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# Hair transplantation to the eyebrow, eyelashes, and other parts of the body

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Since its earliest applications, hair transplantation has been used for treating not only the scalp in pattern baldness but also other parts of the body, commencing with eyebrow reconstruction. The earliest micrografts were applied to the eyebrow more than 20 years before their application to the scalp became the standard of care [1–3].

While the popularity of hair transplantation today is largely a testament to the quality of results attainable for the treatment of male and female pattern hair loss, it can, and is, applied to a number of other areas. The principle behind transplanting these areas is the same—once transplanted, the hairs continue to grow because of the phenomenon of donor dominance. What follows is a review of the role and technique of hair transplantation to the eyebrows and eyelids, chest, beard and mustache, and pubic escutcheon.

## Reconstruction of eyebrows and eyelashes

Bald people are considered to be normal and healthy human beings, and they have the option of staying bald; however, madarosis, the absence of eyebrows or eyelashes, can be an unnatural, humiliating characteristic, attracting curiosity, causing social discomfort, and adversely affecting self-esteem and professional and romantic relationships. It is said that the eyes are the windows to the soul, reflecting our state of mind. Eyebrows create the expressions attributed to the eyes, such as surprise, fear, and rage, and that eyelashes are responsible for the sensual look, with blinking as Mother Nature's way of flirting.

On a functional basis, the absence of eyebrows and eyelashes makes the eyes more vulnerable. Eyebrows keep forehead perspiration away from eyes, and with squinting, facilitate the blocking of bright sun. Eyelashes keep dust and foreign bodies from the eyes and initiate the blink reflex.

In restoring anatomy, eyebrow and eyelash reconstruction surgery restores function, improves appearances, and elevates patients' self-esteem.

### *History*

In 1914 Krusius rebuilt eyelashes by harvesting scalp grafts with small punches then transplanting them to the ciliary border with the same punch [4]. In 1917 Knapp developed the technique of inserting a free strip graft from the eyebrow along the eyelid border [5]. In 1930 Sasagawa reported the method of hair shaft insertion [1]. In 1953 Fujita reconstructed eyebrows by punctiform hair grafting using an injection needle [6–8]. In 1980 Marritt transplanted follicular roots extracted from the periphery of 4-mm circular punches, inserting them in the eyelid border with a needle [9–11].

Other described methods of eyebrow reconstruction include free or pedicled strip hair grafts from the scalp or the contralateral eyebrow [12], temporal artery island flaps [13,14], and punch hair transplantation [15]. For eyelid reconstruction, other described methods include strip grafts from the eyebrows, pedicled flaps from the eyebrows, and strip sideburn grafts [16].

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Surgeons now use single-hair (and occasionally double-hair) grafts obtained through follicular unit dissection, harvested from the scalp.

*Etiology*

Loss of eyebrows and eyelashes can have a number of etiologies. The most common is trauma, such as avulsions and burns, and complications from tattooing and infections, when scarring results in areas of alopecia. The recent popularity of body piercing has been associated with cases of alopecic scarring following infection of piercing channels. Scarring from tumor surgery, radiation therapy, and inadequately placed incisions of direct browlift surgery can produce alopecia. Long-term electrolysis, plucking, or overzealous laser hair removal can result in thinned or absent eyelashes or eyebrows. Trichotillomania, an obsessive-compulsive disorder characterized by repeated hair pulling over a series of years, and a variety of dermatologic diseases [17] must also be considered and, if necessary, treated. Finally, endocrinopathies such as hypothyroidism (which can be treated) and congenital aplasia are also common causes.

*Consultation*

The role of the consultation is patient education and assessment of the patient's appropriateness for surgery. It is a time for the surgeon to provide realistic expectations, investigate potential etiologies of the hair loss, learn the goals of the patient, and ensure that there are no contraindications for surgery. In many cases, because the patient does not consider the procedure to be "real" surgery, there is a risk that some of the patient's medical history will not be provided [18]. A thorough medical history and examination should be focused on finding contributing etiologies to the hair loss.

While rare in the eye region, individuals who are prone to excessive scarring or to keloid formation should be advised of the risk and watched closely in the postprocedure period. The patient must be completely recovered from dermatologic diseases such as discoid lupus and alopecia areata, including obtaining clearance for the procedure by a dermatologist. Psoriasis is not a contraindication for surgery [18,19].

Hypertension and diabetes, while not contraindications for surgery, should be under clinical control. Cases of untreated or poorly treated hypothyroidism should be evaluated by an endocrinologist to reduce the chance of further loss of eyebrow hair. A patient who has trichotillomania or psychiatric illness should have clearance from a psychiatrist.

If desired, preoperative screening tests can include prothrombin and partial thromboplastin times, platelet count, and complete blood count. In nearly all cases, a thorough history is much more accurate than a battery of expensive laboratory tests in detecting any bleeding risks. If such risks are detected, a bleeding time is probably the most accurate objective measurement. Tests for HIV and hepatitis can be included according to the community's standard of care. Because of the risk of graft popping and hematoma formation, patients are advised to avoid aspirin and vitamin E for 10 days and alcoholic beverages and anti-inflammatory drugs for 3 days before surgery. Vitamin C 1000 to 2000 mg/day for 10 days might help reduce bruising.

Patients who have permanent makeup of the eyebrows or eyelashes are good candidates for surgical reconstruction. The tattoo does not interfere with graft integration, and it provides a background shade after surgery, enhancing the appearance of density. Patients who receive transplants are advised of the further enhancement that can be achieved by undergoing permanent makeup application to the area.

While illegal in the United States, in most other countries the implanting of nylon threads for baldness and other hair reconstruction is legal. Patients who have nylon eyebrow implants usually have chronic inflammation/infection with scar sequelae. Before definitive surgery, all remaining nylon remnants must be removed, and full recovery from the infection must be confirmed.

*Designing the restoration*

With the patient seated, the most natural design is marked out. With the patient's input, the limits of the proposed grafting can be altered to provide wider or narrower and shorter or longer coverage. Glamorous

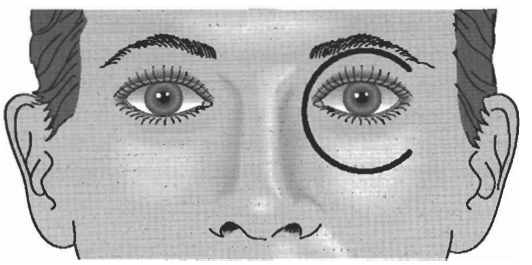

Fig. 1. The "ideal" feminine eyebrow. Note the arched appearance with the peak at a point directly above the lateral limbus.

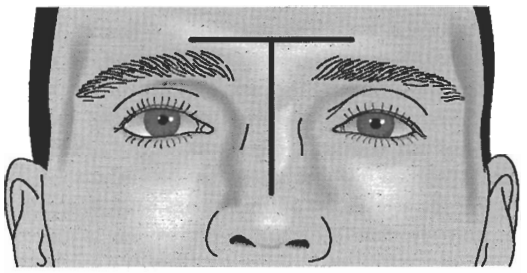

Fig. 2. The "ideal" man's eyebrow. Note the flatter appearance than the woman's eyebrow.

or stylish designs are typically avoided because the goal is to follow natural anatomical patterns.

The female eyebrow is typically more cephalic than the orbital rim, with a mild to moderate arched shape that is most cephalic at a point superior to the lateral limbus (Fig. 1). The male eyebrow is typically lower and less arched with a straighter appearance. Together with the nose a "T" is formed with the horizontal limbs composed of the eyebrows and the vertical limb a line drawn along the midpoint of the nose in its axis (Fig. 2). Attention to the fluctuating direction of growth of the hairs is essential to help ensure a natural appearance. Medially, the hairs in the natural eyebrow grow vertically in a cephalic direction. Laterally, the more cephalic hairs grow somewhat laterally and caudally, whereas the more caudal hairs grow somewhat laterally and cephalically in a crosshatched pattern. While it is important to incorporate these guidelines, the best results are usually attained when the recipient sites are made such that the direction of hair growth is not so cephalic or caudal, but rather more horizontal/lateral. In addition, the angle of growth from the skin should be minimal so the hairs basically grow flat along the surface rather than sticking out from the face.

With the eyelashes, there is much less variation in direction and angle of growth. The goal is to have the hairs grow away from the leading edge of the eyelid. The patient often needs to use a curler to direct the hairs in the proper direction of growth. Photographic documentation of the markings, showing the plan for restoration, are necessary [20].

## *Surgical technique*

### *Preparation and design*

The night before and morning of the procedure, the patient is to wash the face and hair with an antiseptic soap. A light meal before the procedure is recommended, especially if the patient is to receive oral sedation. The authors' choice of sedation is a benzodiazepine, such as diazepam, and sometimes a hypnotic such as zolpidem tartrate (Ambien). In addition, some surgeons prescribe antibiotics perioperatively and for 3 days postoperatively.

Local anesthesia of 2% lidocaine with 1:100,000 epinephrine, in minute amounts, is injected. The use of the Wand (Milestone Scientific, Livingston, New Jersey) can help reduce the discomfort of injection. Betadine preparation is usually preferable to that done with antiseptics such as chlorhexidene, with which there is a risk of corneal damage.

### *Donor material*

When anesthetized, the donor material is excised as a single fusiform-shaped strip that is sutured closed, or extracted as individual follicles using tiny 1.0- to 1.5-mm punches into the donor area using the more recently developed technique of follicular unit extraction and avoiding the need for sutures. In the authors' earliest surgeries the authors attempted to transplant the most delicate hair of the nape of the neck or of the temporal region just behind or above the ear, believing that these thinner hairs would provide a finer, more natural appearance [21]. With time, it became clear that there is no difference when slightly thicker hairs are used from those areas or from the mid-occipital region. Some authors have noted that hairs transplanted to eyebrows, legs, and potentially other areas of the body might grow with a diameter smaller than they had in the donor area, suggesting some role of recipient site dominance. It has been personally observed that transplanted eyebrow hair undergoes a type of metaplasia in its new location, producing a more harmonious and favorable final result.

Dr. William Parsley has measured the diameters of scalp and eyebrow hairs with an optical micrometer. He demonstrated that, in Asian patients, scalp hair is actually thicker than eyebrow hair, whereas in Caucasians the opposite is true—eyebrow hairs have a larger diameter than scalp hair (W. Parsley, personal communication, 2003).

For the eyebrow, the single fusiform-shaped ellipse of donor tissue need not measure larger than 1 × 3 cm, which should provide at least 250 follicular unit grafts. This number is usually sufficient for restoring both eyebrows and can be adjusted downward if less work is to be performed. Closure of the donor site is accomplished with a simple running 3-0 polypropylene (Prolene; Ethicon, Sommerville, New Jersey) suture. The follicular unit grafts will each contain one, and if the surgeon deems, two hairs. Dissection of

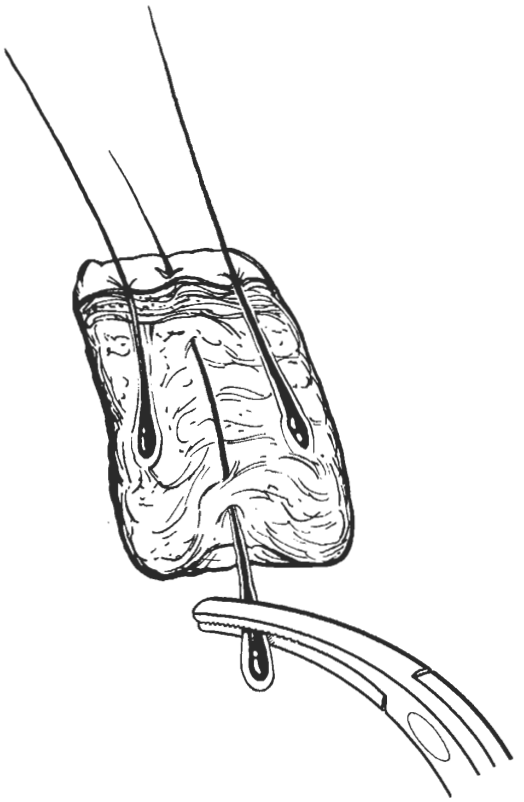

Fig. 3. Stripping away the follicle from the surrounding skin.

each graft is performed under microscopic visualization to assure the inclusion of a minimal amount of surrounding skin [22]. For the eyelashes, most surgeons advocate the removal of virtually all surrounding skin, leaving just the actual hair and follicle. These eyelash grafts can be created by stripping away the surrounding skin with a jeweler's forceps (Fig. 3).

*Recipient sites and graft placement*

Incisions are made along the markings as close together as possible. A variety of instruments are available for this step—a 20- or 21-gauge needle or a 0.7- or 0.8-mm microblade, custom cut from a single-edge razor blade, are appropriate. Direction and angle of recipient sites should closely parallel the direction of natural hair growth to the degree described above. An average of 100 grafts are transplanted to each eyebrow, but this number can be adjusted up or down depending upon the amount of eyebrow to be restored.

Grafts are then placed atraumatically into the recipient sites. The finest one-hair grafts are reserved for the edges, especially superior and lateral. When transplantation is complete, no dressing or other special preparation is applied. The patient can leave the office, wearing glasses if desired, and careful washing can resume 2 days later. Fig. 4 illustrates the steps of an eyebrow restoration procedure.

For the eyelashes, a topical anesthetic is applied to the eyes, then a corneal eye protector is placed. There are several methods of recipient site formation and graft placement. In one, the hair thread is inserted into the hole of a French needle, creating, in essence, a suture. The needle is inserted into the eyelid skin and brought out at the inferior tarsus border, where the eyelashes emerge. The root slides into the hole following the needle, leaving the follicle in place (Fig. 5). Another technique is to make tiny (21-gauge needle or 0.7-mm microblade) incisions along the tarsal border, then insert the grafts retrograde as with conventional hair graft placement. Finally, another technique uses the placement of a one-follicle-wide strip of hair obtained from the sideburn region into an undermined pocket of surrounding skin through an incision made along the tarsal border. The graft is secured in position by one or more 6-0 nylon sutures [16]. One advantage of this technique, according to its authors, is that it can be used for eyelash augmentation.

Because of the risk of trichiasis, procedures in the lower eyelid must be done with caution, and the patient should be alerted to this risk.

*Aftercare*

To avoid dislodging the grafts, for the first night the patient can sleep wearing glasses or with the eye/brow patched lightly although this is not usually necessary. Ice applied for the first 48 hours can prevent edema. Pain is managed with mild analgesics, and most surgeons prescribe antibiotics. For the eyelashes, an ophthalmic ointment or gel is recommended until the crusts fall off.

Frequently, the transplanted hair grows immediately after surgery. The patient must trim the eyebrow and eyelash hairs every 2 to 4 weeks. An eyelash curler can be helpful to control the direction of hair growth. For the eyebrows, training of the hairs to grow in the desired direction can be undertaken with the application of a gel or ointment for the first several months.

While eyebrow hairs typically have a survival rate of 80% or more, eyelash grafts have a growth rate as low as 50%. This loss is probably caused by the extra manipulation of the hairs, and it can be compensated for by transplanting additional grafts.

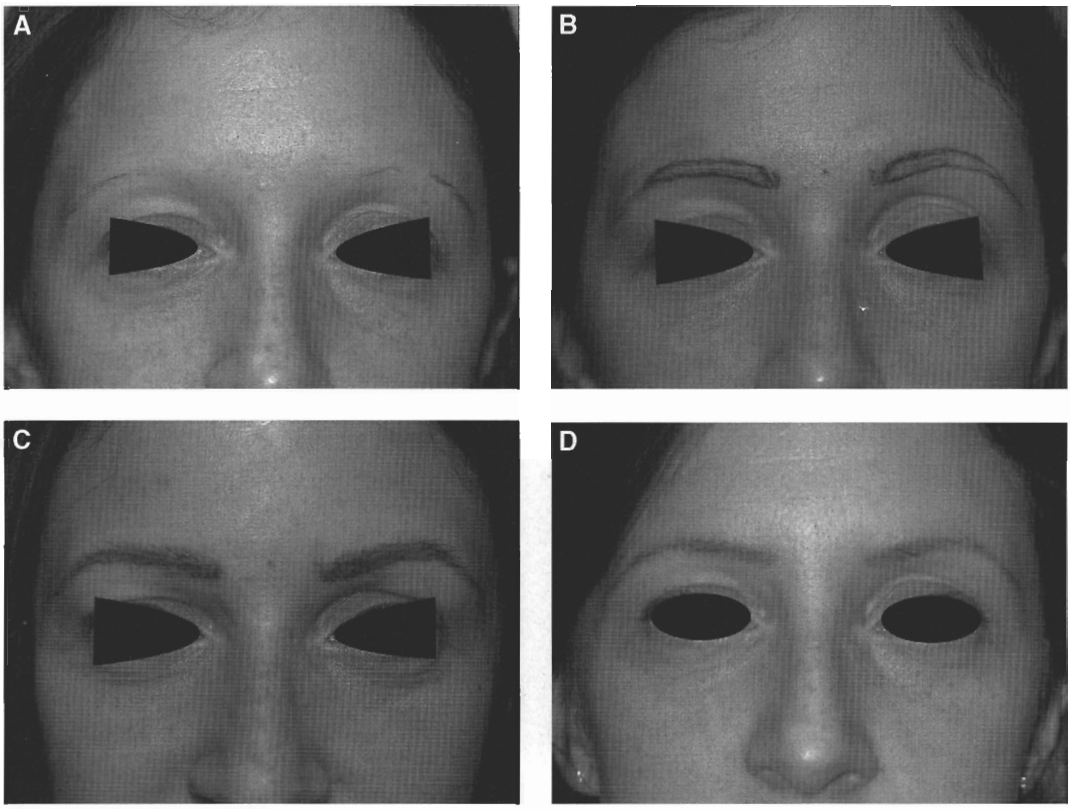


Fig. 4. Thirty-year-old woman who had significant loss of eyebrow hair with etiology congenital and secondary to plucking. (*A*) Before transplant. (*B*) Before with the area of the restoration marked out. (*C*) Immediately after transplant. (*D*) One week after 200 grafts.

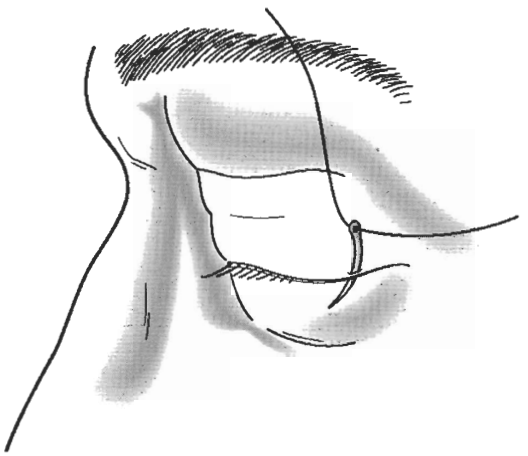

Fig. 5. Needle insertion technique in eyelid transplantation.

**Reconstruction of the sideburn, moustache, and beard**

Sideburns represent the extension of scalp hair from the temporal region to the preauricular region in women, and connecting with the beard in men. The primary etiology for absence of this facial hair in women is postsurgical, following a facelift in which the vector of pull is superior/posterior. This can usually be avoided by using a facelift approach that extends the preauricular incision from the helical root in an anterior horizontal direction through the sideburn rather than an approach that is in a more superior vertical direction through the temporal scalp. Because of its superiority in improving the cosmesis of the lateral brow region, the latter orientation that often results in hairline distortion is commonly chosen by many plastic surgeons. For the beard and moustache region, congenital absence or thinning are the most common etiologies. Scarring from cleft lip surgery or other trauma such as burns are also seen.

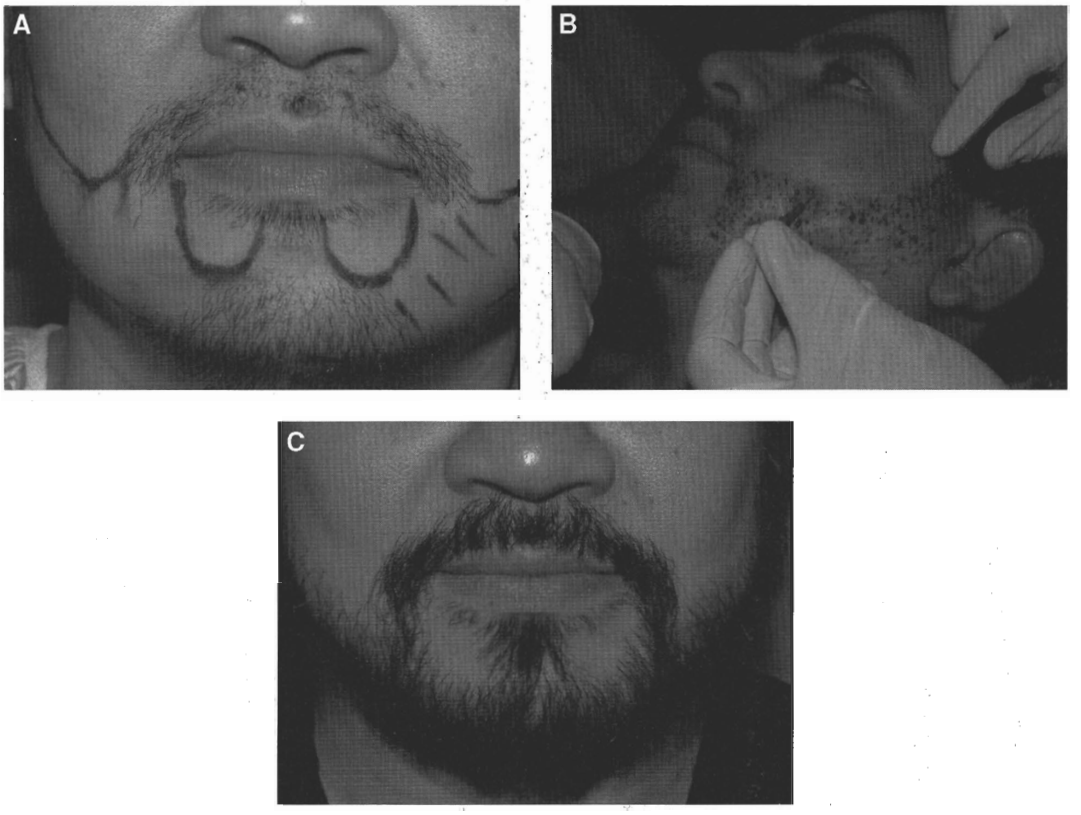


Fig. 6. Thirty-eight-year-old man who had congenital weakness of beard hair. (*A*) Before, (*B*) intraoperatively, and (*C*) 8 months after 1400 grafts. Note the flat angle of the blade for the creation of recipient sites that will allow the hairs to grow along the natural direction.

A variety of surgical techniques have been described for sideburn restoration [15,23–37] and moustache/beard restoration [38–44]. The authors' technique of choice is that of transplanting with one- and two-hair follicular unit grafts

*Surgical technique*

*Preparation and design*

The design of the restoration is marked out on the patient. For the sideburn, the key to achieving a natural appearance is the use of the finest one-hair grafts along the leading anterior and inferior edges, where the direction of growth is caudal and posterior, especially inferior toward the tragus (please refer to the article "The Treatment of Female Pattern Hair Loss and Other Applications of Surgical Hair Restoration in Women" on page 241 of this issue). In the beard and moustache, the direction of growth is essentially caudal, somewhat anterior along the upper

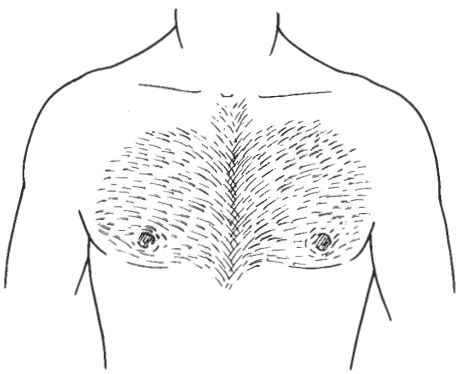

Fig. 7. Natural direction of chest hair growth that can guide transplantation.

cheek region with an angle closely parallel to the skin.

Anesthesia is somewhat difficult to achieve because of the extensive nerve supply of the facial region. Mental and infraorbital nerve blocks only serve parts of the face, requiring local anesthetic to be injected over much of the rest of the areas to be transplanted.

*Donor material*

The donor material comes from the occipital and, if desired or needed, temporal scalp. A single fusiform-shaped strip is excised and the donor area is reapproximated with a 3-0 polypropylene suture. The size of the donor strip is determined by the number of grafts to be transplanted. Complete restoration of one sideburn is typically achieved with 150 to 200 grafts, but this number can be larger depending upon how high the defect extends. For the beard or moustache, it is not uncommon to transplant as many as 1600 to 1800 grafts. Natural results are achieved with one- and two-hair grafts for these areas. In many patients who desire beard/moustache restoration, the concentration of grafts is usually desired in the goatee (perioral) region. Attention must be paid to the natural concave curvature of the superior border of the beard in the infraoral region. It extends caudally from the oral commissure in a vertical direction to a more horizontal direction along the cephalic edge of the mental crease, returning to a vertical direction in the central lower lip.

*Recipient sites and graft placement*

Recipient sites are made with one of several instruments. Twenty-one- or 22-gauge needles or 0.8- to 1.0-mm microblades are appropriate. The angle and direction of the recipient sites are important in achieving a natural-appearing result. The micro-

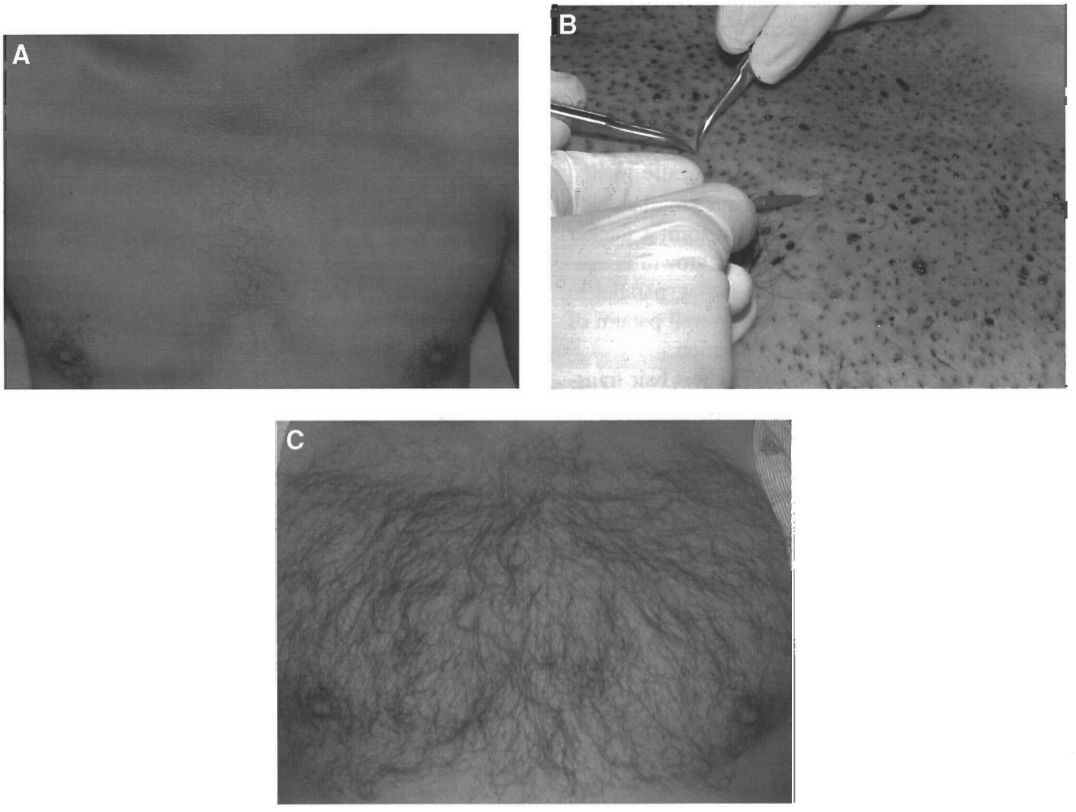


Fig. 8. Thirty-four-year-old man who had congenital absence of any significant chest hair. (*A*) Before, (*B*) intraoperatively, and (*C*) 8 months after the third procedure. A total of 6500 grafts were transplanted.

scopically dissected grafts are then implanted atraumatically into the recipient sites (Fig. 6).

*Aftercare*

Caution with the grafts must be taken in the first 48 hours. After this time there is little risk of graft loss, and gentle face washing can be resumed. All crusts should fall off by 7 days, after which cautious shaving can be performed.

## Chest hair transplantation

A particularly interesting area of transplantation, given the recent trend toward the freedom from body hair, is chest hair transplantation. It is the authors' experience that these patients have legitimate, realistic goals and are quite happy with their results.

As with the eyebrows and eyelashes, the scalp hair that is transplanted needs to be trimmed once or twice monthly. The design of the restoration is such that the concentration of hairs is along the central or sternal region, with hairs extending outwards along the chest, often extending lateral to the areola and down around this important anatomical landmark. At times patients might desire extension of the restoration to the abdomen to as low as the pubis, where it is usually best to concentrate grafts in the midline.

The direction of hair growth is typically medial and inferior, with the most central hairs crosshatching with each other along the sternum to form a thicker density. Periareolarly, the direction of growth is usually circular. The angle of growth is flat, parallel to the chest skin. Fig. 7 illustrates the overall pattern of chest hair growth used for transplantation.

Perhaps the biggest challenge in chest hair transplantation is achieving anesthesia. Because there is diffuse cutaneous innervation that derives from deep and superficial nerves, the entire chest region to be transplanted needs to be injected superficially with local anesthesia. Because of the large quantities of agent required, patients will usually receive intravenous fluids, and areas are injected regionally with intervals between injections to avoid lidocaine toxicity. To reduce the discomfort of injection it is helpful to apply topical anesthetics and ice. If desired, intravenous sedation is provided.

The donor area is the occipital (and frequently temporal) scalp to allow the taking of a large enough donor strip. Typical procedures consist of 2000 or more one- and two-hair follicular unit grafts, with smaller numbers used for less coverage. Recipient sites are created with 20° needles or 1.0- to 1.1-mm chisel blades. The grafts are then carefully inserted. Postprocedure care is minimal. Showering is permitted after 48 hours, and the crusts are expected to fall of within 1 week.

Hair growth typically resumes in 3 to 4 months. Trimming of these original scalp hairs is usually needed once or twice a month (Fig. 8).

## Restoration of the pubic escutcheon

In 1999 Tanaka described the use of a free temporoparietal fasciocutaneous flap for reconstructing the pubic region [45]; however, since the beginning of hair transplantation Japanese surgeons have successfully used one-, two-, and three-hair grafts for reconstruction of this region [46,47]. Similar to the design in chest hair transplantation, the direction of hair growth is primarily medial and inferior to create crosshatching centrally.

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