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Inside this issue

SPECIAL EDITION • SPECIAL EDITION • SPECIAL EDITION • SPECIAL EDITION • SPECIAL EDITION • SPECIAL EDITION •

FUE Roundtable

Co-editors' Message

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This issue of the *Forum* is dedicated to the FUE Roundtable, a discussion of advanced topics in Follicular Unit Extraction surgery by 12 of our members from around the world who have extensive experience in performing FUE. Panel members utilize a variety of methods: manual, motorized, sharp punches, dull punches, and robotics. In developing this project, we first defined a list of important topics in FUE and then prioritized them as to importance. Due to space limitations in this issue, we were not able to cover all the topics. But, we are presenting discussion of certainly some of the most important, including causes of poor growth in FUE, *in vivo* and *ex vivo* splitting, minimizing trauma during extraction, ideal FUE grafts, long-term donor management, minimizing evidence of harvesting in the donor area, common mistakes beginners make, quality control in FUE, proper punch depth, and the role of assistants in FUE. We begin this issue with a featured paper by one of the panel members, Dr. Jean Devroye, on his new powered FU extraction with the Shaky Flat FUE System (SFFS). Then we will meet the panelists and learn about their practices and move into the Roundtable Questions. For some of the topics, I asked three of the panelists to prepare an answer independently so that we could compare views of the same subject. For other parts of the discussion, all panelists participated.

Powered FU Extraction with the Short-Arc-Oscilation Flat Punch FUE System (SFFS)

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**The author has ownership interest in manufacturing and selling the SFFS, punches, and devices. Since no claims are made in this article, there is no real conflict of interest as it is instructional in nature.*

Key Points

- Tethering is probably the main factor explaining the difficulty in obtaining good quality grafts with different FUE techniques.
- Splay is also a major obstacle to creating good FUE grafts without transections.
- Sharp punches are associated with a high transection rate.
- A flat punch moving with low speed decreases dramatically the rate of transection and produces FUE grafts that look more like FUT grafts.
- For a link to videos relating to this article, please go to: https://www.youtube.com/watch?v=wWldpuJQ05o&feature=youtu.be

Introduction

We have been practising the FUE technique for 15 years now, and it's a major advancement in our HTS practice. The goal is to extract an individual follicular unit with a small circular trephine punch.

It is interesting to note that two distinct schools of thought quickly emerged in the development of FUE. The first one, led by Dr. Jim Harris, prefers the blunt punch. In the beginning, it was the 3-step system: very superficial scoring with a sharp punch followed by a dissection with a dull punch, then an extraction with fine forceps.[1] This then evolved into the blunt punch 2-step system where the same punch is used to cut and to dissect. The ARTAS® Robotic Hair Transplant System uses the 3-step approach with a blunt punch sliding along a sharp punch.

The second school of thought, led by Dr. John Cole, has opted for the sharp punch.[2] This system is by far the most widespread and adopted around the world. Only a few punch types dominate the market: Dr. Cole's thin and sharp punches, the titanium nitride coated punches (from Mediquip Surgical, among others), as well as cheaper

➪ page 134

FUE Using the SFFS *from front page*

and lower-quality punches (such as Indian or Ertip's Turkish punches). Dr. Cole has widely argued for the advantages of punches that cut as sharply as possible. He considers that they help reduce as much as possible friction and thrust force on the one hand, and damage caused to hair on the other hand.

The other leader using sharp punches manually is Dr. José Lorenzo, who uses titanium punches manually.

My Personal Experience

I started practicing FUE two or three years after the first pioneers, learning from the experience of doctors such as John Cole, Patrick Mwamba, Allan Feller, Brad Wolf, and James Harris.

I've tried systems based essentially on sharp punches, like Dr. Cole's manual holder or Alan Feller's motorized equipment. I have long been disappointed by the quality of the grafts obtained, fearing the too frequent comments of my assistants: "Doc, the grafts are not that great today…." That is the reason why I felt reluctant to practice the FUE technique. The conferences and workshops I attended could not make me change my mind. I even noted that, despite the optimistic affirmations of my colleagues, I was not the only one doubting. Even during the recent workshop I attended, I saw lot of transections.

Seven years ago, I decided to carry out my own research, first on the motorized system and then on the punch.

Why is it so difficult to obtain good quality grafts?

To clearly understand all the aspects, we should first discuss the basic anatomical components.

Splay

In most Caucasian people, hair grows in a conical shape: the further down towards the depth we go, the wider hair is. Moreover, hair also has a marked convex curvature facing downwards in the sagittal plane (Figure 1).

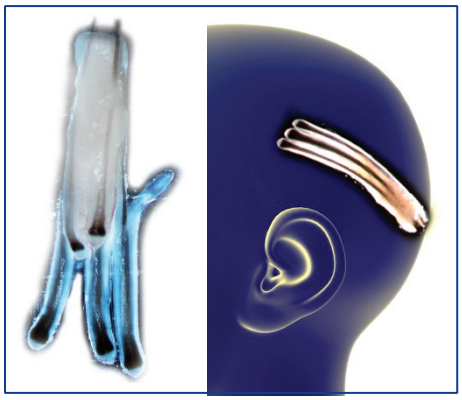

Figure 1. Splay and paring *(left)* and curvature *(right)*

African hair has an extremely marked curvature, which often curves in various directions.

Tethering

Hair is firmly attached to its surrounding tissues. The force we need to pull the graft out is important. This tethering is probably the main factor explaining the broad range of results obtained with different FUE techniques.

This is linked to the existence of various connections between the dermal sheath, the sebaceous gland, the arrector pili muscle and the connective tissue of the hypodermis surrounding the follicles. There are also deep ties between the hair follicle and the subcutaneous tissue (the subcutaneous fat).

A closer examination of a donor strip proves the importance of the fibrous connective tissue on the upper half-part of the follicle (Figure 2).

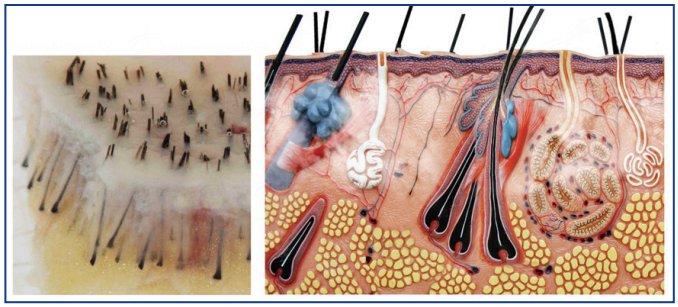

Figure 2. Fibrous connective tissue on the upper half-part of the skin *(left)*; tethering: sebaceous gland, arrector pili fibrous connective tissue *(right)*

What are the other constraints influencing the choice of the technique?

The number of hairs per graft, the damage caused to hair follicles, the size of the scars, the speed of the harvesting process, and the number of grafts reached at the end of the day are all factors that need to be taken into account when choosing the technique.

The number of hairs per graft. Two schools of thought exist. The first one, which I belong to, looks for "beautiful grafts," that is to say, the richest in hair, in order to obtain a density and a covered surface as high as possible. I also prefer "chubby" rather "skinny" grafts.

The other school of thought, however, prefers limiting the number of hairs per graft in the range of 1.8-2 in order not to "deplete" the donor area. They are not afraid of the transections and they also split *in vivo* the biggest grafts.

In order to raise the number of hairs per graft, the only solution is to increase the punch diameter. This causes an increase in the size of the scars (the white dots).

We will see that the SFFS enables us to raise the number of hairs per graft while using small punch diameters.

The size of the scars. This is indisputably linked to the punch size. We can also think that the more the punch size increases, the more the internal healing is important and might deform the surrounding follicles and so increase the difficulty of the future harvesting process. It's important to note that the wound surface increases exponentially with the punch radius.

The time of donor harvesting process. Long experience with FUE shows that the limiting step is twofold: a partial depth cut with the punch (named scoring or dissection) followed by manual removal afterward with steady, gentle traction using jeweler's forceps.

The cutting time process is long if we use the manual technique, but it can be easily reduced by using a powered system. The harvesting time is crucial. If the scoring is too shallow, the extraction time automatically increases.

For several years, I've been working on the improvement of a complete system including a motorization as well as the use of special punches.

The Motorization

My first idea derived from a practice in which I excelled when I was a teenager: sewing with a sewing machine. Those who have used one know how precise the pedal is and how it can produce extremely accurate work. I thus created a system made up of a very sensitive pedal and a hand motor set and handpiece used by dentists (Figure 3).

My feeling is that the less movement you make, the less the risk you take of damaging the follicle. On the other hand, the movement of the punch used manually is oscillatory.

However, the deeper the punch goes, the more it releases the

Figure 3. WOW pedal *(left)* and motor and handpiece *(right)*

follicle from its ties. So the follicle has then the annoying tendency to twist on itself around its deep ties, ending in the worst case with the whole follicle being drawn into the deeper dermis. This is called a "buried graft." The major advantage of oscillation is avoidance of the complete twisting of the follicle. Indeed, we shall see hereunder that inserting the punch deep enough allows us to remove the follicle effortlessly.

The SFFS thus uses an oscillatory and very short movement—between 180° and 90°—that I describe as "shaky." This shiver might have an effect of additional detachment compared with a normal circular movement. I start the movement when the punch is already in contact with the skin, and I stop it as soon as I consider I have reached a sufficient depth. Experience shows that the dissection of the dermis and the hypodermis requires neither force nor high speed. Superficial tumescence facilitates the technique.

Sharp Punches

Having used sharp punches for many years, I gradually came to the conclusion that their use frequently led to a dead end and that the intrinsic characteristics of the punch were to be blamed for this.

As I noted above, the ideal FUE technique has the irreconcilable requirements of obtaining a significant number of grafts that are rich in hair and poor in transections by using small diameter punches and without having to spend too much performing the extraction.

With sharp punches, in order to allow an easy and effective extraction with a high number of hairs per graft and a low transection rate, it is necessary to insert the punch to minimal depth and to increase the diameter of the punch. The negative consequences are that the number of grafts that can be extracted from a given surface are decreased irreparably and the size of the scars is increased.

On the contrary, if the diameter of the sharp punches is decreased, the number of transections is increased inexorably; as the number of hairs per graft is decreased, the depth we can reach is reduced. All this leads to puny grafts, which are poor in hair and difficult and time consuming to extract.

I personally have found no ideal solution to this equation with multiple variables. From time to time, when the situation is particularly favorable (right hair, well-bounded transplant, very good skin laxity, low tethering of the grafts), I am able to obtain quality transplants with good ratios and a small transection rate.

A few years ago, I had the opportunity to observe the work of Dr. James Harris with the SAFE System and I noticed the good quality of the grafts he obtained. I thus decided to pay more attention to the less sharp punches, and finally began to create my own system.

Flat Punches

With a sharp punch, the main problem is it is always sharp—inside and outside the skin. It's so sharp that even slight contact with the follicle will cause an injury, like a paring or, worse, a transection.

But I have learned that we don't need a sharp instrument when we dissect the tissue around the follicle. We just need a system sharp enough to cut the epidermis rather easily but dull enough to dissect the follicle from the adjacent tissue with minimal damage.

It's just a question of geometry (Figure 4). A 90° angle on the outer edge of the flat punch can operate as a cutting edge. The 90° angle has to be perfect, without any kind of irregularities. The angle of insertion of the punch and the skin is between 30° to 60°. In opposition to the sharp technique, the skin undergoes initial deformity with the flat punch. When the punch has penetrated the epidermis, this deformity disappears.

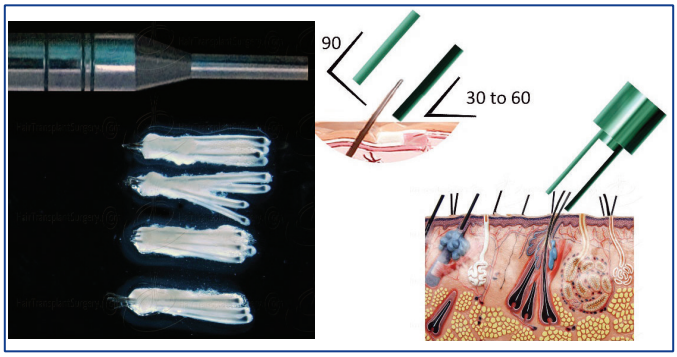

Figure 4. Flat punch and splay *(left)* and angulation of the flat punch *(right)*

Advantages

The main advantage of this system is the ability to penetrate the skin deep enough—often from 4-5mm—without damaging the follicles. The small arc of the oscillation avoids the torsion. This dissection is much less traumatic than the one derived from the use of sharp punches. The transection rate and the paring damage are reduced to the barest minimum. I keep improving the system; some new designs are already tested. The whole system will become available soon.

Additional advantages include the following:

- Easy extraction
- Low follicle transection rate (typically ranging from 3%-8%)
- Higher hairs per graft are obtained. The system improves the yield in difficult situations: curly hair, splay, African hair, body hairs, removal of old plugs, but, in my opinion, it's also superior to the sharp system in almost any kind of situation. (See grafts in Figure 5.)

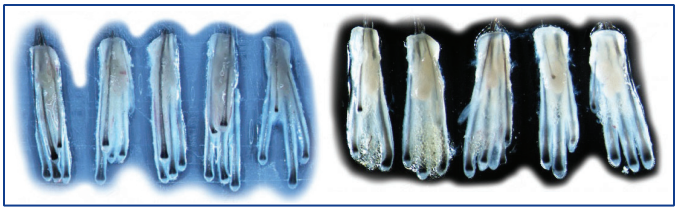

Figure 5. Typical grafts with SFFS technique

Conclusion

The SFFS is promising. The numerous comparisons made with the sharp punches show the superiority of this system in terms of quality. The global speed is the same. Even if the time of scoring increases a little bit, the time of extraction decreases.

It's very exciting to explore this field. All details are very

⇨ page 136

SFFS from page 135

important and technically exacting. Surgeons have to be trained to obtain FUE grafts of the highest quality that look as good or better than grafts produced by FUT.

References

1. Harris, J.A. The SAFE system: new instrumentation and methodology to improve follicular unit extraction (FUE). *Hair Transplant Forum Int'l.* 2004; 14(5):157, 163-164.
2. Cole, J.P. An analysis of follicular punches, mechanics, and dynamics in follicular unit extraction. *Facial Plast Surg Clin North Amer.* 2013; 21:437-447.◆

Editor's note: I have been an advocate of sharp motorized FUE for the past 13-14 years and feel that I have been able to develop a very good technique. At workshops over the past two years in which Dr. Devroye and I have served as faculty, I had an opportunity to view his device and was impressed with the excellent graft quality. I decided to start using it. In many of my cases over the past year, I used my standard sharp punch system for half of the case and the SFFS for the other half. I used the same diameter punch in both, most commonly 0.85mm. There was consistently a higher hair per graft count with the half in which I used the SFFS. I also have found that the system works exceptionally well for curly or curved hair or for those with a lot of follicle splay.

This is a unique system like no other. It is the combination of the variable mini-oscillation with the flat punch that is key. I am increasingly using this as my preferred device for performing FUE. —RHT

Thoughts on Dr. Devroye's "WOW" Motor and Flat Punch

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I have been exploring FUE for more than 10 years. For the first 5 years, I went to almost every FUE workshop and was disappointed with the degree of transection and missed attempts that even "the best" were producing at that time. In addition, the most common punch size was 1.0mm or greater. I had real doubts about the viability of this technique. However, about 6 years ago, my opinion began to change. I finally began to see examples of FUE procedures producing non-transected grafts, with smaller punches, on a consistent basis. However, with the tools available at that time, it was not easy. It required quite a bit of skill and experience to become this proficient. I personally found it difficult to gain this level of adeptness. In my attempts to become better, I tried almost every methodology that was developed over the past 5 years, both manual and motorized. I used Cole's sharp punch, the Harris Dull Punch, the NeoGraft with suction, and I even bought and ARTAS Robotic Hair Transplant System.

Although all these devices had clever technological improvements, I personally still struggled. As I witnessed other physicians become proficient with their FUE, it was frustrating because I had always been proud of my technical ability. I could place grafts as well as if not better than most assistants. I could make recipient site incisions in-between existing hairs without trauma using my 6.0 power loops. But I just could not feel good about my FUE ability. THIS ALL CHANGED WHEN I TRIED Dr. DEVROYE'S "WOW" MOTOR AND PUNCHES. Within the first few attempts, I felt more confident in my ability. I almost immediately started producing non-transected grafts that were easy to extract and had good tissue around the entire follicle. In addition, I was doing this with a 0.85mm punch. Over the last 6 months, I have only gotten better and it is the primary method we use at our office. We still occasionally use a motorized or manual sharp punch in some specific situations. It is good to be skilled in multiple methods as some skin and hair types work better with one method over another. However, in 90% of our cases, Dr. Devroye's WOW motor and flat punch work great.

I believe the reason that this method works so well is that it "marries" the best qualities of manual FUE, motorized FUE, sharp punches, and dull punches. I explain below:

1. Like a manual punch, it uses oscillation rather than rotation with all the benefits of decreased trauma and better control associated with manual punches. With the standard manual technique, you have to learn how to do "oscillation" with your fingers and keep the punch steady and aligned while rotating your fingers. This is NOT easy. With the "WOW" oscillating motor, you simply place the punch in the angle and direction you want and let the motor do the oscillation for you.
2. Like a dull punch, the tip is flat and smooth. This enables you to punch deeper (i.e., the entire length of the graft) with little risk of transection due to the intrinsic safety of blunt dissection. You get grafts with more tissue around the base, less transection, a high hair/graft ratio, and greater and less traumatic ease of extraction.
3. Like a sharp punch, you can penetrate the skin with little force or trauma. The reason for this includes the following: The wall thickness of these punches are very thin like the best sharp punches. This is unlike other dull (flat) punches, which have a thick wall thickness requiring both high force and high rotational speeds to enter the skin.

   The outer edge of the punch (the part away from the graft) is a 90° edge.

   By initially applying pressure on the outer 90° edge of the punch and increasing oscillation speed with the foot pedal, this thin-walled punch will penetrate the skin easily with little of the tangential force shape-distorting forces that Dr. Cole talks about. This makes the flat punch behave more like a sharp punch at this phase than traditional dull punches. BUT, once the punch is past the epithelium, the speed can be lowered to near what a manual method uses and the thin-walled flat punch now easily penetrates the length of the graft without transection.

In my opinion, the principles behind this technique actually translated to clinical effect. I am impressed with it and think it will help beginners achieve proficiency quicker, as well as let good FUE practitioners become better.◆