A 2019 Guide to Currently Accepted FUE and Implanter Terminology

FOREWORD

In 2013, the ISHRS committee on FUE terminology established standard terminology for the practice of follicular unit extraction (FUE). Since its publication, this terminology has become standard among hair restoration surgeons worldwide. The terminology provides clear definitions of various techniques, steps of FUE, graft quality and patterns of graft injury, and ways to measure the quality of FUE surgery. In 2018, the International Society of Hair Restoration Surgery formally changed FUE terminology from Follicular Unit “Extraction” to Follicular Unit “Excision” in order to more accurately define FUE as a surgical procedure. Excision is the combination of “incision” followed by “extraction.” This overall change necessitated change in some other standard terminology. In writing this revision of the Standard FUE terminology, we have fully adopted the use of “excision” throughout the definitions. By utilizing this terminology, practitioners can communicate effectively with one another in day-to-day practice and in academic presentations and investigations and convey to the public the true nature of the procedure.

The ISHRS would like to acknowledge the work of the members of the FUE Research Committee (FUERC) and the members of the Terminology Sub-committee who created the initial terminology document, and the members of the FUE Advancement Committee (FUEAC) who have contributed to this updated version. Robert H. True, MD, MPH, FISHRS is the primary author and editor of the material added subsequent to the original terminology publication. The following physicians were involved in the creation and editing of the initial and current terminology document: Conradin von Albertini, MD, FISHRS, Flavia Barsali, MD, Christian N. Bisanga, MD, John P. Cole, MD, Márcio Crisóstomo, MD, FISHRS, Jean Devroye, MD, FISHRS, Kapil Dua, MD, FISHRS, Koray Erdogan, MD, Bijan Feriduni, MD, FISHRS, Alex Ginzburg, MD, FISHRS, Aditya Gupta, MD, PhD, FISHRS, James A. Harris, MD, FISHRS (Chair, FUEAC), Chiara Insalaco, MD, PhD, Ali Emre Karadeniz, MD, Melike Kuelahci, MD, Jose Lorenzo, MD, Jennifer H. Martinick, MBBS, FISHRS, Parsa Mohebi, MD, FISHRS, Maria Angelica Muricy, MD, Osman T. Oguzoglu, MD, FISHRS, Jae Pak, MD, Paul T. Rose, MD, JD, FISHRS, Ronald L. Shapiro, MD, FISHRS, Mauro Speranzini, MD, FISHRS, Robert H. True, MD, MPH, FISHRS, Arthur Tykocinski, MD, FISHRS, Sanusi Umar, MD, FISHRS, Ken Williams, DO, FISHRS, and Bradley R. Wolf, MD, FISHRS.

Revised Standardization of the Terminology Used in FUE: Part I

ANATOMY

The definition of follicular units, according to Headington (1984), is: “The follicular unit (FU) of the adult human scalp usually consists of two to four terminal follicles and one or rarely two vellus follicles, the associated sebaceous lobules, and the insertions of the arrector pili muscles of the terminal follicles. At superficial dermal levels follicular canals may or may not join each other, although it is common to find two or three hair shafts within a single canal at the level of the infundibulum. The vellus follicle of the follicular units may remain separate or may be joined to the confluent infundibula of the terminal follicles.”

FIGURE 1. Follicular group

- **Follicular Group, Follicular Family, Follicular Cluster or Follicular Bundle** (Figure 1): These are defined as clusters of hair in the scalp that exit the skin in close proximity to each other and are separated by a gap from other clusters of hair. The follicular group may consist of more than one follicular unit in a tightly packed distribution on the surface of the skin. In complex donor areas consisting of multiple large bundles or closely aligned bundles, the number of separate bundles obscures individual interpretation and leads to variable individual assessment.

- **Splay** (Figure 2a): This describes divergence of follicles from one another, typically occurring at the lower one-third of the follicular unit. The degree of splay is widely varied from no splay to substantial splay. Splay may involve one follicle within a group or all follicles within a group. Dr. Robert True recently introduced the concept of structural splay and iatrogenic splay. Structural splay exists anatomically in the tissue and iatrogenic splay (Figure 2b) is splay produced by the method of FUE. FUE techniques in which the punch insertion is superficial may produce extreme splay of the bulb portion of the follicles as a consequence of stripping away the perifollicular tissue during extraction.

- **Sub-Follicular Group Graft**: This is a graft excised from a follicular group where a portion of the follicular group remains in the donor area.

- **CTS**: Connective tissue sheath; **ORS**: outer root sheath
- **IRS**: inner root sheath
- **DP**: Dermal papilla
- **Tethering**: This term is used to describe the attachment...
of the connective tissue sheath and outer root sheath to the surrounding adipose of a follicle. In most individuals, the strength of this attachment is very weak, so we can extract the graft once we cut the superior anchor system, but in others, it is quite strong, requiring more tension during extraction.

**Hypopigmentation**: This is the name given to the loss of skin color caused by loss of melanin, loss of the hue from individual follicles, and the interruption of vascular circulation from the skin surface during the healing process. Following the harvesting process from the scalp or body, the excision sites often heal by secondary intention. The surface area of hypopigmentation (commonly named “white dots”) can be extremely variable depending on different factors, such as skin or hair color, and the tools used for the excision. Based on experience, hypopigmentation is more common in the inferior part of the donor area of the scalp, chest, and abdomen, and less noticeable on the traditional recipient area of the balding scalp, legs, and beard.

**Anchor System of the Follicular Units**: This defines the structures that impede the excision of the follicular group from the surrounding tissue. The follicular adherence includes the sebaceous gland, the insertion of the arrector pili muscle, the attachment of the dermis, and the connections between the CTS and the surrounding adipose tissue.

**TRANSECTION**

**Capping or Topping** (Figure 3): This occurs when, after incising a targeted graft and attempting to remove it with the forceps, we obtain a small cap or top of tissue (epidermis and dermis) with no terminal hair follicles, which remain in the donor site. In most cases, this is due to not having achieved sufficient depth with the punch to liberate the graft. In other instances, this may occur when sub-optimal force or when improper forceps placement is applied to the graft during the extraction process. On occasion, a telogen or vellus hair may be removed within the cap during this process.

**Pluck** (Figure 4): This is removal of one or more terminal hairs by pulling them out with forceps with the aim of the removal of viable follicles from the donor area that can be inserted into the recipient area. A pluck could comprise one or more naked follicles devoid of all components of the connective tissue sheath (CTS), outer root sheath (ORS), and inner root sheath (IRS) and dermal papilla (DP), or a fraction of the CTS, ORS, and IRS. In some instances, only the IRS remains. Generally, when the distal portion of the ORS is left in the donor area as a result of a pluck, the DP also remains in the donor area.

**Broken or Fractured Follicle(s)** (Figure 5): Broken or fractured follicle(s) are follicles that are broken into two or more pieces. Such breakage typically results from excessive force applied with forceps during the extraction phase of FUE.

**Paring or De-sheathing** (Figure 6): These are grafts where the CTS, ORS, and perhaps the IRS are slashed in a longitudinal fashion by the cutting edge of a sharp punch.

**Splitting** (Figure 7): This is the action of separating with the punch *in vivo* (or in situ) a portion of the follicles from a group (follicular family or follicular unit). The excised graft will contain fewer follicles than are in the group. Splitting can be produced deliberately or unintentionally.

**FOLLICULAR UNIT EXTRACTION** (now outdated terminology)

The concept of FUE was first observed in a newspaper advertisement in Australia in 1995 by Drs. Woods & Campbell (Figure 8). The advertisement described the FUE harvesting technique as “Hair Follicle Single Unit Extraction.” FUE was officially introduced in the medical literature in 2002 by Drs. Bill Rassman and Bob Bernstein. They were the first physicians to describe the term FUE in 2002 as “the removal of individual clusters of follicles from the donor area using a sharp dissecting punch or trephine.” In the original article, the grafts were harvested using a 1.0mm sharp trephine.

In strict terminology, the term “follicular unit extraction” is inappropriate and misleading because it is a histological term rather than an accurate anatomical surgical term. More appropriate would be the term Follicular Isolation Technique (FIT).

**FOLLICULAR UNIT EXCISION**

In this revised version of the Standard FUE Terminology, the new terminology approved by the International Society of Hair Restoration surgery in 2018 for FUE is Follicular Unit Excision rather than the previous common usage Follicular Unit Extraction. The “E” in FUE is redefined as Excision as excision is defined as the “act of removing by cutting out.” The purpose of this culture and name change is to be more scientifically, clinically, and academically correct with our procedure and terminology.

**Definition**

Follicular Unit Excision is the surgical technique that refers to circumferential incision of the skin around the follicular unit bundle or group of hair follicles for the purpose of ex-
tracting a full-thickness skin graft containing hair follicle(s), intradermal fat, dermis, and epidermis.

Since its introduction early in this century, FUE has been referred to as extraction, and the term “extraction” is firmly established in our field. However, in common usage, “extraction” has a non-surgical implication. This has unfortunately led to a perception and exploitation that FUE is not surgery and can be performed by lay people.

The ISHRS Board of Governors has reviewed this new terminology and agreed that the above definition more accurately reflects the true nature of the procedure. It also prevents any type of misleading or fraudulent information that may be conveyed to the public.

**Different Techniques Employed**

**Partial Follicular Family Harvesting** (Figure 10): This involves the entire process of harvesting (i.e., splitting and then extracting) a fraction of a follicular unit such that one portion of the follicular unit is harvested from the donor area while the other portion of the follicular unit remains in the donor area. It’s also called “vertically split harvesting,” “vertically cut harvesting,” or “fractional family harvesting.”

**Trimming** (Figure 9): This refers to the removal of the dermis and other undesired perifollicular tissues from an FUE graft under the microscope with the aim of making the graft slimmer. The advantage of trimming is to make a graft fit into a smaller recipient site or to reduce the volume of tissue inserted into recipient sites so that volumetric expansion of the recipient area or ridging is minimized.

**Individual Group Harvesting** (Figure 11): This involves harvesting an intact group of follicles based upon their proximity and position as they exit the epidermis consisting of one or more than one follicular unit at a time.

**Transection** (Figure 12): Term used to report any microscopically visible breakage of a follicle anywhere along its entire length. A graft is considered completely transected when all of the follicles are cut transversely or partially transected when one or more follicles are cut leaving one or more intact follicles.

**External Dissection** (Figure 13): This action details how a graft is divided under the microscope into singles or groups containing fewer follicles than the original intact group, for example, to be used in or near the front hairline.

**Graft Cleaning**: This refers to the removal of the transected part of a follicle from an FUE graft under the microscope.

**Follicular Isolation Technique** (CIT): Developed by Dr. John Cole, CIT is a follicular excision technique that incorporates a variety of highly sharpened, thin wall punches along with a precise depth control mechanism. The goal of CIT is to minimize the follicle transection rate by varying the punch diameter, limiting depth, modifying punch geometry, and altering tangential forces. The objectives of CIT are to match donor harvesting methods to the individual physical characteristics of each patient along with overall goals of both short- and long-term patient planning. CIT may involve harvesting a portion of a follicular group or intact follicular groups.

**Harris Safe Technique**: The method introduced by Dr. James Harris in 2004 is both a manual and a mechanical method of graft harvesting. Initially, the method consisted of using a sharp punch to score the dermis of the skin followed by deeper dissection with an unsharpened dull, or blunt, punch developed by Dr. Harris, which he called a two-step method. Following the second step, the graft is removed with a pair of forceps. Subsequently, Dr. Harris attached his unsharpened punch to a rotating drill. With the mechanical version, the surgeon may perform the procedure in a single step.

**Body Hair Harvest**: Donor follicles are harvested from any region of the body except the traditional scalp donor area. Body hair has an unpredictable and variable yield.

**Beard Hair Harvest**: Donor follicles are harvested from the beard area on the face and neck of a patient. Beard hair,
transplants have a higher mean yield and a much faster rate of growth than other sources of body hair. Beard hair has the greatest hair shaft diameter.

**Woods Technique:** This is the original term given to Follicular Unit Excision by Drs. Ray Woods and Angela Campbell. Even though they never published their results or shared their experience with other physicians, they can be considered an essential part in the development of the FUE technique based on their Internet publications.

**Fox Test:** This refers to a test procedure performed when a physician wants to confirm that a patient is a good candidate for FUE. Drs. Bill Rassman and Bob Bernstein coined the term in their 2002 paper that described the FUE procedure.

### MOTORIZED AND ROBOTIC DEVICES

**Programmable Cole Isolation Device (PCID)** (Figure 14): This programmable device developed by Dr. John Cole allows for a more precise control of rotation, oscillation (and the duration of both), speed, rate, and arc of oscillation.

**Harris Safe System** (Figure 15): Developed by Dr. James Harris, this follicular excision device uses an unsharpened, dull, or blunt punch (0.8-1.2mm) with full rotation at variable speeds and a fixed depth stop.

**NeoGraft®** (Figure 16): This is a motorized rotating excision device using a sharp punch with both negative and positive pressure mounted on a right-angled handpiece. Negative pressure allows the surgeon to suck the graft into a collection chamber and keep the operating field clear of blood. A deep incision is required to loosen the graft enough to allow the weak suction to remove the graft from the donor site. Grafts may also be removed using a pair of forceps. The grafts can be inserted in the recipient area using positive pressure. The NeoGraft is similar to the Calvitrone® originally conceived by Dr. Pascal Boudjema. The term Omnigraft is primarily used in Asia for this device.

Several newer similar devices include the SmartGraft, Atera, and FUE TOR.

**True Device** (Figure 17): Aseptico Porta-Tip – AU-03SS and Osada SH28S handpiece. This is a rechargeable rotary hand engine with variable speed control and autoclavable handpiece that Dr. Robert True uses. He employs Cole Instruments Serronamed™ punches varying in size from 0.8-1.25mm. A silicone collar is fitted onto the punch and adjusted for precise control of incision depth.

**Alphagraft** (Figure 18): This is another FUE device that uses a rotating sharp punch to harvest follicles from the donor area.

**Devroye Device** (Figure 19): Developed by Dr. Jean Devroye, this FUE battery powered device uses an oscillating flat punch controlled by a very sensitive foot pedal. The device allows very short arc punch oscillation.

**Trivellini Device** (Figure 20): Developed by Dr. Roberto Trivellini, the Mamba FUE Device is a multifunction programmable motor that incorporates in-line suction, full rotation, oscillation, and vibration. The device also uses a unique flat punch design called the “Edge-Out” punch.

**Shiao 4-D Device** (Figure 21): Developed by Dr. T.K. Shiao, like the Mamba, the device incorporates programmable multifunction controls. Punch movement is touch activated (also true of the Mamba device). The system uses sharp punches. The handpiece is disposable and printable at low cost with a 3-D printer.

**ARTAS® System** (Figure 22): Developed by Restoration Robotics, this robotic FUE device uses a two-step process where a prong-shaped sharp punch (Figure 23) first pierces the skin followed by an unsharpened rotating punch, which penetrates deeper into the tissue to liberate the graft. This is an “automated” system that evaluates follicular unit density, hair angle, and proper depths of sharp and unsharpened punch insertion based on the physician input data. With that information, the device has the capability to suggest the target units and align the system with the proper direction for dissection. Grafts are harvested while using a tension device developed by Restoration Robotics. The graft is then removed with a pair of forceps.

### References

CHARACTERISTICS OF THE TECHNIQUES

Rotating Excision: The punch is rotated a full repetitive 360-degree cycle during penetration of the skin. This is usually done by motor.

Oscillating Excision: The punch is moves back and forth through different arcs and repetitions per minute (RPMs) during penetration. This may be done by hand or by a motor.

Rotating and Oscillating Excision: When rotation followed by oscillation is employed during penetration of the punch. Rotational speed, arc of rotation, ramp (amplitude from starting position to ending position) of rotation, ramp of arc, and duration of each individual cycle may be controlled.

Step Methods: These methods relate the steps that need to be applied, with a punch or other cutting tool, to release the graft from the surrounding tissue. All methods take a last step common to all the techniques, which is the collection of the follicle with forceps or suction:

1. One Step Method uses an excision punch that is inserted to the desired depth in a single incision using a rotational force, oscillating force, axial force, or combination of rotation and oscillation forces.
2. Two Step Method uses a sharp punch to score the skin using a rotational, oscillating, or axial action. Then either the same sharp punch or a different punch is inserted through the epidermis via the same incision to the desired depth using a rotating or oscillating action. The second punch may be a different sharp punch or a dull punch.
3. Three Step Method uses a sharp punch to score the skin followed by a sharp or unsharpened punch to penetrate as in the two-step method. Then a needle or other sharp device is used to cut the graft free at the base while traction is applied with forceps to remove the graft.

Sequential Method: The surgeon holds the punch and the forceps in both hands at the same time. The grafts are cut with the punch in one hand and then removed with the forceps held in the other hand, one graft at a time and in rapid sequence. This technique was first described by Dr. Bertram Ng as the “Double-Guns” technique (2008) and further popularized by Dr. Koray Erdogan (2012).

Coring Method: A sharp punch is inserted with a single axial force applied along the axis of hair growth without rotation or oscillation. Following the initial axial force a tangential force may be applied to help loosen the graft prior to removal with forceps.

Open Method: Also called Lift and Look. The skin is cut using a punch to score around the graft. Next, the cluster is pulled from the surface of the skin so that the surgeon can see the direction of hair growth and splay. Then a series of maneuvers may be used to dissect along the follicular unit. The process may be assisted using suction to clear the visual field.

Sharp Dissection: This is when a punch with sharp edges is inserted along the course of the follicle to facilitate its excision.

Blunt Dissection: This is when an unsharpened punch is inserted along the course of the follicle to facilitate its excision. Blunt dissection uses a punch with no sharp edges that has a wide wall to allow a wedge-like configuration with the aim of separation of the follicles from the surrounding tissue.

Hybrid Dissection: Uses the sharp outer edge of a flat punch to dissect the skin and the blunt edge along the course of the follicle to facilitate its dissection.

Pulling: This is the traction away from the skin used for the removal of the graft, after it has been punched. Grafts may be pulled with a one-hand pull with single forceps, a two-hand pull with two forceps, with an ATOE (see below), or with suction.

Scoring: This is a superficial cutting of the epidermis and dermis with a punch to produce a superficial circumferential or semicircle incision around a follicular grouping.

Depth Control: This refers to the utilization of different accessories on or around the punch to precisely control the depth to which the punch can be inserted.

Limited Depth Excision: The punch is inserted only to a depth of 2-3mm in order to release the follicles from the surrounding tissue for extraction with the help of forceps or suction. Limited depth excision minimizes follicle transection when using sharp punches.

Full Depth Excision: The punch is inserted the full length of the follicle (from 4 to slightly more than 6mm depending on the patient) to meet or exceed the level of the bulbar region of the follicular group and completely free the follicle(s).

Follicle Distortion: This is the physical movement of the follicle in reaction to the axial and tangential forces resulting from the physical process of follicular unit excision.

Axial Force: This is the force applied parallel down the center line of the hair follicles during graft excision. When the force is evenly distributed, the force is concentric. When the force is unevenly distributed, the force is termed eccentric. Because the inferior margin of the punch touches the skin first due to angle of hair growth, the force is often greater on the inferior aspect of the tissue during graft removal. This uneven force often causes follicle displacement.

Tangential Force: This is the force applied through rotation or oscillation of a punch around a follicle or group of follicles.

Donor Tension or Traction: Tension may be applied to the donor area to stabilize the fluidity of the tissue. Tension may be applied by a variety of means including the following: tumescence, clamps, or manual or stretching forces applied through other means such as tensioners or stapling a latex material from one side of the scalp to the other.

Bulls Eye: This is when the follicles being excised within a follicular group are perfectly centered in the punch during its insertion.

ATOE (Aide to Extraction) (Figure 24): This is forceps with a specialized design, created to facilitate a rapid extraction of the previously dissected grafts.
Delay in Extraction: This is the temporal difference between the time when the punch incises the grafts, in both single and multiple step processes, and when the grafts are physically removed from the donor area. Following the delay, the grafts may be placed into holding solution or reinserted into the scalp immediately.

Follicle Depth: Determined by the distance from the surface of the skin to the full length of the follicle below the hair bulb.

Time Out of Body (TOB): This is the time between the removal of the graft from the donor area and its reinsertion into the recipient area. The graft may go into a holding solution or it may be immediately placed into a recipient site.

DONOR AREA

Donor Area Regions: This defines the zones of the safe donor area from which grafts should be excised.

Safe Donor Area (SDA) (Figure 25): The portion of the scalp that contains follicles presumed to be the permanent hair within the donor area. The concept of the “safe donor area” is based on a study by Dr. Walter Unger and on experience. It is clinically difficult to be completely accurate in defining this area. In some individuals, the SDA may be greater, while in others, it may be less. Furthermore, there is no guarantee that all follicles within a “safe donor area” are permanent. This is a very difficult area to define, especially in young patients.

Donor Area Template (Figure 26): This is a template that allows the margins of the presumed safe donor zone and excision zones to be marked. Major Donor Regions are within the presumed safe donor zones of the occipital and temporal regions. Minor Donor Regions are zones of secondary use and include the nape of the neck and areas located inferior to the major donor regions. Hair in these regions is less reliably presumed to be in the safe donor zone in patients who do not have extreme degrees of hair loss. Individuals with higher degrees of hair loss will often lose hair in these regions as they age. Often hairs in these regions contain a higher percentage of hair in the telogen phase. Additional Donor Regions include the temporal areas in front of the ears, the supra-auricular areas, and lateral humps.

Handle (Figure 27): The tool by which the punch is held, carried, and depth controlled. There are some different handles for the manual FUE technique, the most popular are the Versi handle and the CIT manual punch handle.

PUNCH CLASSIFICATION

A wide variety of punch types have been developed for performing FUE. New designs are being created continuously. Punch designs are categorized by four main categories: 1) tip type, 2) shape, 3) position of dissecting edge, and 4) diameter of the dissecting edge. Each category has subtypes.

In describing a punch, the order of categories would be 1. Tip, 2. Shape, 3. Position of dissecting edge, 4. Diameter of the dissecting edge. Thus, this is the “TSPD” punch classification system.

T Classification by Type of Dissecting Edge or Tip:
(Tip):

T.1 Sharp
T.1.1 Regular – Cannula
T.1.2 Serrated
T.1.3 Bifurcated
T.1.4 Pronged
T.1.5 Coated
T.2 Blunt
T.3 Flat (hybrid)

S Classification by Shape (Shape)

S.2 Concave (inverted or hour glass)
S.3 Lipped
S.3.1 e.g., – Regular
S.3.2 Serrated
S.4 Hexagonal
S.5 Open (slot)
S.6 Window
S.7 Tissue Port

P. Classification by Position of Dissecting Edge (Position)
P.1 Internal
P.2 Middle
P.3 External

D. Classification by Punch Diameter (Diameter)
D.1 Small < 0.8 mm
D.2 Medium 0.8 – 1.0 mm
D.3 Large - > 1.0 mm
DEFINITIONS BY TYPE OF TIP

**Sharp Punch** (Figure 28): This punch has a sharpened cutting edge.

**Blunt or Dull Punch** (Figure 29): This punch has edges that are not sharpened.

**Flat or Hybrid Punch** (Figure 30): This punch has an internal edge that is blunt and an external dissecting edge.

**Serrated Tip** (Figure 31): This tip has a wavelike contour that reduces the amount of cutting edge in contact with the skin.

**Bifurcated Tip** (Figure 32): This tip has two dissecting projections.

**Pronged Tip** (Figure 33): This tip has two more elongated projections.

**Coated Tip** (Figure 34): This tip has a coating on the surface of the steel punch.

**DEFINITIONS BY THE SHAPE**

**Straight Punch** (Figure 35): This punch has the same external diameter throughout its length.

**Tissue Port** (Figure 36): An opening along the shaft of the punch through which tissue drawn into the punch can be extruded or extracted.

**Concave Punch** (Figure 37): This punch has a concave inversion of the external surface of the punch just above the tip.

**Lipped Punch** (Figure 38): This punch has a projection outward from the external surface of the punch at the tip; this may be regular or serrated.

**Hexagonal Punch** (Figure 39): This punch has a hexagonal shape of the punch just above the tip.

**Open Punch** (Figure 40): This punch has a slot or slots in the punch wall that allows for long hair to be protected during graft excision.

**Window Punch** (Figure 41): This punch has an opening above the tip of the punch that allows for the grafts to be visualized as they enter the punch during excision.

**DEFINITIONS BY POSITION OF THE DISSECTING EDGE (FIGURE 42)**

**Inside Diameter Punch** (or outside bevel punch): This punch has the dissecting edge of the bevel located on the inside face or at the inner part of the wall of the punch.

**Middle Diameter Punch** (or middle bevel punch): This punch has the dissecting edge of the bevel located on the middle of the wall of the punch. The location of the cutting edge is not always EXACTLY in the middle wall of the punch.

**Outside Diameter Punch** (or inside bevel punch): This punch has the dissecting edge of the bevel located on the external surface of the wall of the punch. The external diameter of the punch is the diameter from the external surface on one side of a punch to the external surface on the opposite side of the punch.

**Internal Diameter of the Punch**: This punch has the diameter from the internal surface on one side of a punch to the internal surface on the opposite side of the punch. Some punches have an internal diameter that is larger at the cutting edge and narrower in the body of the punch.

**Dissecting Edge Diameter of the Punch**: This punch has diameter from the dissecting part of the punch (end of the bevel) on one side of the punch to the cutting part on the opposite side of the punch. For the same external diameter, the dissecting edge diameter may vary depending on the position of the bevel. The dissecting edge diameter is the main measurement of the punch and it should be used as the main point of reference for all companies that manufacture punches. Currently, the most widely used reference is, incorrectly, the inner diameter. The dissecting edge diameter is equal to the external diameter in an outside bevel punch and is equal to the internal diameter in an outside bevel punch and is between the internal and external diameter in a center bevel punch. Attention should be paid to the specifics of the size of the punch as different manufacturers vary in their production standards.

**DEFINITIONS BY THE DIAMETER OF THE DISSECTING EDGE (FIGURE 43)**

**Small Punch**: This punch has a dissecting edge diameter that is equal to or less than 0.8mm.

**Medium Punch**: This punch has a dissecting edge diameter that is greater than 0.8mm and less than 1mm.

**Large Punch**: This punch has a dissecting edge diameter that is equal to or greater than 1.0mm.
Standardization of the Terminology Used in FUE: Part III

INTRODUCTION

The terms in this part of FUE standard terminology focus on the measurement of quality in excision. Utilizing these measurements in daily practice allows the practitioner to fully assess the quality of his or her technique. In order to perform these calculations, the following must be observed, counted, and recorded in all surgeries: 1) the number of punch insertions; 2) all pieces of tissue removed regardless of appearance; 3) the number of partially and completely transected follicles in all removed tissue; 4) the number of follicles intact and transected per graft, and 5) pre-operative densitometry.

**Total Number of Punch Insertions** (or Punch Attempts): The total of all punch insertions made, whether the insertions yield a graft or not.

**Total Number of Grafts Available for Transplant:** The total number of intact grafts or partially transected grafts available for insertion.

**Total Number of Grafts Unavailable for Hair Transplant:** This is the difference between the total number of graft(s) extracted and the total number of graft(s) available for transplantation. Unavailable grafts include capped, completely transected, and empty grafts.

**Total Number of Grafts Excised:** The number of grafts available for transplant plus the number of grafts unavailable for transplant.

**Missing Graft Rate (MGR):** The number of missing grafts divided by the number of punch insertions. MGR equals: Number of missing grafts × 100/Number of punch insertions.

**Graft Transection Rate (GTR):** The result obtained when the number of grafts containing one or more transected follicles is divided by the total number of grafts excised. GTR equals: Total number of transected grafts (partially + completely) × 100/Total number of excised grafts.

**Completely Transected Graft Rate (Total Transection Rate, TTR):** The result of the total number of grafts completely transected divided by the total number of grafts excised. TTR equals: Total number of completely transected grafts × 100/Total number of excised grafts.

RESULTS

**Intact Graft** (Figure 44): This graft is comprised of the entire structure of a healthy terminal follicular unit, including intact structures of the infundibulum, isthmus, and bulbar structures, and has not suffered any trauma during the process of excision.

**Partially Transected Graft** (Figure 45): Refers to a graft that contains one or more follicles that have been transversally cut, but that still contains intact follicles.

** Completely Transected Graft** (Figure 46): Refers to the amputation of all the follicles within a graft so that there are no intact follicles in the excised tissue.

**Buried Graft:** A graft of skin lacking hair follicles resulting from the insertion of a punch into bald skin.

**Missing Graft (MG):** Any graft (intact, complete or partial transection, capped, buried, or empty) that cannot be located because it is misplaced during the surgery. It’s the difference between the total number of punch insertions and the total number of grafts available for hair transplant, plus the number of grafts unavailable for transplantation. MG equals: Total number of punch insertions – (grafts available for HT + graft unavailable for HT).

**Partially Transected Graft Rate (Partial Transection Rate, PTR):** The result obtained by dividing the number of grafts partially transected by the total number of grafts excised. PTR equals: Total number of partially transected grafts × 100/Total number of excised grafts.

**Calculated Follicles per Graft Expected (CFGE):** The number of intact follicles excised plus the number of follicles transected divided by number of grafts available for transplant plus the total number of completely transected grafts. CFE equals: Intact follicles + transected follicles excised / Total number of grafts available for transplant + completely transected grafts.

**Calculated Follicles per Graft Achieved (CFGA):** The number of intact follicles excised divided by the number of excised grafts available for transplant plus the total number of completely transected grafts. CFGE equals: Intact follicles / Total number of grafts available for transplant + completely transected grafts.

**Pared Follicle Rate (PFR):** The number of follicles pared (or de-sheathed) divided by the total number of follicles (intact and transected) that have been excised. PFR equals: Total number pared follicles / Total number of excised follicles (intact + transected).

**Donor’s Area Calculated Density** (Hairs per Follicular Group): The number of follicles counted in the donor area divided by the number of follicular units or follicular families counted in the same donor area (typically performed with a dermatoscope or trichoscope).
Implantation of Grafts: Part IV

INTRODUCTION

Although the use of implanters to place grafts is common practice with both FUT/strip excision and FUE/punch excision, the FUEAC has decided that this version of the Standard FUE terminology should include standard terminology for graft placement devices. Most implanters, whether sharp or blunt, have a plunger that when depressed pushes the graft out of the device into the skin.

**Sharp Implanters** (Figure 47): In 1992, Choi was first to describe sharp needle implanters that allow simultaneous recipient site making and graft placement. Sharp implanters of varying designs are available from many manufacturers (most from Asia).

**Blunt Implanters**: Blunt implanters are used to place grafts into premade recipient sites. Dr. T.K. Shiao was first to manufacture such tools in 2012 and Dr. Mauro Speranzini was first to publish on the creation and use of blunt implanters in 2016. (Figure 48) The first blunt implanters were made by modifying sharp implanters, but blunt implanters from several manufacturers are now available.

**Placers and Inserters**: Devices such as Dr. Erdogan’s *Keep Implanter* device (Figure 49) and Dr. Devroye’s *WAW Implanter* (Figure 50) can hold seven grafts at a time and have blunt tips but are different from most blunt implanters in that there is no plunger. Thus, for these graft implanter devices, forceps must be used to push the graft out of the needle into the recipient site. Erdogan prefers to categorize his graft implanting device as a “graft placer,” rather than an implanter. With the Keep and WAW implanters, only the tip of the placer is inserted in the recipient site.

Another type of graft implanting device is Dr. Mohebi’s “Graft Inserter” (Figure 51). It is loaded in a similar manner as the Keep by rolling the open slot of the tip of the needle over the graft. The tip of the needle is inserted to the full length of the site and the graft inserted via a plunger. All implanters, other than the Keep and the Mohebi Graft Inserter, are loaded with forceps.