

# Different modalities of eyebrow reconstruction: retrospective study



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## SUMMARY

**Objective:** to evaluate the effectiveness, complications and patient satisfactions of the three applicable methods; composite hair graft, superficial temporal artery island flap and follicular unit hair transplantation in eyebrow reconstruction.

**Patients and methods:** this retrospective study was done on 30 Patients assigned into three groups, each group contain 10 patients. Group A: 10 patients prepared for composite hair graft. Group B: 10 patients prepared for superficial temporal artery island flap. Group C: 10 patients prepared for follicular unit hair transplantation. Follow-up period for 6 months.

**Results:** in group A, the grafted area ranged from 40 to 70% of the entire eyebrow. 4 cases underwent infection and necrosis and 20% of cases were unsatisfied with the results. 6 cases underwent secondary procedures using follicular unit hair transplantation. In group B, the reconstructed area ranged from 25 to 90% of the entire eyebrow, 5 cases were complicated by venous congestion, partial hair loss and donor site alopecia and 10% of cases were unsatisfied with the results. 4 cases were managed by secondary follicular unit hair transplantation. In group C, the reconstructed area ranged from 20 to 90% of the entire eyebrow. One case was complicated by folliculitis. All cases showed degrees of satisfaction on the scale. Six cases underwent secondary sessions.

**Conclusions:** follicular hair unit transplantation is the best procedure for eyebrow reconstruction with least complications. It's suitable for any type of eyebrow defects with the best appearance and hair direction.

## KEYWORDS

Composite hair graft, superficial temporal island flap, follicular unit hair transplantation.

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## INTRODUCTION

The eyebrow is a subunit of the forehead and an aesthetic unit of the face [1]. Both position and continuity of the eyebrow hairline play important roles in the general harmony of the face [2]. It has a combined linguistic and affective function and plays a key role in facial expressions [3].

Women have been highlighting their eyebrows to enhance their style. Eyebrow aesthetics are influenced by a lot of factors, including age, gender, culture, ethnicity and current fashion trends. There is great variety in the size, shape and position of eyebrows that are aesthetically pleasant on different faces [4].

Alopecia of eyebrows especially cicatricial affects both females and males' eyebrows of different ages as a result of an irreversible damage to the hair follicle. Physical or chemical trauma, infectious and noninfectious inflammatory diseases, neoplastic as well as growth and hereditary disorders represent the major causes of eyebrow alopecia [5].

Absence of the eyebrows or distortions in their position changes the character of the face. The shape and position of the eyebrows can express surprise, anger, sadness, fatigue, annoyance, relaxation and a variety of other emotions. Without eyebrows, the face usually looks abnormal [6].

Although eyebrow alopecia is not a frequent subject of consultation in daily practice, plastic surgeons have to know the surgical methods and technical details necessary to reconstruct eyebrows with accepted aesthetic results [7].

Eyebrow reconstruction remains a challenge due to the uniqueness of its hair. Many methods starting from direct closure [8], full-thickness skin graft (post-auricular and composite scalp graft) [9], flaps [2,8,10] and hair transplantation [3] have been used to reconstruct eyebrow defect.

Extensive or complete eyebrow defects may be covered by grafting from the nape of the neck or post-auricular area or by using flaps from the scalp. Bilateral complete eyebrow defects may be corrected using a bipedicle scalp flap [8].

The selection of the reconstructive procedure must be individualized, depending on the extent and site of the eyebrow defect relationship to other structures, sex, and age of patients. Each option helps to maintain the function and aesthetic appearance of the eyebrow [11].

The aim of our study is to find out the current applied eyebrow reconstructive modalities; composite hair graft, superficial temporal artery island flap and follicular unit hair transplantation on the aesthetic end result and the patient satisfaction.

## Patients and methods

After local ethical committee of Mansoura University approval and obtaining written fully informed patients consent, thirty patients with eyebrow hair loss admitted to the Plastic Surgery Department in Mansoura University Hospital.

They were considered for inclusion in this study from January 2012 to February 2015 with follow-up period at least 6 months.

This retrospective study was done on 30 patients assigned into three groups, each group containing 10 patients.

**Group A:** 10 patients prepared for composite hair graft.

**Group B:** 10 patients prepared for superficial temporal artery island flap.

**Group C:** 10 patients prepared for follicular unit hair transplantation.

Patients included in this study were suffering from eyebrow hair loss unilateral or bilateral, partial or complete, congenital, post burn and post traumatic causes.

Excluded patients from this study involved patients who were unable to give a written consent, patients with history of medical illness as recent stroke, myocardial infarction, diabetes mellitus,

anemia, coagulation disorders, atherosclerosis, chronic liver diseases, deep venous thrombosis and malnutrition, patients with history of chemotherapy or radiotherapy, patients with psychological troubles or patients with dermatological diseases affecting eyebrows.

The reconstructive method was decided according to patient's examination and explained to the patients or parents of child patients. Pre-operative photography of the eyebrow deformity and the donor site were also done before operation.

Local examination was done for both donor and recipient sites. The recipient site; regarding size, site, shape, scars, and symmetry with the other eyebrow and tissue viability. The donor site; regarding hair density, hair direction and pattern of superficial temporal artery branches (in case of using superficial temporal artery island flap).

Doppler ultrasound was done to determine the branches of the superficial temporal artery in case of using superficial temporal artery flap.

After complete healing and before doing any secondary reconstructive procedures, a systemic score from 0 to 5 was used to assess adult patient's satisfaction and the satisfaction of the parents for child cases. Grade 0 meant totally unsatisfied, grade 1-3 meant intermediate satisfaction while grade 4-5 meant excellent.

## Techniques

The patient washed hair with an anti-septic such as Betadine (1% povidone iodine), or a regular shampoo the night before and morning of surgery. Marking the recipient site with a permanent marker using a transparent paper as a template, was done according to the contralateral healthy side in unilateral eyebrow defect. In cases with bilateral eyebrow defect, the desired shape and size of the reconstructed eyebrow was determined as the patient favorite according to the normal aesthetic landmarks of the eyebrow.

The template was transferred to the do-

nor area at the lower occipital region of the scalp (in group A and C) and at the temporoparietal region of the scalp (in group B) after matching the direction of hair between both donor and recipient sites, then the donor site was marked also.

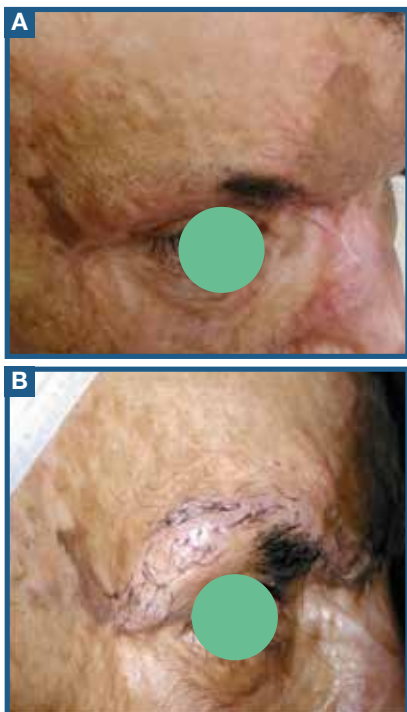
General anesthesia with intubation was the only method in all cases of group B. On contrary, only three child cases in group A and two child cases in group C were used general anesthesia while the remaining cases were operated under local anesthesia. Epinephrine local solution was used in the both donor and recipient regions.

In group A (Composite graft), harvesting was done at about 45 degrees to preserve the hair bulbs. Haemostasis and donor site closure was done. Trimming of the graft to eliminate all unneeded dermis and subcutaneous tissue. Preparation of the recipient site was done by removal of the alopecic area. Application of the graft was done and the graft was sutured to the edges by Vicryl 6/0 continuous sutures. Dressing was light compressive and non-adherent for one week with ice packs placed over the graft for the first 24 hours after surgery to decrease the metabolic requirements of the graft and increase its survival. The patient was discharged next day after operation. Follow up was done by removal of dressing after 5-7 days and the graft was left exposed with application of an antibiotic ointment to prevent infection. Follow up visits were scheduled as once every 2 weeks for 2 months and then once every month for 6 months (Fig. 1).

In group B (Superficial temporal island flap), a T shaped incision was performed. The superficial temporal artery branch was explored and the incision was lengthened according to the selected branch. Dissection was continued at the plane between dermis and temporoparietal fascia. The marked fasciocutaneous flap at the donor region was preserved. The flap was elevated with 0.5 to 1cm superficial temporo-parietal fascial tissue preserved around the artery and concomitant vein. A subcutaneous tunnel was made from the donor site to the recipient site to tran-

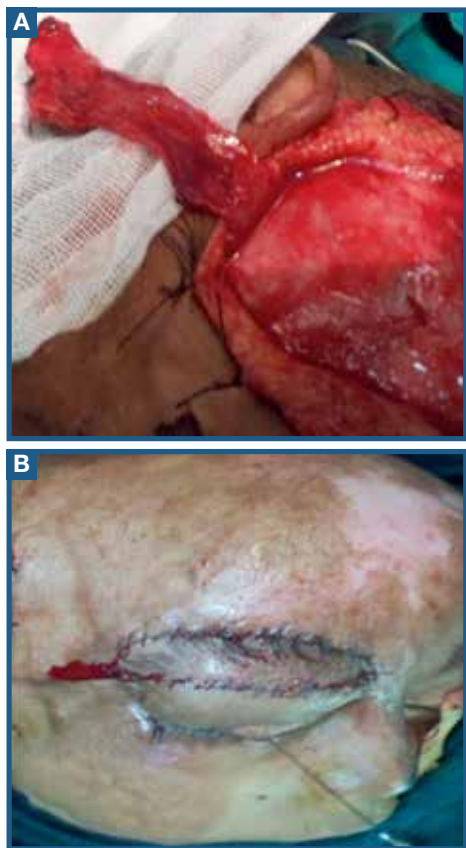
**Figure 1**

(A) Pre-operative and (B) post-operative photography. A case of male patient with right side eyebrow hair loss.



sfer the flap through it. The flap was sutured to the edges by continuous absorbable sutures (Vicryl 6/0). The donor site was closed by mattress non absorbable Prolene 3/0 sutures after putting a drain to prevent haematoma formation with crepe bandage over the donor site dressing. Drain was removed after 24 hours. Light non adherent dressing was used. The flap was monitored to detect venous congestion or flap ischemia in the first 48 hours. Follow up visits were scheduled as once per a month for 6 months (Fig. 2 and 3).

In group C (Follicular unit hair transplantation), harvesting of the strip graft



**Figure 2**  
(A) Dissection and elevation of the flap, (B) post-operative photography.

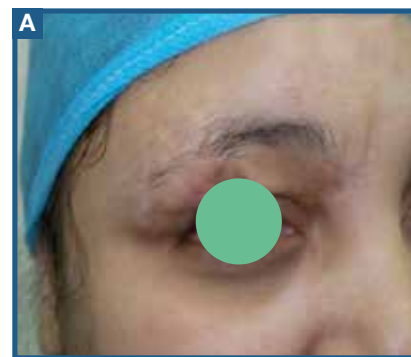


**Figure 3**  
(A) Pre-operative and (B) post-operative photography. A case of male patient with right sided eyebrow total hair loss.

was done at 45 degrees so as not to harm the hair bulbs. The dividing procedure of the strip graft was done under a magnification to prepare one-hair and two-hair grafts. In the recipient site, microholes were made for accommodation of hair grafts. Implantation was done by using a microforceps, the one-hair grafts were placed at the margin of the reconstructed eyebrow while the two hair grafts were placed at the center. Light dressing was used with mild compression to keep grafts in place. KY gel was used to facilitate future removal of the dressing without moving hair grafts. It was kept for one week and then was removed and the eyebrow was left exposed with antibiotic ointments twice daily. Follow up was done every 2 weeks for 2 months then every month for 6 months (Fig. 4).

## Results

Thirty patients with eyebrow hair loss were included in this study. They were divided into 3 groups according to the procedure done; composite hair graft group, superficial temporal island pedicle flap



**Figure 4**  
(A) Pre-operative, (B) Grafts implantation and (C) post-operative photography. A case of female patient with right sided eyebrow loss.



group and follicular unit hair transplantation group. The mean of age was  $19.80 \pm 8.72$ ,  $18.10 \pm 6.38$  and  $22.10 \pm 7.14$  respectively without significant difference. The percentage of males were 60%, 50%, 50% while the percentage of females were 40%, 50% and 50% respectively in all groups. The right sided eyebrow was mainly affected almost in composite hair graft and follicular unit hair transplantation groups. The left sided eyebrow was mainly affected in superficial temporal island pedicle flap group.

In all groups, burns were the most devastating injuries that caused a significant higher morbidity of the eyebrows. Flame burn was the most common cause with a percentage 40% in each group while the other types of burn like scald, chemical and electrical represent 29.9%. An additional cause was road traffic accident with 13.3% of all causes. Also, avulsion and crushing injuries were involved with low percentage. Moreover, congenital eyebrow hair loss was observed in one case.

The range of reconstructed area in composite hair graft group was 40%-70% of the total eyebrow. On the other hand, the reconstructed area in the other two groups was approximately the same. It was 25-90% in superficial temporal island pedicle flap group and 20-90% in follicular unit hair transplantation group.

The reported complications in composite hair graft group, staphylococcus infection was observed in two cases and necrosis in two cases. Two cases of venous congestion, two cases of partial hair loss and one case of donor site alopecia were reported in superficial temporal island pedicle flap group. While in group C, there was one case of folliculitis.

Data from this study revealed significant difference in the operative time. The difference was greater in follicular unit hair transplantation group with a mean time  $95.50 \pm 34.44$  minutes. The mean time in superficial temporal island pedicle flap group was  $80.00 \pm 15.81$  minutes while in composite hair graft group was  $56.50 \pm 10.01$  minutes.

One hundred percentages expressed patient satisfaction in follicular unit hair transplantation group; fifty percentages were intermediate satisfaction and fifty percentages were excellent satisfaction. Sixty percentages of patients were satisfied intermediately in both composite hair graft group and superficial temporal island pedicle flap group. While twenty percentages of patients in composite hair graft group and thirty percentages of patients in superficial temporal island pedicle flap group were satisfied excellently. The remaining percentages were unsatisfied.

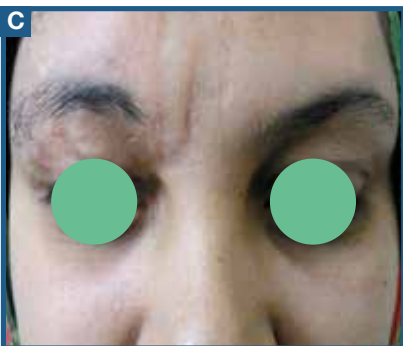
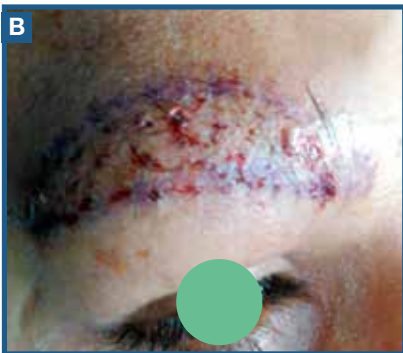
In composite hair graft group, four patients underwent secondary one stage procedure and two patients underwent secondary two stage procedure. In superficial temporal island pedicle flap group, three patients underwent secondary one stage procedure and one patient underwent secondary two stage procedure. In follicular unit hair transplantation group, six patients underwent secondary one stage procedure.

## Discussion

The eyebrows are considered as important features to facial definition. Variable causes can cause the eyebrow hair loss such as congenital, tumors, trauma including facial burns, avulsion injuries and alopecia.

Many different reconstructive techniques were explained previously in the literature. The aim of eyebrow reconstruction is clear, to restore the natural appearance of the eyebrow and to suppress the embarrassment of the patient, restoring his self-confidence and raising his self-esteem. It's important to evaluate the eyebrow deformities and select the appropriate surgical procedure that will provide the optimal post-operative result and achieve excellent patient satisfaction.

The reconstructed methods were explained to the adult patients and to the parents of the child patients. The sequelae, advantages and disadvantages of each



method should be discussed with them for better assessment of satisfaction.

In this study, the reported complications involved necrosis, staph infection, venous congestion, donor alopecia, partial hair loss and folliculitis. In composite hair graft group, necrosis occurred in two cases. They underwent secondary reconstructive procedure. Also, two cases of Staph infection was detected and treated with oral antibiotic for 2 weeks according to culture and sensitivity test.

In superficial temporal island pedicle flap group, venous congestion occurred in two cases. It was managed by aspirin 100 mg as a daily dose and subcutaneous heparin. Also, donor site alopecia occurred in one and underwent secondary reconstructive procedures. Lastly, partial hair loss observed in two cases and they underwent secondary reconstructive procedures. Folliculitis occurred in one case in follicular unit hair transplantation group and managed conservatively by antibiotic ointment twice daily for one week.

Secondary reconstructive procedures were done for 16 patients either to manage the complications or to increase hair density of the reconstructed eyebrow. In composite graft group, four patients underwent secondary one stage procedure as follicular unit hair transplantation and two patients underwent secondary two stage procedure in the form of debridement and follicular unit hair transplantation.

In superficial temporal island pedicle flap group, three cases underwent secondary one stage procedure as follicular unit hair transplantation and one case underwent secondary two stage procedure in the form of flap trimming and follicular unit hair transplantation. In follicular unit hair transplantation group, six patients underwent secondary one stage procedure in the form of follicular unit hair transplantation.

Our study agreed with Motamed and Davami [6]. The use of a composite hair graft for eyebrow reconstruction is a better method to be used in women with

thin eyebrows. Survival of the graft mostly depends on its small size. It also has a natural accepted appearance.

Despite being a simple method, using a composite graft showed a major hair loss 3 to 6 months after surgery and needed several sessions of follicular unit transplantation to get more natural and satisfactory results. The incidence of graft necrosis is also higher and needs well-trimming for the cellular tissue of the graft to increase rate of survival [12].

Although Kim and his colleagues [4] used superficial temporal artery flap for partial eyebrow defect, we used this method for partial and total defects. We found that using this method gave less satisfactory results regarding hair growth and direction. We agreed with Motamed and Davami [6], it is better to be used in men with total and bilateral eyebrow loss because of their thick eyebrows. Hair loss is less and needs only 1 to 2 sessions including flap trimming [10].

The superficial temporal artery flap gave greater hair density than the other two methods. In addition, it owns its blood supply from healthy site and does not depend on the recipient site vascularity and this parallel with Omranifard and Doosti [13]. On the contrary, we disagreed with them, about donor alopecia which was more obvious and well defined in some cases. The risk of developing complications as flap ischemia and necrosis may counter the use of this method. Color mismatching between the donor and the recipient site and partial hair loss from the flap are considered as drawbacks for this technique.

Follicular-unit grafting is the most satisfying procedure to perform. It gave high patient satisfaction and very acceptable results. The advantages of follicular unit grafting are many. The most important is the natural appearing results with an absence of scarring. The direction of implanted hair could be controlled very easily. This method could be used for any type of eyebrow defects as agreed with Raposio and his colleagues [14]. The procedure is ideal for all degrees of hair loss,

from early thinning to advanced hair loss. Also, this method includes the more rapid healing and the ability to place grafts closer together. Although it's a simple method, it requires a highly motivated team of assistants to work under a microscope for prolonged periods.

A particular disadvantage of follicular unit grafting is that it requires subsequent procedures to obtain the density desired. Long time operation is also a drawback of this procedure. Despite being the best reconstructive method, it's not a better choice in cases with cicatricial eyebrow loss as hair grafts depends on the recipient site vascularity to survive and fibrosis of the recipient site would impair the vascularity.

## Conclusions

The eyebrows play an important role in conveying emotions, and loss of an eyebrow, either partial or complete, produces variable degrees of facial disfigurement. Many techniques have been described for eyebrow reconstruction. In this study, we present three methods in our study: composite hair bearing skin graft, superficial temporal island flap and follicular hair transplants. Follicular unit transplantation method showed the best results and least complications. Further studies are recommended to analyze the modalities of eyebrow reconstruction on large samples of patients with eyebrow morbidities.

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