Hair Transplant 360

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VOLUME 2 *for ASSISTANTS*

Emina Karamanovski, MD
Hair-Transplant Coordinator
Lam Institute for Hair Restoration
Plano, Texas

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Corporate Office
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Phone: +91-11-43574357, Fax: +91-11-43574314

Registered Office
B-3 EMCA House, 23/23B Ansari Road, Daryaganj, **New Delhi** - 110 002, India
Phones: +91-11-23272143, +91-11-23272703, +91-11-23282021, +91-11-23245672
Rel: +91-11-32558559, Fax: +91-11-23276490, +91-11-23245683
e-mail: jaypee@jaypeebrothers.com, Web site: www.jaypeebrothers.com

Offices in India

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- **Kolkata**, Phone: +91-33-22276415, e-mail: kolkata@jaypeebrothers.com
- **Lucknow**, Phone: +91-522-3040554, e-mail: lucknow@jaypeebrothers.com
- **Mumbai**, Phone: Rel: +91-22-32926896, e-mail: mumbai@jaypeebrothers.com
- **Nagpur**, Phone: Rel: +91-712-3245220, e-mail: nagpur@jaypeebrothers.com

Overseas Offices

- **North America Office, USA,** Ph: 001-636-6279734
  e-mail: jaypee@jaypeebrothers.com, anjulav@jaypeebrothers.com
- **Central America Office, Panama City, Panama**
  Ph: 001-507-317-0160, e-mail: cservice@jphmedical.com
  Web site: www.jphmedical.com
- **Europe Office, UK,** Ph: +44 (0) 2031708910
  e-mail: info@jpmedpub.com

Hair Transplant 360 (For Assistants), Volume 2

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To VESA,

Who knows how to turn around a bad day...
and always makes me laugh.
Thank you for your love and support.
This accomplishment would not be the same
without you by my side.

Preface

The practice of hair restoration is a combined effort between a physician and a team of surgical assistants. Unlike other cosmetic enterprises that are principally dependent on the physician for success, hair transplantation requires a sophisticated, well-trained and dedicated team of surgical assistants and ancillary staff. Taking into account that assistants perform a significant part of the surgery, the result of hair transplantation highly depends on the assistant's skillfulness in graft preparation and placement as well as their education about and commitment to quality hair restoration.

Most practices face a challenge of training surgical assistants because the current assistant training is hindered by the limitations of live donor tissue, i.e., its availability and narrow margin of error. In addition, when starting a practice, a surgeon may face the untenable situation where he/she would like to undertake a hair transplant on a prospective patient so that the staff can begin to develop their skills but at the same time does not want to subject a patient to the outcomes of a bad transplant from an inexperienced team.

Until now, all available surgical textbooks explain in detail the surgeon's task and give only an overview of the assistant's task leaving surgeons ill equipped to train their staff or perform quality control. This book is a comprehensive guide dedicated to both surgical assistants and physicians; it can serve as a self-study for the novice as well as a reference book for experienced surgical assistants. Considering that the topics shared in this book cover the intricacies of the surgical assistant role, it is also intended for physicians so they can train their staff and supervise their team. In addition, this book will outline the requirements for staff hiring; provide general knowledge on hair biology, hair loss and hair restoration; will address how to develop the technical skills necessary for assisting in hair transplantation, and finally present a unique "without-a-live-patient" training that can accelerate a trainee's learning curve and thereby decrease a trainee's nervousness and improve his or her proficiency.

In addition, it will provide in-depth information on quality standards and guidelines for quality control as well as address patient care and assistant teamwork.

Besides having technical skills required from both the surgeon and surgical assistants, a successful practice demands an excellent assistant-patient relationship. Since it takes six to twelve months for transplanted hair to grow and the patient to see the results of surgery, establishing good rapport with every patient is essential. From the person answering the phone to the person assisting in surgery, all should be amiable, knowledgeable in the basics of hair restoration, and understanding of a patient's concerns such as knowing how to calm a patient who is experiencing postoperative thinning. Because hair transplantation is an elective treatment, every person considering hair restoration is equally customer and patient and should be treated accordingly. With the development of the Internet, patients are researching for the best results and are willing to travel a long distance to receive a quality procedure and obtain the desired look. Considering the profound contribution of the assistant in the quality of the final result, this book was conceived as the first thorough training manual for the surgical assistant in hair restoration. After discussing with my co-author, Dr Lam, we agreed on giving a more colloquial tone to **Volume 2** as opposed to the more scientific voice of **Volume 1** of this book. We wanted to impart valuable knowledge without overwhelming the reader with intimidating medical terminology. My hope is that readers will find it easy to read, its information of great value and that this book will serve as a model and inspiration for a new era in quality standards for assisting in the field of hair restoration.

Emina Karamanovski

Acknowledgments

This book is based on over eighteen years of experience assisting in hair restoration. As a physician with a foreign license who could not practice medicine, I started assisting in hair restoration as a temporary solution to my predicament. Ironically, my seeming indisposition led me to discover my passion and a unique position of being able to relate equally to assistants and physicians. Along the way I met some amazing people, worked with numerous assistants and physicians, and had the privilege to learn from two remarkable teachers, Dr Vance Elliott and Dr Samuel Lam. I would like to thank my teachers for their unique contributions in improving my knowledge and sharpening my critical thinking skills. Above all, I want to thank them for believing in me and supporting me so that I could become the best me possible. Many years ago I had a dream of creating some type of educational platform for assisting in hair restoration. I owe a debt of gratitude to Dr Samuel Lam for his extraordinary vision and leadership that made my dream come true.

I would like to thank Tina Lardner for her generous support and invaluable contribution to this book. Tina's input on microscope set up, graft placement, critical thinking as well as her gift of several clinical photographs made this work richer to you, the readers. Tina's dedication to and passion for hair restoration are exemplary and inspiring. This book would not have been as inclusive without her.

Last but not least, I would like to thank all my students for making me a better person and a better teacher. Assisting in hair restoration allowed me to be part of an amazing process of transformation: for my patients, for my team members, and for myself.

Contents

Videos

DISC 1

VIDEO 1: Phase I Training: Model Practice for Graft Dissection using Cutting Foam

VIDEO 2: Phase I Training: Model Practice for Graft Placement using a Styrofoam Head

DISC 2

VIDEO 3: Setting Up for Surgery

VIDEO 4: Phase II Training: Slivering

DISC 3

VIDEO 5: What Not to Do During Graft Preparation

VIDEO 6: Phase II Training: Graft Dissection

VIDEO 7: Phase II Training: Graft Placement

DISC 4

VIDEO 8: Placing Di-Follicular Unit (DFU) Grafts

VIDEO 9: Preparing the Patient for Surgery

VIDEO 10: Postoperative Final Check

1 Basic Hair Knowledge 360

About Hair Growth

Hair in General

Hair has a great social significance for human beings. It can grow on almost every area of the human body except on the palms of the hands and the soles of the feet, but hair is most noticeable in people in only a small number of areas, which are also the ones that are most commonly trimmed, plucked or shaved. These include the face, nose, ears, head, eyebrows, legs, and armpits, as well as the pubic region. Hair is seen as an indicator of gender or aging; facial hair is one of the most visible differences between the male and female body, and while facial hair is a sign of puberty in men, white hair is an indicator of aging. Hairstyles can indicate social status, acceptance or rejection. For example, the Manchu Qing Dynasty, beginning in the late 17th century China, ordered all Chinese citizens to adopt Manchurian hairstyles by shaving the front of their head and adopting a queue; in Islam, women would cover their hair as a symbol of modesty; while heads are shaved in prisons and concentration camps as a sign of punishment. Although in today's society a shaved head is an acceptable hairstyle for men, healthy hair indicates vitality and youth, which may explain the reason why many people experiencing baldness seek hair restoration.

Hair Anatomy

Hair has two separate structures: the hair shaft (the part we see above the skin) and the follicle (the part that is below the surface of the skin). The hair shaft is composed of strong, structural protein called keratin. This is the same protein that makes up the nails and the outer layer of the skin (Fig. 1.1).

Below the surface of the skin is the hair "root" or hair follicle comprised of several structures: dermal papilla, hair bulb, hair shaft, sebaceous gland and a

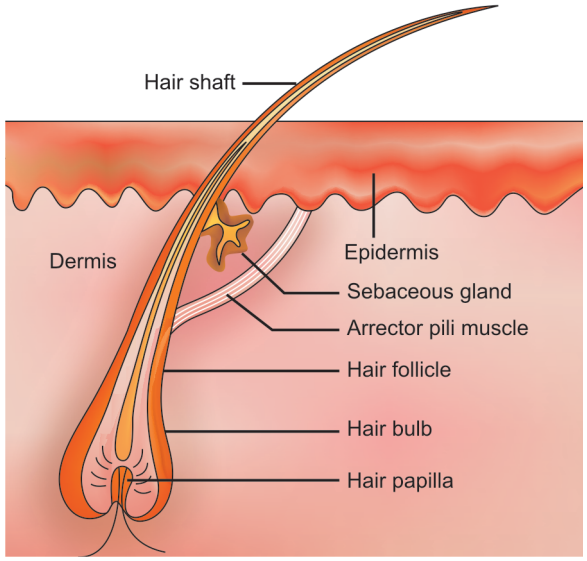

Figure 1.1
Hair anatomy.

tiny muscle. The dermal papilla is made up of connective tissue and a capillary loop creating the place where hair production originates and where hair receives its nutrients. The hair bulb is located directly above the papilla; it contains a collection of epithelial cells interspersed with cells producing a pigment called melanin. Generally, if more melanin is present, the color of the hair is darker; if less melanin is present, the hair is lighter. This part is also called the hair matrix because it is responsible for the manufacture of the hair. The hair matrix is one of the fastest-growing cell populations in the human body, which is why some forms of chemotherapy or radiotherapy that kill dividing cells may lead to temporary hair loss.

Each strand of hair (hair shaft or hair fiber) contains three layers: medulla, cortex and cuticle. The medulla is the innermost layer found in large and thick hair. The cortex is the middle layer, which provides strength as well as imparts color and texture to the hair. The cuticle is the outermost layer made up of tightly packed scales that form an overlapping structure similar to the roof shingles and function as a protective coat over the cortex. Most hair-conditioning products attempt to affect the cuticle by making these scales lie flat, thus imparting a silky feel to the hair. Attached to the hair follicle is a sebaceous gland, a small sebum-producing gland found everywhere except on the palms, lips and soles of the feet. The purpose of the sebum, an oily and waxy matter, is to lubricate the skin and hair keeping them waterproof and protected from dehydration. More sebum is produced after puberty. The sebum production decreases throughout life, with greater reduction in women than in men. Also attached to the hair follicle is a tiny bundle of muscle fibers called the arrector

pilli. When this muscle contracts, it causes the hair to stand up resulting in a phenomenon commonly known as goose bumps.

Hair-Growth Cycles

Unlike other mammals that shed or grow hair according to the season, in humans hair growth and loss are random and not strictly but somewhat seasonal. At any given time, in humans a random number of hairs will be in various stages of growth and shedding.

The three phases of hair-growth cycle are as follows: anagen, telogen and catagen. Anagen is the active growth phase during which the cells in the matrix are dividing rapidly, adding to the hair shaft. During this phase the hair grows approximately 1 to 2 cm (i.e., half to one inch) per month. The catagen stage is a short transition phase that occurs at the end of the anagen phase during which the hair follicle receives a signal to stop growing. Shortly after the hair growth stops, the dermal papilla contracts and releases the hair shaft from the follicle allowing hair to shed. The telogen phase describes the resting time for the hair follicle. During this phase, a secondary hair germ forms from a band of epithelial cells that moves upwards, often seen during graft dissection as a short, smaller version of the hair bulb.

Each hair follicle goes through 10 to 20 cycles in a lifetime, while each cycle lasts a different time: anagen lasts 3 to 10 years, catagen 2 to 3 weeks and telogen 3 to 4 months. This may explain why some hairs live longer than others, as the hairs on the back of the head may be programmed to survive for twenty 10-year cycles and live for 200 years. In the human scalp the cycles are not synchronized. Therefore, at any one time an average of 13% of the hair is in the telogen phase (with the thought that it can range from 4% to 24%), only 1% to 2% is in catagen and the rest (85% to 90%) of the hair remain in the anagen phase. About 25 to 100 hairs are shed normally each day (Fig. 1.2).

Some people have difficulty growing their hair beyond a certain length because they have a short active phase of growth. On the other hand, people with very long hair have a long active phase of growth. The hairs on the arms, legs, eyelashes and eyebrows have a very-short, active growth phase (one to seven months) explaining why they are so much shorter than scalp hair.

About Hair Loss

Humans are born with approximately 100,000 hair follicles on their scalp. Scalp hair only constitutes a small fraction (100,000 to 150,000 follicles) of the total count for the body (approximately 5 million follicles).

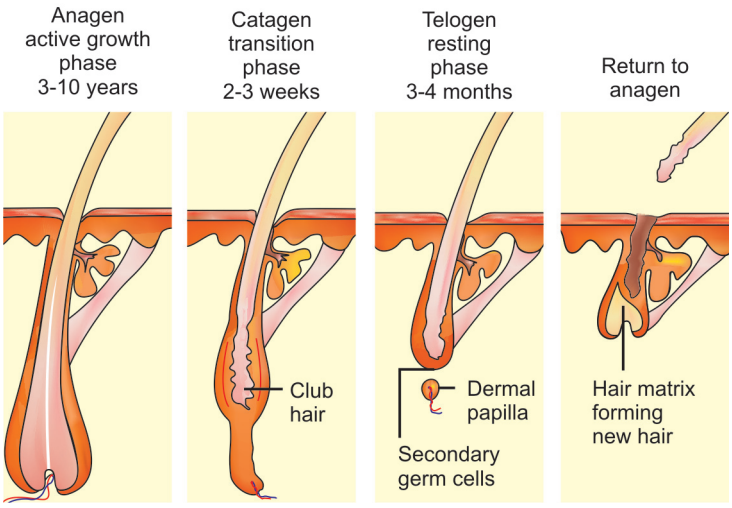

Figure 1.2

Hair growth can be divided into three phases: anagen (active growth), catagen (active loss) and telogen (resting phase). In the scalp, 90% of the hairs remain in the anagen phase. Catagen only lasts about two to three weeks and is characterized by the hair-shaft separation of the dermal root, and it is recognized by a thin connective tissue strand connecting the two. About 10% of the hairs are in telogen phase at any given moment, and this lasts about two to three months. Catagen phase is the shortest of the three phases and occurs prior to telogen. As the basal attachment becomes even more attenuated, the hair shaft detaches from the dermal root ultimately, resulting in the hair falling out (known as exogen). Scalp hairs are asynchronously in these three cycles at any given time.

Alopecia, or hair loss, is the medical term for the loss of hair from the head or body. Unlike intentional aesthetic depilation, alopecia is involuntary and often unwelcomed. However, sometimes hair loss may be caused by a psychological compulsion to pull out one's own hair (*trichotillomania*) or the unforeseen consequences of voluntary hairstyling routines: mechanical hair loss (*traction alopecia*) from excessively tight braids or burns (*scarring alopecia*) caused to the scalp from caustic hair relaxer solutions, both types of hair loss often seen in African-Americans. When hair loss occurs in only one section and appears as bald patches, it is known as *alopecia areata*. Most often, traction alopecia can be treated with hair transplantation, while a dermatologist must treat other types of scarring and non-scarring alopecias before it is "safe" to transplant the hair into the affected area. Hair transplantation is successful and possible in many cases, except when the skin may be affected with a condition that would reject the transplant, such as alopecia areata, or when there is insufficient or non-existent donor hair, such as in the medical condition called *alopecia universalis*, which occurs when complete hair loss on the body manifests including the eyebrows and eyelashes. This condition is different from the total hair loss that follows chemotherapy. In alopecia universalis the return of hair growth is unpredictable, while patients who lose their hair after undergoing

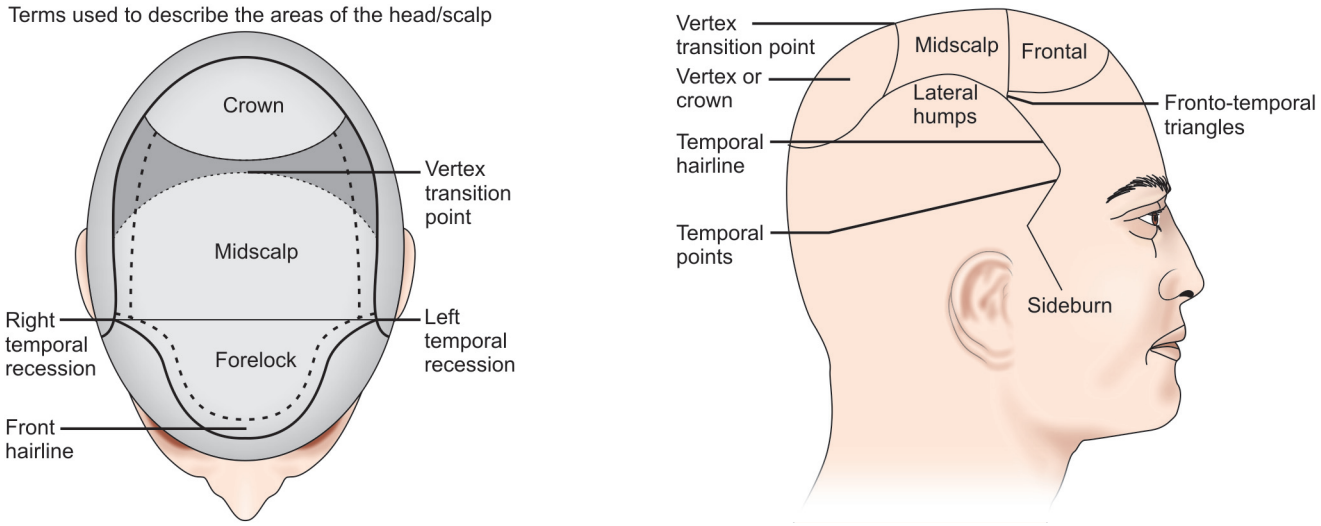

Figure 1.3

These illustrations show the various regions of the hair-bearing scalp that would be rebuilt with hair transplant differently regarding angles, direction, graft sizes, etc. These regional-scalp terms are referenced throughout the text and are shown in this schematic for better understanding of where they are located on the head and how they are related to one other.

chemotherapy are most likely to re-grow their hair and do not require a hair transplant.

The most familiar type of hair loss is called baldness and it is the state of lacking hair where it often grows, especially on the head. The most common form of baldness is a progressive hair thinning condition called *androgenic alopecia* that occurs in men and women. The degree and patterns of baldness can vary greatly depending on gender, age, genetics and sometimes on one's medical condition. The most common areas of hair loss in men are frontal, temporal and vertex, while the most commonly affected areas in women are behind the hairline and the top of the scalp and occasionally a receded hairline and/or vertex. The hair in the back of the head is rarely affected by thinning and serves as the donor area for hair transplantation. However, in some situations of female diffuse hair loss, the occipital areas could be affected, which robs those individuals of the possibility for a hair transplant (Fig. 1.3).

It was previously believed that baldness was inherited from the maternal side only. However, it is now generally accepted that both parents contribute to their offspring's likelihood of hair loss. Although baldness is not as common in women as in men, the psychological effects of hair loss, such as altering one's self-image and self-esteem, tend to be much greater in women than men.

Male-Pattern Baldness

Androgenetic alopecia (AGA) is also known as male-pattern baldness and is the most common cause of hair loss. Approximately 50% of men are affected by the age of 50 and thinning of the hair can begin as early as the age of 12 and as late as 45. Although the condition is benign, the psycho-social ramifications of AGA can be significant. A major determinant of AGA concerns androgen metabolism, more specifically the enzymes 5-alpha reductase and aromatase as well as androgen receptor proteins.

The *5-alpha reductase isoenzymes (type I and II)* convert testosterone (T) to dihydrotestosterone (DHT). Both types of 5-alpha reductase are increased in the frontal-balding follicles compared with the non-balding follicles in the back of the head demonstrating that these isoenzymes contribute to AGA. DHT levels are also increased in the balding scalp compared with the non-balding scalp. Furthermore, women have 3 to 3.5 times less 5-alpha reductase than men, which probably accounts for why female AGA is less severe in most cases than with male AGA. Interestingly, individuals born without 5-alpha reductase type II do not develop AGA.

Aromatase is an enzyme that is part of the normal androgen metabolism that may have protective effects on AGA. Aromatase converts testosterone into estradiol and estrone and thereby results in less conversion of T into DHT. Aromatase is found in much higher levels in female scalps with six times in the frontal scalp and four times in the occipital scalp than in men. This may explain why women who suffer from AGA may still be able to preserve their frontal hairline.

Androgen receptor proteins (ARP) are found in the outer-root sheaths and in the dermal-papilla cells of the scalp follicles. ARPs are found to be 30% higher in the frontal-balding scalp than in the non-balding occipital follicles, while 40% lower in women than in men. ARPs are responsible for the signal transduction in the hair follicle that promotes the conversion of a thick, strong terminal hair into a miniaturized, fine hair. Interestingly, ARPs have the opposite effect in the beard and mustache, promoting thicker follicles in these areas at puberty.

Hair follicles produce both thick, terminal hair and fine, vellus hair. Vellus hairs develop on most of the human body from childhood regardless of sex. At puberty vellus hairs are replaced by terminal hairs in certain areas of the body, such as the axilla, pubis and face; and this change occurs by the influence of androgenic hormones. The differentiation between vellus and terminal hair is in their size and length, i.e., the hairs that grow thinner than 0.03 mm in diameter and shorter than 1 cm in length are considered vellus

while hairs that exceed the parameters mentioned above are considered terminal hairs.

One of the hallmarks of androgenetic alopecia is the conversion of thick terminal hairs into miniaturized, vellus-like hairs. This process of miniaturization (i.e., shrinking of hair volume and growth length) is usually an indication that one is undergoing hair loss. The main mechanism for miniaturization relates to the shortening of the anagen phase, i.e., the hair becomes "lazy" and does not grow to its full term.

Many classification schemes exist to define types and extent of baldness. The most widely accepted standard is the Norwood classification for male-pattern baldness that was based on a study of one thousand adult men with male-pattern hair loss classified by the type of hair loss and age of onset. Some of the findings were as follows:

- The patterns with least hair loss (Type I and II) are most frequently found in men aged 18 to 40 years.
- The "monk's tonsure" Norwood-Hamilton Type III pattern becomes more common as men age and oftentimes could be combined with recession of the hairline.
- Type VII, the most severe pattern of hair loss, occurred in no men under age 30 in the Norwood study and became more prevalent in men older than age 60.
- Typically, AGA occurs early in most cases between the age group of 15 and 25 with lifetime progression. Most oftentimes, the clinical course is a gradual one with periodic episodes of increased hair loss. Maximum pattern is usually attained by one's forties, with ongoing thinning occuring throughout the remainder of one's life (Fig. 1.4).

All patterns of male-pattern hair loss tend to progress in stages and increase in prevalence with the age of the man. However, family history of male-pattern hair loss may be helpful in estimating probabilities for your future hair loss but cannot be predictive with complete accuracy.

Female-Pattern Baldness

While hair loss in men is often a genetic condition thus a lifelong process, it is unclear what predisposes a female toward hair loss. Some females may start exhibiting hair loss as early as after puberty, while others have no signs of any unusual hair shedding until later in life when they enter menopause. In women as in men, the most likely cause of scalp hair loss is androgenetic alopecia: an inherited sensitivity to the effects of androgens (male hormones) on the hair follicles of the scalp. Women with hair loss due to androgenetic alopecia tend to

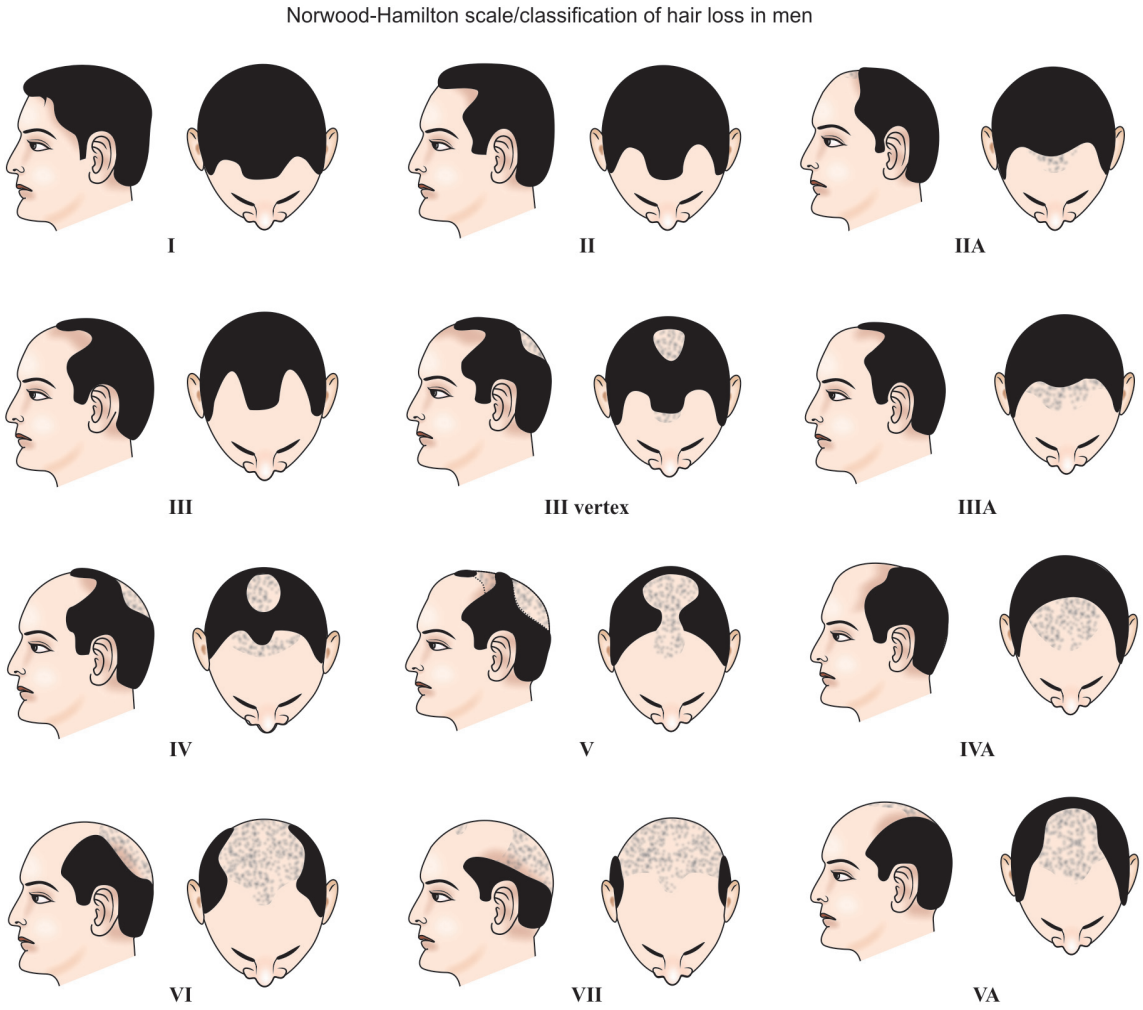

Figure 1.4

The Norwood or Norwood-Hamilton Scale grades degrees of male-pattern baldness. **Type I** shows minimal to no hair loss along the fronto-temporal expanse. **Type II** exhibits both fronto-temporal recession that does not extend further than a line drawn through a coronal plane 2 cm anterior to the external auditory canal. **Type III** hair loss refers to fronto-temporal recession that extends posterior to the coronal plane that lies 2 cm anterior to the external auditory canal. **Type III Vertex** indicates hair loss that primarily affects the vertex (or crown) region with or without accompanying fronto-temporal recession that does not exceed, as described in type III. **Type IV** reveals greater fronto-temporal loss than exhibited in type III along with marked hair loss in the crown area but with a moderately dense swath of hair that bridges the intervening expanse between the two areas. **Type V** hair loss shows more extensive alopecia in both the fronto-temporal and vertex areas with only a small bridge of dense hair between the two areas that remains. **Type VI** hair loss reveals a complete absence of any remaining hair that separates the two now confluent areas of alopecia. In addition, the hair loss is more extensive laterally and posteriorly. **Type VII** represents the most severe expression of male-pattern baldness with only a narrow-horseshoe configuration that remains along the posterior and lateral border of the hairline. Norwood also classified a variant of hair loss that afflicts approximately 3% of male patients with alopecia in which the fronto-temporal recession marches progressively posteriorly in a uniform fashion without a central, anterior peninsula of hair. **Type IIA** refers to a condition in which the entire anterior hairline is receded uniformly across the forehead but does not extend any further posteriorly than 2 cm anterior to the mid-coronal line. **Type IIIA** reveals alopecia that extends to the mid-coronal line. **Type IVA** signifies alopecia that has extended past the mid-coronal line. Finally, **Type VA** indicates significant recession of the hairline into the vertex, and severer forms of this variant become indistinguishable with Types V and VI.

have miniaturizing hairs of variable diameter over all affected areas of the scalp. While miniaturizing hairs are a feature of androgenetic alopecia, miniaturization may also be associated with other causes and is not in itself a diagnostic mark of androgenetic alopecia. In postmenopausal women, hair may begin to miniaturize over the entire head, thereby losing its original volume and becoming difficult to style.

Although in some cases genetics can be the causative factor, health issues such as iron deficiency or hormonal imbalance that arises from pregnancy, menopause, withdrawal of oral contraceptives or hysterectomy can also spur hair loss in women (*telogen effluvium*). Pregnancy can lead to a prolonged estrogen-rich state in which hairs remain in the anagen phase until delivery. Following this, the hair is shed excessively for about four to twelve weeks afterward and most likely re-grows within three to six months. Besides these acute states of telogen eflluvium, women between 30 to 60 years of age are more likely to suffer an unexplained chronic telogen effluvium marked by recurrent hair shedding that does not lead to total baldness. It is important to note that female-pattern hair loss can begin as early as the late teens to early 20s in women who have experienced early puberty. If left untreated, this hair loss associated with early puberty can progress to more advanced hair loss. Hair loss in a woman (even when there is a family history of androgenetic alopecia) should never be assumed to be due to androgenetic alopecia. Examination and diagnosis by a physician, hair-restoration specialist is essential before any hair transplant is undertaken. Routinely, a battery of tests is suggested to female patients exhibiting hair loss, such as a full chemistry profile, sedimentation levels to check for inflammatory diseases, serum iron levels, male/female hormones [including testosterone and dehydroepiandrosterone sulfate (DHEAS)], and thyroid levels to check for proper function and scalp biopsy. For all of these reasons, hair loss in women can be more complicated than in men and should be more carefully explored for the cause so that a proper treatment plan can be instituted.

The most commonly used classification for female-pattern hair loss is the Ludwig Classification (Type 1 to 3). Alternatively, for women who suffer from male-pattern baldness, the Norwood-Hamilton classification can be used. The Ludwig classification emphasizes the diffuse nature of much female-pattern hair loss with frequently preserved hairline and thinning affecting the central top portion of the scalp, while the Norwood-Hamilton classification describes patterns of loss that are similar to male hair-loss patterns with affected hairline and/or thinning in the vertex area (Fig. 1.5).

Hair loss in women is different than in men because the areas affected can thin significantly but rarely become totally bare of hair. There are various

Figure 1.5

This illustration shows the classification scheme for female pattern baldness as defined by Ludwig. Thinning tends to be more generalized than in male-pattern baldness.

patterns of hair loss in women, and the following are the most common types:

- A *"Christmas tree" pattern* of diffuse hair loss, with the "base" of the "tree" at the hairline and the "tip" of the "tree" at the *center of the scalp*. There are two problems with this type of hair loss: the first is the inability to style hair to cover the thin area because the thinnest area is central and the person has to part her hair on the side and comb it over the thin area, and the second is the inability to wear bangs since the hairline is sparse. This type is the most prevalent type of female hair loss (Fig. 1.6A).
- A *"Diffuse" pattern* of hair loss that expands throughout the *top scalp*. Some studies have indicated that a diffuse thinning of hair is experienced to some degree by a majority of premenopausal women and by a large majority of postmenopausal women. There is a visible pattern of thinning that affects the top scalp and often the temporal areas as well. The most common feature for female alopecia is that the involved areas reach a certain point of decreased density but seldom become bare as seen in male-pattern hair loss (Fig. 1.6B).
- A type of *"Male-pattern baldness"* with preserved mid-frontal forelock (central) density. The regular female-shaped hairline is affected by the loss in both *fronto-temporal corners* (i.e., fronto-temporal triangles). The bald areas have triangular shapes that resemble the male-pattern hair loss of Norwood-Hamilton Types I to III (Fig. 1.6C).

It is important to mention that there is one more "model" of hair loss found in women (and rarely in men) called *diffuse unpatterned alopecia* (DUPA). This type of hair loss exhibits hair thinning throughout the entire scalp, oftentimes combined with global miniaturization, depriving these individuals from ever being candidates for hair transplant.

Figure 1.6A

This individual shows a Ludwig type of diffuse female-patterned hair loss. The hairline can be spared or affected with this type of loss. In this case, the individual demonstrates preservation of the hairline.

Figure 1.6B

This woman demonstrates a Christmas tree pattern of hair loss described by Elise Olsen in which the base of the tree is noted anteriorly and the top of the tree is situated toward the crown. The Christmas tree pattern is most easily revealed with the patient looking downward with the hair parted in the midline.

Figure 1.6C

This postmenopausal woman shows fronto-temporal recession similar to the type of hair loss experienced in male-pattern baldness.

About Hair Restoration

History of Hair Restoration

Surgical hair restoration began with the creative efforts of the pioneering Prussian surgeon and scientist, Johann Dieffenbach, in the early nineteenth century. He specialized in skin transplantation and cosmetic surgery, and was very inventive and ingenious in his surgical endeavors. The modern technique of hair transplantation began with interesting efforts of the Japanese surgeons Okuda in 1939 and Tamura in 1943 who transplanted hair in the pubic region. The common use of public bathing made hair loss in the pubic area culturally shameful and thus the interest to replant it. Although other Japanese surgeons worked to replace the damaged areas of eyebrows, they did not attempt to treat baldness per se. Their efforts did not receive worldwide attention at the time, and the traumas of the Second World War delayed the advancement in the field for another two decades.

The modern era of hair transplantation in the Western world was ushered in the late 1950s when New York dermatologist Norman Orentreich began to experiment with free donor grafts to balding areas of patients who experienced baldness. Medical grafting is a procedure similar to organ transplant, where a piece of tissue, i.e., graft, is transplanted from one area to another of the human body. It was originally believed that hair transplanted from the hair-bearing region, i.e., the donor site, into a balding region, i.e., the recipient site, would not thrive more than the original hair did in that region. However, Dr. Orentreich demonstrated that transplanted/new hairs grew and lasted as they did in their original home. This meant that the characteristics of the hair were preserved regardless of where they were transplanted, and this phenomenon is known as *donor dominance*. Otherwise if the recipient area were dominant, the site of transplantation would override the characteristics of the donor hair and cause it to fall out. This was a major discovery that created the foundation of modern hair-transplant surgery and allowed its development into a mature discipline that it is today. Although his method is synonymous with unsightly "plugs", the philosophy behind Dr. Orentreich's approach is the foundation of current hair-restoration surgery.

For the next twenty years, surgeons worked on transplanting smaller grafts; and we have witnessed a tremendous evolution in hair-restoration techniques from cornrow plugs through to one-hair micro grafts, now to follicular-unit grafts.

Basic Principles and the Evolution of Hair-Transplant Surgery

Initially transplanted grafts were 2- to 4-mm round plugs that were punched out from the donor area, then the bald scalp was punched out and removed from

the recipient area and the "holes" on the top of the head were plugged with punched grafts from the back of the head. This procedure created a doll's head-like result and left a shotgun-riddled donor area. Although considered as a progressive and successful procedure at the time, two major downsides existed for this procedure: The donor area was rapidly depleted leaving patients "unfinished" in attempt to cover their bald spots, and the transplanted hair was extremely unnatural. Transplanted plugs were placed far apart and straight up (instead of angled to mimic the natural hair angle), which created unsightly looking doll's-hair results.

In the attempt to yield more natural results, surgeons worked on making hair grafts smaller thus arriving at micro grafts, tiny pieces of scalp containing only 1 to 2 hairs. This technique was popularized in the 1980s. Although micro grafting gave more natural looking results, the chief complaint was the lack of density and "see-through" looking results. Further development in the field arose in 1984 with the discovery by Dr. Headington of follicular units or hair groupings. He described that hair grows in discrete bundles of 1 to 4 hairs instead of single hairs as previously believed (Fig. 1.7). Considering that hairs within the same follicular unit share a common sebaceous gland along with nerve and blood supply, their survival seems better if hairs within the unit are left together (instead of separated). Thus, the shift from micro transplant to follicular-unit transplant began. The discovery of follicular units did not only allow the recreation of more naturally looking patterns but also the creation of greater density within one session of hair transplantation.

The progress in the area of donor harvesting continued over the years. There were two areas of focus for improvement: preserving donor supply and

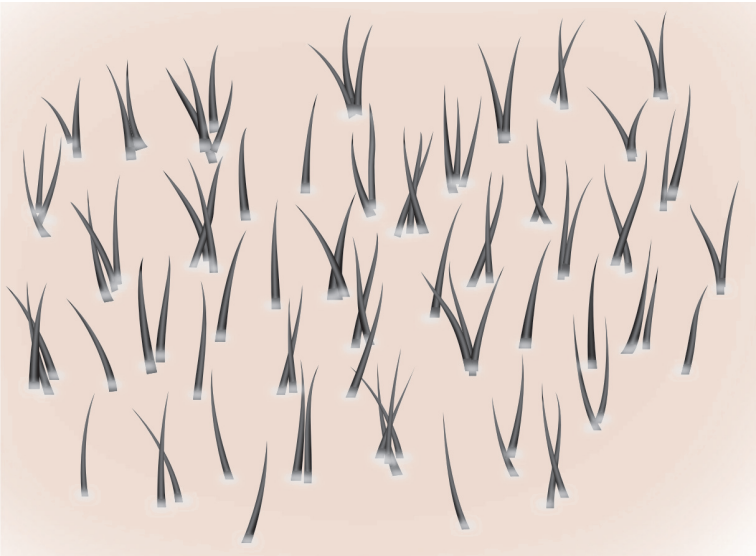

Figure 1.7

In the 1980s, Headington discovered that hairs on the scalp do not grow singly but in groupings that have come to be known as "follicular units." A follicular unit comprises groups of 1 to 4 hairs that grow in clusters spaced a short distance away from a neighboring follicular-unit cluster.

enhancing donor appearance. The progressive nature of hair loss required the physician to anticipate future needs and to plan donor harvest accordingly. Regarding the appearance, every time a surgical procedure is performed, the donor area is left with a higher incidence of scarring. In the original punch donor harvesting after the hair was punched out, the open spaces were left to heal by themselves. Since this technique left significant donor scars behind, the next steps in evolution were in order: first to stitch the open "holes," then to cut out and connect the "holes" and suture them in one straight line. The improvement in the appearance of the donor area with the suturing technique was remarkable. Combining micro grafting with the improvement in donor harvesting, physicians then transitioned to linear strip harvesting. This technique is still widely used in hair transplantation and is featured in this book as our preferred method.

As the progressive nature of hair loss creates the need for repeated surgeries, sometimes the donor area is left with many unsightly scars. The drawback of multiple donor harvesting over time is in the increased chances of creating wide scars as tension on the wound edges, which becomes greater with each subsequent harvest. Thus further refinement of the technique required better donor management. Consequently, two distinct approaches were pioneered. First, the Follicular-Unit Extraction (FUE) technique was developed in order to avoid strip harvest and circumvent a linear scar. Second, surgeons who preferred strip harvesting adopted a new suturing technique (the *trichophytic closure*) that allowed hair to grow through the scar and thereby camouflage its linear appearance.

Non-Surgical Options

Medical Treatment

Today there are a bewildering number of medical options for hair loss. Unfortunately, many of the herbal and vitamin hair-loss therapies lack substantiated evidence of benefit. With the advent of the Internet, numerous sites claim to have the product that can achieve instant hair growth and an enduring fix for baldness. Nevertheless, the Food and Drug Administration (FDA) has approved only two medical therapies for hair loss that have proven to be beneficial in selected patients, oral finasteride (marketed as Propecia by Merck) and topical minoxidil (marketed as Rogaine by Pfizer, now owned by Johnson and Johnson). Finasteride and minoxidil are approved for male hair loss, whereas only minoxidil is approved for female hair loss. Although these products may not be suitable for every person, they do provide a method to reduce or delay further hair loss and in some persons restore some hair fullness.

In addition, these medications can also help to optimize the results of surgical hair restoration.

The effects of minoxidil on hair growth were discovered on the sidelines of another treatment. Originally used as a medication to treat severe hypertension, individuals who received minoxidil observed hair growth not only on their scalp but also on their body. Further investigation was conducted aiming to localize the hair-growing effects of minoxidil to the scalp only, leading to the development of the topical solution. Although, the initial early reports of oral minoxidil for hypertension linked minoxidil to increasing the risk in heart-disease patients, localized topical minoxidil for hair loss is safe and is an over-the-counter treatment in the United States.

Minoxidil is currently manufactured as a 5% and 2% concentration topical solution intended for direct application to the scalp (not the hair). The 5% concentration is designed for male patients, whereas the 2% concentration is designated for women. However, women who desire a more vigorous treatment can take the 5% concentration as an off-label indication. Interestingly, although the 5% concentration in women can show an increased rate of hair growth early on, there is no statistically significant difference in results between the 5% and 2% concentration after one year of usage.

The mechanism of action for topical minoxidil is unclear. As a potassium channel agonist, the cellular effects on hair growth are only speculative. However, it is known that minoxidil can cycle hairs out of telogen (the resting phase of the hair cycle) and push them into the anagen growth phase and also leads to a more sustained anagen period. Consequently, many individuals will experience increased hair shedding early on in treatment for several weeks and should be advised that this phenomenon actually indicates positive effect of the treatment, as hairs move from telogen to anagen. Considering the length of each hair-growth cycle, it takes approximately six months for new hair to re-grow long enough in order for the person to realize the effectiveness of the treatment. Also, because of this effect that minoxidil has on migrating hairs from telogen to anagen, minoxidil is a recommended treatment for individuals who suffer from acute or chronic telogen effluvium.

The main side effect of minoxidil is an allergic contact dermatitis, which causes a flaky and itchy scalp and accounts for one of the two major objections for use of minoxidil. Another side effect can be heart palpitations and/or increased growth of facial hair (seen mostly in women). The most common brand name for minoxidil is Rogaine. Minoxidil is available in generic form and can be purchased in most pharmacies throughout the world.

Beside side effects, another major reason for the lack of compliance to the product is the complaint about minoxidil making one's hair look oily. Not only

does oily hair lack neatness but also it is difficult to style and sticks together, further exposing thin areas. Interestingly, some individuals will complain to the contrary, wherein the product renders their hair looking and feeling dry and in some situations leaves behind an unattractive white film. These complaints were mostly resolved with the release of Rogaine-brand foam.

The original minoxidil formula found in the lotion contains the alcohol-based ingredient propylene glycol, the culprit for scalp irritation and oily-looking hair, which when removed from the 5% Rogaine foam made the product both water-soluble and more tolerable. The correct application of the product is twice a day. However, once-a-day application may be beneficial considering that the product has been thought to last for 22 hours in the scalp when applied topically as compared with a 4-hour half life in the bloodstream when used as an intravenous preparation for hypertension.

The hair growing effects of finasteride were also discovered accidentally when the finasteride 5-mg pill (marketed as Proscar by Merck) was given to patients to manage an enlarged prostate. Subsequent studies found that a 1-mg dosage, which is marketed as Propecia, was adequate to combat alopecia. Finasteride is a prescription-only medication and at the time of publication of this textbook, it is still on patent by Merck so a generic version does not exist. Finasteride works as a type II 5-alpha reductase inhibitor, where 5-alpha reductase is the enzyme responsible for converting testosterone (T) to dihydrotestosterone (DHT). The presence of circulating DHT impacts hair follicles susceptible to hair loss and therefore a lower level of serum DHT can slow progression of hair loss and reconvert vellus hairs back into terminal hairs. The type II 5-alpha reductase is found predominantly in the hair follicles (and the prostate) and therefore does not promote hair growth anywhere else on the body.

Side effects occur in less than 2% of the patients and include decreased libido, erectile dysfunction, decreased ejaculate volume, and breast engorgement and tenderness. Side effects should fade away within six months after cessation and are found to be resolved in 58% of individuals who continue the treatment. Finasteride is known to reduce serum Prostate-Specific Antigen (PSA) levels by 30% to 50%. Therefore, individuals over 40 years of age who are taking finasteride should be informed about their altered PSA value and are advised to make certain that their primary-care physician is consulted. Finasteride has been shown to cause potential anatomical abnormalities (hypospadias) in a male fetus in women of childbearing age who take it but not in men who father children and who are on the medication. Therefore, finasteride is absolutely contraindicated in premenopausal women and has shown only equivocal benefit in those who are postmenopausal. In several controlled studies in postmenopausal women, finasteride was shown to have no benefit,[1,2] whereas one more recent

uncontrolled study indicated that there might be some gain in postmenopausal women who take finasteride.[3] Although finasteride does not cause abnormalities in the fetus when men ingest it, decreased sperm count and semen volume, which may rarely occur, can diminish their fertility. Therefore, men who have difficulties conceiving may consider stopping finasteride during attempts at conception. Trials conducted in 2005 in the field of prostate-cancer prevention initially concluded that the use of finasteride increased the prevalence of prostate cancer. Additional trials conducted in 2008 rectified the original finding: since finasteride shrinks the prostate, it does not cause prostate cancer but facilitates earlier detection of cancer. Finasteride was once banned in sports because of its potential as a steroid-masking agent but recently has been approved for use in the olympics, FIFA and many other sports. Another medication used to treat enlarged prostate is dutasteride (Avodart by Glaxo Smith Kline), which is a potent inhibitor of both Type I and Type II isoenzymes of 5-alpha-reductase.This medication is not FDA- approved for hair loss, and its use is considered experiential and off-label. Nevertheless, discussions about the medication should be relegated to the physician's judgment with this commentary intended for the reader's education only.

Initial FDA trials in the late 1990s focused almost entirely on the benefits that finasteride and minoxidil have on the vertex, also referred to as the crown, region.[4] However, subsequent studies have shown both medications to be proven beneficial in the frontal, temporal and midscalp hair. Therefore, individuals who claim that finasteride and minoxidil are only intended for restoration of the crown region are referencing outdated information.* Unfortunately, all the benefits from using these products would fade away with cessation of the medication. As it takes approximately six months to develop a visible effect from the medication, it usually requires about the same time for hair to reverse to its starting point once the individual stops medical treatment. Taking both medications has shown to have a synergistic benefit for the individual and when an individual decides to stop one medication, the benefits gained from the single product will disappear but the improvement attained from the other product will be maintained for as long as the individual continues on with that product.

Although finasteride and minoxidil can provide wonderful results, they are not a replacement for hair transplantation. As standalone treatments, finasteride and minoxidil can convert many wispy, vellus hairs back into thicker, terminal hairs (but not universally or uniformly so). However, for those individuals who have lost all of their hairs including vellus hairs (so-called slick baldness), neither

*The reason that the package inserts for both medications still only assert a benefit in the crown region reflects the extent to which FDA trials were conducted and therefore to which is permitted by law to declare.

finasteride nor minoxidil will prove to be beneficial. Nevertheless, even in relatively advanced stages of hair loss, finasteride and minoxidil may retard further hair loss even if no hair is actually restored in the regions of slick baldness. There are three observable effects of medical treatment: preserving the status quo (hair is maintained and the progression of hair loss diminished), increasing hair volume (fine, vellus hairs are reverted into thicker, terminal hairs, which in turn provides better coverage and better styling options), and increasing hair count (with fewer hairs going into telogen stage, there are fewer hairs falling out).

As established, finasteride and minoxidil do not entirely restore a full head of hair, but they can contribute to a better aesthetic result when combined with hair transplant. Initially, they can help immediately after the surgery to protect original hair from going into postoperative shock and shedding and possibly to accelerate re-growth of the transplanted hair. Finasteride can be taken without interruption, while it is recommended to stop minoxidil two to seven days before and after the procedure. Ongoing use of the products is of course beneficial and recommended. Whether medications actually cause an increase in hair volume by the conversion of vellus hair into terminal hair or by re-growing or maintaining vellus hair, which would serve to camouflage the scalp, these products can undoubtedly enhance any hair-transplant result. Besides creating a better visual result, medical management will also help retard further hair loss and lengthen the time interval necessary for the next hair-transplant session.

Camouflaging Products

In the process of hair thinning, decreased volume of hair no longer provides sufficient canopy to camouflage the naked scalp. As the light passes through the hair and reflects upon the scalp, an individual experiences bothersome "see-through" effect. The bigger the color contrast between the scalp tone and hair color, the more exposed the scalp appears and the more obvious thinning becomes. Camouflaging agents are topical products applied to the hair or scalp to increase the visual density of the hair. When applied to hair, these products are usually hair-building fibers (such as keratin protein or rayon fibers) that cling to the hair, creating a web-like coverage. Although these fibers can be affixed to the hair more tenaciously with additional hair sprays, a disadvantage of fibers is that they can come off onto pillows or clothes, causing social embarrassment and loss of effect. As people who have dandruff avoid wearing dark clothes, people using hair-thickening fibers should avoid wearing light-color clothing. In addition, these products can be slightly messy during application. Because camouflaging agents intertwine with an individual's own

hair, these fibers should resist light rain but can be displaced with a heavy downpour or worse during swimming. Examples of camouflaging products include Toppik, Hair Magic, ProThik, and Fullmore. Another category of camouflaging product is applied directly to the scalp as a cream or lotion with the benefit that they are more resistant to washing out. The downside to the use of this kind of product is that they are more difficult to apply in a long hairstyle. Examples of this kind of product are DermMatch and COUVRe. In general, these agents are matched to the color of the individual's hair.

Camouflaging products are used principally for two reasons: independently to cover existing baldness and/or in combination with a hair transplant. The first reason is obvious, the individuals are bothered by hair loss but they are not interested in any surgical procedure. Alternatively, when combined with hair transplantation, camouflaging products can be offered as a temporary solution before or after surgery. If an individual has to wait to undergo hair-transplant surgery, these products can ease one's discomfort in dealing with his or her thin hair before surgery. In addition, they can be used in the postoperative setting when the patient experiences disturbing and unacceptable postoperative thinning (telogen effluvium) or during the transition period in anticipation for transplanted hair to grow.

It is important to mention that camouflaging products can accumulate and clog the scalp; hence, proper scalp hygiene should be addressed with every patient. For that reason, it is not recommended to use camouflaging products right after the surgery while scabs are still present. Furthermore, if a person is using minoxidil and camouflaging products simultaneously, it is important to stress the application of minoxidil on a clean scalp first. Therefore, the individual is instructed to apply minoxidil first and then the other products, in the morning, and for the evening application of minoxidil, to wash or wipe off any residual camouflaging product before minoxidil application.

Another way to camouflage baldness includes hairpieces and wigs. Hairpieces refer to partial hair prostheses, which are also known as hair systems or toupees, whereas a wig refers to a product that covers the entire expanse of the head. A cap is the term used to refer to a wig used by a male wearer, i.e., the product also covers the entire expanse of the scalp like a wig leaving no exposed natural hair. Most men wear hair systems as compared to caps. Although more people opt for surgical hair transplantation today making hairpieces not as popular as they were in the past, it is still important for the hair-transplant team to be educated about all hair-restoration options.

The three major complaints against hairpieces in the past were that the hair looked unnatural, that the hairpieces were too thick and bushy, and that the "hairline" was artificial in appearance and thus could not be exposed. Great

strides have been made toward more natural-looking hairpieces in the last few decades. Additionally, no matter how natural a hairpiece may appear, the wearer is always worried that he may be "found out" and must limit certain activities like swimming, driving in a convertible car, or being around other people while grooming. Today's hairpieces are constructed of natural hair; their density and color can be matched very closely to the wearer's natural hair, and the base to which the hair is woven is thin and transparent allowing for an undetectable hairline. Hairpieces can be attached to the scalp through a variety of mechanisms. Tape adhesives are used for daily adherence so that the hair system can be easily removed at nighttime. Glue adhesives provide more durable bonding and oftentimes can keep a system in place for approximately more than a month's time. Similarly, hair weaving uses existing hair to provide anchorage to the hair system through inter-weaving of the two together. Weaving can also provide a month of time for a hair system to remain in place before maintenance is required.

Hairstyling and maintenance for a hairpiece requires special sensitivity and technique to provide proper adhesion and blending and is usually carried out in specialized salons. Women who wear wigs are usually well trained in hairstyling their wig, and wigs require less professional assistance for maintenance than a hairpiece does.

The benefit of a hairpiece and a wig is that they can provide immediate gratification as opposed to a hair transplant that requires six months or beyond to see the result and that may require several sessions to attain the desired level of hair density. Further, in individuals with extensive baldness (Norwood VII) or poor donor hair density, a hairpiece may be the only method to attain desirable levels of coverage and hair density. In addition, someone can undergo one or several hair transplantations while wearing a hairpiece or a wig and thereby have an inconspicuous transition from baldness to having one's hair restored to complete satisfaction.

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2 Staffing and Training 360

Staff Selection and Interviewing

Taking into account that there is no specific training or a specific degree required for assisting in hair transplantation (at the time that this book is written), the ideal candidate is someone who is skillful, conscientious and personable. This person can be a nurse, medical assistant or a beautician and should have good eyesight and should also be able to express his or her liking toward working with people. Some knowledge and/or experience in the medical field, e.g., knowing the difference between a clean and contaminated field, is an advantage. An ideal assistant is capable of being a team player and can also work independently.

There are two characteristics that set apart a hair-transplant assistant from any other surgical assistant: manual dexterity and mental aptitude for tedious work. Proper graft handling is critical to attain uniformly excellent results, and hiring the right person to assist in surgery is essential. Therefore, when interviewing a prospect for the position of hair-transplant assistant, one should inquire about the following: if the person is detail oriented, has patience, can sit still, can work well with others, and can concentrate for long periods of time. In addition, the interviewer should observe if the candidate is neat and possesses good people skills. Although hair transplantation is a clean procedure, lack of cleanliness may bear heavy consequences for the patient.

The 10-minute, sponge-cutting test described in this book can be performed to select appropriate candidates. Gather one tongue depressor, a single-edged razor blade, one jeweler forceps, and several pieces of special foam to cut. The best foam on which to cut and practice possesses medium firmness; and the one that the authors prefer to employ is derived from the foam used to separate toes during a pedicure (Fig. 2.1). Start the test by setting up the cutting station, and then ask the candidate to sliver the foam, like slicing a loaf of bread, making sure that the slices (slivers) are of the same thickness and shape. The interviewer should observe the candidate during the cutting period, then examine

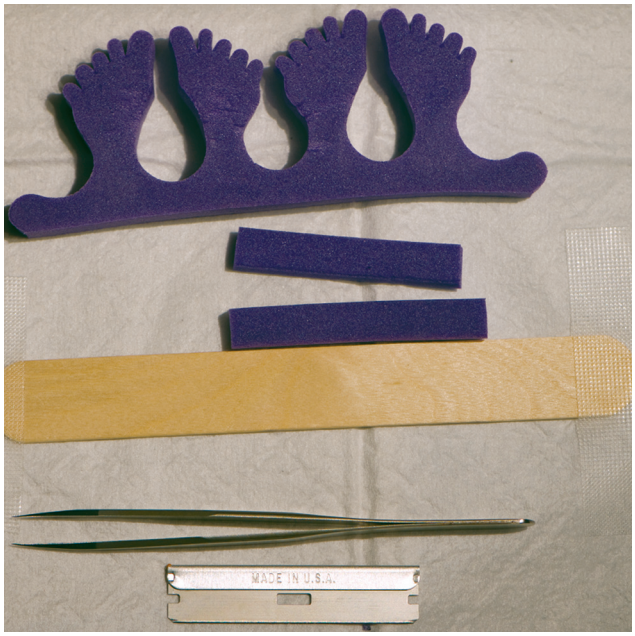


Figure 2.1

This photograph shows the set-up for a 10-minute, foam-cutting test to select candidates for hair-restoration assistants. The materials necessary to perform the test are as follows: One tongue depressor, a single-edged, razor blade, one jeweler forceps, and several pieces of special foam (usually the kind used to separate toes during a pedicure as shown).

the slivers and discuss the experience with the candidate. If the person is restless or cannot identify variation in the shape and size of the cut slivers, then he or she may not be a good match for the field of hair restoration. If the candidate demonstrates patience and the ability to pay attention to details, then the training can be further advanced. (For more details on how to set up and execute the prescribed cutting foam practice, please refer to the section on Phase I training in the next chapter.)

Surgical Assistant Training

A hair-transplant surgeon cannot operate without a proficient team of two or more surgical assistants. Without a skilled team behind a surgeon, quality and efficiency of any hair-restoration procedure will almost certainly fall short of the desired aesthetic mark. However, currently no school for assistant training exists to meet that demand. For that reason, this chapter focuses extensively on assistant training and will cover two training phases: preparatory phase (Phase I Training) during which focus is given to introducing basic knowledge, acquiring stamina and patience for tedious work, developing proper hand movement and correct body posture, and cultivating the mental capacity for self monitoring and critical thinking. The second phase of training is conducted on a live patient, handling real tissue, which will be referred to as the surgical phase of training (Phase II Training). During this phase, attention is given to developing awareness for a patient's comfort and other needs, proper tissue

handling, and safe graft preparation and placement. This chapter will be limited to an overview of how to conduct Phase I and Phase II training, with more clinical topics like graft dissection and placement reserved for upcoming chapters.

Phase I Training

Preparatory training: Phase I Training is designed to develop skills, awareness and judgments required for quality graft preparation and placement without the risk and/or pressure of learning on a live patient. Phase I Training is also intended to help prospective employees get a sample experience of the job and thereby decide whether assisting in hair transplantation is something of interest to them and to help the employer make a better selection among potential candidates. As any training implies anxiety around developing new skills and learning a new trade, working on live tissue and the proximity of a real patient may contribute to greater disquiet and thereby prolong the training curve. During Phase I Training, the trainee has the opportunity to ask questions and make mistakes, while the trainer can teach critical thinking. Instead of crisis management, the trainer can invest time in role-playing and presenting complications, corrective actions and allow the trainee to learn without a high-pressure environment.

To set up a graft practicing station, take one under-pad, tape a tongue depressor to the under-pad, and have on hand the following: foam strips, a Personna No.10 blade on a blade handle, a single-edged razor blade, and one No. 3 jeweler forceps (Fig. 2.2). The authors suggest taking foam that is firm yet

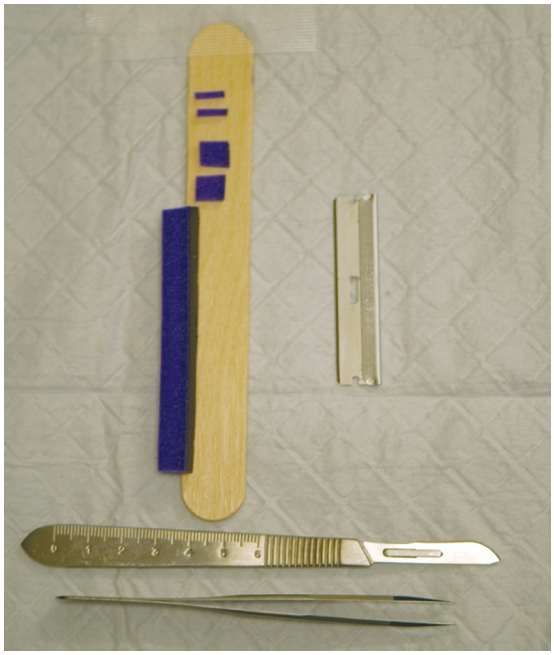


Figure 2.2

Phase I Training: The photograph shows the set-up for a graft dissecting station: a tongue depressor, foam strips, a No.10 blade on a blade-handle, a single-edged razor blade, and one No. 3 jeweler forceps.

Figure 2.3A

Phase I Training: The photograph shows one side of the foam that is marked in black to represent the epithelium and also the correct method for slivering with proper hand positioning, in which the sliver is gently pulled away from the blade.

Figure 2.3B

Phase I Training: This photograph shows "dissecting grafts" from slivers by using a Personna No.10 Blade on a handle.

easy to cut (as mentioned, the foam used to separate toes for a pedicure is ideal) and tailor it into strips 1 cm wide and 5 to 10 cm long (similar to the size of the donor strip). Take a black Sharpie marker and paint one side of the foam to indicate the "top", i.e., indicate where the epithelium would be on the real donor tissue. Instruct the trainee to hold the foam by the top only. Directing the forceps to the top of the foam, securing the foam with the left hand and cutting with the right hand teaches manual dexterity and promotes delicate movements as well as teaching the importance of handling tissue by the epithelium only (Figs 2.3A and B).

Developing skill takes time and practice. A five-day course of Phase I Training is designed to build up the stamina slowly and to introduce progressively new information to a trainee. During the first two days, the trainee spends 2 hours on practicing graft dissection only by cutting foam strips for 15 to 20 minutes, then evaluating and discussing those results for five to ten minutes on what did and did not work well, e.g., if a sliver's size and shape are even and consistent (if not, what action would correct this error), whether the tongue blade is etched (a sign that the trainee is pushing too hard with the blade), etc. (Fig. 2.4A). If the foam lifts while slivering, the trainee should learn to differentiate whether the blade is dull or the hand motion is incorrect, which is important for gaining self-awareness (Fig. 2.4B). On days three and four, the trainee spends 3 hours per day on graft dissection and graft placement. The practice time

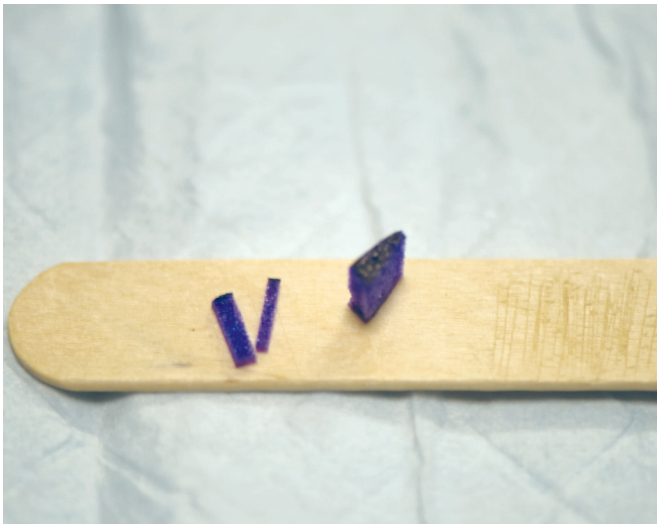


Figure 2.4A

Phase I Training: This photographs shows signs of an incorrect dissecting technique, i.e., uneven slivers and an etched tongue blade.

Figure 2.4B

Phase I Training: This photograph shows other signs of an incorrect dissecting technique, i.e., a dull blade that arises from pressing down with the blade instead of using a sliding motion during graft dissection.

involves 30 minutes of activity followed by 15-minute periods spent on evaluation, discussion, and rest, alternating between cutting and placing practice. Graft placement will be explained in the next chapter. On the fifth day, the training extends to a 4-hour segment, and the practice alternates between graft dissection and graft placement having the trainee spend 45 minutes on practice and 15 minutes on discussion and resting. During the practice, other information about patient care or surgical flow can be introduced for the purpose of establishing basic knowledge as well as to provide a distraction while expecting the trainee to stay focused on the task at hand. As trivial as it may sound, it is important to teach someone to talk and listen while keeping one's eyes on the task (instead of stopping the work and looking at the other person).

During the pre-patient training, the following three parameters are observed: the grip (hand-to-forceps and forceps-to-tissue), the blade movement (sliding instead of a pushing or sawing motion), and the sliver quality (individual shape and width consistency). The correct grip can be developed by observing if the trainee's hand cramps, which would mean that the grip on the forceps is too firm, and if the foam is indented or lifting from the cutting surface, which would mean that the pressure exercised on the foam (tissue) by the tip of the forceps is too strong. The correct blade movement consists of sliding the blade or teasing it through the foam (tissue) but never pushing or sawing it. The blade handle is held like a pen with the index finger on top to delicately manipulate

the blade. Driving the blade through the foam in a consistent, parallel fashion would produce uniform slivers. In case the slivers demonstrate an inconsistent and odd shape, attention should be given to the blade path (wrist rotation or incorrect way of holding the blade handle may cause an oblique or tilted position instead of a straight cut, thus a change in the "graft" shape). In addition, while slivering with the right hand, the left hand holds the foam and gently pulls it away to open the path for the blade. This practice is important to develop the fine motor skills necessary for graft dissection. Video 1 of Disc 1 clearly demonstrates this phase.

Proper and safe graft placement requires steady and precise hand movements with gentle graft manipulation. To develop placing skills, a specially prepared Styrofoam head is attached to the patient's chair in order to reproduce the most realistic placing environment. Grafts made of foam during cutting training are used for practice. While the trainees practice placing grafts, the following parameters are observed: graft handling (specifically hand-to-forceps and forceps-to-graft grip), the hand movement during graft insertion (wrist instead of arm movement is encouraged), the hand pressure on the patient's head (gently dabbing instead of pushing), and body posture (not slouching or having one's elbows in the front of a patient's or colleague's face).

To set up for the practice, take a Styrofoam head (it can be purchased at a local beauty supply store), reusable modeling clay (which should be placed onto the Styrofoam head to create a soft layer of "skin") (Fig. 2.5), a swim cap (then placed over the Styrofoam head to hold the clay in place) (Fig. 2.6), a 3-inch ACE bandage (used to attach the Styrofoam head to the headrest of the dental chair) (Fig. 2.7), a jeweler forceps No. 3 or No. 5 for each trainee, a 16G needle and/or SP 91 blade (to make incisions or sites) (Fig. 2.8), dissected foam "grafts" obtained during the cutting practice, and one or two pieces of 4 × 4 gauze (to hold the "grafts" in the site using only a gentle dabbing pressure). The instructor can make at least 50 to 100 incisions in the swim cap with the needle or blade, over the entire head (hairline, top and vertex), then instruct the trainees to insert the foam "grafts" into the Styrofoam head (Fig. 2.9). The importance of attaching the Styrofoam head to a chair is in creating the opportunity for the trainee to develop proper body and hand position, as well as generating the awareness of a restricted working space. Ideally, one would use real tissue grafts that were left over from a previous procedure, most often encountered following an eyebrow transplant, or obtained from cadaver tissue stored in formaldehyde and kept for practicing purposes. However, using foam "grafts" can be just as effective. Before placement, soak the "grafts" in water for 30 seconds to give them more weight and to prevent them from flying around or adhering to each other. Take a piece of gauze, fold it in four, and hand it to

Figure 2.5

Phase I Training: This photograph shows proper set-up for graft placement using a Styrofoam head with modeling clay affixed to the top.

Figure 2.6

Phase I Training: This photograph shows set-up for graft placement using a Styrofoam head with a swim cap over modeling clay.

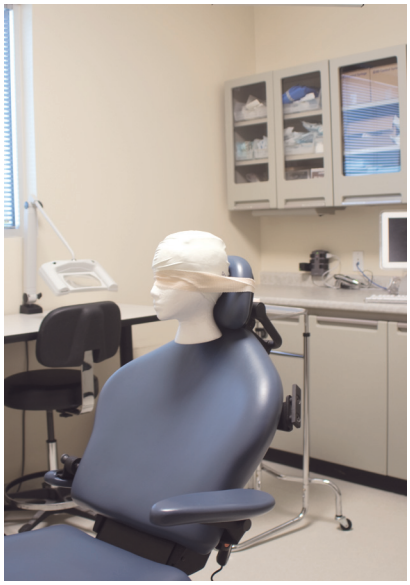


Figure 2.7

Phase I Training: This photograph shows the set up for graft placement now with the Styrofoam head attached to the headrest of a dental chair.

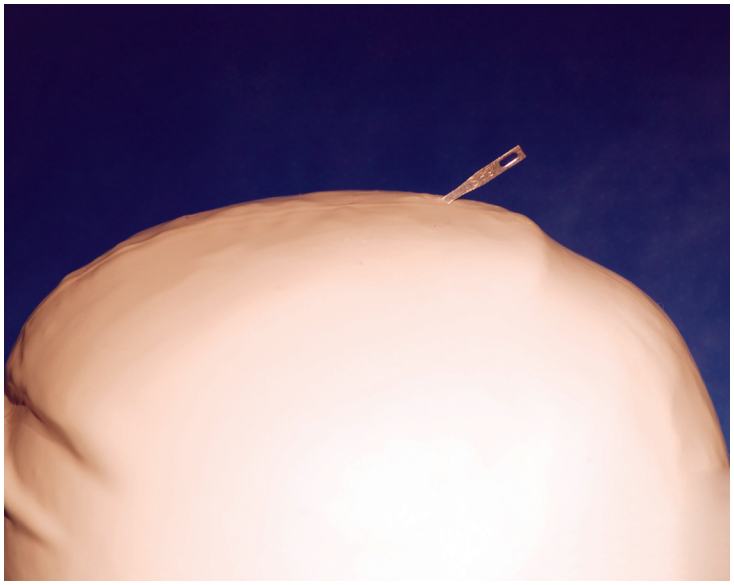


Figure 2.8

Phase I Training: This photograph shows site creation using an SP 91 blade.

Figure 2.9

Phase I Training: This photograph shows proper graft-insertion technique with emphasis on hand and instrument positioning.

the trainee to hold the gauze flat against the scalp using three to four fingers with the nondominant hand, e.g., the left hand for a right-handed individual. Then, instruct the trainee to place several "grafts" on the back of the non-dominant hand resting across the proximal phalanges, i.e., just in front of the knuckles. The most important part of this practice consists of taking the forceps to grasp a "graft" at the opposite end from the black "epithelium" then inserting the forceps into the sites created on the Styrofoam head a few millimeters below the surface, gently opening the forceps to deposit the graft into the site, and then gently sliding the forceps out of the site while ensuring that the graft remains within the site. If needed, use the gauze held in your left hand to hold the "graft" in place while pulling the forceps out. The objective of the training is to have a single movement of inserting and depositing a "graft" and having all "grafts" protruding out of the Styrofoam head at approximately the same height. The trainee should practice placing in all of the following three areas: left and right hairline and in the whorl pattern of the vertex. Once a trainee feels equally comfortable in working on the "entire head" then he or she may continue training on a live patient (with real donor tissue). Placing grafts requires dexterity and excellent hand and eye coordination. Dr. Jennifer Martinick has invented two types of Training Placer Boards, one for developing a basic level and the other for developing an advanced level of dexterity. Each training board has tiny openings that need to be filled in a systematic way. This training tool is excellent for developing precision, reinforcing basic principles, correcting movements, and somewhat for enhancing speed in graft placement. It is

important to mention here that Phase I training and use of different methods and tools cannot replace practice on real tissue but does accelerate one's training progress. Video 2 of Disc 1 gives a detailed view on this training.

Phase II Training

Live surgery training: Phase II should start by attempting to perform smaller sessions or to work part time before venturing to make thousands of grafts in one session. Developing skills and speed in graft dissection and placement may take several months of practice, and the authors suggest starting with developing one skill at the time; for example, one should master graft dissection before venturing into graft placement. Attempting to work full time on a large session too early, thus working long hours highly concentrated on a task, may lead to exhausting assistants and destroying their focus and enthusiasm as well as damaging or wasting precious donor tissue. The results could be devastating ranging from unhappy patients to a demoralized team.

As mentioned earlier, this section will cover all tasks involved with assisting in hair-transplant surgery with the intention to provide an overview of the basic knowledge for assistant training. The training performed on a live patient does not differ from performing the actual procedure and will be explained in detail later. The setup for surgery along with instrumentation and surgical flow are explained in the upcoming sections.

Graft preparation is a process through which donor tissue is dissected and transformed into individual grafts. In the process of graft preparation, we begin with the harvested donor tissue, which comes in one or many strips varying in width and length and ends up with grafts that also vary in size and type. The process of graft dissection can be described in six distinctive steps:

(1) Measuring and segmenting the donor strip

(2) Trimming the excess fat and tissue slivering

(3) Follicular-unit separation

(4) Graft transfer into a storage dish

(5) Graft grouping and

(6) Graft counting

Each step is important for the following reasons: measuring and recording the dimensions of the donor strip makes it easier to calculate and predict graft yield and can also serve as a reference for any subsequent procedure; excess fat left on a graft can compromise graft placement and therefore should be trimmed off (Fig. 2.10); slivering or "slicing" the donor tissue exposes rows of follicular units rendering them more visible for later dissection (Fig. 2.11);

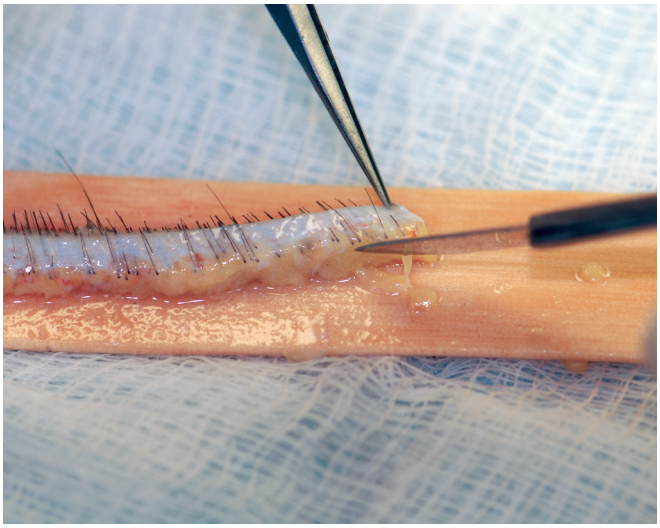


Figure 2.10

Phase II Training: This photograph shows the trimming of extra fat since excessive fat that is left on the graft can compromise graft placement.

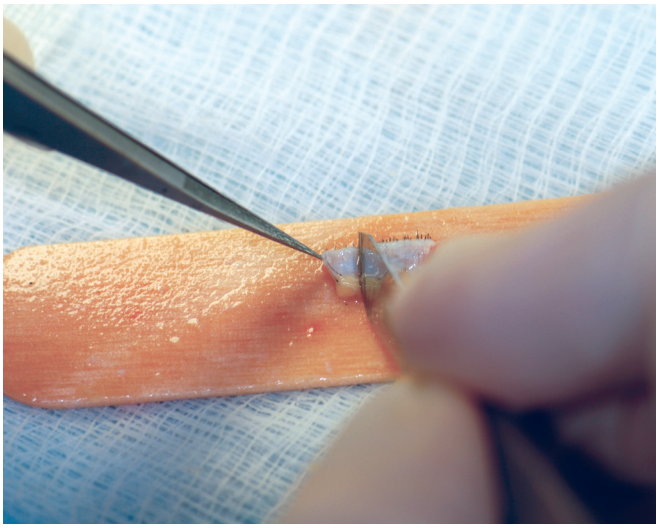


Figure 2.11

Phase II Training: Slivering or "slicing" the donor tissue exposes rows of follicular units rendering them more visible for later dissection.

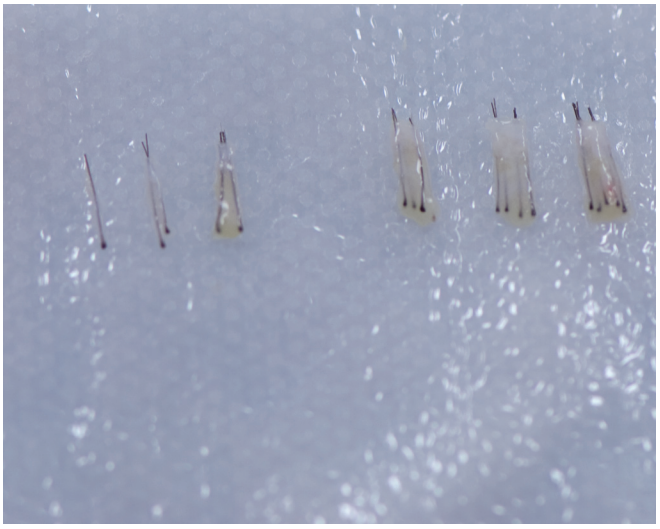


Figure 2.12

Phase II Training: This photograph shows single and multi-follicular unit grafts, starting with a 1-hair graft on the left and finishing with a 6-hair graft on the right.

graft preparation is the actual act of making grafts by isolating a single follicular unit (FUG), or two or more follicular units (MUG) (Fig. 2.12); transferring grafts into a sterile dish filled with chilled saline and grouping them by their size and hair count assures their viability as well as facilitates graft placement (Fig. 2.13); and counting and recording the number and types of grafts dissected ensures accuracy in matching sites and totaling the number of hairs being transferred.

Figure 2.13

Phase II Training: This photograph shows a sterile dish filled with chilled saline solution for proper graft storage with different graft sizes orderly displayed for easy graft counting and immediate access to the appropriate graft size during the process of graft placement. All grafts are placed on Telfa pads and always organized in the same order. Starting from the front is a row of 1-hair FUGs, then a row of 2-hair FUGs, followed by 3-hair FUGs. In the back row are DFU grafts (Telfa pads have been turned sideways to delineate the different grafts from one another more clearly).

To develop proper cutting skills, an assistant should have good judgment and good motor skills, i.e., the method by which a person manipulates the donor tissue with forceps and blade. Holding the tissue must be somewhat gentle yet firm, and the hand and blade movement, delicate and precise. Judgment refers to the assistant's knowledge of conditions required for tissue and hair viability and good graft quality, and their judgment in applying that knowledge. Cutting grafts that are inappropriate in size and quality or permitting them to desiccate can be detrimental to the success of the surgery.

The three main objectives of safe graft preparation are the following: (1) preserving follicular-unit integrity, (2) preserving graft viability and naturalness, (3) maintaining graft size/shape consistency. Follicular units are groupings of hair in which hair naturally grows in clusters of 1 to 4 hairs. Their distribution and spacing is random, and part of the training should consist of examining actual scalp of shaved donor area and visualizing the path of possible dissection or by examining the donor strip and performing the same visualization before starting the process of dissection (Fig.2.14A). Preserving follicular-unit integrity refers to maintaining hair structure from the fat layer to the epithelium including the hair bulb and the hair shaft intact (Fig. 2.14B). The success of hair restoration is greatly affected by the condition of the hair follicles; if the hair bulb or the hair shaft is cut, i.e., transected, the hair may not grow back or may grow weak and damaged (Fig. 2.15). Tissue left to dry out will result in poor or no growth, while tissue being squeezed and traumatized while cutting (such as holding the tissue at the level of the follicles instead of the epithelium will consequently create crush injury to the hair structure) will produce unnaturally kinky-looking hair. All recipient sites made during one surgery should have

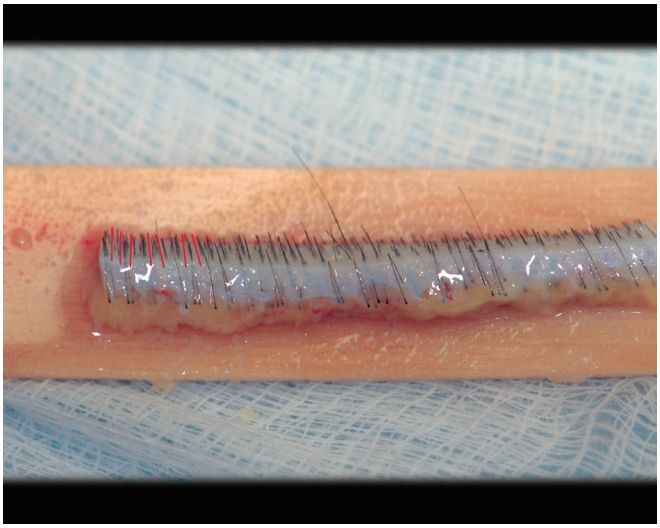


Figure 2.14A

Phase II Training: This photograph shows donor-tissue examination and visualizing the path of possible dissection and slivering.

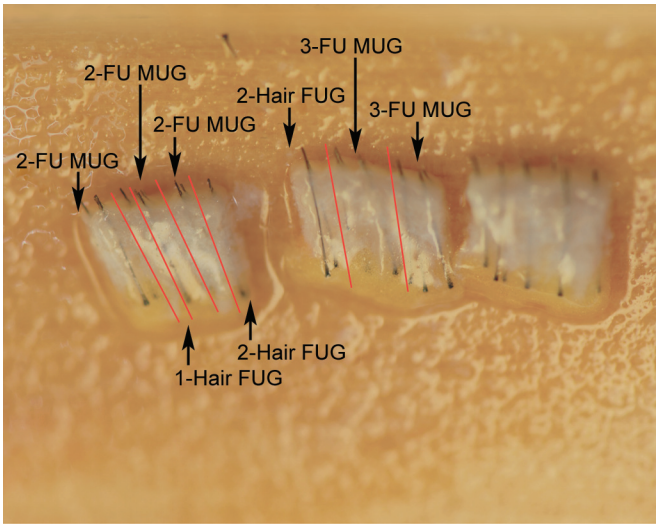


Figure 2.14B

Phase II Training: This photograph shows donor-tissue examination and visualizing the path of possible dissection and graft creation.

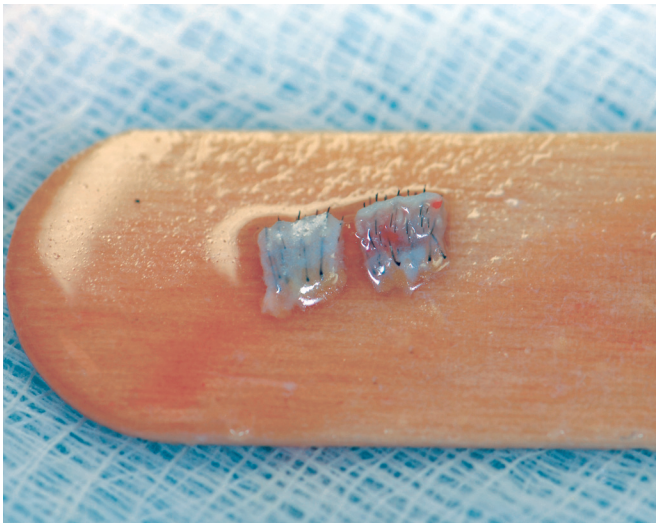


Figure 2.15

Phase II Training: This photograph shows a nicely dissected sliver on the left and a transected sliver on the right.

consistent size and shape (because the size of the instrument is consistent); therefore, grafts should have matching size, hence the need for consistency in graft preparation. If the graft is too small for a particular site, it may fall into the depth of the site and result ultimately in pitting or cause ingrown hair. If the graft is too large, it may be forcefully inserted into a site, thus being damaged and ultimately results in hair growth that is either kinky or compressed, both conditions leading to unnaturalness. Graft trimming is the action by which the

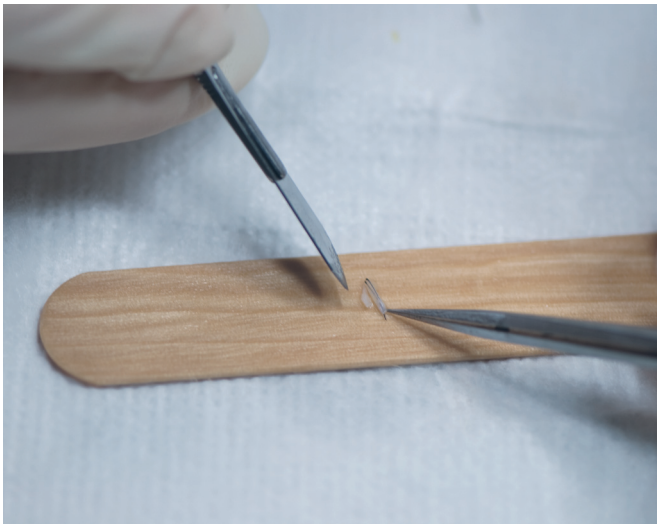


Figure 2.16

Phase II Training: This photograph shows graft trimming as the action by which excess tissue is removed and a graft is crafted into a clean, rectangular shape.

Figure 2.17

Phase II Training: This photograph shows both hands properly positioned to achieve effective and precise graft placement.

excess tissue is removed and a graft is crafted into a clean, rectangular shape (Fig. 2.16).

Graft placement describes the process in which a graft is inserted into a recipient site, like planting a tree. This is a two-hand process of transferring grafts from the back of the assistant's left hand (for a right-handed person) into the patient's scalp by using a fine-tipped forceps. This process requires a steady and precise hand movement with gentle graft handling. The left hand stabilizes the recipient field while the right hand guides grafts into the recipient sites (Fig. 2.17). Incorrect graft placement can directly affect the growth of the transplanted hair. If the grafts are traumatized during the process of their placement into recipient sites, the naturalness of the transplanted hair will be inevitably compromised. In addition, if the grafts are kept outside of ideal conditions, i.e. not kept moist and chilled, they may dry out which in turn lessens the success of hair growth. In order to perform safe graft placement, the following should be considered: conditions needed to preserve graft viability, correct and incorrect graft manipulation, graft position and graft orientation.

The main threat for graft viability is drying out. To prevent grafts from desiccation, smaller groups of 10 to 20 grafts should be taken out of the saline solution at any given time to be transplanted. In addition, while placing grafts, they should be kept moist all the time and should be sprayed frequently with saline solution. There are various ways to carry grafts ready for placement. For example, they can be carried on a 2 × 2 gauze or Telfa pad and then placed on

Figure 2.18A

The photograph shows a Telfa pad placed on the back of the non-dominant hand, carrying grafts ready for placement.

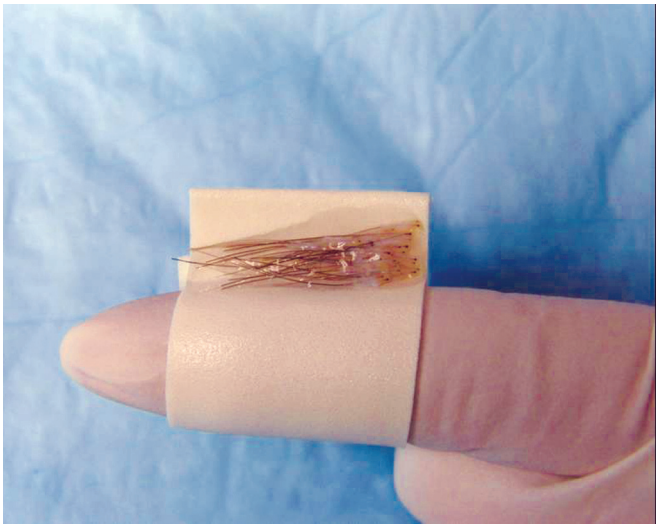


Figure 2.18B

The photograph shows foam tape placed around the index finger, carrying grafts ready for placement.

the back of the gloved nondominant hand (Fig. 2.18A) or on a foam adhesive taped around the index finger (Fig. 2.18B). The correct way to hold a graft is to grasp the fat tissue below the hair follicle with forceps, at a 30 to 45 degree angle between the graft and the forceps (Figs 2.19A and B). The correct way to insert a graft into the recipient site is to guide the tip of the forceps into the site opening, then release the forceps and gently deposit the graft into the site. An additional "push" of the forceps may be needed to slide a graft into the site and position it almost flush with the scalp. The graft should never be forced into a site (the obvious sign is a hair bulb bending upward to resemble a hook). While grafts are inserted with the dominant right hand, the left hand is used to dab the recipient area free of any blood or excessive sprayed saline. Use of wet gauze is recommended because it can help with holding grafts in the site during their insertion (without desiccating them, which may happen if the gauze is dry) and keeping the work field clean of blood. It is important to mention that the dabbing motion should be gentle and light, otherwise a strong push will move the patient's head possibly annoying the patient and making the recipient sites a moving target for other assistants working in the same recipient area.

The naturalness of hair restoration depends on the way grafts are positioned inside the recipient sites (Fig. 2.20). When grafts are placed at a correct depth, the scalp heals undetectably and when the hair curl in a graft follows a natural pattern, the hair-transplant result is seamless and successful. In order to heal undetectably, all grafts should be placed about half a millimeter to one millimeter

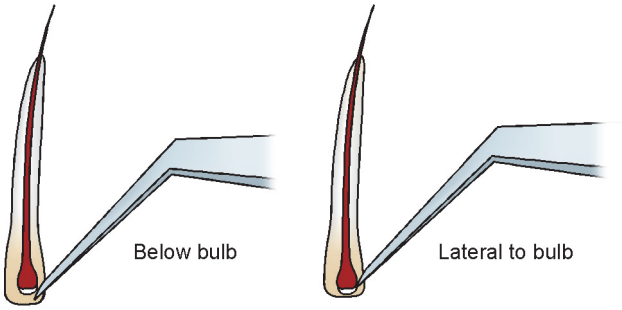


Figure 2.19A

Proper forceps-to-graft angle. The illustration demonstrates correct position of the forceps holding a graft at about a 45-degree angle, with the tips of the forceps always grasping only the fat layer. In the first illustration, there is sufficient fat below the hair bulb allowing the forceps to grasp the fat below the hair bulb. In the second illustration, the absence of fat below the hair bulb mandates grasping the fat layer adjacent to the hair bulb but never grasping the hair bulb itself.

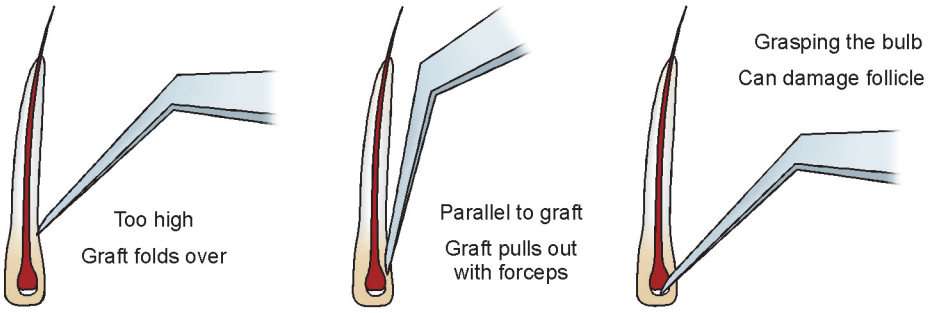


Figure 2.19B

Improper forceps-to-graft handling. In the first illustration starting from the left, the forceps grasp the graft too high and can lead to the graft accidentally folding over during insertion. In the second illustration, the forceps parallel the graft length, which can lead to the graft pulling out during forceps withdrawal. An exception is made when placing grafts into sites made in a very acute angle such as in the temples or the lower vertex where grasping grafts parallel to the shaft can facilitate placement. In the third illustration, the hair bulb is grasped that can lead to a damaged hair bulb (However, if the hair bulb is bare, the assistant will be forced to grasp the hair bulb for insertion, which should obviously be done with utmost care and with as gentle grasping as possible).

Figure 2.20

This photograph shows proper graft-to-site fit of the graft (above) situated half a millimeter above the surrounding scalp and with the graft (below) positioned flush with the surrounding scalp, which is less than ideal. Both show the hair curl correctly oriented facing forward.

above the scalp. Hair grows with a slight curl that almost always faces toward the scalp; in the hairline, hair grows forward and down; in the vertex it swirls from a central point with the hair still curling toward the scalp; and in the occipital donor area it grows downward curling inward. Consequently, each graft will have a curl that needs to be recognized and matched to the natural curl in the recipient area. Placing the direction of the curl correctly is particularly important in the temple area where the angles are very acute. If the curl is not matched and, for example, instead of curling toward the scalp the graft curls upwards or sideways, the result would look sparse or unnatural. Proper graft orientation and matching the natural hair curl is even more important in placing larger MUGs because incorrect orientation becomes much more obvious with a higher number of hairs emanating from one graft.

Surgical Flow

For a beginner assistant, it is difficult to know all the steps of the procedure. Therefore, the author has outlined the surgical flow in form of bulleted points in a sequence in which they normally proceed in her practice. Although surgical practices may vary, the following outline intends to provide an overview and not necessarily universal guidelines for the flow of the surgical procedure.

- The patient is welcomed and changes into a gown. Vital signs are recorded, and he or she receives preoperative sedation. If not already done in advance, the patient is asked to review and sign the consent forms, and his or her preoperative photographs are taken.
- The surgeon designs and outlines the intended area for transplantation (hairline or vertex) and then evaluates and shaves the donor tissue. The assistants help by cleaning away the shaved hair, taping the hair above the donor area with a surgical paper or plastic tape, place an ACE bandage around the patient's head and slide folded gauze under the entire bandage to capture any blood trickling down from the donor or recipient areas, and finally bring ice packs and chilled spray bottles filled with saline into the room for use.
- The surgeon administers local anesthesia and infiltrates the donor tumescent solution, while the assistant refills and hands over syringes, dabs excessive blood, and charts the medication used. (Note: In some offices the assistant administers the ring-block anesthesia.)
- The surgeon harvests the donor tissue. The assistant hands instruments over to the surgeon while holding the patient's head steady (if the patient is sedated) and dabs away any excessive blood. In our office, during this part of the procedure, the patient is sitting upright.

- The surgeon closes the donor site, (sutures or staples[†]) while the assistant may assist in holding the patient's head steady (and if not required, the assistant may proceed to graft dissection). The surgeon administers a ring block of long lasting anesthetic (0.25% bupivicaine) while the assistant measures the donor strips, records the measurements, segments the donor tissue and slivers first then dissects the grafts. The assistant also records the graft yield from several 2 cm segments of donor dissection then calculates to see the average yield per square cm, reporting the estimated yield to the surgeon.
- The surgeon infiltrates tumescent solution into the recipient area and starts to create recipient sites while the assistant tests for proper graft-to-recipient-site fit for the initial three to five sites made with each and every different instrument. The assistant continues graft dissection constantly monitoring graft production and graft "safety" and communicates the ongoing graft yield to the surgeon.
- The surgeon finishes recipient- site creation while the assistant finishes graft dissection and starts graft placement. (If more than one assistant are working together, then one may continue to make grafts while the other may start placing them). The assistant may offer a snack, refreshment and restroom break to the patient at this time (depending on how awake the patient may be) and then charts the total number of each kind of graft dissected.
- The assistant(s) places grafts, constantly making sure that the grafts remain moist and are placed at the proper depth and further that the hair curl faces a natural direction. In the meantime, the surgeon occasionally checks on graft placement progress and, when all grafts are placed, makes a final verification that all grafts are slightly elevated in the correct position and that the recipient area is properly cleaned. Finishing graft placement, the assistant sprays and cleans both the donor and recipient area with saline solution and then combs the patient's hair and blow-dries it.
- The assistant gives verbal and written postoperative instructions to the patient, hands a zip-lock bag filled with several pieces of gauze (in case of bleeding), and escorts the patient to his or her postsurgical caregiver.
- The assistant(s) cleans all the working surfaces with a disinfectant (wiping ice packs, light and cabinet handles), disposes of all the sharp items into the

[†] Physician's preference for sutures vs staples may be based on the following: staples are easy and quick to place but most patients do not like them; suturing takes longer but tends to be more comfortable for the patient than staples. There are two types of sutures, dissolvable and non-dissolvable. Dissolvable sutures do not require a postoperative visit to remove them but may cause allergic reactions and the speed in which they dissolve cannot be controlled and thus may cause problems, too early dissolving leading to wound dehiscence or too delayed leading to irritation. Non-dissolvable sutures have to be removed, but with a gentle hand, the process should not be uncomfortable and this method has become favored by many physicians.

designated sharps container, scrubs instruments according to OSHA regulations, sterilizes them in pouches within the autoclave, and restocks and reorders below-par surgical materials.

- At follow-up appointment(s), the assistant verifies that the donor and recipient areas are clean of blood and large scabs, removes sutures and reinforces postoperative care.

Medication

Surgical assistants are involved in patient care and therefore should have the basic knowledge about medication used in the procedure. All medication used in the procedure can be relegated to five purposes:

(1) To relax the patient

(2) To anesthetize from pain

(3) To decrease bleeding

(4) To diminish swelling

(5) To distend the tissue through tumescence

Medication used for sedation can help the patient to relax muscles, e.g., diazepam (Valium), to decrease anxiety, e.g., alprazolam (Xanax), to induce drowsiness, e.g., zolpidem (Ambien), or to sedate with amnesia, e.g., midazolam (Versed).

The most common anesthetic medication used for a ring block is lidocaine (1% or 2%). Lidocaine is quick to produce an anesthetic effect, but its numbing effect is short-lived lasting approximately for one to two hours. To extend the period of anesthesia, another medication is used, called bupivacaine (Marcaine), which takes several minutes to take effect but can last between eight and twenty hours in duration.

Epinephrine (or Adrenaline) is used to constrict blood vessels and thereby facilitates easier surgery. Epinephrine is usually diluted with saline solution to make a so-called "super juice." Epinephrine takes several minutes to produce effect on blood vessels and one should be patient before re-administering because an overdose of epinephrine can increase the heart rate to dangerous levels. Epinephrine is often found in combination with other anesthetics for the purpose of providing vasoconstriction and thereby keeping the anesthetic from being reabsorbed systemically and losing its effect too quickly.

Saline solution alone or in combination with a low dose of lidocaine and epinephrine defines the ingredients of a tumescent solution. Tumescent solution can be infiltrated into the donor area to create firm tissue, to straighten and separate hair, to provide additional vasoconstriction and to lift the scalp away

from the blood vessels and nerves. Tumescent solution in the recipient area has the purpose to create vasoconstriction and to elevate scalp and protect blood vessels and nerves.

It is important to mention here that women respond to epinephrine very well and usually half the amount of epinephrine is sufficient to create good hemostasis (absence of bleeding). However, infiltrating too much tumescent solution or administering too much epinephrine in the recipient area in women may cause extensive postoperative shedding. Because of its devastating effect, to avoid excessive shedding one should be cautious of the amount of medication being infiltrated locally in women.

Assistant's Duties

Surgical assistant's duties can be organized into six tasks which are as follows:

1. Setting up the surgery room encompasses preparing the preoperative medication, setting up the surgical tray, preparing the patient's chair and gown and setting up the cutting stations.
2. Assisting the doctor means helping with shaving and taping of the patient's hair, holding the patient's head firmly, handing instruments, dabbing blood, and adjusting the light as necessary.
3. Graft preparation describes the time when the assistant sits down and dissects tissue/grafts under magnifying glasses or microscopes, first slivering then separating FUGs and MUGs while carefully handling the tissue, spraying and keeping the tissue moist, measuring the strip, and grouping and counting grafts.
4. Graft placement is often performed standing by the patient and carefully inserting grafts into the recipient sites, matching the size of the site with the size of the graft as well as matching the hair curl with the natural hair pattern, keeping grafts moist, the recipient area clean, grafts slightly elevated, hair combed and never trapped under grafts and delivering the postoperative instructions.
5. Cleaning up the surgery room consists of undoing the cutting stations and the surgical tray, carefully disposing of the blades and needles into the sharps container, collecting instruments that need to be cleaned and wiping all the contact surfaces with a disinfectant of choice, e.g., CaviCide.
6. Cleaning and sterilizing instruments as per standard sterilization procedure, cleaning instruments according to OSHA regulations by paying special attention to fragile instruments such as forceps by protecting their tips with special covers, and packaging instruments and sterilizing them in the autoclave.

Surgical Set-up

For most of the procedure, set up is similar to a set up for any small surgical procedure. There should be a chair for the patient, electrically operated from lying flat to sitting-up position. This chair should be narrow in the back rest area and should have an adjustable headrest, designed to the specifications of a dental chair. The surgical instruments tray is similar to any small excision tray, and the exact content of instruments is decided by the physician. An assistant should be aware to display them in an orderly and efficient manner and always protect them from any contamination.

The only major difference is in the set up of the cutting stations. There are many ways to arrange a cutting station depending if microscopes, magnifying light, or loupes are used for graft dissection. In our office, we use table-mounted magnifying lights over an inclined board. The inclined table (at a 20 to 30 degree angle) provides an ergonomic cutting position for the long hours of graft dissection. As a substitute for a microscope, a fluorescent light (with three-sided illumination) with a magnifying visor (3x to 5x magnification) is used because the optical visor provides sufficient magnification for fine dissection, its size allowing easy visibility of both the central and peripheral fields and the fluorescent light yielding a cool, bright and shadowless illumination (Figs 2.21A to C).

Figures 2.21A to C

(A and B) Magnifying lights that can be mounted to a table or a wall with three-sided or round fluorescent light bulb and adjustable magnifying lens. On the left is a Waldmann Omnivue magnifier with a 3 diopter lens (for a 5- to 11-inch work distance) and on the right is a Luxo Circus magnifier with a 5 diopter lens (for a 6-inch work distance). (C) Stereoscopic microscope with adjustable work field height and LED light.

Depending on the arrangement of the station, the set up would be established in a fashion to protect the equipment, the tissue and the assistant, as well as to have all the instruments and blades needed for the process of graft dissection readily available. We will offer two basic ideas of how a cutting station is set up, first for the set up that uses magnifying lights and second for a set up that uses microscopes. For the first type of set up, one should prepare the following:

- Two under-pads per station, place one below the cutting station and one above to protect the cutting station
- A tongue depressor soaked in saline solution for a minimum of 30 minutes before cutting will be initiated for each cutting station
- Measuring tape, pen and paper, and one fine-spray bottle filled with chilled saline solution. This type of bottle sprays saline in a small, focused field providing desired moisture without making the entire cutting surface excessively wet.
- A single-edged, razor blade to sliver Caucasian and Asian hair-bearing tissue, which can be bent to match the curve found in African-American donor tissue
- Jeweler No. 3 forceps to hold the tissue, No.10 blade and a blade handle for trimming and dissecting grafts/follicular units, and a hemostat to help change the blades
- One sterile dish per station to soak grafts (such as a Petri dish or oval baking ramekin), ice pack, and a dish to dispose of the blades (Fig. 2.22A). Kindly refer to Video 3 of Disc 2.

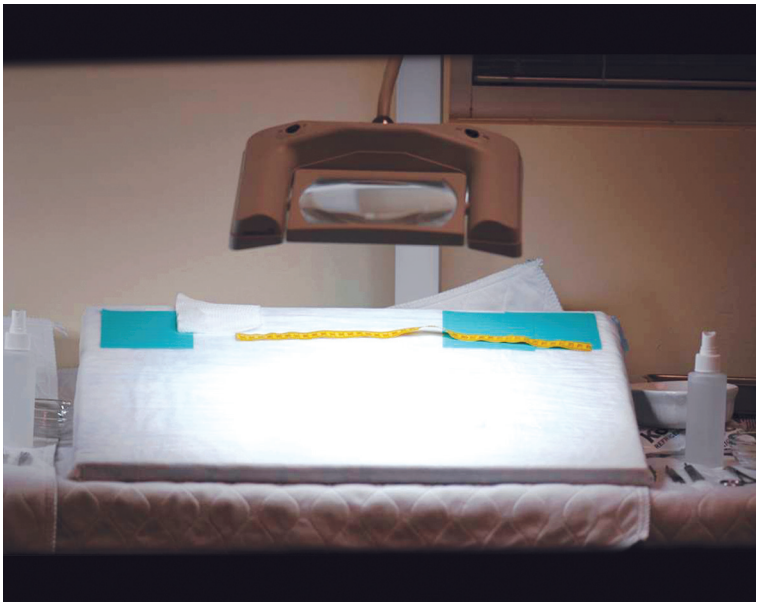


Figure 2.22A

Magnifying light set over an inclined board for ergonomic position during graft placement. The measuring tape, the instruments, spray bottles, storage dishes, pen and paper for recording graft number, and extra blades are situated between two cutting stations.

Figure 2.22B

This photograph shows the set up for graft preservation: a stainless steel dish placed on ice and filled with chilled saline holds the donor strip and ramekin dishes placed on ice packs and filled with chilled saline solution for graft storage. Travel-size spray bottles are selected because of their small and focused spray. A glass dish is used to store used blades before they are discarded into a sharps container. Blades, blade handles, forceps and hemostat (intended to change blades) are positioned for easy access for a right-handed person by placing the instruments to the right of the workstation. (The opposite arrangement would be the case for a left-handed assistant).

Figure 2.22C

The work surface on the microscope is covered with plastic wrap for its protection. Two tongue blades are prepared for dissection; and instruments, storage dishes, timer, pen and paper for recording graft number and extra supply are placed around the microscope.

The second type of set up relates to using microscopes for graft preparation:

- One under-pad underneath the microscope
- Microscopes are covered with barrier film on knobs and the base of the microscope

- One tongue blade soaked in saline for 30 minutes placed closer to the assistant, intended for cutting grafts
- One tongue blade (farther from the assistant) wrapped in barrier film intended to hold dissected grafts while cutting. (Barrier film is a heavy-duty clear film purchased from a dental supply outlet.) The purpose of barrier film is to hold saline bubbles (paddle), in which grafts will be temporarily placed before being transferred into a Petri dish. Four bubbles of saline are sprayed onto the tongue blade. Each bubble will hold 1-hair, 2-hair, 3-hair and 4-hair grafts separately.
- Two Petri dishes on ice filled with Plasmalyte A: one to hold slivers and another Petri dish quad to hold dissected grafts
- Instruments are decided upon by the staff; for slivers, most often a scalpel with a No. 10 blade is used, while for cutting grafts the use of instruments may vary such as a scalpel with a No. 10 blade, a single-edge prep blade or a double-edge blade with handle.
- A timer is used to set a pace for cutting grafts and sorting on the tongue blade. At the end of 12 minutes, assistants count grafts, keeping the numbers for 1-, 2-, 3-, and 4-hair follicular units separate; record those numbers on a sheet; and then transfer the grafts to a labeled quad Petri dish (Fig. 2.22B).

Performance Progress and Evaluation

Physicians or clinicians should develop their own training protocol. The basic training should span for a period of several months, ideally six to eight months, during which time the trainee should demonstrate proficiency in knowing and performing tasks related to assisting in hair transplantation. An optimal learning curve is achieved when didactic and practical tasks are well balanced.

There should be two types of training objectives for each month of the training: one that focuses on acquiring knowledge and the other type that focuses on developing skills. For example, during Phase I Training, the person being trained can learn about the difference between a clean and sterile procedure (didactic portion) as well as how to clean surgical instruments (practical portion). During the first month of Phase II Training, the trainee should observe the surgery, assist the physician, and learn the surgical flow and how to clean the surgical room while practicing basic graft dissection in order to grasp the concept of identifying and preserving follicular units. During the third month of training, the didactic objective can be centered on learning about hair growth, while practical objectives can focus on slivering. During the fourth month of training, the objectives can be to learn about hair loss as well as graft dissection (didactic) with the intention to make good-looking grafts and monitor total

number of grafts produced (practical). For the fifth month of training, the trainee can learn about hair restoration (didactic) and increase efficiency in graft production, e.g., to aim to increase the number of grafts made per hour by an extra 50 (practical). During the sixth month, the trainee can learn about setting up the surgical room, prepare medication and instruments and the patient for the surgery, while further improving graft-cutting production with the objective to reach, as an example, 150 grafts per hour. As mentioned above, the training schedule can be designed to accommodate the surgical schedule and the size of the transplant procedure performed. However, it will be beneficial to the trainer and the trainee to have clearly outlined objectives at the beginning of each month of training. Similarly, it will be beneficial also to have an evaluation process established in order to monitor the training progress as well as to identify areas for improvement.

Disinfection

Disinfection is the process that applies antimicrobial agents to the work environment in order to destroy potential microorganisms. In other words, disinfection is a cleaning process that intends to destroy pathogenic organisms that may cause infection. Disinfecting agents should be distinguished from antibiotics that are used to destroy microorganisms within the body and from antiseptics, which destroy microorganisms on the living tissue. Sanitizers are substances that can reduce the number of microorganisms to a safe level, while disinfectants are usually stronger in their action and intend to kill pathogenic bacteria.

Hair transplantation is considered a clean procedure because the patient's head cannot be entirely sterilized but only disinfected. However, instruments used in surgery are sterilized, while gloves and working surfaces are made clean. The two most common antibacterial skin cleansers are povidone-iodine (Betadine, Purdue Pharma L.P.) and chlorhexidine gluconate (Hibiclens, GC America Corp.). The most common disinfecting agent used in hair transplantation to clean surfaces is a combination of isopropanol and ethylene glycol monobutyl ether (Cavacide, Metrex Research Corporation) because it can destroy the blood-born bacteria.

Sterilization

Sterilization refers to any process that effectively kills or eliminates transmissible agents that can cause infection, such as bacteria, viruses, spore forms, fungi, etc. Most offices have an assigned area for cleaning and sterilizing instruments. Before sterilizing can be initiated, surgical instruments are cleaned and lubricated according to OSHA regulations. OSHA, or the Occupational Safety and Health

Administration, is an agency in the United States that provides guidelines for safe handling of surgical materials in order to protect human health, specifically workers from work-related injury. For further information on OSHA guidelines, one should contact one's local branch.

Surgical instruments are often sterilized using high heat. A widely used method for heat sterilization is the autoclave, which commonly uses steam heated to 252°F to 273°F under high pressure. To achieve a desired level of sterilization, instruments should be sterilized between 15 and 45 minutes depending on whether they are sterilized open or contained in specialized packaging. The cycle for sterilizing open instruments is shorter taking about 10 to 15 minutes, while packaged instruments take approximately 45 to 60 minutes for the entire cycle. The open cycle flushes instruments, and they can dry in the open air. However, packaged instruments must go through the drying cycle otherwise trapped moisture within the package may counterfeit effective sterilization. The efficiency of the sterilization process should be monitored on a regular basis by checking the indicator strips placed with the instruments and by checking the indicator vials placed inside of the autoclave itself. Cleaning and sterilizing instruments fall into the domain of each individual practice and will not be discussed further herein.

Patient Follow-up

The follow-up consists of monitoring the patient during the healing process as well as during the time until hair is fully grown. We can divide the follow-up process into the immediate, which transpires between the first to the 14th day following surgery, and later follow-up, which occurs during the first 12 months after surgery. The immediate follow-up period comprises of verbal and written instructions given at the time of the procedure. The instructions cover postoperative care, pain management, what to expect after the surgery, and important contact information. Another aspect of immediate follow-up arises in the days after the procedure while managing patient concerns regarding swelling, scabs, hair washing, and suture removal, among other queries.

The later follow-up that occurs after suture removal navigates the patient through the emotional and psychological perceptions while the patient awaits hair growth. The patient is informed that transplanted hair will probably fall out in the first few weeks while the hair roots remain dormant without visibility for three to four months at which time early hair growth may start to become visible. However, many times the patient undergoes shock hair loss (telogen effluvium) that may make the hair density appear even sparser (at times dramatically so) and should be reassured that this hair loss is temporary. As hair growth is variable, the patient must be reassured that hair may not start to

become more apparent until six months in many cases and less commonly but possible even nine to twelve months in some cases. Considering that a full result is expected between 12 to 18 months post-transplant, the follow-up visits could be scheduled for four, eight, and twelve months after surgery during which time photographs may be taken and before-and-after results compared. Waiting for hair to grow and trusting good results may be challenging for an impatient patient. For that reason, the first follow-up visit that is scheduled at the four-month mark oftentimes does not show significant hair growth, as that encounter can be an important time to strengthen the relationship with a worried patient. Obviously, hair loss and hair restoration are progressive in nature. Therefore, excellent follow-up and patient care are vital to ensure patient loyalty and a possible return for further sessions as hair loss inexorably continues.

Inventory

In business, inventory consists of a list of goods and materials held available in stock. The inventory required for hair transplantation can be divided into permanent and disposable supply. The permanent supply could further be divided into surgical (includes equipment and instruments) and non-surgical (shaver, cape, measuring tapes, etc.). The disposable supply can also be divided into surgical and non-surgical supply. Surgical supply includes gauze, blades, protective pads, saline solution, medication, etc. while non-surgical supply includes plastic combs, pens, Post-It notes, paper gowns, etc.

When managing the inventory of the disposable supply one should develop a system of monitoring, ordering, verifying received material, and stocking rooms with them, performed on a weekly or monthly schedule. One can create an order sheet by listing all the items required and matching them with the information of the preferred suppliers. Sometimes items can be on back order, and to prevent interruption in the schedule every office should have a minimal par level of stock at all times. The buffer stock should cover one or two weeks of surgery depending on the surgical volume and the storage size. Some offices prefer to have one person assigned to keep up with the inventory while other offices prefer that every surgical assistant be trained to manage the inventory.

It is important to mention once again that this chapter was created to provide an overall picture and basic guidelines for assisting in hair transplantation. All subjects pertinent to the surgical-assistant tasks addressed above will be discussed in more detail in the forthcoming chapters.

3 Graft Preparation 360

Magnification and Lighting

Magnification is necessary for proper graft preparation. Magnification can range from 2x to 8x using a suitable lens, which is available through loupes, lights with magnifying lens or a microscope. It is paramount to see well and each assistant should be responsible for selecting the best magnification in order to create a quality product. However, good magnification helps enormously but is not sufficient alone for delivering high-quality slivers and grafts.

Although microscopes provide the strongest magnification, there are several magnifying lights that offer 3- or 5-diopter magnification along with fluorescent illumination that can be used for slivering and graft dissection. Regarding graft placement, the authors prefer loupes that allow for peripheral vision, such as Magni-Sight, Opti-Sight, or MagEyes and not Optivisor because a visor restricts the visual field to a more limited view of the head and thereby promotes skipping or missing to fill sites with grafts.

Appropriate lighting adds to the comfort and clarity of the work field. The light should be cool (otherwise it would create heat and cause the tissue to dry) and should be focused (spot light instead of diffused) so it does not create shadows. Lighting used for graft preparation can be either halogen or LED. In addition, a back-lighting system (a slim 6-inch × 4-inch box) can provide supplementary illumination to facilitate visualizing hair follicles during dissection. If back-lighting is used, then the cutting surface should be clear (thus a tongue depressor cannot be used for this purpose) in order to allow light to come from the front and the backside of the tissue being dissected. For graft placement, an overhead light with the same characteristics described above is recommended. In our office, we use a Burton Outpatient II Light mounted to the ceiling above the patient chair, and we also have a freestanding Burton Outpatient II floor-stand model for additional illumination, which we use as needed. Please note that in some situations power outage may interrupt the surgical procedure but

with battery back-up supply the procedure may continue unimpeded. Alternatively, it is recommended that each operating room have a battery-operated flashlight and two battery-powered LED headlights if a battery back up is not used in order to complete a procedure during a power outage.

Donor Tissue

Harvesting Techniques

The donor tissue can be harvested as a single strip or multiple strips depending on the physician's preference and on the instrument used in the process. The single strip can be cut out by using a single-blade knife, (this type of harvest is often referred to as a free-hand harvest), or using a special handle that holds two or more blades (often referred as a multi-blade harvest). The advantage of a free-hand harvest is to minimize the chance of damaging hair (transection) during the harvest, while the advantage of a multi-blade harvesting technique is in the better control of the strip width, which in some situations accelerates dissection. Most commonly, the donor strip is a single rectangular piece of tissue that has approximately 1 cm (10 mm) width and anywhere between 5 cm to 30 cm length and that requires slivering before graft dissection (Fig. 3.1A). When a multi-bladed knife is used, the harvested tissue can be taken as multiple thin strips of a narrow 1 mm width and consequently immediately dissected directly into grafts thereby bypassing the need for slivering (Fig. 3.1B). However, this aggressive type of multi-bladed harvesting has a much higher risk of transection and should only be undertaken in skilled hands. In our office, we now commonly practice what we envision as the best of both worlds using a multi-blade instrument with only 2 blades spaced approximately 1 cm apart. This set up permits a perfectly uniform harvest width, more rapid harvesting and minimal transection.

Another method of donor harvesting that has gained more recent attention is Follicular-Unit Extraction (FUE). This technique is performed by extracting individual follicular units from the donor area by using a small punch device. This technique circumvents the graft-dissection process and requires very little participation from the assistant to examine, trim and sort grafts. Usually, FUE grafts have less tissue surrounding the hair shaft and hair bulb, making these grafts very vulnerable to injury and with the hair trimmed short to facilitate extraction, the hair curl may be more difficult to identify accurately. Due to the uniqueness of this procedure and the delicate nature of these grafts, only experienced assistants should place them. FUE can be tedious, labor intensive and time consuming for the physician. As the harvest is executed by the physician, the assistant may or may not assist in graft extraction. However, the

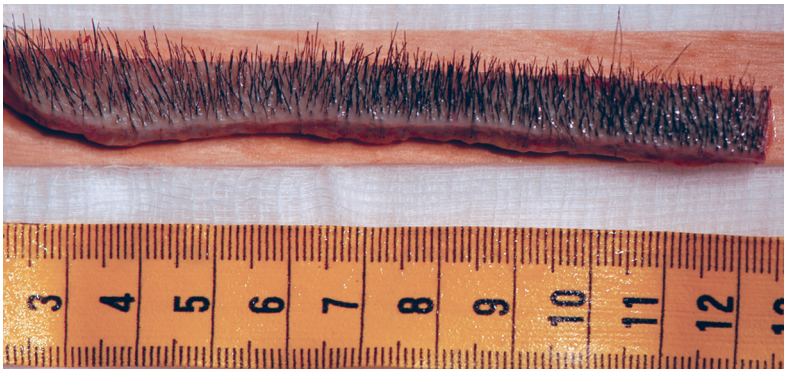


Figure 3.1A

A single strip harvested from the donor area.

Figure 3.1B

Multi-strip harvesting is undertaken by using a special handle. This photograph demonstrates the donor area being dissected into three strips.

assistant's participation in this technique is minimal in most cases and therefore will not be further elaborated in this textbook.

Donor Tissue Evaluation

As the donor tissue is harvested, it should be inspected for the variations in hair density, quality and color. Oftentimes, the hair density between the temporal and the occipital region varies significantly. The temporal hair may be sparser, finer and contain more gray or white hair in comparison to the hair found in the occipital region. There are two reasons for which it is important to evaluate the donor tissue: one, to predict the final yield/graft count more accurately, and two, to be able to separate, dissect and place hair in a more systematic and strategic way. In other words, if there is a discrepancy in hair color between the occipital and temporal areas, the tissue from those two areas should be kept

separately. The darker hair should be dissected into grafts that would be placed into the hairline, while the hair coming from the temples should be used to reconstruct the temporal hairline, lateral humps or intentionally interspersed with darker hair in order to create a softer, more natural result. Similarly, if the previous scar is removed and found within the donor tissue, it should be kept separately from the "virgin", i.e., not previously operated-on, tissue. The hair growing around the scar is usually coarser, often yielding a significant number of single-hair grafts. It is important to keep these single-hair grafts separate during graft dissection from other single-hair grafts that are derived from non-scarred areas. The softer hair should be placed in the very front of the hairline, and the single-hair grafts coming from the scar should never be placed in prominent areas like the central anterior hairline but interspersed and camouflaged between the other grafts.

Slivering

Technique

Slivering is a process during which the donor tissue is dissected into thin slivers, similar to slicing a loaf of bread. The purpose of slivering is to create thin pieces of tissue that expose follicular units from two sides. This means that each sliver should be no wider than the width of one row of hairs.

Considering that donor tissue will most commonly come as a single strip, explanation of graft dissection will reference dissection of such tissue. The first step after the donor tissue is examined is to measure and record the length and the width of the harvest. The next step is to reduce the donor tissue into shorter lengths for further slivering, which is known as blocking. These shorter segments, or blocks, are usually approximately 2 cm in length. It is during the blocking process that darker from lighter and denser from sparser pieces are separated. All blocks should be kept completely immersed in chilled saline solution at all time. Saline solution used for graft preservation is 0.9% saline for irrigation as compared to saline that is used for intravenous injections and to prepare the tumescent solution.

Slivering can be performed under the microscope or using some type of magnification. Further, slivering can be done on different types of cutting surfaces, by using different types of blades, and by cutting from the top or from the side of the tissue. Nevertheless, the principle of slivering should always be repeated in the same manner that begins with the block of tissue pinned to the surface with a needle in order to provide stability and resistance for traction. If a right-handed person is dissecting the tissue, the needle is positioned toward the right end of the tissue, placed through the epithelium,

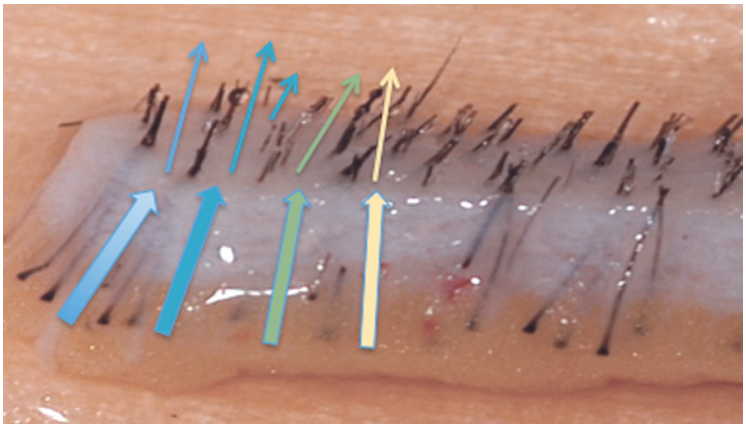


Figure 3.2

The photograph indicates the path of the blade during slivering. Vertical and horizontal lines demonstrate that slivering is not accomplished by making parallel cuts but by following the path of the hair shaft and cutting between them.

and bent away from the working area. Then, forceps with tiny teeth is held in the left hand to grasp the upper left part of the donor tissue. Before any cut is made, the assistant should examine the way hair is exiting the tissue and visualize the path of the blade (Fig. 3.2). Then, holding the tissue with the left hand and pulling away from the blade with the forceps in order to provide gentle traction, the right hand slides the blade between rows of hairs to create individual slivers, which can be observed in Video 4 of Disc 2. Each sliver should be made in such a way as to preserve an individual's hair follicles with attention paid to the forceps never imparting crush injury to any part of the hair shaft and bulb. Further, the blade should slide through the tissue and not cut through any part of the hair shaft or bulb. It is important to mention the movement of the blade, which should not be sawing or pushing but rather a sliding back-and-forth motion, slowly exposing hair follicles. Caution should be given to keep the movement of the blade consistent while slivering and never to use a blade to scrape debris off of a graft. There is a tendency to slide the blade gently to three-fourths of the way through the tissue and then to push it for the last one-fourth of the way through. This ultimately may lead to transection. Kindly refer to Video 5 of Disc 3.

Instruments

Blades: Slivering can be performed using Personna Plus No. 10 blade (on a surgical handle No. 3 or 5) or Personna Plus No. 20 blade (on a surgical handle No. 4), Personna single edge prep razor blade or Personna double-edge prep razor blades on a specifically designed holder (Fig. 3.3). The sharper the blade, the easier it is to sliver. The authors prefer Personna surgical blades to any other brand because they have proven to be sharper in our clinical experience

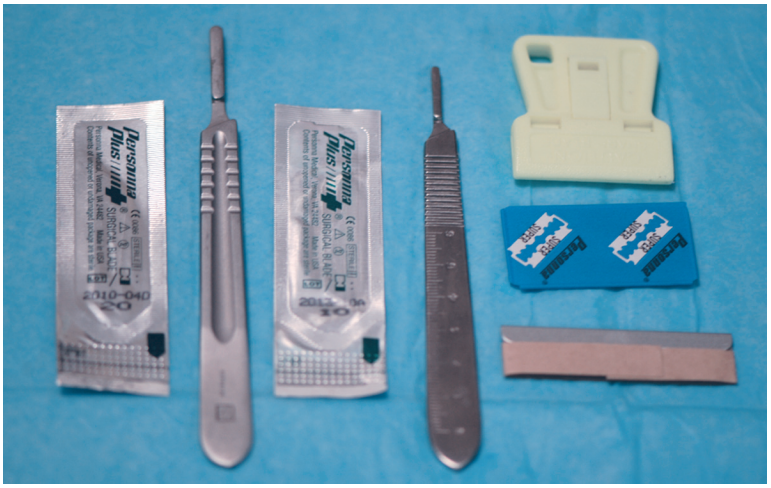


Figure 3.3

This photograph shows several types of blades and blade handles. Starting from the left to right are a Personna No. 20 blade, handle No. 4, Personna No. 10 blade, handle No. 5, and then from top to bottom: A plastic holder for a double-edge blade, a Personna double-edge razor blade and a single-edge Prep blade.

and stay sharp longer than any other blade manufacturer.[§] A standard surgical blade handle should be sufficient although some assistants may prefer a wide or soft-grip handle. A scalpel blade remover or surgical mosquito clamp should be used to remove and load blades in order to prevent assistant injury. If a sharps container is not easily accessible, the assistant can use any type of small receptacle to keep used blades in the interim until ultimately they are disposed of in a sharps container. A glass container would be ideal as a temporary receptacle since one could be re-sterilized. It is important to be very cautious while handling blades, e.g., to remove blades from the handle by sliding them away from oneself and loading them by always pointing the sharp edge of the blade away from one's body.

Forceps: To facilitate good grip and gentle traction on the tissue during slivering, micro forceps with teeth serves the best purpose. Examples of such forceps are Castroviejo forceps 0.12 mm, 1 × 2 teeth with a 4-inch long platform or Castroviejo forceps with a 4.25-inch suture platform and 0.3 mm straight teeth (Fig. 3.4).

Surface: Slivering surfaces can range from a disposable, sterile tongue depressor to an autoclavable silicone platform with non-slip surface. The slivering surface should be able to permit securing the donor tissue with a needle while slivering and should be kept moist at all time. A small, travel-size spray bottle or syringe filled with saline could be used to keep the tissue and cutting surface moist (Fig. 3.5).

[§] The authors would like to state they have no direct or indirect financial gain from any manufacturer.

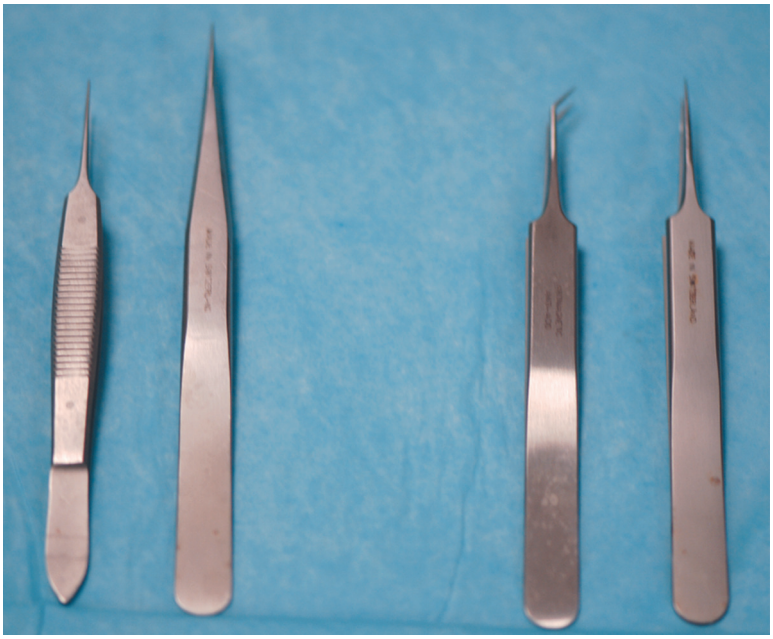


Figure 3.4

This photograph exhibits several types of forceps. Starting from the left, a Castroviejo forceps 0.12 mm, 1 x 2 teeth with a platform 4 inches long used for slivering, a jeweler No. 3 forceps used for graft dissection, a jeweler No. 5S angled and a jeweler No. 5 straight forceps used for graft placement.

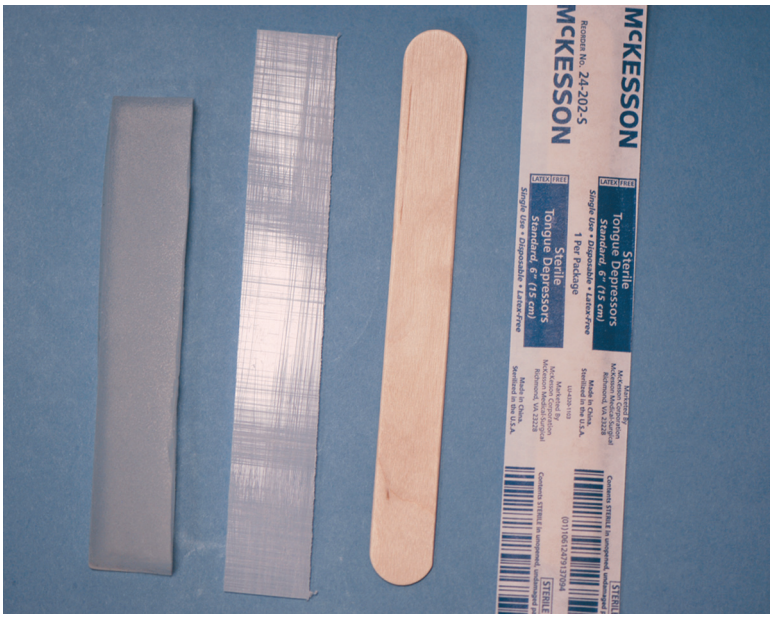


Figure 3.5

This photograph shows several cutting surfaces: starting from the left, an autoclavable transparent soft surface, a silicone-type translucent surface for cutting on back lighting, and an unpackaged tongue depressor along with one in its sterile package.

Setting Up the Cutting Field

There are several ways to set up a workstation: the cutting surface can be oriented in a parallel, diagonal or perpendicular manner vis-à-vis the assistant's shoulders. In a horizontal and diagonal setting, a right-handed person cuts from left to right, and in the vertical setting, the dissection proceeds from bottom to top. The author prefers placing the tongue depressor in a diagonal manner, as it allows one to see the side and top of the tissue while dissecting. However,

regardless of the orientation of the cutting surface, as long as the quality is achieved, the way to attain that level of quality is considered a personal preference and not a requirement. Of note, our experience demonstrated that sterile tongue depressors absorb moisture significantly better than non-sterile ones and that they are not as slippery as a silicone strip. Therefore, we use sterile tongue depressors as our preferred cutting surface. The exception is during the dissection of white hair when back lighting becomes necessary, in which case silicone strips are used because of their transparency.

Donor tissue, slivers and grafts are stored constantly in a chilled saline solution for optimal graft viability. Throughout the entire dissection when the tissue is being handled outside the chilled saline bath, the tissue should be sprayed frequently with saline solution using a spray bottle or alternatively with a 5- or 10-cc syringe. The experience in our office suggests using travel-size spray bottles during dissection is preferable because the spraying surface is focused, sufficiently large to cover the tissue and sufficiently small not to dampen the surrounding work area. However, using a medium-size spray bottle is more effective during graft placement because the spraying force is higher and better for cleaning the larger recipient-area surface. In addition, the stations should be equipped with note pads and pens to record ongoing graft counts. Each station should be stocked with a measuring tape (plastic tape used for sewing may work the best since it is flexible, can be cut into shorter pieces and can be disinfected easily). Of note, caution should be exercised in preventing the donor tissue or grafts in contact with any disinfecting agent.

Quality Control and Performance Evaluation

To begin with, we must define quality standards relevant to obtaining desirable results. Quality control is a continual process of comparing one's work against set standards. Quality standards for hair restoration have two objectives: (1) Obtaining a maximum yield from the transplanted hair and (2) achieving an undetectable, natural-looking result of the transplanted hair.

Furthermore, quality control is also a process of constantly monitoring one's work for possible mistakes. Accordingly, mistakes that may occur during hair-transplant surgery are grouped around those that can compromise hair yield and/or naturalness. All possible mistakes made by the surgical assistant are deemed human factors considering that they cannot be blamed on faulty equipment. The most common mistakes committed by surgical assistants encompass trauma done to the hair-bearing tissue and/or improper technique.

1. Trauma
    - Hydration (drying out)
    - Handling (physical damage)

2. Technique
    - Lack of dexterity
    - Lack of attention
    - Lack of knowledge.

Although hair restoration is a team effort and therefore quality control should be the responsibility of the entire team, each surgical assistant should keep quality standards in mind and continually check his or her work against those standards. Quality control could be performed during and after surgery. During surgery, three areas exist in which quality control can be observed: during slivering, during graft dissection and during graft placement. A section will be dedicated below to address quality control in each phase accordingly.

During slivering, the performance of the assistant is measured by the quality and the number of slivers made. The quality of good slivers includes being well hydrated, gently handled, and demonstrating no more than 5% transection. That means that per 100 grafts there should be no more than 5 individual hairs transected. To determine the quality of slivers, one should examine each one from all four sides. Each sliver has two narrow sides and two wide sides, wherein the narrow side measures 1 mm to 2 mm and the wide side, 8 mm to 10 mm. If transection occurs during strip harvesting, it will show on either narrow side of the sliver; while if the assistant commits it, the transection will be evident on either wide side of the sliver. The ideal speed of slivering is to sliver 2 cm of a 1-cm wide tissue in five to eight minutes of time.

Graft Preparation

Technique

In this process, slivers are further cut into smaller pieces called grafts, which contain one, two or more follicular units, i.e., a single FU, or a Follicular-Unit Graft (FUG); two FUs, or a Di-Follicular Unit Graft (DFU); and three FUs, or a Multi-Unit Graft (MUG). Single follicular-unit grafts are used in most practices though there are still a substantial number of physicians who use di-follicular unit grafts as well. As the grafts are dissected, they are transferred into a storage receptacle, which is filled with saline (although some physicians may prefer lactated ringer or other specific formulated storage solutions). A storage receptacle is either autoclavable or disposable. Plastic Petri dishes are typically disposable, but if these receptacles are meant to be sterilized in an autoclave, then they can be made of glass, ceramic or stainless steel, i.e., they can be a Petri dish, ramekin or surgical tray. These containers should always rest on a bed of ice for better tissue preservation. In our office, we use ramekin dishes because they can hold more grafts than a Petri dish (so fewer containers are

needed to hold dissected grafts) and because they are deeper than a Petri dish, which makes them easier to move around.

Grafts can have different shapes; single follicular units almost always look somewhat square, while multi-unit grafts can be rectangular or square depending on the size and the shape of the intended recipient site. If the recipient sites for a DFU are made with a blade that leaves a linear incision, the graft should be trimmed as a rectangle to fit the site. Some physicians prefer in certain situations to use small round punches instead of blades and needles because these punches remove a portion of bald scalp and thereby increase the ratio between hair and empty scalp, consequently improving overall visual density. A common shape for an FUG to fit this round-punch recipient site is square. However, a DFU can be cut into a rectangular or square shape depending if the site is made with a needle, a blade or a round punch. If a rectangular graft instead is placed into a round hole, the fit would not be snug, leaving empty space around the graft to fill in with scar and consequently produce an unnatural result. The purpose for different types of grafts will be explained more thoroughly in the section on graft placement.

Grafts can also be classified as "skinny" and "chubby" based on the amount of tissue left surrounding the hair shaft. Some physicians prefer skinny grafts because their technique is based on making small incisions and packing them densely in the recipient area. Skinny grafts and dense packing facilitate mega-sessions, which are surgical procedures that transfer 2000 to 3000 grafts in one setting. The disadvantage of skinny grafts is that they are denuded and therefore fragile and susceptible to dry out or become traumatized. The opposite of a skinny graft is a so-called chubby graft. Physicians who prefer this type of graft use fewer recipient sites/grafts per square centimeter but believe that their grafts have a higher chance of survival. The finding of a study conducted by Dr Seager in 1997 and Dr Beehner in 1999 comparing chubby vs skinny grafts demonstrated higher re-growth rate in favor of chubby grafts after six months.[1,2]

During graft dissection, each sliver is examined from one or both sides in order to separate delicately the follicular units. When the spacing between grafts is visible at first glance, further examination of the sliver is unnecessary. However, hair follicles can overlap each other, and hair roots can splay blurring the spacing between follicles and complicating their separation. In those situations, the sliver is examined from both sides in order to execute a cut between follicular units and not to damage the hair.

The principle of dissection is the same as in slivering, i.e., grasping the tissue with forceps held in the left hand and cutting with the blade held in the right hand (the opposite for a left-handed person). Hair does not grow in a consistent pattern in regards to spacing and distribution of the follicular units, making graft dissection a challenging task requiring the assistant to maneuver the blade

in order to cut between the hairs without transecting the hairs themselves (Fig. 3.6A). As the hair count in each follicular unit may vary (some have one, some two, three or four hairs), the amount of "empty" tissue between units varies too. Therefore, when follicular units are separated, there should be about 1 mm of protective tissue left around hair follicles and the extra tissue trimmed away. All grafts containing the same number of hairs should look uniform in size. The most effective and efficient graft dissection is achieved by limiting unnecessary hand movements and making each blade motion as precise as possible. Imagine two follicular units with an "empty space" of 3 mm between them. Instead of separating the units by cutting the empty space in half to make two grafts, thus leaving about 1.5 mm of tissue around each hair follicle then trimming off the 0.5 mm of tissue off each graft, the first cut should be about 1 mm from the first follicular unit, making this graft a finished product, then making additional cuts to trim off the 1-mm excess tissue from the second graft. Eliminating one unnecessary cut per graft makes dissecting more effective and the assistant more efficient (Fig. 3.6B).

Figure 3.6A

During graft dissection, follicular units are identified along the top of the pre-dissected slivers first, then the hair shaft is visually followed from the top (epithelium) to the bottom (hair bulb) in order to determine the direction of the hair and thereby the proposed passage of the blade. Arrows indicate that sometimes the cut should be initiated from the top and at other times from the bottom of the graft. In addition, sometimes dissecting between follicular units requires maneuvering the blade as shown on the far right side of the sliver.

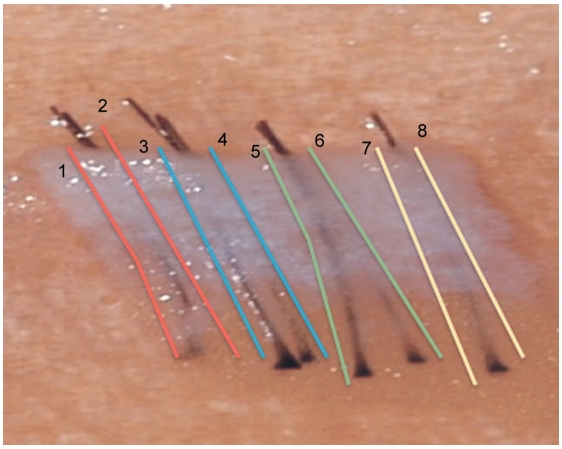


Figure 3.6B

This photograph explains efficient graft dissection accomplished with fewer cuts. Four grafts are made with eight cuts that are close to the graft to be dissected free from other FUs, and at the same time the excess tissue can be trimmed in a single move.

Dissecting Strategy

Natural distribution of follicular units is somewhat unpredictable; therefore, during graft dissection, 1-, 2- 3-, and 4-hair follicular units will be created simultaneously. It is helpful to develop a strategy of separating and grouping grafts as they are produced. First, only several slivers should be dissected at one time, e.g., three to five slivers, in order to avoid piling up a large number of grafts and to best preserve their hydration. During dissection, slivers and grafts should be sprayed frequently. As the grafts are produced, all grafts containing 1 hair should be grouped together, those containing 2 hairs should be grouped together, and so on. If, for example, 2-hair grafts are dissected in the highest number, then they could be kept and grouped in the central part of the working field, while 1-hair grafts could be grouped at 11 o'clock and 3- and 4-hair grafts at the 1 o'clock position. Furthermore, to increase efficiency an assistant can keep a mental count for 2-hair grafts while dissecting them until all slivers from one group, e.g., the three to five slivers suggested above, are finished. As the number of obtained 2-hair grafts is recorded, then other grafts are counted and recorded before the next group of slivers would be dissected. Some assistants may find it difficult to keep a mental tally while listening and talking. In that situation, the alternative approach for efficient dissection is to make small piles of five or ten grafts as dissection progresses and then at the end count the piles in order to obtain the total number of grafts dissected in one setting. With this approach, a total number of grafts were obtained by adding an "inconsistent" number of grafts recorded as they were produced. Another approach would be always to have a consistent number of, e.g., 50 grafts per pad, then count the pads at the end in order to obtain the grand total number of grafts (Fig. 3.7). Regardless of the technique

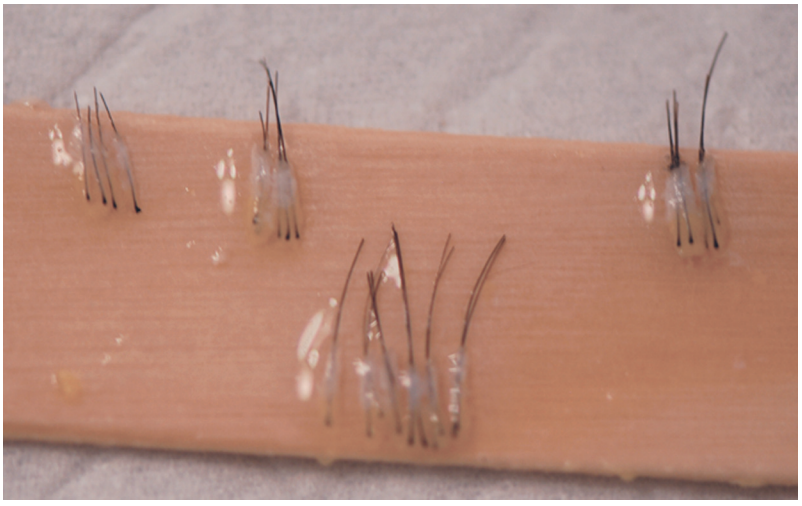


Figure 3.7

Organizing grafts on the cutting surface to achieve higher efficiency. The upper row shows starting from the left, 1-hair grafts, 3-hair grafts, 4-hair grafts and on the bottom row, 2-hair grafts.

used to keep the graft count, every 15 minutes or every five to eight slivers dissected, all grafts made are transferred into the storage dish filled with chilled saline. Alternatively, two tongue blades can be used: one for cutting grafts and the other covered with a clear plastic wrap for temporary graft storage. Plastic wrap is used because it holds tiny bubbles of saline. As assistants dissect grafts, they place them into four separate saline micro puddles (1's, 2's, 3's and 4's). A timer could be set to 12 minutes to remind the assistants to count their grafts, record their count and transfer grafts into a Petri dish at prescribed, even intervals. Kindly refer to Video 6 of Disc 3 for details.

As grafts are transferred, they are organized in a systematic and consistent manner. For example, if all grafts are transferred into one rectangular container, pads containing grafts should be placed in rows of the same number of hairs per grafts, starting from the bottom and going up or starting from the left and going to the right. Another way to organize grafts is to have a dish that contains only 1-hair grafts, then a separate dish for 2-hair grafts and so on.

Quality Control and Performance Evaluation

In order to perform quality control we have to establish standards of quality in graft dissection. Quality standards refer to the ideal sliver and ideal graft, which are based on the minimum requirements in order to achieve an optimal result. The two most important standards that should be respected at all times relate to tissue hydration and to the preservation of hair follicles. The tissue (whether the donor tissue, the blocks of the donor tissue, or slivers or grafts) should be kept immersed in the chilled saline or sprayed with saline when handled outside the chilled saline. The integrity of the hair follicles should be kept intact avoiding any crushing, scraping or cutting them. These standards assure hair survival and optimal as well as natural re-growth of the hair.

During tissue dissection, one should consider the following:

- *Tissue hydrated vs desiccated*: To assure survival of hair follicles, donor tissue and grafts must be kept moist at all times through immersion in a physiologic solution. Moist tissue, whether it is a donor strip or an individual graft, looks *glossy,* whereas tissue that is drying out appears *matte*. The assistant and surgeon should be keenly aware of the difference in appearance between these two conditions (Figs 3.8A and B). Consequences of dried-out tissue are poor to no hair growth.
- *Proper manipulation vs trauma*: Hair-bearing tissue should be held by the epithelium, the perifollicular dermis or the fat and never at the bulb level. In addition, grip of the forceps should be precise but not too firm. If hair bulbs are traumatized, the hair matrix cells get damaged inflicting a change

Figure 3.8A

Moist grafts look shiny and plump.

Figure 3.8B

Desiccated grafts look matte, dull and somewhat shriveled.

in the quality of the re-grown hair, e.g., development of a smaller-diameter or kinky-appearing hair shaft. In addition, if the graft is held too high above the hair bulb and forced into the site, it can fold over making the hair bulbs bent and twisted, consequently causing poor growth, ingrown hair and other problems (Figs 3.9A and B).

- *Hair follicle intact vs transected*: Considering that the surgeon and surgical assistant can transect hair follicles, we will address this issue from their individual perspective. In order to determine if transection occurred, one may evaluate the donor strip and grafts directly or indirectly by examining the dissected waste (the tissue discarded during graft dissection). Looking at a sliver as a loaf of bread, if transection is observed at either end of the loaf, then it occurred during harvesting; but if transection is observed on either side of the loaf, then it happened during slivering.
  - — *Surgeon:* If there is more than one transected follicle in 10 along the path of the blade, the quality of the harvested strips is considered sub-optimal. This is an arbitrary number only given as a guideline. The consequence of hair transection at this level was explained earlier in this section.
  - — *Assistant:* The graft is considered favorable if the entire hair follicle is intact, i.e., a hair shaft and bulb are one continuous structure. If transected hair is left within a graft and placed into the recipient sites, the transected hair can become ingrown, leading to epidermal inclusion cysts and/or poor growth. If the harvested donor strip exhibits no visible transection but the yield is below expected and the assistant has a large amount of discarded tissue, then the assistant is most likely creating transections during graft dissection and thereby wasting viable hair. In that situation,

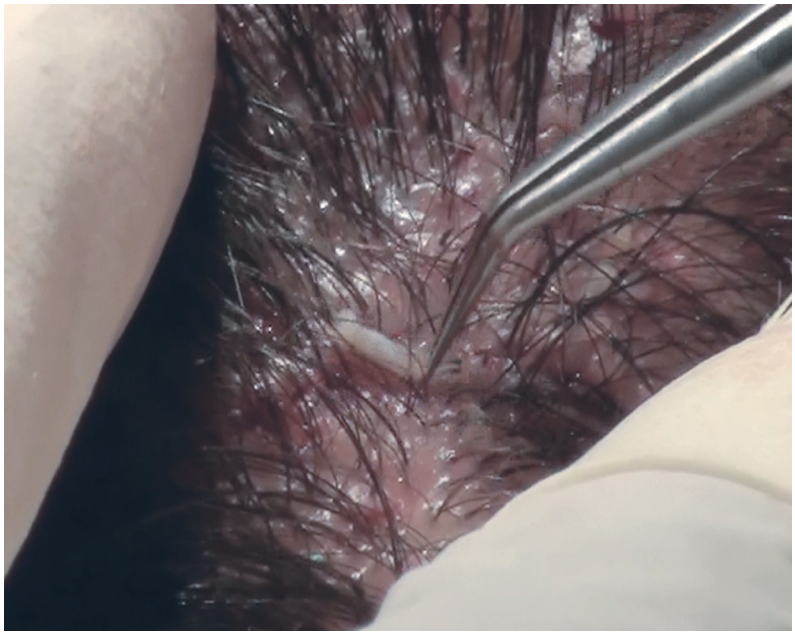


Figure 3.9A

This photograph demonstrates incorrect graft handling in which the graft is held too high along the shaft leading to traumatic folding over of the graft during insertion. Note the folded hair bulbs on the right side of the tips of the forceps.

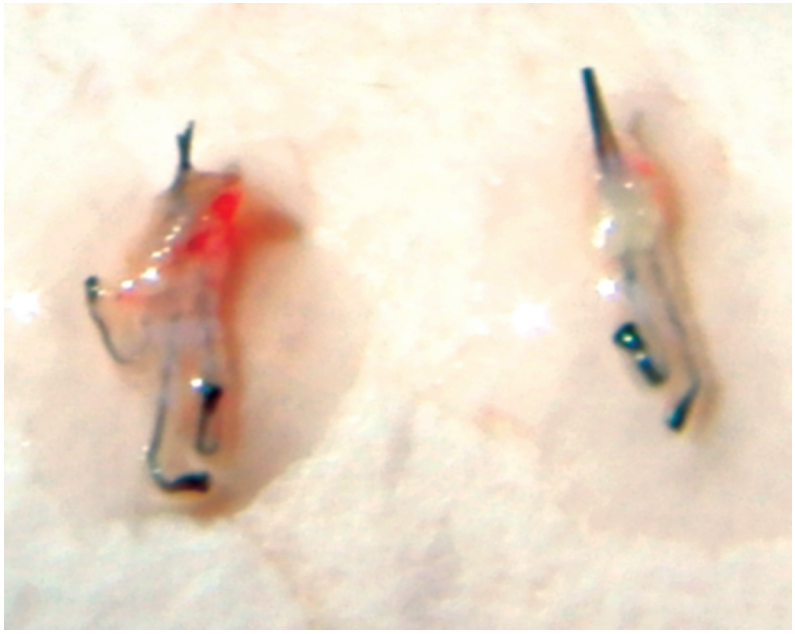


Figure 3.9B

Traumatized grafts showing hair bulbs bent and twisted as a consequence of grafts being mishandled as seen in figure 3.9A.

evaluation of the assistant's skills and retraining may be required. However, if the upper one-fourth of the hair shaft above the sebaceous gland is transected and the rest of the hair and the hair bulb are intact and firmly attached to the graft, they should be left as it is since these injured grafts will still most likely produce hair if transplanted (Fig. 3.10).

Figure 3.10

Two rows of grafts demonstrating the difference between transected and clean grafts. The upper row shows damaged grafts by transecting the hair shaft. The bottom row shows grafts that are well dissected, all maintaining hair shafts and hair bulbs intact.

- *Protected vs denuded graft*: Regardless of whether grafts are made skinny or chubby, they should always have a hair-shaft thickness of tissue surrounding the hair follicle otherwise they are considered denuded of necessary protective tissue. Denuded grafts are prone to desiccation and thereby are more at risk for poor growth. They are also more susceptible to the mechanical injury during handling and insertion into the recipient sites (Fig. 3.11).

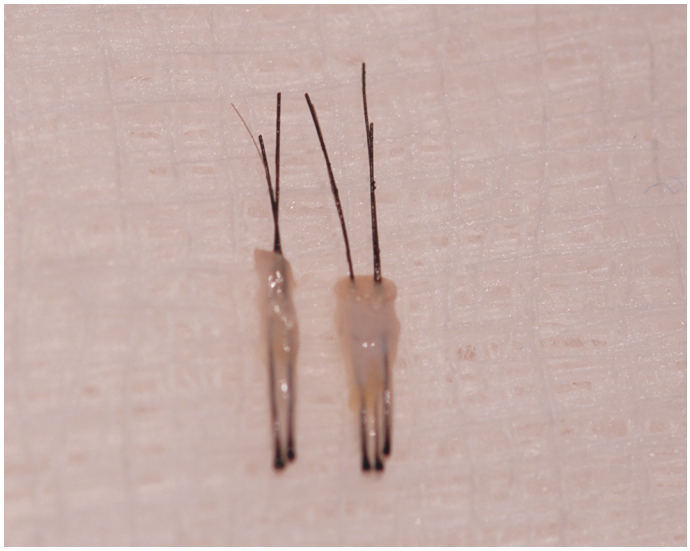


Figure 3.11

Hair bulbs denuded and stripped of the protective fat layer. They are fragile, difficult to place since the hair bulb can easily be crushed or splay out during placement.

- *Consistent vs inconsistent graft size*: Inconsistency in graft size means that for any given number of hairs per graft, there is a significant variation in the physical size of the grafts, i.e., some grafts could be half the size of another graft bearing the same number of hairs. The inconsistency in graft size affects site-to-graft fit and may lead to unnatural hair growth and/or difficulty in graft placement. If the grafts are too large for the site, then graft placement would be difficult, leading to forceful insertion, staff frustration, longer procedure times and traumatic graft placement, which may in turn result in kinky hair growth or graft compression. If the sites are significantly larger than the grafts, then the grafts may fall deeper into the site, causing ingrown hair or double graft placement where the second graft is stacked on top of the previous graft ("piggybacked") with the inevitable development of ingrown hair. In addition, with larger than necessary sites, the total trauma to the scalp is needlessly increased, which in return may cause more edema, poor growth, and/or less hair density (less hair density because fewer sites are made per square centimeter and in addition every site has wasted space).

Performance in graft dissection is evaluated by the quality of grafts and the speed in which they are made. The quality comes first. However, the speed is equally important because keeping the tissue *ex vivo* for a protracted period of time decreases graft survival rate significantly. In a performance evaluation the following observations are made and the assistant's progress is measured against these ideal parameters: proper hydration; correct handling, i.e., not traumatizing the tissue; not exceeding a 2% to 5% transection rate; and dissecting 250 to 300 grafts per hour.

Graft Yield Estimation

In general, estimating the number of grafts that will be produced from the donor tissue is a helpful technique for a physician who is interested in the estimate as a guide for creating the number and distribution of his recipient sites. There are two approaches in recipient-site creation: pre-made sites technique or stick–and–place technique. In the pre-made sites technique, all sites are made before any graft is placed, while in the stick–and–place technique, a site is made then a graft is placed immediately into that site, then another site made and graft placed, etc. Some physicians prefer to have all grafts cut before making any sites. Considering that graft dissection may take several hours, the most common practice is to start making sites as the grafts are being dissected. The ideal scenario would have sites made for the grafts all at once where the number of sites made closely matches the number of grafts made, with no extra grafts or no extra sites. Although extra sites would heal well and extra sites could be made easily for extra grafts, additional work or unnecessary trauma to the scalp can be avoided with proper estimation.

The correct estimation allows blending a physician's desired number of grafts and the actual yield from the donor tissue and thereby promotes a more efficient procedure. The first step in projecting the total number of grafts is to evaluate the donor tissue for the variations in the density. If the density does not vary from the middle to the end parts of the donor strip, then the entire strip is cut into 2 cm blocks, those blocks slivered and grafts yielded from each 2 cm are recorded. The total number of grafts made from each block is initially compared between assistants in order to determine consistency and an average yield. Then the calculation is performed following this formula: the total length of the donor strip is divided by the total length dissected, e.g., two assistants cut a total of 4 cm, i.e., 2 cm each, in order to obtain the "multiplying number". For example, the total length is 22 cm, 22 divided by 4 is 5.5. The next step is to total the number of 1-hair, 2-hair, 3-hair and 4-hair FUGs made from a 4-cm block and then multiply each number by the "multiplying number", which in this case is 5.5. If the density of the donor tissue varies, then the sparse and dense pieces should be totaled in length and treated like individual strips. In summary, the blocks of dense hair are kept separately; their length, totaled; the 2 cm block, slivered and dissected; then the multiplying number, calculated; and the total number of grafts, projected for dissection using the dense part of the donor tissue. After the same procedure is applied to the sparse tissue, the number of grafts obtained from both is totaled and communicated to the physician.

Total donor length ÷ 4 cm (2 cm × 2 cm block) = *N*

1-hair FU obtained × *N*	=	total number of 1-hair grafts	*(A)*
2-hair FU obtained × *N*	=	total number of 2-hair grafts	*(B)*
3-hair FU obtained × *N*	=	total number of 3-hair grafts	*(C)*
DFU obtained × *N*	=	total number of DFU	*(D)*

A + *B* + *C* + *D* = Total Number of Grafts

During the process of learning to estimate the total graft number, it is safer to underestimate then to overestimate. The total number of grafts estimated could be rounded up or down by 10 to 20 grafts. For example, if the calculated number of 1-hair grafts is 223, you may round it down conservatively to 200 because some of the grafts may not be usable. If the calculated number of 2-hair grafts is 584, it could be rounded to 550; while if the number calculated for 3-hair grafts is 191, it could be safely rounded to 200. The reasoning behind rounding numbers to the higher or lower number is to accommodate for subtle

variations in hair density and is also based on the probability of having to sort through and discard some of the "weaker" grafts. For example, a weaker graft would be a 1-hair graft that is short and denuded, or a supposed 3-hair graft that has two transected follicles and one intact thus a viable one.

Instruments

Instruments, blades and set up for graft dissection are almost the same as for slivering with the exception of using different forceps and possibly a different cutting surface. For slivering, the forceps with small teeth that is helpful for slivering may not be delicate enough for graft dissection (e.g., Castroviejo 0.12 mm, 1 × 2 teeth with a platform that is 4 inches long). A straight jeweler No. 3 forceps works better for graft dissection. Regarding the cutting surface, during slivering the surface has to be pliable enough to accommodate for a needle stick (to hold the tissue), a feature that is no longer needed during graft dissection. The tongue blade can be used for both slivering and graft dissection. However, soft silicone is only good for slivering, and it should be changed for graft dissection. Soft silicone is slippery so either a tongue depressor or rough, non-slippery silicone is preferred for graft dissection.

Challenges and Solutions

Scar Tissue

Tough tissue makes the blades dull more quickly mandating that the assistant should be vigilant and changes the blades often. If blades are dull, the assistant has a tendency to compensate and push harder on the blade thereby risking transection. Even more challenging, scar tissue can also alter the hair direction and accordingly require more assiduous manipulation. In scar tissue, the assistant should develop the sophisticated skill of maneuvering the blade between hairs without damaging them, which is not easy to do when first starting in the field.

White Hair

If the hair is white and difficult to see, coloring it with *Just for Men* (Combe Inc.) hair color before harvesting may aid in dissection. Additional back lighting may help but only if a clear cutting surface is used. Methylene blue or gentian violet can also be added to the storage solution and poured into the dishes containing the slivers. The dye highlights the white follicles rendering them more visible. However, coloring does not work well on scar tissue.

Curly Hair

Whether it is African American, African or any other curly hair, it is of value to mention that in these patients the graft dissection may be more challenging than slivering because hair "roots" from different follicular units may curl together. However, proper hand maneuvering of the blade through the tissue or using single-edge prep blade and bending it to match the hair-curl direction may help with this challenge.

Ethnic Hair

We may somewhat generalize the commonality between people of Asian descent and notice the following similar characteristics:

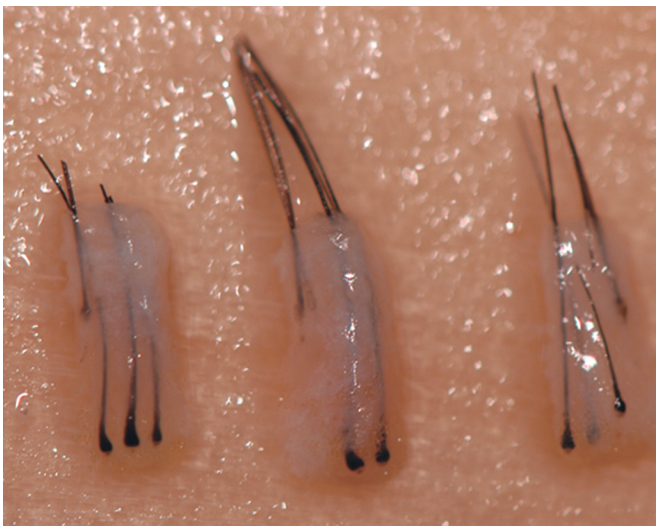


Figure 3.12A

Asian patients often have a higher occurrence of telogen hair. The photograph demonstrates DFUs comprised of follicular units showing both anagen and telogen hair (The telogen hairs are the shorter hairs in each graft).

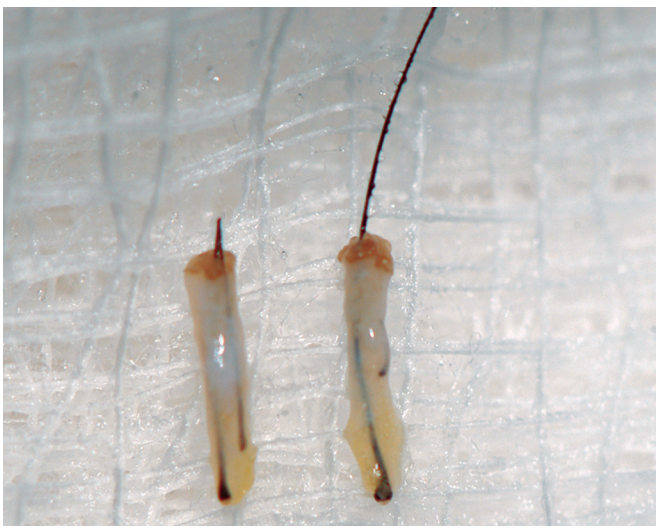


Figure 3.12B

This photograph shows two grafts seemingly the same; the graft on the left has one viable (long) and one transected (short) hair while the graft on the right demonstrates two viable hairs wherein the short hair is moving into the telogen phase.

- The hair shaft may be coarser than Caucasian hair and consequently may require larger recipient sites for a proper fit.
- Follicular-unit density per square cm may be average or sparse, and therefore the dissection may require additional trimming.
- Typically in the Asian patient the hair content per follicular unit rarely exceeds 3 hairs, predominantly containing 1 and 2 hairs only, which is important to know for accurate graft number estimation. Interestingly, these patients demonstrate a higher occurrence of telogen hair in comparison to Caucasian patients (Fig. 3.12A).
- Oftentimes, there is a significant number of telogen hairs present, and they should not be mistaken for transected hairs and/or similarly dismissed as non-viable hair (Fig. 3.12B). Accordingly, if a follicular unit has one "strong" (anagen) and one "tiny and short" hair (telogen), the graft should be counted as a 2-hair FU and placed accordingly behind the first row of the hairline.

References

1. Beehner ML. A comparison of hair Growth between follicular-unit grafts trimmed "skinny" vs "chubby". Hair Transplant Forum International. 1999; 8(1):16.
2. Seager DJ. Micrograft size and subsequent survival. Dermatol Surg. 1997; 23(9):757-61.

4 Graft Placement 360

Recipient Area

Hair Direction and Angle

Understanding the intricate changes in hair angle for every part of the scalp is very important in achieving natural results. Before explaining technique for graft placement, we must first comprehend the angles and directions of hair growth that occur as natural patterns across each region of the scalp. Although every person is unique and may have subtle yet distinct hair patterns, there are basic principles to how hair grows on each scalp region that should be understood as a prerequisite to graft placement. There are four distinct areas of the head that hair restoration targets: frontal, temporal, top (midscalp) and vertex (crown), each of which demonstrates its own subtleties in hair-growth pattern and which will be discussed further in this chapter.

The frontal area comprises the hairline and the fronto-temporal triangles. Hair angles in the hairline are directed forward at a 10 to 20 degree angle vis-à-vis the horizontal plane of the head. In the male hairline, almost all of the hair is directed straightforward except the lateral areas where frontal hair gradually transitions over to the temporal hair, which begins to point downward and almost parallel to the scalp. This fronto-temporal junction is oftentimes the first evidence of hair loss for many men, as these triangular alleys begin to recede backward. Of note, the female hairline can be radically different than the male counterpart in many respects: the whorl pattern of the central cowlick with many hair angles directed backward toward the vertex, the closed fronto-temporal angles, the less jagged anterior hairline, etc. The reader is encouraged to review these details enumerated more thoroughly in the section on recipient-site creation in Volume 1 for physicians.

The temporal area includes the temporal hairline, the temporal points, the sideburns, and the hair above the ears, or parietal hump. Hair in the temporal

area grows in an acute angle of 5 to 10 degrees relative to the scalp. The hair curl always faces the scalp, and for the most part, the direction of the hair in this area is pointing downward.¶ The temporal point is an exception regarding the direction of hair growth because, in order to form a "point," the hair direction changes from growing downward and forward to downward and backward, i.e., from pointing toward the chin to pointing toward the ear. As it is essential for physicians to understand this directional change, it is just as important that the assistant understands it, otherwise during graft placement the assistant can ruin the end result by placing the grafts incorrectly. For example, a physician can make perfectly oriented recipient sites but if hair is placed with the hair curl facing upward and/or forward, the hair would look unnatural and would be difficult to style. Eyebrow hair angles are similar to those found in the temples, almost flat and parallel to the skin; and graft placement into the eyebrow region is treated in the same way as placement into the temples.

Parietal humps (also known as lateral humps) are the areas above the ears where the scalp and hair transitions from the horizontal scalp plane to the side vertical scalp plane and from the midscalp hair to the temporal hair. A large number of people retain hair in this area; however, some people will lose it and will require hair restoration. The younger the patient is the greater is the concern that the patient may need his parietal humps restored in his lifetime. Considering the change of hair direction and angle occurring in these areas, it is important to understand the natural hair patterns in the parietal humps so that restored hair will provide natural coverage with a seamless transition from transplanted to un-transplanted hair.

The top or midscalp is the area covering most of the horizontal surface of the scalp. Hair-direction changes from facing forward to splaying out to face sideways in the lateral centimeter or so approaching the parietal humps and to curve gently to match the hair angles in the vertex. In order to accommodate this transition in direction, hair angles will also change and lift upward from an acute 10 to 20 degree angle in the hairline, to 25 to 35 degrees throughout the body of the midscalp and especially in the lateral and posterior transition areas. During graft placement, it is important to keep in mind that the midscalp provides central density and coverage; and therefore grafts containing a higher number of hairs (3- and 4-hair grafts or DFUs) should be placed accordingly. While the hairline frames the face, the midscalp provides a frame to the entire head; if this area lacks density, the light reaching the head will reflect upon the

¶ Again, the reader is encouraged to review the recipient-site creation section of Volume 1 to study these concepts more in depth, as the understanding how a physician creates recipient sites can facilitate graft placement by naturally following the angle and depth of the created sites.

Figure 4.1A

A head model demonstrating recipient-site angles in different regions of the scalp: Hairline, temporal hairline, temporal point, sideburns, midscalp and parietal humps as observed from a profile view.

Figure 4.1B

A head model demonstrating recipient-site angles from a posterior view featuring the vertex in particular.

scalp exposing it and making every other area look thinner, i.e., the hairline, parietal humps and vertex (Figs 4.1A and B).

The vertex, also known as the crown, represents the area where the head slopes from the top, which is horizontal, to the back of the head, which is vertical. The whorl is the most distinct hair pattern in this area. The swirling pattern of hair growth accommodates the change of hair direction and angle; from the center of the whorl, hair grows either clockwise or counter clockwise with the hair curl always pointing toward the scalp. Considering that the whorl and the swirling effect of the hair direction provide seamless transition and connection between various areas of the head, it is important to understand and respect this unique hair pattern.

Eyebrows and eyelashes are areas that in some situations require transplantation. A person with an unknown loss of eyelashes or a burn victim may need eyelash transplant, while the most common situations that require eyebrow transplant are caused by over plucking or by some kind of trauma. Eyelashes have an important role to protect the eye from dust and other airborne debris. Eyelashes are very delicate to transplant, and their survival is low. Therefore, it is our opinion that eyelash transplant is not intended for cosmetic purposes but only for functional improvement, e.g., to guard the globe against the entry of dust or other unwanted debris. Although eyebrows are easier to transplant than eyelashes, the sophistication of their unique pattern requires a high level of skill in order to recreate faithfully a naturally-looking eyebrow. Eyebrows frame the eye and render a more alluring countenance. In the medial portion, hairs in the eyebrow grow upward; then spiral downward to criss-cross in a fish-bone pattern, i.e., hairs from the upper fringe grow downward and hairs from the bottom fringe grow upward; all of these uncompromising elements are crucial to form a well-defined eyebrow. In addition, the overall eyebrow shape extends straight across the forehead, and then at the mid-pupil gently curves downward. The hair exit angle in the eyebrow is very low, almost parallel to the skin, and the hair curl always points toward the skin. Hairs should be trimmed no shorter than 5 mm in order to make the hair curl well visible. Taking into consideration that the eyebrow hair pattern is very sophisticated and that if not done correctly can engender more damage than benefit for a patient, we will limit our discussion to the above basic introduction and promote more in-depth discussion between the assistant and physician for greater insight.

Recipient Sites

Many placing difficulties can be avoided if the assistant understands natural hair patterns and if graft size and site size are aligned for a proper fit. Since the angle and direction of recipient sites change to follow a natural hair pattern, the assistant should adjust hand movements accordingly in order to insert grafts seamlessly into the sites. Regarding proper fit, grafts vary in size depending on

Figure 4.2

This photograph demonstrates that the length of the instrument used to make recipient sites should match the length of the appropriate-sized grafts. In this photograph, the needle is bent to match the length of the graft.

the number of hair they contain and consequently the size of the recipient site will vary too. Usually, a 3-hair graft is larger than a 1-hair graft and should not fit into 1-hair sites. Before making all sites and making all grafts then discovering that they do not fit, a test placing should be performed. Several sites should be created with each different type/size blade and tested by inserting several average-sized grafts into these test sites. Two factors are observed for accurate fit: the width and the depth of the site (Fig. 4.2). Grafts should slide into a site easily yet not sink deeper than 1 mm below the surface and they should fit snugly. If the incision width is too wide, the graft may rotate or "float" out; if the site is too tight, multiple attempts to stuff the graft in can cause damage to the graft and/or cause popping of the neighboring grafts. If the incision is too deep, the grafts may slide inward causing either pitting or accidentally double stacking grafts resulting in ingrown hairs and related cyst formation. Conversely, if the incisions are too shallow, grafts would pop out, placing would be a nightmarish experience, and grafts could end up damaged from multiple placing attempts or dry out if they protrude too far above of the site, leading to either a "bumpy" appearance and/or poor growth.

There are two types of recipient sites, sagittal (also referred to as parallel) and coronal (also referred to as perpendicular or lateral), depending on the direction of the blade relative to the scalp. In sagittal sites, the direction of the incisional slit is front to back, while in coronal it is side to side. Most offices use sagittal sites. However, in some offices such as the author's, both types of sites are used based on their advantages. We often use coronal sites in the temple region only because the "anatomy" of the site creates an upper flap that contributes to keep the graft/hair angle low in this area.

Technique

Proper Graft Handling

Graft placement is a critical part of hair transplantation. Correct or incorrect graft handling and placement can significantly affect the end result and define the difference between a successful and failed outcome. In order to avoid human error (H-factors), the following behaviors should be monitored:

- *Physical trauma:* Grafts are very delicate and crushing them with forceps by careless, forceful or excessive manipulation can cause damage to the graft thus reducing its survival rate.
- *Dehydration:* Prolonged exposure to air during graft placement can lead to dehydration, which is the leading cause in diminishing graft survival. The greatest incidence of graft desiccation occurs while grafts rest on the finger or back of the hand awaiting graft placement. An inexperienced assistant makes the mistake of loading too many grafts at one time. However, even with fewer grafts loaded at any given time, waiting-to-be-placed grafts should be frequently sprayed with saline and thereby kept as moist as possible at all times.

Placing Method

Placing is a process during which grafts are inserted into the recipient sites. In order to facilitate and make placement efficient while preserving the vitality of the tissue, a small number of grafts are transferred from storage to the assistant's hand in order to be further inserted into the patient's scalp. The following five steps outline the method of placing: loading; finding the angle; grasping, inserting, and adjusting grafts; then dabbing.

1. The index finger or the back of the hand at the junction with the index finger are the ideal places to load grafts because they are the closest to the recipient sites. A right-handed person loads on the left hand and vice-versa. To prevent dehydration, a beginner should load 4 to 5 grafts at one time, while a seasoned assistant may load up to 20. Furthermore, grafts should be loaded in a pile rather than spread out so that they can preserve their moisture more easily. The author's office uses Telfa pads to load grafts, while other offices may use foam adhesive taped around the index finger, 2 × 2 gauze, ring-like graft cups, or alternatively leave grafts sitting directly on the glove. Regardless of the loading "location", it is paramount to keep the grafts well hydrated.
2. All incisions are made at a certain angle and determination of the angle should be established before initiating graft insertion. To attempt graft insertion by assuming the incorrect recipient-site angle may result in unnecessary popping

and frustration. If the graft is guided into a site at a wrong angle, it will hit a wall of the site instead of gliding easily parallel between the walls. Therefore, a test to find the correct site angle is performed by closing the tips of an empty forceps, then inserting the tips into several sites in one small area to determine if site angles are consistent or they exhibit unexpected variations. Once the angle is identified, placement can begin apace.

3. Grasping the graft should be delicate enough so as not to crush the graft, yet firm enough to hold and guide the graft into the site. The manner in which a graft should be held is described by having the tip of the forceps grasping the fat below the hair bulb or just lateral to the bulb (Figs 4.3A and B). Sometimes,

Figure 4.3A

The correct way to grasp a graft is below the hair bulb with forceps holding the fat layer and oriented at approximately a 45 degree angle to the graft.

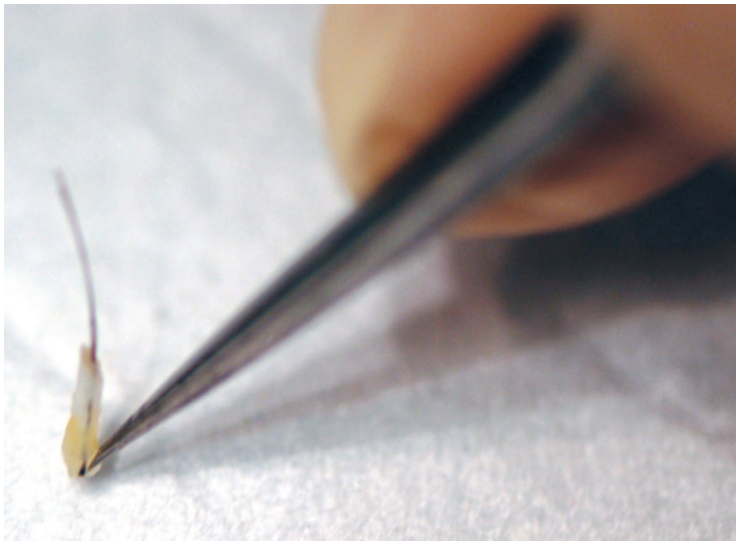


Figure 4.3B

In this photograph, there is an absence of the fat layer below the hair bulb requiring that the fat layer be grasped adjacent to the hair bulb.

there is minimal tissue surrounding the bulb, or the bulbs are splayed out, which mandates a gentle policy when having to grasp the bulb directly. In order to avoid squeezing the bulb, the tip of the forceps cannot be oriented perpendicular to the graft but should be held at an angle to the graft. Each graft is held at the same place, the fat layer; however, the position of the forceps on the graft would vary depending on the hair curl. As an easy reference, imagine each graft as a rectangular, four-sided block, wherein the front of the block is aligned with the direction of the hair curl. Depending on which side of the head the graft is placed, grasping will be performed in the following manner: Working on the right side of the patient, the forceps grasps the front of the graft having hair curl point toward the forceps, (Fig. 4.3C), and working from the left side of the patient's head the forceps grasp the side or the back of the graft and working from behind the patient, the forceps grasp the back of the graft and thereby hair curl points away from the forceps (Fig. 4.3D). To facilitate grasping and orienting the hair curl correctly, the

Figure 4.3C

Correct way to grasp a graft when working on the right side of the patient: The forceps grasps the front of the graft having the hair curl point toward the forceps. Straight forceps are preferred for placement on the right side of the patient's head.

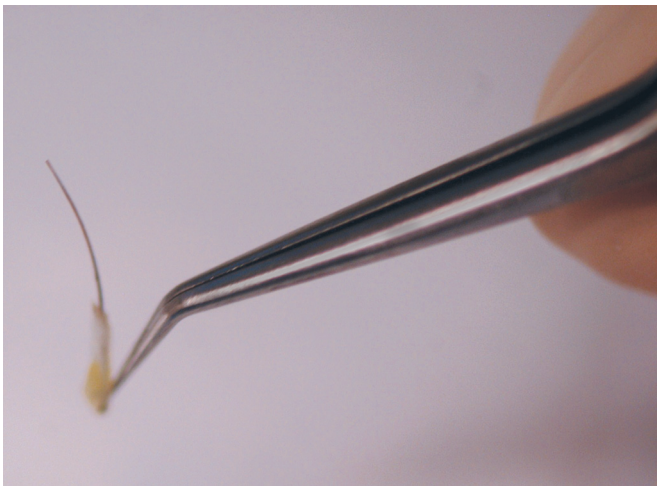


Figure 4.3D

Correct way to grasp a graft when working from the left side (or from the back side) of the patient's head: the forceps grasps the side or the back of the graft with the hair curl facing away from the forceps. Angled forceps are preferred for placement on the left side (and the back side) of the patient's head.

donor hair is left 5 to 10 mm long before harvesting to make the hair curl more obvious, and the assistants are required to align the grafts with respect to hair curl during graft dissection. It is important to mention that grasping grafts too high, e.g., by the mid-shaft, could cause the graft to bend during insertion or make the forceps enter the site but cause the bulb to pop out of the site. While grasping the graft, one should be careful not to over squeeze the forceps allowing the tips to cross, since that could crush or chop the graft.

4. Insert, release and adjust are the three steps that guide and deposit a graft into a site. During the first movement of insertion, approximately half of the graft length should be inserted into the site before it is released. At this point, the graft is grasped again by its top edge or at the level where the graft enters the site and pushed deeper into the site until the epidermis remains slightly above the skin. If the graft adheres to the forceps and comes out when the forceps are withdrawn, the assistant should use a folded, damp gauze in the opposite hand to cover the site and then the forceps should gently slide out of the site while using the gauze to hold the graft in place within the site.

   To achieve precision and stability during insertion, the assistant can position the fifth digit (the pinky finger) on the head while holding the forceps between the thumb and index finger. One should be cautious not to lean the pinky finger on the area filled with the grafts since the pressure of the finger itself may engender graft popping. In addition, one should be aware of the placement of one's finger not to rest too low on a patient's forehead, e.g., a finger placed between the eyebrows can be highly irritating or one's nails embedded into the patient's skin can elicit unspoken discomfort.

   The angle of the forceps should be aligned with the angle of the site. Imagine a line going through the center of the site and extending 3 inches above the scalp. Close your forceps and imagine a line traversing through the center of the forceps. Now, imagine those two lines overlapping. This little exercise helps position one's forceps to facilitate insertion. Otherwise, improper angulations of the forceps can lead to forceful rather than gentle entry into a site and thereby manifest as graft damage and impede graft placement. The ideal insertion occurs with one or two deliberate movements and anything more than four movements/adjustments can traumatize grafts unnecessarily and waste valuable time and energy.

   Previously, we mentioned that there is a difference when grasping the graft while placing on the patient's right, left or the back of the head. Likewise, hand movement changes depending on the position of the assistant relative to the area of the head being placed. A straight forceps is used for placing when standing on the right side of the patient, and the graft is inserted as if

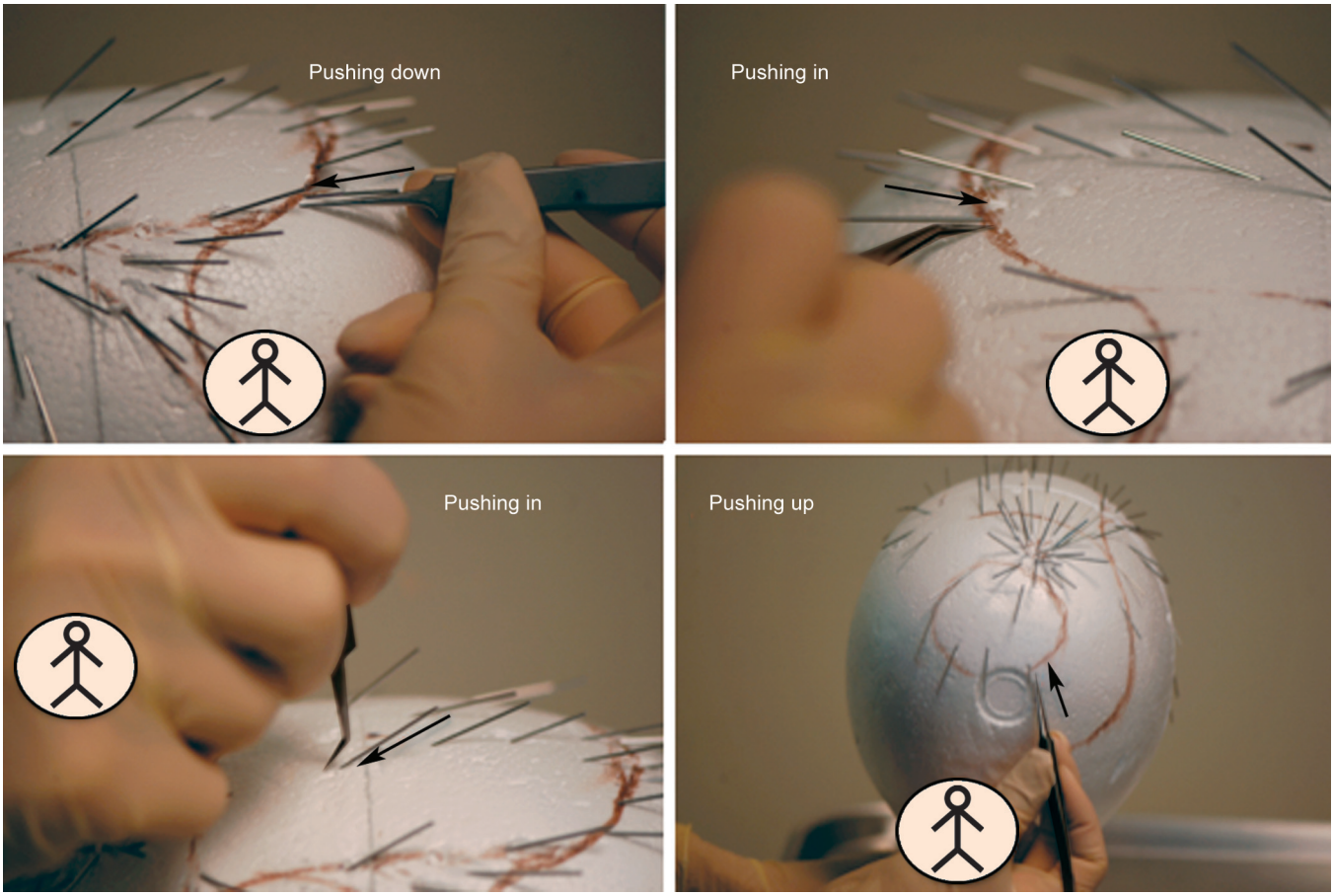


Figure 4.4

This photograph demonstrates correct hand positioning for graft placement vis-à-vis the patient. The stick figure indicates the position of the assistant's body relative to the patient's head. Placing on the right side, the assistant uses straight forceps and pushes the graft down into the site; on the left side, the assistant uses angled forceps and pushes the graft in; working from the back, the assistant pulls the graft in; and working in the vertex, the hand movement for graft placement is pushing up.

pushing down into the site. Placing on the left side or from the back of the patient's head, angled forceps facilitates the proper movement; on the left side, the hand movement is similar to pushing in, while working from the back, the movement is similar to pulling in the graft into the site. Placing the graft into the temple area requires straight forceps and a pushing up movement (Fig. 4.4). Placing in the vertex can be challenging because of the swirling angles and directions of the sites. Therefore, all hand movements are applicable when placing grafts in the vertex depending if one, two, or three assistants are placing grafts. However, understanding correct recipient-site angles and basic hand movements for graft insertion from the right and left side of the patient as well as the upward direction necessary for insertion in the lower crown allows for proper body positioning and appropriate hand

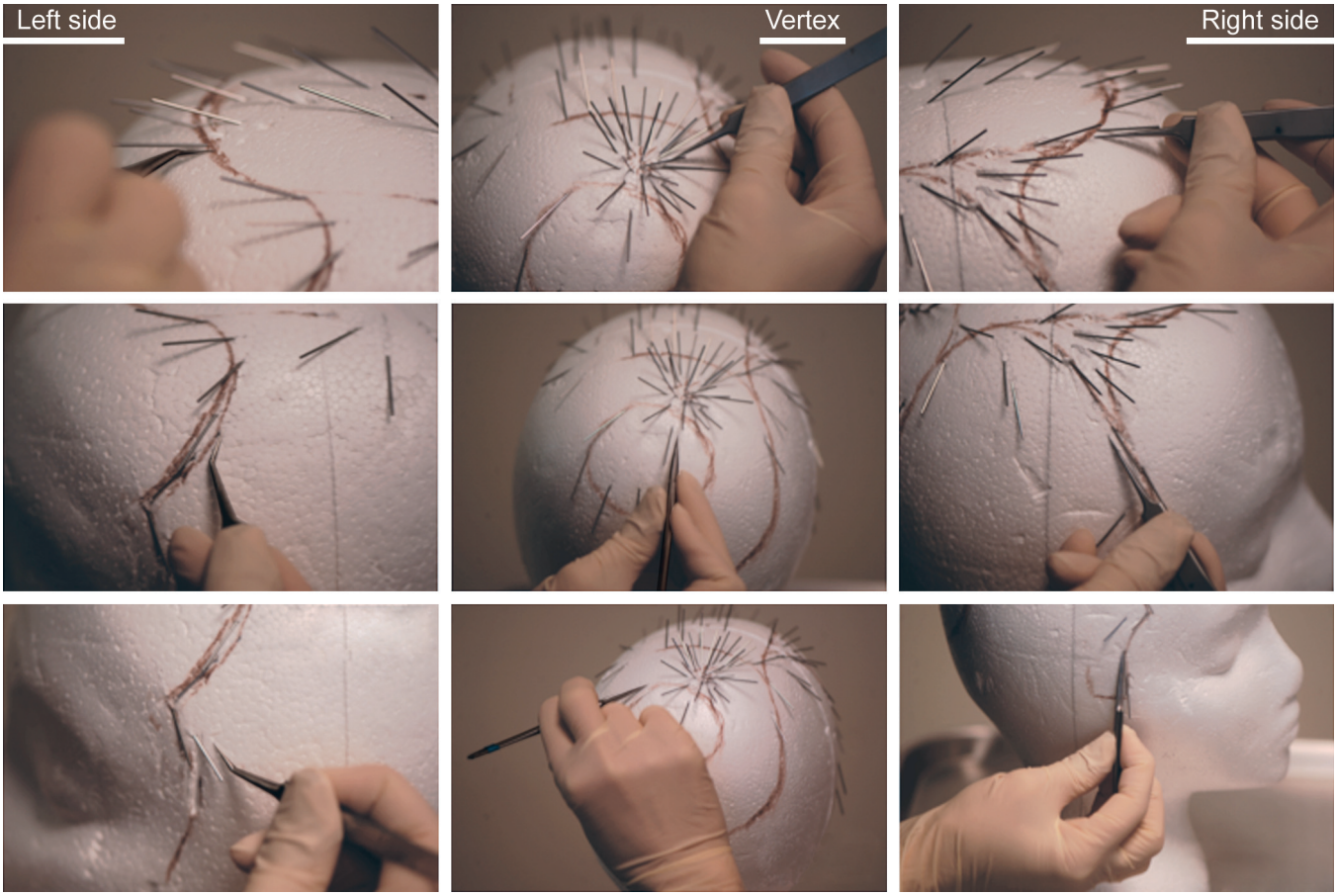


Figure 4.5

Placing grafts demands that hand movement and forceps position follow the natural hair pattern. The photographs exhibit different hand positions in respect to working in the front from the right and the left sides of the patient and working in the vertex area from behind the patient.

movement in every circumstance. The reader should note that all movements described are for a right-handed person and would be used in reverse for a left-handed assistant (Fig. 4.5).

Hand movement should come from one's fingers or wrists but never from the shoulder. Shoulders should be relaxed with elbows pointing down (with elbows never high, close to, or above the shoulder level), and the work field should be adjusted to a height that falls somewhere between the assistant's upper chest and neck area (while the patient is sitting up). For example, while placing grafts in the hairline, midscalp or vertex, the field should be at chest level because the hand movement emanates from above. While placing grafts into the temples and/or the lower vertex, the assistant should have the work field somewhere at the level of his or her neck (never higher, as

shoulder fatigue would develop) in order to allow for good visibility and easy access to the recipient sites. If the patient is reclined or placed prone, the work field resembles a desk, and hand movements become easier and more relaxed. The prone position is defined by the patient lying on his stomach facing down, a pose that can facilitate placing grafts in the lower portion of the vertex. Another useful position is for the patient to lie on his side (medically known as decubitus) while placing grafts into the temples. Caution should be given when a recumbent patient rotates to the side so as not to disturb an already transplanted area. However, a patient who remains recumbent for long hours may suffer an unpleasant experience, which also does not allow several assistants to place at the same time. In the authors' office, patients are sitting up and partially reclined except during eyebrow transplantation when they are lying flat on their back.

Ideally, quality graft placement is characterized by atraumatic insertion, correctly positioned height of the inserted graft, matched graft-to-site size and location, and proper hair-curl direction. We have already explained that smooth insertion occurs in one or two deliberate hand movements. The height of the inserted graft should be about 1 mm to 2 mm above the surrounding scalp (Figs 4.6A and B). Any graft placed higher than 2 mm above the surrounding scalp would risk exposure of the sebaceous gland leading to graft desiccation. Contrariwise, if the graft is placed below the scalp surface, the graft can form inclusion cysts, ingrown hair, leading to unnatural healing and pitted-looking results. We have also mentioned the importance of placing smaller grafts into smaller sites and larger grafts into appropriately designed larger sites. For instance, it is important to place 1-hair grafts only into sites that were designed for 1-hair grafts otherwise if a 2- or 3-hair graft were forced into a 1-hair site it would cause the hairs to grow compressed and look "pluggy" (Figs 4.7A and B). Finally, the orientation of the hair curl is critical, especially in the temple. Hair curl should always be directed pointing toward the scalp. When placing hair in the vertex, the direction of the whorl should also point toward the scalp, but in addition, follow the direction of the whorl (Figs 4.8A and B).

5. Dabbing is the motion of blotting blood off the field and further securing placed grafts. Dabbing is performed by using one 4 × 4 gauze folded in four, moistened with saline solution and placed under the fingers of the non-dominant hand. It is important to keep this gauze folded well and fingers flat in order to apply even pressure onto the field, otherwise the gauze bunched under one's fingers may cause uneven pressure and lead to grafts popping out. The non-dominant hand is used for two important functions: to carry grafts on the back of the hand waiting to be placed and to hold the gauze

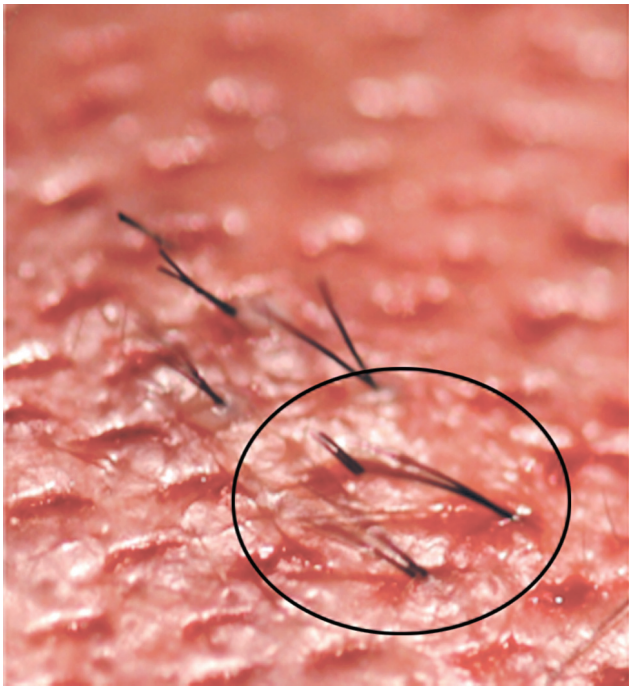


Figure 4.6A

Incorrect depth occurs when the graft is placed too deep. Epithelium on placed grafts is not visible because it is tucked below the scalp surface.

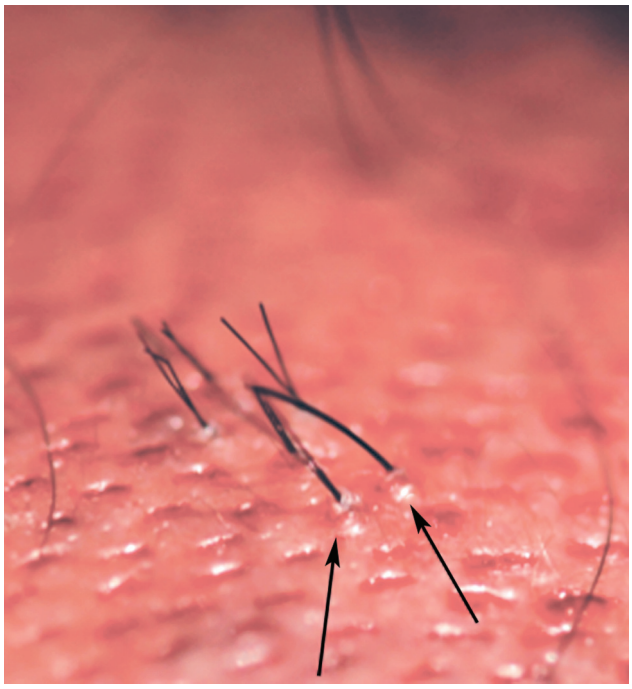


Figure 4.6B

Correct depth is achieved when the grafts as seen in Figure 4.6A are pulled up with the epithelium visible and resting 1 to 2 mm above the scalp surface.

that helps to keep the field clean. Because grafts are loaded on the non-dominant hand, the movement of this hand should be minimal and stray not far from the working field. This means that the hand should always be

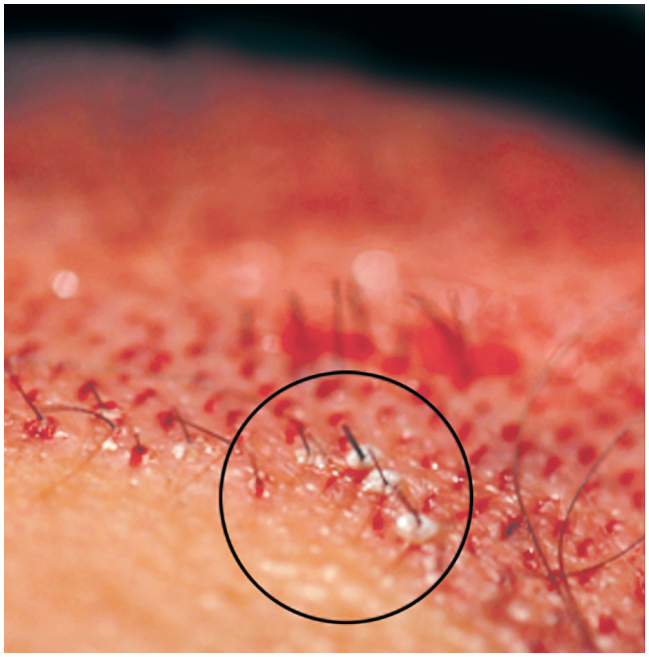


Figure 4.7A

Incorrect location occurs when 2- to 3-hair grafts (as shown) are incorrectly placed into 1-hair sites (frontal view).

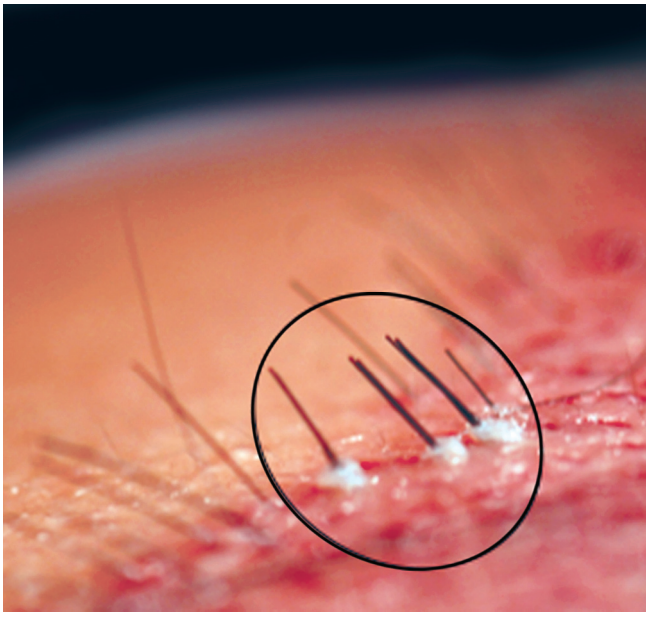


Figure 4.7B

Incorrect location is when 2- to 3-hair grafts (as shown) are incorrectly placed into 1-hair sites (lateral view).

kept gently resting against the patient's head while grafts are retrieved and placed. Any excessive pressure on the head while dabbing makes the patient's head bob, thereby transforming the working field for other assistant(s) into a moving target. As the placement progresses, the gauze rests on top of already placed grafts, keeping the area clean and the grafts in place. In

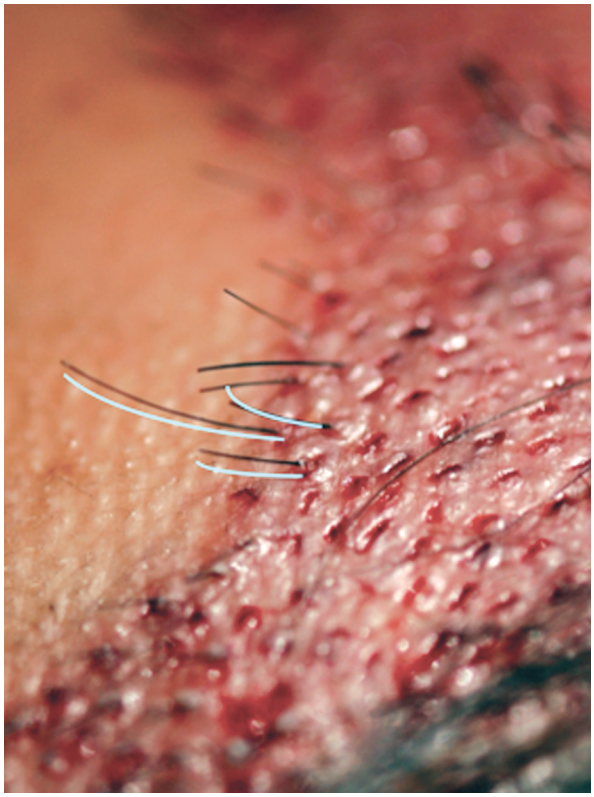


Figure 4.8A

Incorrect hair curl, as seen in the photograph, is demonstrated by the three anterior grafts placed with the curl pointing incorrectly upward.

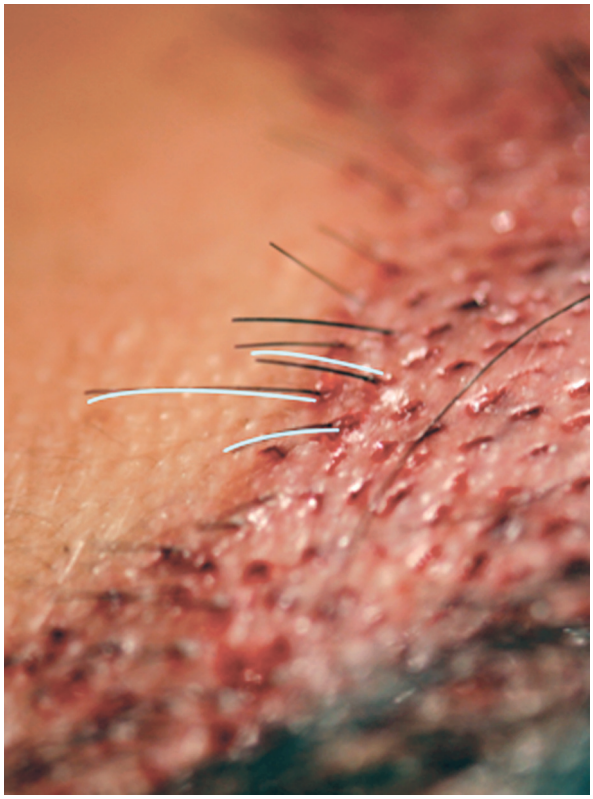


Figure 4.8B

Correct hair curl is depicted in the photograph demonstrating the three grafts mentioned in figure 4.8A are rotated now so that their hair curl points correctly toward the scalp, i.e., downward and forward.

addition, if the patient has long hair that may obstruct the view of the sites, using gauze held in the non-dominant hand can help by holding these native hairs out of the way. Using the tips of a closed and empty forceps, the native hair can be combed in a line parted to reveal a localized area for graft placement. Then the edge of the gauze can be placed adjacent to the exposed sites to hold the hair down. Then while inserting a graft, the assistant quickly dabs and repositions the gauze to hold the hair out of her way while placing. By doing so, the gauze and the hand do not travel far (a micro movement) and the work field remains always clean and visible.

Occasionally, a spray bottle filled with 0.9% saline for irrigation is used to clean the field. While spraying the field, a stack of several 4 × 4 gauze is used to catch the saline from trickling down unwittingly into the patient's face or ears. Similar to the dabbing direction, the spraying stream should be directed downward with gravity onto the grafts. It is highly recommended to clean the field frequently for several reasons. First, it is easier to see the sites. Second, it is more pleasant for the next assistant to take over a clean field. Third, it is easier to clean the entire field sequentially than trying to counteract a clotted recipient bed and coagulated, bloodstained clothes at the conclusion of graft placement.

The direction of the dabbing motion is in alignment with the recipient-site angles. When dabbing, the pressure of the damp gauze is firmly applied to the surface of the transplanted grafts along the angle of insertion to help secure their nestled position. Otherwise, if pressure is directed tangentially to the angle of insertion, grafts may be more inclined to pop. The same tenet holds true during dabbing that follows cleaning of the working field. Kindly refer to Video 7 of Disc 3 for a detailed view on the above section.

The stepwise procedure of graft placement looks as follows:

- Clean the field using a spray bottle and stack 4 × 4 gauze ready for use.
- Take one piece of folded gauze, make it damp, and hold it in the non-dominant hand with two or three fingers flat against it.
- Load the grafts onto the index finger of the non-dominant hand.
- Hold forceps in the dominant hand, keeping the non-dominant hand in close proximity to the work area. Insert forceps to determine the site angle. Dab as necessary if probing the site should induce bleeding. In case of working with long hair, use an empty, closed forceps to comb the hair away to expose the sites and the working field better.
- Grasp the graft below the bulb and orient the hair curl in a natural direction.
- Insert the graft—*dab*—push deeper—*dab* or insert—push deeper—*dab* or insert—*dab*—move to the next graft.

- Spray to clean and reassess the area that has been placed to make sure all grafts are in place, that no grafts are too high or too low relative to the surrounding scalp, and that no sites have been accidentally skipped, all the while constantly evaluating one's progress and planning the next step.

Placing Strategy

Recipient sites are tiny and numerous, which can induce fatigue or result in technical errors during graft placement. Therefore, developing a consistent placing strategy by following a standard, repeatable placing pattern and limiting the scope of the work field at any given time can be very beneficial tactics to improve results. Placing strategy means communicating effectively with other team members and working together in harmony without competing for the same area. Before starting, if two people are placing, one should start working from the side moving toward the middle of the hairline, and the other person should start in the middle and work toward the contralateral side. If a third person is placing, that individual should work in an area where he or she is not in the way of the other placers (Fig. 4.9A). A similar strategy applies to placement in the vertex (Fig. 4.9B). As much as two or three people placing can accelerate placement at the beginning of the procedure, toward the end when the work area becomes progressively restricted it is more efficient to use fewer people instead of trying to maneuver around each other.

A placing pattern refers to the systematic way of "filling" in the sites. The easiest way is to progress by placing 1-hair grafts first all along the hairline, then 2-hair grafts behind the hairline until all the sites of the same size are filled, moving on to 3-hair grafts thereafter and so on. It is important to stay focused on one small area, to make a tight progression, and never to skip around since skipping increases chances of missing sites or placing two grafts into the same site. One of the placing patterns that one can employ is to work one staggered row of sites from one end to the other end of your field, then to start again with another row until all sites of the same size are filled. After that, one can move to the next size of grafts and follow the same prescription (Fig. 4.9C). Another pattern is to work in increments of 5 cm, by placing 1-hair grafts, then 2- and 3-hair grafts in that portion of the field until finished, then moving on to the adjacent area and repeating the same. While placing long hair grafts, e.g., in the temples or eyebrows, the order of placement should be from the outside going inward since the other way around will have the long hair from the placed graft block the visibility of the empty sites.

Having grafts lined up, loading them from a place that is close to the patient, e.g., not having to make several steps to get to a place where grafts are stored in order to load them, and keeping a loaded finger very close to the work field,

Figure 4.9A

This schematic diagram shows the ideal placing strategy for three concurrent assistants placing on a patient's head that will limit each assistant from interfering with the placement of another assistant. For example, the assistant on the patient's left side places from left lateral hairline and progresses toward the central hairline starting with the anterior-most row and progressing backward with each successive row (as shown by the color gradient, progressively moving from the darker to the lighter shade). The assistant on the patient's right side places from the central hairline and progresses laterally toward the right lateral hairline (also starting from the outside working toward the midscalp). If a third assistant is present, he or she stands behind the patient and progresses from center to back (placing from right to left as indicated by the color gradient, progressively moving from the darker to the lighter shade).

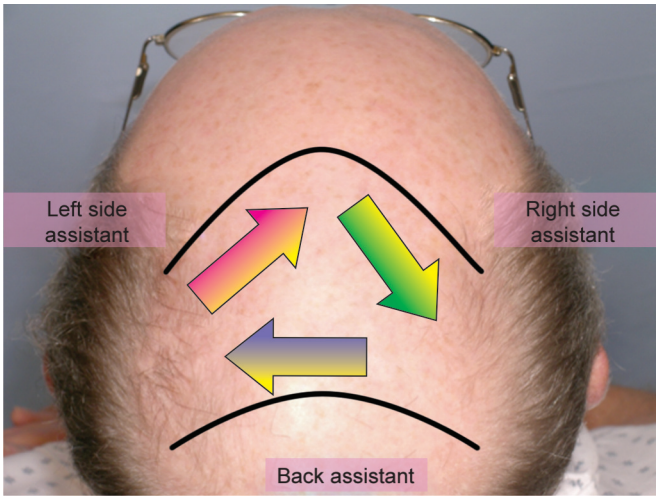


Figure 4.9B

This schematic diagram shows the same placing strategy with three assistants for the vertex as used for the midscalp and hairline as shown in this figure.

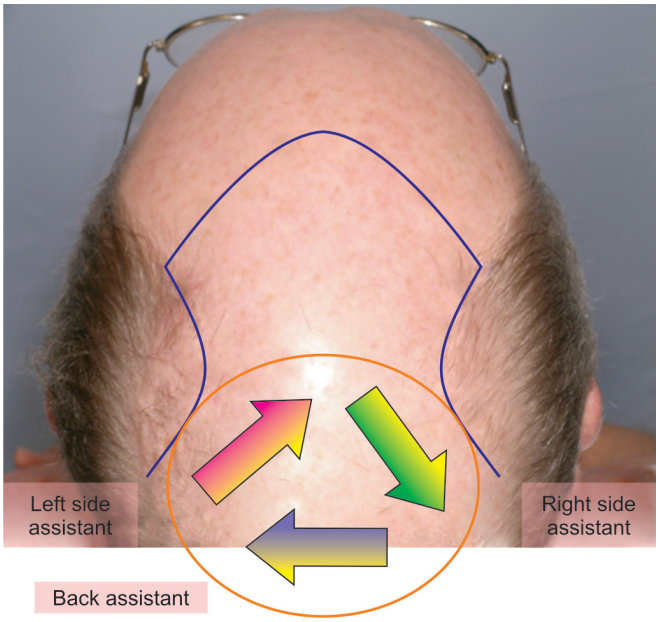
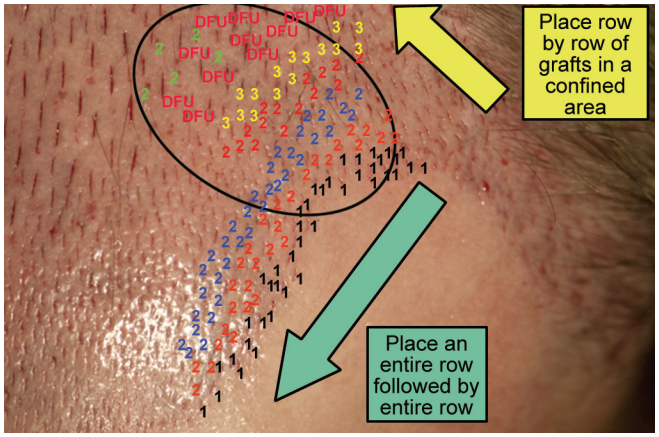


Figure 4.9C

Placing strategy showing order to place grafts with respect to the size of the graft: first placing several rows of 1-hair grafts (in black), then two rows of 2-hair grafts (in red), then two more rows of 2-hair grafts (in blue), then two more rows of 2-hair grafts (in red again), then two rows of 3-hair grafts (in yellow), then DFU grafts (in red), and then finally interspersed with the DFU grafts additional 2-hair grafts (in green). One can place an entire row of grafts first before moving to the next row (green box and arrow). Alternatively, a shorter row of grafts can be placed before moving to the next row then after this more limited area is completed to repeat the same sequence (yellow box and arrow and the circumscribed zone with a black circle).



the assistant can significantly accelerate the procedure. Taking an extra second per graft, on a 1500 graft case, if calculated equals to 25 minutes of wasted time and energy.

The order in which grafts are placed on the head should be prioritized according to graft viability and optimal hair density, as will be explained. Finer grafts such as 1- and 2-hair grafts are more fragile than DFUs and therefore should be placed first. However, the central forelock assumes a close second priority, as it plays a critical role in imparting visual hair density. The central forelock located at the midline of the head receives its blood supply from the periphery on the side of the head. During site creation, some small blood vessels may be cut which can compromise the already weak blood supply to that area. Allowing grafts to sit outside the body for a prolonged period of time further diminishes graft survival. Given the priority of the central forelock in hair restoration, the assistant should strive to place grafts in this area early on to combat the aforementioned risk of diminished blood supply in this critical zone.

When placing DFUs it is vital to pay attention to the hair curl as shown in Video 8 of Disc 4. The areas of higher density such as the central forelock, the midline of the midscalp, or the upper arc of the vertex should receive grafts with the highest hair density and of the thickest caliber. Also, these strategic regions that mandate visual density cannot be compromised by filling them with 1- or 2-hair grafts or by leaving sites open or unfilled. If the case progresses and a shortage of grafts arises, the zones of importance should be addressed first according to the following principles of priority: front before back and center before sides.

Another aspect of a good placing strategy refers to the judgment vis-à-vis graft selection and distribution depending on the respective regions of the scalp. In the hairline, the first two rows of sites must be filled with single hair grafts since they will be the most exposed and they will contribute significantly to how natural the appearance of the transplanted result will be. If a 1-hair graft consists of one viable and one transected hair, or one anagen and one telogen hair, it should not be placed in the very first row of sites since it may yield an additional hair and compromise the naturalness of the result. If the donor hair yields a high number of 1- and 2- hair follicular units, instead of making a wide zone of 1-hair grafts these grafts can be mixed and placed into the temples, fronto-temporal angles, lateral humps, posterior midscalp (transitioning to a bald crown), or circumferentially along the fringes of the vertex. In case a high number of 1- or 2-hair grafts are produced but the patient would benefit better from larger numbered follicular-unit grafts, these follicular units can be paired so that 2 FUGs are placed into the same site. The caution should be given to ensure that the hair bulbs are inserted at the same level (otherwise, one may slip deeper and cause an inclusion cyst or ingrown hair) and that the hair curl

is oriented in the same direction. Following the concept of graft selection respective to the recipient area, it is important to mention that when placing grafts into the scar 2-, 3- and 4-hair follicular units (and occasionally DFUs) should be selected because of their higher chance of survival. Scar tissue exhibits compromised blood supply and therefore 1-hair grafts do not survive in the scar tissue as well as stronger grafts.

The guidelines for graft placement in the vertex are as follows: first, the central part of the whorl is filled with 3-hair FUGs for approximately a distance of a 2 cm to 3 cm radius; then, the whorl is extended laterally and into the upper arc first, as the upper arc visually takes priority. If the whorl is rotating clockwise, the upper arc, especially the upper left quadrant, can be filled with 4-hair grafts preferably to create more visual punch, then for the lateral extent, most of the time sites are filled with 3-hair FUGs or 2- and 3-hair grafts mixed together, while the lower portion of the vertex is filled with 2-hair grafts. In case there is a significant number of 1- and 2-hair FUGs, they could be either paired or placed individually in the lower portion of the vertex and/or peripheral areas where vertex reconstruction blends with the existing surrounding hair. It is very important to blend the upper arc into the posterior midscalp or vertex transition point and posterior lateral hump.** The angle of the recipient sites in this area may vary from 25 degrees in the upper arc to 35 to 45 degrees in the center of the vertex but depends ultimately on your physician's particular technique and desire when creating his recipient sites (Fig. 4.9D).

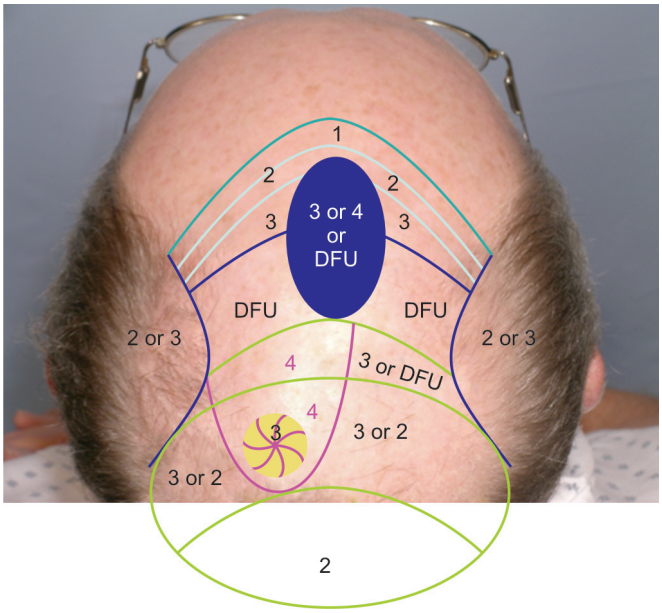


Figure 4.9D

This schematic diagram shows the proposed graft distribution based on size, e.g., 1 = 1-hair grafts, 2 = 2-hair grafts, etc. Of note, the central forelock illustrated as a dark blue oval requires stronger grafts to increase visual density where it counts, and larger grafts, e.g., 3-hair FUGs, 4-hair FUGs, or DFUs, can be used to achieve this goal. The vertex is denoted in lime green with the central filled-in yellow circle representing the center of the whorl, and the purple radiating spokes indicating the direction of the whorl. The purple V-shaped area signifies the most important area for achieving good density and coverage in the vertex. The upside down U-shape in lime green that bisects the vertex illustrates the divide between the upper and lower arc of the vertex where the upper arc takes precedence for density over the lower half.

** For more details regarding these regions of the scalp, please refer to Volume 1 in the recipient-site section of chapter 2.

Considering the complexity of graft-placement technique and need for critical judgment, fewer assistants are typically trained in graft placement than in graft dissection with the training for graft placement taking on average several months longer than the training for graft preparation. In addition, taking into account the impact that proper graft placement can have on the end result, a surgical assistant who is selected for graft placement should be skilled, knowledgeable and conscientious.

Instrument Selection

As mentioned earlier, loupes and good illumination are required for quality graft placement. Regarding placing instruments, forceps used for placing grafts should have long, fine tips, such as a straight jeweler No. 5, angled jeweler No. 5S or curved jeweler No. 7. Straight forceps are ideal for placing on the right side of the patient and for temples; angled forceps are preferred for the left side of the patient and placing from the back of the patient; both types can be used to place in the vertex.

Quality Control and Performance Evaluation

Quality control consists of setting specific quality standards relevant to obtaining desirable results, monitoring their implementation, identifying as well as providing guidelines for correcting one's mistakes, and continually comparing one's work against those standards. Quality control is a team effort and therefore it should be the responsibility of the entire team. Generally, the head assistant is in charge of the quality control for the team of assistants although some surgeons desire to be involved to a varying extent in the process. Quality of grafts dissected and placed should not be underestimated, as rough manipulation and improper placement can lead to poor growth and an unnatural hair appearance.

- *Graft hydration vs desiccation*: Considering that hydrated grafts have a higher survival rate, attention should be given to keep grafts moist all the time. Caution should be admonished by novice assistants to take fewer grafts to place at one time. Because it takes them longer to insert grafts into the recipient sites, neophytes should carry no more than 10 to 15 grafts at a time out of the saline solution. Desiccated grafts diminish hair survival and lead to poor or no growth.
- *Proper manipulation vs trauma*: Improper manipulation during graft placement refers to either squeezing the hair bulb while holding the graft or damaging the hair bulb while inserting the graft forcibly into a site. Squeezing the hair bulb or forcing it into a site can damage the hair matrix and can result in a thinner diameter hair that appears as suboptimal density or kinky-appearing

hair growth that visibly separates original from transplanted hair and unquestionably looks unnatural.

- *Appropriate vs inappropriate fit*: Forcing large grafts into small sites makes graft placing difficult, damages hair, and leads to compressed hair growth, eventually giving rise to an unnatural look. While placing a small graft into a larger site may be easy, it can lead to buried grafts and/or ingrown hair.
- *Graft placed at correct vs incorrect depth*: The epithelial surface of the graft should be about half a millimeter above the scalp level. Some hair-restoration techniques advocate grafts, deepithelialization, but the authors find this technique as adding increased risk of transecting hair or placing the graft at an incorrect depth. When the graft is placed below the epithelium, the healing of the scalp becomes uneven, causing scalp indentation around a graft, commonly known as pitted growth (Fig. 4.10A). If the grafts are placed high above the epithelium, they may dry out (high and dry).
- *Hair curl aligned vs misaligned*: Hairs exhibit a natural curl. The curl and the site angle should be mutually aligned to match the surrounding native hair angles. When the curl of the hair is misaligned with the orientation of the site, the hair grows in a more haphazard manner, which can cause difficulty in hairstyling and eventually result in sparse and unnatural transplanted hair. Respecting and matching the hair curl is vital in areas such as the temporal hairline, temporal point and eyebrow (Fig. 4.10B).
- *All sites filled and grafts placed correct side up*: It is important to fill all the sites especially those in the hairline and the central forelock. If several neighboring sites are left empty in the hairline, the patient will have a gap in hair growth. If several sites are left open in the midscalp, the gap will expose the scalp and contribute to a see-through effect. If the assistant cannot distinguish between the top and the bottom of the graft, i.e., the top as the epithelium with hair exiting the graft and the bottom as the bulb surrounded with a fat layer, then grafts could be placed upside down. The consequences of such an action are no growth, wasted hair and spotty hair growth. Either of the challenges mentioned above can be avoided with using good magnification during placement. In addition, following a systematic placing pattern would minimize omitting sites, while leaving hair 5 mm long. This would prevent someone from making a mistake in identifying a graft's top from the bottom.
- *Understanding and respecting the design*: In general, recipient sites are made following a specific design created in order to achieve an optimal result as far as density and naturalness is concerned. For example, 1-hair grafts are intended to create a natural- and soft-looking hairline. If 2-hair grafts or if coarser instead of finer 1-hair grafts are placed in the very front of the

Figure 4.10A

This photograph shows a poor result with pitting, i.e., scalp indentation at the point where the hair exits the scalp, as well as the hair angle being higher than recommended, and finally with 2-hair grafts placed in the very front row (instead of only 1-hair grafts).

Figure 4.10B

This photograph shows a poor result with large grafts being placed in the very front of the hairline, spaced far apart, in addition to hair angles and hair curl being incorrectly oriented. (This photograph is a courtesy of Dr. Vincenzo Gambino.)

hairline, the result would look cosmetically unpleasing. The appearance of density is created by populating the central forelock (the central front portion of the midscalp area) with 4-hair FU or 5- and 6-hair DFU grafts. It is important that the person placing grafts respect the design and place stronger grafts (i.e., grafts that have coarser hair or higher number of hairs per graft) into the central forelock otherwise the end result would be more see-through.[††]

[††] For a better understanding of the central forelock and its strategic importance, the reader is encouraged to review this concept elaborated more in depth in Volume 1.

Quality control during graft placement encompasses supervision of the graft placement and the quality of grafts being dissected. One person could be assigned to oversee all staff; however, since graft dissection and placement are function of a team, quality control should be a part of everybody's job description. One way to help each other maintain good quality is to have one assistant place another assistant's dissected grafts and further to change sides at the end of the procedure to evaluate and judge each other's work. It is not recommended to switch sides too often since it disrupts the work flow, which may result in skipping sites, and also would be difficult to examine results and learn from them. As a part of the medical record, the name of the assistant that worked on a specified area of the scalp should be meticulously noted. Accordingly, feedback as to quality can be attained as the physician and/or assistants review the aesthetic results when the transplanted hair begins to grow several months later.

Assistant performance in graft placement refers to the knowledge of proper graft placement, the quality execution of that knowledge and the speed of delivery. Although the speed of placing matters, quality is prioritized over speed. Quality is defined as meeting the standards of proper placement and exercising good judgment. With those prerequisites fulfilled, speed can be developed as the second most important goal. For a beginner, the focus is always on achieving correct movement and on developing proper judgment. As the person progresses in experience, the number of grafts inserted in a minute should automatically increase. A seasoned assistant of high caliber should be able to place about 300 to 400 grafts per hour.

Challenges and Solutions

Popping

Popping occurs when a graft is placed into a site and then the lateral pressure on the tissue around the graft causes it to pop out. This pressure may be due to multiple factors, including grafts that are too large for a given site, a site that is too shallow, skin with limited elasticity (e.g., scar tissue), and scalp that is manipulated and pulled by two assistants working in close proximity, rough placement, and excessive bleeding. The best way to avoid popping is to test the fit at the beginning of the site-creation process. Sometimes, with an originally good fit, grafts seem to "swell", due to soaking in the saline solution and hence, require redoing the sites. Another method to resolve this problem is to skip sites in a consistent manner, placing every other site and then coming back to fill in the sites left vacant in the first pass. Using damp gauze and applying gentle pressure with the entire palm of the hand over the full expanse of the

recipient area for a sustained two minutes can help settle the area and minimize further popping. In some situations, using a blow-dryer to dry placed grafts may help, i.e., "seal" them before progressing to the next area.

Bleeding and Oozing

Bleeding not only impairs visibility but can also force the grafts to slide out of their sites. In addition, bleeding can wash out the local anesthesia, decreasing numbness and increasing a patient's sensitivity, causing the patient to fidget and the placing process to be interrupted for additional numbing. If the bleeding is occasional and it is provoked by the insertion of a graft, inserting a chunkier graft into the same site may solve the problem. When bleeding pushes the graft out of the site or obstructs the visibility of the site, the gauze should be placed right at the edge of the site with slightly firm pressure as if blotting something to diminish the bleeding and to absorb enough blood to expose the site. The assistant should start with damp gauze and if that does not work, then switch to dry gauze. If bleeding is more generalized, the physician should be informed who will then infiltrate a solution containing additional epinephrine for hemostasis. A few minutes are required for this medication to take its full effect during which time the entire recipient area can be more thoroughly cleaned and the patient is offered a refreshment and a restroom break. Interestingly, sometimes increased bleeding can arise due to unspoken patient anxiety or discomfort, and a little change of position or calming the patient's energy may significantly reduce the extent of bleeding.

Oozing is different from bleeding because there is a constant seepage of blood throughout the recipient field. However, most of the same techniques outlined for handling bleeding can be applied here as well. In addition, using very chilled saline to clean the entire area may cause vasoconstriction sufficient to diminish or prevent further oozing. Oozing or bleeding may elicit investigation to discover that the patient had forgotten to stop aspirin or had alcohol the day before the surgery, which is forbidden in the preoperative instructions. The assistant should refrain from lecturing the patient since that may only cause him or her to become upset and consequently provoke in turn more bleeding. Nevertheless, finding out what advice the patient ignored can be valuable information to be noted so as to be reiterated more forcefully before the next procedure but not delivered during an already difficult placement session.

Grafts Sinking In

The "danger" of grafts sinking in is twofold. First, the sites may appear empty, then the same site is filled with grafts placed on the top of the previous graft, resulting in ingrown hair, a complication for the patient and causes the hair to

be wasted. Second, the healing that occurs over a deeply placed graft creates a skin dimple, since the top of the graft is below the surrounding skin, resulting in cosmetically unsightly pitting. The most obvious reason for grafts to sink inward is that the sites are too large for the size of the graft, which may be caused by sites being created greater in size than planned. Sometimes, the blade slides during site creation making a wider aperture than intended, or the assistant mismatches the size of the graft to the size of the site. The less obvious reason for this problem is placing in an area of principally scar tissue where the skin has little elasticity and instead of the incision hugging the graft, the incision edges gape open and the graft slides in or out of the site. In summary, rules to subscribe to are as follows: keep grafts slightly more elevated, dab very gently, leave hair long so that when the graft sinks in the site it is not misinterpreted as empty, and finally, check the position of all grafts at the end of the procedure by pulling all transplanted grafts to approximately 1 mm above the skin level.

Sites Difficult to See

Placing is very challenging when sites are difficult to see. Sometimes it may be the color of the skin; sometimes it is the absence of any oozing making the sites entirely white against a white background; sometimes light glaring on the scalp can be the cause. Using loupes with higher magnification, adjusting the light, gently rubbing the area to provoke mild oozing or applying methylene blue can help solve this challenge. To apply methylene blue, it is placed on gauze then wiped onto the sites going against the grain, which opens the sites so that the dye can seep into them. A few minutes are allowed to transpire, then the dye is removed with saline sprayed and dabbed in a regular fashion. Methylene blue should be applied before any graft is placed in and one should be cautious using it in patients with soft, white hair due to the risk of tattooing the skin permanently.

Long Hair

Some offices would overcome the challenge of dealing with a patient's long hairstyle by insisting to shave a patient's head. However, shaving a head causes inconvenience to the patient and may not be a viable option in female patients. In short, it is unnecessary if proper technique is used. When hair is very long, it should be braided and bundled with rubber bands in quadrants to keep it out of the field and prevent it from tangling. A useful tip is to cut the finger of a rubber glove widthwise into small donut-shaped rubber bands. Regarding hair being obtrusive during graft placement, it was explained above how to comb it with closed forceps and to keep it out of the way under gauze while placing. This technique exposes sites and prevents surrounding hair to be entrapped

below transplanted grafts. However, at the end of the procedure, the entire recipient area is cleaned and combed, and then hair should be gently tugged upward in order to dislocate and expose grafts that have native hair entrapped below them. Once those grafts are reinserted, a final verification and cleaning can be undertaken.

Lax Tissue

Some regions of a particular person's scalp or the entirety may be excessively lax. For example, the temples tend to exhibit greater laxity that may cause difficulty during placement. Lax skin makes grafts difficult to place, as sites jiggle during placement, which in turn can lead to popping of neighboring grafts. One of the solutions to this challenge is to pull gently on the skin transversely with the non-dominant hand to make the skin taut and to open the mouth of the sites more widely to accept the grafts. Another solution is to ask the physician to infiltrate some tumescent solution into the challenging area to increase the skin turgor immediately before placing will be initiated.

5 Patient Care 360

Before the Surgery

In Preparation for Surgery

After a patient decides to proceed with surgery, the authors' office arranges a preoperative appointment with the patient within two weeks prior to the surgery date. During this preoperative visit, the patient signs consent forms; photographs are taken; the physician completes a history and physical evaluation and outlines the surgical plan with the patient; and finally preoperative instructions are reviewed. He or she also receives written instructions addressing the most common concerns, such as avoiding aspirin and some herbal medications for seven days prior to surgery and avoiding alcohol for 48 hours prior to surgery. The patient is given a prescription for pain medication and sleeping-aid pills to use after the surgery as needed and dispensed a small bottle of Hibiclens shampoo to wash hair and body the night before and the morning of the surgery. During this visit all concerns are addressed; postoperative care is discussed in detail; and the patient is encouraged to take several days off from work if possible. At the end of the visit, the patient is given a hard copy of the preoperative and postoperative instructions as well as office contact information and encouraged to call if any questions or concerns arise. Every office crafts their own specific instruction sheet.

During the preoperative session, the patient is also instructed to wear comfortable clothes for the day of surgery and whether or not to eat depending on the type of the anesthesia elected for surgery. For oral sedation only, the patient is encouraged to have a light breakfast; and for intravenous sedation, the patient must remain without food for eight hours prior to surgery. The patient is further reminded of the precise time to arrive for surgery and to arrange for a post-surgical companion as needed based on the level of anesthesia. Depending on the type of anesthesia administered and according to state law, some offices permit patients to drive after surgery. In the authors office, the

patient is forbidden to drive for 12 hours following surgery because Level II conscious sedation is used as the preferred method of anesthesia delivery.

Described next are the examples of instructions given at the authors' office to be followed *Before Hair Transplant* and *On the Day of Surgery:*

Before Hair Transplant

Aspirin and aspirin-related products: Aspirin and aspirin-related products should not be taken either seven days before or seven days after the surgery because they increase the tendency of bleeding. For this reason, it is very important that the contents of any "over-the-counter preparations" be checked carefully prior to their use. Many headache preparations, cold remedies and hangover cures contain "Aspirin". The chemical name of aspirin is acetylsalicylic acid. Check with your pharmacist if you are uncertain whether a medicine contains aspirin or not. You can substitute "Tylenol" (acetaminophen) for these products if you require pain medication before surgery.

Vitamins: If you are taking a routine multi-vitamin, you may continue doing so. However, if you are taking any vitamin E pills, please stop seven days before and seven days after the surgery, as this may increase chances of bleeding.

Tobacco: Nicotine in any form, including cigarettes, cigars, chewing tobacco, and even transdermal patches and gum can adversely affect your wound healing. If possible, you are advised to stop all forms of tobacco two weeks before and after the surgery.

Diet: You must remain without any food or drink that morning, starting from midnight (including coffee or tea).

Alcohol: Try to abstain from any alcohol 48 hours prior to and after the surgery.

Hair cut: Do not cut your hair immediately before surgery or cut it shorter than 2 inches long, as longer hair in the back will cover and camouflage your incision.

Rogaine and Propecia: Propecia can be taken before, during and after surgery. Use of Propecia can help reduce further hair loss and minimize temporary hair shedding that may occur after transplantation. However, Rogaine must be stopped two days before until seven days after surgery. At times, Rogaine may cause some scalp irritation, especially after surgery. If this happens, the patient should wait and resume Rogaine at a later time.

On the Day of Surgery

1. Please wear a button-down shirt instead of a pullover shirt so that you may change clothes afterwards without disturbing your wound or soil your clothing.
2. Also do not engage in any vigorous cardiovascular exercise the morning of the surgery. Increasing your blood flow with exercise the morning of surgery may increase your chance of bleeding.
3. Please make sure that you have arranged to have someone transport you home after the surgery.
4. You may also bring a cap to wear after the procedure to hide the transplanted area if you feel more comfortable, but it is not required.
5. Please wash your hair with "Hibiclens" solution the night before the procedure and the morning before coming to our center. We will provide you with a sample of the cleaning solution for your convenience.

Immediately Before Surgery

Immediately before surgery, the physician or nurse in charge conducts a quick interview with the patient to assure compliance with all preoperative instructions and queries the patient for any other health issues in the preceding 48 hours that would preclude surgery. Then the physician designs the hairline and reviews the plan for restoration with the patient.

At this point, the patient is ready for surgery. He or she changes into a gown; and the donor area is selected, shaved and prepared for harvesting. Prepping the donor area consists of outlining the length and width of the donor strip to be harvested using a permanent marker, then taping the hair up and away from the outlined area as seen in Video 9 of Disc 4. After that, the hair is shaved with an electric razor (with a guard that leaves a remaining 5 mm to 7 mm length of hair) a few millimeters above and below the outlined area. For example, for a 1-cm wide harvest, 1.5 cm is shaved. Shaving above and below the outlined area allows the physician to close the incision wound cleanly without ensnaring hair with each suture pass. Caution should be given not accidentally to nip the hair that is taped above the prepped area or to shave an area that is too wide since the hair above the suture line should be preserved long in order to camouflage the incision postoperatively.

After the donor hair is shaved and the patient is installed in the operating chair, a 1-inch wide ACE bandage is loosely wrapped around the patient's head. The bandage is lined with sterile gauze along the entire circumference and positioned below the shaved area in order to catch any fluid from running

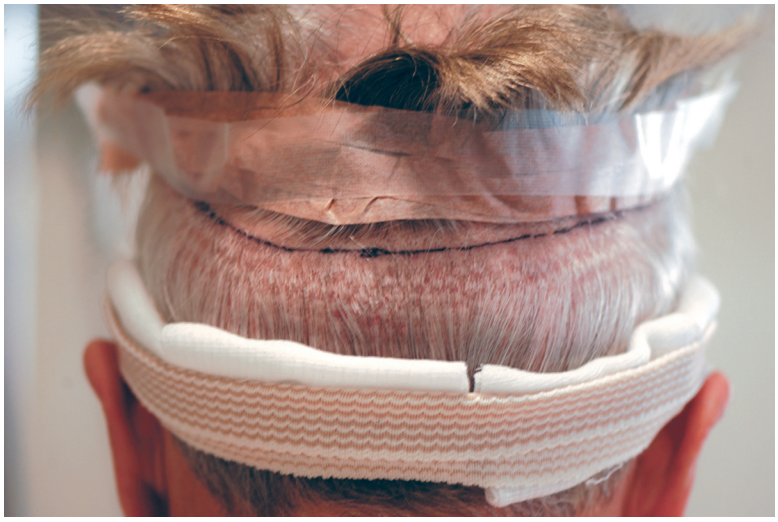


Figure 5.1

Patient's donor area prepared for donor harvesting in which the hair above the donor harvest is combed up and taped, the hair on the area selected for harvest is shaved, and the area below is covered with ACE bandage and gauze to protect from any leakage (blood or tumescence running down on patient's neck).

down the patient's neck or forehead (Fig. 5.1). Because we give our patients Hibiclens shampoo to be used twice in a 12-hour period prior to surgery, an additional disinfecting agent is not needed in the donor area before infiltrating local anesthesia and harvesting. Another protective cape made of a folded underpad (obviously with the cotton side up) is placed around the patient's neck for additional protection from leakage or spraying.

In some offices, the assistant would have additional tasks such as taking photographs just before surgery, determining the donor area to be shaved, and/or performing local anesthesia. These tasks vary by office and are based on a physician's preferences.

At the End of Surgery

Final Check

At the end of the procedure, the entire transplanted area is checked for empty or missed sites, for grafts being placed at the proper level, and for the hair curl facing the correct direction. If the patient sports long hair, the hair pull test should be performed to detect if any hair is entrapped under the grafts. The physician performs the final check, but prior to his verification the assistants should switch sides and check each other's area for quality control. Once the entire recipient area is checked and cleaned, the donor area is also cleaned; the hair is combed, styled if possible and dried using a blow-dryer. Beside drying a patient's head, it is suggested to use a blow-dryer at a warm setting to blow dry the entire recipient area to stop any oozing, start the process of scab formation, and to seal grafts thereby preventing them from shifting or drifting upward. Kindly refer to Video 10 of Disc 4.

If the donor area has encrusted blood, a 1:1 mixture of saline and hydrogen peroxide is used to dissolve caked-in blood in that area. It is important to rinse the peroxide solution with plain saline and never to use peroxide on the recipient area. If peroxide is left in the donor area, it may discolor hair and if applied to the grafted recipient area, it may severely damage the tissue. Since the graft and site fit should be quite snug, the authors have found no need to bandage a patient's head in the postoperative setting. Very rarely, during the cleaning of the donor area, some bleeding may be provoked. If bleeding arises and does not stop with pressure after three minutes, then the ACE bandage is loosely placed around the head for an additional two hours. If the bandage is left tight and for too long a time, it may cause excessive postoperative swelling of the forehead.

Patients are encouraged not to wear a hat immediately after surgery or at least not for a prolonged, e.g., several hours a day, especially in the first four days postoperatively when edema may occur and wearing a tight hat could aggravate swelling. However, author suggests that the patient refrain from wearing a hat for the first 12 hours after the end of the surgery.

Postoperative Instructions

Considering that the postoperative care may affect the success of surgery, it is recommended that the staff repeats the instructions several times for better patient retention. Immediately following surgery, instructions pertinent for the first night after surgery are verbally reinforced to the patient, which are as follows: to rest, avoid bending over or doing anything strenuous, to take pain pills every four to six hours for the first 24 hours after surgery, and to take sleeping pills before going to sleep. The author strongly suggests that the patient consumes pain and sleeping medication for the first night following surgery and thereafter to continue only as needed. Patients receive verbal and written instructions at multiple time intervals. A copy of instructions is given to them at the preoperative visit so that they can study and prepare themselves in advance. We also provide them the same instructions immediately after surgery and highlight the important points to remember.

Described next is an example of the instructions given at the authors' office to be followed *After Hair Transplant:*

After Hair Transplant

General

1. Most patients experience minimal or no discomfort. If you should have some mild discomfort, Tylenol is generally sufficient to ease the discomfort. You can be given a prescription for a small amount of

stronger medication, but most patients find it unnecessary to take these. Significant pain or discomfort is very unusual and should be reported to our office.

2. Remember to avoid aspirin, herbal medications, vitamins, tobacco, and alcohol as prescribed in the preoperative instruction sheet.
3. If you feel discomfort in your donor area (in the back of your head), apply ice packs 20 minutes on and then 20 minutes off while awake for the first 2 days as needed.
4. Avoid any strenuous activity for a minimum of one week. Always listen to your body and do not over exert yourself. Gradually return to your exercise regimen. If you do not feel up to it, wait until you feel ready to return to your normal exercise routine.
5. Be careful combing your hair for the first week, trying not to catch the comb on any of the scabs (in the transplanted area) or the suture (located along the donor site in the back and/or sides of the head).
6. You may use hairstyling products three days after the surgery (please use them conservatively) and cut or color your hair at the earliest two weeks after surgery.

Swelling

1. Sleep sitting up (at a 30 degree angle) for the first three to four nights. An adjustable "Lazy Boy" recliner would be ideal. If not available, then sleeping with a couple of pillows will serve as a second-best alternative.
2. Apply ice on the forehead (never directly on the transplanted area) for 20 minutes on and 20 minutes off while awake for the first two days. Thereafter, further application of ice will not be of benefit. Never apply any hot packs near the transplanted area so as to avoid risk of a burn injury.
3. Swelling is a normal part of healing. It typically worsens after two to three days and then quickly subsides. Swelling will not adversely affect your hair growth.

Bleeding

1. If you should notice any bleeding, apply pressure with a gauze for three minutes without interruption. This action should slow down or arrest any further bleeding.
2. We expect some oozing from the donor area (back of the head) for the first day. We recommend that you protect your pillow with a dark towel to avoid staining it with blood.

Washing Your Hair

1. Do not wash your hair or touch the transplanted area for the first 24 hours.
2. Thereafter for the first week, you may wash your hair daily or twice daily gently massaging your hair with your fingers using regular shampoo with conditioner and gentle/normal shower pressure and a gentle hand motion. To dry your hair, gently dab the area with a towel (avoid rubbing).

Scabbing

1. You will have tiny scabs that indicate healing around the transplanted hair. Please allow the scabs to fall away by themselves. Do not pick at them.
2. You may return to your normal hair washing routine after one week. You should not notice any scabbing left approximately 10 days after surgery and if you do, please wash your hair more vigorously, allowing water to wash off the remaining scabs.

Rogaine and Propecia

1. It takes a minimum of three months before you begin to notice hair growth in the transplanted areas. You may notice some temporary hair loss in the transplanted areas, typically six to twelve weeks after surgery. Do not worry: these "shocked" hairs will return. Use of Rogaine and/or Propecia will help minimize this temporary shedding and will also help reduce future hair loss and strengthen post-transplanted hair.
2. Propecia can be taken before, during, and after surgery. However, Rogaine must be stopped two days before until seven days after surgery. At times, Rogaine may cause some scalp irritation, especially after surgery. If this should happen, you should wait and resume Rogaine at a later time.

DO NOT TAKE ANY CHANCES – If you have any questions or concerns, please contact us immediately. During office hours (M-F 9AM to 5PM) call xxx-xxx-xxxx. After hours, call xxx-xxx-xxxx.

Follow-up

Immediate

Immediate follow-up spans the first 14 days after surgery. This is a period of time that is often replete with questions regarding hair washing, scabs, swelling, hair shedding, and other concerns. In the authors' office, the patient returns

the next day after surgery to report how the first night went, to have the donor area inspected for proper healing, and to have the grafts evaluated as intact in the recipient areas. At the same visit, the postoperative instructions are reiterated one more time.

If the donor area is closed using non-dissolvable sutures, the sutures should be removed approximately 10 days postoperatively. Although many physicians would feel comfortable removing sutures after one week, we have found that seven days is too premature for occipital suture removal and risks wound dehiscence. However, suture removal that occurs a few days after the 10th day typically poses no problem except for patient nuisance and lingering discomfort. At this visit, all scabs should be gone and if not, the patient is encouraged to remove any remaining scabs within the next 48 hours. The authors suggest to the patient to wet his hair (in the shower preferably), then to use a hair conditioner only and vigorously massage the scalp until all scabs are removed. The patient is cautioned not to become alarmed if transplanted hairs fall out with the scabs. The authors believe that scabs that remain beyond two weeks postoperatively may compromise seamless skin healing and therefore strongly suggest vigorous hair washing for the purpose of complete scab removal. During this visit, the patient is reminded of the possibility for the surrounding hair to shed and explained the timetable needed to await hair growth.

During the First Year

Considering a long waiting period for hair to begin growing, postoperative visits are scheduled at four-month intervals of four, eight, and twelve months post-surgery. The first four-month visit is typically dedicated to encourage patience about hair growth, as most oftentimes little hair growth is evident and at times worse off than before surgery due to recovery from shock loss (discussed below). During these office visits, photographs are always taken with before-and-after results compared and the patient, reminded that additional improvement is yet to come. While evaluating before-and-after results, the following observations should be made to educate the patient: the face starts to acquire an aesthetic frame with the emerging hairline (frontal view), more volume and styling options develop as more hair becomes present in the midscalp (profile and top view), and less see-through effect should be apparent. Follow-up visits are a very important component of relationship building between the patient and the office staff and should not be discounted.

Postoperative Shock Hair Loss

The most common concern that patients express after surgery relates to hair shedding caused by trauma induced during surgery, a condition known as telogen

effluvium. Postoperative hair loss may occur between two to six weeks after surgery and may last several weeks before it stops. This hair loss is temporary, and it primarily affects miniaturized (vellus) hair although it may affect even transplanted hair. Women seem to be more affected than men. However, men who have significant miniaturization who are not on medical management are more affected by shock loss than those with the same type of miniaturized hair but who have been on medical treatment for at least six months prior to surgery. The hair that sheds postoperatively should come back along with the transplanted hair. Nevertheless, the situation can be very alarming and unpleasant for the patient. Therefore, it is always better to prepare the patient for the possibility of looking significantly thinner after surgery, even suggesting shopping for a wig in some cases for women or suggesting the use of camouflaging products. Meaningful patient dialogue may help a patient better accept the inconvenience of looking worse after surgery and help him or her cope with the situation more easily. To avoid alarming patients, it is helpful to educate them about shock loss by explaining that they may look worse before they look better and to brainstorm solutions with them in case excessive shedding arises. Regardless if shedding becomes excessive or not, a patient would always appreciate being prepared in advance to deal with such a possibility. Dr. Lam often states, "We may impart the same information to the patient but if it is given before the surgery it is considered an *education*, while delivered after the surgery it becomes an *excuse*". He also suggests, "We should always keep in mind the impact of our words on others".

Critical Thinking

Every hair-restoration procedure depends heavily on the technical expertise of both the hair-restoration surgeon and the team of assistants. Technical expertise, in turn, must be combined with astute judgment in recognizing and correcting errors that contribute to failed or poor results. To date, no systematic algorithm exists to help guide both the surgeon and assistants in the avoidance, recognition and correction of potential or observed problems that can affect the naturalness of a result and/or visual hair density. This section offers guidelines on how to evaluate hair growth, identify intraoperative mistakes and offer ways to correct the mistakes.

Aiming for naturalness and fullness, a hair-restoration result can be divided for the sake of clarity simply into favorable and unfavorable. The favorable results are considered those in which the hairline and the appearance of hair are natural, seamless and easy to style. The hairline is nicely shaped, framing the face proportionately. The transition between the bare forehead and the hairline is exemplified by a progressive increase in hair density and a

non-linear hair distribution (undulating rather than straight). The unfavorable results are organized into three categories: (1) poor hair density, (2) unnatural hair and/or scalp quality, and (3) unnatural hairline.

1. Poor hair density reflects mistakes committed during site creation or demonstrates compromised graft survival. The following mistakes lead to poor hair density:
   a. Insufficient number of sites per square cm.

      Correction: One should be beware of spreading grafts too thinly over a large area. As a related topic, the physician should avoid promising to cover too large an area that may not be achievable.

   b. Inadequate number of hair per follicular-unit per square cm.

      Correction: Too many 1- and 2-hair FUGs cannot provide sufficient hair density, especially in the central forelock. The assistant should consider pairing grafts (in which two grafts are placed into one site) to increase the number of hairs per site.

   c. Sites created with the angle obtuse or straight.

      Correction: It is a natural tendency for a surgeon to hold an instrument straight up and conversely a somewhat unnatural feeling to create sites at a very low angle. A helpful tip is to recline the patient fully supine during site creation so that the surgeon's hands remain in a natural position to create low-angled sites. To correct the hair angle in a second session, the new angle has to be somewhat lower than in the first but not excessively low otherwise there is a possibility of transecting prior hair grafts or creating a vertical splay in hair.

   d. Sites created in parallel, non-interlocking rows.

      Correction: To correct the consequences of this type of mistake, in the second session the surgeon should stagger the sites to interlock with the previously created sites.

   e. Grafts placed with disregard to the natural curl may cause hair to grow away from the scalp and not to overlap naturally.

      Correction: One should consider leaving the donor hair 5 mm long so that the hair curl is easier to observe and pay attention in order to match the hair curl to the site orientation.

   f. Hair damaged by transection or desiccation

      Correction: To avoid transection, a person dissecting grafts may need to slow down or use a stronger magnifier. To avoid desiccation, the assistant placing grafts can take fewer grafts at one time and should raise one's awareness for keeping tissue and grafts moist at all times.

g. Compromised blood supply

Correction: Sites that are created too densely or too deeply may damage the scalp vasculature, causing skin necrosis or poor hair growth. To prevent this mistake during site creation, the length of the needle and/or the blade should be adjusted to the length of the graft and consider using sequential recipient tumescent to maintain adequate tumescence during a prolonged time of recipient-site creation.

h. Non-uniform growth, i.e., patchy hair density

Correction: This result may be caused by compromised graft survival either due to desiccation or blood-supply damage or alternatively by incorrect graft placement (e.g., 3- to 4-hair follicular units instead of being placed in the midline/central forelock, they are mistakenly placed on one side of the head more than the symmetrical opposing side).

i. Postoperative trauma to the scalp

Correction: Accidents that occur after a procedure may dislocate and thereby permanently damage and waste grafts or engender a large scab formation that might remain on the scalp for a long period of time. This in turn leaves an area of the scalp deprived of hair. If such an area deprived of hair growth is observed, inquiry should be made regarding possible injury to the scalp.

2. Unnatural hair and/or skin quality:

a. Kinky hair is caused by the injury at a hair-bulb level produced by rough manipulation either during graft dissection or graft placement.

Correction: One should adjust the placement of the forceps away from the hair follicles, evaluate graft-to-site fit and adjust hand movements during graft placement.

b. Graft pitting appears as a slight indentation of the epithelium surrounding the hair at the point of graft insertion.

Correction: At the end of graft placement, one should perform a final check and position all of the grafts so that they remain at or slightly above the level of the scalp.

c. Epidermal inclusion cysts and/or ingrown hair occur

Correction: One should pay attention if grafts are placed too deep, if one graft is stacked on top of another or if transected hair becomes entrapped below the scalp.

d. Graft compression

Correction: One should consider that either sites were too small for the grafts or the grafts were too large for the sites. In addition, the

graft-to-site fit should be attentively verified with every assistant and every time a different blade is changed for site creation.

3. Unnatural Hairline
   a. Hairline too low

      Correction: A hairline may be deemed too low if the distance from the mid-brow to the hairline is shorter than 7 to 8 cm or less than one-third of the patient's face. If this occurs, the physician may consider removing grafts that are placed too low or de-emphasizing them by creating a stronger hairline at a position where it should more ideally be situated.

   b. Hairline too wide and/or flat

      Correction: If the hairline extends beyond the lateral canthus or the central convexity extends wider than the mid-pupil, the hairline could appear unnatural. The physician may review the basic tenets of good hairline design to plan the correction. If the hairline is too wide, at times an advancement flap can draw the width of the hairline medially to an anatomically correct position. If the hairline is too wide and flat, the central convexity of the hairline can be drawn in front of the existing hairline or a simple widow's peak created visually to break an overlying flat hairline design.

   c. Abrupt "wall" of hair

      Correction: One should consider creating a deeper and undulated transition zone using 1- to 2-hair FUGs.

   d. "Pluggy" look

      Correction: If MUGs or large 3- and 4-hair FUGs were placed in the front hairline and if the hairline can be lowered and still be natural, a transition zone of 1- to 2-hair FUGs in front of the unnatural hairline can be designed to recreate the delicate disposition of a natural hairline. If compressed grafts were the cause of the pluggy look, the physician should consider ensuring a better graft-to-site fit for future sessions.

6 Other Things to Know 360

Standardized Photography

In some offices, the assistant would be the person in charge of all clinical photography. The most important factor in superlative clinical photography is rigorous standardization between the before and the after photographs. If before-and-after photographs are inconsistent, the observer may question whether the photographs were tampered with, which diminishes the impact and credibility of the results.

Standardized photography is achieved by keeping the same background, the same camera and lighting, the same position of the patient's head, and the same person taking all the photographs. A room in the office should be assigned as the photographic studio in order to keep a consistent background, lighting and positioning. The background wall for clinical photography should be painted a standardized light blue color.[§§] The lighting should be soft and diffuse albeit strong enough to illuminate the room. Photography should be undertaken in a small room; our photographic alley is approximately 8 by 6.5 feet. A patient's head should be photographed in the following pose: straight forward, top down, right oblique, right profile, left oblique, left profile, back, back tilted up. To facilitate keeping photos as consistent as possible, the patient is instructed to keep the bottom of the chin parallel with the ground. Also, a sticker with numbers can be placed on the walls to help a patient gaze at the right place and in the desired sequence (Figs 6.1A to H).

Ergonomics

Proper body position during graft preparation and placement is very important since both parts of the procedure are tedious and performed over long periods

[§§] It is a good idea to record the PMS code of the background wall so that an exact color match can be attained in case the physician moves offices or rooms. For additional information on standardized photography, please refer Volume 1 of this book.

Figures 6.1A to H

This series of photographs depicts standardized photographs of a patient in all recommended positions (face forward, left oblique, left lateral, right oblique, right lateral, posterior, posterior with head toward ceiling, anterior with head toward floor) with areas of alopecia exposed as needed. (Of note, his postoperative oblique photographs show his head slightly tilted upward too far.)

of time. During graft dissection the assistant should be aware not to shrug the shoulders or slouch over the cutting field. To avoid eye strain and to relax one's eyes, the assistant is encouraged occasionally to lift up the head and look into the distance for at least 30 seconds.

Graft placement requires assistants to stand on their feet for hours, performing repetitive movements. The simplest way to diminish fatigue from repetitive movements is to eliminate unnecessary movements. While placing, the body should be in a comfortable position, arms close to the body and making movements that originate from the hands and not from the shoulders. Using anti-fatigue mats (especially designed cushioning mats that can reduce some of the foot, knee and back strain associated with long, standing periods) and on occasion propping one leg on a stool will help with leg and lower-back strain.

To maintain bodily health and to prevent excessive fatigue, assistants are encouraged to take breaks and to stretch. Several, simple exercises such as stretching the neck, chest, shoulders, and hands to increase circulation and flexibility done once or twice a day can make the difference between feeling exhausted and only slightly tired by the end of the day. To stretch one's neck muscles, one should rotate the head five times clockwise and then five times counter clockwise (Figs 6.2A to F). To stretch the shoulders, one should grasp the hands behind the back, extend the arms and pull one's shoulders back and down while looking slightly downward and stretching the arms until the chest feels open. Maintain that position for 10 to 20 seconds (Fig. 6.3). Alternatively, one can stretch leaning into a corner of the room, pushing against opposite walls with hands, allowing elbows to go behind the back and thereby stretching the front of the body (Fig. 6.4). To increase circulation, one should cross the arms over the chest with the right on the top of the left arm, squatting eight times (Fig. 6.5). Repetitive hand motion may cause cramps or strain, and two simple exercises can prevent injuries. *Stretch one:* Weave your fingers together and turn your palms outward as you extend your arms forward. You should feel a stretch all the way from your shoulders to your fingers. Hold for 10 seconds and repeat eight times (Fig. 6.6A). *Stretch two:* Extend an arm in front of yourself with elbow straight. With your palm down, use the opposite hand to bend the palm down toward the floor. Turn the palm up, and stretch the hand toward your body. Hold 10 seconds and repeat eight times (Fig. 6.6B). The practice of yoga can enhance flexibility, muscle tone, and circulation and be helpful for an assistant as a way to limit bodily injury over the years. Most of the authors' team members engage in the practice of yoga several times a week.

Figures 6.2A to F

To stretch one's neck muscles, one should rotate the head five times clockwise and then five times counterclockwise.

Figure 6.3

To stretch the shoulders, one should grasp the hands behind the back, extend the arms and pull one's shoulders back and down while looking slightly down and stretching the arms until the chest feels open. Maintain that position for 10 to 20 seconds.

Figure 6.4

One can stretch leaning into a corner of a room, pushing against opposite walls with hands, allowing elbows to go behind the back and thereby stretching the front of the body.

Figure 6.5

To increase circulation, one should cross one's arms over the chest with the right on the top of the left arm, squatting eight times.

Figure 6.6A

Weave your fingers together and turn your palms outward as you extend your arms forward. You should feel a stretch all the way from your shoulders to your fingers. Hold for 10 seconds and repeat eight times.

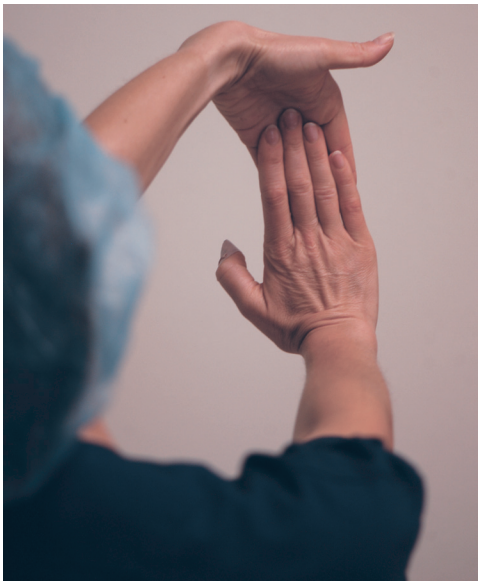


Figure 6.6B

Extend an arm in front of you with elbow straight. With your palm down, use the opposite hand to bend the palm downward toward the floor. Turn the palm up, and stretch the hand toward your body. Hold for 10 seconds and repeat eight times.

Teamwork

Dividing Tasks

For a surgical team to function well there should be an equitable distribution of tasks and organizational flow. In order to organize the team to work in unison, one must understand the major steps from the beginning to the end of the surgery. The content and distribution of each task must be communicated clearly. The entire day of surgery can be divided into the following tasks: setting up for surgery (the patient chair, dissecting stations, instrument tray and medication), preparing the patient (shaving and prepping the donor area, making the patient feel comfortable, and/or taking photographs and administering anesthesia), assisting during donor harvest (dabbing and handing instruments), graft preparation (slivering and graft dissection), graft placement, immediate postoperative care (final check, blow drying and giving instructions), disinfecting the room, and finally instrument cleaning and sterilizing. At the end of the day, some offices would undertake "pre-setting" for the next day of surgery where some basic set-up is performed in order to expedite the set-up time the following morning.

When setting up for or cleaning up after the surgery, assistants can either share tasks so that all contribute or they can assign or rotate tasks to specific team members. During graft preparation, usually only one person slivers while the other assistants dissect grafts. In the authors' office there are four assistants with all of them engaged in graft dissection until 75% of the tissue is completed, and then two assistants begin placing. During our dissection the physician creates the recipient sites, and our assignments are timed so that when the physician finishes making sites the two assistants who will place are done with their portion of dissecting. Placing may be an exclusive skill, and most offices have fewer assistants placing compared to the number participating in graft preparation. However, in the authors' office everyone is cross-trained and takes turn placing. In order to perfect every team member's skills, we encourage rotating sides so that an assistant has the opportunity to become adept at the various positions needed for graft placement.

Relationships

Every successful team is built on healthy relationships. There are several levels of relationships observed in every office: between physician and assistants (fulfilling graft requirements requested by the physician, handing off instruments and assisting donor harvesting, and ensuring overall patient comfort); assistant to assistant (feedback on tissue and hair quality, number

of grafts produced for consistency and progress, feedback on placement, caring for each other's comfort, and support for personal and professional growth); and assistants to front desk (communicating patient's comments or requests, scheduling and managing payments). In all levels of team interaction, sharing results and accomplishments as well as learning from satisfied (and discontented) patients can give the team a sense of ownership that helps a person envision this work as a vocation and not as a mere job.

The authors' office promotes clear communication, mutual respect and appreciation, and striving for a common goal. Every intention is made to praise each other and to share moments that give us pride and satisfaction. Practice is made to ask how things can be improved instead of why something went wrong; all team members try to serve as examples and inspiration to each other so that their work environment is a place that is fun and energizing. Dr. Lam and the author sincerely care for what they do, and they inspire others to do the same. As most individuals prefer to be inspired rather than motivated, we strive to spread that mentality to the entire team.

Attitude

The definition of attitude is a person's state of mind and feeling about a specific subject. How we carry ourselves is very important, considering that hair restoration is an elective and cosmetic procedure. Cleanliness and professionalism should be integral to the image an assistant projects that matches the aesthetic and health-care business of hair restoration. To demonstrate professionalism and elegance to a patient, mild and encouraging words should be selected to suggest that something may but not necessarily will occur, such as to state, "There may be some postoperative swelling or oozing." At the end of the procedure complimentary remarks can encourage the patient that he or she made the right decision, e.g., one can compliment how cooperative the patient was, how dense the donor area was, how well the procedure went, how beautiful the design would look on the patient, and how exciting it must be to look forward to one's hair growing in. Since this is an elective surgery, patients can elect any other office to undergo hair transplant. Creating an overall pleasant experience and building trust and confidence can ensure patient loyalty, which translates into returning patients and/or referrals and indirectly secures the viability of the business.

Hair restoration is performed over long hours, and assistants share their energy, which can contribute to a collective mood. Choosing one's attitude is the key to success. A very simple yet inspiring book that can help improve one's attitude is *The 4 Agreements* by Don Miguel Ruiz. This book carries no

religious or political overtones and its Toltec wisdom outlines four simple rules for peaceful living (and a healthy office environment):

1. Always be impeccable with your word. Impeccable comes from the Latin meaning "not to sin" so Ruiz argues that we all should be clean with our words, e.g., no gossiping, negative speech, etc.
2. Do not take anything personally. The idea is not to take words given by another to you as a reflection of who you are. Most oftentimes another person saying that you are fat or stupid usually stems from a poor self-image that is a greater reflection of the person dishing out the negative commentary than it is of the recipient of that venom.
3. Do not make any assumptions. Too often we all make an assumption about someone else's actions without proper knowledge of the situation or even asking. The authors like the book's saying, "We judge others by their actions, and we judge ourselves by our intention." For example, we might say, "Oh, that person did this terrible action because he or she is a bad person"; whereas, we say, "Oh, I did not mean anything bad by it. I'm a good person."
4. Always try your best. This just eliminates all the self-rebuke but instead exhorts one to give all that one has to be the best, nothing more and nothing less.

Stress Management

Stress is a word commonly used to describe our emotional strain. In the fast-paced society, we are constantly adding tasks to accomplish and expectations to meet, while progressively feeling emotionally overextended and unsatisfied. Trying to keep up with the increasing number of demands placed upon us, we end up suffering physically, mentally and emotionally. Back pain, insomnia, or anxiety attacks are just a few of the many symptoms associated with pent-up stress.

Hair restoration is performed working in close proximity to the patient and coworkers over many hours. This setup creates a unique work environment as well as specific sources of stress. While the tedious work of graft dissection and graft placement may cause muscle tension and mental fatigue (and thereby contribute to work injuries), the positive or negative emotions displayed among people involved in the process of hair restoration can dictate the work mood, cause poor performance, color the patient's experience and affect the overall result of hair restoration. The purpose of this section is to help you understand the symptoms of stress related to hair restoration and to give you the tools to manage stress effectively.

Have you ever felt on top of the world, only to be suddenly deflated by a grouchy coworker? It is no surprise, considering that emotions are more

contagious than colds or flu. According to a study published in *Psychiatry Research*,[¶¶] just looking at happy or sad faces can evoke those same feelings in us. Brain and heart researchers tell us that we are biologically programmed for sensing others' feelings. For centuries, the heart was associated with emotions. For example, putting one's heart into something describes passion, while being rejected by a loved one can leave you with a broken heart. Only recently, we are finding that the connection between the heart and emotions is not coincidental but scientific. The researchers in the domain of neurocardiology shows that within the heart a sophisticated web of approximately 40,000 neurons forms a functional brain-like structure that can sense and remember.

In your lifetime, you have probably had the uncomfortable experience of walking into a room and sensing "thick air", only to later learn that the people in the room just had an argument. The research at the Institute of HeartMath® shows that our emotional state is revealed in heart-rate variability; when feeling love, care, or appreciation our heart rate is even and smooth while when feeling anger or hostility our heart rate is irregular and jagged. Furthermore, the heart with its activity, i.e., producing electrical stimuli for muscles to contract and for blood to circulate, generates a strong electromagnetic field that is five thousand times stronger than the field produced by the brain. Thanks to its strong field, the electromagnetic presence of a heart can be measured at a ten-foot distance from the body. When someone is upset, the heart broadcasts the person's feelings into the electromagnetic field; and others around him can pick up on the person's overall mood. For example, have you noticed that when you are tired or upset and the only thing you want is to be left alone, your children or your partner are "acting out"? It shows how our suppressed feeling can make others unsettled, which in return makes you more stressed out. The simplest technique to disseminate this disturbing "relationship" is to take a few minutes and to go inside yourself, acknowledge the feeling that is preoccupying you, and then decide to change the attitude and make the best of the present moment.

In spite of the fact that our emotions can be affected by the emotions of others, it is important to know that we hold the control panel of our own sentiment. We have the power to choose our attitude and transform our feelings. According to the principle of physics called entrainment, when two or more oscillating objects are in proximity, they synchronize. When two people "on the same wavelength" work on a project, their hearts synchronize and both people accomplish more. The opposite is true too! When there is tension or animosity between two people, their productivity decreases significantly and each individual becomes less efficient. The same law applies to our mind-heart

[¶¶] Are emotions contagious? Evoked emotions while viewing emotionally expressive faces: quality, quantity, time course and gender differences, by Barbara Wild, Michael Erb, Mathias Bartles Psychiatry Research, Volume 102, Issue 2, Page 109-124 (June 2001).

communication. When our mind is upset, it can upset our heart and vice versa. It is important to know that if we notice that we are stressed, we can relax our inner tension by thinking differently or feeling differently. One of the suggested techniques to manage stress would be to engage in a meaningful conversation because when we talk about something we enjoy our mind and heart align, we feel good, and our feelings can guide others around us to feel good too.

In order to manage stress effectively we have to do the following:

a. Identify the signs of stress
b. Recognize its source
c. Determine our options
d. Choose our response.

a. *The signs of stress:* Hours spent in a limited motion while focused on tedious work can cause us to feel stressed yet we neglect to notice its signs:

   1. Tension.
   2. Restlessness.
   3. Frustration and irritability.

   Tension can be caused by the prolonged focus on a small field, the body's unchanged position, repetitive motion, a difficult case, and thereby expressed through muscle tension, eye fatigue, headache and/or nervousness. Restlessness is easy to recognize in a patient; he or she becomes fidgety, while restlessness in a surgical assistant is less obvious and can be observed when a person is distracted, inattentive or clumsy. Frustration and irritability are usually two sides of the same coin; when someone is frustrated he or she becomes irritable, thus rough and/or edgy. Pay attention to your feelings; they provide you with the information so that you can discover whether you are comfortable or stressed.

b. *The source of stress:* Although the authors' focus is on the surgical staff, one should not overlook a patient's feelings as a contributor to stress. Considering that we can affect each other's emotions, there are four sources of stress: you, your coworkers, the patient, and the environment. After you recognize that you are experiencing stress, identify its source.

   - Always start with you. Identify what you feel and take responsibility for your feelings. Remember emotions are contagious both ways; you can be affected by the feelings of others, as well as you can contaminate or uplift others depending on your mood.
   - If you notice that your coworker is upset about something, share your observation gently, offer to help her find a solution later, suggest a break and a change of attitude. If someone is sick with the flu, you would not

let that person spread germs around the room. The same applies to spreading an unpleasant mood.

- Then, there are the patient's feelings. Have you ever been trapped on a Tarmac for hours? That is how your patient feels sitting in a chair for hours. Be aware of his physical comfort, physiological needs for the restroom or to stand up and stretch, and his feelings, such as anxiety or boredom. Be tuned in to your patient.
- Your environment or the condition of the patient's tissue may also cause you undue stress. Recognize if the background is noisy, the temperature too warm or too cold, or your work area uncomfortable. The patient's tissue may be additionally challenging, such as with the presence of white hair, mushy tissue or an inelastic scalp. However, when you get frustrated, remind yourself that the patient did not do anything intentionally to make your work harder.

c. *Determine your options:* Whether you are getting tired or tense, whether the source of stress is you or a frustrated coworker or your patient, you may find solace in one of the following:

- *Create comfort:* Take or suggest a break, get a snack or drink. Sometimes a little sugar can lift up one's energy and change one's mood. Move around and/or stretch your body; let your patient stand up for a few minutes, give him a pillow to sit on or put behind his back, and/or offer him a snack or something to drink.
- *Create distraction:* Start a conversation, turn on the television or suggest a movie (if applicable).
- *Change attitude:* Change the mood in the room, find a meaningful topic that can engage everybody's heart and thereby evoke pleasant feelings. Do not be upset with a patient if his case is challenging; he or she did not do anything intentionally to make your work more difficult. (Even if the patient did have a glass of wine in spite of hearing the preoperative instruction not to do so, keep in mind that he or she did not choose to partake of alcohol in order to make your work more difficult.) Do not take things personally and avoid reprimanding the patient, rather educate him or her.
- *Change your approach and/or technique:* If the hair is white and difficult to see, try coloring it with "Just for Men" before harvesting, or occasionally lift your head and gaze into the distance to relax your eyes. If your patient's tissue is not cooperating and the grafts are popping, try taking a break while giving your patient a break; try applying gentler pressure on the recipient area or use the blow-dryer to "seal" one grafted area at a

time. If your patient starts bleeding halfway through the procedure, offer him a bathroom break; his blood pressure may be elevated because of inner tension. You can also try to calm down bleeding by causing blood vessels to contract. Take several pieces of gauze, dip them into chilled saline, put them over the entire recipient area and apply steady pressure for five minutes.

d. *Choose your response:* Depending on the source of stress, in choosing your response, you can address the environment or your attitude. It is important to mention that there is a difference between reacting and responding, mindlessly reacting to a stressful situation and mindfully choosing your response to it. When you react, you are acting instinctively, but when you choose your response, you are deliberately expressing and demonstrating your values and qualities.
   - In addressing the environment, you can create a physical or mental comfort by choosing to take a break or engage in a meaningful conversation.
   - In addressing your attitude, you have to recognize your mood, determine that it is unhelpful and decide to change it. For example, you discover that you are grumpy. Ask yourself would you want to be around (or treated by) people in such a mood, then determine your preferred attitude (such as being pleasant or funny) and take the appropriate action.

Because we generally lack education on emotional intelligence, most of us are unaware that we do have the capacity to alter our emotional state. As you can open or close your heart, send or receive love, transform anger into determination or decrease inner agitation by being honest, you can choose your attitude. Before you react to any given situation, take a minute to choose your response so that it can reflect the true you.

Imagine working on a patient who is bleeding and in which graft placement is challenging. Your neck and shoulders are hurting. In addition to being frustrated, you are becoming irritated because your coworker is rough, pushing hard on the patient's head, and you learned that the patient had taken an aspirin the day before his surgery. You have been working for hours, fighting with grafts to stay in place and now your patient starts to fidget. There are many ways you can handle this predicament. You can be short tempered with the patient and blame him for your discomfort and tell him that he is bleeding because of the aspirin he took, causing the procedure to be more difficult and lengthy, and then order him to sit still and bear the consequences of his action. You may temporarily feel better because you doled out "justice" and the patient calmed down, but this is only a short-term benefit. The tone of your voice and the words you used to talk to the patient has only aggravated the situation

further. After you reprimanded him, his disturbed emotions make his blood pressure go up, causing more bleeding and more tension. Your patient feels worried about the result of his surgery, concerned that he had made you upset and his overall experience has changed to unpleasant. Or, you can make a different choice. You can recognize that all parties involved are tired and tense, and you can offer a break and a snack. Change your approach and/or technique. Try the compression technique, hold your hands on the recipient area and use that time to close your eyes and to relax. Show compassion, and it will soothe you and your patient. Apologize to the patient that the procedure is taking longer than estimated and for the discomfort and the inconvenience it may be causing him. Educate your patient: explain that the reason he must sit in the same chair for long hours is due to the aspirin he took but emphasize that the results will not be affected. Discover an interesting subject that you may have in common with your patient and engage him in conversation, or offer him to relax and put on appropriate music. Create a pleasant environment, free of tension for both you and your patient.

The interesting aspect of stress is that it depends on personal perception. A steep rollercoaster ride can cause fear and anxiety in one person, while excitement and enjoyment in another. Furthermore, stress can emerge from a relaxing situation, such as getting a flat tire while on vacation. Remember to pay attention to your feelings so that you can recognize when a situation changes from challenging to taxing and use your power to choose your attitude. The guidelines for stress management offered above are only good if you apply them.

Being a hair-transplant assistant does not have to be stressful but can be rewarding, fun, and profitable with the right training, skills and attitude. The author hopes that this book provides the foundation for enhancing and developing your career in the field of surgical hair restoration.

Index

P

Q

R

S

T

U

V

W