Forehead-supporting chair system for follicular unit extraction hair transplantation

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The seated and prone positions are the most common surgical positions used during follicular unit extraction (FUE). Compared to the latter, the former eases centering and enables more optimal surgical field exposure due to gravitational effects on intraoperative bleeding. Furthermore, the surgeon can simultaneously work with multiple assistants, increasing efficiency and reducing operative time. During the harvesting stage of FUE, the patient is often seated in an electric height-adjustable salon chair. Such equipment, however, does not provide support for the head; maintaining a fixed upright position for an extremely long-lasting and delicate surgery that requires loupes with $\times 5$ or higher magnification is challenging for both the surgeon and the patient. On the other hand, a support system that firmly fixes the patient's forehead would have ergonomic benefits during the process of FUE donor harvesting in a seated position. Firm support of the forehead would also enable upward traction to provide tension on the scalp, lessen the gap between the hair exit angle and internal hair angle, and reduce graft torsion, ultimately minimizing follicular injury and optimizing graft quality.

Keywords Hair / Hair follicle / Transplants

INTRODUCTION

Compared with follicular unit transplantation, the follicular unit extraction (FUE) method has its benefits and drawbacks. With FUE, no linear donor scar is created, and postoperative pain is lessened. On the other hand, FUE often involves donor-area shaving and a long learning curve for the surgeon. Moreover, the time-consuming and labor-intensive process requires intense concentration, physical endurance, and technical precision.

A no-shave (NS) FUE technique has recently been introduced to overcome the inconvenience, on behalf of the patient, of donor shaving, and is now widely employed by many expert hair surgeons. It mandates even more prolonged operative hours com-

pared to full- or partial-shave FUE procedures, thus necessitating a higher level of endurance and concentration, as well as a highly organized and equipped team with surgical expertise.

Surgical positioning of the patient during the FUE harvesting procedure is either seated or prone. In the seated position, compared to the prone position, centering is better facilitated upon punching, and the surgical field is better exposed because blood from intraoperative bleeding flows downwards due to gravity. Such a position is far more beneficial for the NS-FUE method as well, because the surgeon and two assistants may work concurrently for more efficiency, with the added advantage of reducing the overall operative time.

The assistant on the same side as the surgeon sweeps the hair up to secure a clear surgical view, simultaneously applying upward traction. Of course, unlike NS-FUE, cases of a shaven donor only require upward traction. Meanwhile, the assistant positioned on the other side extracts the scored grafts. In other words, while the surgeon moves onto the left side after punching a portion of the donor region on the right, the assistant on the right extracts. NS-FUE is an extremely time-consuming surgical method due not only to the punching itself, but also to the enhanced level of difficulty when extracting through long hair shafts. Therefore, it is mandated that the process of punching and extraction be over-

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Fig. 1. Simultaneous punching and extraction.

Fig. 2. Follicular unit extraction chair system (graMAX): names of each part.

lapped for better efficiency as well as time reduction (Fig. 1).

Conventionally, when harvesting donor hair in the seated position, a hairdresser's electric height-adjustable chair is employed. In this case, the patient's head has no supportive system, which exhausts the patient, and such fatigue is redoubled as the patient is unable to make movements due to the delicate process of FUE surgery, which is usually performed with the aid of loupe magnification at a level of $\times 5$ or more. Massage chairs are used as well [1]; however, they introduce the inconvenience of transferring the patient to the surgical table for the graft insertion process. In cases of additional harvesting, this inconvenience is repeated. It is also difficult to accurately predict the hair exit angle when the surgeon looks down at the donor area with the patient in a prone position. Manipulating the patient's head position, such as moving it from left to right and up and down or tilting it forward and backward, is difficult. Moreover, the surgeon and assistants are unable to work concurrently.

IDEA

This motorized forehead-supporting FUE chair system (graMAX, Seson Medical Company, Iksan, Korea) will facilitate the process of

Fig. 3. Motorized forehead-supporting follicular unit extraction chair system.

FUE harvesting by providing firm forehead support, which can be adjusted up and down, forward and back, by simple manipulation (Figs. 2, 3).

DISCUSSION

There are five major benefits of this motorized forehead-supporting FUE chair system, which the authors are currently using.

During surgery, the patient's head is securely fixed on a forehead rest, which the surgeon or assistants can easily adjust to glide up, down, forward, and backward, or tilt forward and backward with a foot pedal.

Zontos et al. [2,3] observed that the average FUE punching angle is 45.07° and ranges from approximately 33.37° to 55.83° ; they also noted that vertical punching is advantageous for several reasons compared to acute punching. With vertical punching, the resulting wound surface is smaller, and better visualization of the hair exit angle helps reduce graft transection, accordingly creating a smaller wound scar and less fibrotic change. It is apparent that vertical angle punching has a decided advantage over acute angle punching. There are two main ways to convert the hair exit angle to a more obtuse one, specifically, tumescent injection and upward traction of the scalp. Such techniques are especially useful when working on the lower occipital area, where the hair exit angle tends to be closer to parallel to the skin's surface. Patients with hyperelastic skin may also need, in combination with upward traction, a downward counter-traction to create more skin tension. In order to apply such upward traction, it is mandatory that the forehead is firmly fixed on an apparatus like the forehead-supporting structure of the chair discussed here.

According to Rose et al. [4], there is an average difference of 6.43° between the hair exit angle and internal hair angle, which becomes 14.65° when only curly hairs are taken into account. They also explained that upward traction helps reduce the angle disparity as more traction is applied at the surface compared to lower lay-

ers of the skin. Such a maneuver requires a forehead-supporting structure capable of stabilizing the patient's head.

Graft torsion is one of the main drivers of transection. Its rate rises proportionately to friction force due to the increase in contact surface between the punch tip and skin. Increased axial force, rubbing or loose skin, and low punch torque can also increase graft torsion. However, these phenomena diminish when the punch is operated at a higher torque (revolutions per minute), tumescent solution is injected, tension is applied, or oscillation rather than rotation mode is used [5]. In conclusion, upward traction of the scalp with the forehead supported tenses the scalp tissue and thus prevents graft torsion.

Improvement of ergonomics is a key issue in long-lasting hair transplant surgery, particularly in the FUE procedure. Its importance is heightened when performing an NS-FUE procedure, which requires the longest operative time [6]. For both the patient and surgeon to feel comfortable for the entire duration of surgery, the patient's forehead or chin must be resting on a support. Chin support, however, is likely to produce muscular discomfort in the neck after a while. Forehead support is more favorable.

CONFLICT OF INTEREST

The author JHP declares that there is a possible ownership interest in that he has obtained patents regarding the graFUE of the Seson Medical Company. No other potential conflict of interest relevant to this article was reported.

ETHICAL APPROVAL

The study was performed in accordance with the principles of the Declaration of Helsinki.

PATIENT CONSENT

The patients provided written informed consent for the publication and the use of their images.

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