International Surgery Journal
Goil P et al. Int Surg J. 2018 Jul;5(7):2461-2464
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20182747

Original Research Article

Tissue expansion in operated cases of transposition flap of scalp for correction of donor site alopecia and patient's satisfaction

Pradeep Goil, Abhimanyu Singh*, Hiranmayi Kumari, Ayush Jain

Department of Plastic and Reconstructive Surgery, Sawai Man Singh Medical College and Hospital, Jaipur, Rajasthan, India

Received: 29 May 2018
Accepted: 16 June 2018

***Correspondence:**
Dr. Abhimanyu Singh,
E-mail: dr_abhi03@yahoo.in

ABSTRACT

Background: Scalp defects managed by local transposition flaps with donor site alopecia are aesthetically not acceptable to patients. Scalp expansion with tissue expanders is needed for proper correction of this deformity.
Methods: Authors retrospectively reviewed all cases of post traumatic and post burn scalp defects that were managed initially by local transposition flap and later by scalp expansion by tissue expanders at our institute over a period of 5 years and conducted an outcome survey. Authors' institutional protocol in such patients and results of the review are presented.
Results: Twenty-eight patients were included in the study. Eight patients had post traumatic and 20 cases had post electric burn scalp defect. The mean age of patients was 28.92±8.26 years. Thirty-eight tissue expanders of various sizes (200-600 ml) were used in 28 patients. The mean follow-up time was 9.07±1.92 months. Major complication rate in present study was 2.63%. Results of outcome survey revealed more than 90% patients were satisfied after third surgery.
Conclusions: Scalp transposition flap donor site alopecia can be easily corrected by tissue expansion. The complications are not severe and can be managed easily. It should be offered to all such types of patients, as it leads to proper social rehabilitation and satisfaction among these groups of patients.

Keywords: Level of evidence, Level IV, Therapeutic study

INTRODUCTION

Scalp is an important part of one's personality. Such scalp defects that require a reconstructive surgery needs a proper planning to regain the cosmesis as well as coverage of that defect. The techniques of scalp reconstruction evolve over a period of time. Initially for scalp defects, perforations of bare cranium were done to allow growth of granulation and subsequent epithelialization.[1] Later Netolitzky, in 1871, used skin grafting of the calvaria over granulation tissue.[2] In 1908, Robinson demonstrated the success of skin grafting on intact periosteum before the presence of granulation tissue, this technique is still used in many current scalp surgeries in all parts of world for coverage of scalp defects with intact periosteum.[3] Following this many authors published their studies of scalp reconstruction with local flaps.[4-6] In 1967 frand 1971 Orticochea published his 4 flaps and 3 flaps technique for coverage of large scalp defects.[7,8] The disadvantage associated with use of local transposition flap is donor site alopecia. This patch of alopecia can lead to loss of self-esteem in many patients and is a cause of inadequate social rehabilitation. This problem can be treated with scalp expansion by use of tissue expander. Neuman was the first person to introduce tissues expansion.[9] This tissue expansion

technique which was popularized by Radovan has become one of the major armamentarium of plastic surgeons for coverage of hair bearing scalp defect.[10] Expansion of scalp shows typical biphasic progress:

An initial period of resistance is followed after a few weeks by destruction of the galeal barrier, with a continuous and rapid increase in skin compliance.[11]

This technique of tissue expansion requires proper and careful preoperative planning to achieve desirable results. The current study is a retrospective analysis of present clinical experience with the aesthetic treatment of post traumatic scalp defects that are managed initially by local transposition flap coverage. The brief description of present management protocol and results of the review are described. Outcome and patient satisfaction following the procedure are also assessed.

METHODS

A retrospective study was conducted at the Department of Plastic and Reconstructive Surgery, Sawai Man Singh Medical College and Hospital, Jaipur, which is a tertiary care trauma and referral centre. Records of all patients who underwent reconstruction of scalp by local flaps and later treated by tissue expansion of scalp and flap advancement as a full course of management of post traumatic or post burn scalp defect from July 2012 to June 2017 (duration, 5 years) were reviewed. The study was approved by the institutional Ethics Committee and was performed in accordance with the ethical standards as laid down in the 1975 Declaration of Helsinki and all its later amendments. Demographic data, indications, details of surgical treatment and postoperative outcome were recorded and assessed.

Exclusion criteria

- Patients with diabetes
- Hypertension
- coagulation abnormality
- other concomitant medical illnesses
- smokers

Details of patients, investigations and operative procedures were collected. The patients were contacted by phone and interviewed either in person or telephonically for an outcome survey. The questionnaire included following subjective parameters- satisfaction status with hair pattern over scalp, dog ear correction, scar over scalp and improvement in social activity after third surgery. These parameters were graded by the patient as very satisfied, satisfied or not satisfied.

Institutional management protocol

Tissue expansion was used for patients with scalp defect who underwent staged reconstruction. At first surgery post debridement, scalp defect was covered with local transposition flap and donor site was covered by split skin graft. Patients underwent another surgery 3 months later for tissue expander placement.

For all the patients, rectangular-shaped tissue expanders were used. Preoperative preparation for insertion of tissue expanders included bathing with antibacterial soap immediately before surgery. All patients received a preoperative antibiotic prophylaxis 1/2 h before the procedure, preferably first-generation cephalosporin. With the patient under general anesthesia, the following intra operative protocol was followed. An incision was made, whenever possible, within the borders of the lesion, perpendicular to the expander's major axis, preventing suture from exposure resulting from diastatic action of the expansion.

A generous pocket for the expander was created between the galea aponeurotica and pericranium adjacent to the defect to be repaired. To obtain a more homogeneous distribution of the hair follicles, tissue expanders as large as possible were preferred.[12] The filling reservoir was located away in a separate pocket at surgeon preference. Two separate pockets were prepared through the same single incision. Attention was paid to ensuring that the pockets were large enough to accommodate the expander. After careful hemostasis, the expander was inserted under the galea. During insertion of the expanders, attempts were made to avoid any knuckling or bending of the prosthesis. The incision then was closed in two layers. First, the galea on both sides were sutured together along with the subgaleal fascia and pericranium with 3/0 vicryl sutures to stabilize the suture line against tension. Later, the skin was closed with 3/0 monoflament polyamide. Expanders were filled to about 10% to 20% of their volume to allow better hemostasis through pressure. A suction drain was kept in the pocket until output was minimal (<5 ml) and serous in nature. Postoperatively, authors routinely used antibiotics for a period of 5 to 7 days during the initial placement of the expanders. The wounds were dressed with a light gauze wrap.

The dressing was removed within 48 hours and then left open to air. Scalp expansion was stared after 2nd post-operative week. Patient was called for saline inflation on weekly opd visits, till desirable scalp expansion was achieved. To prevent infection, the inflation site was prepared carefully with 5% povidine iodine solution immediately before inflation. Expansion was carried out to the point of tightness, blanching, and mild patient discomfort. This process was repeated 8-10 times till desirable expansion was achieved. Patient was readmitted after 2 weeks of last saline inflation for 3rd surgery. The preoperative preparations were similar as patient was operated once again under general anesthesia. The incision was given over previous incision scar, and expander along with its port was removed. Skin graft was removed, and previous local scalp flap was repositioned back to its original place. Now expanded scalp flap advancement/rotation done as per need to close the

original defect. At removal of the expander, the capsule surrounding the tissue expander was not removed. The capsule and sometimes the galea were incised with multiple crossing incisions to increase stretching of expanded flap without comprising its blood supply. All sites were sutured in 2 layers, the subgaleal fascia and pericranium with 3/0 vicryl sutures and skin was sutured with 3/0 monoflament polyamide. A negative suction drain was kept in all cases and removed after 48 hrs when output was serous and minimal (<5ml). Skin sutures were removed after 2 weeks.

Statistical analysis

Measures of central tendency and dispersion were calculated for the continuous variables. In the case of categorical variables, frequencies and percentages for each category were used. The results were tabulated and analyzed using SPSS software for Windows Version 23.0 (Armonk, NY).

RESULTS

The ages of these patients ranged from 14 to 45 years. The mean age (±SD) of the patients was 28.92±8.26 years (Table 1).

Table 1: Patients preoperative characteristics.

Variables	Value
Mean age, years (range)	28.92 (14-45)
Sex	**N (%)**
Male	18 (64.28)
Female	10 (35.71)
Causative factor for scalp defect	**N (%)**
Trauma	8 (28.57)
Electric burn	20 (71.43)

Table 2: Complications summary in patients.

Complication	N (%)
Infection	1(2.63)
Flap necrosis	0
Implant exposure	0
Implant failure	0
Seroma	0
Hematoma	0
Pain	3 (7.89)
Scar widening	2 (5.26)
Total complication	6 (15.79)
Total expansions	38

Altogether, 38 tissue expanders of various sizes (200–600 ml) were used in 28 patients. In 8 patients more than one expander was placed for scalp expansion. The follow-up period ranged from 6 months to 12 months. The mean follow-up (±SD) of the patients was 9.07±1.92 months. Most of them were males (18 patients, 64.28%). Authors have encountered surgical site infection in one patient (Table 2). However, authors treated this infection using antibiotics as per wound swab culture sensitivity without the need for prosthesis removal.

Minor complications that occurred, included pain in three patients were controlled by analgesics and widening of the scar (up to 0.5 cm) in two patients, were treated later by scar revision surgery under local anesthesia.

Analysis of outcome survey revealed that all patients were very satisfied with correction of dog ear after final surgery. More than 90% of present patients were very satisfied with social rehabilitation they achieved after 3rd surgery (Table 3).

Table 3: Result of outcome survey.

Parameters	Very satisfied N (%)	Satisfied N (%)	Not satisfied N (%)
Hair pattern over scalp	25 (89.29)	3 (10.71)	0
Scar over scalp	20 (71.43)	6 (21.43)	2(7.14)
Social rehabilitation	26 (92.86)	2 (7.14)	0
Correction of dog ear	28 (100)	0	0
Overall satisfaction after 3rd surgery	22 (78.57)	6 (21.43)	0

DISCUSSION

As the number and speed of vehicles are increasing on roads, frequency and severity of road traffic accidents are increasing. Although in majority of cases extremities and face suffer injuries, but incidences of scalp lacerations with tissue loss are also increasing. Traumatic lacerations to scalp can lead to distortion of hair line with primary closure or loss of portion of hair bearing scalp which might not be able to close primarily. These cases generally are of poly trauma and require multispecialty involvement. Debridement of scalp following burns can also lead to scalp defects. In such cases scalp defects are mostly managed by local transposition flaps, but these patients are never satisfied with their scalp surgery due to patch of alopecia over flap donor site.

A large amount of scalp tissue is needed to fill the alopecia site. Tissue expansion is the ideal procedure for reconstruction of scalp defects and is the only procedure that allows development of normal hair-bearing tissue to cover alopecia area or to restore the normal pattern of hair line. In 1984, Manders et al. reported reconstruction of nearly half the scalp with hair-bearing tissue using tissue expansion.[13] The current time tissue expanders are silicone envelopes that have self-sealing injection ports. As the volume of expander increase by saline inflation,

tension placed on the overlying tissue increases. This new expanded tissue arises from two sources: first is recruitment from adjacent tissue and second are two main biological changes in the skin:

a) Tissue creep: is the time dependent plastic deformation of any material in response to constant stress, it gradually stretches the skin.
b) Stress relaxation: as tissue stretches it relaxes and less force is required to maintain it stretched.

The result will be increase in tissue volume through proliferation of epithelial cells, increased epidermal mitotic activity, expansion of the sub dermal vascular network, and increased synthesis of collagen by fibroblasts.[14] The advantage of this expanded skin is that it matches to original skin which was lost after the incident in almost all aspects except the decrease density of skin appendages. But in scalp this decrease hair density in expanded scalp skin remains unnoticeable by patient and his or her relatives. This plays an important role in social rehabilitation of these patients in terms of attending family/community programs and going to public places without covering their scalp to conceal scalp deformity.

In this retrospective study authors studied the change in social behavior and satisfaction of patients after scalp expansion surgery to replace skin grafted site with normal appearing scalp tissue. All of studied patients become socially interactive after 3rd surgery, with a low complication rate (2.63%) that is comparable to other studies.[12,15] The survey revealed that outcome in all domains was satisfactory for more than 90% patients except wide scar after third surgery, which was managed by scar revision surgery. Although not included in this study, studied patients were little uncomfortable with weekly OPD visits and in situ expander in scalp due to center of attraction, which were unavoidable.

CONCLUSION

Scalp transposition flap donor site alopecia can be easily corrected by tissue expansion. As patients have nearly normal hair bearing scalp and hair line that is not easily noticeable by other people, they become more socially interactive and happy as compared to their lifestyle after scalp trauma. The complications develop due to stage surgical processes are not severe and can be managed easily. Hence should be offered to all such types of patients.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Strayer LM. Augustin Belloste and the Treatment for Avulsion of the Scalp: The Odd History of an Operation in Head Surgery. N Eng J Med. 1939;220(22):901-5.
2. Netolitzky J. On the case of skin transplantation. Vienna Med Weekday. 1871;21:820-2.
3. Robinson EF. Total avulsion of the scalp. Surg Gynecol Obstet. 1908;7:663.
4. Marcks KM, Trevaskis AE, Nauss TJ. Scalp defects and their repair. Plastic Reconstruct Surg. 1951;7(3):237-43.
5. Gaisford JC, Hanna DC, Susen AF. Major resection of scalp and skull for cancer with immediate complete reconstruction-fourteen cases. Plastic Reconstruct Surg. 1958;21(5):335-44.
6. Coleman Jr CC. Scalp flap reconstruction in head and neck cancer patients. Plastic Reconstruct Surg. 1959;24(1):45-52.
7. Orticochea M. Four flap scalp reconstruction technique. Br J Plastic Surg. 1967;20:159-71.
8. Orticochea M. New three-flap scalp reconstruction technique. Br J Plastic Surg. 1971;24:184-8.
9. Neumann CG. The expansion of an area of skin by progressive distention of a subcutaneous balloon: Use of the method for securing skin for subtotal reconstruction of the ear. Plastic Reconstruct Surg. 1957;19(2):124-30.
10. Radovan C. Tissue expansion in soft-tissue reconstruction. Plastic Reconstruct Surg. 1984;74(4):482-92.
11. Azzolini A, Riberti C, Cavalca D. Skin expansion in head and neck reconstructive surgery. Plastic Reconstruct Surg. 1992;90(5):799-807.
12. 1Guzel MZ, Aydin Y, Yucel A, Hariri S, Altintas M. Aesthetic results of treatment of large alopecia with total scalp expansion. Aesthetic Plastic Surg. 2000;24(2):130-6.
13. Manders EK, Graham WP, Schenden MJ, Davis TS. Skin expansion to eliminate large scalp defects. Ann Plastic Surg. 1984;12(4):305-12.
14. Bauer B. Tissue expansion.In: Beasley RW, Aston S, Bartlatt S, Gurtner G, Spear S. Grabb and Smith`s plastic surgery. 6th edition. Philadelphia: Wolters Kluwer/Lippincott Williams and Wilkins; 2007.
15. Gürlek A, Alaybeyoğlu N, Demir CY, Aydoğan H, Bilen BT, Æztürk A. Aesthetic reconstruction of large scalp defects by sequential tissue expansion without interval. Aesthetic Plastic Surg. 2004;28(4):245-50.

Cite this article as: Goil P, Singh A, Kumari H, Jain A. Tissue expansion in operated cases of transposition flap of scalp for correction of donor site alopecia and patient's satisfaction. Int Surg J 2018;5:2461-64.