

## Follicular Unit Transplantation for Male and Female Pattern Hair Loss and Restoring Eyebrows

Marc Avram, MD

905 5th Avenue, New York, NY 10021, USA

Hair transplantation can consistently restore a natural undetectable frame of hair around the face. From the 1960s to the late 1990s, 3- to 4-mm grafts containing 15 to 25 hair follicles were the mainstay of hair transplantation despite the fact that hair naturally grows in bundles of 1 to 4 hair follicles. The 15- to 25-hair grafts looked unnatural because they were unnatural on the scalp. This technique created the poor public perception of “pluggy” transplanted hair, which no patient should experience in the twenty-first century. Today, surgeons meticulously harvest natural 1- to 4-hair follicular groupings from donor hair and implant them in the recipient region in men and women, creating consistently natural appearing hair (Figs. 1 and 2).

### The consult

All patients undergoing hair transplantation should expect natural appearing transplanted hair. Anything less is unacceptable with the changes in technique over the past decade. Patients with all skin types and hair colors are candidates for surgery. The Norwood and Ludwig classifications are used to stage hair loss for men and women (Figs. 3 and 4). A physical examination of the scalp and questions regarding the patient's hair loss history are performed at the beginning of the consult (Table 1). An important part of creating realistic expectations is to review the expected density from the procedure. The perceived density of a procedure is equal to the number of hair follicles transplanted minus the natu-

ral ongoing hair loss in the transplanted region. Patients with below average donor density and fine hair will have natural but thin transplanted hair. Patients with above average density and caliber of hair can expect a greater perceived density. Patients with an abundance of remaining hair but rapid loss of hair may have less hair 12 months after surgery, whereas a bald patient will have a major increase in density 12 months after surgery.

Minoxidil and finasteride are excellent adjuncts to help maintain existing hair (Table 2). Both medications are more effective for patients with earlier stages of hair loss and are an excellent treatment option for patients losing hair who are not candidates for surgery. For patients who are candidates for surgery, continuing medical treatment will often help increase the density of transplanted hair by slowing down the rate of loss of existing hair and increasing the caliber of existing and transplanted hair. In addition, these medications may help reduce a post-surgical telogen effluvium in women and men with diffuse thinning and maintain donor density. Despite recent 5-year studies confirming the long-term benefit of these medications, it is vital surgeons still apply the same criteria for candidate selection and hairline design in patients with successful medical treatment. These medications are elective and should always remain that way for patients. If a patient decides to stop medical therapy, the transplanted hair must have a natural distribution and appearance.

### Eyebrows

Eyebrows frame the face. For most patients with alopecia totalis (complete loss of hair on the scalp and

E-mail address: DocHair@aol.com

0896-1549/05/\$ – see front matter © 2005 Elsevier Inc. All rights reserved.  
doi:10.1016/j.ohc.2005.03.001

*ophthalmology.theclinics.com*

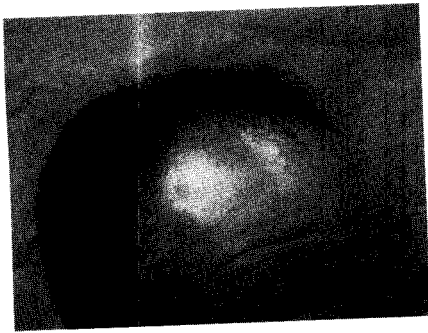


Fig. 1. Preoperative photograph of a patient with Norwood type IV hair loss.

eyebrows), the most pressing cosmetic goal is to restore the eyebrows and not scalp hair. In today's society, many men choose to shave their scalp hair completely. Actors, men in print advertisements, and colleagues at work have electively chosen this style, but all have remaining eyebrows. In addition, eyebrows reflect our emotions, surprise, concentration, and other facial expressions.

Patients with alopecia areata or totalis should be treated medically not surgically. Traumatic injury and skin cancer scars are the most common referral for surgical reconstruction of eyebrows. Many traumatic injuries are self-induced from chronic plucking. It is vital to establish whether the trauma is still occurring. If active trauma is still occurring, surgery should not be performed, and the patient should be referred to a behavioral therapist.

No donor source has the same caliber and rate of growth as eyebrows. The best available donor source is from the posterior scalp. This hair has a different caliber and rate of growth. All patients will need to trim the transplanted hair in the eyebrows every 2 weeks. In addition, the cosmetic appearance will never be completely natural. Transplanting hair into

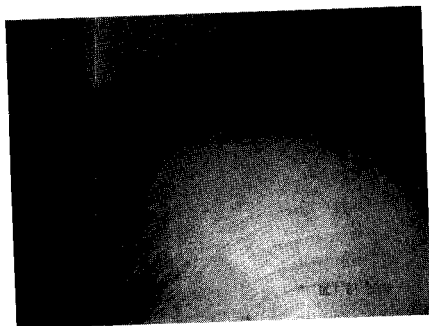


Fig. 2. Patient in Fig. 1 after 1430 1- to 4-hair grafts.

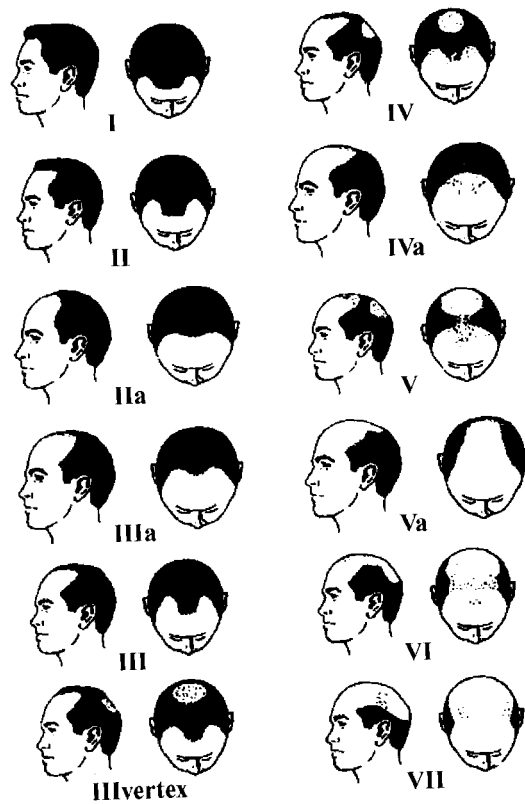


Fig. 3. Norwood classification of staging hair loss.

the eyebrow is not a perfect cosmetic solution but will often improve the cosmetic defect in a patient. If the patient understands the risks and benefits of transplanting eyebrows, he or she will be happy.

**The procedure**

The limiting factor in hair transplantation is the amount of hair available in the donor scalp of patients. For decades, steel punches measuring from

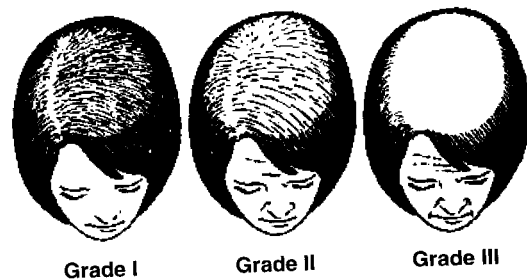


Fig. 4. Ludwig classification of staging hair loss.

Table 1  
Hair transplant consult

Questions	How long have you noticed hair loss? Rate of hair loss? Which medications (prescription or alternative) have been tried and for how long? Expectation?
Physical examination	Norwood or Ludwig stage of hair loss Donor density Caliber of hair follicles
Key points to emphasize before hair transplantation	Ongoing rate of hair loss affects the perceived cosmetic density of a hair transplant Ongoing hair loss may affect the cosmetic appearance of a transplant Visible donor scar or scars if hair is shaved in posterior scalp Limited donor supply

3 to 5 mm were used to harvest donor tissue from the posterior scalp. This harvesting resulted in extensive scarring over the posterior scalp and an inefficient use of valuable donor hair. The introduction of the scalpel in donor harvesting has made 3- to 5-mm steel punch harvesting obsolete in the field of hair transplantation. By taking an ellipse from the posterior scalp, the surgeon can optimize the amount of donor hair used in hair transplantation while limiting the resulting scarring over the posterior scalp. To produce thin 1- to 3-mm wide scars, the width of the donor ellipse

should not be more than 1 cm. The size of the donor ellipse harvested is a reflection of the density of the donor hair. The average patient has 75 1- to 4-hair grafts per squared centimeter. For example, an average 1000-graft surgery using all natural follicular bundles requires a 13- to 14-cm long by 1-cm wide donor ellipse.

The donor region is anesthetized with 1% lidocaine with 1:200,000 epinephrine. A total of 30 to 50 mL of saline is added to create an infiltrated donor region. The increased turgor results in better hemostasis and less transection of hair follicles. The ellipse is removed by a scissor, carefully dissecting below the bulbs of the hair follicles. The donor strip is placed in chilled saline, and the site is closed with staples that are removed 1 week after surgery.

Recently, a few surgeons have advocated using 1-mm punches to harvest donor tissue. This proposed method has a limited role in donor harvesting for several reasons. First, less hair is harvested for each session, resulting in longer and more transplant procedures for comparable density. Second, there is a much higher transection rate than with an ellipse. Third, more scarring occurs in the donor region. Fourth, patient discomfort is increased owing to the longer operative time.

The surgical team carefully separates the natural bundles from the donor strip. The 1-to 4-hair grafts are produced by a variety of methods. Cutting instruments include a No. 11 or 15 blade, a No. 10 prep blade, and other instruments. Good lighting, comfortable chairs, and well-designed instruments are prerequisites to produce thousands of high-quality grafts.

Table 2  
Food and Drug Administration approved medications for male and female pattern hair loss

Parameter	Finasteride	Minoxidil
Mechanism of action	5-Alpha reductase type 1 inhibitor blocking the conversion of testosterone to dihydrotestosterone	Unknown
Key to success	Emphasize maintenance over regrowth of hair and compliance for at least 6-8 months to see benefit	Emphasize maintenance over regrowth of hair and compliance for 6-8 months to see benefit
Side effects	2% Of men experience sexual dysfunction that is reversible within days if discontinued No allergic reactions, blood monitoring, or drug interaction Females should never handle or take medication	Dryness and pruritus of the scalp Rare allergic reaction
Clinical onset of action	6-8 Months	6-8 Months
Dose	1 mg qd with or without food	2-4 Drops one to two times daily to frontal and vertex of scalp
Candidate selection		
Norwood II-IV	Highly effective	Highly effective
Norwood V-VI	Somewhat effective	Somewhat effective

Microscopic dissection of 1- to 4-hair grafts from donor tissue may help create high-quality grafts. Data regarding microscopically dissected donor tissue and the subsequent yield of transplanted hair are inconclusive. What is not debated is the need to create intact minimally traumatized follicular groupings, placing the transplanted hair as efficiently and quickly as possible into the recipient sites to optimize the survival of hair and produce the greatest density possible.

While surgical assistants create the grafts, the physician anesthetizes the recipient region with a combination of 1% lidocaine and 0.25% Marcaine with epinephrine using a combination of field blocks and local infiltration. The key to success with anesthesia and hemostasis is superficial infiltration in the dermis.

The hairline defines the cosmetic success of a hair transplant in men. As is true for hair graft creation, the trend in hairline design has been to mimic as closely as possible what occurs in nature. The goal of a hairline is to frame the face in an undetectable manner.

For decades, surgeons creating hairlines took the name *hairline* literally, resulting in a straight sharp demarcation between skin and thick hair-bearing skin. Such a literal hairline does not exist; rather, a natural transition zone occurs of gradually increasing density from skin to terminal hair-bearing skin. The level at which the transition zone is created varies from individual to individual. The surgeon should look at each patient in a global 360-degree view before deciding where to place the hairline. Androgenetic alopecia is progressive, but transplanted hair will grow long-term; therefore, when viewing pa-



Fig. 5. Preoperative photograph of woman with thinning hair.



Fig. 6. Increased density in the frontal hairline after placement of grafts in patient in Fig. 5.

tients, surgeons must assume that all patients will progress to at least Norwood level V. A newly created hairline should look equally natural 1 year and 20 years after surgery.

The height of the hairline varies from person to person. Hard and fast rules of how many centimeters a hairline should be placed above the glabella should not be followed. The shape of the patient's head and forehead and the level of temporal hairline recession will determine the ideal esthetic placement of grafts to produce a natural frontal hairline.

The posterior hairline should mimic the natural semicircle that expands as hair loss progresses in the vertex of the scalp. As is true for the frontal hairline, the posterior hairline should be designed anticipating ongoing hair loss in the future. To avoid future esthetic complications, the posterior hairline should be placed in the same plain as the frontal hairline. This placement will avoid "chasing" the ever-



Fig. 7. Preoperative photograph of woman with loss of hair in the temporal hairline.



Fig. 8. Increased density after placement of 1- to 4-hair grafts in patient in Fig. 7.

expanding ring of hair loss on the vertex of the scalp with valuable donor grafts.

#### *Grafting in women*

The advent of 1- to 4-hair grafts has created a highly effective natural solution for the millions of women affected by androgenetic alopecia. Unlike for men, hair loss is not socially acceptable for women. Unfortunately, it is often dismissed by a spouse or physicians.

In women, hairlines thin but do not recede. The "see through" appearance of hair is the main source of anxiety for women. The goal for women is not to create a new hairline but to place hundreds of 1- to 4-hair grafts behind the frontal hairline to recreate a natural density. The majority of transplanted grafts are placed in a 3- to 5-cm zone behind the frontal hairline to maximize density and minimize the risk of a postsurgical telogen effluvium. The increased density in the frontal hairline gives women the freedom to style their hair and not fear a gust of wind (Figs. 5 and 6).

The 1- to 4-hair grafts also produce natural appearing hair for women with significant loss of hair in the temporal hairline following facelift or endoscopic forehead surgery. It once again gives women the option to pull their hair back over their ears (Figs. 7 and 8).

#### *Eyebrows*

Harvesting hair from the donor region is performed for the eyebrows in the same manner as for the scalp. The donor site is trimmed with a moustache trimmer. The patient is placed in the prone position, and the donor strip is anesthetized with 1% lidocaine with 1:200,000 epinephrine. Approximately 75 follicular groupings are found per squared centimeter in the posterior scalp. On average, a 3 cm long  $\times$  .4 cm wide strip will yield 75-100 grafts. After harvesting the donor strip, staples or sutures are used and removed 7 days after surgery.

The instruments used to separate the hair follicles from the donor strip are the same ones used in the scalp. Eyebrows are the only area where two or three natural bundles are separated into individual hair follicles, because that is the natural pattern of eyebrow hair. The donor sites in the eyebrows are anesthetized with 1% lidocaine with 1:200,000 epinephrine. As is true in the scalp, the recipient sites are created with 18- or 19-gauge needles following the natural angle of eyebrow hair. Hemorrhagic crusting during the postoperative period resolves 6 to 8 days after surgery. The transplanted hair will begin to grow 3 to 4 months after surgery and fully grow in 6 to 8 months after surgery.

#### **The future**

Hair transplant teams can consistently create natural appearing transplanted hair for men and women that frames the face. The legacy of the large graft is the main obstacle challenging hair transplant surgeons. The public image of hair transplantation remains the "corn row." Hundreds of thousands of patients have benefited from the revolutionary changes in technique and are in the position to inform voluntarily a friend or the public of their surgery.

The next quantum leap will be the cloning of hair follicles. The quantity of available donor hair is the only factor limiting the density a hair transplant can produce. For patients undergoing eyebrow transplantation, cloning their own hair will provide the ideal source for transplant.

---