World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

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Cutaneous expansion of the scalp in the treatment of burns: Techniques and result (Experience of the plastic and reconstructive surgery department of the mohamed VI University Hospital in Tangiers)

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World Journal of Advanced Research and Reviews, 2025, 25(02), 798-804

Publication history: Received on 28 December 2024; revised on 02 February 2025; accepted on 05 February 2025

Article DOI: https://doi.org/10.30574/wjarr.2025.25.2.0414

Abstract

The after-effects of scalp burns are sometimes difficult to treat, and call for a variety of plastic surgery techniques, including scalp expansion.

Scalp expansion enables us to restore optimal skin quality and surface area to the patient in cases where there is a loss of substance to be covered. It represents a major advance in the treatment of burns of the scalp.

This work is a retrospective study of three cases who underwent skin expansion following sequelae of scalp burns in the Department of Plastic and Burn Surgery at CHU Mohamed VI in Tangier from November 2023 to November 2024.

The aim of our work is to report on our department's experience with this reconstruction method, specifying the surgical procedure, and to study the results of this technique in the management of scalp burns.

Keywords: Skin expansion; Sequelae; Burns; Scalp

1. Introduction

Scars on the scalp are often an obstacle to the patient's social and professional reintegration. Cutaneous expansion is an essential method for the plastic surgeon which allows the scalp's available hair surface to be increased. It consists of fitting empty expansion prostheses which are gradually filled with physiological saline using a valve, thus enabling the skin to be gained and the loss of substance to be treated, with the ultimate aim of rehabilitating the burn victim and reintegrating him or her physically and psychologically into his or her environment.

The scalp is an ideal expansion zone because it is a thick, resistant tissue. The underlying area is a hard surface allowing very gradual convex expansion, the shape of which is often adapted to the convexity of the skull [1]. This is the most widely used technique for treating the after-effects of scalp burns and the only solution for treating the after-effects of burns larger than 50 cm2.

The aim of this work is to study the results of this technique in the treatment of burns of the scalp in the plastic surgery department of the CHU Mohamed VI in Tangier.

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2. Material and methods

Our retrospective study was conducted from November 2023 to November 2024. It included 3 patients with scarring alopecia following scalp burns treated with skin expansion prostheses. Their ages ranged from 10 to 15 years, with an average of 12 years.

We excluded from this study patients who had undergone skin expansion for other causes of scalp loss. A pre-established form was completed containing the following data (Table 1):

- Age and sex of patients
- Site of sequelae
- Number, shape and volume of expanders;
- Modalities, techniques and type of reconstruction performed
- Complications and final results.

Table 1 Summary of the cases

Clinical case	**Patient 1**	**Patient 2**	**Patient 3**
Age	12	15	10
Sex	M	M	M
Location	Temporo-parietal	Temporo-parietal	Temporo-parietal
Number of prostheses	1	1	1
Volume	240 cc	350 cc	100 cc
Form	Rectangular	Rectangular	Rectangular
Fill time (days)	68	56	68
Rate of filling	1/week	2 /week	1/week
Flap types	Advancement	Advancement	Advancement

The clinical examination carried out accurately assessed the situation, shape, size and topography of the scalp scar, in order to choose the right prosthesis and future flaps.

In all our patients, the hair was cut very short. The implantation site of the prostheses, their valves and the extent of the detachment were drawn.

The operation was performed under general anaesthetic and the approach was extensively infiltrated with adrenaline serum after washing with an antiseptic shampoo. The prostheses were siliconised (rectangular) prostheses of different sizes, with remote internal valves.

The technique was performed in two stages: first, the expansion prostheses were inserted and then the prostheses were removed and the alopecic area was covered with the expanded flaps.

The approach was radial and short (depending on the size of the valve), usually at the border between healthy and scarred skin. It respected the course of the future flap and the direction of the hair to avoid residual alopecic scarring.

The dimensions of the prosthetic pocket exceed the surface of the base of the expander by 2 cm. Careful rinsing with physiological serum and good haemostasis of the space created. The expander is sealed before being placed in the pocket. A second incision is made to place the internal valve, which should preferably rest on a hard surface. The incision is closed with simple sutures in two planes and a suction drain is inserted.

The drains were removed around day 4. The sutures were removed on day 15.

Filling was started intraoperatively, and 15 days later, filling was started once or twice a week and continued for two to three months.

The quantity injected each time varies (from 10 to 15% of the volume of the expander), depending on the appearance of tension under the examiner's hand and the tolerance of each individual. The second stage of the operation consisted of removing the balloons and covering the affected area, with suction drainage and antibiotic therapy as a matter of course

3. Results

In our study three cases were managed in our department during this year 2023-2024, all male,

- Their average age was 12 years, ranging from 10 to 15 years. The 3 patients presented with cutaneous sequelae secondary to thermal burns caused by a flame.
- All patients received a single scalp prosthesis.
- The inflatable prostheses used were rectangular silicone-framed prostheses, all with remote internal valves.
- The average duration of expansion was 60 days (8 weeks).
- The flaps used were all advancement flaps.
- No complications were observed in our patients.
- It is difficult to evaluate the aesthetic result because it always depends on the patient.

The result was considered as:

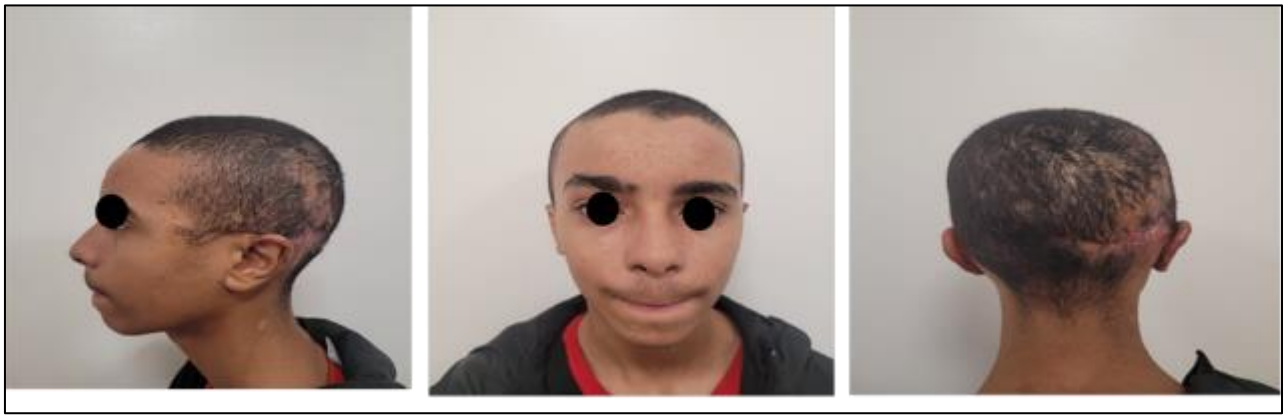
- Excellent: when the objectives defined during the preoperative consultation were met: removal of the lesion was complete and scarring was deemed acceptable;
- Good: when the repair and replacement are greater than 2/3 of the scar tissue;
- Fair: When the repair is less than 50%.

The overall results were excellent for 2 patients and good for the last, who required a second expansion of the scalp.

A: Preoperatively; Alopecic lesion in the left temporo parietal region

B: After 8 weeks of the 1st surgical procedure (insertion of the expansion prosthesis)

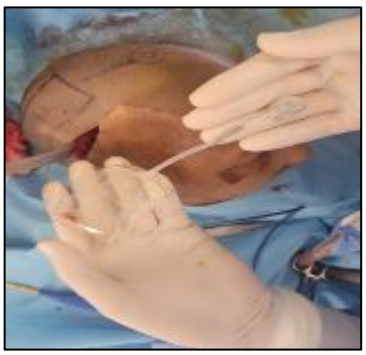
C: Intraoperatively (2nd surgical procedure : removal of the prosthesis)



D: One month after removal of silicone prosthesis

Figure 1 15-year-old patient with an alopecic burn sequel.

A: Preoperatively alopecia of the right temporo-parietal region



B: Intraoperatively: insertion of the silicone expansion prosthesis

C : After 6 weeks of the 1st opération (insertion of the expansion prosthesis)

D: 20 days after removal of the prosthesis

Figure 2 A 10-year-old patient with an alopecic burn sequel

4. Discussion

Skin expansion is inspired by various methods of tissue elongation observed in nature and in humans. Examples include the stretching of abdominal skin during pregnancy [2], Ethiopian and Chadian women who use labrets to increase the volume of their lips, and Burmese women who superimpose several necklaces to lengthen their necks and achieve a 'royal head' appearance [3]-[4].

In 1957, in the journal Plastic and Reconstructive Surgery, Neumann described the reconstruction of a traumatic ear by tissue expansion using an air-filled balloon. In 1976, Radowan reported the use of silicone prostheses for skin expansion. This technique was perfected by researchers such as Austrad Rose (1982), Argenta (1984) and Manders (1984). Finally, skin expansion has been the subject of several international congresses, including the first in San Francisco, the second in Marseille, and the third in Japan [5]-[6].

The patient profiles in terms of sex and age are broadly similar to those of the study by D.A. Hudson and Martha FI De La Cruz, the majority of whom were young boys with an average age of 11-12 years. Domestic accidents involving flames were also a common factor in both studies, reflecting the clinical reality of thermal injuries in this age group. [6]-[7].

The most frequent reason for consultation in our series was aesthetic, with or without functional discomfort. In the study by Adouani et al, the reason for consultation was functional and aesthetic in 4% of cases, whereas in 52% of cases it was purely aesthetic. [8]

There are two types of scalp expander valves:

- Internal valves: these are valves tunneled under the scalp at a distance from the expander. This is the most commonly used and safest type.
- External valves: placed outside the scalp. It avoids the pain of the puncture during filling, which is dreaded in children. The risk is essentially infectious.

The choice of silicone prosthesis in our study was all prostheses with internal valves such as duclert bompaire and Ezzoubi M. [9] [10]. Internal valves offer the advantage of being more discreet.

The duration of expansion reported in the literature varied between 3-6 weeks and up to 8 weeks, identical to our study where the average duration was 8 weeks, however the exact duration always depends on the individual response of the patient and the extent of skin loss and the protocols used [11].

Prolonged filling not only increases the risk of infection, but also compromises social activity and quality of life. Short-term filling, on the other hand, can lead to insufficient expanded tissue or can cause severe flap retraction after the expander has been removed.

We performed advancement flaps in all our patients, a similar approach to the duclert bompaire study, but unlike the Ran hiet on study where most flaps were rotation flaps (50%) [12].

As with all surgical procedures, tissue expansion is not without risks and complications, such as :

- Skin necrosis, Infection, Exposure of the prosthesis, implying removal of the prosthesis.
- Finally, the occurrence of hematoma, which remains frequent in the highly vascularised scalp, occurs in 8.7% of series [13].

In our retrospective study of 3 cases, we noted a total absence of complications, which is rare in the literature. In reality, it is difficult to compare the population of this sample with other series in a statistically acceptable way because the number of patients is small.

The aesthetic results of our study are similar to those of N Tzolova . It should be noted that the aesthetic evaluation remains subjective and may vary from one patient to another, but overall, the two studies report favorable aesthetic results, with a better restoration of the scalp's appearance. [14].

Skin expansion is therefore the only plastic surgery technique capable of providing scalp skin of normal quality and sensitivity [15]. In general, skin expansion prostheses are considered to be a major advance in reconstructive surgery. This technique gives good results, particularly in the treatment of burns with extensive scarring. Despite the disadvantage of being a two-stage procedure, the expansion technique provides tissue of the same texture and color with minimal donor site morbidity. Taking into account the complications that may arise.

5. Conclusion

Skin expansion remains the reference method for covering extensive loss of substance and correcting the after-effects of burns, as it provides tissue identical to that in the original area, thus guaranteeing optimal aesthetic results. However, it requires particular care and rigour to prevent complications, which are often serious. Thanks to its many advantages, this technique offers patients lasting satisfaction.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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