (FL)2022.