

Easy, Fast and Trauma-Free Follicular Graft Placement with Disposable Microimplanter

Tseng-Kuo Shiao, MD, Jessica C. Shiao Overland Park, Kansas, I-Sen Shiao, MD Taipei, Taiwan

BACKGROUND In follicular unit transplantation (FUT), the placement of fragile grafts into small recipient incisions using forceps requires great precision and can be very traumatic to the follicles. This delicate procedure must be performed by highly skilled assistants, who can be difficult to find, train, and retain.

OBJECTIVE To introduce an alternative method of graft placement using the Shiao microimplanter.

MATERIALS AND METHODS The microimplanter consists of a thin plastic tube and a push rod. Data regarding the rate of graft placement was collected and evaluated from 54 consecutive patients.

RESULTS Graft placement using the microimplanter is easy, even for beginners. A trained assistant can place up to 14-15 grafts/minute and during routine FUT, our team comfortably placed 730~798 grafts per hour or 12.17~13.30 FU per minute. These microimplanters significantly reduce the risk for crush injury and are great for graft pairing and for placing grafts extracted in FUE.

CONCLUSION The advantages of using the microimplanter for graft placement include a shorter learning curve, faster placement, and a lower risk of follicular crush injury. For clinics employing more than four assistants or located in areas with relatively inexpensive labor cost, this can be a very effective alternative graft placement technique.

The final step of follicular unit hair transplant is the placement of dissected follicular units into recipient sites. Traditionally, this step is performed using forceps. During graft placement, the technicians grasp the lower part of a follicular unit with forceps and position it inside a small recipient incision. If a technician grasps the follicular unit with too much force or requires multiple attempts to place the graft into the incision, the bulb of the follicles may become damaged. Thus it has become common knowledge that graft placement can be the most traumatic step to the follicular units. Therefore, this step requires the most skillful technicians. Such competent assistants not only require significant training, but must also exhibit natural talent in their manual dexterity. Unfortunately, they can be difficult to find and retain. In a sharp contrast with placing follicular units using forceps, placing using the Shiao microimplanter makes graft placement the easiest step of the hair transplant surgery and allows anyone to be trained with ease. Furthermore, during the process of graft loading and placing, the root of the follicle is never grasped, reducing the risk of crush injury dramatically. This ease of placement also translates to a faster rate of graft placement, which in turn decreases a follicle's out of-body time and reduces ischemic injury.

Materials and Methods

Instead of forceps, Shiao microimplanters were used for graft placement during follicular unit transplantation.¹⁻⁴ The microimplanter's simple design includes a plastic outer tube and a firm inner pushrod. A guide attached to the inner pushrod extends outward from the outer tube to control the depth of insertion. This simple design is both inexpensive and disposable. Currently, the Shiao microimplanters come in four different sizes: 20G, 19G, 18G, and 16G (figure 1).



Figure 1. Shiao microimplanter and its four different sizes :

20G for 1 hair follicular unit

19G for 2 hairs follicular unit

18G for 3 hairs follicular unit and paired follicular units

16G for double follicular units

As with any implanter, the graft must be loaded into the implanter before it can be placed. To load a graft into the Shiao microimplanter, we grasp its skin with a fine tipped straight forceps, aim the tip to the tube opening and slide the graft into the tube, as demonstrated in figure 2 and 3. The forceps never touch the follicle's bulb. Most people find loading surprisingly easy due to the elasticity of the tube.



Figure 2. Straight forceps grasp the skin of the graft

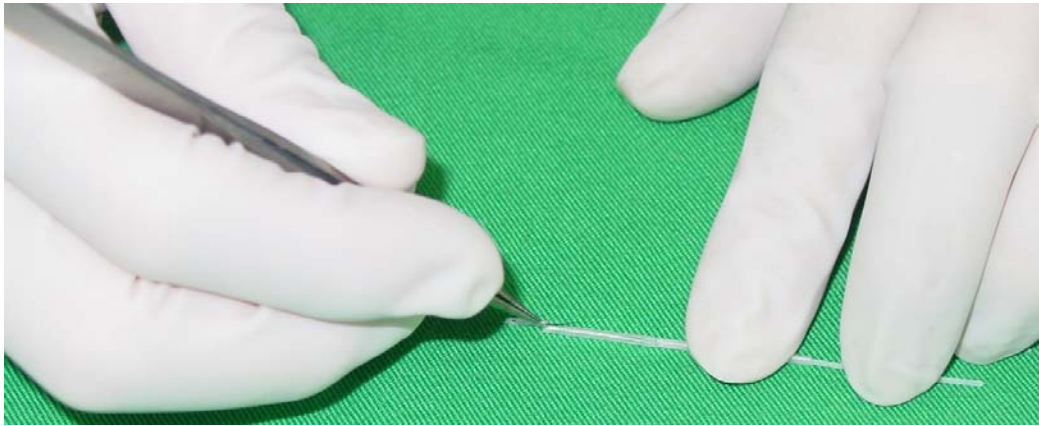


Figure 3. The graft slides into the microimplanter without the forceps touching the bulb

Recipient incisions are made prior to graft placement using different gauges of needles. Incision depth is controlled with depth control sleeve slipped over the needle⁵. Recently, we have designed a new version of the Shiao needle sleeve. By slipping over the syringe connector instead of the needle itself, one sleeve can fit over four different gauges (18, 19, 20, 21) of needles, as shown in figure 4. This new sleeve⁶ is more convenient than those we reported two years ago, and still allows for the creation of faster and safer recipient incisions.

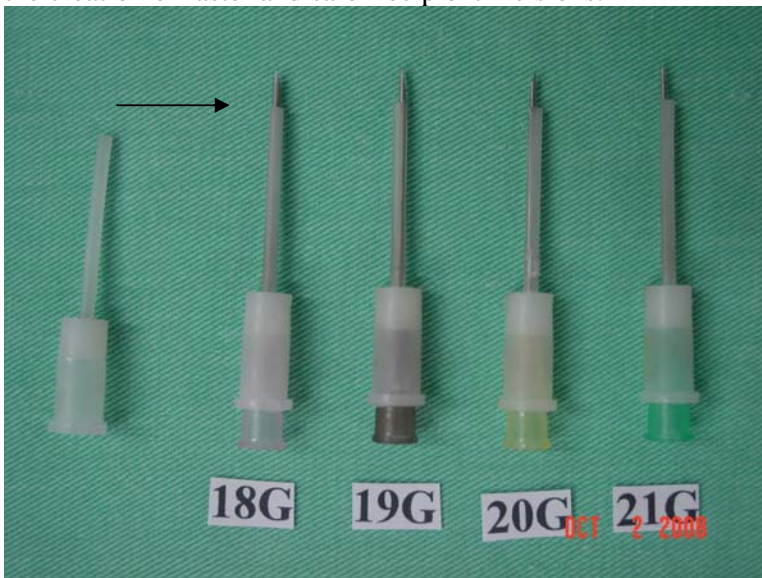


Figure 4. Shiao needle sleeve; one sleeve can fit four different gauges of needles.

Once the recipient sites are made, they are usually stained with gentian violet for better visualization of the incisions.^{7,8}

After the recipient incisions have been made, we start the process of graft placement using the Shiao microimplanters. Our graft placement team includes two placers, two loaders and one transporter. Our working arrangement is shown in figure 5.



Figure 5. The graft placement team: 2 placers, 2 loaders, and 1 transporter. To evaluate the effectiveness of the Shiao microimplanter, we separated 54 consecutive FUT patients between April and July of 2008 into three groups based on the number of follicular units they received. The amount of time taken for all grafts to be placed were recorded and averaged for each group and a rate (number of follicular units placed per hour) was calculated for each group.

Results

THE LEARNING CURVE

Due to the simplicity of the Shiao microimplanters, all of our assistants feel it is very easy to learn and almost all of them can comfortably place grafts using the microimplanters after two weeks of practice or after about five patients¹.

THE RATE OF LOADING GRAFTS INTO THE MICROIMPLANTERS

Each assistant can load 12—15 microimplanters per minute⁹.

THE RATE OF PLACEMENT

In specially designed speed trials performed over small bald patches on our patients, each assistant could place between 9 and 15 grafts per minute with the

microimplanters⁹. During routine FUT, however, the speed was significantly slower due to several reasons given below.

In our three groups of 54 consecutive patients, the number of follicular units placed and the amount of time it took to place these grafts were recorded. Based on this recorded data, the average number of grafts placed for the group and the rate of graft placement are computed and shown in table 1.

Table 1. Graft placement data from 54 consecutive FUT patients (graft placement team includes two placers, two loaders, and one transporter)

	N o. of Patients	Average number of FU placed on each patient	Average graft placement time from start to finish	Number of FU placed per hour	Number of FU placed per minute
Group I 800-1,000 FU	10	876	71 minutes (1 hr 11 min)	730	12.17
Group II 1,000-1,500 FU	20	1,278	104 minutes (1 hr 44 min)	730	12.17
Group III 1,500-2,000 FU	24	1,763	131 minutes (2 hr 11 min)	798	13.30

Discussion

Implantation of the follicular units into recipient sites is known as the most challenging part of follicular unit transplantation. There can be tremendous variations between the skills of assistants when it comes to graft placement, and the absence of one graft placement assistants can cause great disruption for the team. After our experience with this scenario when our most skilled assistant departed unexpectedly, we began focusing a great deal of time and effort on developing our microimplanters.

The Shiao microimplanter is the great equalizer for the assistants' varying degrees of graft placement skill, because it has made graft placement a trivial task. It has removed much of the individual variability in an assistant's ability to place grafts. We also worry less about assistants leaving since all of the assistants can place grafts equally well, and the training of new assistants is much easier and faster.

In a specially designed speed test for the Shiao microimplanters, our assistants achieved an average rate of 14.4 grafts per minute⁹. This rate of graft placement nearly doubles the rate of graft placement using forceps alone.

Furthermore, in a preliminary study using 18G twin microimplanter on patients with

large area of complete hair loss; our assistants achieved an average rate of 21 grafts per minute¹⁰.

Because 85 % of the follicular units contain only 1 to 2 hairs in Asian patients, we routinely pair single-hair follicular units into one 19G microimplanter and place them as one 2-hair-follicular unit⁹. The purpose of such pairing includes: 1) better illusion of density for the frontal forelock, and 2) fewer incisions to reduce the chance of injuries to vasculature and existing hairs in female pattern hair loss.

When compared to our previously performed speed trials on small bald areas of the patients, the cumulative rate of graft placement in these 54 cases is significantly slower. In the clinical settings, the time period for graft placement is usually prolonged due to the following reasons: 1. cleaning bleeding areas, 2. searching for incisions between existing hairs, 3. popping of previously placed grafts, 4. adding more local anesthetics or dilute epinephrine, and 5. waiting for the microimplanters to be loaded. If the time used on these tasks can be reduced, the implanting time can be correspondingly shortened.

The rate of graft placement among the three groups reveals no significant difference. Although we still see room for improvement in the performance of microimplanters, they provide much faster graft placement when compared to forceps graft placement in our own past experience. Unfortunately, we were unable to find similar type of rate data on forceps graft placement from literature for comparison.

Increasing the rate of graft placement can shorten operation time and increase patient comfort. More importantly, it can reduce grafts' out-of-body time and subsequently, decrease their ischemic injury and promote better growth.

While our microimplanters are beneficial in traditional strip-harvesting follicular unit transplantation, they can be even more helpful in follicular unit extraction (FUE). Follicular units taken during FUE often have a denuded appearance. They generally do not have very much tissue and fat surrounding the follicles. These follicular units are particularly fragile and susceptible to desiccation and crush injury. The microimplanters can protect the follicles against both. With the wrap around plastic tubing, the microimplanters keep their contents moist. By never having to handle the bulb, the microimplanters eliminates crush injury. Hence these microimplanters complement FUE very well.

Because the microimplanters go together well with standard FUE, we plan to test the powered FUE (P-FUE) method described in Dr. Masamitu Onda's paper¹¹ with our microimplanters. Once the grafts are extracted using P-FUE, an assistant will quickly load them into the microimplanters until 200 to 300 of them are loaded. These loaded microimplanters will be stored in chilled storage solutions. After the recipient incisions are completed, two assistants immediately place the grafts with the pre-loaded implanters while a third assistant reloads the emptied implanters. Since grafts extracted from FUE can be placed directly into recipient sites without the need for slivering or dissection, only three assistants are needed to perform the procedure. Although this new procedure will require several hundred more microimplanters than usual, the number of assistants necessary is reduced from five to three which significantly reduces the total expense of the surgical procedures. Furthermore, the

overall procedure time for this combination method can be much shorter than that of the conventional method. Detailed results will be reported after more cases.

Conclusion

The advantages to using the Shiao microimplanters for follicular unit transplantation include: short learning curve, consistent placement skill across all assistants, lowered risk of crush trauma, rapid graft placement and potentially decreased ischemic injury. While graft loading (into the microimplanters) requires two additional assistants, it is not a significant problem for clinics with more than four existing assistants and clinics in areas where labor cost is inexpensive. These many advantages justify the cost of two extra loaders and the microimplanters can provide an alternative to traditional forceps graft placement.

Patent applications have been submitted for both the Shiao microimplanter and the Shiao needle sleeve described in this article.

References

1. Shiao T, Shiao I. Easier and more efficient implanting: a two-handed technique for faster and less traumatic graft placement. *Hair Transplant Forum* 2006;16(5):169-170.
2. Shiao T, Shiao I. Disposable micro-implanter for mega session and dense packing. 2006 ISHRS 14th Annual Scientific Meeting, Hotel del Coronado, San Diego, CA, USA. 19 Oct. 2006.
3. Shiao T, Shiao I. New Implanter. ESHRS 10th Annual Congress and Live Surgery Workshop, The Marriott Paris Champ Elysees, Paris, France. 24 May 2007
4. Shiao T, Shiao I. Faster and safer graft placement with disposable Shiao microimplanters. *ESHRS Journal* 2008;8(1):17.
5. Shiao T, Shiao I. Graft site depth control sleeves for needles. *Hair Transplant Forum* 2006;16(4):133.
6. Shiao T, Shiao J, Shiao I. Shiao needle sleeve; a new depth control sleeve that fits four different sized needles (18G, 19G, 20G and 21G). This article has been submitted to *Hair Transplant Forum*.
7. Rashid M. Recipient site staining: a powerful tool in follicular unit hair

transplantation. *Hair Transplant Forum* 2005;15(6):196

8. Speranzini M. The use of methylene blue to enhance site visualization and definition of areas by number of hairs per graft. *Hair Transplant Forum* 2008;18(2):59
9. Shiao T, Shiao I. Pairing technique with Shiao micro-implanter: a low traumatic method to place 18-30 FU per minute per assistant. *Hair Transplant Forum* 2007;17(5):165.
10. Shiao T, Shiao I. Safely placing 20 grafts per minute – is it possible. 2007 ISHRS 15th Annual Scientific Meeting, The Venetian, Las Vegas, NE,USA. 29 Sep. 2007
11. Onda M, Igawa H, Inoue K, Tanino R. Novel technique of follicular unit extraction hair transplantation with a powered punching device. *Dermatologic Surgery* 2008;34(12):1683-1688

Address correspondence and reprint request to : Tseng-Kuo Shiao 13309 W. 111 th terrace, Overland Park, Kansas, USA 66210, or e-mail : tkshiao@yahoo.com