A number of factors make it intrinsically difficult to objectively compare different techniques in the field of hair restoration surgery. I believe an awareness of these factors is important and may help both physicians and patients be more open minded when attempting to evaluate and compare various techniques.

**Long-Learning Curve**
It may take up to one year to see the final results of a single hair transplant procedure. When multiple procedures are needed, as is often the case, it may take even longer to see the true final results of a specific technique. This is unlike other plastic surgery procedures where results are seen in a matter of weeks. This leads to a longer learning curve since a greater length of time is needed to see a sufficient number of results and to make the required adjustments in technique.

**Limited Patient Follow-Up**
It is difficult to have every patient return for follow up. We don’t know how many of our patients with less than optimum results simply don’t return. I send a one year follow-up evaluation to all my patients asking for their opinion on the naturalness and density produced with the procedure. In addition I encourage all patients to come back for a follow-up. However even with this effort a large number of patients simply don’t return and are lost to follow-up. From my observation many practices have the same problem with follow-up. This limited follow-up adds to the difficulty in objectively evaluating our results especially when added to the long learning curve.

**Wide Variety Of Patients And Hair Characteristics**
We see wide variety of patients at different ages and with different patterns and degrees of baldness. In addition, patients possess different combinations of hair characteristics (color, curl, and caliber). This creates a rich multi-factorial environment that is difficult to objectively evaluate. All these variables impact results. Two patients may identical procedures with the exact same number of grafts but look totally different after the grafts grow due to differences in their hair characteristics. This variability in characteristics has to be factored in when evaluating the results of different procedures.

**Unpredictable And Variable Degrees Of Hair Loss Progression**
Hair loss progression in different patients is variable and unpredictable. The degree and rate of progression affects the ultimate look of procedure and the need for more work, as time goes on. This means the visual results of identical procedures in two separate patients will appear different depending on their rate of hair loss. Differences in the degree of shock loss or post surgical telogen effluvium affect results in the same way adding to the difficulty of evaluating results.

**Differences In The Amount Of Hairs Per Graft (Comparing Apples to Apple)**

- By far the most common type of graft used today is the follicular unit (FU) graft which can range in size from 1-4 hairs. The normal distribution of different sized FU grafts found in patients donor tissue are 1 hair =15%, 2 hairs =51%, 3 hairs =29%, 4 hairs=6%.
- Occasionally, when a greater number of smaller grafts are desired, the 3-4 hair FU grafts are broken apart to create smaller 1-2 hair grafts. These are called sub-follicular unit (SFU) grafts. When this
is done a larger total number of grafts are produced but since the increase in number consists of smaller grafts, the total number of hairs remains the same.

- Conversely, there are times when slightly larger grafts containing more than one follicular unit and called multi-follicular unit (MFU) grafts are created and used. An example of a multi-follicular unit graft is a double follicular unit (DFU) graft which contains two follicular units and 4-6 hairs.

There are clinical reasons where one type of graft may be preferred over the other. For example if doing only a hairline or temporal points it may be better to subdivided the FU’s in order to get more 1-2 hair grafts and less 3-4 hair grafts. On the other hand, if one is primarily doing the bridge or midscalp area it may be better to limit the number of ones and use a larger number of 3-4 hair FU grafts or even DFU’s which can contain 4-6 hairs per graft.

The subject of graft choice is the topic of another paper. The point I want to make here is when comparing procedures, especially with respect to how much hair is moved, it is important to be specific about the type and size of graft that is being created in order to compare apples to apples. This is especially true when trying to make sense out of graft counts (session size) as well as degree of dense packing.

- Comparing graft counts (session size) - Identical numbers of grafts can contain different amounts of hair depending on the size of the grafts. In normal donor tissue, about 35% of the FU grafts created are 3’s and 4’s. Therefore, if all the 3-4 hair grafts are split into smaller grafts consisting of 1-2 hairs, the graft count would be about 35% higher. In other words a 3000 graft case with all the 3 and 4 hair grafts intact would be equivalent a 3900 graft case when the majority of the 3 and 4 hair grafts have been converted to 1’s and 2’s. However the numbers of hair moved would be the same. Remember slicing a pizza into smaller slices does not create a bigger pizza.

- Comparing degrees of dense packing - When interpreting the “true” hair density of grafts placed in different recipient areas it is important to know the size of the grafts used in that area. For example if someone dense packs a hairline with 50 FU/cm and the majority of the hairs are 1 hair FU’s than the hair density will be ~ 50 hairs/cm (50 x 1 = 50). On the other hand in the central core, if the grafts are placed at a density of 35 FU/cm but the majority of the grafts are 3 FU’s than the true hair density in this area would be 105 hairs/cm (35 x 3 = 105). Although the recipient sites were made were made at a density of 35/cm the actual hair density is 3 times higher. Without this knowledge one may incorrectly assume that the 50 incisions per cm created more hair than the 35 incisions per cm.

Wide Variety of Patient Expectations

Patients expectations and desires vary considerably. Some patients with hair loss truly only want a thinner mature look to feel good and would actually feel self-conscious with too low or thick of a hairline after being bald for many years. Others want to get as close to their younger looking full head of hair as possible. Therefore when inquiring about patient satisfaction with results we need to remember that the same exact results and look produced in 2 different patients may lead to totally different levels of satisfaction. Understanding a patient’s expectation is important when evaluating a patient’s satisfaction with a procedure.

Different levels of skill and experience

It is well known that different levels of skill and experience can dramatically influence the results achieved with various techniques. A great technique can get a bum rap when performed by surgeons not experienced with the technique. This is one reason why it is important to make changes slowly in ones practice. It is better to get a good result with a tried and true technique than risk a poorer result with a new technique before you have mastered it.

In addition surgical assistants at different facilities vary tremendously with respect to their skills at preparing grafts and placing. The availability of the most skillful surgical assistants may suffer within a facility from time to time depending on vacation schedule, illness, and depth of skilled back-up. This is one reason I believe...
a physician should be skilled at all steps of the procedure himself but especially placing. If a physician can place he has the ability to step in and take over if, for whatever reason, he is missing or loses one of his most skilled placers. When evaluating the results of a technique the degree of skill required by the assistants and the ability to consistently supply that skill needs to be taken into consideration.

**Unreliability of studies on survival and density**

It is very important for us to know the survival of grafts when using different techniques. However this is a very difficult task. The studies of survival in small areas (1-4 cm) cannot automatically be extrapolated to that which occurs in the larger areas treated in actual clinical situations. In addition, manually counting hairs in grafts before and after they have been planted is notoriously inaccurate and adds to the unreliability of studies. Furthermore, nobody is certain how many hairs are in the invisible telogen phase, and therefore not visible to be counted at any point in time. For all these reasons survival studies to date have been traditionally unreliable. This does not mean that studies are not of value but only that the information should be evaluated with this in mind. The recent advancements and greater availability of digital photography and computer imaging to count hairs will hopefully lead to more reliable survival studies in the future.

One issue in particular that has been difficult to evaluate is the survival of grafts placed at higher densities. Simply empirical evaluating the results of grafts placed at high densities can be deceiving and lead to a false sense of security. For example, if grafts are placed at a density of 50FU/cm but only grow at a density of 40/FU/cm, the results would still look good to the eye because a density of 40fu/cm looks good. However in reality this is a loss of 20 percent of the grafts, which is unacceptable in hair transplantation do to the limited donor supply. We need true studies to tell us rates of survival at different densities and as we have seen studies are difficult to do.

**Differences in methodology used during different parts of a procedure**

There are many steps in a hair transplant procedure and many places within a procedure where the specific methodology can vary. Often multiple differences, in addition to the specific step being evaluated, exist between techniques. This makes it difficult to evaluate the true affect of a single variable. It is hard to keep everything else consistent.

- Differences in degrees of graft trimming performed (i.e. whether chubby, pear-shaped, very trimmed grafts are used).
- Differences in graft storage solutions.
- Differences in incision orientation (i.e. whether coronal incisions, sagital,
- Differences in the size of the recipient site incision size (.6-1.2 mm)
- Differences in method of graft distribution (i.e. whether one uses random or selective distribution of different sized grafts to create density gradients)
- Differences in method of placing (i.e. whether the “stick and place” or “make all the incisions first and place later” method of placing is used)

The point is that there are many factors that can vary within a technique. This introduces more variables into an already complex equation and further increase the difficulty of objectively comparing different techniques.

**Understanding Importance of Risk/Benefit Ratio When Evaluating a Techniques**

Some times a new technique can be a double edged sword by creating both the potential for better results on one hand yet increasing the degree of risk involved on the other. We need to ask at what point is the potential risk not worth the potential benefit. I like to remember that it’s not only the “home runs” we hit that are important but also the number of “strike outs” we avoid. We need to know how great is the benefit provided and how often does it occur. On the other hand we need to know how bad is the potential risk and how often does that occur. This is the Risk/Benefit ratio and sometimes it is difficult to know exactly what the ratio is. Some of the controversial questions in hair transplantation that need this type of evaluation include:
1. What degree of dense packing is safe and optimal: If dense packing at very high densities is associated with good survival and faster results most of the time (a home run) but causes poor survival some of the time (a strike out) is it worth the risk?

2. What size sessions are optimal? If larger sessions requiring wider donor strips results in fine scars (a home run) much of the time but lead to wide scars and poor survival (a strike out) some of the time is it worth the risk.

No one has the definitive answer to these questions as true studies have not been done at the time of this writing. In general I feel it is better to err on the side of limiting risk until we are sure that the benefits outweigh the risk. With this approach we see a gradual but safe application of more aggressive techniques.

Summary
The above discussion elucidates some of the reasons why it has been difficult for physician to objectively compare the results of different techniques in the field of hair restoration surgery. In spite of these difficulties, we have made great progress in evaluating the relative advantages and disadvantages of using different techniques with respect to their effect on naturalness and density. Some of this progress is due to the knowledge gained from clinical studies. Some comes from clinical experience and empirical observation. It is just important to remember to be open minded and not dogmatic as we move ahead and improve in the field of hair restoration surgery.