

## Original Article

# Comparison of four surgical methods for eyebrow reconstruction

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## ABSTRACT

**Background:** The eyebrow plays an important role in facial harmony and eye protection. Eyebrows can be injured by burn, trauma, tumour, tattooing and alopecia. Eyebrow reconstructions have been done *via* several techniques. Here, our experience with a fairly new method for eyebrow reconstruction is presented. **Materials and Methods:** This is a descriptive-analytical study which was done on 76 patients at the Al-Zahra and Imam Mousa Kazem hospitals at Isfahan University of Medical University, Isfahan, Iran, from 1994 to 2004. Totally 86 eyebrows were reconstructed. All patients were examined before and after the operation. Methods which are commonly applied in eyebrow reconstruction are as follows: 1. Superficial Temporal Artery Flap (Island), 2. Interpolation Scalp Flap, 3. Graft. Our method which is named Forehead Facial Island Flap with inferior pedicle provides an easier approach for the surgeon and more ideal hair growth direction for the patient. **Results:** Significantly lower rates of complication along with greater patient satisfaction were obtained with Forehead Facial Island Flap. **Conclusions:** According to the acquired results, this method seems to be more technically practical and aesthetically favourable when compared to others.

## KEY WORDS

Forehead flap, hair graft, reconstruction, superficial temporal artery flap

Eyebrow loss is a major problem in facial injury. Causes of eyebrow loss are burns, trauma, tumour, tattoo and alopecia. Facial burns comprise one-fourth to one-third of all burns. Many facial burns result in eyebrow loss. Eyebrow loss may be complete or incomplete and unilateral or bilateral. The eyebrow is an important subunit of facial aesthetics and expression. Partial or total absence of eyebrow is an unpleasant and disturbing condition which can alter the character of the face. Aesthetic reconstruction of eyebrow is a challenging task for the reconstructive surgeon, thus eyebrow repair can be an important finishing touch in the overall reconstruction of a burned face.<sup>[1]</sup>

Classic methods for eyebrow reconstruction are:

1. Grafts: micrograft or minigraft, punch graft and strip graft.
2. Flap: superficial temporal artery island flap with anterior or posterior branch.
3. Interpolation flap from scalp.<sup>[2]</sup>

Here, we are going to describe a fourth method named as "Forehead Facial Island Flap with inferior pedicle" subcutaneously transferred from hair bearing front temporal area to eyebrow site.

## MATERIALS AND METHODS

In this descriptive analytical study, we evaluated 76

patients with eyebrow injuries who were hospitalized at the Imam Mousa Kazem and Al-Zahra University Hospitals, Isfahan, Iran from 1994 to 2004. In this study we compared four surgical methods for eyebrow reconstruction. These methods were superficial temporal artery, scalp flap, graft and forehead flap with INF pedicle (facial pedicle).

Patients were followed for two years after surgery and the required data were collected from questionnaires. The collected data were then analyzed with SPSS. Statistical methods applied to analyze data included Student's *t* and Chi-square tests.

Methods of surgery in our study were: Superficial temporal artery island flap for 49 patients, Interpolation scalp flap for six patients, Graft for 12 patients and Forehead facial flap with INF pedicle for 19 patients. The last technique which was only partly practiced by Koceru and Ulusoy<sup>[3]</sup> was the focus of our attention in this study.

This method includes a skin island with hair from the frontal area or anterior temporal area with subcutaneous facial pedicle - supratrochlear or supraorbital arteries in the medial side of pedicle can help increase its blood flow; however, this flap survives with lateral facial pedicle even without such supply.

To design our flap [Figure 1a], we take an island of hair-bearing scalp skin. Preferably, the island is designed at least 2-3 cm posterior to the temporo frontal hairline to avoid future male type alopecia in the reconstructed eyebrow.

The posterior incision of the flap is cut deep to the upper layer of the periosteum. The anterior edge of incision extends to frontalis muscle fascia [Figure 1b].

Dissection is continued from the posterior to anterior in the forehead area *via* a subfacial approach. Anteriorly, dissection is continued subcutaneously up to one-third of the forehead height. This is especially to protect the

frontal branch of the facial nerve during dissection. A subcutaneous tunnel is dissected from the donor site of the hair-bearing island to the eyebrow recipient site and the skin island is transferred to new site subcutaneously [Figures 1c-1e]. New eyebrow site designing in bilateral eyebrow loss is performed with special index like Leonardo but in unilateral eyebrow loss, the contralateral eyebrow is used as a model.

## RESULTS

Of the 76 patients, 24 (31.6%) were male and the rest 52 (68.4%) were female. Ten cases (13.2%) had bilateral eyebrow injury while the remaining 66 (86.8%) suffered unilateral defects. Totally 86 reconstructed eyebrows were included in this study. Defects were on the right (36), left (30) and both eyebrows (10). Burns accounted for 72% of these cases, whereas trauma and tumour were associated with 20% and 8% of the cases respectively.

After completion of all surgical stages, all patients underwent evaluation for the following indices:

1. *Hair direction*: According to our results shown in Table 1, hair direction in all those operated with Frontal Flap method was excellent. However, with other methods, the results were less favourable. Comparing the results of different methods *via* the Fisher Exact test, it was revealed that a statistically significant difference between Frontal Flap and other modalities exists ( $P \leq 0.005$ ).

2. *Complications*: The results of this study showed that early congestion as a complication of eyebrow surgery was seen in 10 (4.4%) cases who were operated with superficial temporal method, however, this does not affect flap survival [Table 2]. As reviewed in Table 2, other complications of eyebrow reconstruction such as hair loss, donor alopecia and temporary facial disfiguration, were less in Frontal Flap with inferior flap when compared to other methods. Virtually, we did not find any serious complications with Frontal Flap method (our innovation flap).

Table 1: Hair direction results

Hair direction methods	Excellent		Good		Intermediate		Total	
	No.	%	No.	%	No.	%	No.	%
Superficial temporal artery	25	51	23	46.9	1	2	49	100
Frontal flap with INF ped.	19	100	0	0	0	0	19	100
Scalp flap	4	66.7	2	33.3	0	0	6	100
Graft	6	50	6	50	0	0	12	100
Total	54	62.8	31	36	1	1.2	86	100



**Figure 1:** a. Initial defect of eyebrow is assessed and the flap is designed and traced in hair-bearing temporofrontal area at least 2-3 cm posterior to the temporofrontal hairline to avoid probable male type alopecia in the reconstructed eyebrow. b. Skin island flap incised with facial pedicle flap. c and d. Flap in place at eyebrow site

3. *Patient satisfaction:* As shown in Table 3, all patients who underwent eyebrow reconstruction *via* Frontal Flap method enjoyed perfect satisfaction. Similarly, those operated with Scalp Flap method were fully satisfied with surgery outcome. However, with Superficial Temporal

Island flap method, only 19 (38.8%) of the 49 patients expressed complete satisfaction.

4. *Stages of operation:* Number of operation stages is a determining factor in choosing a method for eyebrow

**Table 2: Complications of various methods**

Surgical method	Early congestion		Temporary flap hair loss		Complete hair loss		Donor alopecia		Temporary facial disfiguration	
	Yes N (%)	No N (%)	Yes N (%)	No N (%)	Yes N (%)	No N (%)	Yes N (%)	No N (%)	Yes N (%)	No N (%)
Superficial temporal artery island flap	10 (24.4)	39 (79.6)	12 (24.5)	37 (75.5)	4 (8.2)	45 (91.8)	49 (100)	0 (0)	0 (0)	49 (100)
Frontal flap with inferior flap	0 (0)	19 (100)	0 (0)	19 (100)	0 (0)	19 (100)	0 (0)	19 (100)	0 (0)	19 (100)
Scalp flap	0 (0)	6 (100)	1 (16.7)	5 (83.3)	0 (0)	6 (100)	6 (100)	0 (0)	6 (100)	0 (0)
Graft	0 (0)	12 (100)	12 (100)	0 (0)	0 (0)	12 (100)	0 (0)	12 (100)	0 (0)	12 (100)

**Table 3: Patient satisfaction with various methods**

Surgical methods	Excellent		Good		Intermediate		Total	
	No	%	No	%	No	%	No	%
Superficial temporal artery	19	38.8	19	38.8	11	22.4	49	100
Frontal flap with INF ped.	19	100	0	0	0	0	19	100
Scalp flap	6	100	0	0	0	0	6	100
Graft	8	66.7	4	33.3	0	0	12	100
Total	52	60.5	23	26.7	11	12.8	86	100

reconstruction [Table 4]. Frontal Flap method with inferior pedicle seems to need a lesser number of stages to be completed. Other methods like graft may need three or more stages and Scalp Flap method needs two stages for flap inset and two successive stages for eyebrow trimming and repair.

**DISCUSSION**

Several approaches have so far been introduced for eyebrow reconstruction. Grafting is usually simple but hair density is not enough<sup>[4,5]</sup> and requires more than two stages to be completed [Figures 2a and b].

Motamed and Davami<sup>[1]</sup> believed that composite graft was preferable for females while the Superficial Temporal Artery Island Flap seemed more suitable for males.

Although temporal vessels enjoy a constant anatomical course, along with a large diameter and long axis,<sup>[6]</sup> to our experience we can achieve excellent results in eyebrow reconstruction through applying methods of much more simplicity. Kocer *et al.* performed Forehead Flap with

facial inferior pedicle in a few cases.<sup>[3]</sup> We applied this method to 19 patients which was a much greater sample size [Figures 3a and b].

Kim *et al.* introduced a simple variant of this method for partial eyebrow defect.<sup>[7]</sup> In this study we included both partial and complete defect reconstruction. In addition, to prevent male pattern baldness in the transferred flap,<sup>[8]</sup> we took our skin island from 1.5 to 2.5 cm posterior to the anterior frontal or temporal hairline.

The direction of hair in this area parallels eyebrow hair and donor alopecia and scar are minimal [Figures 5a-6c].

This was the particular innovation we added to this method. With this method, dissection and incision is minimal and donor alopecia is simply treated. On the contrary, in the classic method of posterior branch of the superficial temporal artery island flap the dissection is wide and requires greater experience and a longer learning curve on the part of the surgeon.<sup>[9]</sup>

It is also technically difficult and the bulk of flap and donor alopecia are problems and the direction and hair density do not usually provide satisfactory results [Figures 4 and 6].

For medial eyebrow reconstruction, supratrochlear and supraorbital arteries can provide a favourable perfusion supply; however, the flap may even survive without such

**Table 4: Methods**

Method	Stages of operation
Superficial temporal artery	Two or more
Frontal flap with INF pedicle	Two
Scalp flap	Two or more
Graft	Two or more



**Figure 2:** Burned face with left eyebrow defect reconstructed with hair follicular graft: a. Before operation graft, b. After operation graft



**Figure 3:** a and b. Partial eyebrow loss with burn injury reconstructed with facial forehead flap before and after operation



**Figure 4:** Left eyebrow loss, eyebrow defect reconstructed with superficial temporal artery island flap: a. before operation, c. after operation, donor scar showed in Figure 5b.

supplies. Though mini or micro follicular-unit hair grafting is a safe and simple method, it is advised for minor eyebrow defects.<sup>[10-12]</sup> In case micro follicular grafting is applied for large defects, it may require several stages and therefore is not cost-effective.

## CONCLUSION

Forehead Island Flap with inferior facial pedicle is suggested as a safe and simple method with less donor alopecia and other complications.



**Figure 5:** This patient suffered from facial burn with acid and eyebrow defect. a. Before eyebrow reconstructed with forehead flap with inferior pedicle donor scar is minimal b-c. final outcome



**Figure 6:** a and b. Case of burn injury with eyebrow defect which was reconstructed with superficial temporal artery flap. In Figure 7b, hair density and direction need some revision

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## REFERENCES

1. Motamed S, Davami B. Eyebrow reconstruction following burn injury. *Burns* 2005;31:495-9.
2. McCarthy JG, May JW, Littler JW. *Plastic surgery*. 1<sup>st</sup> ed. WB Saunders Company: Philadelphia; 1990. p. 2218-22.
3. Kocer U, Ulusoy MG, Tiftikcioglu YO, Aksoy HM, Cologlu H. Frontal scalp flap for aesthetic eyebrow reconstruction. *Aesthetic Plast Surg* 2002;26:263-6.
4. Omranifard M. Eyebrow reconstruction. In: *Proceedings of the 9<sup>th</sup> international society of craniofacial surgery*. Craniofacial Surgery 9. Bolognay: Monduzzi; 2001. p. 271-2.
5. Strauch B, Hall-Findly LO, Hall-Findlay EJ. *Grabb's encyclopedia of flaps*. Lippincott-Raven: Philadelphia; 1998.
6. Stamatopoulos C, Alexakis R, Tsoutsos D, Michaelidid CH, Kastanan O, Ioannovich J, *et al*. The use of temporal artery flap in defects of the head and neck. *Ann Medil Burns Club* 1994;7:28-39.
7. Kim KS, Hwang JH, Kim DY, Lee SY, Cho BH. Eyebrow island flap for reconstruction of a partial eyebrow defect. *Ann Plast Surg* 2002;48:315-7.
8. Juri J. Eyebrow reconstruction. *Plast Reconstr Surg* 2001; 107:1225-8.
9. Ziccardi VB, Lalikos JF, Sotereanos GC, Patterson GT. Composite scalp strip graft for eyebrow reconstruction: Case report. *J Oral Maxillofac Surg* 1993;51:93-6.
10. Wang J, Fan J. Aesthetic eyebrow reconstruction by using follicular-unit hair grafting technique. *Zhonghua Zheng Xing Wai Ke Za Zhi* 2002;18:101-3.
11. Vachiramon A, Aghabeigi B, Crean SJ. Eyebrow reconstruction using composite graft and microsurgical transplant. *Int J Oral Maxillofac Surg* 2004;33:504-8.
12. Wang J, Fan J. Cicatricial eyebrow reconstruction with a dense-packing one- to two-hair grafting technique. *Plast Reconstr Surg* 2004;114:1420-6.

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