

The Science and Art of Eyebrow Transplantation by Follicular Unit Extraction

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Abstract

Eyebrows constitute a very important and prominent feature of the face. With growing information, eyebrow transplant has become a popular procedure. However, though it is a small area it requires a lot of precision and knowledge regarding anatomy, designing of brows, extraction and implantation technique. This article gives a comprehensive view regarding eyebrow transplant with special emphasis on follicular unit extraction technique, which has become the most popular technique.

Keywords: Eyebrows, transplantation, follicular unit extraction, implantation

INTRODUCTION

Eyebrows are the most expressive feature and create a masterline of the face. It is the reference point towards which all other angles and contours of the face are set. Hair transplantation for eyebrow loss was pioneered by Dr. Okuda in 1939 and thereafter has been performed for many years. Restoring eyebrows have become a very popular procedure due to the growing information and outstanding results. With the extensive experience of authors in the field of follicular unit extraction (FUE), especially in advanced baldness, body hair transplant and facial hair restoration, it is now feasible to perform high-quality surgical techniques creating satisfactory results and a happy outcomes to patients with realistic expectations.

ANATOMY

Eyebrow has been divided into 3 sections^[1] [Figure 1]:

- **Head:** It is most inner portion, pointing upwards for 0.5–0.7 cm. It contains small calibre, lighter colour hair. Some individuals do not like to highlight this section and want to keep it minimum.
- **Body:** This is the central 2.5 cm part which is most dense and wide. In the medial part, hairs point upwards and laterally. At medial limbus, central convergence begins leading to herringbone pattern, that is, lower portion

points upwards and upper portion points downwards creating a ridge of high density.

- **Tail:** It is the outer 2 cm where central convergence continues till tail end. This is a less dense area filled with smaller calibre hair. This area becomes less pronounced with age.

An ideal brow^[2] includes an ideal mediolateral extent and an ideal shape [Figure 2]. The medial end of brow should start on the same vertical plane as the lateral extent of ala and inner canthus. However, it may change according to intercanthal distance.^[3] Brow should begin medial to medial canthus for an increased intercanthal distance (equal to an eyewidth apart) and lateral to medial canthus for decreased intercanthal distance. The eyebrow should end laterally at an oblique line from the most lateral point of the ala through lateral canthus. The major consensus in the past was to keep medial and lateral ends at the same horizontal level. Still some believe that the medial brow should be lower than the lateral brow and should start as a continuation of the superciliary ridge.^[4] Excessive elevation of medial brow can lead to surprised look. Even medial placement of peak creates 'surprised' appearance. Low medial brow with

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Access this article online

Quick Response Code:



Website:
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DOI:
10.4103/JCAS.JCAS_27_17

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How to cite this article: Gupta J, Kumar A, Chouhan K, Ariganesh C, Nandal V. The science and art of eyebrow transplantation by follicular unit extraction. *J Cutan Aesthet Surg* 2017;10:66-71.



Figure 1: Anatomy of eyebrow showing 3 sections, head (red), body (blue), and tail (green) from medial to lateral end

a high lateral peak induces angry look. Inferior placement of lateral edge can create a sad expression.

The apex or the arch should lie on a vertical line directly above the lateral limbus. However, this is the most controversial point of eyebrow implantation, and recent consensus is to keep the arch more lateral than the lateral limbus and may be just medial to the lateral canthus.^[5,6]

In males, the eyebrows overly the orbital rim, are heavier and thicker with little or no arch. The lateral brow appears more prominent, because there is uniform thickness and density throughout.^[7] [Figure 3]. However, in females, the eyebrow extends a few millimetres above the orbital rim. There is a pleasant arch peaking in the lateral third. The medial part is more dense and thicker than the lateral end. The average length of eyebrow is 5.5 cm in men and 5.0 cm in women. The maximum eyebrow width is 1.5 cm in men and 1.3 cm in women.^[8]

An idealised brow will be an eyebrow drawn taking consideration of above-mentioned features on an idealised face, that is, an oval face. However, the brow is supposed to be individualised according to the face shape. The basic concept is to have more horizontal portion to make a long face appear more round and to have more vertical orientation to create an illusion of length in round faces.^[9]

The oval face will require soft angled idealised brow. The goal in a round face is to make it appear longer which is achieved by high arch eyebrows with peak moved out towards the end of brow and tail kept short. Gentle curving of brow is avoided. Long face should have flat eyebrows to make the face appear shorter. The goal in a square face is to soften or just balance a strong jawline. The brow should start with a little curve and then add more angle to balance it. The peak should be directly above the square of jaw and stronger the jawline, more defined the peak should be.

PRE-PROCEDURE EVALUATION

The most common indications of eyebrow transplant are cosmetic such as congenital absence or inadequate coverage,

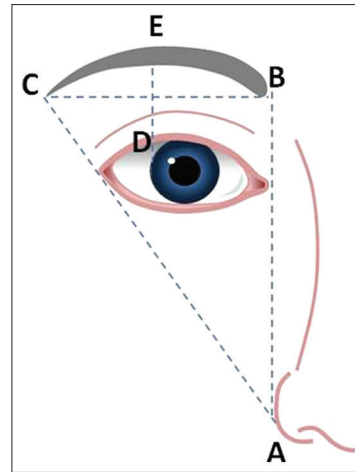


Figure 2: Westmore's model of eyebrow aesthetics

of a normal appearing eyebrow requiring darker colour or an uneven eyebrow with lack of lateral third or medial portion. The other common indications are trichotillomania, scar due to trauma, burn or tumours, stable alopecia areata, madarosis due to hypothyroidism, leprosy, etc.^[10]

A right candidate is one who has realistic expectations, understands limits in density achieved, has a pronounced defect than purely cosmetic purposes and stable or treated disease.

The patient should be counselled regarding the limit of density achieved in a single session and requirement of a repeat session if desired density is not achieved. The patient should also be counselled regarding need for doing make-up using eye brow pencil to enhance the results achieved. Furthermore, there will be some misdirection in 10%–15% follicles and trimming would be regularly required (biweekly in most). However, growth rate may get synchronised with time due to recipient codominance.^[11,12]

No special pre-operative blood work is required except ruling out blood-borne viral infections such as HIV, hepatitis B and C. Anaesthesia sensitivity test should be done to prevent any anaphylaxis.

METHODS

Previously, hair-bearing superficial temporal artery island flap leading to brush looking eyebrow and whole strip grafting causing poor growth were used.^[13] Neither the desired growth nor desired direction was achieved with either of these primitive techniques. Follicular unit transplant (FUT) has been used for a long time using single hair grafting for brow transplant.^[14,15] However, with growing advent of Follicular Unit Extraction (FUE), brow transplant can be done easily without the unease of any sutures and with minimal downtime. There has been use of artificial hair implantation for eyebrow reconstruction, especially in cases where donor area is not available, for example, alopecia universalis. However, author prefers not to use them because of the risk of foreign body reaction [Figure 4] which scars the area permanently leaving



Figure 3: Male (a) versus female (b) eyebrow

more psychological impact than having no or sparse eyebrow. In case of limited donor area availability, it is preferable to do camouflage techniques only.

HAIRLINE DESIGNING

Usually, the patient is first asked to recreate the eyebrow known as desired eyebrow. Then, an effort is made to have active inputs from the patient to choose from desired brow, ideal brow and individualised brow. It eliminates the gap between expectation and outcome leading to more happy patients later. Pre-cut eyebrow templates are also available but they are usually not preferred as it leads to formation of less aesthetic eyebrows.

Special precaution should be taken for ensuring symmetry of eyebrows. After finalising the shape, mark the normal eyebrow on one side. This marking is then transferred to a sterile Telfa pad by applying moderate pressure which is then cut along the markings, and a template is obtained. This is then reversed horizontally and placed over the opposite brow area at desired height and position and the new brow is marked.

ANAESTHESIA

Since there is not a single nerve which supplies the eyebrow, a single nerve block would not be possible to anaesthetise the full brow. Eyebrow is usually innervated by infratrochlear, supratrochlear, supraorbital, lacrimal and zygomaticotemporal nerves. It is better to give a ring block by infiltration with lignocaine and bupivacaine with adrenaline to have immediate and prolonged action. Use of tumescence is restricted to minimum amount to prevent post-procedure eyelid swelling. Pressure taping is applied just below the eyebrow on the eyelid to decrease post-operative swelling [Figure 5].

RECIPIENT SITE CREATION

Ideally, few one hair follicles should be extracted from donor area and then requisite size and depth should be created on

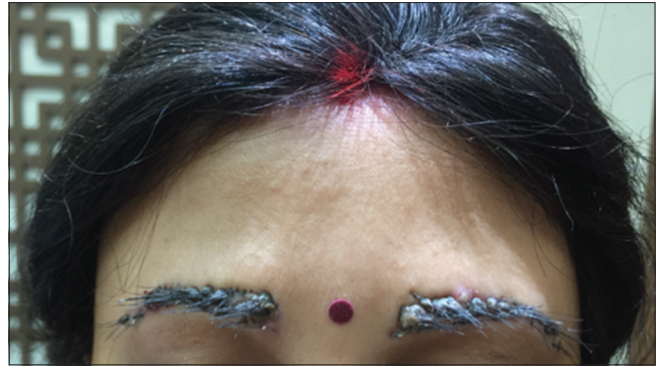


Figure 4: Foreign body reaction to artificial hair implantation in case of alopecia universalis

recipient site [Figure 6]. Usually, 0.7–1.1 mm blades (preferred by authors) or 19–21-gauge sharp injection needles are used.

All the boundary of the marked area should be first created with blades to avoid any wrong creation of eyebrow shape in case if marking is erased whilst slit creation. Direction in the head region should be directly vertical or superior. Laterally, direction rapidly becomes horizontal (first along the upper edge) creating a herringbone pattern. In the tail, direction is primarily lateral, with little cross-hatching at the end [Figure 5].

Coronal slits provide better control of angle whereas sagittal slits take better control of curl. Since curl control is more crucial to the final aesthetic outcome, sagittal slits are preferred. Hair should usually exit at a very acute angle, almost as flat as possible at a density of not more than 30–35 FU/cm².

EXTRACTION

An ideal donor hair provides natural shape, natural hair shaft calibre and without hair growing to excessive length.

In a case of scar or where only part of brow has to be restored [Figure 7], it would be essential to actually measure the diameter of brow hairs and match them with different parts of scalp. The best possible matching should be chosen as the donor area.

The donor area could be occipital area, pre-auricular or nape of the neck. Occipital area has coarse, long hairs with few single follicles. Nape and pre-auricular areas have softer, finer and genetically shorter hair than scalp hair. Since males have thicker eyebrows and can have possibility of retrograde alopecia in future, occiput and pre-auricular areas are preferred. However, females have thin and fine eyebrows and risk of retrograde alopecia is minimal. Therefore, nape of neck and pre-auricular areas are preferred.^[16] However, good healing is usually seen in this area but women wearing hair in a ponytail should be well informed before surgery.

Since body hair regrowth is less reliable and it is difficult to control curl, it is not personally preferred by the authors.

In a FUE procedure, hairs need to be trimmed which is considered as downside in comparison to FUT because

natural curvature of the hairs, which is used to help guide the placement of the grafts becomes difficult to assess. Authors usually prefer doing a conservative trimming, that is, around 3–4 mm hair left on the surface to see curl of the hair.

Usually, 0.75–0.80 mm sharp serrated punches are preferred.^[17] One hair FU^[18] is extracted preferentially which is one of the major advantage in FUE over FUT procedure. In case of shortage of single hair FU, subfollicular harvesting is preferred. On an average, 200 single FU each side are required at a density of not more than 30–35 FU/cm². However, number of grafts can differ according to the thickness and length of the eyebrow. Extreme densities can cause an increase in number of sebaceous glands transplanted along with the grafts, which are unregulated and over produce sebum.^[19] Furthermore, transection of sebaceous glands during incisions in the recipient site to create slits, can release sebum into the surrounding tissue causing cyst formation.^[20] These can occur more frequently during dense packing of grafts.^[21]

Not all hairs are extracted in a single session as out of body time increases due to prolonged time consumed during implantation. Usually, not more than 200 FU are taken at one point of time.

IMPLANTATION

Grafts are placed in group of 50's and implanted in the first extracted first implant basis [Figure 8]. Out of body time should

be limited less than an hour. The grafts are stored in chilled saline 4–8°C for hydration. They are implanted using no touch to root technique with use of 2 forceps. Extra care is given to match up the curl of existing hair. Ideally, best and most experienced planter should do implantation to decrease trauma to follicle roots caused because of multiple attempts to implant known as repetitive placement trauma. It is preferred to have only one planter on one eyebrow throughout the implantation procedure.

No trimming, no defatting, and de-epithelialisation of grafts are done as it is usually not required in grafts extracted by FUE technique.

Differential placement is done where finest single follicles are reserved for edges, especially superior and lateral and coarse hair are reserved for central eyebrows.^[16]

Consideration of vascular factors for survival of hair grafts is important.^[22]

Till 3–7 days of transplant, nourishment of grafts is obtained through passive oxygen diffusion. By end of 7 days,



Figure 5: Recipient site creation with pressure taping just below eyebrows

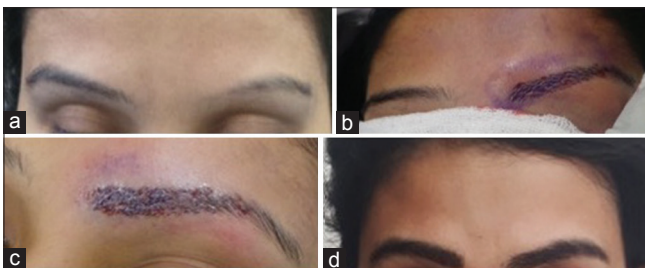


Figure 7: Unilateral loss of left eyebrow due to burn (a), recipient site creation (b), immediately after transplant (c), after 9 months of eyebrow transplant with additional eyebrow pencil (d)

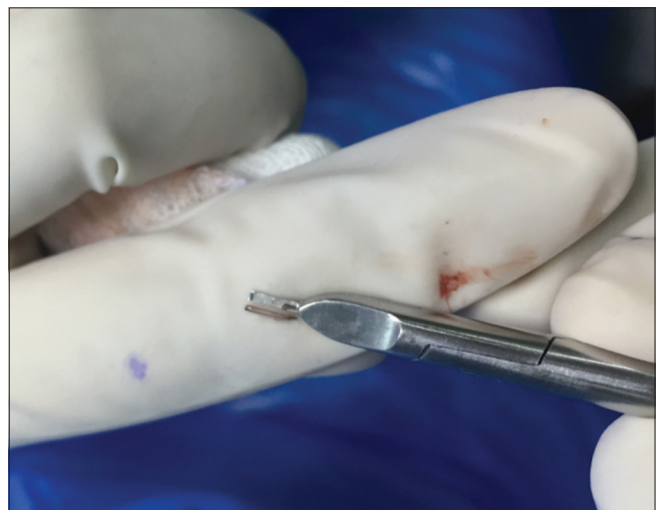


Figure 6: Matching of size and depth of follicles with blades

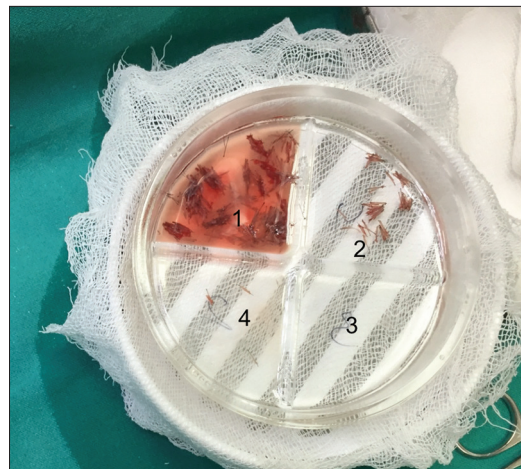


Figure 8: Storage of grafts



Figure 9: Eyebrows immediately after surgery (a), 2 weeks after surgery (b), 6 months after transplant (c)

revascularisation of graft is restored. Bio-enhancement with the use of liposomal adenosine triphosphate (ATP) (ATPv adenosine triphosphate lipid vesicle solution Energy Delivery Solutions, Jeffersonville, IN 47130, USA) during initial 7 days every 2 hourly as a post-operative spray can make up for shortfall in oxygen and can lead to better growth of grafts.^[23,24] The author also prefers to do bio-enhancement at the end of transplant with platelet-rich plasma therapy in both recipient and donor area. It stimulates angiogenesis and decreases anagen effluvium leading to early result of transplant. It also enhances donor area healing.^[22]

POST-OPERATIVE CARE

Recipient areas are kept open and donor area dressing is done for 2 days. Liposomal ATP in normal saline (1:10 ratio) is given as a spray every 2–3 hourly. Bruise and swelling can last for few days. Antibiotics, painkillers and oral steroids 40–60 mg/day are given for initial 3–5 days.

The patient can start doing make-up on the periorbital area from the next post-operative day and in the eyebrows after all crusts have fallen off. Hair wash starts after 3rd post-operative day, that is, after removal of dressing. Initially, almost all brow transplanted hair fall due to anagen effluvium.^[25] Hair regrowth begins at 3–4 months. In next 4–6 months, number increases leading to increased density [Figures 9 and 10]. Patients are instructed to apply hair gel from 3-week onwards to train misdirected hairs. No touch-up session are done before 9 months of transplant.^[14]

COMPLICATIONS

Usually, most common complications are related to direction and curl, colour and texture mismatch or lack of regrowth.^[26] These complications are operator dependent and decrease with experience and using the right technique. There can be asymmetry because of frontalis or orbicularis retraction after giving anaesthesia which creates misjudgment regarding

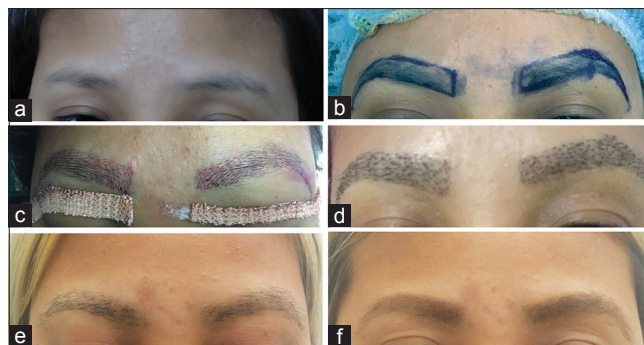


Figure 10: Eyebrows at baseline (a), marking before transplant (b), recipient site creation (c), 2 days post-surgery (d), 6 months after transplant without make-up (e), 6 months after transplant with make-up (f)

eyebrow shape whilst slit creation. Infection, swelling, bruise, folliculitis and scarring are rarely seen.^[21]

CONCLUSION

With the use of highest standards of techniques and with increasing experience, one can provide excellent and beautiful results provided patient has informed and realistic expectations.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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