

# TECHNIQUES OF HAIR RESTORATION

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## Introduction

Few other subspecialties in the field of aesthetic surgery have experienced such profound advancements in technique and outcomes over the past 15 years as those in hair restoration. What once consisted of the procedure of *plug transplants* that yielded unaesthetic tell-tale results has now evolved into one of the most technically demanding procedures of *follicular unit grafting* that truly enables surgeons to create results that appear natural and undetectable.

Other advances in hair restoration include the newest surgical technique of *follicular unit extraction*, which eliminates donor strip excision, extends this procedure to the eyebrow, beard, and chest, and other body areas and includes the use of nonsurgical adjuvant therapies including the DHT-blocker finasteride and laser light therapy.

## Follicular Unit Grafting

The goal of hair transplantation is to create a natural appearance, one that mimics natural hair growth both in terms of numbers and pattern. The evolution of hair transplant techniques have been progressing toward this goal from the beginning of plug grafts to micrografts and minigrafts and to the follicular unit graft that contains hair exactly as it grows in the scalp.<sup>1-4</sup> Follicular unit grafting has made the more “surgically oriented” techniques obsolete, including scalp flaps, bald scalp reductions, and tissue expansion surgery except when used for scalp reconstruction for scarring.<sup>5</sup>

In follicular unit hair grafting, each graft contains a follicular unit, which is the natural bundling of one to three and sometimes four hairs, surrounded by a fine adventitial

sheath.<sup>6</sup> First described in the early 1990s, follicular unit grafting involves the dissection of each individual graft from a single donor strip under microscopic visualization to permit the careful removal of surrounding non-hair-bearing skin.<sup>7</sup> These tiny grafts are then transplanted into the scalp into incisions that measure 0.5 to 0.8 mm in size. Typical procedures include from 1,800 to 3,500 grafts, with a mean of 2,500 grafts, but can include as many as 4,000 or more. To dissect and then place thousands of grafts in a 6- to 8-hour procedure, most surgeons employ a team of 4 to 10 assistants.

## The Step-by-Step Procedure

The first step in the procedure is the marking of the proposed area, which often involves designing the hairline. With greater appreciation of the natural hair loss progression, current trend is toward more conservative hairline design. Many men today are receptive to having a more natural yet somewhat receding and/or thinning hairline versus no hair at all or an unnaturally flat hairline that is incompatible.

In the next step, the donor strip is excised, and the site is sutured closed. The fusiform-shaped strip, located along the back (and sometimes sides) of the anesthetized scalp, measures 8 to 14 mm in width and can extend up to 30 cm in length. Most procedures are performed under local anesthesia complemented by mild oral sedation. The donor site defect is closed primarily with a single row of running 3-0 Prolene® that are removed at 10 to 14 days. For out-of-town patients, a 4-0 Caprosyn® suture is used that dissolve in 3 to 4 weeks. In cases of high tension, several 2-0 or 3-0 Vicryl deep sutures are placed. In patients who do not have thick hair, a trichophytic closure can be used without complication helping avoid the risk

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of cyst formation by allowing hair growth through the scar by suturing the upper lip of the superior edge of the donor-site defect over the deepithelialized lower edge.

As soon as the donor strip is removed, the assistants begin the dissection process. Performed under the microscope to minimize transection of follicles, slivers are created from the large donor strip, each 1 to 2 follicular units wide. From these slivers, individual grafts can be then easily dissected, with the preservation of a small cuff of surrounding fat and skin. With an average scalp density of 70 to 80 follicular units per square centimeter, a donor strip 12 mm wide by 25 cm long will yield approximately 2,000 follicular units (equivalent to between 4,000 and 4,400 hairs).<sup>8,9</sup>

While the grafts are being dissected, the surgeon can begin making recipient sites. This all-important step must incorporate considerations such as angle of hair growth, hairline location and composition, and achievement of density. Anterior angulation of hairs is generally more aesthetic and creates the appearance of maximal density. Maximum density is further enhanced by the very close placement of recipient sites, especially in the central area of the frontal forelock. A natural-appearing hairline is one that contains primarily one and some two hair grafts arranged in an irregular pattern and alternating micro-zones of greater and lesser density. Figures 46-1 and 46-2 show close-up hairline views of this procedure. The design of the hairline must anticipate the aging of the patient and

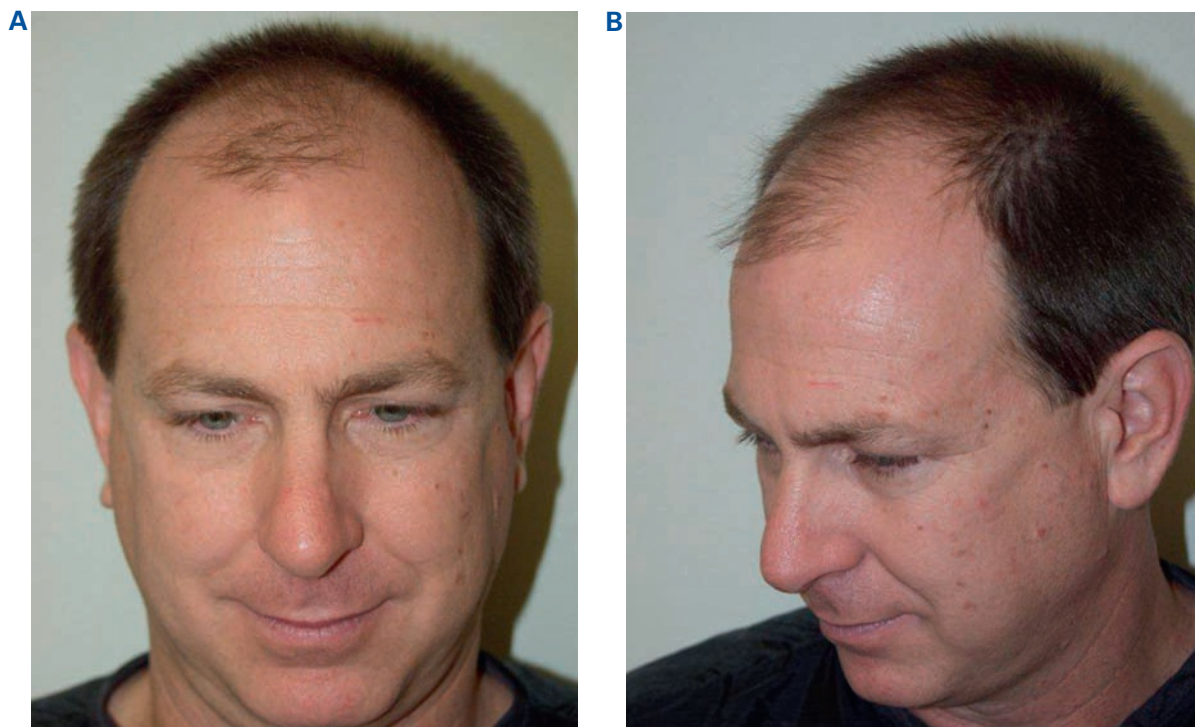
future hair loss to assure that the transplant looks natural for years into the future.

Once the recipient sites have been prepared, the grafts can then be placed. Taking caution to gently handle the grafts while keeping them moist, they are inserted one at a time into the recipient sites. This is usually the longest step and clearly the most technically challenging, particularly when grafts are being placed closely together into recipient sites to achieve maximum density.

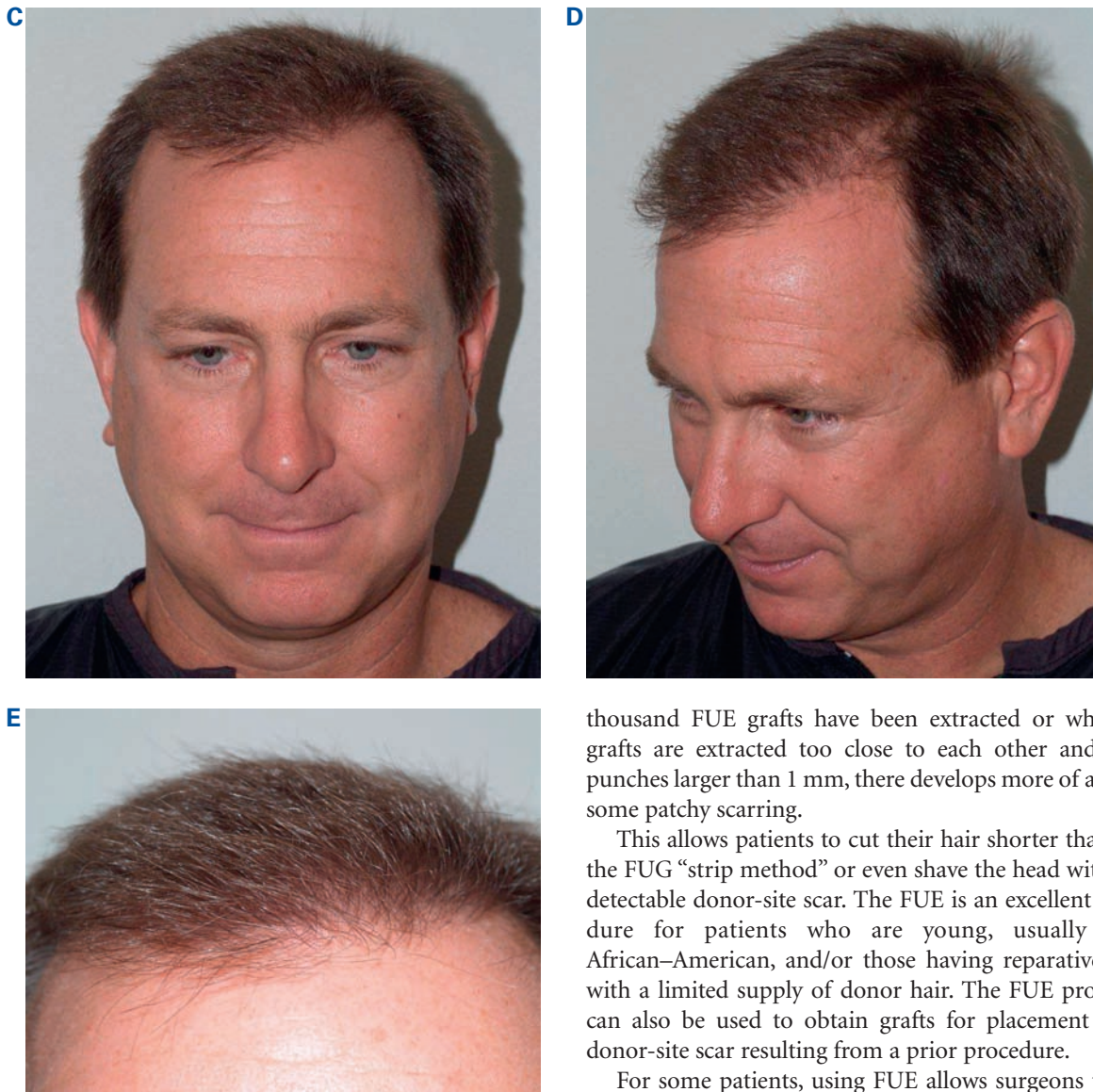
### Postprocedure Care

Post procedure care is straightforward and simple as follows:

- Patients are permitted to leave the office wearing a baseball cap or bandana to conceal any visible signs of transplant work.
- Hair washing is permitted on the first postoperative day.
- Full resumption of normal exercise and activities without restrictions is permitted 5 to 6 days after the procedure.
- All patients are offered the opportunity to receive post-procedure laser light therapy twice weekly for the first month as it may help healing and accelerate the regrowth of transplanted hairs (laser therapy discussed below).



**Figure 46-1** Before a 3,000 graft procedure *A*, and *B*, and 10 months after *C*, *D*, and *E*.



**Figure 46-1.** (Continued)

### Follicular Unit Extraction: An Alternative to Strip Grafting Technique

An alternative to obtain grafts from a single donor strip, follicular unit extraction (FUE) involves the individual extraction of donor grafts one at a time, using tiny 0.8 mm punches. This method is incredibly time-consuming and requires one full-day procedure by an experienced FUE team to extract, trim, and then implant 1,400 to 1,800 grafts and 2 days for 2,000 to 2,400 grafts.

The FUE donor sites heal as undetectable dots on the scalp. For most patients, there is no detectable reduction in hair volume in the recipient area or visible scarring after one or two procedures. However, after several

thousand FUE grafts have been extracted or when the grafts are extracted too close to each other and/or by punches larger than 1 mm, there develops more of a risk of some patchy scarring.

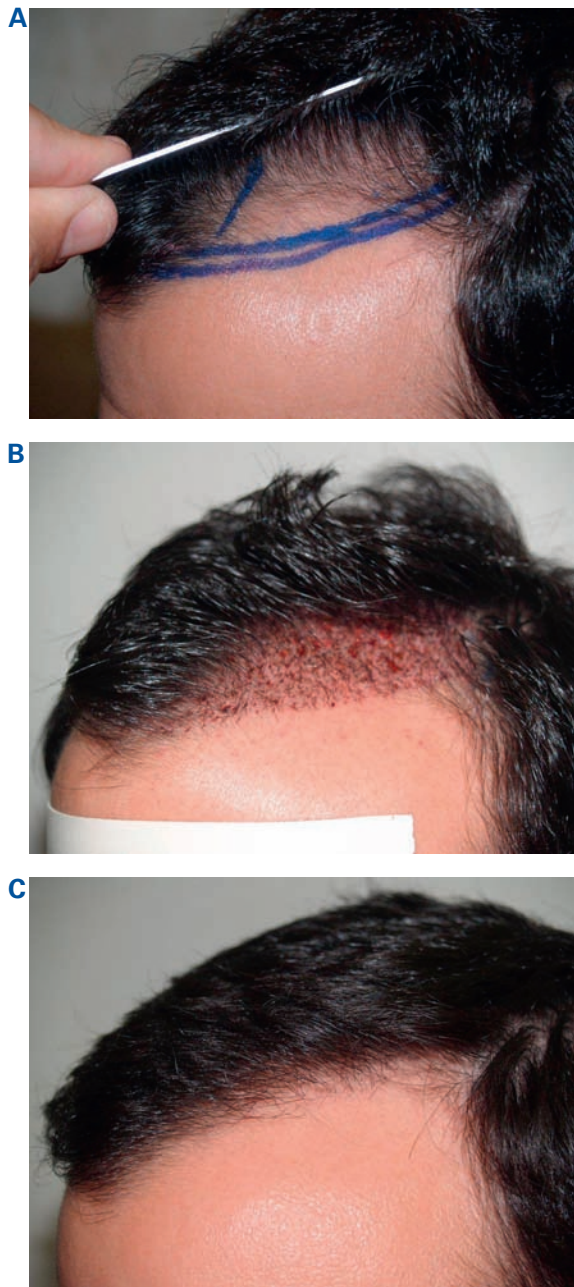
This allows patients to cut their hair shorter than with the FUG “strip method” or even shave the head without a detectable donor-site scar. The FUE is an excellent procedure for patients who are young, usually male, African-American, and/or those having reparative work with a limited supply of donor hair. The FUE procedure can also be used to obtain grafts for placement into a donor-site scar resulting from a prior procedure.

For some patients, using FUE allows surgeons to harvest body hairs, particularly from the chest and the beard, and then transplant them into the scalp, where they often grow as long as scalp hairs. For patients with a low supply of scalp donor hairs often due to prior transplants, these body hairs can provide extra scalp coverage.

### Treating Hair Loss in Women

Several classification schemes are used to categorize the different patterns of hair loss in women. Regardless of the pattern, features common to female-pattern hair loss include diffuse thinness that can involve the donor area, miniaturization of terminal hairs throughout areas of thinning, and widespread involvement. This presents several challenges to transplantation that the older technique of micrografting or minigrafting was largely unable to overcome. The larger grafts with a relatively

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**Figure 46-2.** Before a 2,100 graft procedure *A*, 1 day after the procedure *B*, and 8 months after the procedure.

large content of non-hair-bearing tissue required larger recipient sites, which increase the risk of damage to surrounding hairs and make it impossible to be closely placed together.

Follicular unit grafting to a large degree overcomes these challenges as the smaller grafts require smaller recipient sites, thus minimizing the damage to surrounding hairs. To maximize new hair coverage, more than one follicular unit containing one to two,

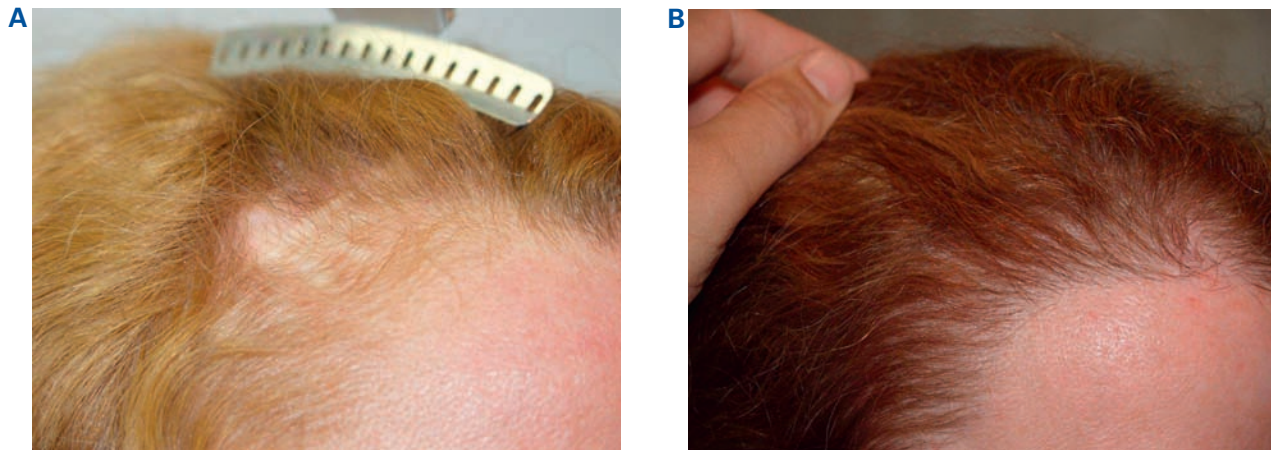
sometimes three hairs can be placed into a single recipient site so that a single recipient site may contain as many as three to five hairs.<sup>10</sup> This technique significantly expands the candidacy for hair transplants for many of my female patients, who represent over 25% of my surgical patients.

Successful results judged by the patient satisfaction are critically dependent upon establishing realistic expectations preoperatively. When treating female-pattern hair loss, I advise each patient on how much improvement to expect based upon the following important criteria:

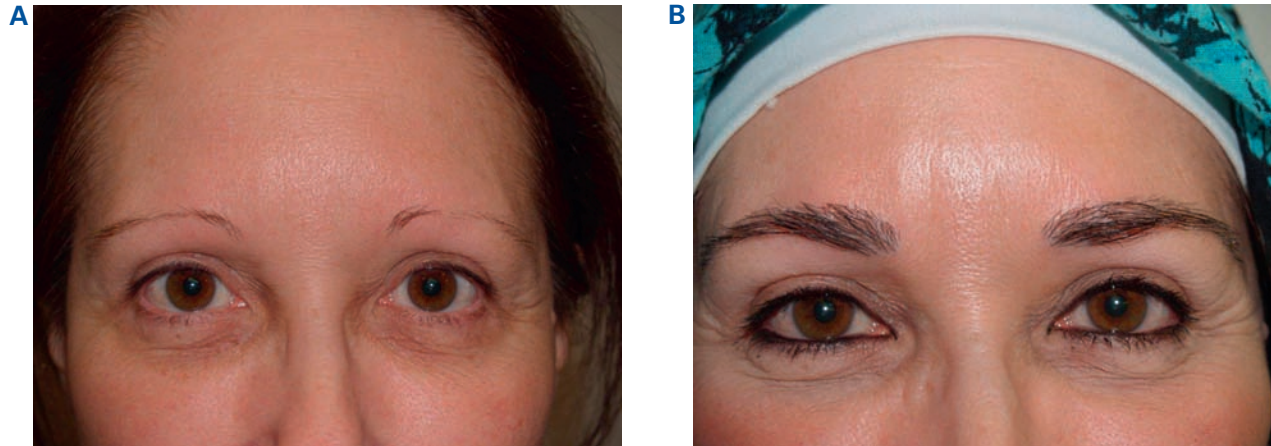
1. The caliber of her donor hairs
2. The total number of grafts that I anticipate obtaining in a procedure
3. Whether the hair loss pattern in the recipient area is composed of normal caliber hair with large spaces between the existing hairs or diffuse miniaturization with little spaces between these finer hairs
4. The color contrast between hair and scalp

Even using the very best technique, the patient who can expect the most impressive result is one with thick caliber donor hairs, a large number of donor hairs able to be harvested in a single procedure, a hair-loss pattern with spaces between average-to-thick caliber hairs into which the maximum number of grafts can be placed, and little color contrast between the scalp and hairs such as light scalp with blonde or gray hairs or dark scalp with dark hairs. Therefore, a typical procedure of 1,600 to 2,200 grafts can produce very different results in different patients. In each case, however, these grafts need to be concentrated in the most cosmetically important areas of the scalp, allowing for the most noticeable and impressive results.

In addition to treating female-pattern hair loss, other hair procedures in women include hairline advancement procedures, the treatment of scarring and hairline distortion from prior plastic surgery, and eyebrow and eyelash restoration. Two techniques are available for advancing the overly high hairline: (1) a modified browlift in which the entire frontal scalp is advanced forward and secured resulting in a shortened forehead (with or without brow elevation) and (2) hair grafting. For most female patients, the unique ability to round out the hairline as well as to fill in the frontal areas of thinning makes hair grafting the superior approach. Typically, to round out and advance the hairline by 2.5 cm requires a procedure of 1,800 to 2,200 grafts, with procedures as large as 2,800 grafts sometimes indicated for more advancement. When transplanting to areas of scarring most commonly resulting from prior plastic surgery, near-normal rate of hair growth can be expected when the scar tissue is mature and has a reasonable blood supply. See Figures 46-3 and 46-4.



**Figure 46-3.** *A*, Before a 850 graft procedure to repair scarring from prior plastic surgery and *B*, one year after the procedure.



**Figure 46-4.** *A*, Before a 600 graft procedure to eyebrows and *B*, seven months after the procedure.

### Body and Face Hair Transplants

Prior to the technique of follicular unit grafting, transplantation to areas such as the beard and eyebrow was not a very aesthetic option. With follicular unit grafting, the combination of the minute size of the grafts that is free of a larger cuff of skin that if present can result in scarring in the area transplanted, and the reliable control provided by microscopic visualization to assure that grafts have only one or two hairs and grow in exactly the direction placed, allow for the aesthetic restoration of body and facial areas.<sup>11</sup> There is a wide range of procedure sizes for each area transplanted. For the eyebrows, 100 to as many as 375 grafts can be placed into each eyebrow; for the chest, as many as 3,500 grafts or more can allow for coverage that can extend down to the abdomen;

and for the beard, 200 to as many as 2,600 grafts can restore just the goatee, the sideburns, or the entire beard. See Figure 46-5

### The Transgender Patient

Hair transplantation can play an important aesthetic and psychological role in the transgender process. For the more common male-to-female process, the receded and thinning hairline can be effectively rounded out and filled in to be made to look much more feminine with procedures of as large as 3,000 or more grafts Figure 46-6. Because female hormones are frequently administered, the hair loss tends to be stabilized, thus allowing for a more aggressive approach in transplanting. For the female-to-male process, transplantation of facial and chest hair can allow for a

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**Figure 46-5.** *A*, Before a 2,200 graft procedure to beard and *B*, eight months after the procedure.



**Figure 46-6.** *A*, Before a 2,300 graft procedure to advance the overly high female hairline in a transgender patient and *B*, one year after the procedure.

much more masculine appearance of two very important areas. Furthermore, chest hair can help conceal whatever scarring is present from breast reduction surgery.

### Nonsurgical Treatment

A few nonsurgical treatments, the medications minoxidil and finasteride and laser light therapy, have shown any

efficacy against male- and/or female-pattern hair loss. Minoxidil, used in concentration of 2% for women and 5% for men, is most effective in the crown region, where, realistically, approximately 50% of men respond with stabilization of hair loss and some hair thickening. Finasteride, a 5-alpha reductase inhibitor that should be taken orally once daily only by men, is somewhat more effective than minoxidil with an approximate 70% efficacy

in the crown and 30% efficacy further anterior. I find finasteride to be particularly indicated in young men who present with a high risk of advanced hair loss, in any male concerned about the progression of crown hair loss, and in those with thinning of the donor supply where finasteride can help increase the density.

Low-level laser light therapy has become a legitimate modality in the treatment of hair loss. While inconsistent in results, studies have shown that as many as 80% of patients stop losing more hair, and half that percentage actually show an increase in hair density due to thickening of vellus hairs. To date, there is an absence of strong clinical evidence of much efficacy, but there are suggestions that it truly is a worthwhile treatment. Many more studies need to be conducted to provide otherwise, but until then, I offer all my patients this treatment, including for the first 4 weeks post-transplant to help accelerate the regrowth of transplanted hairs.

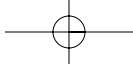
### Future Treatment Possibilities

Other than some minor refinements in existing treatment techniques within the next 5 years, major changes in how the specialty is practiced will likely not occur for at least 8 to 10 years. The near-future refinements will likely include improved graft storage solutions that lead to a higher percentage of hair regrowth and a reduction in the typical 3- to 4-month interval for hair regrowth to occur, improvements in efficacy of current medications, and perhaps some automation of the transplant procedure such as in graft dissection.

The major and revolutionary changes in the treatment of hair loss will focus on two important developments in general medicine: cloning and gene therapy. Cloning is more accurately described as cell multiplication or cell therapy. Early studies show the ability of in vitro-developed follicle stem cells to elicit some hair growth from hair deficient scalps. Currently set to begin phase II studies, hair multiplication may one day potentially overcome the problem of limited donor hair supply. With gene therapy, the possibility exists to treat hair loss from a genetic level one day, thus potentially stopping hair loss before it even begins to occur. Where and when this technology will be clinically applicable remains unknown, but such developments will certainly dramatically change the entire field.

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AQ1: Please confirm whether FUG can be expanded to follicular unit grafting.

AQ2: Please note that some comments (Reference these studies here?) given in the article has been deleted.

