

FORUM

VOLUME 33 | NUMBER 2
MARCH/APRIL

2023

HAIR TRANSPLANT FORUM INTERNATIONAL

IN THIS ISSUE

An Operation Restore Project: Procedure to Reconstruct the Eyebrows in a Victim of Scalp Avulsion from the Amazon

Common FUE Graft Harvesting Problems and Solutions

Parsa Mohebi, MD, FISHRS | Los Angeles, California, USA | pmohebi@parsamohebi.com
Michael Pan, MD | Los Angeles, California, USA

ABSTRACT

Technological innovation in follicular unit excision (FUE) has made graft harvesting more efficient than ever, allowing surgeons to increase the number of grafts they can obtain in a single session. Factors such as scalp quality and follicular characteristics such as thickness, length, and curvature of hair follicles vary between individuals, which is why device settings and technique must be personalized for each patient. When performing a hair transplant, the surgeon needs to be able to receive regular feedback about the quality of grafts being excised so that the technique can be corrected accordingly throughout the procedure. We describe common problems and solutions that may occur during the harvesting of grafts via FUE: tethering, capping, skeletonized follicles, aspiration, transections, paring, and broken follicles. This article builds upon principles previously published in "Dynamics of FUE."¹

Keywords: capping, FUE technique, graft harvesting, transection, skeletonized, tethering

This article is open access and may not be copied, distributed, or modified without written permission from the International Society of Hair Restoration Surgery.

IDEAL FOLLICULAR UNIT EXTRACTION

Ideal FUE results in a complete follicular unit graft with each excision attempt. One of the most important indicators of a successful complete excision is the slight elevation of the graft above the skin. After the surgeon scores the graft, the potential energy from the anchor system is transformed into kinetic energy, which slightly elevates the graft 1-2mm above the surrounding skin. The elevated skin cap should be parallel to the scalp and not twisted. The grafts are then removed from the scalp without much effort. When examined, an ideal follicular unit does not have any damage throughout its length and all follicles are held together by a skin cap.

THE IMPORTANCE OF CONSTANT FEEDBACK

We perform FUE using a team-based approach. The surgeon scores the grafts while a technician "chases" behind the surgeon on the scalp and removes the grafts, typically with forceps. Since the scoring by the surgeon is usually faster than the removal by the technician, the technician needs to be able to recognize and communicate any problems to the surgeon to prevent further follicular damage. It is also advisable for the surgeon to periodically ask the technician to "check" several grafts in a new area of the scalp before proceeding to ensure that the settings and technique are appropriate.

We present common problems that can be identified by the surgeon or technician, organized into two categories: inappropriate punch depth and incorrect approach angle.

PROBLEMS WITH INSUFFICIENT PUNCH DEPTH

The punch device should be set to the minimum depth required for the graft to be liberated with minimal force. When the punch depth is insufficient, the follicular unit will remain attached to the anchoring system in the superficial dermis, making removal difficult. Insufficient punch depth can create the following three problems: tethering, capping, and skeletonized follicles.

Tethering

Tethering is when a scored or excised follicle cannot be easily removed by a one- or two-handed technique by the removing technician using forceps. Tethered grafts require excessive force to be removed

➤ PAGE 54

PLAN TO ATTEND!



31ST WORLD CONGRESS
NOVEMBER 1-4, 2023



or may not be able to be removed at all. The surgeon may notice the technician is falling behind since removal is not as efficient. The technician can also notify the surgeon when they have to spend too much time or apply too much force removing the scored grafts.

How to correct: Increasing punch depth will usually rectify tethering. Punch length increases should be done in small increments to avoid sharp dissection and transection of the grafts. We recommend a starting punch length of 2.5mm and increasing by increments of 0.2mm at a time for scalp hair harvesting when indicated. The starting punch depth could be different for other donor areas, such as facial and body hair. This increment could be less in beard hair harvesting. With every increase, a few grafts should be tested for tethering, and if it still needs to be improved, this action should be repeated until grafts can be removed without much effort.

Capping

Capping is when the scored cutaneous layer of the graft, or the skin cap, is removed while the hair shaft and follicle remain anchored. The punch has not completely cut through the anchoring system, causing the follicle to remain in the skin.

How to correct: Similar to tethering, increasing the punch length in increments should first be attempted. Capping generally requires more aggressive depth adjustment than tethering. If the surgeon is using a device that allows for multiphasic excision, increasing the time or the power of the second phase (either by adding speed or increasing the arc of the oscillation) can be helpful. Finally, manually advancing the punch with slightly more force can sometimes add 0.2 to 0.4mm more depth, which may be sufficient to release the graft.

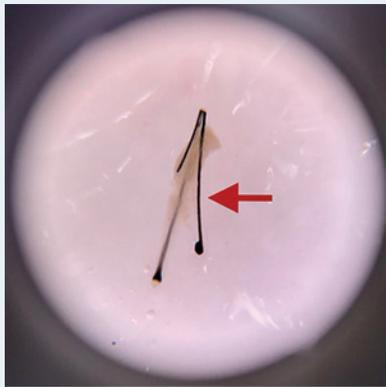
Skeletonized Follicle

A high-quality graft should contain the entire hair shaft and bulb surrounded by a thin translucent layer representing the follicular root sheath, which consists of the connective tissue sheath, outer root sheath, and inner root sheath. When the hair shaft is missing these layers, it may appear “naked” or skeletonized (Figure 1). This occurs when the follicle remains slightly anchored such that when the technician pulls on the hair shaft with forceps, the hair shaft

detaches from its root sheath, leaving it behind in the skin. Without this vital root sheath, the follicle may have poor or no chance of survival.

How to correct: If skeletonized follicles occur, the same principles associated with capping/tethering apply but to a smaller degree as most of the graft is liberated.

FIGURE 1. Skeletonized follicle missing the translucent layer of the follicular root sheath (red arrow).



PROBLEMS WITH EXCESSIVE PUNCH DEPTH

Aspiration

Aspiration occurs when the graft enters the lumen of the punch, especially in devices with suction. If the punch depth is too great or the surgeon applies too much axial force, the punch will cut through the adipose-rich subcutaneous layer of the follicle, causing it to prematurely detach from the skin and be aspirated into the punch.

How to correct: Because punch depth can be affected by manual force, aspiration can occasionally happen even when the punch length is set appropriately. If the surgeon finds that aspiration is happening too frequently, such that grafts are being lost and the procedure is inefficient, we recommend decreasing manual force and then the length of the punch by a small increment of 0.2mm. With every decrease in punch length, it is important to work together with the technician to remove a few grafts to ensure that the change does not overcompensate, resulting in tethering or other problems with insufficient punch depth. Ideally, the surgeon should stop adjustments when no more grafts are aspirated into the punch without any tethering, capping, or skeletonization.

PROBLEMS WITH INCORRECT APPROACH ANGLE

One of the most important goals of the FUE technique is to harvest intact follicles by reducing the rate of transection. Transection is when the punch cuts some or all of the hair shafts in a follicular unit during the process of scoring. This occurs when the punch does not align correctly with the hair follicle, causing the sharp edges of the punch to cut through the follicle prematurely. We define the approach angle as the angle between the punch’s longitudinal axis and the skin’s surface. Ideally, the approach angle should be as close as possible to the internal angle, which is usually slightly different than the external angle. The internal angle of hair is generally deviated slightly from the external angle in the shape that the hair follicle gets closer to the vertical line. When a follicle is transected, the surgeon may notice that the graft may elevate excessively, twist, or not elevate at all. Depending on whether the approach angle is too large or small, the following problems may occur: complete transection, partial transection, paring, or broken follicles.

Complete Transection

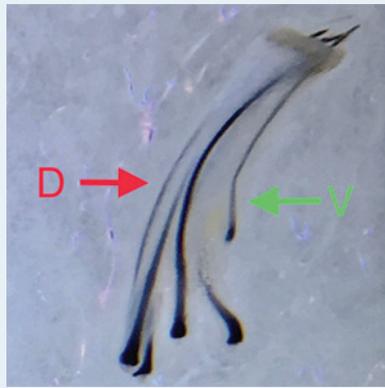
Complete transection is when the entire follicular unit is severed above the bulb (Figure 2). The surgeon can immediately recognize this problem because the graft will not have the release of kinetic energy that allows it to elevate above the skin. When a completely transected graft is removed, the skin cap will contain only the top portion of the follicles with no follicular bulb.

FIGURE 2. Complete transection of grafts. Note that there are no visible follicular bulbs.



How to correct: Complete transections should be recognized and corrected immediately to prevent further graft damage. It can be difficult to determine the cause of a complete transection. Teamwork is important as the surgeon should ask the technician to work closely with them to excise and remove grafts sequentially as the surgeon evaluates the type and angle of transection and troubleshoots their technique with different approach angles and movements until an intact graft is obtained.

FIGURE 3. Intact follicular unit with dorsal (red arrow) and ventral (green arrow) orientations marked based on the curvature of the follicles and skin cap.



appears in the skin by following the curvature of an intact hair shaft and the direction of the skin cap and then assign a dorsal and ventral side (Figure 3).

FIGURE 4. Partial transection of the dorsal follicles in two grafts.

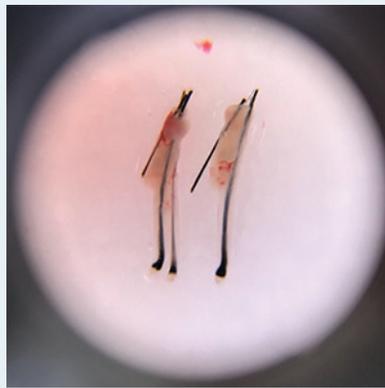
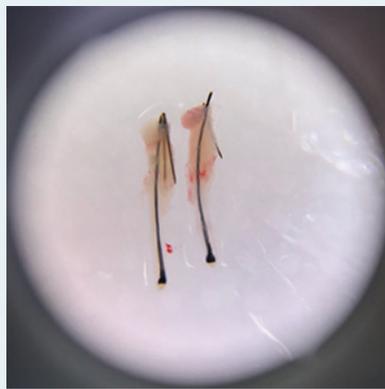


FIGURE 5. Partial transection in the ventral follicles in two grafts.



Partial Transection

A partial transection (PT) occurs when one or more hair shafts within a follicular unit are transected while at least one hair shaft remains intact. This is the most common type of transection and it can be classified according to whether the transected follicles are dorsal (superficial) or ventral (deep) in relation to the skin surface. We orient the graft as it

Partial transection dorsal (PTD)

occurs when the approach angle is too large, causing the punch to cut through the most superficial (dorsal) hair shafts within the follicular unit (Figure 4).

How to correct: The surgeon should orient the punch with a more acute angle in relation to the skin.

Partial transection ventral (PTV)

occurs when the approach angle is too small, causing the punch to cut through the most ventral hair shafts within the follicular unit. PTVs can occur in the superior portion of the occipital donor area where hair grows more perpendicularly to the skin, or in any area if a surgeon overcompensates by directing the punch too acutely (Figure 5).

How to correct: The surgeon should orient the punch with a less acute angle in relation to the skin.

Partial transection lateral (PTL)

occurs when the punch is off-center or tilted away from the direction of the hair follicle, causing a premature transection of the more lateral hair shafts (Figure 6). PTLs can also occur more frequently in follicular units with significant splay.

How to correct: Using proper loupes that provide good stereotactic magnification can assist the surgeon in orienting and centering the punch directly at the hair follicle with zero tilt.

Paring

Paring is one step before partial transection, and it is when a part of the follicular sheath is cut longitudinally by the cutting edge of a sharp punch (Figure 7). Paring is a milder version of partial transection as the hair shafts remain intact. Paring is a precursor of transection, and if the approach angle is not corrected, it can lead to transection of follicles.

How to correct: The same principles of partial transection apply for paring. The approach angle and advancement of the punch should be corrected based on the surface on which the paring occurs (dorsal, ventral, lateral). For example, if the paring is noted on the dorsal aspect of a graft, the punch should be angled more acutely in relation to the skin surface.

Broken follicle

A broken follicle is an intact follicle that has been injured at some point along its length, causing the follicle to bend or separate (Figure 8). Broken follicles usually occur when the sharp cutting edge puts a dent in the external layers of the follicle due to an incorrect punch angle or when the punch is advanced too deeply.

FIGURE 6. Partial transection in the lateral follicle.



FIGURE 7. Paring within the follicular root sheath (red arrow).

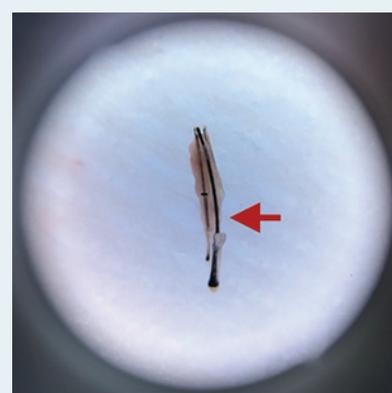
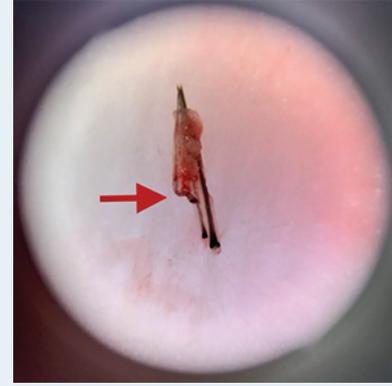


FIGURE 8. Broken follicle showing bending and separation (red arrow).



How to correct: There are several methods to avoid a broken follicle: adjust the punch angle to keep the cutting edge away from the follicle, use the minimal effective punch depth that will liberate the follicle, or use flared punches to keep the cutting edge away from the follicles.

CONCLUSION

As FUE becomes more technologically advanced, hair transplant surgeons can perform bigger and more complex surgeries involving a greater number of grafts per session. We believe that more effective recognition and communication of problems that may arise during FUE graft harvesting will allow the surgeon and the team to yield more high-quality, intact grafts. Table 1 gives a brief summary of some of the common problems encountered and how to correct them.

Reference

1. Mohebi P, Straga J. Dynamics of FUE. *Hair Transplant Forum Int'l*. 2017;27(6):232-236. ■

Table 1. Summary of Common Problems During FUE Graft Harvesting

	Problem	Description	Correction
Problems with insufficient punch depth	Tethering	Graft requires excessive force to be removed or may not be able to be removed at all.	Increase length of punch by small increments (0.2mm) and test a few grafts with technician with every increase until grafts can be removed easily.
	Capping	Scored cutaneous layer of the graft (skin cap) is removed while the follicular unit remains anchored.	Manually apply more force during each excision, which can provide 0.2-0.4mm more depth.
	Skeletonized follicles	Graft does not contain the thin translucent layer representing the follicular root sheath.	
Problems with excessive punch depth	Aspiration	Graft immediately enters the lumen of the punch after being scored.	Decrease length of the punch by small increments (0.2mm) until aspiration stops. Work with technician to ensure that change does not overcompensate and result in tethering.
Problems with incorrect approach angle	Complete transection	Entire graft is severed above the bulb.	Cause is multifactorial and can be difficult to identify. Work closely with technician and troubleshoot with different approach angles.
	Partial transection dorsal	Approach angle is too large, causing the punch to cut through the most dorsal hair shafts within the follicular unit.	Orient the punch with a more acute angle in relation to the skin.
	Partial transection ventral	Approach angle is too small, causing the punch to cut through the most ventral hair shafts within the follicular unit.	Orient the punch with a less acute angle in relation to the skin.
	Partial transection lateral	Punch is off-center or tilted away from the direction of the hair follicle, causing a premature transection of the more lateral hair shafts.	Using proper loupes that provide good stereotactic magnification to orient the punch directly at the hair follicle with zero tilt.
	Paring	Follicular sheath is cut in longitudinal fashion. Paring is a milder version of partial transection as the hair shafts remain intact.	Approach angle should be corrected based on the surface that the paring occurs (dorsal, ventral, lateral), similar to partial transections.
Multifactorial	Broken follicle	Bending or separation of a follicle due to stress at some point along the length of the follicle.	Adjust the approach angle and use flared punches to keep the cutting edge away from the follicle. Use the minimal effective punch depth that will liberate the follicle.