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Reflections on the role of hair grafting in wound healing

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Introduction

Given the abundant body of evidence indicating that the main cellular machinery that fuels the wound healing process resides in hair follicles, why not use such machinery in clinical practice as a therapeutic weapon to stimulate the healing of chronic ulcers? This is the fundamental question that we tried to address in a paper recently published in the journal *Wound Repair and Regeneration*.[1]

The Hair Follicle and the Healing Process

The hair follicle appears to be the main anatomical structure that contributes to the healing process of cutaneous wounds. There is abundant clinical information to support the fact that wound healing starts around the hair follicles. Both the epithelial portion and the mesenchymal portion of the hair follicle contribute to the healing of skin wounds.

I would highly recommend a paper published in 1945 by G.H. Bishop, a neuroanatomist from Washington University in St. Louis.[2] This paper, published in the *American Journal of Anatomy,* is the most relevant paper I have read about the wound healing process in humans. Bishop studied how the connective tissue and epithelium regenerate after removal of superficial layers of the skin. What is more, he did it in the hardest, but at the same time, the most objective way he could by self-inflicting cutaneous wounds on his forearm at different tissue depths and observing the healing process that took place clinically and histologically. He noted that not only did reepithelialization start around the remaining hair follicles, but also that when the skin was destroyed down to the deep dermis, the granulation tissue that regenerated came from the connective tissue surrounding the hair follicles.

Wounds in hairy areas heal faster than in non-hairy areas. One fact that supports the notion that hair follicles contribute to the healing process is the clinical evidence showing that wounds heal faster in hairy than in non-hairy zones. This property has been clinically demonstrated when scalp is the donor source for harvesting split-thickness grafts (0.2-0.3mm in depth): the healing time to complete reepithelialization of the donor wound averages 5 days in comparison with 10 days in areas such as the thighs, buttocks, or abdomen.[3]

The hair follicle is the main repository of cutaneous stem cells with multipotent capacity. At cellular level, the follicular stem cells are key players in the proliferation and differentiation of follicular cells in the wound bed. Keratinocytes that reepithelialize the wound are thought to derive from hair follicle epithelial stem cells that reside within the bulge. Hair follicle dermal papilla and dermal sheath harbor mesenchymal stem cells for which a role in wound healing has been proposed. Accordingly, transplantation of hair follicles with vital dye-labeled dermal sheath cells into a murine wound bed resulted in dermal sheath fibroblasts from the lower hair follicle being incorporated into the wounded dermis.[4]

Why Transplant Hair Grafts in Chronic Leg Ulcers?

Chronic leg ulcers are one of the most costly and prevalent diseases for health services worldwide. Have you ever considered how much money is spent on the treatment of a patient with a chronic leg ulcer? Accurate estimations recently published give a figure of 9,569 euros per ulcer per year. We are facing a major health care problem that consumes an enormous amount of highly costly resources.[5] Most cutaneous chronic ulcers are located in the lower extremity and are caused by venous insufficiency, followed by arterial insufficiency and neuropathy (especially of diabetic etiology). It is estimated that 1 out of 100 adults will suffer from chronic leg venous ulcers at some point in their lifetime.

Chronic leg ulcers need better therapies. Compression therapy and wound dressings continue to be the mainstay treatment for venous ulceration in clinical practice. However, some 20% of ulcers remain unhealed after more than 50 weeks of appropriate compression therapy. Skin grafts have been used, but there is still insufficient evidence for the effectiveness of autologous skin grafting.[6] Those grafts were taken from non-hair-bearing areas such as the buttocks that are preferentially composed of dermal tissue with no terminal hair follicles. By contrast, the original approach of our research work is that the punches are removed from the patient's scalp using a small punch, as is usually performed in hair transplantation (punch grafting technique).

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President's Message

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Two of Gandhi's "7 Dangers to Humanity" are *Knowledge without Character* and *Business without Ethics*. After years of a cooperative effort by the ISHRS membership to disseminate knowledge and improve the overall quality of outcomes in hair restoration surgery, our profession stands at a crossroads of evolutionary development that threatens the long-term survival of those improvements and possibly the profession itself. There are a few physicians, both ISHRS members and non, who have elected to put patients at risk by delegating critical-to-quality surgical tasks to unlicensed technicians.

A trusted senior colleague recently saw a patient who had three hair restoration procedures in the last few years, whose results were far less than desirable. The hair growth was less than expected after 3,200 grafts, and the donor area had wide, stacked scars. The patient related a historical account of the three procedures that left no doubt that all the critical decision making was made not by the physician, but rather the hair technician, including design of the hairline, distribution of grafts, selection of donor area, and creation of the recipient sites. The surgeon did remove the donor, but according to the patient, he was instructed about where to take the strips and how to close by the technician. Unfortunately, these kinds of occurrences are becoming even more frequent with the advent of novice physicians allowing technicians to harvest FUE grafts.

The entire profession benefits from any single surgeon's high-quality outcomes and is harmed by any surgeon's poor-quality outcomes. Many of us have worked for years to find ways to improve the aesthetic results achieved from prior technologies. The market or demand for our services shrinks a little every time a patient's results demonstrate that the quality of our service is unreliable. High-quality HRS results demand attention to many physiological and aesthetic variables, most of which are beyond the scope of a technician's understanding and certainly beyond their training. Yet we continue to see physicians delegate these responsibilities for the sake of convenience or because they do not want to take the time to develop their own skills.

Worse yet, many physicians are naively being enticed into HRS purely by the profit motive, unconscious of the complexity of the specialty. I was recently contacted by an "FUE-only" physician in my community seeking additional training, explaining to me that after performing 17 or 18 procedures he realizes that there is more to the procedure than just moving a few hairs.

So what must we do to protect our potential patients? Just ignoring these untrained newcomers will result in many more patients with suboptimal outcomes. And those suboptimal outcomes will discourage other potential patients from availing themselves of our services. I truly believe that no physician wants to intentionally harm a patient. I believe we must encourage all physicians, members and non-members alike, to practice with both Knowledge *with* Character, and run their Business *with* Ethics.

The ISHRS has surveyed its membership and published strong positions against technicians harvesting tissue and performing other critical-to-quality parts of the hair restoration procedure. The ISHRS and its members must stand ready to train those responsible physicians who realize they are "in over their heads" to minimize the harm to both the patient and the growth of the industry. I urge those ISHRS members, physicians and technicians alike, who are encouraging these behaviors to abandon those activities, and bring both *Character* and *Ethics* back into your practices.

I realize that this position may not be the easiest to accept, that of essentially asking you to help train your competition, but as physicians we serve a higher calling than the routine businessman. With our Hippocratic Oath, we promise to serve patients before we serve ourselves. Just as we came together to solve the problems created by the HRS techniques of the 60s, 70s, and 80s, we must come together to solve the problem of unlicensed technicians performing surgery, and marginally trained physicians encouraging that behavior.

When you are presented with a patient who may have been better served, please take a moment to call the responsible physician, inform him of what you have observed, and offer suggestions to prevent a recurrence. Encourage communication. The ISHRS encourages its members to be strong patient advocates. As ISHRS members, we should be the textbook example of professional ethics to our patients and within our communities.◆

Co-editors' Messages

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Each issue of the *Forum* requires the co-editors to write on a topic of our choice, and I must say that for this issue I struggled to come up with something. For the first time, I experienced writer's block! The deadline came and I was asked to submit my editorial, so I finally sat down to write this and it turns out that when the pressure was on, I had too many topics. But then the decision had to be made: Should I write about the latest regulations that are about to be forced on those in private cosmetic practices? Or should I write about a recent complication that we had in an FUE procedure? How about recent cases of scalp necrosis that have been referred to us? But as spring is on the horizon in the Northern Hemisphere (I hope), I decided to leave these topics until another issue and discuss something more positive: educational opportunities in the upcoming months. This year seems to be particularly full of ISHRS sponsored workshops each with different themes. So if you want to learn more about female hair restoration, FUE techniques, strip surgery, hairline design, and eyebrows and eyelashes, then there is a workshop for you. In addition, there are the annual ISHRS meeting and hair research meetings.

The meeting that I'm particularly excited about is the World Congress for Hair Research (see Upcoming Events for the web link). In particular, I am looking forward to attending the pre-congress clinical day. This year there is a different format to the first day with the focus on basics in areas of hair biology. If you want to listen to the world's experts discussing some of the basic concepts in hair sciences, then this is the opportunity to listen to them all in one venue. My dilemma is that I want to listen to all the talks but they have been split into concurrent sessions. Session 1, *Genetics and Epigenetics: All You Wanted to Know but Were Afraid to Ask,* includes such talks as "Reprogramming hair follicle cells to a pluripotent state: an exciting new tool for medicine" by Dr. Michael Rendl. Session 2, *What's New in Hair Follicle Model Systems?,* details mouse model systems, updates on dermal papillae cultures, culture media, reprogramming hair follicle cells to a pluripotent state, and delivering molecules via

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Among the issues that continue to intrigue me from our meeting in the Bahamas is the role of inflammation in producing alopecia of one type or another. The proinflammatory and inflammatory cascade of events are becoming ever more clearly understood. When such questions come to mind, it is satisfying as editor to recall articles in the *Forum* for reference: Marty Sawaya's excellent review of her work on inflammasones,[1] an earlier article on strontium,[2] as well as other investigations such as that by Dr. Sadick and his study investigating an aspect of the "acquired immune response": basement membranes of follicles being laden with antibodies.[3] There seems to be a growing consensus that the "incidental" perifollicular inflammatory infiltrate may not be as incidental and insignificant as was thought for decades. Add to that intriguing questions regarding strontium's anti-inflammatory properties and you're in for a good ride of reflection and speculation.



Dr. Sawaya discusses the "innate immune reaction" (IIR) and especially the "inflammasome." The inflammasome is formed from "pattern recognition receptors" that are on the membranes and in the cytoplasm of many cells including epidermal and dermal cell lines in the skin and its appendages. When activated by a specific "molecular pattern" from an invading pathogen, for instance, these recognition receptors oligomerize with other proteins to form the inflammasome, which in turn can activate both proinflammatory cytokines such as IL-1A, IL-1B, IL-6, and TNF-A as well as the part of the immune system that most of us are more familiar with that involves T and B lymphocytes further downstream and are part of what is called the "Adaptive Immune Response" (AIR).

Dr. Sawaya refers to an article by herself and Drs. Vaccari, Nusbaum, Bauman, and others wherein a protein that interacts with the inflammasome cascade, Caspase-1, is studied in balding scalp.[4] Caspase-1 is recognized as an inducer of apoptosis and inflammation and they studied its levels as well as quantified androgen receptors in various *in vivo* and *in vitro* conditions involving the presence or absence of testosterone and finasteride. That androgen levels increase Caspase-1 levels and finasteride decreases them suggest the IIR (i.e., the inflammatory response) is perhaps the final common pathway for AGA.

Dr. Sadick's article summarized a study he performed predominantly on women with AGA. He found IgM deposits continuously along the basement membrane of the dermal-epidermal junction in 64% of afflicted women with associated evidence of complement activation and found that those with this deposition responded better to a combination therapy that included beclomethasone and spironolactone. A non-specific perifollicular lymphocytic infiltrate was present and was perhaps more predominant in the positive group. One can speculate that his findings are compatible with and are a further downstream manifestation of the inflammatory reaction from the AIR and whose "upstream" progenitor, the IIR, is discussed by Dr. Sawaya.

A few years ago I wrote a summary of strontium[2] that is now marketed as an anti-itch formulation named TriCalm by a San Diego company, Cosmederm Bioscience. Strontium is a divalent cation just beneath Ca++ in the periodic table. It may replace Ca++ and hence affect the Ca++ cellular functions as the mechanism of action. As you can see by reading the review, strontium has strong anti-inflammatory properties via inhibiting the release of Substance P from the "nociceptor" Type C nerves, a non-myelenated nerve type that extends to the outermost layer of the epidermis. This has been termed "neurogenic inflammation" and their stimulation can release Substance P by depolarization exclusively within the terminal arborization of the nerve and needn't go all the way to the dorsal root, much less upstream via the spino-thalamic tract, before returning with its message to release Substance P and its "neurogenic inflammation." There is some evidence that strontium additionally acts even more directly on the pro-inflammatory proteins in addition to this function at the terminal synapse of the Type C nerve.[5]

Another pearl I took away from the Bahamas meeting was from Dr. Jeff Donovan when he said that he finds an itching or tender scalp to be a very useful complaint for detecting cicatricial alopecia. This is not surprising when you think of the inflammation driving the cicatricial alopecia and it begs the question of whether strontium and suppression of the IIR would help these conditions.

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2. If results are presented, the medical regimen or surgical techniques that were used to obtain the results should be disclosed in detail.
3. Articles submitted with the sole purpose of promotion or marketing will not be accepted.
4. Authors should acknowledge all funding sources that supported their work as well as any relevant corporate affiliation.
5. Trademarked names should not be used to refer to devices or techniques, when possible.
6. Although we encourage submission of articles that may only contain the author's opinion for the purpose of stimulating thought, the editors may present such articles to colleagues who are experts in the particular area in question, for the purpose of obtaining rebuttal opinions to be published alongside the original article. Occasionally, a manuscript might be sent to an external reviewer, who will judge the manuscript in a blinded fashion to make recommendations about its acceptance, further revision, or rejection.
7. Once the manuscript is accepted, it will be published as soon as possible, depending on space availability.
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9. A completed Author Authorization and Release form—sent as a Word document (not a fax)—must accompany your submission. The form can be obtained in the Members Only section of the Society website at www.ishrs.org.
10. All photos and figures referred to in your article should be sent as separate attachments in JPEG or TIFF format. Be sure to attach your files to the email. Do NOT embed your files in the email or in the document itself (other than to show placement within the article).
11. We CANNOT accept photos taken on cell phones.
12. Please include a contact email address to be published with your article.

Submission deadlines:
April 5 for May/June 2013 issue
June 5 for July/August 2013 issue

Farjo Message

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the hair follicle. Session 3, *Hair Fibre Science with a Focus on Curly Hair,* covers the genetics of curly hair, physics of the hair fiber, and protein loss during hair straightening.

The subsequent two days of the meeting will be in the usual format of mainly researchers presenting their new work that to some of us is too complicated to understand. There will be some clinical sessions, though, on topics such as androgenetic alopecia and alopecia areata, which will be more useful to clinicians. I am very much looking forward to attending this meeting and hope that some others who normally would not attend a research meeting will take the opportunity to join me, especially as it is in such an interesting venue: Edinburgh, Scotland.◆

Notes from the Editor Emeritus

Michael Beehner, MD *Saratoga Springs, New York, USA* mlbeehner@saratogahair.com



What we are really selling

I read an article in a local newspaper recently that impressed upon me once again what it is that we are really selling to the public, and that is *trust*. This article emphasized that, no matter what business someone is in, people want more than anything to trust the person with whom they are dealing, no matter what the product or service is. Poll after poll show that the public has lost trust in most companies and professions. There is a pervading feeling of being "marketed" with superficial, glitzy come-on's and of being disappointed after receiving the service or product. Everything is impersonal. When is the last time you called a car dealer, a bank, or even a doctor's office and heard a real human's voice on the other end? The customer wants to trust the integrity of the person and institution he or she is dealing with. It's not even about expecting a totally perfect product or perfectly performed service, but just knowing that the person you are dealing with has your best interest at heart, cares that you are satisfied and happy with what you are purchasing, and will stand behind it if something isn't quite right down the road.

This is true in spades in hair transplant surgery, a profession in which we expect patients to take this enormous leap of faith and entrust to us, whom they have never met in their life, the life-changing task of filling the top of their head with hair. To successfully bring about this partnership with the prospective patient, you must first succeed in gaining the trust of the patient. Most patients visit at least two or three clinics before choosing where to go. Eventually they will get a "gut feeling" as to which physician or clinic they trust most, feel they will be most comfortable with, and believe they will receive a professional and competent surgical result. How do you maximize your chances for convincing them of this? I would propose that there are four major components. First is your website. Because the majority of people today do their window-shopping on the Internet, your website is the first place people will learn about you. What does yours tell people? Do they sense that you are a caring and competent physician? Second is having a very personable person at your front desk to greet the patients and make them feel at home. It is equally important that your greeter's voice be friendly and upbeat when dealing with patients over the phone. The third component is your clinical staff. Do they create an atmosphere that makes patients feel they are professional, caring, and competent? A great team of assistants who take pride in their work and enjoy working together is an enormous plus—and, believe me, patients can sense whether this is present or not. And fourth—actually, it probably should have been listed first—is the physician himself (herself). He or she should have a significant role during each consultation, to the point of performing the entire interview whenever possible. Patients should see a physician who conveys a warm, caring manner and is truly trying to figure out what is best for them, even if it means sometimes telling them that surgery at this time is not their best option. All questions should be answered by the physician in an honest, thorough way and never in an adversarial type of atmosphere.

A book that does a wonderful job of summarizing much of what I discussed above is Steven Covey's *Seven Habits of Highly Effective People.* The principle point of his book is that there has to be an inner character to a person or a business, a commitment to certain principles of acting in a fair and honest way in all dealings, and it has to be present all the way from the boss on down to the least important person in the business; and it has to be real. It's not something you can fake or "cover over" your practice with like icing on a cake. Most people are pretty good at detecting when this commitment isn't really present.◆

Reed Message

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With strontium becoming ever better understood and the great work of Dr. Sawaya and her colleagues working to better understand the IIR, I can see intriguing ideas to pursue: Can we be comfortable (as we were with the perifollicular inflammatory infiltrate in AGA for decades) that seborrheic dermatitis and psoriasis, symptomatic chronic inflammatory states, are not contributing to hair loss? Perhaps even their inflammatory states that are below the threshold of producing symptoms are eroding our hair counts. Should scalp biopsies be done more often for routine male pattern balding to consider this, especially if the inflammatory pathogenesis of alopecia becomes more certain? And other questions arise: Will antagonists of the IIR, perhaps strontium or something similar, prove to be useful in reducing the induction of apoptosis in the post-transplant state?

Will antagonists of the IIR prove to be useful in treating any or even all forms of alopecia? One nice feature of writing an editorial instead of a quality investigation of science is that it only has to express an opinion and can be primarily based upon speculation! Whatever the truth, I'm becoming a believer that the answer is "yes" that many alopecias, and perhaps even the "Big One"—AGA—are related to this immune response… and just in time to save my teenage son's hair from balding to the Stage VII of his two grandfathers! Many of these questions can be investigated fairly cheaply with the use of Hair Check, for example. I would appreciate a letter to the editor from anybody who can add to this line of thought. Let's get started and enjoy the speculation that can abound in the emerging sophistication of our field!

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Hair grafting in wound healing

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Pilot Study Results

Ten patients with ulcers (60% venous and 40% mixed) of an average 36.8cm^2 and a 10.5-year duration were included in this pilot study. Within each ulcer we randomly assigned a 2×2cm "experimental square" to receive 20 hair grafts and a non-grafted "control" square of equal size. A transplant density of 5 follicular grafts/cm^2 was chosen as we considered this to be the minimum density required to guarantee tissue regeneration of the treated square of the ulcer.

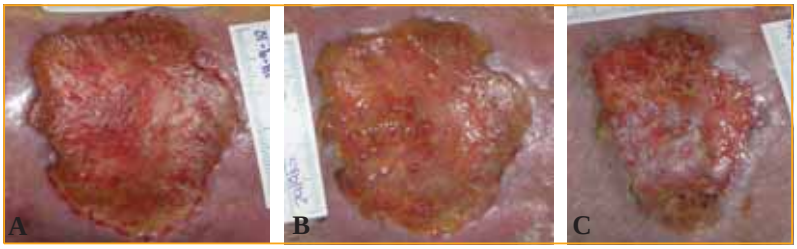


Figure 1. Macroscopic evolution of a chronic venous ulcer treated with hair grafting. *A:* The ulcer on the day of the surgery just before grafting. *B:* The ulcer 1 week after grafting. Twenty 2mm punch grafts were inserted into the 2×2cm experimental zone. *C:* The ulcer 8 weeks post-intervention. Note the remarkable healing and healthy granulation tissue formed only in the grafted area.

Hair grafts were harvested from the occipital scalp using small-diameter (1-2mm) circular punches. After anesthetizing the "experimental square" of the wound bed, each punch hair graft was introduced one at a time using the "stick-and-place" method. The donor area was left to heal by secondary intention. Once the 20 hair grafts had been inserted in the experimental square, the whole ulcer was covered with Vaseline gauze and closed with an elastic bandage for 24 hours.

At the 18-week end point, we observed a 27% ulcer area reduction in the experimental square as compared with 6.5% in the control square ($p = 0.048$) with a maximum 33.5% vs. 9.7% reduction at week 4 ($p= 0.007$). Improvement of clinical symptoms (appearance of granulation tissue, wound border reactivation, and a lesser amount of exudation) was noted in 7 of the 10 patients.

Conclusions and Research Implications

This pilot study appears to indicate that hair grafting into chronic leg ulcers is not only practical but also successful in improving clinical evolution of ulcers of long duration.

This study was originally conceived as a feasibility trial. We did not address the various questions related to the hair grafting technique that are listed below:

- What is the ideal thickness of the punch (1mm vs. 2mm, or even bigger)? We chose a size of punch that would not require suturing the donor wound but it didn't need to be a 1mm punch since we were not concerned with the naturalness of the transplant. Our main aim was to develop a method without excessive technical difficulties regarding the extraction of entire hair follicles as would occur with a 2mm punch.
- What would be the ideal recipient density in order to ensure inter-mesenchymal connections and to promote granulation tissue?
- Would it be better to insert the hair grafts closest to the border of the ulcer to take advantage of the "edge effect" from the reepithelialization border, or should we transplant the hair grafts randomly?

We do not know why 3 out of the 10 patients did not improve. We wondered if there are other factors that play a role in the success or failure of this technique such as infection of the wound bed, post-op care, etc.

We need to investigate the application of this technique in other non-venous leg ulcers such as diabetic, ischemic, etc. Would there be any influence of the etiology of the ulcers on the outcome of this therapy?

More studies are needed to compare hair grafting with simple dressings or to compare hair grafting obtained from the scalp versus skin grafts obtained from non-hairy areas. As hair transplant surgeons, we are in the perfect position to undertake this kind of investigation. Our field can expand enormously if we use our skills in other pathologies besides baldness.

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Cell-based treatments for hair loss: research update on "hair cloning"

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The hope of cultured follicular cell implantation, or hair cloning, has held a special place in the imagination of hair restoration surgeons and the public alike for many years. Several decades of basic animal research established the seeming inevitability that cell therapy would be a successful treatment for alopecia by this point in time, with the attendant hope for unlimited hair. Yet, the current situation suggests that cell-based treatments are no closer to successful realization than when the author last reviewed this topic 10 years ago.[1] The present review will cover published research over the past 10 years. The basic rationale and conceptual framework for using cell therapy to treat hair loss has been discussed in prior reviews and will not be covered here.[2,3]

Although clinical trials are underway using cultured follicular cells, no published results in humans were available at the time of this writing. Furthermore, because of the inherent commercial potential of research findings, it can be assumed that much more is known than is publicly available. While knowledge of the cellular and molecular mechanisms underpinning hair growth has progressed substantially over the past 10 years, it appears that this has not yet translated into a clinically useful method to treat hair loss in humans.

The basis for cell therapy began in the fundamental research of normal mammalian hair growth. It had been established that hair growth occurred because of the dynamic interaction between epidermal and mesenchymal cell populations within the hair bulb. Using the rat whisker as a model, Oliver showed that the spherical aggregate of mesenchymal cells in the bulb known as the dermal papilla could induce new follicles when removed from the whisker and subsequently implanted into skin that normally lacks follicles.[4] Carrying this research further, Jahoda showed that rat whisker dermal papilla that had been cultured *in vitro* could induce new hair growth when implanted into incisions in the rat ear.[5] This research, published in the mid-1980s, initiated the race to develop cell-based treatments for hair loss. In the ensuing years, several commercial ventures were launched based on the work of Oliver and Jahoda.

Over the past 10 years, we have seen a major commercial venture fail that was based on using implanted cultured autologous DP in humans. While some increased hair growth was claimed, it was largely agreed that simply implanting cultured DP in humans did not result in clinically meaningful hair induction. A second commercial venture combining cultured DP and keratinocytes is also being put through human clinical trials at the current time.[6] While the results have not been published, early reports are that no follicular neogenesis has been observed, although some thickening of native hair may result, which may be clinically beneficial. What has become increasingly clear is that methods that routinely induce new hair follicles in mice and rats are largely unsuccessful in humans.

A third venture is based on using not cultured dermal papilla, but the adjacent mesenchymal dermal sheath "cup" cells (DSC).[7] This is based on the research of McElwee who showed that implantation of cultured DSC cells from mouse whiskers could be injected into the ear, resulting in "colonization" of the dermal papilla of ear hair follicles with whisker cells programmed to produce thicker hair.[8] Early reports from clinical trials using cultured DSC in humans suggest it is safe and may produce some hair thickening.

It is important to note here that no published reports exist of reproducible de novo hair follicle induction in humans (i.e., the formation of entirely new hair follicles in alopecic skin). What the current commercial ventures mentioned above do appear to show is that implantation of cultured follicular cells may result in clinically apparent thickening of native hair follicles. Whether these implanted cells incorporate into the structure of the native follicle and survive cycling or whether they merely secrete stimulatory agents that transiently promote thicker hair is an important distinction. If it is the former, then such a treatment may represent a true breakthrough in alopecia treatment with long-lasting or permanent effects. If it is the latter, then the expense of cell-based treatment may not justify the temporary benefits. Furthermore, the increasing popularity of injecting platelet rich plasma (PRP) for hair loss,[9,10] as well as an injectable treatment under development containing growth factors secreted by cultured neonatal fibroblasts (Histogen),[11] may produce similar gains at a fraction of the expense, without the burdensome regulatory requirements of cell therapy.

Animal Research and Study Models

These commercial ventures have their origin in basic research conducted on rat or mice. The seminal studies by Oliver and Jahoda were based on manipulating dissected rat vibrissa (whisker), which later proved cumbersome and limiting as research methods became more advanced. Over the years, more refined models have been developed that have allowed researchers to study the intricate inner workings of follicular neogenesis.

For many years, the silicon chamber model, pioneered by Ulrich and Yuspa, was the dominant model used by researchers in this area.[12] Dermal and epidermal cells, either fresh or cultured, were combined in full-thickness wounds on the backs of immunodeficient mice and covered with a bell-shaped silicon chamber that confined and protected the cells; after one week, the chamber was removed, and new hair growth was apparent within three weeks.

Qiao created a "flap graft" model that dispensed with the need for the chamber, and allowed implantation of trichogenic dermal and epidermal cells below a flap of host skin.[13] This model still required the implantation of, and subsequent removal of, a silicone sheet. Stenn developed a "Patch Assay" that consisted of injecting dermal and epidermal cells subcutaneously into immunodeficient mice. The resulting "hair ball" consists of hair bulbs located centrally with hair growth occurring radially outwards.[14]

Almost all *in vitro* models have relied on mouse, usually embryonic, as the source of cells. It has been noted by researchers that successful hair follicle induction using mouse or rat cannot necessarily be translated into success using human cells.

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Cell therapy

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Although Stenn did report success with the "Patch Assay" using adult human dermal cells, it is important to note that the epidermal cells were from human fetus and the host was immunodeficient mouse.[15]

One report stands alone in using only adult human cells and tissue. Krugluger described a human skin organ model in which injections of human DP and epithelial cells resulted in follicle induction and growth of vellus type hair.[16] However, no follow-up studies from this group, or using this technique, have been reported in the many years since its original publication.

Cell Culturing Conditions

Early experiments clearly showed that culturing conditions determined the success of dermal papilla–induced follicle morphogenesis. Cultured dermal papilla gradually lose their inductive ability as they are passaged and expanded in culture. Yoshizato showed that the presence of keratinocytes or keratinocyte-conditioned media could keep cultured DP inductive through many passages.[17] Subsequent to this, it was found that the factors present in conditioned media were soluble Wnt proteins excreted by keratinocytes whose primary function appears to be keeping beta-catenin in the DP active, which is essential for maintaining inductive potential.[18,19]

In addition to the presence of soluble Wnt factors to keep beta-catenin in cultured DP active, it has been found that three-dimensional culture conditions favor subsequent follicle induction over standard two-dimensional techniques.[20] Several reports have shown that cultured DP cells are more inductive when coaxed to aggregate into spheres rather than as the standard monolayers present in two-dimensional culture.[21-23]

Cell Implantation Technique

When the first reports of successful follicle induction in animals using cultured cells was reported in the mid-1980s, it was assumed that not only would success in humans follow shortly, but that the envisioned treatment would consist of injections of dissociated cells directly into the scalp, where they would induce the formation of new follicles. Over the past 10 years, it has become increasingly clear that injection of dissociated dermal cells, with or without epidermal cells, is largely unsuccessful in inducing new follicle formation in humans.

Many reports using animal models have appeared focusing on modifying and augmenting the method of culture and implantation. The rationale is that by optimizing the culture and delivery of cells, follicle induction will be successful in humans. One report describes the comparative success of different implantation techniques on hair regeneration when using cultured DP alone (no epidermal cells). Cultured rat DP placed directly beneath the host epidermis using the "hemi-vascular sandwich" technique showed superior hair induction.[24] These researchers claimed that this technique allowed use of dissociated DP cells alone, and that success was due to contact between DP cells and host epidermal cells as well as better oxygenation of the implanted cells.

Toward a New Paradigm

Current research appears to be leading toward a treatment paradigm where dermal and epidermal cells are combined for a period of time before implantation. In a method reported by Qiao, mouse dermal and epidermal cells were cocultured prior to implantation, resulting in the formation of primitive "proto-hairs" that could be subsequently transplanted, resulting in growth of mature, cycling hair.[25] It bears repeating that this involved animal cells, not human.

Along these lines, Lindner described the creation of "neo-papilla" using cultured human DP and components of extracellular matrix, followed by coculture with human keratinocytes and melanocytes. This resulted in the formation of *in vitro* follicles with vellus-like hair shaft growth.[26]

Similarly, Tsuji and colleagues reported that cultured DP and epidermal cells could be combined in a collagen gel to create a "bioengineered follicle germ," which could then be transplanted along with a fine suture that served as a guide for follicle directionality and connection to the outside epidermis, thus preventing cyst formation.[27] When transplanted into the hairless skin of mice, these bioengineered "hair germ" grafts took root and produced hair, and analysis of these hair follicles showed all correct layers of normal follicles and accessory structures including connection with surrounding host tissue (i.e., arrector pili muscles and nerve fibers).[28] Normal hair cycling occurred, confirming presence of necessary stem cell populations within the new hair follicles.

Furthermore, these researchers reported similar success using adult human follicle stem cells (DP and bulge-region derived epithelial cells), which may represent an important breakthrough. In a variation of their method, they implanted the bioengineered hair germ into the subrenal capsule of mice, providing a protected, vascularized space for induction to occur. After two weeks, mature hair follicles were seen in clusters and could be harvested for subsequent transplantation as 1- and 2-hair follicular units.[29] They suggested that these bioengineered hair grafts could be used in a manner similar to follicular unit transplantation (FUT). One might envision a treatment where the patient's follicles are shipped to the lab, where the cells are dissected out and grown first in organ culture, then matured in surrogate mice, before being harvested and shipped back to the surgeon where they could be implanted via the FUT technique.

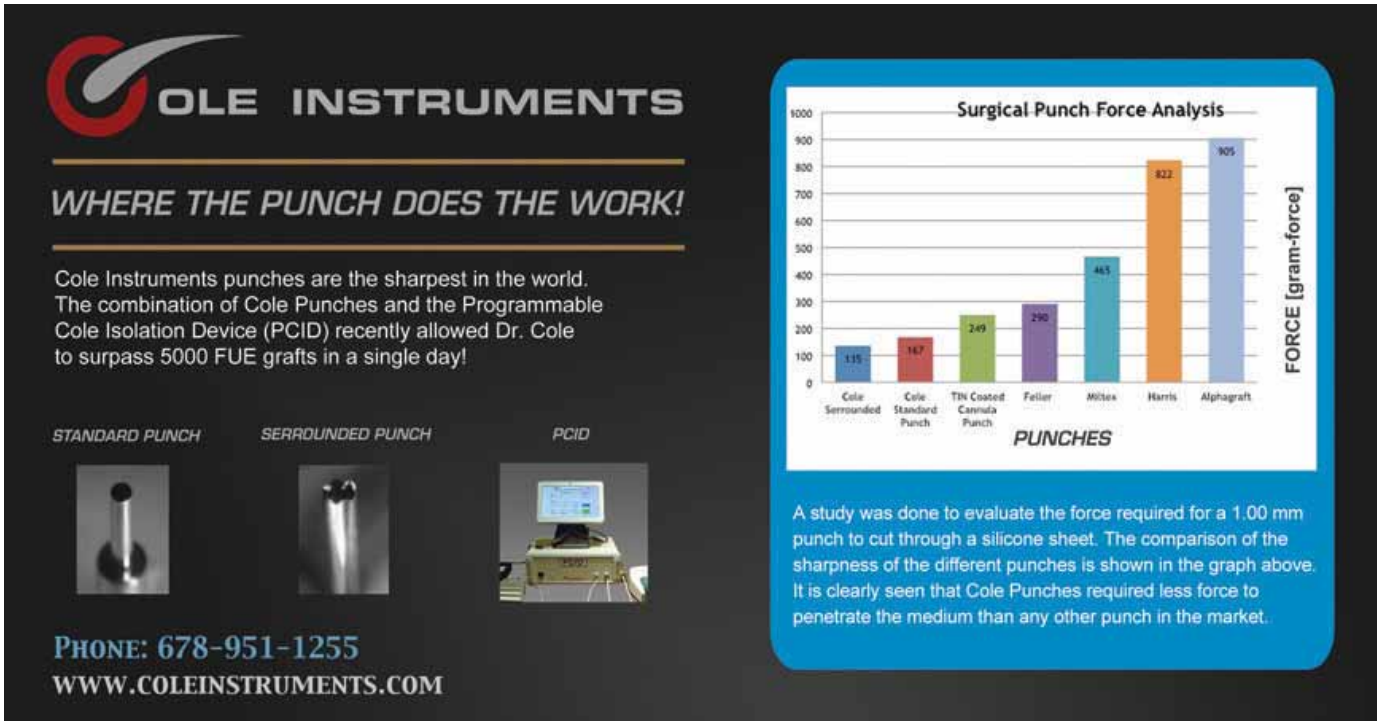
Conclusion

Follicular cell implantation for hair loss remains an exciting possibility, but true hair multiplication is a long way off from practical reality in the clinic. Cell-based treatments may come online first as "hair thickening" treatments, where periodic scalp injections produce modest clinical gains similar to finasteride and minoxidil. True hair follicle neogenesis in humans has proven far more complex than that which has been routinely carried out in rats and mice, but intricate models are now being developed that keep alive the dream of unlimited hair.

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Tissue expansion and hair restoration

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Introduction

Since its introduction by Neumann, tissue expansion has been considered a major reconstructive surgery procedure.[1,2] Its use along with scalp flaps in hair restorative surgery is not new especially in post-burn alopecia.[3-7] Tissue expansion allows the advancement of hair-bearing skin after the excision of the non-hair-bearing/scarred/burned skin. Although follicular unit grafting can be performed, the density of the grafted hair is often not adequate and is dependent on the condition of the recipient skin; in many of the cases, there is loss of fatty layers of the scalp or, if skin-grafted, the grafted areas of the scalp are generally good recipient areas. In the placement of tissue expanders, the volume and shape depend upon the geometry of the defect and upon the available hair-bearing areas. Generally, two or more tissue expanders are used. Precise pre-operative planning is, therefore, of utmost importance.

The aim of this audit study is to share our experience of hair restoration using tissue expansion.

Materials and Methods

The following study was conducted from June 2005 to June 2010 in a private hair restoration/plastic surgery clinic. Patients of all ages undergoing hair restoration using tissue expansion were included. The patients in whom the defects were excised and closed primarily without expansion were not included. The shape and volume of the tissue expander was selected according to the geometry of the defect. Under general anesthesia, the tissue expanders were placed under the normal skin close to the defect. Meticulous dissection and haemostasis of the pocket was ensured. A drain was also placed to remove any collection developing in the pocket and was removed after 46-72 hours. Second-generation cephalosporins were administered pre-operatively, which were continued for 8-10 days post-operatively.

Tissue expansion was started on day 10 post-operatively. The expanders were filled using a butterfly needle (24^{o}G) to the bearable discomfort/pain level of the patient. The tissue expanders were filled twice weekly. Once adequate expansion was achieved, no filling was done for 24-48 hours prior to the second stage. The tissue expanders were removed under general anesthesia. The defects were excised and the rotation flaps were used to reconstruct the defects. The patients were followed up for at least 3 months. A second follow-up visit at 6- and 12-month interval was advised to all patients. Any complication arising was also noted.

Results

A total of 16 patients were included in the study (Figure 1). The male to female ratio was 2.2:1. The mean age in male patients was 31.4 years (range 24-42 years) and 28.8 years (range 20-56 years) in female patients. The most frequent cause was burn (43.7%) followed by post-traumatic scar (31.3%), post-traumatic skin graft (18.7%), and androgenic alopecia (6.3%). In most of the cases (62.5%), two tissue expanders were used; three tissue expanders were used in 25% cases whereas single tissue expander was used in only two cases. The fill volume of tissue expanders varied from 100-320ml (average 193.4ml). The average expansion time was 33.6 days (range 28-56 days). No major complication was noticed in the post-operative period. Slight leakage was found in only one case.

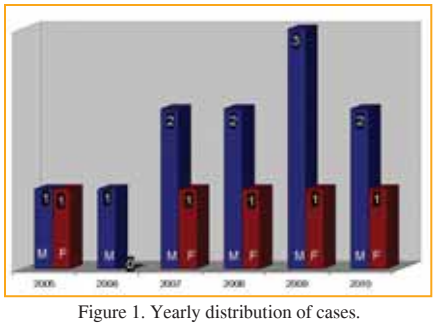


Figure 1. Yearly distribution of cases.



Figure 2. Pre-operative and post-operative case of post-burn alopecia.

Case 1

A 24-year-old female presented with post-burn alopecia involving the right side of scalp (frontal, temporal, and part of parietal area). She underwent tissue expander placement in the first stage. A single tissue expander of 320ml was used, which was serially expanded. The final surgery was performed on day 40. The scarred tissue was excised and the defects were reconstructed using rotation flaps (Figure 2).

Discussion

Tissue expansion is a versatile technique for the plastic and reconstructive surgeon. It adds an extra procedure to the armamentarium of the hair restoration surgeon. With the increasing use of follicular unit transplantation, many hair restoration surgeons might prefer to use hair transplantation instead of flap reconstruction using tissue expansion. Tissue expansion produces a mechanical stretch resulting in localized ischemia of the expanded skin and, hence, promotes angiogenesis.[8] A tissue expander has three parts: 1) an elastic silicone elastomer balloon, 2) a connecting tube, and 3) a self-sealing injection port. Once the tissue expander is placed in the pocket, the tissue around it reacts to form a "capsule." This capsule has been shown to have a circulation exceeding that of the subdermal plexus.[9]

Although there are many case reports with traumatic/burn alopecia in which follicular unit hair transplantation has been performed with success, there are a few issues that vary from case to case. The most important issue is the density in the

grafted area. The achievable density depends on the thickness of the underlying soft tissue and the duration of the pathology/deformity. Even with the multiple sessions of grafting, it might not be possible to obtain reasonable hair density. In such cases, tissue expansion could provide an excellent result and superior density. Similarly, in cases where skin grafts were placed on the scalp, there would be virtually no underlying soft tissue and follicular unit transplantation might not provide satisfactory results.

Tissue expansion has a twofold advantage. First, it provides hair-bearing local skin, and, second, it removes the defect (burn scar/graft scar, etc.). The planning of the surgical procedure is of the utmost importance in expansion-assisted hair restoration. The size and shape of the defect relative to potential supply of the donor hair and quality of scar and thickness are very important factors.

Many surgical alterations can be made during the reconstruction process; for example, the use of multiple tissue expanders allows the geometry of the flaps to be rotated easily. Similarly, we use the trichophytic wound closure technique while suturing the flaps together. This allows for a more natural closure and avoids subsequent minor surgeries. In many cases, we also score the galea and the capsule formed around the tissue expander, which helps to gain some extra length of the flaps as well. Moreover, in the patients with frontal hairline defects, we can create a hairline with follicular unit hair transplantation later on.

The most frequent complication we encountered was pain/discomfort during the expansion process, especially at the later stages of the expansion. We found no infection post-operatively. The reason could be that we began with slightly filled tissue expanders (20-30ml) in all the cases. This helps to produce an internal haemostatic effect that results in a low volume of drain-fluid and an associated reduction of incidence of infection to "zero." In most of the cases, we use rectangular, oval, or crescentic tissue expanders. A large series of scalp reconstruction using tissue expanders was documented by Saleh.[10] Minor complications were reported to be 21.5%. Infection was found in 8.25% and expander extrusion occurred in 5% of the cases. None of these complications were found in our present audit. The overall complication rates in other studies by Zellweger et al., Governa et al., and Manders et al. were 22%, 27.9%, and 25%, respectively.[11-13] The total complication rate was 0.6% in the present study. In another large series by Fan et al., tissue expansion was used in 82 cases with a moderate to major scalp defect (from 25% to 75%).[14] Surprisingly, infection was noted in only 3 patients and minor complications were noted in only 7% of cases. An interesting innovation had been presented by El Sadat et al. using an endoscopic approach for tissue expander placement in a pediatric population.[15]

Conclusion

Tissue expansion is a safe technique when used in reconstructive surgical procedures. It can also be used in select cases in hair restoration including post-burn or post-traumatic alopecia.

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An overview of Biotin as it relates to hair loss

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Does Biotin supplementation actually help encourage hair growth or simply create expensive urine? (Biotin is water soluble and any excess consumed is excreted in the urine.)

Biotin was first recognized as an essential nutrient factor in mammals in 1936.[1] Biotin is one of the water-soluble B vitamins that helps the body to convert food (carbohydrates, fats and amino acids/protein) into fuel (glucose). The body only needs a small amount of biotin for its metabolic functions and is easily obtained through various foods such as yeast, whole-wheat bread, egg or yolk, leafy green vegetables, nuts, legumes, cheese, liver, port, salmon, avocado, raspberries and cauliflower.[1,2] Also, the intestinal flora produce biotin that the body can use and the vitamin is essentially recycled every day so deficiency is rare because the intestines produce biotin in excess of the body's daily requirements.[3] For this reason, most countries including the USA and Australia do not prescribe a recommended daily intake or allowance of biotin.[4,5] The Adequate Intake level (AI) for adults is 30mcg per day, which is usually available in most multivitamins and numerous foods.[2] The recommended dose to treat deficiency for adults varies from 3,000mcg per day for brittle fingernails up to 7,000-15,000mcg per day for diabetics.[6] The usual dose I see recommended for hair loss patients by physicians is 3,000mcg per day.

There are basically only a few causes of true biotin deficiency. The first is by inherited metabolic disorders where an individual's metabolism of biotin is abnormal, such as a deficiency in the holocarboxylase synthetase enzyme or biotinidase which covalently links biotin onto carboxylase, where biotin acts as a cofactor.[6]

Biotinidase or Holocarboxylase synthetase deficiency prevents the body's cells from using biotin effectively, and thus interferes with multiple carboxylase reactions (these are complex bio-chemical reactions that occur to convert biotin to a usable form by the body).[7] This enzyme deficiency is rare and is usually discovered in infants when they present with symptoms. Clinical findings as described below are usually adequate to make the diagnosis but a serum assay is available.[6]

The other causes of biotin deficiency are related to lack of consumption or more likely malabsorption, prolonged intravenous (parental) feeding without biotin supplementation and consumption of raw egg white for prolonged periods (many weeks to years). Raw egg whites contain avidin, a protein which binds strongly to biotin, making it unavailable to the body. Some anti-seizure medications and long-term antibiotic therapy can create a deficit. Additionally, conditions such as Crohn's disease, partial gastrectomy and alcoholism make it hard to absorb nutrients and can cause deficiency.

Regardless of the etiology of biotin deficiency, clinical manifestations are essentially the same. The first symptoms of biotin deficiency are associated with the skin and hair. Symptoms develop within 3-5 weeks of the onset of deficient biotin intake or absorption. The most common cutaneous findings include the following:

- Dry skin
- Seborrheic dermatitis
- Fungal infections
- Rashes, including erythematous periorofacial macular rash
- Fine and brittle hair
- Hair loss or total alopecia

Approximately 1-2 weeks later, neurologic symptoms begin to develop. The most common neurologic findings include the following:

- Mild depression, which may progress to profound lassitude and, eventually, to somnolence
- Changes in mental status
- Generalized muscular pains (myalgias)

Intestinal tract symptoms also develop and most commonly include the following:

- Nausea, occasionally severe
- Vomiting
- Anorexia[8]

As indicated above, symptoms of biotin deficiency present as a syndrome or cluster of symptoms. Supplementation adequately treats and corrects these symptoms.[1,2] An isolated finding such as hair loss is not indicative of biotin deficiency, but is most likely related to another cause.

Current literature is conflicting regarding the benefits of biotin supplementation for brittle nails and diabetes. No literature or scientific studies exist that show that biotin supplementation assists with hair growth. Some uses for biotin discussed are speculative but include studies that show biotin supplementation might help reduce blood sugar levels in people with either Type 1 or Type 2 diabetes and possibly reduce the symptoms of diabetic neuropathy. However, no double-blind, placebo-controlled studies have been reported on these potential uses of biotin. Two double-blind studies have found benefit for diabetes with a mixture of biotin and chromium; however it is not clear how much the biotin in this combination contributed.[9]

Very weak evidence, too weak to rely on, has been used to support biotin supplementation for brittle nails. Biotin has been proposed for treating cradle cap in infants,[8] but there is no scientific evidence to support this theory,

Again, there are no studies to date that show improvement in hair loss while taking biotin supplements. However, biotin is one of the most frequent recommendations by health care providers for individuals suffering from hair loss.

Because biotin is a water-soluble vitamin, no risk for toxicity or overdose exists as any excess biotin is excreted in the urine.[10]

To date, very few treatment modalities are available to correct significant hair loss. Prescriptions such as minoxidil (Rogaine®) and finasteride (Propecia®) have been shown beneficial for AGA; correcting other underlying disease processes that cause alopecia is key, however. Exhibiting a healthy lifestyle with regular exercise, proper nutrition while limiting alcohol intake and not smoking are also essential.

In all of my years of practicing medicine, first as an ICU surgeon and lastly as a hair transplant surgeon, I have never encountered a patient with a true biotin deficiency. While practicing as a critical care surgeon in ICU, most of our critically ill patients were routinely tested for vitamin B deficiencies but none of my patients ever had an abnormal result. I have not requested any serum laboratory testing for my hair transplant patients to check for biotin level deficiency, but there has been no ancillary reason to do so. As noted above, biotin deficiency seemingly creates a global set of symptoms that does include hair loss. Isolated hair loss not accompanied by the constellation of symptoms discussed here would not occur in this deficiency.

To date, 60-75% of the patients I see in my hair restoration practice take biotin supplementation as prescribed by their other health care providers and physicians in hopes that this would be the panacea to cure their hair loss. The data that even suggest it might be beneficial to hair is based on poor data at best for nail growth and brittle nail therapy.

Although no scientific evidence exists that supports biotin supplementation is beneficial to help treat hair loss, it certainly doesn't cause any harm. Hopefully, this article will help us to better understand the scientific mechanism of biotin while we continue to seek more data and other treatments for hair loss.

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Folliculitis and scarring after eyebrow transplantation: an uncommon complication

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We report a case of recalcitrant folliculitis resulting in atrophic scarring after eyebrow transplantation. Folliculitis, a common complication in hair transplant surgery, is an uncommon occurrence in eyebrow transplantation for unknown reasons. The various factors possibly affecting the eruption of folliculitis in this case are: 1) dense packing, 2) skin type and pre-existing lesions, 3) hypersecretion of sebaceous glands, and 4) post-operative care. Atrophic scarring is a consequence that may still be managed with various dermatologic treatments such as chemical peels and other skin resurfacing procedures.

Introduction

Folliculitis is a common complication from hair transplant surgery, second only to widened donor scars,[1] that typically occurs 1 month after surgery and may last up to 6 months.[2] These inflammatory, often pruritic papules and pustules are caused by bacteria (Staphylococcus aureus) and are thus treated with topical (Mupirocin) and/or antibiotics (Tetracyclines), warm compresses, and antiseptics such as chlorhexidinegluconate (hibiclens), hexachlorophene (phisohex), and povidone-iodine (betadine) shampoo. We rarely perform cultures since folliculitis is usually superficial and mild, and resolves spontaneously with or without medical management. With deep recurrent or more resistant cases, however, other etiologies should be considered such as gram-negative bacteria (Pseudomonas, Enterobacter, Proteus, and Klebsiella), fungal infection (Malassezia), or viral infection (Herpes simplex), and in severe cases MRSA.[2,3]

Folliculitis has been attributed not only to microbial etiologies but also to the inappropriate depth of insertion causing burial of grafts,[4,5] to the "piggy-backing" of grafts,[2,5] and to a high density of the transplanted grafts (more than 30-35 FUs/cm^2). It has been proposed that extreme densities cause an increase in number of sebaceous glands transplanted along with the grafts, which are unregulated and over produce sebum.[6] Other factors noted to increase the occurrence of folliculitis include scalp oiliness, pre-existing inflammatory scalp lesions, dusty work environments, infrequent scalp washing, or immunosuppressive states such as diabetes mellitus.[7,8]

Eyebrow transplantation can have folliculitis as a complication for similar reasons as in scalp transplantation, although occurrences seem to be rarer. We present a case of folliculitis after eyebrow transplantation resistant to usual antibiotic management that eventually led to atrophic scarring.

Case Study

A 35 year-old Asian male consulted for hair transplantation due to mild frontotemporal recession with androgenetic alopecia Norwood II classification and diffusely sparse eyebrows (Figure 1). Prior to surgery, he had minimal erythematous patches over both medial eyebrows and few closed comedones on the forehead diagnosed as mild seborrhea and mild acne, respectively. The patient had been using various topical medications to manage his oily skin and acne eruptions.



Figure 1. *A:* Pre-op: Mild frontotemporal recession. *B:* Pre-op: Bilateral sparse eyebrows.

The patient underwent hairline and eyebrow transplantation and had a total of 2,007 grafts and 3,782 hairs (1-hair grafts = 559, 2-hair = 1,167, 3-hair = 235, 4-hair = 46) for hair transplantation and a total of 710 grafts for eyebrow transplantation (right eyebrow: 1-hair = 330, 2-hair = 25; left eyebrow: 1-hair = 330, 2-hair = 25). For his hairline, grafts were inserted into pre-made incisions using 18-21 gauge needles. For his eyebrows, stick-and-place technique with depth control was performed using 21 and 23 gauge bent needles. The patient was prescribed Doxycycline 100mg BID for 5 days and mild shampoo daily.

Two months after surgery, the patient reported (over the phone) to have eruption of multiple erythematous papules and pustules diffusely spread over the frontal hairline and eyebrows, for which topical antibiotic ointment (Mupirocin) was advised twice a day with report of some improvement. Upon follow-up at the clinic, he was found to have several erythematous papules on the frontal hairline, enlarged pores over inflamed skin, and comedones on both medial eyebrows (Figure 2). He was advised to use the following medications: Fusidic acid with Hydrocortisone cream BID, Ciprofloxacin 500mg BID for a week, and a mild shampoo for daily cleansing.



Figure 2. 2 months' post-op: erythematous papules (hairline and eyebrows), comedones and enlarged pores (eyebrows).

Three months after surgery, there was a decrease in erythema and papules at the hairline and atrophic scar formation at the medial eyebrow (Figure 3). He was advised to take Doxycycline 100mg BID for 1 month, Metronidazole gel BID, Tretinoin 0.5% gel OD, Betamethasone cream BID, and Nizoral shampoo daily (left on for 5 minutes before rinsing).



Figure 3. *A:* 3 months' post-op: decrease in erythema and number of papules. *B:* 3 months' post-op: atrophic scarring.

At 4-month follow-up post-transplantation, there was resolution of papules and pustules over the hairline and some improvement over the eyebrows (Figure 4). Minimal erythema

(attributed to topical retinoids) and atrophic ice-pick shaped scars remained over the medial eyebrows (Figure 4C). Open comedones were extracted and the patient was recommended topical Benzoyl peroxide in combination with Adapalene and to undergo skin-resurfacing treatment with a Dermatologist. The patient underwent several weekly TCA chemical peel treatments with gradual improvement of his scars (Figure 5). Hair growth at the medial aspect of both eyebrows had been minimal but signs of regrowth, though gradual, are promising.



Figure 4. *A:* 4 months' post-op: resolution of lesions (hairline). *B:* 4 months' post-op: improvement of lesions (eyebrows). *C:* 4 months' post-op: increase in "ice-pick" (atrophic) scars.


Figure 5. 5 months' post-op: improved scars with TCA peel.

Discussion

Dense Packing and Overcrowding

Reconstruction of eyebrows using micrografts usually produces good results. We use single-hair transplantation technique with meticulous dissection of grafts into ultra-skinny single hairs with the aid of stereomicroscopes with 10× magnification. Stick-and-place insertion using 23-25 gauge needles has been used in the past to provide dense packing with a survival rate of more than 80%.[9] Stick-and-place technique using 21-23 gauge needles is now our preferred method for eyebrow transplantation, which allows for less dense packing and less need for ultra-skinny grafts without compromising cosmetic outcome.

The number of grafts per eyebrow ranged from 116-252 grafts for males and 130-215 grafts for females in the five eyebrow transplant cases among Asians we transplanted.[9] The use of approximately 600 single-hair grafts in total for eyebrow reconstruction has also been reported.[10] Previously, we have utilized an average of 100-200 single-hair grafts on each eyebrow without complications.[11] Most hair surgeons who do eyebrow transplantation usually insert between 200-300 single-hair grafts per eyebrow. In our case, a total of 710 grafts with approximately 350 grafts per eyebrow have been transplanted, including 25 2-hair grafts per side. The use of 2-hair grafts to add more density to the eyebrows may have promoted overcrowding.

It has also been suggested that transection of sebaceous glands during incisions in the recipient site to create slits, which releases sebum into the surrounding tissue, has caused cyst formation.[11] This can occur more frequently during dense packing of grafts.

Skin Type and Preexisting Lesions

Skin type, such as oily or dry skin and whether preexisting sources of infection are present, should be included in the physical examination of patients. These factors may increase the risk of having a more severe eruption of folliculitis. Our patient had oily skin, mild erythema over both medial eyebrows (seborrhea), as well as small closed comedones on the forehead (acne)—factors that may have influenced the severity of the eruption of folliculitis.

Hypersecretion of Sebaceous Glands

We could not explain the occurrence of folliculitis using skinny grafts as they are almost devoid of surrounding tissue, including sebaceous glands. Possibly there is regeneration of these sebaceous glands, unregulated secretion of sebum, and an increase in the total number of sebaceous glands in the area.

Post-Operative Management and Care

Post-operative wound care reports have compared the use of dry and moist dressings with results showing no difference in growth and no reports of folliculitis as a complication.[12] No occlusive dressing was applied in our case. Post-operative care also included preventive oral antibiotics and adequate daily cleansing. Subsequent folliculitis after failure to respond to empiric therapy in our case was treated with a combination of topical and oral antibiotics, topical anti-inflammatory steroids, and daily cleansing, though response to these treatments was slower than expected. A superimposed fungal infection from seborrhea or presence of gram-negative bacterial infection could have occurred, hence the possible resistance to usual gram-positive oral and topical antibiotics. The addition of appropriate management was then included for complete coverage.

Atrophic Scarring: Sequelae from Deep Infection

Scarring from folliculitis occurs when the extent of the inflammation and infection is deep (dermal). Most deep folliculitis requires incision and drainage and a more broad-spectrum antimicrobial therapy. Eventual treatment of the atrophic scars is needed and may prove difficult since they are located in a hair-bearing region. Topical keratolytics (retinoids, chemical peels) and microneedling are several treatment options. Other modalities, such as microdermabrasion, and skin resurfacing lasers, such as ablative and non-ablative fractional lasers,[13,14] also may be utilized. Weekly TCA chemical peels for our patient have been beneficial and have shown satisfactory results.

Conclusion

Folliculitis from eyebrow transplantation may be a rare complication, but it is important to anticipate its occurrence and be able to manage it appropriately to prevent eventual permanent scarring. The reason for its occurrence can be multifactorial. Factors to consider are dense packing, skin type, and presence of preexisting lesions, sebaceous gland hypersecretion, and the need for individualized appropriate post-operative management and care. Other considerations are the depth of graft insertion, the use of ultra-skinny grafts, and the "piggy-backing" of grafts (not considered in our case). Eventual skin resurfacing treatments should be offered if scarring occurs.

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- **Featured Videos:** Over the next several months, we will be rolling out over 30 new consumer-focused videos talking about a number of hair loss and restoration subjects.
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- **New & Improved "Find A Doctor" Section:** We have improved the search functionality and features of our "Find A Doctor" section allowing consumers to more quickly access our physician directory and search by keyword (e.g., address, last name, practice areas, etc.).

Each Physician Member has received a welcome email introducing the new site and providing personal, new login information for access to the "Member's Only" section. Instructions are included and members are urged to verify personal information displayed in the "Find A Doctor."

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Upon Completion of the Program, participants will:
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- Understand the development of the latest techniques in hair restoration surgery and when they are best utilized for the patient.
- Evaluate the efficacy of hair loss medications and how to effectively use them in conjunction with surgery.
- Learn the various forms of alopecia, diagnosis techniques and the best approach to relevant treatments both medical and surgical.
- Comprehend the current data in genetic and medical research and its impact on hair restoration and patient care.
- Understand the various surgical techniques and their appropriate use with emphasis on follicular units, follicular extraction, scalp reductions, extenders, etc.

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Hair transplantation into scars

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Introduction

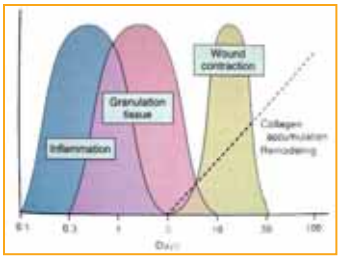
Hair transplantation into scar tissue has been noted to be unpredictable in outcome. This appears to be especially so if the scar is thickened or tethered to underlying structures. An understanding of basic wound healing has led me to believe that simple changes in instrumentation used to create the recipient sites will optimise graft growth. There are added benefits in transplanting into scars that are underreported in the literature. A brief mention of some supporting research in this area is made.

Background to Wound Healing

Scar tissue is formed when the extracellular matrix (ECM) is damaged resulting in the development of fibrous tissue. A thin scar will result from primary wound closure, and will have some undamaged ECM that is comprised of collagen (triple helix of three polypeptide chains with tensile strength from cross linking), elastin (creates tissue recoil), cell adhesion molecules (CAMS) (creating blood clot), proteoglycans, and hyaluronic acid (binding a lot of water thereby resisting compression forces).

A thick, mature scar is comprised of dense, non-stretch collagen bundles with poor blood supply. This is more likely to occur where there is more damaged ECM, as an intact ECM is necessary to allow cells to migrate to the injured site.

After a recipient site is made in a scar, the same wound healing process takes place as in normal skin. As illustrated in the graph, there is an inflammatory phase during the first three days during which time there is swelling due to vasodilatation to allow inflammatory cells to migrate in and out to the injured area. This is then followed by the development of granulation tissue, wound contraction from day 3 to 30, and eventually remodelling of the tissue, which can take 10 to 12 months to complete.



Source: Clark, R.A.F., ed. The Molecular and Cellular Biology of Wound Repair, 2nd Ed. New York: Plenum Press, 1996.

Transplanted follicles take up "space." Results from OLSW Density Studies in 2004 showed that transplanted follicles take up space. This is not surprising, but it is frequently overlooked. In the accompanying diagrams, the follicles were transplanted at 50 per cm², yet a year later, the measured density would be closer to 40 per cm², due to expansion of the 1 cm² test area to 1.21 cm², an increase of 21% in the size of the test area, as measured by the tattoo marks (Figures 1 and 2).



Figure 1. Transplanting 50 sites per cm². Tattoo marks are 10mm apart.



Figure 2. Follow-up 12 months later. Tattoo marks are now 11.5mm apart.

Effects of scar behavior on newly transplanted hair follicles. How do these three factors, non-stretchy scar tissue, post-surgical edema, and follicles occupying space affect the newly transplanted hair follicles in the scar tissue? The most likely scenario is that there is an increase in intra-scar pressure, more so in hypertrophic scars, resulting in death of the follicles in the first three days post-operatively.

Change in instrumentation. Of these three factors, the one that is easiest to alter is the size of the recipient site. Over the past 8 years, I have regularly used small punches to remove tissue and create recipient sites in dense scar tissue. It creates space for the graft and post-operative edema, so there is no pressure on the graft, and oxygen can diffuse easily.

An added benefit is that the punch debulks the scar. If a 0.7mm punch is removed from each 1mm², 38.5% of the scar is removed (πr^2). If 0.6mm punch is removed, 28.28% of the scar is removed.

Full thickness grafts "conditions" scars. Patient follow-up one year after surgery suggests a reversal of scar tissue back toward normal skin architecture. Reports include increased skin-like texture and pinkness from angiogenesis, increased mobility and pigmentation, and decreased bulk of the scar, most noticeable in hypertrophic scars.

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In personal discussions with Dr. Ralf Paus at the Bahamas meeting, he told me that injury to a scar causes it to return to a more embryonic stage, whereby it can remodel itself. With the insertion of hair follicle, which is essentially a full thickness skin graft full of stem cells, it is not surprising that these positive changes occur. Dr. Paus's comments concur with my own research on scar behaviour; fenestrating large contracted scars with a series of punch holes leads to more mobility and comfort for the patient when healed. The only category in this research that gave better outcomes was where hair follicles with dermal papillae removed (to try to avoid scalp hairs growing in these large body scars, which was largely successful) were transplanted into the punch holes.

Dr. Paco Jiminez-Acosta reported at the Bahamas meeting that he had placed hair follicles into long-standing varicose ulcers with resulting healing. This is as I would have expected, given my own experiences.

In dealing with hair follicles and their associated stem cells, we are in a perfect position to use these amazing cells in other ways to treat other conditions. There will be other areas where we can apply our considered knowledge to help other patients.

Patient 1 had a history of prior flap necrosis that was first transplanted using blade sites with little ensuing growth (Figure 3). The second procedure was made with a 0.7mm punch and



Figure 3. Patient 1. History was of prior flap necrosis which was first transplanted using blade sites with little ensuing growth *(top)*. The second procedure was made with a 0.7mm punch and grew well *(bottom)*.

grew well. Patient 2 had mixed trauma of partial and full-thickness scarring posteriorly (Figures 4). Sites were made with a 0.7mm punch posteriorly and blade sites anteriorly.

Patient 3 had a history of burn during laser hair removal. This was subsequently rectified with a continuous W-plasty, which in time became widened and sunken. It was transplanted using a 0.7mm punch with donor sub-mental beard hair (Figures 5).



Figure 4. Patient 2. Mixed trauma of partial and full thickness scarring posteriorly. Sites were made with a 0.7mm punch posteriorly and blade sites anteriorly.



Figure 5. Patient 3. History of burn during laser hair removal. This was subsequently rectified with a continuous W-plasty that in time became widened and sunken. It was transplanted using a 0.7mm punch with donor sub-mental beard hair.

General Rule for Instrument Choice

- If scar is thin, pigmented, mobile and pink, use blade incisions.
- If scar is thick, white and immobile,use 0.6-0.7mm punch to de-bulk.

Follicle Killing Combination

- Non-stretch scar
- Space-occupying follicle
- Post surgical oedema

May lead to DEAD FOLLICLES in the first 3 days

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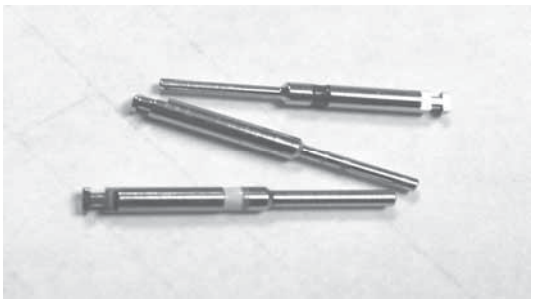


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Call for Editors for the 2014–2016 ISHRS *Forum*



We are looking for two ISHRS physician members to fill the positions of *Forum* Co-Editors for the term 2014–2016, which equates to 18 issues. These are uncompensated, volunteer positions, but very rewarding nonetheless!

Interested members should forward an e-mail to ISHRS headquarters office and Victoria Ceh, ISHRS Executive Director, at info@ishrs.org and vceh@ishrs.org by June 1, 2013, indicating their interest. The Executive Committee will review all candidates and make a determination at its June 2013 meeting. Candidates will be notified in July.

Duties

- To produce 6 issues of the *Hair Transplant Forum International* per year within the pre-established timeline. The *Forum* is the ISHRS's official publication. It is not peer-reviewed and is considered a newsletter.
- The co-editors may wish to alternate issues as the "lead" editor, thus, serving as the lead for 3 of the 6 issues per year. The "lead" editor can expect to spend 10–20 hours per issue. The non-lead editor can expect to spend 4–6 hours in helping with proof review.
- One of the two editors should serve as the primary point person in regards to submitted articles from the membership. All articles are required to be submitted electronically via e-mail. Staff at ISHRS headquarters provides copy relating to Society announcements.
- Each co-editor writes a "Message from the Editor" on any topic he or she wishes for each issue.
- Co-editors have the discretion to determine which articles to include.
- The physician co-editors work with the Managing Editor (staff person), Cheryl Duckler, by forwarding the articles to include for a particular issue. The Managing Editor lays out the issue and both co-editors review the proofs, which are e-mailed as a PDF file before signing off to go to print. The printing and mailing is handled by ISHRS staff.

Qualifications

The editor must:

1. be an experienced hair transplant surgeon;
2. have experience in publishing papers in the *Forum* or in any other peer-reviewed journals or textbooks, because this experience gives you familiarity with the reviewing process of papers;
3. appreciate the diversity of approach represented by members of the ISHRS and not show favor to any particular "niche" technique;
4. have the ability to write easily and fluently in English;
5. be computer and e-mail literate and not have to rely on a secretary as an intermediary (or work will grind to a halt after office hours, when most of the editors' work is usually done); and
6. be organized and adhere to deadlines.

Send e-mail indicating intent, and include qualifications and C.V., to Victoria Ceh at vceh@ishrs.org and info@ishrs.org by June 1, 2013, to be considered for the position of *Forum* Co-Editor.

Deadline for Application for 2014–2016 *Forum* Editor: June 1, 2013

Hair's the Question

Sara Wasserbauer, MD *Walnut Creek, California, USA* drwasserbauer@californiahairsurgeon.com



Okay! Time to see who has been paying attention! In the September/October 2012 (Volume 22, Number 5) issue, several of our esteemed Editor Emeriti took the time to point out one article from their tenure that they regarded as significant. Many of these I had read in fellowship, but some I did not—however, taken together they provided a refresher course combined with a best practices manual of sorts. These articles should be considered required reading. I highly recommend going back and perusing this issue (if you have not read it already cover to cover). For those of you who HAVE done the reading, here is a POP QUIZ!

1. In 1997-99, Seager and Beehner reported that

A. survival rates of chubby grafts were superior to that of skinny grafts by significant and reproducible margins.
B. survival rates of skinny grafts such as those obtained via FUE were equivalent to those obtained via the "strip" method.
C. extra hair growth (i.e., above 100%) in hair studies was due to reactivation and growth of previously dormant telogen hairs.
D. preservation of the dermal papillae in grafts was important for optimal graft survival

2. In investigations by Cooley in 2004, ischemia reperfusion injury (IRI) was

A. proven to be nonexistent as long as grafts were kept in chilled saline and re-implanted in 6-8 hour time frame.
B. determined to be a possible source of suboptimal growth in an otherwise normal hair transplant.
C. eliminated by using HypoThermosol® and keeping grafts at room temperature.
D. measured in the recipient tissue only using a check for free radicals called the MDA assay (which is also used in the field of organ transplantation).

3. The idea of larger hair transplant sessions was explored in the *Forum* by Seager in 2002 and

A. was hypothetically worse than several smaller sessions due to the "micro-scarring" that could result.
B. typically involved taking donor area anterior to the superficial temporal arteries and in excess of 30cm^2 (i.e., commonly >3,000 grafts per session).
C. covered approximately 1/3 of the patient's frontal bald area to an average density of 37 FU/cm^2 with approximately 3,000+ grafts.
D. was noted to often be worse for the patient due to the increased length of the surgery, anxiety for the patient, and scarring at the donor areas.

4. Which of the following is an accurate quote from Seager's 2002 *Forum* article discussing the "one-pass hair transplant" technique?

A. "Staff selection and training is the least difficult but most expensive component of the whole enterprise."
B. "It is better to first provide an aggressive prediction than it is to underpromise."
C. "Bleeding and popping, while tolerable nuisances in small or intermediate-sized sessions, can cause almost insurmountable difficulty in a large megasession."
D. "The decrease in convenience for the patient of the one-pass technique is enormous."

5. According to Abbasi's 2005 article, which of the following was the most effective method for preventing post-operative edema?

A. Oral steroids (30mg prednisolone pre-op, 25mg procedure day, 20mg post-op day 1, 15mg post-op day 2, 10mg post-op day 3, 5mg post-op day 4)
B. 45-degree sleep angle with oral steroids
C. Vertical sleep angle with tumescent steroids
D. Tumescent steroids, although all steroid treatment groups had more effective prevention than physical preventive methods

6. Hwang was able to show which of the following about recipient site influence on transplanted hair?

A. It does NOT change the volume of the transplanted hair follicles.
B. It is minimal with donor dominance accounting for the majority of growth characteristics post-transplantation.
C. It can cause the transplanted hair to have generally higher survival rates and growth rates.
D. It did not alter the internal clock of the grafted follicles.

7. In 2008, Paus theorized which of the following?

A. Stem cell therapy would be the definitive treatment for hair loss due to androgenetic alopecia in the next few decades.
B. Hair transplantation would continue to play a role in the treatment of hair loss.
C. Immune privilege restoration therapy held more promise for reversing hair loss than the oft-touted stem cell therapies.
D. Vellus to terminal hair conversion would be the most promising area of new research since it was likely that the absolute number of scalp hair follicles in MPHL is not reduced.

8. Several of the "small details" laid out by Ruston in 2010 as making a great positive difference in hair transplantation included

A. checking in with the patient as little as possible throughout the operative day so as not to disturb him or her and to protect the patient's privacy.
B. allowing the patient to read books, speak on his or her cell phone, or use personal computing devices during graft placement.
C. using the trichophytic closure, absorbable SQ suture, and strong massage in the donor area during donor anesthesia.
D. shaving the recipient area as well as the donor area to allow the hair to grow in at the same rates thus camouflaging the fact that the patient had a hair transplant surgery.

⇨ *Answers on page 62*

Hair's the Question

from page 61

1. **A.** The numbers are Seager 89% survival vs. 113% and Beehner 103% vs. 133%. Seager and Beehner reported their findings in 1999, before significant comparative studies for FUE grafts were available. Growth above 100% may be accounted for by telogen hairs, but has not been proven although it seems the most likely explanation. D may be true but was not studied by Seager and Beehner.
2. **B.** B is true and this important research seems to receive less attention than one might expect. The other answers are incorrect because for optimum growth, grafts should be stored in a chilled solution, re-implanted within a 6-8 hour time frame for optimal survival, and were shown to have less IRI (as measured by the MDA assay in the grafts not recipient tissue) when preserved in a holding solution (such as HypoThermosol) instead of saline.
3. **C.** A single "megasession" seems so normal in hair surgery that it is revelatory to read the evolution of this technique. Seager's insights included that the single large session might be hypothetically better than several smaller sessions due to the "microscarring" that could result. Even now, his observations that densities not greater than 40 FU/cm^2 (he mentioned 37 was his average), sessions not often greater than 3,000 grafts usually covering the anterior one-third of the scalp, and removal of donor area not more than 28cm in length, 1.2cm in width, and posterior to the superficial temporal arteries are relevant and concurrent with standard arguments for best practices! While the increased length of the surgery was true, these larger initial surgeries reduced patient anxiety and donor scarring.
4. **C.** All quotes other than C have been altered (by me) to imply the opposite of Seager's quote.
5. **D.** Of the steroid treatment groups in this statistically powerful study (N=372, tumescent steroids were the most effective while oral steroids were the least. Note that of the physical prevention methods studied, the vertical position was, not surprisingly, the least successful.
6. **A.** Recipient site was shown to influence graft survival rates (generally lower), growth rates (which may change immediately after transplantation and maintain according to recipient site), and hair cycle (i.e., the internal clock of the grafted follicles). Also noted in the article was the fact that skin thickness and vascularity influence growth and survival. The donor characteristic that remained constant was hair follicle volume, but other aspects showed "a significant role for recipient area influence."
7. **B.** Although all of these areas seem promising, this article reiterated that our surgical skill will not soon be obsolete.
8. **D.** I must admit, I snickered to myself as I wrote this question. ◆



How I Do It

Bertram Ng, MBBS *Hong Kong* ngbertram@yahoo.com.hk



Dr. Park states that "it is important to adjust the depth of recipient sites to the length of grafts." In the July/August 2012 *Forum*, Dr. Tommy Hwang warned that improper depth controlled graft placement can occasionally result in problems such as pitting, tenting, folliculitis, and cysts. His study showed that there are significant intra-patient graft length differences.

I would like to share with you a personal "nightmare" case. I hold the hypodermic needle with a Vari-handle to make incisions. As is usual, I asked the nurse to measure the length of the grafts and set the needle depth. This was a 2,400-graft case. After making all the incisions, we started the insertion with forceps, only to find out that the incisions were not deep enough! Many grafts had the upper segment exposed and easily popped out.

What happened? The assistant had only measured the length of the shorter grafts. Unfortunately, most of the grafts were longer than that. Because resulting dehydration and popping would lead to poor graft survival, I had no choice but to deepen all the incisions (except the 1-hair FUs). Bleeding was more massive because the tumescense had dispersed. Worst of all, I lost track of which holes I had reinserted the needles. It was quite a traumatic experience.

From a practical point of view, it is easier to make incisions deep enough to accommodate the longest of grafts. You can always pull the shorter ones out a bit during the final check to avoid pitting. We are glad to have Dr. Park introduce his simple technique for setting the depth control.

Handy tips for slit depth control

Soo Ho Park, MD, Jung Wook Hwang, MD, Sung Jae Yi, MD *Seoul, Korea* hairsurgeon@naver.com

It's important to adjust the depth of recipient sites to the length of grafts. There are several methods to adjust the incision depth with the hypodermic needle such as bending the needle at a right angle or putting the needle into a special cap. Because the hypodermic needle tip becomes blunt easily, dozens of needles are needed. Bending a needle is inconvenient to use and it is difficult to make needles with the same length. In addition, a special cap is quite expensive.

When we make the recipient sites, we use hypodermic needles. There are two materials we use to adjust the depth. One is a tube of a scalp vein set (butterfly needle set) and the other is a disposable plastic coffee stick (Figure 1). After the graft's length is measured (Figure 2), the materials are cut into the adequate length. Next, the hypodermic needle is placed into the materials. The needle tip exposed is the same length as that of the grafts (Figure 3). The tube can be fixed on the base of the needle (Figure 4). The hole of the coffee stick must be narrow enough to securely fit the needle.



Figure 1. Scalp vein set (left) and Coffee sticks (right).

There are pros and cons to using these materials. With the tube, the incision could be made deeper than expected due to the elasticity of the tubes. Second, it makes the field more bloody because the blood that entered the tubes can flow back from the tubes when we make incisions. These problems, however, do not happen with a coffee stick. The other way, the cutting edge of the coffee stick can make superficial injuries around the incision site (Figure 5). Therefore, the cutting edge should be trimmed bluntly.



Figure 2. Measuring the follicular length.



Figure 3. Adjusting the guide materials.

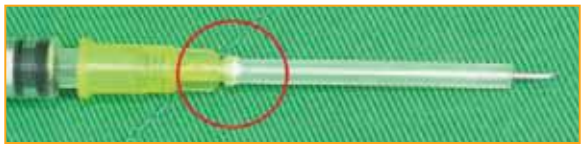


Figure 4. The tube can be fixed on the base of the needle.

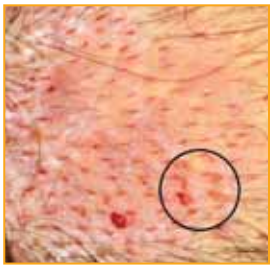


Figure 5. A sharp cutting edge of the coffee stick could injure the skin (black circle).

We think this could be one of the simplest and most cost-effective methods for making recipient incisions with good depth control.◆

Cyberspace Chat

Sharon A. Keene, MD *Tucson, Arizona, USA* drkeene@hairrestore.com



Topical minoxidil and association with cardiac arrhythmia

In the face of recent, albeit scientifically flawed, adverse publicity regarding finasteride for the treatment of hair loss, more patients than before seem to be opting instead for topical minoxidil therapy. While this treatment for hair loss does not require a prescription, there are some important caveats to keep in mind when recommending it. I met a patient some months ago who reported that after a month of using topical minoxidil he had experienced an episode of ventricular tachycardia, which required cardioversion and resuscitation. He had been advised by his doctor never to use it again, and has not experienced another episode since that time. I was surprised by the serious nature of this ectopy and its reported association with topical minoxidil, and inquired if other hair restoration surgeons had seen or heard reports of anything comparable.

The following anecdotal reports were provided in regard to cardiac rhythm side effects from topical minoxidil:

Dr. Jennifer Martinick had this to share: "Palpitations only, which ceased when minoxidil stopped. One went to the hospital and was told he had hypotension."

Dr. Ken Washenik had these comments: "I have had a number of patients complain of 'palpitations' from using topical minoxidil. It always stopped when they discontinued it (and recurred with re-challenge), but I never had a patient undergo a cardiac evaluation while they were experiencing this."

Dr. David Perez recounted findings from a minoxidil study group: "No, I haven't seen any cardiac arrhythmia with minoxidil. I recall one of our studies with Pfizer 6-7 years ago in a group of male patients treated with minoxidil 5% or different concentrations, all had blood tests and echocardiograms. As I recall, though, none of them had cardiopulmonary issues as side effects."

A physician patient of Dr. Shelly Kabaker illustrated a potential hazard of high dose topical minoxidil: "Many years ago when we were compounding minoxidil solutions, I had a physician patient who was having syncopal episodes on a 15% solution applied topically. He was definitely hypotensive, but we never did any cardiac tracings."

Dr. Ron Shapiro reported a similar observation of infrequent cardiac arrhythmia side effects, one of which was also from a higher than approved dose of topical minoxidil: "I have not heard of anyone having V-tach. I have heard of people having palpitations and stopping it because of that. But none had documented Holter monitoring to see what the rhythm was. I was never sure if they were just anxious, had a little low BP, or a true S.V.T. I have only had patients tell me this history 2-3 times in many years. One of them told me they were using a much higher 15% topical dose he received from a private source."

Finally, Dr. Brad Wolf noticed a greater frequency or rhythm disturbance than others: "I have one or two patients a year complain of side effects from minoxidil, mostly rapid heart beat. In some, I think they say so as an excuse not to use it. The prototypical patients who have tachycardia are usually thin and slightly built, sometimes runners. I think these men (don't remember seeing it in women) are borderline hypotensive at around 90/60. With slight systemic vasodilation, their HR increases enough to cause symptoms. In some cases the BP decreases. It seems to be a common theme. Proves there is absorption."

Discussion

The reports of cardiac arrhythmia associated with topical minoxidil in this small but highly experienced group of hair restoration surgeons reflects the clinical observations of many decades and patient/years of this therapy. The fact that topical formulations in the U.S. and many other countries do not require prescriptions or medical doctor oversight implies to the public and medical profession that there are minimal risks of adverse side effects. However, because hair restoration doctors and dermatologists are often consulted for advice regarding this particular hair loss treatment, it seems important to know if there is a group of patients who may be more prone to the potentially serious side effect of cardiac arrhythmia.

A review of the medical literature yielded only two articles dealing with the subject of topical minoxidil therapy and cardiac side effects. The first was a small, placebo controlled study of 35 men with visible signs of androgenetic alopecia divided into a treatment group (n=20) with 2% topical minoxidil vs. placebo (n=15), and was coauthored by our esteemed colleague, Dr. Walter Unger. After 6 months both groups were evaluated with echocardiograms; those in the 2% topical minoxidil group were seen to have statistically significant increases in heart rate (3-5 beats/min) and cardiac output (0.5-1l/min), compared to the placebo group. There were no reports of arrhythmia in this study. The authors concluded that healthy men would tolerate these changes, but those with ischemic cardiac disease may be at risk from an increased work load caused by the drug's systemic absorption. Importantly, however, the authors noted that plasma drug levels were not measured and so could not correlate this with their findings.[1]

The second article was a case report in the *Japanese Heart Journal* in 2000 discussing a myocardial infarction temporally associated with topical minoxidil therapy for hair loss. The patient was a 45-year-old smoker with a history of paroxysmal atrial fibrillation, and a coronary angiogram that revealed previously asymptomatic but significant stenosis of the left anterior descending artery. The authors acknowledge an inability to prove causality in their case, as the patient had clear physiologic reasons for an MI to occur. Nevertheless, they speculate that topical minoxidil may possibly have contributed to the onset of his acute myocardial infarction via systemic hypotension or elevated sympathetic activity caused by the latter.[2]

While these articles are suggestive of cardiac influence in some patients, neither addresses the subject or observation of cardiac arrhythmias or palpitations induced by topical minoxidil. In the several reported cases seen in our peer group, including mine, where patients experienced an arrhythmia that did not re-occur after cessation of topical minoxidil, causality is highly suspected. However, in a more recent 2004 placebo controlled trial (n=382) comparing 2% and 5% topical minoxidil solutions in women, palpitations were reported in 1% of each treatment group, but in 3% of the control group, suggesting no causality in this controlled study population.[3] Notably, however, none of the episodes of palpitations in either the treatment or the control group were evaluated with ECG, echocardiogram, or Holter monitoring in order to know if the palpitations were clinically equivalent. That a serious arrhythmia such as ventricular tachycardia can occur, as it reportedly did in my patient, has not been previously reported in the medical literature.

The clinical scenario most reported among our peers was that when palpitations occurred and stopped with cessation of medication, there was no EKG or Holter monitor tracing to establish the nature of the palpitations. An interesting report on the evaluation of patients with palpitations suggests that associated symptoms such as syncope and dizziness warrant more aggressive investigation, and can be symptoms of either supraventricular or non-sustained ventricular tachycardia. These are also usually rapid and regular. Rhythms that are rapid and irregular suggest atrial fibrillation, atrial flutter, or tachycardia with variable block. If patients present with reports of palpitations while using topical minoxidil, in addition to discontinuing the possible cause (i.e., topical minoxidil) a full personal cardiac history, including family history, is necessary to determine if further evaluation is warranted.

Patients at high risk for cardiac arrhythmia should be discouraged from any non-essential exposure to potentially arrhythmogenic stimuli. These include patients with organic heart disease, such as scar formation from myocardial infarction, idiopathic dilated cardiomyopathy, significant valvular or stenotic lesions, or hypertrophic cardiomyopathies. All of these cardiac entities have a known association with the development of ventricular tachycardia. Other high-risk factors include a family history of arrhythmia, or sudden cardiac death, cardiomyopathy, or the long QT syndrome.[4] The latter is associated with inherited genetic defects in cardiac conductivity. Some medications can lengthen the Q-T interval and upset heart rhythm, including certain antibiotics, antidepressants, antihistamines, diuretics, heart medications, cholesterol-lowering drugs, and diabetes medications, as well as some antifungal and antipsychotic drugs. However, people who develop drug-induced long QT syndrome may also have some subtle genetic defects in their hearts, making them more susceptible to disruptions in heart rhythm relative to taking the aforementioned medications.[5,6]

Recommendations for evaluation in patients with palpitations include a baseline 12 lead ECG. If no evidence of heart disease is found, or if the palpitations are not sustained or are well tolerated, ambulatory monitoring can assist in making a diagnosis. Given that normal sinus rhythm is found in up to one-third of patients with palpitations, in patients who are at low risk with no history of organic heart disease or a family history suggestive of propensity for rhythm abnormalities, a costly work-up is apparently not warranted,[4] particularly if the arrhythmia has resolved.

Conclusion

Topical minoxidil is a safe therapy for treatment of hair loss in most patients. Patients with known organic heart disease are at higher risk for arrhythmias in general, and should be made aware of the small risk of this side effect due to topical minoxidil use. Even for patients whose symptoms resolve, palpitations may be a harbinger of underlying organic disease, including unrecognized long Q-T syndrome, and they should undergo at least a 12-lead ECG. Persistent palpitations despite cessation of topical minoxidil therapy warrant more aggressive evaluation for etiology and therapy.

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ISHRS Research Grants Available

The annual ISHRS research grants with amounts in the range of $1,200 to $2,400(USD) per grant.

The deadline for grant applications is **July 15, 2013**

Further information and a full application can be obtained on the ISHRS website at

www.ISHRS.org/member-grants.htm

Controversies

Russell Knudsen, MBBS *Sydney, Australia* drknudsen@hair-surgeon.com



Does FUE change donor planning?

Does the choice of FUE as the donor harvest technique change the planning of the donor harvest? In addition, though it seems self-evident that the different techniques of donor harvesting don't really change the recipient site planning, is this true in all scenarios? We'll come back to this subject shortly.

Let's first consider the rationale of strip harvesting. In this technique, we harvest *all* the donor hairs in a selected area. If we choose the strongest donor hairs from the "safest" zone, we can be more confident of the longevity of the result. This makes it an efficient harvest of the safest zone. Post strip harvest, there is minor thinning of surrounding areas but the same area can be re-harvested including removal of the previous linear scar.

Let's now consider the rationale of FUE harvesting. In this technique, we *partially* remove hair from the donor zone. The harvest is typically in the 25-35% range of available hairs. Over harvesting of any individual area produces a significant variation between donor zones leading to the desire to harvest the stronger areas in future surgeries. This is unlikely to be a problem in smaller cases with small harvests, but in extensive balding requiring large harvests, this theoretically creates a problem.

If you harvest at 25%, then you must use 4 times the area of donor zone compared to a strip harvest for the equivalent number of grafts. A 35% harvest requires approximately 3 times the area. In extensive balding, requiring a large number of grafts, this mathematical fact, combined with the desire to produce an even thinning of the donor zone WILL require harvesting of less-safe donor areas.

The downside of this requirement is that future balding may encroach into a harvested donor zone. This may then result in loss of grafts via balding. In addition, harvesting into a future balding zone will expose FUE scars as the balding progresses.

So, how do we deal with this potential problem? It is my view that extensively bald, younger patients should be encouraged to maintain long-term medical therapy to limit further possible hair loss. They should be properly warned as to the possibility of future thinning of some of the grafted hairs. This is probably wise, regardless of donor harvesting technique, to prevent extension of the balding area. However, with FUE it may also act to preserve the grafts harvested from the less safe areas and reduce the possibility of unmasking of FUE donor scars. This approach, if it has permitted the surgeon to leave the safe zone, requires long-term, mandatory use of finasteride, which is a consideration requiring careful thought.

I do not believe that choice of donor technique changes any absolute contra-indications to surgery, but may influence relative contra-indications to surgery. Consider a young man (less than 30 years) developing extensive balding (Norwood VI or higher) who also presents with anterograde thinning from the nape of the neck. The sheer restriction of available donor will limit the number of safe donor grafts that could be harvested by FUE whereas, theoretically, a larger number of grafts could be harvested from the safest donor by strip. In this scenario, more could be achieved by strip than FUE.

Does any of this influence planning of the recipient area? I believe it can in the case of FUE, because we need to consider the possible impact of "non-safe" hair grafts being potentially placed into cosmetically significant areas such as the hairline. Perhaps the solution to this problem, as has been suggested by some physicians, is to ensure that any grafts harvested via FUE from potentially unsafe donor zones are deliberately placed into less cosmetically important areas of the recipient area.◆



Meetings and Studies

David Perez-Meza, MD *Mexico City, Mexico* DrDavidPM@permanenthairsolutions.com



The 4th Annual Saint Louis workshop was held at the excellent facilities of the Saint Louis University School of Medicine and organized by Dr. Sam Lam. It was another successful meeting. There were 74 participants including faculty, physicians, and assistants. It included the latest High Definition Live 3D lectures and surgery dissection, and an extensive hands-on Cadaver Workshop.

"Thank you" to Dr. Paul Cotterill for his excellent summary.

Review of the 4th Annual Saint Louis University Hair Transplant 360 Cadaver Workshop, November 15-18, 2012 • St. Louis, Missouri, USA

Paul Cotterill, MD *Toronto, Ontario, Canada* paul@drcotterill.com

The 4th Annual Saint Louis University Hair Transplant 360 Cadaver Workshop was organized by Dr. Sam Lam and was a big success. This year there were 74 attendees including physicians, faculty, and assistants. Nine countries were represented including Russia, Finland, Ecuador, and Brazil.

The meeting, which is aimed at the beginner and intermediate-level hair restoration surgeons and technicians, included an extra day this year to give added educational opportunities.



Bessam Farjo marking the hairline.



Workshop faculty and participants.

The first day included basic principle lectures on medications, hairline design and anatomy, the consultation and selection of appropriate patients, as well as how to select and train technicians. For the first time ever at a hair scientific meeting, Dr. Lam introduced the use of a 3-D high-definition camera system that used optics designed by James Cameron. This camera remained on the stage in front of the attendees in the audience and was used throughout the meeting both in the mornings and during the didactic lectures. On the first day of the meeting, Dr. Bessam Farjo had attendees with varying stages of hair loss brought up on stage to illustrate how to design a hairline utilizing the 3-D camera system. Audience members wore 3-D glasses during the demonstrations that provided a unique 3-D experience. During the first afternoon, two hours of high-definition video of Dr. Farjo's surgeries were presented using a stop-and-go format so that Dr. Farjo could explain the surgery and field questions.

Friday and Saturday continued with the use of the high-definition camera system during the didactic lectures in the morning to illustrate recipient site creation, hairline design, dissection techniques, and FUE and strip harvesting, as well as eyebrow and eyelash design. In the afternoons, the physicians and technical assistants were split into two groups. The physicians spent time in the hands-on cadaver lab with the physician faculty. They were able to use cadaver heads to design hairlines, remove strip grafts, practice FUE, and practice surgical suture technique. Foam models and live participants were also utilized. In the adjoining room, the technicians each had stereoscopic microscopes that they were able to learn to use and to practice slivering and dissection techniques. They also practiced placing grafts. The entire setup at the Saint Louis University Practical Anatomy and Surgical Education lab was state-of-the-art.

Sunday morning was spent reviewing some of the major points that were brought up during the previous three days. The physician faculty was on stage to discuss the approach and handling of difficult cases as well as how to manage complications. In addition, there was a very good instructional segment that discussed how each faculty member performed a specific technique and their own individual approaches to hair restoration. This enabled the attendees to see that there is variation in the practice of hair restoration surgery and that many roads can lead to an excellent result. An overriding principle that was maintained during the 3½ days was to present to the attendees ways of performing hair transplantation that would keep them out of trouble and to approach hair restoration in a safe, cosmetically appropriate manner.◆

If you are interested in attending this year's workshop, go to:

http://pa.slu.edu

November 14-17, 2013

Letters to the Editors

Re: Help Hair. Does it grow hair? Giving new ideas a chance.

Jennifer H. Martinick, MBBS *Perth, Western Australia*
jennifer@martinick.com

At the Istanbul meeting in 2011, Dr. Larry Shapiro from Florida lectured on a specially treated whey protein concentrate with added known vitamins and herbs in conjunction with a low androgen profile, which, he alleged, when given to bodybuilders, could encourage muscle growth while not losing hair due to elevated DHT levels.

Since that time, it has been offered to men and women with hair loss, particularly those with post-menopausal and post-pregnancy thinning, and as a post-workout protein shake.

It contains no whey protein isolate or growth hormones that Dr. Shapiro feels can contribute to hair loss.

It is common knowledge that taking anabolic steroids and some other androgen supplements such as androstendione can cause hair loss in susceptible men. Dr. Shapiro also feels creatine, branch chain amino acids, and many other supplements can cause hair loss as well.

I reasoned that if, as I suspect, stress, smoking, regular marijuana use, and certain oral medications can cause hair loss, why shouldn't there be an alternative that actually makes hair grow?

Dr. Shapiro has obviously given many years to thinking about this and has a daunting biochemical chart that covers the different pathways how hair loss may happen. It is complex and I don't fully understand it now.

However, we are becoming more aware of other effects of the environment and epigenetics on our well-being, and it is only by having an open mind that we can consider whether something new will be beneficial or not.

My scepticism of Help Hair as a treatment has made me progress slowly in offering it to patients, just in case it may not benefit.

Over the past 18 months, this protein concentrate has been given to many men and women throughout the world complaining of hair loss. At this point in time there have been no proper scientific trials on its use; rather multiple doctors in various countries who are frustrated by the lack of proper treatment regimes, especially for women, have been giving it to their patients in the hope that some will benefit from it.

I believe that there is something to the components in this product. Some patients, in my experience, have had remarkable improvement in their hair and nail growth; some, little improvement. No medication can be a panacea for all hair loss.

Some outstanding results that I have personally observed:

1. A female with alopecia totalis of 12 years standing regrew three-quarters of her hair in the last nine months and now is feeling physically stronger leading to a more positive outlook on life.
2. One man who was transplanted in 2007 suffered rapid hair loss in late 2011 shortly after commencing a whey protein isolate in association with attending the gym. Four months after ceasing this product and taking Help Hair, his hair returned.
3. More hair continues to grow after transplant without passing through anagen effluvium.
4. If transplant patient has shock loss, it is followed by complete regrowth in 3 months.
5. Thicker, healthier hair and stronger nails in both men and women.

Patients on their own volition keep buying more as they feel the benefits.

I recognise that these results are anecdotal and may be due to some other factors, such as natural resolution or previous poor protein intake, but I now have commenced a proper clinical trial to establish scientific evidence of the above subjective observations:

That is: Can Help Hair assist some of our patients?

I would encourage other doctors throughout the world to undertake similar studies to attain a multi-centred result.

Editor's note: There is no doubt that external factors exert an effect on many body systems including hair growth and hair loss. There is now much in the literature about epigenetic effects, free radical effects, and other stress-related consequences. However, as doctors and scientists, we do need to have a reasonable measure of the effect of something that we advise our patients to take. The issue that I have with the description above by Dr. Martinick is that it is based on the perception of better growth without any tangible measurements. The results that have been seen so far have to be based at least on standardised global photography.

To address the examples of patients described in the letter:

As Dr. Martinick herself says, the first case of alopecia areata (AA) has no proof that this wasn't a spontaneous recovery and the patients "feeling stronger" could have been due to their more positive outlook once the hair had regrown. A placebo effect may conceivably have produced the same result. Also AA is not related to DHT levels so this doesn't explain why the supplement would work anyway. In the second case, the stopping of the WPI would surely have resulted in decreased hair loss anyway, so again there is no proof that the shake added any benefit. Point 3 needs to have some measures against it. How much "more" hair grows? Is there a baseline against which to judge this increase? Some photos I have seen from other doctors claiming hair growth following the shake are nothing more than the usual stubble that remains *in situ* and isn't expelled until new hair grows. And many of the photos shown as positive results are taken by patients themselves on phone cameras. As far as point 4, one would have to do hair counts and growth rate studies to prove that there is complete regrowth. Again for point 5, it would be nice to see proof of these claims with baseline measurements before and at time points after starting treatment. –NF◆

Message from the 2013 Annual Scientific Meeting Program Chair



Robert True, MD, MPH *New York, New York, USA* drtrue@hairlossdoctors.com

Plans for the San Francisco Annual Scientific Meeting in October are taking shape and promise interesting and stimulating educational opportunities. There's a lot to look forward to.

For newcomers, the Basics Course in Hair Restoration Surgery will again be expanded to a full-day schedule with hands-on stations and, for the first time, an FUE station.

If you are interested in getting some in-depth training on a particular extraction (FUE) device, you will have a chance with new non-CME hands-on mini-workshops on Wednesday, October 23, 2013.

Dr. Vera Price, world-renowned authority on alopecia areata and cicatricial alopecias, will participate in sessions on early recognition of non-AGA and when surgery is appropriate.



San Francisco Travel Association photo by Phillip H. Coblentz

The popular Hairline Design Panel with Dr. Russell Knudsen will return with some new twists. Topics covered will include The Techniques and Pitfalls of Internet Consultation, Repair Strategies, and State-of-the-Art FUT and FUE.

Morning workshops and lunch symposia will again include a variety of in-depth discussions including HT Outcome Improvement (PRP, ACell, storage solutions), Social Media in Marketing, and Complications and Their Avoidance.

If you are interested in what's new around the corner, then you can look forward to the innovative research of Dr. Colin Jahoda's presentation, "Hair follicle cloning, regeneration, and other prospective developments for the transplant clinic—where are we now?" or the exciting insights from Dr. Cheng-Ming Chuong's talk, "Extra-follicular environmental modulation of hair regeneration."

Member participation is really the heart of the meeting and the Annual Scientific Meeting Committee will be reviewing abstracts in March and filling out and enriching the program with your contributions.◆



In fond memory of Arturo Sandoval-Camarena, MD, Guadalajara, Mexico

It is with heavy hearts that we inform the ISHRS membership of the passing of our dear friend and colleague, Dr. Arturo Sandoval, who passed away in January 2013. On behalf of the ISHRS Board of Governors, Past Presidents, and other ISHRS members and friends here are a few of the many tributes that were sent in to ISHRS headquarters:



Arturo with his wife, Cristina, with their children in California, August 2008.

It was such sad and unexpected news to hear of the passing of Arturo Sandoval. Arturo was one of the most creative, generous, humble and sociable leaders in our field. I met him before he was a hair surgeon when he had made a decision to specialize in hair restoration rather than be a facial plastic surgeon. He visited me and a number of the innovators in hair restoration to pick out a pathway for himself. He prophetically told me, even then, that my flap and expander work had limited application. He saw that follicular unit grafting would be his future and the future of the field. He incorporated and modified techniques and practice policy from everyone he visited. He eventually developed his own unique and successful practice and became one of our true leaders. His practice involved key roles for his family and friends. And, his unrelated employees were treated as family.

Arturo saw fit to give back to those who inspired him with his master's workshops. He was kind enough to invite me to three of his workshops where I met so many of you "younger guys". I can state that Arturo's workshop/meetings were the finest educational experiences of my career. He also did pro bono work at his workshops and in between them. I travelled to Guadalajara on 4 occasions to consult and participate with reconstructive pro bono cases that were completed or demonstrated at the workshops. Arturo combined sound clinical, business and marketing principles along with these charitable works. We also learned a great deal about Mexican culture, cuisine and hospitality. The faculty dinners and entertainment have given us lifetime memories.

Amongst the "pearls" I have taken home from Arturo's workshops are the mosquito clamp separation of the donor strip (the predecessor and inspiration for the Haber Spreader), the three section donor strip harvest, the dimensions of cutting room stations, the concept and execution of staged reexpansions of the scalp, and the intensity of the inquisitive and productive minds of John Cole, Tony Mangubat, Ron Shapiro, Bill Parsley, Jerry Cooley, Bill Rassman, Walter Unger, Patrick Frechet, Jung Chul Kim, Jim Arnold, Bob Haber, Marcelo Gandelman, Paul Rose and Russell Knudsen. The friendships I developed will last my lifetime. They would not have developed without Arturo.

My deepest sympathies to Cristina, the children and Arturo's nephew, Hector, who will undoubtedly carry on Arturo's practice.

Sheldon S. Kabaker

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Like Shelly, I remember Arturo's first Masters Meeting as one of the best learning experiences ever. A true leader that was much respected by his senior peers but perhaps under-recognised by the ISHRS.

He was always in the discussions for the Follicles but didn't get across the line somehow.

Arturo and Christina were wonderful hosts and he will be very much missed.

Condolences from Anne and me.

Russell Knudsen

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I have such fond memories of the one meeting I attended in Guadalajara. Watching Arturo's clinic in action with all the staff, listening to Arturo's jokes, and the phenomenal mariachi band performance he arranged for us… unforgettable! I've enjoyed getting to know Hector a little bit and hope he gets more involved in the ISHRS; he will no doubt keep the Sandoval name and reputation alive in Mexico. I offer my condolences as well and wish them the best in this difficult time.

Jerry Cooley

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Horrific and devastating few days. A scary and sobering story.

Every time Arturo saw me, without fail he would break into song of "Besame Mucho." Cristina just smiled as she always does. I'm smiling now as I'm remembering this.

Our hearts go out to the whole family.

Bessam & Nilofer Farjo

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It's hard to believe. He gave so much to our field—far more than the newer members realize. Many of the techniques used all over the world started in his office and in his Master's meetings, and I always felt he never received the honors that he so richly deserved. He will be missed.

Bill Parsley



Arturo Sandoval, Mari Carmen Morales de Bournigal and Bessam Farjo, Cancun, February 2012.

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He was a visionary. The Haber Spreader was born from Arturo's cleverness. Our field is diminished with his absence.

Bob Haber

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I of course echo the accolades and warm memories already expressed. Arturo was a special person and I have even used his "shingle" area concept in discussions with patients and in practice. He is already missed.

This is yet another example of why we should not sweat the small things and enjoy our precious opportunities and friends and family while we are able to do so

Jim Vogel

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I am saddened to hear of Arturo's passing.

Although I haven't seen him in two years, I have fond memories of many insightful discussions on how to improve techniques; in particular was a lunch with Bill Rassman where we worked out how to carry out FUE without shaving the donor area completely—by shaving in thin horizontal rows.

It's amazing how these pearls of wisdom stay with you and although not Earth shattering, help to make for happier patients.

Arturo had one of those brains that could "think outside the box." I will miss him.

My sincere condolences to Cristina and his family.

Jennifer Martinick

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Surgical Assistants Corner



Ailene Russell, NCMA *Charlotte, North Carolina, USA* arussell@haircenter.com

All offices struggle with some similar issues. Time management is always a challenge. Time is important for many reasons, but from the perspective of the practice management, it is a matter of cost effectiveness. In my opinion, this is a balancing act for the supervisors who deal with the employees and their personal problems. It becomes an issue of the human element vs. the idea of being a part of the working machine.

The following is a submission from Deirdre Cullen who works with the HRBR Ltd group in Dublin. Deirdre has been a nurse at HRBR Ltd for just over 2 years and is Deputy Transplant Manager and part of the transplant team. She also manages a team of technicians by taking part in all tasks from design to supporting the purchasing department, and is in charge of stock control and operating theatre.

HRBR has implemented the "Lean Healthcare" technique into their hair transplant clinic. This is a brief overview of how they feel it improved their efficiency and CHANGED their clinic.◆

Hair transplant surgery and continuous improvement of processes using Lean Healthcare methodologies

Deirdre Cullen, RN *Dublin, Ireland* Deirdre@hrbr.ie

With a view to continuous improvement at our clinic, we have introduced the principles and methodologies of Lean Healthcare. Lean thinking was developed in the 1960s from the Toyota Production System in Japan, since then it has successfully been applied to non-manufacturing industries such as financial and healthcare areas. It was introduced to the Western world in 1991.[1]

Lean Thinking

Lean thinking is defined as "a systematic approach to identifying and eliminating waste or non-value-added activities in a process through continuous improvement." This means that by reviewing every step in a process and identifying any wasteful steps or duplication and removing these steps from a process, it will bring about a more efficient process.

Applying Lean in any hair transplant surgery process will utilize less:

- Human effort
- Operational Space
- Capital Investment
- Materials and services
- Time

Applying Lean Thinking

During a hair transplant procedure, most human effort and time is involved in the cutting and planting of grafts. If these processes are critically examined and wasteful steps are identified, graft numbers can be increased and human effort decreased thus benefiting the patient and the staff involved.

It is widely documented that the quicker the grafts are transplanted and returned to the body, the better their survival rate is; therefore, all effort that can speed up these processes will benefit the patient.

We first introduced Lean Thinking in the "cutting" areas, and several steps of the cutting process were improved by rearranging supplies in a "Pull System" and creating flow. The Pull System is a core principle of Lean, where all supplies are arranged and stored in sync with how they are used.

The process of cutting a graft was critically examined. We found that by doing one long cut at a time along the surplus tissue that was being trimmed, instead of several small cuts, we can reduce steps in the process and thus reduce time.

In relation to the planting of grafts, by creating the role of a coordinator to collect grafts from each cutting station and deliver the grafts directly to the hand of the "planter," we were able to reduce the overall time needed to plant all the grafts.

This analysis can be applied to any process in hair transplant surgery, such as donor strip removal, stitch removal, and the design process.

Our latest Lean project involved the process of ordering, stocking, and storing supplies. This has proven to be very successful. Using Lean tools, such as "Kanban," "5S," and "Value Stream Mapping," the process of ordering and storing supplies has been streamlined by the removal of several "non-value-added" steps. This has lead to reduced costs, more consistency of ordering, reduced inventory, and fewer invoices, which has positively impacted administration, increased supplier input, and allowed for appropriate storage.

Figure 1 shows how lean thinking has helped create an orderly

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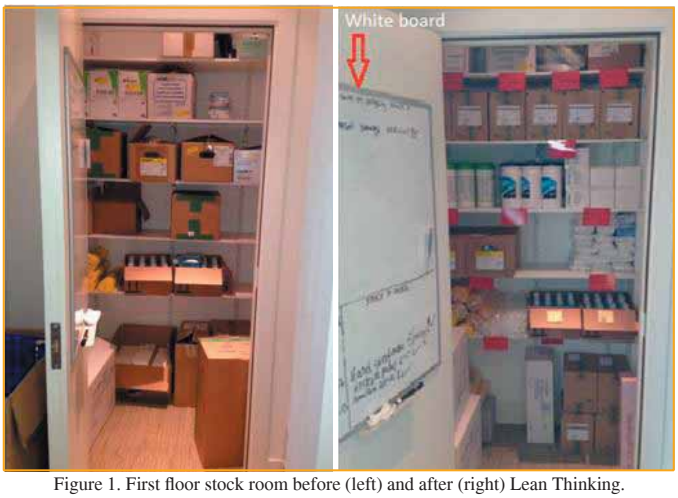


Figure 1. First floor stock room before (left) and after (right) Lean Thinking.

Message from the 2013 Surgical Assistants Program Chair



Diana Carmona *La Jolla, California, USA* karis_137@yahoo.com

I am putting together this year's San Francisco Surgical Assistants Program. I am really excited about this workshop! I believe you will find it interesting and informative. The meeting will be filled with amazing new concepts, helpful hints for both basic and new techniques from our experienced panel. Below are some pictures from this past meeting.



Remember to also sign up for the Surgical Assistants Hands-on Workshop where you will get to experience all aspects needed for a successful career as a Hair Restoration Surgical Assistant. You will benefit from this workshop whether you are experienced or new to this field.

I know there are many helpful hints waiting to be shared!

I welcome any suggestions as to what you think should be included in this program. If you would like to be a part of this program or have ideas to share, please contact me at Karis_137@yahoo.com.

In addition, we always welcome articles to be included in the Surgical Assistants Corner of the *Forum*.◆









system for storing inventory. The Pull System ensures inventory is only ordered as needed in keeping with Lean Thinking. Each item is easily seen and the "Kanban" card, which lets everyone know how much of the item should be in stock, at what point it should be reordered, and how much of the item should be ordered.

This streamlined ordering process has lead to reduced time spent counting stock, and has removed the need to regularly check to ensure there is enough stock for the upcoming surgeries. In addition, it also eliminated the problem of keeping excess stock on hand and the resulting shortage of space.

Since the introduction of Lean Thinking into this area, the ordering of supplies only takes place once every two weeks and the number of suppliers has been reduced by liaising with the most efficient suppliers. Requests for monthly rather than weekly invoices have also reduced the workload for administration staff. The new layout of the storage areas was essential to the overall success of the project as it allowed each item to be easily visible and correctly stored to ensure items were only ordered as required.

Our small team of nurses, technicians, and administration staff, who were involved in this project, concluded that Lean Healthcare can have a very positive impact on hair transplant surgery as in any other area of healthcare.

The multidisciplinary team led to a cross-sectional view of the problems identified, and ensured all aspects of the ordering process were incorporated in the project ensuring compliance with new changes. This is essential to the success of any project.

References

1. Womack, J.P., D.T. Jones, and D. Roos. *The Machine That Changed the World: The Story of Lean Production—Toyota's Secret Weapon in the Global Car Wars That Is Now Revolutionizing World Industry*. Free Press, New York. 1990.◆

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Our rate sheet can be found at the following link: **http://www.ishrs.org/ishrs-advertising.htm**



The International Society of Hair Restoration Surgery (ISHRS) recently reviewed advertisements and other marketing materials directed at dermatologists, plastic surgeons, cosmetic surgeons, family practitioners, gynecologists, otolaryngologists, and other physicians encouraging them to incorporate hair restoration surgery into their practice via a proposed "turnkey" technology. **The ISHRS is concerned that the marketing materials jeopardize patient safety and place physicians at risk.**

The marketing materials offer to sell a mechanized device and provide technicians to perform hair restoration surgery with minimal input from a physician. Hair restoration surgery is a complex cosmetic procedure requiring attention to detail and proper long term treatment planning to ensure patient safety and achieve optimal results. While using non-physician personnel/technicians to perform hair restoration surgery may have economic benefits for a practice, doing so may jeopardize patient safety and create legal liability for physicians. In many if not all States, the harvesting of scalp tissue is considered surgery and/or the practice of medicine. In those jurisdictions, such action by non-physician personnel may constitute the unlicensed practice of medicine, potentially subjecting said personnel, the responsible physician(s), and the practice to civil and/or criminal liability. Furthermore, physicians utilizing non-physician personnel to perform procedures, who fail to notify their professional liability insurance carriers of the same, may jeopardize their coverage in the event of a claim.

Like all surgical procedures, hair restoration surgery must be taken seriously and should be performed only by physicians with the appropriate education, training, experience, and proven competence. Hair restoration surgery can be very rewarding to both patients and surgeons. If you are a physician interested in offering hair restoration surgery to patients, the ISHRS encourages you to diligently pursue the education, training and experience necessary to properly and competently perform hair restoration surgery.

The ISHRS is a nonprofit corporation, exempt from federal income tax pursuant to Internal Revenue Code Section 501(c)(3). The ISHRS seeks to advance the art and science of hair restoration by licensed, experienced physicians; educate and increase the level of knowledge of physicians and their assistants regarding hair restoration techniques, procedures, and related issues; encourage and facilitate the free interchange of ideas, knowledge, and experience among physicians and assistants providing hair restoration; and encourage professional excellence and patient safety in connection with hair restoration surgery.

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- State of the Art Hair Restoration Techniques
- Small Group Discussion Tables on a Variety of Topics
- Approaches to Difficult Cases
- Finasteride Symposium
- Practice Tips and Surgical Gems to Achieve the Best Results
- Advances in Hair Biology
- Hairline Design Panel
- Live Patient Viewing

MORNING WORKSHOPS

- What the Hair Restoration Surgeon Needs to Know – Medical & Surgical Management of Non-Androgenetic Alopecia
  Directors: Vera Price, MD & Marcelo Pitchon, MD
- Corrective Surgery & Strategies
  Director: Jerzy Kolasinski, MD, PhD
- Hairline Design & Recipient Area Planning
  Director: Tony Ruston, MD
- Body Hair FUE
  Director: Alex Ginzburg, MD
- Ethnic Considerations in Hair Restoration
  Director: Kapil Dua, MD

LUNCH SYMPOSIA

- Hair Transplant Complications & Their Avoidance
  Director: Michael L. Beehner, MD
- Question the Experts
  Director: Sharon A. Keene, MD
- Hair Transplant Marketing Strategies
  Director: Bessam K. Farjo, MBChB
- Hair Transplant Outcome Improvements (PRP, Storage Solutions, ECM UBM, etc.),
  Director: Francisco Jimenez, MD

OTHER OFFERINGS

- FUE (Follicular Unit Extraction) Hands-On Courses on Specific Devices
- Basics in Hair Restoration Surgery Course – full day with hands-on stations
- Advanced/Review Course – full day
- Surgical Assistants Program and Dissecting & Implanting Workshop
- Networking Luncheon
- Social program including
  - Optional tours and activities in San Francisco
  - Welcome Reception
  - Annual Giving Fund Reception and Saturday Evening Gala Dinner/Dance
  - After Hours Party & Jam Session

NEWCOMERS ARE WELCOME!

We offer a "Meeting Newcomers Program" to orient those who are new to the ISHRS annual meeting. Newcomers will be paired with hosts.

We want to welcome you, introduce you to other colleagues, and be sure you get the most out of this meeting.

2013 ANNUAL SCIENTIFIC MEETING COMMITTEE

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INTERNATIONAL SOCIETY OF ISHRS HAIR RESTORATION SURGERY

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Upcoming Events

Date(s)	Event/Venue	Sponsoring Organization(s)	Contact Information
April 17-20, 2013	OLSW: 19th Annual Live Surgery Workshop ISHRS Regional Workshop *Orlando, Florida, USA*	International Society of Hair Restoration Surgery Hosted by Matt L. Leavitt, DO	Valarie Montalbano, Coordinator 407-373-0700 ext. 103 *HValarieM@leavittmgt.com*
April 29-30, 2013	Patient Selection and Hairline Design ISHRS Regional Live Surgery Workshop *Manchester, England*	International Society of Hair Restoration Surgery Hosted by Bessam K. Farjo, MBChB *www.ukhairsurgeryworkshop.com*	Tel: +44(161)237-3517 *dr.bessam@farjo.com*
May 4-6, 2013	7th World Congress for Hair Research *Edinburgh, Scotland*	European Hair Research Society *www.hair2013.org*	*hair2013@meetingmakers.co.uk*
May 24-26, 2013	2nd Mediterranean FUE Workshop ISHRS Regional Workshop *Madrid, Spain*	International Society of Hair Restoration Surgery Hosted by Alex Ginzburg, MD & José Lorenzo, MD *http://www.2ndmediterraneanfueworkshop.com*	Regarding the Program: *joselorenzo@injertocapilar.com* Tel: +34-610-0444-033 Regarding Registration: *info@ishrs.org* Tel: 1-630-262-5399
August 4-5, 2013	2013 FUE Palooza ISHRS Regional Workshop *Denver, Colorado, USA*	International Society of Hair Restoration Surgery Hosted by James A. Harris, MD Clinic Sponsor: Hair Sciences Center of Colorado *www.fue-palooza.org*	*jlmccasky@hsccolorado.com*
October 23-26, 2013	21st Annual Scientific Meeting of the International Society of Hair Restoration Surgery *San Francisco, California, USA*	International Society of Hair Restoration Surgery *www.ishrs.org*	Tel: 630-262-5399 Fax: 630-262-1520
October 27-28, 2013	Beautiful Brows ISHRS Regional Workshop *San Francisco, California, USA*	International Society of Hair Restoration Surgery Hosted by Sara Wasserbauer, MD *www.ishrs.org*	*To Come*
November 14-17, 2013	5th Annual Hair Restoration Surgery Cadaver Workshop *St. Louis, Missouri, USA*	Practical Anatomy & Surgical Education (PASE), Center for Anatomical Science and Education, Saint Louis University School of Medicine In collaboration with the International Society of Hair Restoration Surgery *http://pa.slu.edu*	*http://pa.slu.edu*
November 22-24, 2013	AAHRS 2013 and Haircon 2013 (Joint meeting of AHRS and AAHRS) *Hotel Le Méridien, Bangalore, Karnataka, India*	Association of Hair Restoration Surgeons (India) and Asian Society of Hair Restoration Surgeons *www.haircon2013.com*	*mysorevenkat@hotmail.com* *drvasa@gmail.com* *drkapildua@gmail.com* *pradeep@vacationsexotica.com*

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Dates and locations for future ISHRS Annual Scientific Meetings (ASMs)

2013: 21st ASM
October 23-26, 2013
San Francisco, California, USA

2014: 22nd ASM
November 12-16, 2014
Bangkok, Thailand

2015: 23rd ASM
September 8-13, 2015
Chicago, IL, USA

2016: 24th ASM
September 2016
Rio de Janiero, Brazil