2nd Edition

Volume 2

HAIR TRANSPLANT 360

for Assistants



EMINA KARAMANOVSKI VANCE

Get Full Access with added features at **emedicine360.com**

JAYPEE

Contents

SECTION I: CORE 360 1

1. **Basic Hair Knowledge** 5
   - About Hair Growth 5
     - Hair in General 5
     - Hair Anatomy 5
     - Hair Growth Cycles 7
   - About Hair Loss 8
     - Male-Pattern Baldness 9
     - Female-Pattern Baldness 13
     - Other Types of Alopecia 16
     - About Hair Restoration 18
   - Nonsurgical Options 24
     - Medical Treatment 24
     - Low-Level Laser Therapy (LLLT) 28
     - Platelet-Rich Plasma 29
     - Camouflaging Products and Treatments 30
2. **Surgery Overview** 35
   - Terminology 35
   - Size of the Surgical-Assistant Team 35
   - Surgical Flow 36
   - Surgical Timing 38
   - Other Things to Know 40
     - Medication Used 40
     - Emergency Situations 41
     - Clean Procedure 43
     - Do's and Don'ts 44
3. **Assistant's Duties** 47
   - An Overview 47
   - Surgical Set-up 48
   - Assisting the Physician 57
   - Graft Preparation and Placement 60
   - Postsurgery Cleaning (Disinfection and Sterilization) 60
   - Charting (Documentation) 63
   - Patient Follow-up 64
   - Other Duties 66
   - Suppliers 67

4. Graft Preparation **69**
Magnification and Lighting 69
Ergonomics 72
Graft Survival 74
Graft Preservation 76
Harvesting Techniques 79
Strip Harvesting (FU-Strip) 79
Follicular Unit Extraction (FUE) 80
Donor-Tissue Evaluation 81
Slivering 82
Technique 82
Slivering Strategy 89
Instruments 89
Graft Dissection 90
Technique 90
Dissecting Strategy 95
Instruments 97
Graft Yield Feedback 99
Graft Extraction 102
Technique 102
Graft Sorting and Trimming 105
Extracting Strategy 106
Instruments 106
Graft Yield Feedback 108
Challenges and Solutions 108
Quality Control 112
5. Graft Placement **123**
Magnification and Lighting 123
Recipient Area 124
Hair Direction and Angle 124
Recipient Sites 128
Graft Handling and Survival 130
Placing Technique 134
Cleaning 134
Loading Grafts 134
Choosing the Forceps 136
Testing the Angle 138
Graft Grasping and Hair Curl Orientation 139
Graft Insertion 139
Dabbing 141
Other Things to Know 143

Final Check 145
Placing Principles 146
Placing Strategies 150
Patient Positioning 157
Ergonomics 158
Challenges and Solutions 160
Popping 160
Bleeding and Oozing 160
Grafts Sinking In 161
Sites Difficult to See 163
Long Hair 163
Lax Tissue 164
Scar Tissue 164
Splayed Follicles or Different Length Hair Follicles 164
African Curly Hair 166
Quality Control 167

SECTION II: MORE 360 **171**

6. Patient Care **175**
Before the Surgery 175
In Preparation for Surgery 175
Immediately Before Surgery 177
At the End of Surgery 178
Final Check, Cleaning, and Bandaging 178
Postoperative Instructions 180
Follow-up 183
Immediate 183
During the First Year 186
Postoperative Shock Hair Loss 189
Critical Thinking 190

7. Assistant Training **197**
Overview 197
Staff Selection 198
Phase I Training 199
Slivering and Dissection 199
Graft Placement 202
Graft Extraction in FUE 205
Phase II Training 209
Continuing Education 210
Performance Progress and Evaluation 210
Test Your Knowledge 212

8. Other Things to Know 213
Standardized Photography 213
Talking on the Phone 215
Ergonomics and Stretching 215
Teamwork 220
Dividing Tasks 220
Relationships 221
Attitude 222
Stress Management 223

Index 229

4 Graft Preparation

MAGNIFICATION AND LIGHTING

Magnification is necessary for proper graft preparation, and the use of stereo microscopes is considered the gold standard. Stereo microscopes provide a three-dimensional view of a specimen, and the top brands to consider are Meiji, Nikon, Motic, Zeiss, and Mantis. For viewing, most microscopes have binocular (two) eyepieces, Mantis has a single optical viewing lens, and some microscopes use a light-emitting diode (LED) screen (Figs. 4.1A and B).



A B

Figures 4.1A and B

(A) Single-view Mantis microscope and (B) Binocular Meiji microscope

JAYPEE BROTHERS

The two major considerations regarding the use of stereo microscopes are work field and comfort; in other words, how well you see the specimen and how comfortable it is to work on a microscope for long periods. The "ideal" microscope gives you the following: (1) a clear and magnified view of the follicular unit (FU) structures, (2) a wide viewing field that allows you to clearly see one sliver and/or several groups of dissected grafts, (3) a sufficient distance from the lens to the dissecting surface so that your hands and instruments can fit comfortably, and (4) an adequate light to see well without having shadow spots or straining your eyes.

Recommended magnification should range from 4× to 10×. It is important to mention that the stronger the magnification the smaller the work field and the shorter the work distance. Some microscopes can accommodate an auxiliary lens that can increase the work distance and work field. The size of the field that is observed under the microscope is represented by the field number, which should be ≥ 22 mm. Binocular optical microscopes can combine different lenses to offer more flexibility in achieving the desired magnification while maintaining an acceptable work field and work distance. In contrast, the Mantis microscope offers a fixed magnification of 2×, 4×, 6×, 8×, or 10×.

Most microscopes come with a built-in light that reflects downward on the work surface (from overhead), and some models offer additional transmitted light shining upward from the work surface (backlight). Considering that the scalp is both opaque and translucent, some assistants may use reflected light for slivering and transmitted light for graft dissection. Most stereo microscopes come with appropriate top lighting. It is worth noting that built-in halogen lights may heat and unduly dry grafts during dissection. Thus, LED ring lights may be a better choice. Some microscopes can accommodate bottom lighting, and these lights usually need to be purchased separately. Alternatively, a backlighting system (a slim 20 cm × 30 cm box) can provide supplementary illumination to facilitate an enhanced view of hair follicles during dissection. If backlighting is used, then the cutting surface should be clear (accordingly, a tongue depressor cannot be used for this purpose) to allow light to come from the front and the backside of the tissue being dissected (Figs. 4.2A to C).

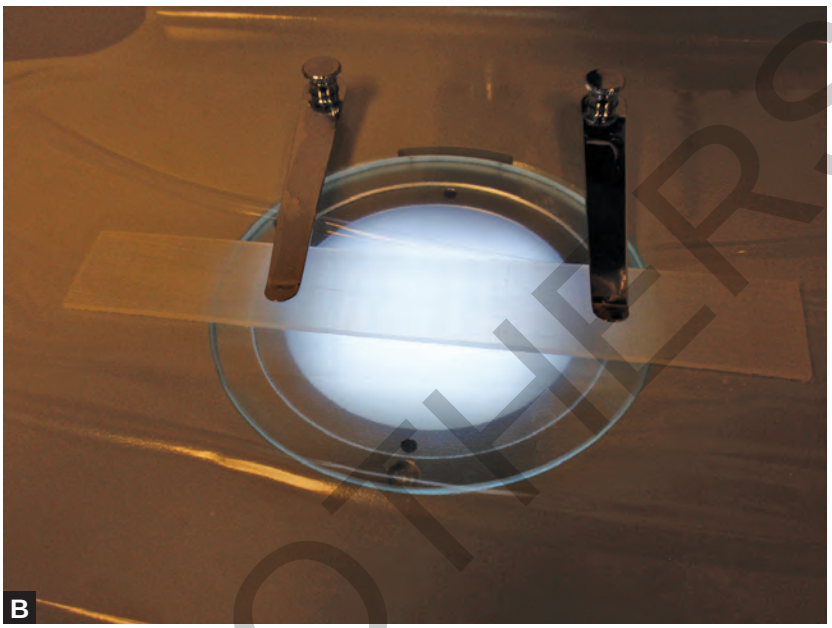


Considering that every person has different eyesight and interpupillary distance, adjusting the microscope to a personal preference may be necessary. In our office we assign a microscope to a specific assistant to avoid any readjustments. Please view Video #4 to learn more on how to adjust microscopes.

Depending on the ambient lighting in the surgery room, additional light may be installed along dissection tables to add to the brightness in the room. I have noticed that since we have added these lights, all assistants in our office have reported significant decrease in eye fatigue. We leave these lights on through the entire day until the procedure is completed (Fig. 4.3).

JAYPEE BROTHERS







Figures 4.2A to C

(A) Stereo microscope with bottom light (B) When using the bottom light, a clear cutting surface is necessary (C) Back lighting box used with Mantis microscope

Please note that in some situations a power outage may interrupt the surgical procedure, but with a battery backup supply the procedure may continue unimpeded. Alternatively, if a backup power supply is unavailable, it is recommended that each operating room have a flashlight and two battery-powered LED headlights to complete the procedure.

JAYPEE BROTHERS

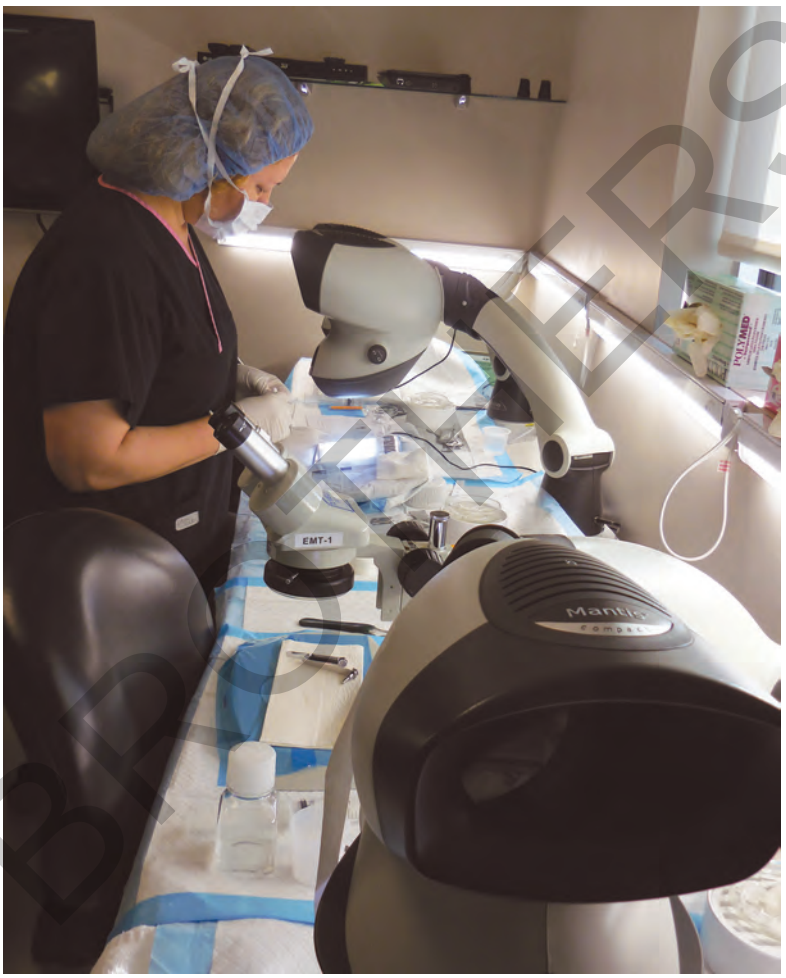


Figure 4.3

Additional lights installed on the wall behind the cutting stations

ERGONOMICS

While working, the angle of the assistant's head and neck is the most important factor when considering comfort. Though it takes practice and coordination to become comfortable working under a microscope, the most painless head and neck position is achieved when the individual looks straight forward or slightly down. When selecting binocular microscopes, the eyepiece should be at ≤45° angle to avoid neck strain. Mantis microscopes or microscopes with an LED viewing screen offer a zero-degree viewing angle, so you are able to work looking straight forward and thereby reduce neck strain.

Your body position should be as comfortable as possible. The spine needs to be straight, not compressed, or stretched. Your shoulders should not be raised but relaxed, your arms and elbows should fall naturally by your body, and your wrists should rest comfortably on the table (similar to how you would sit when eating in

JAYPEE BROTHERS

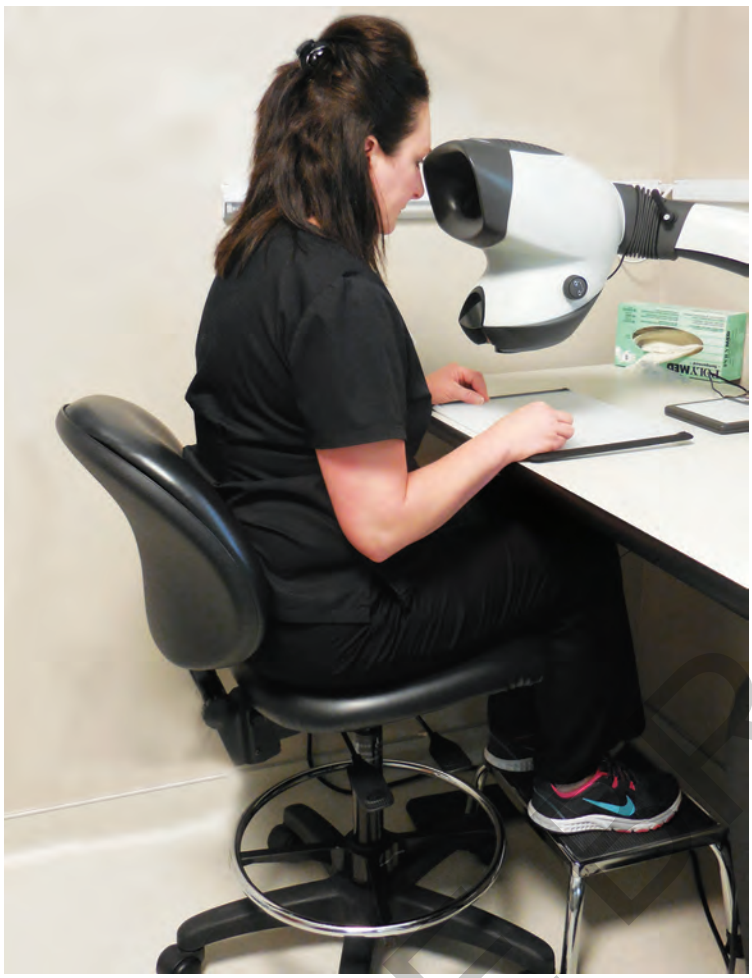


Figure 4.4

An assistant using a microscope that has 45° viewing tubes. Her neck is straight, her wrists and hands are gently resting, and her shoulders and arms are relaxed. Her feet are resting either on the floor or a step stool, her back supported, and her body is straight

a fancy restaurant). The work platform should be as thin as possible to allow hands to comfortably rest without feeling the height difference between the platform and the table (otherwise, the edges of the platform would "cut" into hands). If you are experiencing muscle tension or pain, reevaluate your body position. Have someone look at you while working or have your teammate take a photograph of you. It is easier to make adjustments as soon as you start noticing discomfort than to correct a bad habit or heal chronic pain.

Most microscopes have a fixed platform and thereby a relatively fixed distance from the eyepiece to the work field. Every person is built differently and depending on one's height, the stool on which the assistant is sitting should accommodate height adjustments from very low to very high. While sitting, the back should be supported, the feet should be resting on the floor or a step stool, and one's entire thighs should be resting on the seat. Dangling feet, tucking them underneath the stool, or sitting at the edge of a seat all can cause pain and discomfort (Fig. 4.4).

JAYPEE BROTHERS

GRAFT SURVIVAL

During the course of a hair-transplantation procedure, the tissue and cells within the patient's body can experience many forms of stress that can greatly affect graft survival and overall success of the procedure. All factors that affect graft survival may occur during different parts of the procedure and can be divided into preoperative, intraoperative, and postoperative. Considering that the most significant damage can happen during the procedure, this section will focus on the intraoperative factors that affect graft survival and briefly outline the preoperative and postoperative factors. Preoperative factors to consider are a patient's overall health, his or her ability to heal well (e.g., smokers or diabetic patients exhibit compromised healing), and whether the hair is transplanted into a virgin scalp or scarred tissue (e.g., scar tissue has diminished blood supply, which can compromise graft survival). All factors that can affect graft survival postoperatively may be divided into internal and external causes, internal referring to the healing process and external to the care of the recipient area. After grafts are transplanted, it takes 5–7 days for the blood supply to regenerate and the scalp to heal around the grafts. Thus, proper care of the transplanted area is important. Although there are no published studies demonstrating the effectiveness of the following, keeping the area moist by spraying liposomal ATP (adenosine triphosphate) or copper peptide may contribute to improved healing and graft survival. An injury to the transplanted area may cause bleeding that in turn can dislocate transplanted grafts or cause increased scabbing and/or scarring. In addition, not keeping the transplanted area clean, picking on scabs and pulling transplanted grafts out, or applying camouflaging products or a hairpiece before the healing is complete may cause infection and/or significantly compromise graft survival.

There are many intraoperative factors that can affect graft survival and that can happen during donor harvesting, graft preparation, and graft placement. The type of the trauma can be mechanical (done by blade or forceps), chemical (dehydration, inadequate storage solution, and/or temperature) or circumstantial (size of the graft and/or size, depth, and number of the recipient sites).

There are several studies demonstrating that intact FUs survive better than transected ones. Transection implies damage done to the hair follicle by cutting through its structures. Transection may occur during FU-strip and FU extraction (FUE) donor harvesting. When excising the donor strip, transection may occur to the side or bottom of the tissue. Most often, transection occurs during slivering and graft dissection. Drs Kim and Choi performed a study in which they divided hair follicles into two and three parts and horizontally cut them at different levels: upper third, upper two thirds, bottom third, bottom two thirds, upper half, and bottom

JAYPEE BROTHERS

half. The study demonstrated *no growth* when transplanting the upper or bottom third. When transplanted, the upper two thirds survived at 60% and the lower two thirds at 80%. Furthermore, when hairs were transected at the midshaft and then transplanted, 40% of grafts survived when the bottom half was transplanted and only 20%, when the upper half was transplanted.[1] Dr Mayer performed a comparable study with similar results but also noticed that the upper two thirds produced hairs of finer diameter while the bottom two thirds produced hairs of a normal diameter.[2] Dr Swineheart examined the importance of the bulge area in follicle regrowth and found that transection at the bulge produced 46% survival for the upper segment and 47% for the lower segment.[3] In conclusion, these studies suggest that hair follicles that are partially transected should be implanted since they could potentially survive. However, all studies favor intact grafts and unanimously show that not transecting the hair follicle is vital to graft survival (Fig. 4.5).

Besides transection, physical injury also has the potential to reduce graft survival. Dr Beehner conducted a study intentionally damaging hair follicles at the hair bulb and bulge with both a hard- and soft-crush injury.[4] His study demonstrated a 42% survival after hard-crushed injuries at the bulb and merely a 17% rate after hard-crush injuries at the bulge. Accordingly, from these data, it is critical that the assistant handle the bulge area during graft preparation and placement with utmost care. More encouraging was the survival rate of 82% after soft-crush injury at the bulb. In conclusion, whether during graft extraction, slivering, graft dissection, or graft placement, it is important to gently grasp tissue around hair follicles and at all cost avoid firmly grasping (squeezing with the forceps) around the hair bulge or bulb.

The condition of the graft and the site in which it is placed can also affect graft survival. Grafts can be divided into the categories "skinny" and "chubby" depending on the amount of tissue left around the FU during graft preparation or FUE. Skinny or denuded grafts are more fragile and easier to dry out or become damaged during handling. The finding of a study conducted by Dr Seager in 1997 and Dr Beehner in 1999 comparing chubby versus skinny grafts demonstrated a higher regrowth rate in favor of chubby grafts after 6 months.[5,6] Another circumstantial factor to be considered relates to recipient sites and their blood supply to grafts. A high number of sites per square centimeter and/or sites that are made deep can compromise blood supply and consequently affect graft survival. Chemical injury induced by dehydration or inadequate immersion in a proper graft-storage solution will be discussed in the following section. For more information on graft-survival studies, please review Chapter 11 "Graft Survival and Growth Studies" in *Hair Transplantation* (5th edition), eds., Unger W, Shapiro R, Unger R, Unger M.

JAYPEE BROTHERS

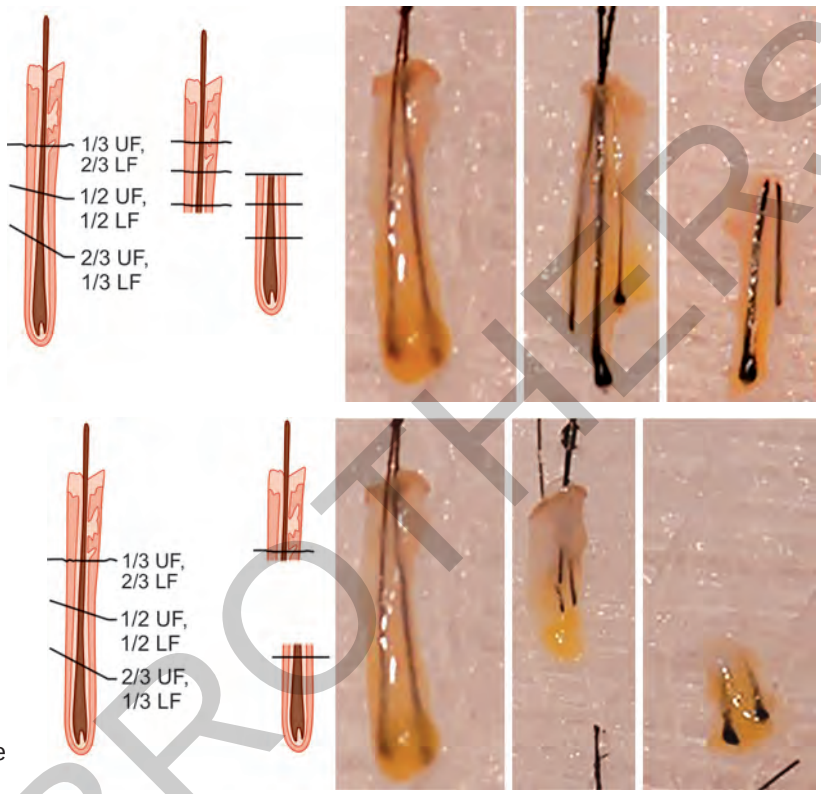


Figure 4.5

Different levels of transection and how they relate to graft survival

GRAFT PRESERVATION

From the moment a hair-transplant donor strip or grafts are obtained by removal from their native environment, a degradation process begins and stress accumulates. Methods of tissue biopreservation for hair transplantation were adopted from organ transplantation; and for that reason we believe that storing that storing tissue in a specific solution at a specific temperature is critical to graft survival and ultimately for good results.

The purpose of chilling tissue is to decrease its metabolic rate and to retard the process of degradation. Similar to hibernation, chilling tissue decreases the metabolic rate and increases survival. The ideal temperature to store grafts lies between 4°C and 8°C. Temperatures higher than ideal potentially decreases graft survival and freezing grafts impedes their survival. The purpose for a specific storage solution is to create an environment that would provide oxygen, energy, and osmotic balance to a cell necessary for its survival. To chill grafts, one may use an ice pack, a cooling tower, or a tabletop electric chiller (available from Cole Instruments) (Figs. 4.6A and B). The advantage of the electric chiller is that it maintains consistent temperature but the chiller unit is bulky and awkward to use. Cooling towers and ice packs are easier to use because of their size and convenience, but they have to be changed several times throughout a surgery and fresh ice must be maintained every 2–4 hours.

JAYPEE BROTHERS

There are two major factors to consider regarding tissue preservation: the first is hydration and the second is proper environment. To prevent dehydration and to protect its survival, as soon as the donor tissue is extracted from the patient, it should be placed into a chilled storage solution. Most commonly used storage solutions are normal saline, PlasmaLyte A, and Ringer's lactate. A newer storage solution that is gaining popularity is HypoThermosol FRS.

Several studies have demonstrated that graft dehydration has a detrimental effect on graft survival. The results have shown considerable diminished graft survival after dehydration and for that reason this book will repeatedly stress the importance of keeping the tissue moist and hydrated. Although several studies were conducted, the most alarming results came from the study performed by Dr Gandelman involving 12 patients and 120 grafts that were left on a surgical glove for 3 minutes to dry and then they were implanted into a bald scalp.[7] After 12 and 24 months, there was no graft growth. Of note, it took *only* 3 minutes for grafts to dry and die!

Although your physician will ultimately choose the type of storage solution used in your office, it is good to know the purpose and benefits of each kind. Under normal conditions, cells bathe in extracellular fluid that is isotonic, and cell-membrane pumps move minerals in and out of the cell to maintain osmotic balance. When tissue is taken out of the body and placed into a storage solution, it is necessary that the storage solution has mineral content that is similar to the native



Figures 4.6A and B

(A) Cooling tower with a Petri dish holding grafts (B) A tabletop electric chilling device available from Cole Instruments

JAYPEE BROTHERS

environment. For example, sterile water does not have any necessary minerals to keep osmotic balance, allowing water to flood cells making them swell to the point of their destruction. This is why sterile water should never be used for graft storage! Different storage solutions have different mineral compositions that are close to the native physiologic environment. The three most common holding solutions are normal saline, PlasmaLyte A, and Lactated Ringer's, each used for intravenous rehydration. PlasmaLyte A and Lactated Ringer's contain various minerals in addition to normal saline. In 1992, Dr Limmer set up a study to determine graft survival of implanted grafts after they had been stored in chilled saline for 2, 4, 6, 8, 24, and 48 hours.[8] The result of the study showed that 95% of grafts survived when transplanted at 2 hours, 90% survived at 4 hours, 86% survived at 6 hours, 79% at 24 hours, and 54% at 48 hours. This study was corroborated by other studies demonstrating that the longer time out of body the greater the decline in graft survival.[9] In the past when hair transplantation consisted of moving only a small number of grafts with the procedure lasting just a few hours, saline as a storage solution seemed sufficient. Nowadays, hair-transplant procedures move thousands of grafts and procedures last 10–12 hours, indicating a need for more sophisticated storage solutions. There is a growing argument that normal saline is not only insufficient to store grafts over many hours but also that it is not designed for a chilled environment. HypoThermosol FRS (BioLife Solutions) is gaining popularity as the solution of choice for hypothermic (chilled) tissue storage. HypoThermosol is more expensive than saline and in some patients can cause tissue to become slimy or sticky. We have been using HypoThermosol for a couple of years now and we have seen earlier hair regrowth since its introduction.

In addition to needing minerals, cells require energy in order for cell membrane pumps to work. Normally, the flow of nutrients inside of a cell produces ATP but since the cell is "disconnected" from its normal condition, many offices add liposomal ATP (ATPv, available from Energy Delivery Solutions) to their storage solutions. Adding ATPv seems to provide an energy supply for grafts to survive outside of the body longer than expected (waiting to be implanted) and to survive better once transplanted. Dr Cooley tested the effectiveness of HypoThermosol and ATPv on graft survival. His patient was a 70-year-old man who had skin cancer removed from his temple and underwent radiation therapy, both therapies destroying hair follicles and leaving behind scar tissue in the treated area. Dr Cooley harvested tissue from the donor area as usual, then he divided grafts into three groups, and stored them in a refrigerator for 5 days before transplanting them. The first group of grafts was stored in normal saline, the second group was stored in HypoThermosol, and the third group in HypoThermosol with ATPv. The patient was followed periodically and the final result evaluated at 18 months. Graft survival per area/storage solution

JAYPEE BROTHERS

was as follows: 0% for saline, 44% for HypoThermosol, and 72% for HypoThermosol with ATPv. Although this study was done only on a single patient, its results suggest that grafts can survive even when stored for extended periods of time.[10]

HARVESTING TECHNIQUES

Strip Harvesting (FU-Strip)

The donor tissue is harvested as a single strip that can vary in length and width depending on the donor density, the number of grafts required, and the permissible scalp elasticity (Figs. 4.7A and B).

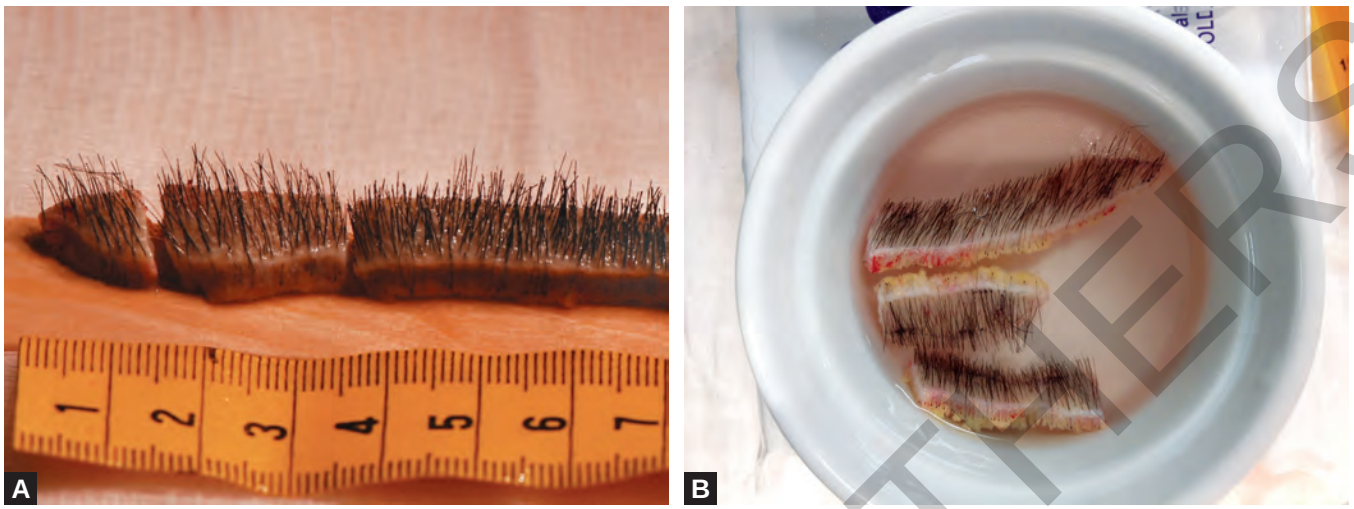
The physician may use a hair densitometer to evaluate the number of FUs per square centimeter and outline the area to be harvested that could measure approximately 1 cm (10 mm) to 1.5 cm (15 mm) in width and anywhere between 5 and 30 cm in length. After the donor area is anesthetized, the donor strip is excised and extracted and the wound edges are closed together with suture or staples. In our office, we measure the donor strip before and after harvesting, then we examine it closely for any variations in width and density. The ends of the strip are tapered and we measure the length of the strip by excluding the ends, then we take the average width and density and use these measurements to project graft yield. The graft calculation will be explained in details later in this book. The donor strip is first divided into smaller segments approximately 2–4 cm in length (known as blocking). 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 a chilled storage solution at all times (Figs. 4.8A and B).



Figures 4.7A and B

The two photographs show stages of strip donor harvesting: (A) The donor strip is being harvested (B) The donor area after it has been sutured

JAYPEE BROTHERS



Figures 4.8A and B

(A) Donor strip being measured, evaluated, and segmented into blocks (B) The donor tissue totally immersed in a chilled storage solution

Follicular Unit Extraction (FUE)

Another method of donor harvesting that has gained more recent attention is FUE. This technique is performed by extracting individual FUs from the donor area by using a small punch device. There are many types of instruments available for FUE, and the instrumentation used in the procedure depends on the physician's preference. The instrument used to cut a follicular unit graft (FUG) is called a punch, and it can be sharp, dull, or a combination of sharp and dull. The punch can be mounted on a handle or a device. Hence, dissection can be manual, motorized, or robotic. Regardless of the instrumentation used, this process is time consuming and labor intensive because grafts are dissected by one person holding a single instrument one graft at a time.

As grafts are dissected by the physician, an assistant removes the grafts using forceps and places them in the holding solution, and then one or several assistants inspect and sort the grafts, making them ready for implantation. This technique circumvents the graft dissection process performed by surgical assistants in an FU-strip transplant. Nevertheless, this method of donor harvesting still requires the involvement of the surgical assistant, just a smaller team than in the FU-strip procedure. Usually, FUE grafts have less tissue surrounding the hair shaft and hair bulb, and with the hair trimmed short to facilitate extraction these grafts are very vulnerable to injury and more challenging to place. Due to the uniqueness of this procedure and the delicate nature of these grafts, only experienced assistants should extract and place grafts. FUE can be tedious, labor intensive, and time consuming

JAYPEE BROTHERS

HAIR TRANSPLANT 360
for Assistants

This second edition of *Hair Transplant 360 (Vol. 2)*, featuring extensive study of graft preparation and placement, is thoroughly revised and expanded, as it has never been discussed anywhere before. The book also discusses a new technique for extraction of follicular unit grafts and further elaborates on bioenhancement methodologies. Videos have also been thoroughly revised and expanded.

Salient Features

- The basics of hair anatomy and hair growth cycles necessary for assisting in hair restoration
- Male and female pattern baldness, nonsurgical hair loss solutions, and the evolution of hair restoration
- Surgery overview and surgical assistant's duties
- Graft preparation (magnification and lighting, donor-harvesting techniques, graft survival and tissue preservation, managing difficult situations during graft preparation, quality control)
- Slivering (technique, instruments used, slivering strategy, tissue preservation)
- Graft dissection (technique, instruments used, dissecting strategy, graft preservation)
- Graft extraction (technique, instruments used, extracting strategy, tissue preservation)
- Graft placement (technique, choosing the forceps, placing principles and strategies, proper graft handling and preservation, quality control, managing difficult-placement situations)
- Postoperative care, short- and long-term patient follow-up
- Assistant training: Phase I and II (new inanimate models)
- Creating standardized hair-transplant photography
- Stress management.

Videos: The updated list contains 25 new videos, covering various topics such as Surgery Overview, First and Second Phase of Surgical Set-up, Prepping the Donor Area, Microscope Adjustment, Slivering, Graft Dissection, Extraction and Placement, Various Graft Placement Challenges, Patient Follow-up, Phase I Assistant Training and finally, Test Your Knowledge, a video that allows training assistants and physicians to evaluate their knowledge.



Emina Karamanovski Vance MD obtained her medical degree from the University of Belgrade in 1989. In 1991, she immigrated to North America and since has assisted in surgery and performed training, assessment, and quality control in Canada and the United States. Emina is the recipient of the Distinguished Assistant Award for 2010 and is the author of many articles and chapters on quality control and assistant training in hair restoration. She has been the co-director of the Hair Transplant 360 Workshop in St Louis, Missouri, USA for numerous years and co-chair of the Live Hands-on Assistant Training Workshop in Denver, Colorado, USA. Since 2004, she has been in Dr Samuel M Lam's team as a co-ordinator for the Lam Institute for Hair Restoration in Plano, Texas, USA.

Available at all medical bookstores
or buy online at www.jaypeebrothers.com

JAYPEE BROTHERS
Medical Publishers (P) Ltd.
www.jaypeebrothers.com

Join us on facebook.com/JaypeeMedicalPublishers

Shelving Recommendations
DERMATOLOGY, PLASTIC SURGERY & HAIR TRANSPLANTATION

ISBN 978-93-5250-037-6