

**A Clinical Study of Various Methods of Reconstruction of Scalp Defect and its Outcomes**Sanjay Kumar<sup>1</sup>, Sanjay Kumar Gupta<sup>2</sup><sup>1</sup>Senior Resident, Department of Plastic Surgery, Patna Medical College and Hospital, Patna, Bihar, India<sup>2</sup>Sanjay Kumar Gupta, Associate Professor, Department of Plastic Surgery, Patna Medical College and Hospital, Patna, Bihar, India

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**Abstract:****Background:** Scalp defects, arising from various causes, present intricate challenges in reconstructive surgery, demanding tailored approaches to restore both function and aesthetics. The aim of this study is to comprehensively evaluate and compare various techniques for reconstructing scalp defects, exploring their efficacy, safety, and cosmetic outcomes.**Methods:** This prospective cohort study, conducted at a tertiary care facility, evaluated and compared different scalp defect reconstruction techniques in 74 adult participants. The study incorporated randomization, blinding, and standardized assessments to ensure robust findings. Participants were assigned to four surgical technique groups: skin grafting, local flap reconstruction, tissue expansion, and microsurgical free tissue transfer.**Results:** Notably, skin grafting and local flap reconstruction demonstrated faster wound healing, while tissue expansion and microsurgical free tissue transfer had longer healing times. Complications were observed in 24% of cases, with the latter group experiencing the highest rate. Cosmetic outcomes were generally favorable across techniques, with high patient satisfaction. Age and surgical technique were identified as predictors of outcomes.**Conclusion:** This study provides valuable insights into optimal scalp defect reconstruction strategies, offering potential enhancements in patient care and quality of life.**Recommendations:** Based on the study's findings, it is recommended that clinicians carefully consider patient-specific factors and defect characteristics when selecting the most suitable scalp defect reconstruction technique. Additionally, further research should explore ways to refine and optimize these techniques for improved patient outcomes.**Keywords:** Scalp Defects, Reconstruction Techniques, Wound Healing, Complications, Patient Satisfaction.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Scalp defects, whether arising from trauma, surgical resection of tumors, or pathological conditions like alopecia, present a significant challenge in reconstructive surgery. The scalp's unique anatomical features, including its dense vascular network, limited elasticity, and the presence of hair follicles, necessitate specialized approaches for effective reconstruction. The primary goals in scalp defect reconstruction are to restore the protective function of the scalp, achieve aesthetic harmony, and, where possible, preserve or restore hair growth [1]. This field has seen considerable advancements, with a range of techniques being developed and refined to address defects of varying sizes, locations, and complexities.

The complexity of scalp reconstruction is influenced by several factors, including the size and depth of the defect, the cause (traumatic, oncologic,

congenital, or disease-related), patient-specific factors (age, comorbidities, hair pattern), and the availability of adjacent tissue for grafting or flap procedures [2]. The choice of reconstruction technique is critical and is based on a thorough understanding of these variables. The spectrum of reconstructive options includes primary closure, skin grafting, local flaps, regional flaps, free tissue transfer, and more recently, tissue expansion and advanced regenerative techniques [3].

Primary closure, often preferred for its simplicity and excellent match with surrounding tissues, is typically limited to smaller defects. Skin grafts, while useful in covering larger defects, may not always provide the best cosmetic results, especially in hair-bearing areas. Local and regional flaps offer better aesthetic outcomes and are preferred for larger or more complex defects, but they require careful

planning and surgical expertise [4]. Free tissue transfer, although more complex, is reserved for extensive defects where other options are not feasible. Tissue expansion and regenerative techniques represent the cutting edge in scalp reconstruction, offering new possibilities, especially in terms of hair restoration and aesthetic outcomes [5].

The aim of this study is to comprehensively evaluate and compare various techniques for reconstructing scalp defects, exploring their efficacy, safety, and cosmetic outcomes. This research aims to provide valuable insights into the optimal approaches for addressing scalp defects, ultimately improving patient outcomes and quality of life.

### Methodology

**Study Design:** This is a prospective cohort study.

**Study Setting:** The study was conducted at Patna Medical College and Hospital, over a 2018-2021.

**Participants:** 74 adult participants (aged 18 and above) presenting with various scalp defects due to trauma, tumor resection, or congenital deformities were recruited for this study.

### Inclusion Criteria

1. Adult patients aged 18 years and older.
2. Scalp defects requiring surgical reconstruction.
3. Willingness to participate in the study and provide informed consent.

### Exclusion Criteria

1. Patients with scalp defects deemed medically unfit for surgery.
2. Patients with a history of significant allergies or contraindications to surgical materials.
3. Patients unable or unwilling to provide informed consent.

**Bias:** To minimize bias, the allocation of participants to specific surgical techniques was randomized, and the surgeons involved in the study were blinded to the randomization process. Outcome assessors were blinded to the treatment group.

**Variables:** Variables included different surgical techniques for scalp defect reconstruction, surgical

outcomes, including wound healing, complications, cosmetic appearance, and patient satisfaction.

**Data Collection:** Data was collected through a combination of medical records review, pre-operative assessments, intra-operative notes, and post-operative follow-up visits. Outcome assessors was conducting standardized assessments of wound healing, complications, and cosmetic outcomes using validated tools. Patient satisfaction was assessed using a Likert scale questionnaire.

**Surgical Techniques:** Participants were randomized into different surgical technique groups, including but not limited to Skin grafting, Local flap reconstruction, Tissue expansion, and Microsurgical free tissue transfer.

**Statistical Analysis:** Data was analyzed using statistical software SPSS. Descriptive statistics was used to summarize patient demographics and baseline characteristics. Comparative analysis was performed using appropriate statistical tests to assess differences in outcomes between the different surgical technique groups. Statistical significance was set at  $p < 0.05$ .

**Ethical considerations:** The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

### Result

The results of this study were obtained through a comprehensive evaluation of various scalp defect reconstruction techniques and their outcomes in 74 adult participants. The study design incorporated randomization, blinding, and standardized assessments to ensure the accuracy and reliability of the findings.

The study included 74 participants with scalp defects resulting from trauma, tumor resection, or congenital deformities. The participants' ages ranged from 19 to 72 years, with a mean age of 42.5 years. There was an even distribution of gender among the participants, with 50% being male and 50% female.

**Table 1: Surgical techniques utilized during the study.**

Surgical Technique	Mean Wound Healing Time (weeks)	Complications (%)	Cosmetic Outcome (Excellent/Good)	Average Patient Satisfaction (Likert Scale)
Skin Grafting	3.6	11%	85%	4.4
Local Flap Reconstruction	4.2	15%	80%	4.3
Tissue Expansion	5.8	22%	75%	4.2
Microsurgical Free Tissue Transfer	6.5	33%	70%	4.1

Participants were randomly assigned to four different surgical technique groups: skin grafting (n=18), local flap reconstruction (n=20), tissue

expansion (n=18), and microsurgical free tissue transfer (n=18).

The time to complete wound healing varied among the different surgical technique groups. Skin grafting and local flap reconstruction demonstrated faster wound healing, with a mean healing time of 3.6 weeks and 4.2 weeks, respectively. Tissue expansion and microsurgical free tissue transfer had longer healing times, averaging 5.8 weeks and 6.5 weeks, respectively.

Complications were observed in 24% of the participants across all surgical technique groups. The most common complications were infection (n=6, 8%) and hematoma (n=4, 5%). The microsurgical free tissue transfer group had the highest rate of complications (33%), while the skin grafting group had the lowest (11%).

Cosmetic outcomes were assessed using a validated scoring system. Skin grafting and local flap reconstruction achieved the highest cosmetic scores, with 85% and 80% of participants reporting excellent or good cosmetic results, respectively. Tissue expansion and microsurgical free tissue transfer also yielded favourable cosmetic outcomes, with 75% and 70% reporting excellent or good results.

Patient satisfaction was assessed using a Likert scale questionnaire, with scores ranging from 1 (very dissatisfied) to 5 (very satisfied). Overall, participants reported high levels of satisfaction with their surgical outcomes, with an average satisfaction score of 4.3 out of 5.

Statistical analysis revealed no significant differences in demographics or baseline characteristics among the surgical technique groups. Logistic regression analysis identified age and type of surgical technique as predictors of wound healing time, while Cox proportional hazards modelling showed that surgical technique and age were significant predictors of complication risk.

## Discussion

The study encompassing 74 adult participants with scalp defects from diverse causes employed rigorous methodology, including randomization and blinding, to investigate various scalp defect reconstruction techniques and their outcomes. Results revealed notable variations among the techniques studied. Skin grafting and local flap reconstruction showcased swifter wound healing, with respective mean healing times of 3.6 and 4.2 weeks. Conversely, tissue expansion and microsurgical free tissue transfer demonstrated longer healing periods, averaging 5.8 and 6.5 weeks. Complications occurred in 24% of cases, with the microsurgical free tissue transfer group showing the highest rate (33%) and the skin grafting group the lowest (11%). Cosmetic outcomes were favourable across all techniques, with skin grafting and local flap reconstruction achieving the highest scores

(85% and 80% excellent/good). Patient satisfaction was high across the board, with an average score of 4.3 out of 5. Statistical analyses highlighted the influence of age and surgical technique on healing times and complication risk. Overall, the study underscores the importance of individualized surgical approach selection for scalp defect reconstruction, and the need for further research to refine these techniques for optimal patient outcomes.

Recent studies in the field of scalp defect reconstruction have provided valuable insights into various techniques and their outcomes. A study comparing split and full-thickness skin grafts found superior outcomes with split skin grafts, particularly when secured with foam tie-over dressings, suggesting an effective approach for scalp reconstruction [6]. The feasibility of expanded scalp flaps combined with laser depilation, although primarily studied in paediatric patients, offers potential applications in adult scalp reconstruction as well [7]. The use of dermal templates and staged skin grafting has been highlighted as a reliable option for post cancer scalp reconstruction, especially in patients unsuitable for flap procedures [8]. In terms of extensive scalp reconstruction following oncologic resection, a comparative study of different free flap techniques, including anterolateral thigh, latissimus dorsi, and omental free flaps, provides insights into complication rates and aesthetic outcomes [9]. Additionally, the use of a new artificial dermis has shown promising results in terms of efficacy, safety, and aesthetic outcomes in scalp reconstruction for skin cancer [10]. These studies collectively contribute to a deeper understanding of the various surgical options available for scalp defect reconstruction, their effectiveness, and associated outcomes.

## Conclusion

In conclusion, this study demonstrated that various scalp defect reconstruction techniques can yield favourable outcomes in terms of wound healing, complications, cosmetic appearance, and patient satisfaction. The choice of surgical technique should be individualized based on patient characteristics and the specific nature of the scalp defect. Further research is warranted to refine and optimize these techniques for improved patient outcomes.

**Limitations:** The limitations of this study include a small sample population who were included in this study. The findings of this study cannot be generalized for a larger sample population. Furthermore, the lack of comparison group also poses a limitation for this study's findings.

**Recommendation:** Based on the study's findings, it is recommended that clinicians carefully consider patient-specific factors and defect characteristics when selecting the most suitable scalp defect

reconstruction technique. Additionally, further research should explore ways to refine and optimize these techniques for improved patient outcomes.

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### References

1. Yoo BW, Oh KS, Kim J, Shin HW, Kim KN. Modified Keystone Perforator Island Flap Techniques for Small- to Moderate-Sized Scalp and Forehead Defect Coverage: A Retrospective Observational Study. *J Pers Med.* 2023 Feb 15;13(2):329.
2. Lu Y, Chang KC, Chang CN, Chang DH. Reconstruction of a secondary scalp defect using the crane principle and a split-thickness skin graft. *BMC Surg.* 2021 Jan 18;21(1):41.
3. Petrocelli M, Togo G, Ricci S, Zeneli F, Cutrupi S, Baietti A, Bonavolontà P, Califano L, Vaira LA, Scarpa A, Di Stadio A, Salzano G. Dermal Substitutes and Skin Grafts in the Reconstruction of Post-Traumatic Total Scalp Avulsion: A Case Series. *J Clin Med.* 2023 Mar 10;12(6):2167.
4. Okwesili OR, Achebe UJ, Onumaegbu OO, Mezue WC, Chikani MC, Onyia EE. Scalp Reconstruction following Excision of Malignant Tumors in Southeastern Nigeria. *Nigerian Journal of Medicine.* 2023 May 1;32(3):309-13.
5. Seretis K, Bounas N, Lykoudis EG. Concomitant Reconstruction of Multiple Scalp Defects With One Rotational Flap. *J Craniofac Surg.* 2023 Nov-Dec 01;34(8):e774-e776.
6. Sun L, Patel AJ. Outcomes of split vs full-thickness skin grafts in scalp reconstruction in outpatient local anaesthetic theatre. *Scars Burn Heal.* 2021 Dec 21;7:20595131211056542.
7. Ding Y, Huang X, Wang Y, Jin R, Sun D, Yang J, Lu L, Luo X. Reconstruction of Facial Multi-unit Defects Using Expanded Scalp Flap with Laser Depilation in a Group of Predominantly Pediatric Patients. *Facial Plast Surg Aesthet Med.* 2022 Sep-Oct;24(5):352-356.
8. Maus JC, Hemal K, Khan M, Calder BW, Marks MW, Defranzo AJ, Pestana IA. Dermal Regeneration Template and Staged Skin Grafting for Extirpative Scalp Wound Reconstruction: A 14-Year Experience. *Otolaryngol Head Neck Surg.* 2021 Aug;165(2):275-281.
9. Del Castillo Pardo de Vera JL, Navarro Cuéllar C, Navarro Cuéllar I, Cebrián Carretero JL, Bacián Martínez S, García-Hidalgo Alonso MI, Sánchez-Pérez A, Zamorano-León JJ, López-Farré AJ, Navarro Vila C. Clinical and Surgical Outcomes in Extensive Scalp Reconstruction after Oncologic Resection: A Comparison of Anterolateral Thigh, Latissimus Dorsi and Omental Free Flaps. *J Clin Med.* 2021 Aug 27;10(17):3863.
10. Lembo F, Cecchino LR, Parisi D, Portincasa A. Utility of a New Artificial Dermis as a Successful Tool in Face and Scalp Reconstruction for Skin Cancer: Analysis of the Efficacy, Safety, and Aesthetic Outcomes. *Dermatol Res Pract.* 2020 Jul 20; 2020:4874035.