



On the Origin of Follicular Unit Transplantation

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Commentary

It is wonderful to see that follicular unit transplantation has reached such a level of importance that a lengthy commentary has been devoted to assigning credit to its origins. From the tone of his dissertation, however, Dr. Marritt seems to be defending Dr. Limmer from an enemy camp. This is, of course, unnecessary as my commentary will hopefully show. The important point is that we should all be delighted that, with its increasing popularity, more of our patients can benefit from the follicular unit transplantation procedure.

This writing is a result of being asked to comment on some of the opinions and exuberances expressed in Dr. Marritt's flamboyant letter. If the reader expects this to be anything other than light-hearted commentary, please read no further.

Before I begin, I want to emphatically express my personal feeling that Dr. Limmer's contributions to follicular unit transplantation are immeasurable. Dr. Limmer had the incredible foresight to be performing transplants, largely using follicular units, many years before anyone else had even considered it. His recognition that stereo-microscopic dissection and single strip harvesting are the only ways to insure maximum yield from the donor supply, even exceeds in importance follicular unit transplantation itself. Stated another way, follicular unit transplantation can not truly be performed unless microscopic dissection and single strip harvesting have been implemented. Dr. Limmer has been encouraging the hair transplant community to adapt these techniques almost as soon as he began using them (which goes as far back as 1988), and he has been the sole spokesperson on these ideas for much of this time.

Once these issues are respectfully acknowledged, one can chat about the much less significant issue of how the concept of follicular unit transplantation evolved. After observing literally thousands of patients scalps through the densitometer (that was originally designed to simply measure hair density), Dr. Rassman and I came upon the idea of building the entire transplant around the exclusive use of individual follicular units. This was approximately the same time we were exploring transplanting in very large sessions. Using individual follicular units seemed to be the ideal way to minimize total wounding in these larger procedures (initially performed, by the way, with a multi-bladed knife and loop magnification). We also felt it would address the issue of the "thin look" seen with extensive micrografting, since now each implant could contain more hair and still fit into a very small site. In addition, we were surprised to note that not only were these naturally occurring groups distinct, but their spacing in the scalp seemed to be relatively constant, and practically independent of the density of the patient's hair.

The idea of a follicular constant added simplicity to the surgical planning as pretty much the same number of grafts would be needed to cover a given area regardless of the patient's hair density. The size of the donor harvest could be simply calculated, since the spacing of the follicular units was relatively constant (at 1 per mm²). In addition, follicular units could be "sorted" according to size in order to maximize the cosmetic impact of the transplant. For example, those containing 3 and 4 hairs might be placed in the forelock region for greater density and the smaller units in the transition zones. Most importantly, this sorting allowed us to increase hair density in certain areas without having to make the sites closer together. Sessions involving larger numbers of grafts had the additional benefit of generating more units of each size that could be used for these aesthetic decisions.

A more subtle revelation was that patients with only a few hairs per follicular unit would have a more thin look and this would be an essential characteristic of their transplant, since combining these units would not produce more hair, but only significantly increase wound size. At the other end of the spectrum, patients with greater numbers of hair per follicular unit could have dramatic results from a single session, given that their other hair characteristics were also favorable. These issues have the greatest significance in subsequent transplant sessions, and their understanding would be needed for setting realistic goals and for appropriate long-term planning.

We called this procedure, which involved the movement of large numbers of individual follicular units into very small recipient sites "Follicular Transplantation" and published it in 1995 in the *Journal of Aesthetic and Restorative Surgery*. The article, besides defining the follicular unit, and stressing the importance of very small wounding, discussed practical and aesthetic issues to be considered when these implants were transplanted in large sessions. Prior to publishing the article, I searched for other references in the hair transplant literature that discussed transplanting with individual follicular units, but found none. Unfortunately, being relatively new in the hair transplant field, at that the time of the writing, I had no first hand knowledge of Dr. Limmer's work.

While preparing the follicular transplantation article, I called Dr. Alan Halperin who was head of dermatopathology at the

Albert Einstein College of Medicine in NYC, and asked him to put together a series of very thin horizontal and vertical sections of the scalp so that we could examine histologically the orientation of follicular units at different levels in the skin. Samples of these histologic sections were included in the original 1995 paper of which Dr. Halperin was a co-author. The following is the abstract of that original 14 page paper:

ABSTRACT: Follicular Transplantation is a method of hair restoration surgery which recognizes the follicular unit as the basic element of tissue to be moved in the transplant. The anatomic and physiologic basis of this procedure, as well as its potential advantages, are discussed. We then describe in detail how follicular implants may be used in extensive quantities for the treatment of androgenetic alopecia.

Bernstein RM, Rassman WR, Szaniawski W, Halperin A: Follicular Transplantation. International Journal of Aesthetic and Restorative Surgery 1995;3:119-132.

Dr. Halperin mentioned that Dr. John Headington, a dermatopathologist at the University of Michigan had done extensive work with horizontal scalp sections. I spoke with Dr. Headington about our project and he sent me an article that he had written in 1984 entitled "Transverse microscopic anatomy of the human scalp." To my surprise, not only had Headington defined the follicular unit histologically, but noted the same follicular unit constant that we had observed clinically. Clearly, he is responsible for originating the term "follicular unit" back in 1984.

I sent Dr. Headington a letter and reprint of the 1995 Follicular Transplantation article thinking that he would be impressed that we applied his histologic observations to hair transplantation, but he never responded. I later learned that he had retired from practice. The following is a copy of that letter:

May 6, 1996

Dear Dr. Headington:

I have enclosed a reprint of an article that we recently published quoting your "Transverse Microscopic Anatomy of the Human Scalp" that you wrote in 1984. I hope we were able to capture the essence of your basic science research and put it to good clinical use. I would greatly appreciate your comments.

Since the publication of Follicular Transplantation, we have become more observant of the natural hair patterns of patients and have found significant racial differences in density. Preliminary observations suggest the following:

Caucasians have an average density of 1 follicular unit/mm² and 2.0 hairs/mm². Asians have an average density of 1 follicular unit/mm² with 1.75 hairs/mm². Africans have an average density of 0.65 follicular units/mm² with 1.6 hairs/mm².

It is apparent that Asians have an average of 1.75 hairs per follicular, Caucasians 2.0 and unit and Africans 2.46 hairs per follicular unit. Could it be that in Africans, the low density in high follicular groups with darkly pigmented hair, enhance photo-protection and minimize heating of the skin? Curly hair in tight groups of 3 may act like a scaffolding that holds the hair off the surface of the scalp (to cool it), and in a tight meshwork (that blocks the sun).

We are in the process of examining racial variation in natural hair groupings and density. If you would like to be involved in our future work, please let me know.

Looking forward to hearing from you.

Sincerely,

Robert M. Bernstein, M.D.

I first presented the 1995 "Follicular Transplantation" paper at the 1996 ISHRS in Nashville. At that same meeting, Dr. David Seager gave two pivotal presentations "Does the Size of the Graft Matter?" in which he showed that intact follicular units actually grew better than when they were split, and "Dissection with binocular stereoscopic dissecting microscope" in which he ran a video displaying, in vivid detail, the technique that he had learned from Dr. Limmer. As a result of this meeting the concept of follicular unit transplantation was launched, and the impressive nature of microscopic dissection was illustrated to hair transplant surgeons from around the world.

As I was preparing references for the "paired" follicular transplantation articles titled Follicular Transplantation: Patient Evaluation and Surgical Planning, and The Aesthetics of Follicular Transplantation, Dermatologic Surgery 1997;23:771-799, I again scanned the hair transplant literature for relevant articles, and specifically reviewed the article that Dr. Limmer had sent me titled "Elliptical donor stereoscopically assisted micrografting as an approach to further refinement in hair transplantation" Dermatol Surg 1994;20:789-793 (the one that Dr. Marritt quoted in his commentary). I included this reference in our publication as well as another article by Dr. Limmer "Relating Hair Growth Theory and Experimental Evidence to Practical Hair Transplantation" (references 6 and 8). In body of the text, near the beginning of the first article, I commented:

The recognition that this naturally occurring biologic unit must be kept "whole" is the fundamental principle of follicular transplantation. Dr. Bobby Limmer has long used, and strongly advocated, stereoscopically assisted microscopic dissection to improve the quality of micrografts.⁸ This is equally valuable when follicular implants are used exclusively in the transplant, as it significantly increases the visibility of the follicular anatomy.

I find it surprising that Dr. Marritt would adamantly state in a publication with the stature of Dermatologic Surgery that "In twenty-eight pages of text the word Limmer, appears not once," without carefully reading the article. In any event, although we referenced Dr. Limmer for microscopic dissection, his article did not discuss the actual use of individual follicular units. The single statement "depending upon the density of the individual follicular groupings within the donor area, such as an ellipse will bear approximately 1200-2400 hairs" did not give us, nor other readers, the impression that this was an article suggesting that individual follicular units be used in the surgery. There is a difference between noting that natural groupings exist, and recommending the use of intact, individual units in the transplant. I think that this is part of the problem that Dr. Marritt discussed in Dr. Limmer not receiving enough recognition for his work., and, despite Dr. Marritt's repeated proclamations in his commentary, I do believe that it is accurate to state that the 1995 "Follicular Transplantation" article introduced both the concept, and the term "follicular unit," to the hair transplantation literature for the first time.

Our impression from carefully reviewing the writings of Dr. Limmer, and with conversations with those that he trained, was that at least until Dr. Seager's 1996 ISHRS presentation, his primary focus in using stereo-microscopic dissection was to preserve the integrity of the hair follicle, and that the generation of follicular units was the natural outcome of meticulous microscopic dissection, rather than an end in, and of, itself. In fact, this was the impetus for Dr. Seager conducting his study on the importance of maintaining the integrity of the follicular unit. For example, in the technique of micrografting, one might divide a larger group to generate single hair grafts, or to combine single units to produce larger units, especially when 16 gauge needle sites were used, as this size wound is large enough to accommodate multiple follicular units. In contrast, individual follicular units, even containing four hairs, will readily fit into an 18 gauge Nokor needle site due to their compact nature, and the ability to use the smallest possible wounding is their unique advantage.

Dr. Marritt recently sent me the 1992 tape that he mentioned in his commentary "Elliptical Donor Stereoscopically Assisted Micrografting." To my surprise "the close, careful, dissection of the conical, tapered follicular bundles" that Dr. Marritt describes was actually performed in the video with scissors, without specifically isolating individual follicular units, and without removing any intervening tissue. All micrografts have a somewhat conical appearance (due to the relative contraction of the dermis with respect to the fat), regardless of how they are dissected. The definition of Follicular Unit Transplantation is "A method of hair restoration surgery where hair is transplanted exclusively in its naturally occurring, individual follicular units." In Follicular Unit Dissection "Some non-hair bearing tissue is removed to decrease the overall bulk of the implant." In contrast, "Mini-Micrografts Cut to Size" is a dissection technique whereby "the donor strip is subdivided to produce grafts of specific sizes as defined by the number of hairs they contain and/or the size of tissue that will fit into a specific recipient site. The removal of excess skin is not required. The dissection can be carried out with or without magnification." Clearly the latter is what was shown in the video and that is why the video is appropriately named "Micrografting," rather than Follicular Unit Transplantation.

Regardless of this follicular nit-picking, as I mentioned at the outset, I feel the exclusive use of individual follicular units is actually less important than the innovative techniques of single strip harvesting and microscopic dissection. However, the clear articulation of follicular unit transplantation, in its pure form, is what seemed to ultimately allow the hair transplant community at large to understand the concept, and its potential benefits.

As a final note, Dr. Limmer and I, in conjunction with 18 of our colleagues, have recently completed an article to clearly define follicular unit transplantation with all of its essential components, and to differentiate it from the technique of mini-micrografting where the grafts are "cut to size." As you can imagine, almost every issue was debated, and our e-mails and faxes were running at full steam for months. No issue, however, was as hotly debated as the term itself. I represented the camp that wanted to keep the original name "follicular transplantation" unchanged, as I felt that the term had already received wide acceptance, and was short and sweet. Dr. Limmer represented the group that wanted to change the name to the more precise "follicular unit transplantation" and we each fervently lobbied the other authors. From the title of this commentary, the outcome should be obvious.

For those who have continued to read on, let me conclude by saying, that for someone relatively new in this field, it has been exciting to see changes occur so rapidly, and it has been an incredible experience to interact so closely with such wonderful colleagues as Drs. Limmer, Seager, Norwood, Shapiro, Stough, and all the other people that have been involved with follicular unit transplanting, and of course with Bill Rassman, from whom I have learned so much.

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