Advances in Hair Restoration

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KEYWORDS

• Robotic surgery • FUE • PRP • Scalp micropigmentation • Stem cells • Low-level light lasers • Hair graft survival

KEY POINTS

- Selection of hair transplantation methodology depends on patient's goals, type of hair loss, and quality of hair.
- Robotic hair transplantation is the latest frontier in hair restoration.
- Platelet-rich plasma, low-level laser therapy, and stem cells can be used together with hair transplantation to enhance graft survival.

INTRODUCTION

Modern hair transplantation is based on the use of naturally occurring hair groupings referred to as follicular units (FUs)[1] These FUs may be acquired with the use of strip harvesting or the extraction of the FUs with a small punch, generally 0.8 mm to 1.2 mm in diameter.

The decision as to how the grafts should be obtained will vary with each individual patient and their particular needs at the time of surgery. Each technique has advantages and disadvantages. The process of hair restoration continues to be refined in an effort to create better cosmetic results, growth of hair, and preservation of existing hair. The advances that we are witnessing in hair restoration are occurring in several areas. These include technological advances in recovering grafts and placing grafts, bio-enhancements with storage media and intraoperative manipulation, and adjunctive treatments.

In this article we discuss many of the latest advances in hair restoration.

Technological Advances

For the past several years, a robotic modality for harvesting grafts has been available.[2,3] This device (Artas; Restoration Robotics, Sunnyvale, CA) harvest grafts using a double-needle apparatus that is controlled through the use of a video camera system. Since the initial iteration, this device has been shown to harvest FU extraction (FUE) grafts very reliably. The newest software update is reported to permit harvesting at rates of more than 1500 grafts per hour with low transection rates. The system allows for the use of smaller needles, ranging in size from 0.8 mm to 1 mm and different needle designs to suit various situations. It may be that smaller needles could create smaller wounds in terms of eventual healing.

An improved lighting system enables the operating staff to more easily visualize the operative field and access the grafts for removal within the grids as the machine is functioning. The latest software allows the robot to assess the area to be harvested within a grid and with a single-button, one-touch system the device can ascertain the potential graft positions within the grid rather than having the operator manipulate the device to position it properly. The robotic head has undergone a design change that facilitates greater ease of movement of the device without having to shift the patient.

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The algorithm for harvesting allows the operator to differentiate 1-hair, 2-hair, and 3-hair grafts and the ability to select these to harvest. In terms of making recipient sites, the new software permits the creation of recipient angles of 35° and is most helpful in making sites on the top/horizontal aspect of the scalp. It should be noted that this program may not be optimal in making sites at the lateral aspects of the scalp.

The robotic system has an integrated design feature that can allow the surgeon to draw out a hairline and the area to be transplanted. This design pattern can be transferred to the patient and followed by the robot in making recipient sites. Many physicians prefer to make the hairline sites themselves before considering using the site making mode. The author still prefers to make his own sites throughout the recipient area.

As with any approach to surgery, the robotic device is not perfect for all patients, and the surgeon must select patients who will benefit most from this approach. The author has found that patients with fine hair, thin skin, and very mobile skin can be less well suited for treatment with the robotic device.

Several new drills have been developed to which FUE punches can be attached. One drill in particular has been well received. The WAW (Devroye Instruments, Brussels, Belgium) uses an oscillating mechanism to facilitate the extraction of grafts. A foot pedal with 3 dials controls the initial speed of rotation, degree of oscillation, and speed of oscillation.[4]

In addition, Dr Devroye has developed a punch that he refers to as a "trumpet punch."[4] This punch is constructed so that the inner bore of the punch is sloped and blunted to facilitate obtaining grafts and the external border is flat and sharp. The blunt internal border aids in avoiding transection.

It is advised that the surgeon use light pressure to allow the sharp edge to enter the epidermis initially and then allow for the oscillation to begin before venturing deeper into the tissue.

Other developments with punches include the hex punch from Dr Harris.[5] The hex design acts to disrupt the tissue around the graft using vibratory action, which allows easier removal of the FU with less transection as compared with other punches.

A slotted punch developed by the author[6] originally to facilitate visualization of hair angles and proper centering for FUE harvesting, has been adapted by Drs Park and Boaventura[7,8] to allow for harvesting of long hair grafts.

The process of long hair harvesting allows the patient to avoid shaving large areas of donor. The slotted punch technique for long hair is quite tedious and there can be higher rates of transection.

Usually small areas in various parts of the donor area are shaved and the grafts are taken from these areas. This allows the patient to cover any evidence of the surgical process.

Implantation

Traditionally the primary approach to placing grafts has been the use of jeweler's forceps to grasp the FU grafts and then place them into the recipient sites. To do this proficiently can involve substantial practice. Holding the grafts too tightly can lead to damage to the grafts and repeated attempts to place the grafts can also lead to damage. This may be a factor in some poor growth outcomes.

Increasingly, clinicians are adopting the use of implanters to aid in placing grafts. There are multiple implanters on the market, such as the Lion (Hans Biomed, Korea), OKT (Choi Instruments, Korea), and others, but the basic design is similar.[9–11] A needlelike cylinder with a slit is attached to a spring-loaded stem that can push a graft into the skin after the implanter has been appropriately loaded. Sharp implanters are used to make the recipient site and place the grafts at the same time. Some surgeons are blunting the tips of the implanters and use the implanters after sites have been created.[12] It is felt that the use of this type of implanter allows for less trauma during graft insertion. The technique uses premade sites that can be sagittal or coronal. Currently the surgeon must make or have someone else take a sharp implanter and make the tip dull. This is accomplished by using sandpaper such as 400 or 600 g weight paper and rubbing it over the edge of the needle of the implanter until it is sufficiently blunted.

Implanters come in various needle sizes to accommodate differing graft sizes. The surgeon must select the appropriate size to be used, and if there is difficulty placing the graft, repeated manipulation may damage the grafts. Many implanters are re-useable and can be taken apart, cleaned, and then sterilized for reuse.

An important aspect of the use of implanters is the work flow that must occur to perform implantation efficiently.[11] In general, there must be at least 1 person loading the grafts, a second person handing the grafts to the surgeon to implant, and that person must then receive the unloaded implanter and pass it back to the loader. This system can take considerable time to develop. If the surgeon attempts to use 2 people implanting, this adds more complexity.

Bio-Enhancements

In an effort to improve graft survival, hair transplant surgeons are increasingly using bio-enhancements