

## Follicular Unit Transplantation Versus Scalp Expansion in Management of Secondary Cicatricial Alopecia

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### ABSTRACT

**Background:** The bad impact of cicatricial alopecia among population leads to increase the desire of correcting that type of hair loss. There are many methods of hair restoration, but the efficacy of each, its indications and the possible hazards hasn't yet been clearly identified.

**Objective:** To evaluate the use of two different techniques for hair restoration in patients with secondary cicatricial alopecia. Either using follicular unit extraction (FUE) or scalp expanders (SE) to correct the deformity depending upon many factors (Inclusion & Exclusion criteria). Indications, operative time, Aesthetic outcome and complications are to be discussed.

**Patients and Methods:** This study included 30 patients who were grouped into two populations. The first one (Group A) those who underwent FUE included 13 cases while the second group was SE (Group B) included 17. All of them were suffering from secondary cicatricial alopecia and they were grouped according to the surface area of the alopecia.

**Results:** The mean value of the surface area of alopecia was significantly larger in the SE group than FUE group with a  $p$ -value  $<0.001$ . Post-operative recovery was nearly similar apart from being faster gain in group B and better hair density.

**Conclusion:** In management of secondary cicatricial alopecia, many factors affect surgical planning. Both FUE and SE are very useful tools in managing those patients when properly selected and tailored to the patient.

**Key Words:** Follicular unit – Transplantation – Scalp expansion.

### INTRODUCTION

Cicatricial alopecia (CA) refers to scarring that ends up with loss of hair due to a set of various diseases which devastate the hair follicle. They turn the hair follicle into a scar tissue with permanent hair loss [1].

CA is further subdivided into primary and secondary. In primary CA the stable portion of the hair follicle (stem cells of the bulge area and the infundibulum) is the target of the destructive in-

flammatory process. This may occur in the course of an auto-immune process (e.g. Lichen planopilaris and Discoid lupus erythematosus) or infectious process (e.g. Folliculitis decalvans) [2].

Secondary CA result from damage of the hair follicle as a part of non-follicle directed process or injury. This may occur with burns, trauma, radiation or skin infections like tinea capitis [3].

Surgical correction of CA is highly valuable. Many surgical approaches are used. Hair transplantation, surgical excision of hairless areas and/or flap procedures with the preliminary use of skin expansion techniques are all used for this purpose [1].

Surgical excision of scarred areas over the scalp is used to treat small areas of secondary CA. To treat larger areas (scars wider than 5cm), tissue expander may be inserted under the normal scalp adjacent to the area of alopecia (Scalp Expansion, SE). It is then progressively filled with normal saline over a period of 8-12 weeks. The expanded hair-bearing scalp is then advanced or rotated to fill the surgical defects created after excision of the scarred alopecic area [4].

Hair transplantation is the harvesting hair follicles from a suitable hairy area (donor site-usually occipital or occipito-parietal). This harvesting may be done by either strip excision or follicular unit extraction (FUE). After that the prepared follicular units are grafted and implanted into the area of alopecia (recipient site) [5].

In this work we present our experience and results of managing patients with secondary CA using either FUE technique for hair transplantation or SE for correcting such a deformity.

## PATIENTS AND METHODS

This work was done in Department of Plastic and Reconstructive Surgery, Faculty of Medicine, Zagazig University within the period from Sep. 2017 to Sep. 2018. It included 30 patients, all of them were suffering from secondary CA. Patients demographic data are all illustrated in Table (1). Group A involved 13 patients, were managed using FUE technique for hair restoration. While group B included 17 patients, SE group. Table (1) reveals absence of any significant difference between both groups with respect to age, sex, residence and occupation.

### *Group A (FUE Group):*

Patients of this group were 13, all of them suffered from 2ry CA. Those patients were chosen according to certain inclusion criteria:

- 1- Age >15 years: To be able to understand the procedure and its related postoperative instructions (Table 1).
- 2- Surface area of the scarred area is small with a mean of 19cm<sup>2</sup> (Table 2).

FUE was done as day surgery. Informative signed consent was obtained from the patient or his medico-legal guardian before proceeding. Patients were instructed to shave their hair to the length of 1mm. During harvesting of follicular units, the patient was seated on a comfortable chair with the head supported and leaning forward (donor site was occipital and/or occipito-parietal). Pre-operative medications were given to all cases in the form of broad spectrum antibiotic (Sulbctam and Amoxicillin 1.5gm vial IV). Occipital and post auricular nerve blockage was obtained using local infiltration anesthesia, (Fig. 1).

We used the powered SAFE System Fig. (2a), developed by Dr. Jim Harris, which uses blunt dissection punch to isolate the follicular units from the surrounding tissue Fig. (2b) [6].

Fig. (3) (from a to e) shows the operative steps of FUE procedure. All patients were given post-operative medications (pre-operative ones + Diclofenac sodium 75mg tab as moderate pain killer). Some patients were advised to put ice bags over the eyes and forehead for the 1<sup>st</sup> 48 hours to combat edema. The first Post-operative dressing was done 3 days later, the patient came to the outpatient clinic and the dressing was removed very slowly under running normal saline. Patients started washing the scalp by anti-dandruff shampoo after another 3 days.

### *Group B (SE Group):*

Patients of this group were 17, all of them suffered from 2ry CA. Those patients were chosen according to certain inclusion criteria:

- 1- Age >5 years: As most studies proved that children above this age can tolerate expanders very well [7].
- 2- Surface area of the scarred area is large with a mean of 142cm<sup>2</sup> (Table 2).

We used rectangular expanders with semi hard base and remote filling port. Their size varied from 250cc to 400c. Shaving of the area of operation was done in the day of operation. The patient was anaesthetized generally with endo-tracheal intubation in supine position with the head elevated. Prophylactic Broad spectrum antibiotic (Sulbctam and Amoxicillin 1.5gm vial IV) was administrated intravenously at the start of the operation. Sub-galeal injection of saline + adrenaline (1:500,000) to reduce blood loss. A small incision 2mm from margin of the scar was made to insert the expander.

The pocket for tissue expander was dissected 2cm larger than the dimensions of the expander in the sub-galeal plane of the scalp (facilitated by the use of a urethral dilator). The pocket is copiously irrigated with an isotonic saline solution, prior to the insertion of the expander, the expander was sited 2mm from the edge of the incision to avoid scar expansion and puncture during wound closure. Remote valve was placed at a reasonable distance from the expander on a bony prominence. Complete meticulous hemostasis, insertion of a suction drain and the wound was closed in two-layers with sub-cutaneous 3/0 or 4/0 vicryl sutures and 2/0 or 3/0 polypropylene sutures for skin closure.

Expansion was started on table once the wound was closed by 10-20% of the volume of the expander using normal saline and a 23-gauge butterfly needle. However, if blanching or skin tension is noted, fluid was withdrawn. Suction drain was removed 5 days post-operative and stitches were removed on day 14 post-operative. Expansion was continued after one week later (three weeks PO) being sure that the wound healed nicely without complications.

*After six months of follow-up, a five point questionnaire was made for all cases to measure their opinion in:*

- 1- Hair density at the treated area.
- 2- Proper hiding of the scars post operatively.
- 3- Hair direction related to its new position.
- 4- Their general satisfaction.

5- How much they advise other patients to go for the same surgery.

Their answers were graded as: Excellent (86-100%), very good (65-85%), good (50-64%), bad (30-49%) and poor (<30%).

**RESULTS**

Post-burn scarring was found to be the leading cause of 2ry cicatricial alopecia in both groups of patients included in this work, Table (2). It represented 61.5% in group A and 52.9% in group B.

Table (3) reveals a highly statistically significant difference between both groups regarding the mean surface area of alopecia and time elapsed since injury (*p*-values are 0.0006 and 0.001 respectively), while the difference was statistically insignificant with respect to operative time.

Table (4) shows the number of estimated hair follicles needed & the number of sessions in Group A. Two sessions were done in two patients only (Add-on session). It also shows the estimated size of expander, the maximum size of expansion reached and the need for more than one stage of expansion in Group B. There were two cases that needed two stages of expansion (two surgeries for each stage).

Table (5) represents the complications recorded in both groups. In Group A, while there was no complications in the donor site (white scar, pseudo-syphilitic appearance or necrosis) or anesthesia-related complications, there was some complications in the recipient, in the form of partial loss of transplants in 4 cases (30.77%), transplanted hair thinning in one (7.69%) and un-satisfaction in two (15.38%). While in Group B hematoma was recorded in two cases (11.76) and seroma, expander exposure and expander loss in one case each (5.88%). Unsatisfied patient/parent and anesthesia-related complications, both, were zero.

Table (6) shows the statistical analysis of patient questionnaire about the results and patient satisfaction. In general, no patient/parent assigns excellent results in both Groups (0%). Speaking of general satisfaction, very good results were reported in 7 cases (53.8%) in Group (A) & 12 cases (70.6%) in Group (B). In concern to hair density: no patient assigns excellent results in both Groups (0%) also, very good results reported in 7 cases (53.8%) in Group (A) & 10 cases (58.8%) in Group (B) while good results were found in 3 cases (23.1%) in Group (A) & 4 cases in Group (B) (23.5%). Hair direction was reported to be very good and good

in Group A in 8 and 3 cases (61.5 & 23.1%) respectively and in Group B in 11 and 4 cases (64.7 & 23.5%) respectively also.

Hidden scars were very good in 7 cases (53.8%) in Group (A) & 12 cases of Group (B) (70.6%) and good results were found in 4 cases (30.8%) in Group (A) & 5 cases of Group (B) (29.4%). Finally, advice for other patient to do this surgery from current cases: Very good reported in 9 cases (69.2%) in Group (A) & 13 cases (76.5%) in Group (B), Table (6), (Figs. 5,6).

Table (1): Demographic data of both groups.

Item	Group A		Group B		<i>p</i> -Value
	No.	%	No.	%	
<i>Age (in years):</i>					
<15	0	00	5	29.4	0.043
15-25	11	84.6	10	58.8	
>25	2	15.4	2	11.8	
	Mean ± SD = 13 ± 2.8		Mean ± SD = 21.1 ± 3.5		
<i>Sex:</i>					
♂	9	69.2	9	52.9	0.191
♀	4	30.8	8	47.1	
<i>Residence:</i>					
Rural	6	46.2	9	52.9	0.558
Urban	7	53.8	8	47.1	
<i>Occupation:</i>					
Student	3	23.1	5	29.4	0.642
House wife	1	7.7	5	29.4	
Clerk	4	30.8	3	17.6	
Manual Worker	5	38.4	4	23.6	

Table (2): Causes of Alopecia in both groups.

Item	Group A		Group B	
	No.	%	No.	%
Post-burn	8	61.5	9	52.90
Post-trauma	3	23.1	4	23.55
Post-tumor Excision	1	7.7	4	23.55
Post-Expansion	1	7.7	-	-

Table (3): Comparison of mean surface area of alopecia, mean time since injury and mean operative time in both groups.

Item	Group A	Group B	<i>t</i> -test	<i>p</i> -value
Mean surface area of alopecia (cm <sup>2</sup> )	22.91±15.1	133.62±66.15	7.423	0.0006
Mean time since injury (yrs)	12.08±6.26	4.66±2.42	3.828	0.001
Mean operative time (hrs)	3.22±1.42	4.25±1.44	1.95	0.066

Table (4): Comparison between both groups regarding to intraoperative information.

Group A:		
No of Estimated Hair Follicles	Range	150-1200
	Mean	441.45
	SD	308
No of Sessions	One	11 pt
	Two	2 pt
Group B:		
Estimated Expander Size	Range	250-400 cc
	Mean	312.5 cc
	SD	60 cc
Maximum Size Reached	Range	400-1100 cc
	Mean	725 cc
	SD	208 cc
No of Sessions	Two	15 pt
	Four	2 pt

Table (5): Complications in both groups of the study.

Group	Complication	No.	%
Group A	Partial Transplant Loss	4	30.77
	Transplant Thinning	1	7.69
	Unsatisfied Patient	2	15.38
	Donor-site Morbidity	0	0
	Anesthesia-Related	0	0
Group B	Hematoma	2	11.76
	Seroma	1	5.88
	Expander Exposure	1	5.88
	Expander Loss	1	5.88
	Unsatisfied Patient/Parent	0	0

Table (6): Patient satisfaction for both groups.

Item	Excellent 86-100		Very Good 65-85		Good 50-64		Bad 30-49		Poor <30	
	A	B	A	B	A	B	A	B	A	B
<b>HDN:</b>										
No	0	0	7	10	3	5	2	1	1	1
%	00	00	53.8	58.8	23.1	29.4	15.4	5.9	7.7	5.9
<b>HDR:</b>										
No	0	0	8	11	3	4	1	1	1	1
%	00	00	61.5	64.7	23.1	23.5	7.7	5.9	7.7	5.9
<b>HSC:</b>										
No	0	0	7	12	4	5	1	0	1	0
%	00	00	53.8	70.6	30.8	29.4	7.7	00	7.7	00
<b>GST:</b>										
No	0	0	7	12	4	5	1	0	1	0
%	00	00	53.8	70.6	30.8	29.4	7.7	00	7.7	00
<b>AFO:</b>										
No	0	0	9	13	4	4	0	0	0	0
%	00	00	69.2	76.5	30.8	23.5	00	00	00	00

HDN = Hair Density.  
HDR = Hair Direction.  
HSC = Hidden Scars.

GST = General Satisfaction.  
AFO = Advice For Others to Do.



Fig. (1): Patient positioning and injection of local anesthesia.

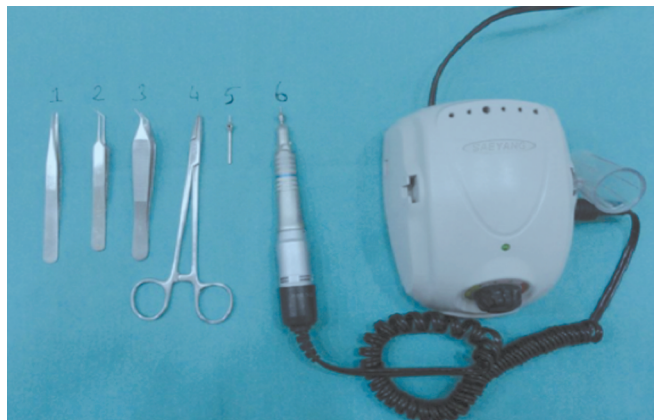


Fig. (2A): Instrument set used in hair transplantation.



Fig. (2B): Punch used for extraction (0.9mm diameter).



Fig. (3A): Graft harvesting.



Fig. (3B): Grafts set on wet gauze.



Fig. (3C): Recipient area with the receiving holes.



Fig. (3D): Insertion of FU grafts.



Fig. (3E): Post-procedure dressing; donor site is covered while the recipient area is left exposed.



Fig. (4A): Scalp is expanded and ready for Stage II.

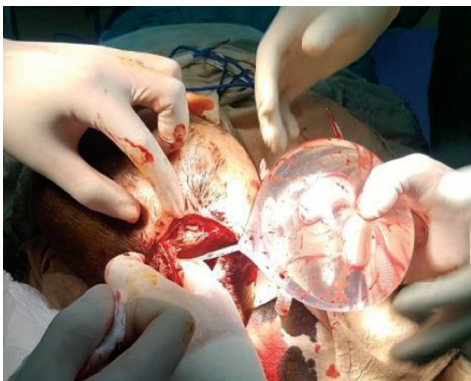


Fig. (4B): Expander Removal.



Fig. (4C): Expanded Flaps ready for advancement.



Fig. (4D): Wound closure with suction drain inserted.



Fig. (5A): Rt. Temporal Post-burn alopecia (Before FUE).



Fig. (5B): Same patient 6 months post-transplant.



Fig. (6A): Mid-vault and upper occipital Post-burn alopecia in a 6 years old girl.



Fig. (6B): The same patient after full expansion.



Fig. (6C): After removal of the expander.



Fig. (6D,E): After one year.

## DISCUSSION

Secondary cicatricial alopecia is amenable to hair transplantation. Follicular unit grafts transplanted over scars can provide camouflage resulting in an improved cosmetic appearance, especially in highly visible areas, such as the scalp. Important considerations include wider spacing of grafts compared with regular hair transplantation of androgenic pattern hair loss because of the decreased vascularity over these scarred areas. Staged procedures can be done to increase density and improve coverage [8].

Meanwhile, expanders have been proved to be fruitful in the pediatric population. In particular, scalp expansion has proved to be useful in the reconstruction of posttraumatic and post-burn alopecic defects [9,10].

In this study, patient population was very heterogeneous. While in Group A, most of patients were males (9/13) above the age of 15 years, Group B included 17 cases nearly equally distributed between males and females (males, 9/17) and their age range was extending between 6 to 26 years. Mean age  $\pm$  SD of both groups was  $21.1 \pm 3.5$  in Group A and  $13 \pm 2.8$  in Group B, (Table 1).

Regarding Group A, this was slightly lower than that of Shau et al., 2014 [10] who made their work on 37 cases with their mean age  $\pm$  SD was  $24.7 \pm 5.9$  years. But, it is worthy to mention that in addition to the bigger number of cases who underwent FUE in this study, it was done over a period of 5 years. Meanwhile, for Group B, Tayyaba et al., 2015 [11] managed 30 cases of secondary cicatricial alopecia using scalp expansion within one year during the civil war in Pakistan (between 2013-2014). Their mean age  $\pm$  SD was  $16 \pm 8.3$  years which is also quite near to our figures.

The mean values of the surface area of alopecia, in Group B was significantly larger than that of Group A ( $p < 0.001$ ) (Table 3). In Group A, the mean surface area of alopecia  $\text{cm}^2$  was  $22.91 \pm 15.1$ , which differs from that given by Shau et al., 2014 [10] which was  $10.08 \pm 19.55$  this may be because they limited their work to small linear scalp scars. In Group B, the mean surface area was  $133.62 \pm 66.15$ , while Handschel et al., 2014 [12] studied 40 patients with mean surface area  $40 \pm 43$  this is due to totally different patients as they studied only patients after radiotherapy (smaller scalp alopecic areas).

However, the time since exposure to the causative injury was significantly longer in Group A

than that of Group B ( $p < 0.01$ ) due to smaller defects in Group A that can be tolerated while in Group B, larger surface area of defects with younger ages that cause psychological problems.

In the current study, the mean duration of hair transplantation in Group A was  $3.12 \pm 1.42$  hours which was very near to that recorded by Shau et al., 2014 [10] ( $3.61 \pm 1.32$ ). Also, there was no significant difference between both groups regarding the mean of operation duration ( $p > 0.05$ ) (Table 3).

In this study, the mean follicular unit density per recipient area in Group A was  $22.03 \pm 3.26$  FU/ $\text{cm}^2$  while Shau et al., 2014 [10] had the mean density of  $36.28 \pm 6.44$  FU/ $\text{cm}^2$ . This difference was due to our consideration of the poor vascularity of the recipient area, so we were intended not to overcrowd the recipient area during implantation.

While in Group B, the mean expansion volume was  $725 \pm 208$  Table (4), Handschel et al., 2014 [12] had mean expansion volume  $224 \pm 189.03$  this might be due to relatively smaller alopecic areas he included in his study (Post-radiation therapy alopecia).

The total incidence of complications in Group A was 53.8%, Table (5). But these complications occurred in 4 patients only and were recorded in the early cases at the onset of the study. This means that the real incidence of complications in Group A is 30.77%. This is much bigger figure than that mentioned by Shau et al., 2014 [10] that were only 5.6%. But we have to mention that he only recorded the long term complications including 2 patients out of 37 patients with epidermoid cysts.

In Group B we faced complications in 29.4% of patients. When comparing this figure with other studies, we found a great variation. Tayyabba et al., 2015 [11] faced complications incidence of 46.67%, with 26% of them were due to mild infections. Chen et al., 2017 [13] stated that complications of the use of tissue expanders are controversial, having complications incidence of 6.25%. They compared their results to that of Qing et al., 2006 [14] who faced 14% incidence of complications in a study of 57 patients and also to Saleh et al., 2004 [15] who faced complication rate of 21.5% in their study which is quite near to our figure. Also, Oh et al., 2010 [16] faced complications in 12.8% in their series of 62 patients and they referred this low incidence of complications to strict measures in postoperative care.

Although we couldn't attain excellent results in both groups (Table 6), we reached very good

and good general patient satisfaction in Group A in 11 cases (84.6%). Oh et al., 2010 [16] showed excellent results in 69.4%, good results in 29%, and bad result in only one patient (1.6%). While Shau et al., 2014 [10] stated that patient Satisfaction at their study was 100% for 30 patients, 90% to 100% for five patients and <90% for two patients.

Also in Group B, general patient satisfaction very good and good marks were recorded in all patients and neither any of the patient or their parents were unsatisfied. Drissi et al., 2007 [17] reported that their results were excellent and good in 90% of their expanded patients.

In another paper by Chen et al., 2017 [13], they adopted the use of scalp expansion combined with FUE for post-burn scalp alopecia. They reported excellent results in 60.5% and good results in 36.8% with only one patient (2.7%) who was lost to follow-up. Although some of these figures are near to ours but still it is worthy to say that we have some limiting factors in our study.

First, is the short term of follow-up that was only one year. Second was the lack of definitive unified criteria that can objectively judge the final outcome. And this may be the reason why some of our figures in the final evaluation are different from others.

#### Conclusion:

In this study, we were able to certify that both hair transplantation and skin expansion are very useful in the field of cicatricial alopecia management. Also we reached to a conclusion that hair transplantation is a good option in alopecic areas less than 50 cm<sup>2</sup> and patients above the age of 15 years (being able to understand and obey the PO instructions) while skin expansion is the best solution for bigger areas of alopecia and younger patients from the age of 5-6 years who can tolerate the process of expansion nicely.

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