



Original Article

Management of Postburn Scalp Alopecia Using Tissue Expanders: A Clinical Evaluation

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ABSTRACT

Background: Post-burn alopecia is a challenging reconstructive problem that often involves the restoration of extensive hair-bearing scalp areas. Tissue expansion has emerged as an effective technique for scalp reconstruction due to its ability to provide hair-bearing tissue with similar color, texture, and thickness.

Objective: To evaluate the efficacy and safety of tissue expansion as a primary modality for the reconstruction of post-burn scalp alopecia.

Methods: This prospective study was conducted over a one-year period and included 25 patients with post-burn alopecia. Scalp reconstruction was performed using rectangular tissue expanders. Patients were assessed for surgical outcomes, hair-bearing scalp restoration, and procedure-related complications.

Results: Tissue expansion proved to be a highly reliable method for scalp reconstruction, providing expanded skin with matching hair follicles, color, and texture. Minor complications, including port exposure and mild infection, were observed in a small number of cases and were managed successfully. The majority of patients achieved satisfactory aesthetic and functional outcomes.

Conclusion: Tissue expansion is a safe and effective technique for the reconstruction of extensive post-burn scalp alopecia. Despite requiring multiple surgical stages, it remains a cornerstone of treatment because of its high success rate and ability to restore natural hair-bearing scalp tissue.

Keywords: Post-burn alopecia; Scalp reconstruction; Tissue expansion; Burn scar; Hair-bearing scalp; Reconstructive surgery.

INTRODUCTION

Post-burn alopecia is a distressing condition that often necessitates the reconstruction of extensive defects involving both skin and soft tissue and presents a significant challenge for reconstructive surgeons. The psychological impact of such extensive scalp defects can be profound, adversely affecting patients' self-esteem and quality of life. Tissue expansion has emerged as an effective reconstructive option for post-burn scalp alopecia, enabling the restoration of hair-bearing scalp with satisfactory cosmetic outcomes.¹⁻³

Since its description by Neumann in 1957, tissue expansion has become a cornerstone of reconstructive surgery.^{2,4,5} Conventional reconstructive methods such as rotational scalp flaps, serial excision, and microvascular free flap transfer have several limitations, including prolonged hospital stay, risk of flap necrosis, donor-site morbidity, and inadequate coverage of large scalp defects.¹⁻³ The use of skin grafts or non-hair-bearing flaps from distant body sites may also result in cosmetically unacceptable outcomes due to color mismatch, texture differences, and persistent bald areas.^{1,3}

The principal advantage of tissue expansion lies in its ability to generate "like-with-like" tissue. The expanded skin retains its native hair follicles, pigmentation, texture, and vascularity, making it particularly suitable for aesthetic scalp reconstruction.^{2,5} Owing to these advantages, tissue expansion is now widely accepted as a routine reconstructive procedure in plastic surgery for managing defects resulting from burns, trauma, tumor resection, congenital anomalies, and infections.^{4,5}

The present study aims to evaluate the success rates and complication profiles associated with the use of tissue expanders in the reconstruction of post-burn scalp alopecia.

MATERIAL AND METHODS

A prospective study was conducted at the Department of Plastic Surgery, SMS Medical College, Jaipur between January and December 2021. THE study cohort consisted of 25 patients, aged between 13 and 45 years. The demographic distribution included 16 males and 9 females, with mean age of 24 years. The primary aetiology of alopecia in majority of cases was flame burns, with parietal temporal region being the frequently affected site.

The patient evaluation included personal and demographic data, mode of scalp burn, any medical or surgical treatment received. The surgical procedures were explained to patients with the possible outcomes and complications in detail. Preoperative photographs were captured.

Rectangular tissue expanders with remote valves system and ports were surgically placed distal to the alopecic area in the subgaleal plane, under general anaesthesia. Adequate space was made for the expander so that there were no bends, haemostasis achieved. Another space for the port was made over a bony prominence in the scalp distant to expander. Following a 14-day healing period, expansion commenced and was continued over 3 to 4 months through weekly saline injection. Prophylactic and post-operative antibiotics were administered to minimize the risk of infection. Upon reaching the desired expansion volume i.e. around 2.5 times the area of alopecia area to be reconstructed.



Figure 1. Partial coverage of the scar alopecia by one-time tissue expansion.

A second stage procedure was performed to remove the expanders and advance the expanded hair bearing flaps over the defect in a rotation or rotational advancement manner to maintain the direction of hair growth. Linear incisions over the capsule around the expander were made to further increase the surface area. Closed suction drains were placed to prevent seroma formation. The study comprises of 25 patients. In 20 patients single expanders were used whereas in 5 patients, two expanders were used. Hence, total of 30 expanders were used. We used one 100cc expander, twenty-six 150cc expanders and three 250cc.

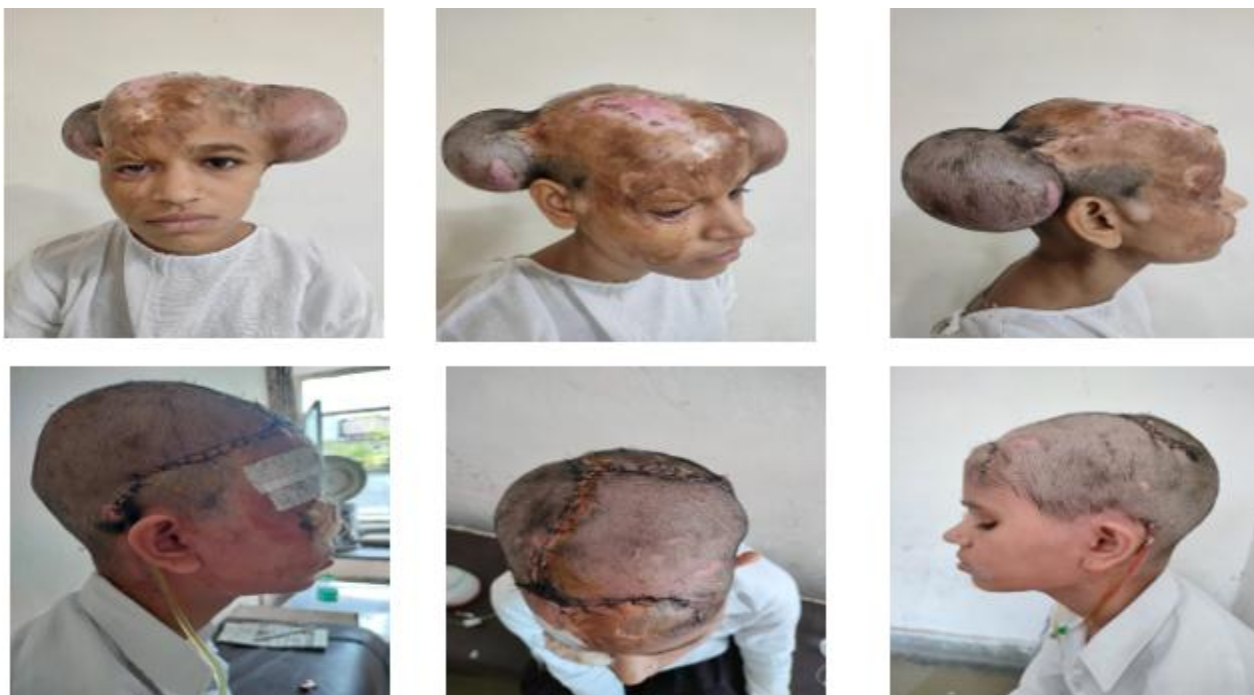


Figure 2. Tissue expansion in a patient with post burn scar alopecia involving temporo-parietal region.

RESULTS

The reconstruction of scalp defects was tailored according to the size of the alopecia defect. One hand where small defects could be resurfaced with a local flap the larger defects on the hand needed tissue expansion for similar hair bearing skin resurfacing and a natural appearance.

The study recorded high success rates in flap survival and hair bearing capacity. Major complication like expander extrusion was not noticed in our cohort.

Although minor complications are like post site exposure, mild localized infection and wound dehiscence were noticed

Table 1: Sites Of Scalp Reconstructed

SITE	NUMBER	PERCENTAGE
PARIETO TEMPORAL	12	48
FRONTAL	5	20
FRONTO-PARIETAL	2	8
OCCIPITO-TEMPORAL	2	8
TEMPORAL	2	8
OCCIPITAL	2	8
TOTAL	25	100

Table 2: Frequency Of Complications During Reconstruction Of Scalp Burn Alopecia

COMPLICATIONS	Number of cases
No Complications	17
Port site exposure	2
Mild localized infection	3
Wound dehiscence	2
Seroma	1



Figure 3: port site infection and extrusion



Figure 4. Tissue expansion in a patient with post burn scar alopecia of the parietal region.

DISCUSSION

Tissue expansion serves a vital tool in the plastic surgeon's armamentarium for post burn reconstructions. On one hand where smaller defects could be managed with serial excisions or by local rotational flaps, the larger defects around 3-5cm width were best managed by tissue expansion. By utilizing adjacent healthy scalp, surgeons can cover large area of baldness with skin that is functionally and aesthetically identical to the surrounding area.^{6,7}

Several studies have confirmed the effectiveness of tissue expansion in scalp reconstruction. Manders et al. reported that the scalp is one of the most favorable sites for expansion because of its rich vascularity and the ability to achieve substantial tissue gain with a low incidence of ischemic complications.⁸ Similarly, Argenta et al. demonstrated high success rates in the treatment of post-traumatic and post-burn scalp defects using expanded scalp flaps, emphasizing the superior cosmetic outcomes compared with skin grafting or distant flaps.⁹

Hair grafting can be an option in treating patients with large scalp defects but it is usually difficult to achieve aesthetically natural looking hair. Tissue expansion has revolutionised the method of aesthetic reconstruction by providing a natural hair bearing skin for scalp reconstruction with near normal hair bearing skin for reconstruction. Scalp, having a rich blood circulation, thick overlying tissue and unmoulding base becomes an ideal site for tissue expansion.

However, to fully harness these advantages and achieve success, the expansion process must also aim to minimize complications. This starts with careful planning preoperatively. Many of the more recent articles on tissue expansion have focused on identifying risk factors for complications and the technical aspects of tissue expansion have received less attention.

The major complication in this procedure is expander extrusion which was fortunately not seen in our patients. Complication rates associated with tissue expansion vary considerably in the literature. Neumann first described the principle of tissue expansion in auricular reconstruction and noted the importance of gradual expansion to maintain tissue viability.¹⁰ Subsequent studies by Hudson and Grob highlighted that complications are most commonly related to infection, hematoma formation, expander exposure, and extrusion, with reported rates ranging from 13% to 25%.¹¹ Careful patient selection, meticulous surgical technique, appropriate pocket dissection, and adherence to aseptic protocols have been shown to significantly reduce these complications.^{11,12}

Usually the reason for extrusion is believed to be inadequate space creation. Another reason being the incision placed too near to the area to be expanded was also avoided to prevent extrusion. To prevent infection, the expanders pockets were irrigated with gentamicin solution. All expansions were done under proper aseptic conditions every week to further prevent infection of port site too.

Overall, our findings are consistent with those reported in previous studies and reinforce the role of tissue expansion as the gold-standard technique for the reconstruction of extensive post-burn scalp alopecia.

CONCLUSION

Tissue expansion is a remarkably reliable and effective technique for the management of post burn scalp alopecia. Although it is time consuming, two staged procedures and associated with cosmetic embarrassment when the patient undergoes expansion, the superior aesthetic outcome –characterised by natural hair growth and matched skin – outweighs all these disadvantages. With a low incidence of manageable complications, it remains the gold standard for large areas of scalp alopecia reconstruction.

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