

IN THIS ISSUE

A Retrospective Study on the Safety of Systemic Minoxidil for Hair Loss in the Older Population

Clinical Practice Guidelines for Follicular Unit Transplantation (FUT)

Developed by the International Society of Hair Restoration Surgery FUT Guidelines Task Force

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Disclaimer: These guidelines on follicular unit transplantation (FUT) are provided for educational and informational purposes only. They should not be interpreted as a standard of care, or be deemed inclusive of all proper methods of care, nor exclusive of other methods of care. Following these guidelines will not ensure successful treatment in every situation. Each physician should make an independent judgment regarding the proper treatment of each patient based on the facts and circumstances. These guidelines are provided “as is.” The International Society of Hair Restoration Surgery (ISHRS) makes no representation or warranty as to their accuracy or completeness. The guidelines reflect the best available data at the time they were prepared. Future studies may yield results that require revisions to the recommendations in this guideline to reflect new data.

The Follicular Unit Transplantation Guidelines Task Force of the International Society of Hair Restoration Surgery has written this treatise on Follicular Unit Transplantation (FUT) in which suggestions for the safe practice of this harvest method are provided. It was authored and reviewed by the committee, and the suggestions were based on any available studies as well as the combined experience and expertise of the committee members. It is intended to provide basic information on the harvest technique for any physician performing FUT.

Please be aware that any suggestions are subject to the laws and regulations of the physician’s respective country/state, and we strongly advise you to familiarize yourself with those in your area of practice.

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INTRODUCTION

The following guidelines for follicular unit transplantation (FUT) provide general recommendations for hair restoration surgeons, considering the current lack of large randomized controlled studies. It’s important to understand that these guidelines do not exclude alternative methods of performing the surgery. Ultimately, the technique and instruments used should be tailored to the individual surgeon’s experience, the expertise of the surgical team, and the unique characteristics of each patient.

TECHNIQUE NOMENCLATURE

Follicular unit transplantation (FUT) is a method of hair transplantation that involves microscopically dissecting follicular unit (FU) hair grafts from a linear strip of skin. While the term “follicular unit transplantation” is most commonly used by practicing surgeons, it’s not very specific. A more accurate term for this procedure may be “follicular unit strip surgery,” or FUSS. However, due to its widespread usage, FUT has become the most commonly recognized abbreviation. For the purpose of these guidelines, the terms FUT and FUSS will be used interchangeably.

HISTORICAL CONTEXT

The term hair transplantation derives from the fact that hair cells (i.e., follicles) are transferred from one area (called the donor area) to other areas of the scalp or body (i.e., recipient area). The first attempt was



published by German surgeon Dieffenbach in the 1820s. Japanese dermatologists performed eyebrow transplantation in the 1930s and 1940s. It was the work of Orentreich, in the late 1950s, that established the accepted basis of modern hair transplantation, when he stated that follicles behave, in their new environment, as they would have had they remained in their original setting: “follicles are donor-area dominant.” The manner in which these grafts were removed and transferred (using 4mm punches) soon proved to result in artificial-looking results (called the doll-hair aspect). Subsequently, surgeons began removing strips of skin from the scalp; a team of technicians would then cut-to-size, producing what was known as micro- and minigrafts. The removal of these strips would result in linear scars, usually well hidden under remaining hairs of the donor area.

In the 1990s, surgeons started using microscopes to identify follicular units (FUs) for transplantation, leading to more natural results. During the early 2000s, the direct removal of FUs using small punches gained popularity, eliminating the need for strip removal. This marked the beginning of the widespread adoption of the Follicular Unit Excision (FUE) technique.

TECHNIQUE NOMENCLATURE

Follicular unit transplantation (FUT) is a term that has been used by hair transplant surgeons and the public to describe the method of donor hair harvesting that involves the excision of a segment of scalp skin and the dissection of follicular unit (FU) grafts from it under magnification. There are many other terms that are also used for this harvesting method including “strip follicular unit transplantation” (strip FUT), “linear strip excision” (LSE), and “follicular unit strip surgery” (FUSS). Although technically not accurate, FUT has become the most commonly recognized abbreviation and so, for the purpose of these guidelines, the term FUT will be used. Where FUT is written, any of the other terms can be substituted. The ISHRS recognizes that its members use different terms to describe the strip harvesting procedure on their websites and social media platforms and in written communications and consultations with patients.

THE FUT PROCESS

Evaluating Patients for FUT Candidacy

It is important to determine whether a patient is a suitable candidate for FUT. In the era of follicular unit excision (FUE), many surgeons and patients view the surgical removal of a strip of scalp skin leaving a thin linear scar as outdated. However, an experienced hair restoration surgeon, backed by a team of competent technicians who can dissect the follicular units under microscopic assistance, should still offer their patients the option of a follicular unit strip surgery.

When choosing donor harvesting methods, patients should be informed about the pros and cons of FUE and FUT since both are current standard practices. By using a combination of these methods over multiple procedures, or both of these techniques in a single surgical session (commonly known as the hybrid approach), a surgeon can often enhance the overall yield of follicular grafts.

Using FUT in hair restoration offers several benefits. It allows for the maximum removal of permanent hairs from the donor area with minimal scarring even after removal of a large number of grafts. Instead of having more than

2,000 tiny 0.9mm diameter punctuate scars, there is a single linear scar. Over the life of most patients, more grafts can be obtained using the FUT technique than FUE as the strip approach is more efficient, creating less scarring per graft. Additionally, the graft preparation is of high quality, with minimal transection created under direct microscopic vision. When desired, the scar can be removed as part of a second harvest, and there’s usually no need to shave large areas of the occipital scalp, allowing the suture to be hidden by hair.

In cases where a strip procedure is requested, patients typically need to maintain hair length of at least 2-3cm throughout their life to adequately cover the scar. The wound closure may cause some pain or discomfort in the first week post-op. While rare, there’s a possibility of experiencing paresthesia or even temporary loss of sensation above the incision site. Removal of a horizontal segment of skin will result in a slightly more tense scalp, which might rule out a second FUSS procedure. If a second procedure is done using the FUE technique, and the donor area is shaved, the scar will be noticeable for 2-3 weeks.

Ideal candidates for a strip procedure are those who fully understand and accept the presence of a linear incision and subsequent scar. Many women might prefer to have a strip removed instead of having their scalp shaved. Also, the “safe zone” might be limited in the female patient, with a narrower area of follicular units resistant to androgenetic alopecia, and so would be ideally suited for FUT.

In summary, the ideal candidate will have a narrow safe donor zone, good elasticity in the scalp, and typically does not wear his or her hair very short. Providing images or videos that showcase examples of thin or wider scars can be helpful in educating the patient about potential outcomes.

Ruling Out Patients for FUT

To identify and rule out unsuitable patients for strip removal in hair transplantation, there are certain factors to consider. These include patients who worry about developing a linear scar, patients who prefer or require short hair, and those with a tight scalp. Additionally, patients with a history of hypertrophic or keloid scarring or poor wound healing are also excluded. These considerations are essential in identifying patients who are not suitable for strip removal, and when noted should result in consideration of alternative treatment options.

Assessing the Donor Area to Determine Strip Location/Width

It is important to note that patients who have general thinning in the donor area might not be good candidates for FUT, or for any hair transplant surgery. A physician must consider a patient’s potential for future baldness and the patient’s skin elasticity when determining strip location. Ideally, the strip should be harvested in the densest and permanent area of the donor zone.

In hair transplantation, it is crucial to understand two key concepts when determining strip width: 1) how the scalp glides under the galea, and 2) the true elasticity of skin. Evaluating the elasticity of the scalp is essential for determining that a strip of sufficient width is removed, without resulting in excessively tight closure. It is recommended to err on the side of caution and remove a narrower strip, especially

over the mastoid and at the lateral ends. Removing the strip under tension can result in a widened scar, and this can be unpleasant for the patient and difficult to correct.

Methods such as the Meyer-Pauls Scale or Scalp Elasticity Scale can help the physician to more easily assess the patient's scalp for mobility and elasticity. To calculate density, the physician can use a manual or digital dermatoscope to assess three different areas: the center point and two lateral points. Estimating the length and width of the strip will give the total area of skin that is to be removed. Next, by multiplying by average density, the physician will have a good estimation of the total number of FUs that will need to be removed.

FUT TECHNIQUE BASICS

Administering Local Anesthesia

To administer local anesthesia, it is important to have a fundamental understanding of anatomy and scalp innervation. Nerve blocking is typically done by injecting a local anesthetic (LA) below the designated strip of the scalp and within the demarcated area. Tumescence is often employed to achieve vasoconstriction. It is recommended to use a combination of short-acting and long-acting LA agents with epinephrine for optimal outcomes. The harvest area, although generally smaller compared to when performing FUE, still requires meticulous attention. Accurate and safe doses must be calculated so that the limits of any anesthetic agent are not exceeded.

Removing the Strip

To perform the surgical removal of a strip of skin from the occipital scalp, it is imperative that the physician has undergone formal surgical training. The final demarcation of the area to be removed is typically done with the patient in an upright sitting position. As noted above, it is important to verify the elasticity of the tissues beforehand. Once the patient is correctly positioned (either sitting up or on their side), local anesthesia is infiltrated. When making the skin incision, the physician should ensure that it is parallel to the hair shafts to prevent inadvertent transection of hair follicles at the edges. Moreover, before proceeding to deepen the incision, it is advised to score the skin by making a shallow cut with a scalpel while ensuring direct visibility.

So that the scalpel does not reach the dermal papillae and inadvertently cut them, some surgeons prefer to use a spreader, hemostatic tweezers, or blunt dissection to spread the deeper tissues. This spreading allows for a better separation of the bulbs in the deep dermis, resulting in a lower transection at the edges of the strip and at the level of the hair bulbs.

The ellipse of skin is now prepared for excision at the subcutaneous level. This keeps the strip as superficial as possible, limiting trauma to deeper structures as well as the dermal papillae. It is important to note that the galea should never be removed to avoid any unnecessary damage to vessels or nerves. Before proceeding with electrocautery for hemostasis, wet gauze can be placed over the wound and left for 2-3 minutes. This should allow sufficient time for the tiny vessels to stop bleeding, leaving only the larger vessels to be cauterized. It is important to avoid using electrocautery on bleeders located at the edge of the wound to prevent permanent injury to follicles. Some surgeons avoid electrocautery altogether.

This particular method involves removing a strip of scalp, either in sections or as a whole unit. Alternatively, one half of the strip can be removed, and the follicular units are prepared and transplanted. Afterwards, the second half of the strip is excised, and the remaining grafts are prepared and grafted. Ultimately, the different techniques give the surgeon options for how they approach the hair transplantation based on the patient's needs and expectations and according to the best methodology for the surgical team.

Preparing the Follicular Units

Once the strip has been removed, the technicians must handle it carefully to avoid desiccation; it is crucial to constantly protect the strip and grafts to prevent drying out. The follicular units are dissected using 10× augmentation. Initially, the strip is sliced into layers of a single follicular unit width, a process known as "slivering." Next, a skilled team further dissects each sliver into individual follicular units. Until they are ready for implantation, the grafts are kept in room temperature or chilled saline or another suitable holding solution.

Creating the Recipient Sites

To ensure optimal aesthetic results, it is critical that the physician personally carries out this surgical step during the procedure.

Depending on the surgeon's preference and experience, the recipient sites can be created using micro-scalpels, needles, or sharp implanters. Their size and depth should be adjusted to the individual grafts; smaller and finer grafts are often used in the hairline. The direction and angle are often guided by remaining original hairs. A staggered distribution of the incisions may lead to a more natural appearance and coverage.

Inserting the Follicular Units

To insert the follicular units, forceps, implanters (either sharp or dull), or other instruments may be used. It is important to note that the safe handling of the grafts at all points of the process is crucial to the good outcome of a hair transplant procedure. To minimize graft trauma, the use of implanters or placers is encouraged; in unskilled hands, forceps can cause irreparable damage. When choosing the method of insertion, the surgeon should consider the available number of technicians and their skill levels.

Closing the Wound

Proper wound closure serves two essential purposes: 1) minimizing tension or achieving a medium to no tension closure, and 2) ensuring precise alignment of both wound edges. It is important to note that if the strip was infiltrated with fluids, the initial tightness of closure may diminish as the injected fluid is absorbed. When possible, the wound edges should be approximated without undermining. However, if tension exists, careful undermining can help alleviate this. It's important to exercise caution during undermining as excessive dissection may lead to bleeding and post-operative shock loss. For example, Ziering's technique involves creating "tunnels" on the lower edge and undermining the upper flap through meticulous subgaleal undermining; this is preferred because it is performed below the level of blood vessels and nerves.

To ensure that there is no tension on the superficial suture, some surgeons prefer to deeply place a subcuticular absorbable suture. The outer layer is then closed with a continuous, running suture, typically nylon 4-0. Alternatively, other surgeons may opt for prolene 3-0 or 4-0 with a tapered needle. To prevent hairs from getting trapped inside the sutures, the surgeon may prefer to shave a 0.5cm strip on both sides of the wound edges. This will also facilitate in the removal of the stitches on post-op days 8-10. Alternatively, sutures may be left in for 3 weeks, thus eliminating the need for subcuticular sutures due to the deterrent effect of the tapered needle to prevent "track marks." It is worth noting that the use of staples for closure, although useful to the surgeon because it is quicker to perform, is usually associated with patient discomfort during sleep and when they are subsequently removed.

Opting for Trichophytic Closure

To enhance hair growth within the linear scar and improve its camouflage, the surgeon may opt for a trichophytic closure. This technique involves using a scissors or a blade to remove a narrow strip of the epithelium at the lower or upper edge of the wound, creating a small step approximately 1mm wide and deep. By bringing the skin edges together, the step is concealed beneath the border of the upper edge, and the transected hairs will grow through the scar.

Caring for the Wound/Removing the Sutures

It is a well-known fact that hair-bearing skin, such as the scalp, has an increased resistance to infection. Generally, antibiotics are unnecessary at any stage of the operation. Maintaining a clean and dry incision site significantly reduces the risks of untoward healing. Typically, patients can safely shower by the second or third day after the procedure, ensuring they clean the occipital wound and avoid any contact with sprays containing alcohol and avoid scratching or towel-drying movements that may harm the sutures until 10-14 days post-op. It is advised to avoid stretching the neck for several weeks after the operation. Patients experiencing low-level pain over the scar may be offered over-the-counter or prescription analgesics.

FUT AS A SECOND SURGERY

Patients with a previous linear scar who seek a second hair restoration procedure should be carefully assessed. The decision to proceed with another follicular unit strip surgery (FUSS) depends on various factors, including the width of the initial scar, scalp elasticity, and the patient's prior experience with pain or discomfort. If considered feasible, removing the initial scar during the second procedure is preferable to prevent a second scar. Some surgeons opt to leave a thin scar alone, removing a second strip from another location. However, if the patient had an inexperienced surgeon remove a strip resulting in an undesired scar location, the second strip may be taken from the preferred area, and grafts can be placed in the initial scar if necessary.

Correcting a Widened FUT Scar

Although uncommon, when a scar is wide or visible among the hair, a patient may request a procedure to

improve its appearance. In such cases, the surgeon may consider scar resection with double-layered sutures, which would result in a thinner scar. It's important to note, however, that due to the stretch-back phenomenon, the scar may widen over time, resulting in minimal improvement. Some surgeons have discovered that subgaleal undermining of the upper flap can enhance mobility and reduce wound tension, leading to an improved scar. A recently published technique, the "punching-out" technique, involves using a 1mm FUE punch to create multiple perforations in the scar, resembling a honeycomb. After removing the scar tissue, the wound edges are carefully sutured together using a fine, continuous nylon 5-0 suture without any tension. An alternative approach is to transplant follicular units over the entire scar, but this requires using valuable donor hair. In experienced hands, another option worth considering to effectively camouflage a widened scar is scalp micropigmentation (SMP), which involves the non-surgical application of tiny pigment dots on the scar to give the appearance of fine hair growing on the scar itself.

SUMMARY

Follicular unit transplantation, or FUT, is a well-established technique that has been used for hair restoration for over 30 years, and it is often the standard of care. FUT involves carefully removing a strip of hair-bearing skin and preparing follicular units under magnification. When performed correctly on suitable candidates, with high-quality grafts and proper distribution, FUT can naturally improve androgenetic alopecia. To ensure safety and quality, the surgeon should be well-trained, personally perform the cuts, and have knowledge of all aspects of medical and surgical hair restoration.

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