



Marking the recipient sites in hair restoration surgery – new methodology to attain symmetric density

Marcação de incisões receptoras em cirurgia da restauração capilar – nova metodologia para simetria de densidade

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■ ABSTRACT

Introduction: In hair restoration surgery, recipient sites for insertion of follicular units are made with microblades or needles, with the goals of achieving the closest proximity possible and to maintain vascular nutritional support for the grafts. This study describes the methodology for preparatory marking of the frontal scalp with dots or lines. Stamps developed by the author are used to make incisions at these sites in order to attain symmetric density. **Methods:** Several types of stamps are described. Individualized options for use in the frontal region were defined in four groups of patients; three types of inks were used in order to choose the ink with greater permanence in the skin. Groups A and B were respectively tested with common concentrations of inks for medical use and with a permanent ink. Groups C and D were tested with an alcoholic solution of 3% gentian violet, with and without the application of a barrier film spray. **Results:** Stamps moistened with the ink tested in group D marked lines and dots on the scalp which were resistant to blood and frequent washing, when covered with a barrier film. **Conclusions:** The use of stamps to mark bald skin with the methodology described improves incision symmetry and slot identification for the insertion of follicular units, in turn resulting in symmetric density in the frontal region.

Keywords: Recipient sites; hair transplant; skin marking.

■ RESUMO

Introdução: Em cirurgias de restauração capilar, as incisões receptoras para a inserção das unidades foliculares são realizadas com micro lâminas ou agulhas, procurando conseguir a maior proximidade possível, mas visando a segurança da nutrição sanguínea dos enxertos. O objetivo deste trabalho é relatar uma metodologia de marcação prévia de traços ou pontos na pele calva da região frontal, usando carimbos criados pelo autor, objetivando fazer incisões nessas marcas, a fim de se obter simetria de densidade. **Métodos:** Alguns tipos de carimbos são descritos, e também suas opções de utilização na região frontal, juntamente com três tipos de tinta, uma em cada indivíduo de quatro grupos de pacientes, visando a escolha da tinta que apresentasse maior tempo de permanência na pele. Nos grupos A e B, foram testados,

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respectivamente, o uso das concentrações usuais das tintas de uso médico e o de uma tinta permanente. Nos grupos C e D, foi testada uma solução alcoólica de 3% de violeta de genciana, sem e com uma película de barreira em spray. **Resultados:** Os carimbos descritos, umedecidos com o corante testado no grupo D, deixaram traços e pontos sobre o couro cabeludo que, cobertos com a película de barreira, foram resistentes a sangue e lavagens freqüentes. **Conclusões:** O uso de carimbos para marcar a pele calva, usando o método descrito, facilita a simetria das incisões e a identificação das fendas para a inserção das unidades foliculares, resultando em densidade simétrica na região frontal.

Descritores: Incisões Receptoras; Transplante de Cabelo; Marcação de Pele.

INTRODUCTION

Androgenetic alopecia (AGA) is hair loss caused by the gradual atrophy of hair follicle cells due to the inhibitory action of 5-alpha-dihydrotestosterone, a degradation product of testosterone generated by the enzyme 5-alpha-reductase. It affects both men and women who genetically inherit an accentuated number of hormone receptors in follicular cells, or receptors with increased hormone sensitivity. This deleterious hormonal action can affect smaller areas of the scalp, such as only the upper frontal or occipital region; alternatively, it can progress in a retrograde or anterograde manner from the frontal to the occipital regions, joining these on the top of the head and extending laterally. These differences were first described in the classification of degrees of male pattern hair loss by Norwood,¹ for females by Ludwig², and, more recently, by Basto³.

The frontal region is critical to facial esthetics, and cosmetic density of the frontal hairline is extremely important for the formation of a facial "frame" in hair restoration surgery. The creation of an irregular frontal hairline⁴ in a natural manner, with cosmetic density and symmetry, are the main goals of patients and of surgeons devoted to this branch of surgical reconstruction; such a result would be admired in any observed position.

Drawing lines on the skin is a common procedure for marking sites in areas to be cut, resected, and aspirated. In hair loss surgery, it is common to mark only the skin strip taken from the donor area, the anterior hairline, and the contour of the recipient regions. In transplantation of follicular units (FUs), numerous incisions are made by the surgeon using micro-blades, or with hypodermic needles, usually 18- 22G. These incisions are millimeter slots, placed at a safe interval according to the thickness of the graft in each area and the experience of the surgeon. These are either always placed randomly or in an intercalated alignment to give the visual effect of higher density. However, different densities may result on each side of the head when surgeon and assistant simultaneously perform incisions and insertions on opposite sides, especially when they have different levels of experience.

Stamps measuring 6.25 cm², with pattern density from 25 to 60 dots per cm², were developed by Gimenez and Sosa⁵ to estimate the number of FUs to be transplanted. The stamp face was coated with gentian violet (GV) or methylene blue (MB) 1% aqueous solutions, using a paint roller. The authors did not report a long clinical experience, and indicated that after stamping

the skin, then making the incisions and washing the area with saline solution, several slots remained marked with ink.

In our clinical experience, after testing similar instruments over the last five years, we have had difficulty using large stamps to mark more than 30 dots per cm²; due to the curvature of the skull, these do not work properly with MB and GV in a 1% aqueous solution. In addition, due to inked margin proximity, the stamps leave blurred marks that take time to dry and do not last through the entire surgery.

OBJECTIVE

This study describes instruments developed by the author to provide less experienced teams with a methodology to attain symmetry in the frontal region by using his personal technique,⁶ and reports procedures for selecting more resistant inks. These instruments can also be used in other areas of total alopecia to attain symmetry when slots and insertions are simultaneously performed by surgeon and assistant.

METHOD

A total of 54 men, 28-62 years-old, with frontal hair loss were operated on from May, 2008 to September, 2013 by the same team, using stamps to mark the recipient sites.

Stamps of various sizes and formats were tested and three models were found to be the best. Two were made of silicone and fixed to acrylic plates, and could be sterilized in ethylene oxide; the other, made of stainless steel, could be autoclaved. Each 1cm² of skin is marked with 30 lines, measuring 0.8-1mm each. These small lines are 1.5mm apart and are intercalated with other front and rear marks. The distance between anterior and posterior lines is also 1.5mm, which determines the number of slots per 1cm² of each stamp.

As the stamp needs ink to work, the difficulty in using this instrument was in finding an ink and an application methodology enabling the marked lines to persist through the entire surgery. During the subsequent study period, the type and concentration of ink were tested for their best use with the stamps.

New stamp pads, sterilized with ethylene oxide, were used with each ink and for each patient. We tried to use the same types of stamps and inks in different patients, who formed the first group. To complete the marking, and due to

the inefficiency of the inks tested, a different ink was then used for another group of patients. While stamps and inks were being tested on the author's private patients, four groups (A, B, C, D) were thus forming in a natural manner. This study was not previously submitted to an institutional ethics committee; it is a clinical observation of the efficiency of a method tested in private patients of the author who were operated on in his Clinic and in the Fluminense Clinic of Plastic Surgery.

In group A (12 patients), MB and GV in 1% aqueous solutions were tested. In group B (22 patients), a red permanent ink was evaluated. In group C (9 patients), GV in 3% alcohol solution was used. In group D (11 patients), lines marked with a 3% GV stamp were spray-coated with two layers of Cavilon (a product that protects the skin of colostomy patients against the prolonged use of adhesives).

The types of stamp used were the following:

A - Square stamp – This is more useful for the first centimeter of the anterior hairline (Figure 1A).

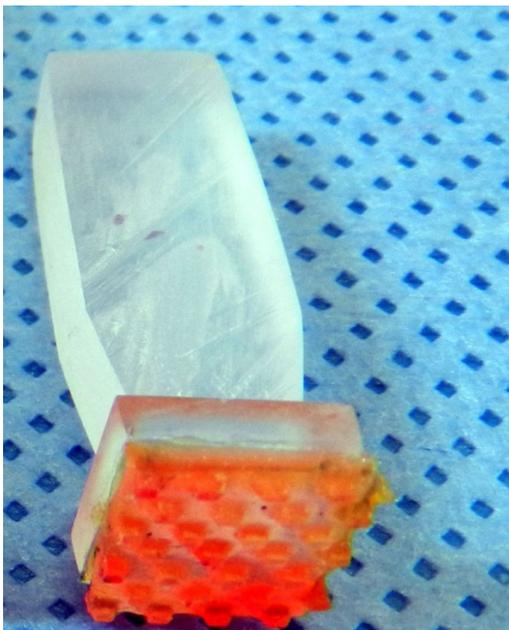


Figure 1. (A) Stamps attached to acrylic plates and roller stamp. Square stamp type.

B - Elliptical stamp – This was designed to mark sites in the forehead (central part of the frontal region). It measures 7cm in length and 5cm in its maximal width (27.49cm²). If manufactured for 30 lines per cm², it can stamp 810 lines. It becomes more precise for marking skull curvature if divided into two (Figure 1B) or four parts (Figure 1C), resulting in two or four smaller stamps. At the inferior border of the elliptical shape, it is possible to make two diagonal incisions to match the frontal hairline; the intent is to facilitate the use of roller or square stamps to create this hairline.



Figure 1 (B) Elliptical stamp.

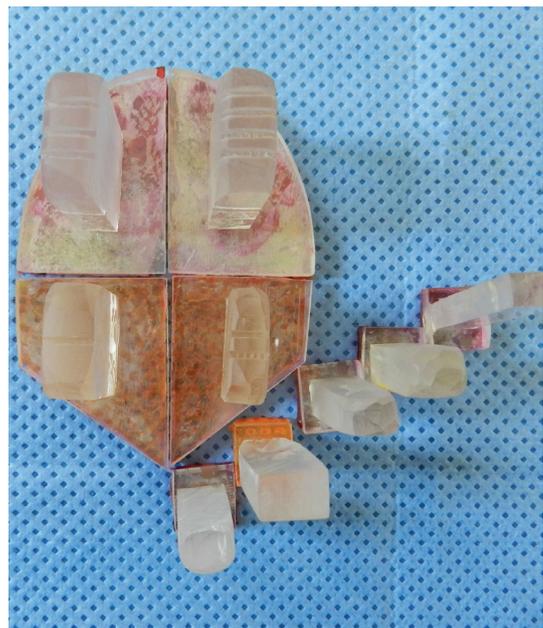


Figure 1. (C) Elliptical stamp with cuts at the inferior border and five square stamps in sagittal position relative to the shape of the anterior hairline.

A - Roller stamp – The roller stamp is made of stainless steel and measures 0.6cm wide (Figure 1D). It also marks 30 lines per cm².



Figure 1. (D) The roller stamp is made of stainless steel.

Surgical plan

In group A, The surgical plan followed skin sterilization, with use of ink on sterilized stamps. In groups B, C, and D, initial sterilization was performed with alcohol-ether to reduce skin oil. The skin was then marked with non-sterile stamps and another more thorough sterilization was performed in the operating room.

The best sequence is described below.

1. Point A - corresponds to the anterior midpoint of the frontal hairline and is marked according to criteria chosen by the surgeon.

Point B - is located 1cm above point A, on a midline 7cm in length. The entire elliptical stamp is used above point A (Figure 2A), or a part cut diagonally is used above point B (Figure 2B). The frontal hairline is approximated and initially marked with dots from point A to the temporal recesses as planned.



Figure 2. (A) Marking future slots in the frontal area. Elliptical shape with marks above point A and green dashes delimiting the hairline.



Figure 2. (B) Dots marked above point B with the inferior half of the elliptical stamp cut diagonally.

2. A irregularities in the frontal hairline are then marked with a square stamp in the sagittal position, with alternating heights along a dotted line to form a "ladder" shape (Figure 2C). If used in coronal position along a dotted line, square stamps draw a "speed bump" shape (Figure 2D). Roller stamps can also be



Figure 2. (C) "Ladder" hairline in the postoperative period: square stamps were used in sagittal position.



Figure 2. (D) "Speed bump" hairline: square stamps were used in coronal position.



3. (A) Demonstrating total visibility in surgery after spraying acrylic film. "Ladder" hairline marked with a square stamp; frontal forehead marked with the two parts of the elliptical stamp; the remaining area was marked with a roller stamp.

used behind the dotted line or any irregularities in the frontal hairline, which is drawn with a permanent ink pen to achieve a more natural result. Roller or square stamps can be used to mark the dots in the remaining bald region. Then, two coats of Cavilon are sprayed over the area, once the lines marked are dry; 2–3min are necessary to dry the film (Figure 3A) before sterilizing the entire scalp with chlorhexidine detergent.

3. Local anesthesia was administered along each line marked, and receptor slots were made using 0.7–1mm microblades (Figure 3B). Insertion of the FUs followed, with no difficulty in localizing the slots or the incisions. Single incisions followed by



Figure 3. (B) Making receptor slots with a 0.8mm blade on the right side of the frontal area.



Figure 3. (C) "Stick-and-place" technique in the central area after an initial phase of filling prior incisions on the right side. All small marks made are completely visible.



Figure 3. (D) After the first phase of filling. All marks are visible despite the frequent use of saline spray.

immediate insertion were performed by the "stick-and-place" technique^{7,8} (Figure 3C), without deleting the lines that were marked. The same distance between grafts was obtained on both sides (Figure 3D). If additional density is requested after initial graft placement, other FUs are placed among the initial grafts, making it possible to place 40 or more FUs per cm².

RESULTS

In group A, the outcome was not successful, as inks in aqueous solution dried slowly and tended to blur the skin during or after stamping. Lines faded prematurely during sterilization, and were deleted by saline washing if made afterwards.

The permanent ink tested in group B showed better resistance than that used in group A, but also did not last through the entire surgery. It was difficult to clean, requiring the use of alcohol.

In group C, the ink persisted longer due to the increased concentration of 3% GV solution. However, the ideal condition, in which the ink marks the skin during the entire surgery, was not achieved.

In group D, adding the sprayed film enabled performance of two common techniques of incision and insertion with high precision; the marks were resistant to frequent use of wet gases and saline spray and lasted throughout surgery. Prior tests for cutaneous sensitivity to the product were conducted, with no untoward reactions.



Figure 4. (A) Results. Right lateral preoperative profile.



Figure 4. (B) Outcome after transplantation of 2450 follicular units.



Figure 4. (C) Left lateral preoperative profile.



Figure 4. (D) Outcome after 2450 follicular units.

The expected outcome of frontal symmetric density with 2450 FUs was observed with this method (Figure 4). The frontal receiving area measured 60 cm². With the stamps described, 1,800 future slots were marked. After initial graft placement, an additional 650 FUs were inserted among the initial grafts. This method could not be used in subsequent sessions.

DISCUSSION

Teams experienced in modern and labor-intensive hair loss surgery, involving large numbers of receiving sites measured in millimeter fractions, can insert FUs with precision to achieve high cosmetic densities. The prospect of visualizing

marks at sites where incisions should be performed would contribute to the training of a less experienced team in the art of inserting tiny grafts.

A study published in August 2012 described the use of stamps⁵ to pre-estimate capillary density, although no clinical experience was reported. This publication used larger stamps with higher density and inks that could be used to estimate the number of grafts, but these do not work properly in surgical procedures.

Since 2008, the author has experimented with the use of stamps to mark receiving sites, reporting his experience in July 2012⁶ and further describing it in this article. This resource can assure the surgeon that his assistants will be better able to identify the location of the slots used to insert grafts. An anterior irregular line can be drawn in front of the marks made with the stamps, or can be marked by the stamps themselves in two ways, according to the planned surgical sequence.

Prior marking of the sites with stamps is clearly a process that relies on resistant inks and can be performed only in areas of total alopecia. Therefore, it is not indicated for diffuse alopecia or subsequent treatment sessions. For this reason, the author selected cases of total frontal alopecia to test the use of the stamps.

The author recognizes that good outcomes in terms of density and symmetry do not depend solely on the separate marking of each receiving site, but rather on a number of factors. Especially important is the experience of the surgeon and his assistants in handling these delicate structures, which are inserted into receiving slots created in the correct location, and at the correct density, suitable slope, and depth.

Correct use of the stamps required assessment of the maximum effective density of the marks per cm², the size of the stamps, the most appropriate ink, their characteristics, and the sequence of their application.

In this study, the author tested small stamps of 1 cm²; the elliptical stamp developed for the frontal forelock area was cut into two or four parts, since use of the entire stamp was not suitable for the curvature in this area. Larger stamps with higher density tend to blur the skin when used on a convex area. Therefore, the use of smaller stamps was more effective. However, depending on the manufacturing process, it may be possible to use stamps with higher density by using the ink employed in group D, together with a protective spray.

CONCLUSION

The square, elliptical, and roller stamps described here were useful for marking incision lines in the hairline, frontal region, and rest of the scalp, when these areas are devoid of native hair. The stamps are properly used with inks which mark without running off the skin, are highly concentrated, dry quickly, and persist through a prolonged procedure.

The best ink for the appropriate use of the stamps was a 3% alcoholic solution of GV coated with a protective spray film, as used in group D. This method resulted in improved symmetry of the frontal hair and less time in surgery.

Marking the receiving slots aided the training of the author's team. There was improved understanding of how to transplant the same number of FUs on both sides of the frontal region, with a single space between grafts; this allowed the surgeon and assistant to simultaneously perform incisions and insertions on opposite sides. The results in group D were satisfactory and consistent. The use of these stamps is not recommended for diffuse hair loss or subsequent filling sessions.

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