Facial Feminization Surgery: The Forehead. Surgical Techniques and Analysis of Results

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**Background:** Facial feminization surgery encompasses a series of surgical techniques derived from plastic and craniomaxillofacial surgery to soften facial features that are generally perceived as being more masculine, mainly in patients diagnosed with gender dysphoria. This article describes the main surgical techniques used in feminization of the forehead complex, sequences the different steps in forehead reconstruction, evaluates results obtained using cephalometric analysis, and includes the level of patient satisfaction.

**Methods:** Between January of 2008 and December of 2012, the authors performed a total of 172 forehead operations. The postsurgical results were analyzed using postoperative cephalometric studies that were compared with preoperative teleradiographies. The patients’ level of satisfaction was also evaluated using a satisfaction questionnaire that they filled out after a 6-month postoperative period.

**Results:** Along with an evaluation of patient satisfaction and clinical and cephalometric results where significant setback of the frontal bossing was observed, the authors present the sequencing of frontonasal-orbital reconstruction/recontouring with systematic osteotomy of the anterior wall of the frontal sinus in addition to developing a modification of the standard coronal approach.

**Conclusions:** By treating the forehead region with the different surgical procedures described in this article, masculine facial features of the upper third can be modified with predictable and satisfactory results. Facial feminization surgery must be considered part of the process of treating patients with gender dysphoria, because the modification and elimination of masculine facial features allows these patients to adapt more easily to the workplace and social and family environments. (Plast. Reconstr. Surg. 134: 609, 2014.)

**CLINICAL QUESTION/LEVEL OF EVIDENCE:** Therapeutic, IV.

The concept of facial feminization has been presented in the scientific literature by various authors over the past few years. Facial feminization surgery embraces a range of surgical techniques, the objective of which is to soften and harmonize the different aesthetic sectors of the face, bringing features that are usually identified as male more in line with female features. This surgical discipline is particularly important for patients with gender dysphoria or gender identity disorder, a diagnosis included in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition and classified in the International Classification of Diseases, Tenth Revision, with a prevalence that can vary from one in 12,000 to one in 50,000 according to different studies. The disorder requires a multidisciplinary approach following a strict protocol, in which the alteration of the facial features leads to an improvement in the patient’s

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self-esteem and successful integration into the workplace, society, and family, all contributing to a significant improvement in quality of life.\textsuperscript{8,9} The principal differences between masculine and feminine facial features are related to the bone structure,\textsuperscript{3,10} although other important differentiating characteristics also exist, such as skin type, distribution of facial hair and fat, type of hair and hairline shape,\textsuperscript{11,12} the prominence of the thyroid cartilage or Adam’s apple, and differentiating characteristics in the soft tissues, among others.\textsuperscript{3,13}

We describe our experience with facial feminization during the period between January of 2008 and December of 2012, reviewing the different procedures and the surgical techniques used in the treatment of the forehead that allow the frontonasal-orbital complex to be retropositioned, which were later analyzed using preoperative and postoperative cephalometries. The patient satisfaction level was also evaluated using postoperative questionnaires. Finally, the most important results obtained are presented here.

### PATIENTS AND METHODS

Between January of 2008 and December of 2012 (60 months), we performed 214 facial feminization operations. All of the patients that we operated on had been previously diagnosed with gender dysphoria (\textit{International Classification of Diseases, Tenth Revision} code F-64). The average age of the patients was 39 years (range, 18 to 61 years). Postoperative follow-up ranged from 6 to 65 months. The facial feminization procedures performed break down as follows: 172 frontonasal-orbital recontouring procedures with osteotomy of the anterior wall of the frontal sinus, of which 110 used a modified coronal approach and 62 used a hairline approach; 99 mentoplasties with osteotomy, bone sculpture using shaving, or both; and 63 jaw recontouring procedures with bone sculpture using shaving and 42 mandibular angle osteotomies. All of the results and images that appear in this article belong to patients who have given their express consent for their images to be published in scientific publications in compliance with current personal data protection regulations.

### Clinical Evaluation and Surgical Techniques

When evaluating the facial feminization needs of a patient, we choose to follow the classic evaluation technique of dividing the face into thirds and focusing on the key areas. In the upper third, the key areas to evaluate are the frontonasal-orbital region, the nasoglabellar angle, the superciliary and supraorbital ridge, the protrusion of the anterior wall of the frontal sinus, the frontomalar suture, the forehead bone shape, the distance between the nasal root and the beginning of the hairline, the hairline shape, the type of hair and skin, and the expressive areas and established wrinkles. In the middle third, the focus is on the shape of the nose, the projection of the malar region, and the length of the upper lip (the point between the columella and the vermilion border). In the lower third, attention is focused on the chin, its shape and position, and the mandibular body and angles. The following sections describe exclusively what we consider to be the most important techniques being used in the field of facial feminization of the forehead.

### FOREHEAD RECONTOURING AND RECONSTRUCTION

Frontonasal-orbital recontouring includes bone sculpture along with osteotomy, recontouring, repositioning and, finally, securing the anterior wall of the frontal sinus. (See Video, Supplemental Digital Content 1, which is a three-dimensional animation of the forehead reconstruction technique. This video demonstrates the steps of the forehead operation through a surgical animation in which the areas approached are visible and the technique is described in detail, available in the “Related Videos” section of the full-text article on PRSJournal.com or, for Ovid users, available at http://links.lww.com/PRS/B74.)
Two possible approaches exist that vary depending on whether or not the vertical dimension of the forehead (the distance between the nasal root and the beginning of the hairline) needs to be modified. When some modification of this distance is required to reduce it, the approach is made through the hairline, where the remaining cutaneous fragment is eliminated to modify this vertical dimension (Fig. 1). The second access route is the modified coronal approach (Fig. 2). This modification includes the elimination of an elliptical fragment of the scalp, making it possible to eliminate the excess skin after the bone recontouring and allowing for better attachment of the edges of the wound, a discrete lifting effect on the forehead and, when necessary, the use of the follicular units in this fragment for immediate transplant in the hairline and the temporary recesses. For both types of approaches, hairline and coronal, we recommend an oblique cutaneous incision with a 35- to 45-degree scalpel inclination, which will help to preserve the follicular units and, after a suitable scarring period, produce hair growth through the scar itself. Once the approach route is chosen, detachment is performed in layers to prevent injury to the frontal branch of the facial nerve, and the frontoorbital region is exposed, including the nasal bones. In both cases, it is important to identify the supraorbital nerves and detach them correctly, which may require osteotomy of the bony septum that separates the orbital cavity. The next step is osteotomy of the anterior wall of the frontal sinus, which is removed and meticulously sculpted, always taking care to prevent any perforations. With access to the sinus secured, the permeability of both frontonasal ducts is ascertained and the undamaged sinus mucous preserved (Fig. 3). The forehead region, frontomalar transition, superciliary and supraorbital ridge, and nasoglabellar transition are sculpted at the same time. Once all

Fig. 1. Detail of the hairline approach. The marked cutaneous area will be eliminated during surgery.

Fig. 2. Detail of the modified coronal approach. Front and side views.
of the recontouring is finished, the anterior wall of the now sculpted frontal sinus is secured using 1.2 osteosynthesis material, either screws or mini-plates, depending on the requirements (Fig. 4). It is important at this point to eliminate any possible interferences and inspect the transition zones. Then, the area is closed, paying special attention to the galeal-pericranial flap suture. In the event that a coronal approach is used, when repositioning the scalp flap, two resorbable fixation devices (Endotine Forehead Fixation Device 3.0; Coapt Systems, Inc., Palo Alto, Calif.) are placed to ensure that the flap is secured correctly and help to position the eyebrows over the new bone shape. With the hairline approach, a meticulous cutaneous suture is made that guarantees accurate positioning, with no tension in the beveled cutaneous edges and the best possible scarring. The use of magnifying optical instruments is recommended to obtain optimal results with this closure. Whenever a coronal access is used, a drainage device is placed that is removed 24 to 48 hours after surgery. During the preoperative and immediate postoperative periods, teleradiography control radiographs are obtained to obtain an initial evaluation of the surgery performed (Fig. 5). Figure 6 provides a step-by-step description of the frontonasal-orbital recontouring-reconstruction technique.

**RESULTS**

The average medical follow-up for patients was 28 months, with the interval ranging from 6 to 65 months. The demographic distribution of patients is shown in Figure 7. No serious complications were observed and no new emergency surgical operations were required. It was not necessary to drain any postsurgical seromas or hematomas. It was possible to remove all of the drains placed in the coronal approaches between 24 and 48 hours after surgery. One patient had a cerebrospinal fluid fistula along a linear cut in the posterior wall of the frontal sinus that resolved spontaneously 72 hours after surgery with the assistance of posture measures. There were no complications related to the approach to the frontal sinus such as sinus dysfunction, sinusitis, or mucocele or any fractures in the anterior wall of the frontal sinus. All of the patients received preoperative and postoperative lateral teleradiography x-ray examinations. Both hairline and coronal scarring showed positive development, with hair growth in the scar beginning 8 to 12 weeks after surgery. Most of the patients reported light to moderate paresthesia, with complete recovery starting 3 months after surgery in the supraorbital, forehead, and scalp regions. No injury was reported to the forehead branch of the facial nerve, although a slight degree of paresis occurred in some cases, with complete recovery a few weeks after surgery. Most of the patients had low to moderate postsurgical edema that responded very well to hilotherapy. No complications associated with any of the complementary procedures related to the operations were reported. Preoperative, intraoperative, and postoperative imaging was performed on all of the patients operated on during this period. The average level of patient satisfaction, assessed using postsurgical questionnaires, was between satisfied and completely satisfied, with an average overall satisfaction level of 4.5 in the questionnaire filled out 6 months after surgery (Table 1 shows
the satisfaction questionnaire and Table 2 shows the average satisfaction level, calculated using the average of all of the answers obtained from each questionnaire and patient. Figures 8 through 12 show different intraoperative, radiologic, cephalometric, and clinical presurgical and postsurgical results. Table 3 shows the average preoperative and postoperative cephalometric measurements where setback of the frontal bossing is determined by measuring the distance from the point corresponding to the frontal prominence landmark (PF) to the gonion (Go) and to the sella (S). For the case in the figure, preoperative measurements include the following: frontal prominence landmark to sella, 81.17 mm; and frontal prominence landmark to gonion, 121.15 mm. Postoperative measurements include the following: frontal prominence landmark to sella, 72.66 mm; and frontal prominence landmark to gonion, 112.42 mm. A setback of 8.51 mm from frontal prominence landmark to sella and a setback of 8.73 mm from frontal prominence landmark to gonion can be observed.

**DISCUSSION**

The concept of facial feminization surgery was first introduced by Douglas Ousterhout in 1987. Since then, several authors have published accounts of their experiences in this surgical discipline. Facial feminization results from the need to modify masculine features in patients with gender dysphoria who are in the process of adapting their identity or patients with overly pronounced facial features. Facial gender identity is a field of interest because certain areas of the face are easily recognizable as masculine or feminine. The frontonasal-orbital region and jaw are especially important areas in the visual identification of facial gender. In contrast to studies by Brown and Perrett, Spiegel attaches particular importance to the nose as an isolated element in facial gender identification. For Becking et al., the zygomaticomalar complex also plays an important role in differentiating facial gender.

The modification of masculine facial features is increasingly important in the framework of gender reassignment for patients with gender dysphoria. Emphasis has been placed on the significance of this treatment for the patient’s self-esteem and confidence, and their ability to incorporate and adapt to their new role in the workplace, society, and family. Some authors advocate—and we fully agree with this line of thinking—that facial feminization is a key element in the treatment of gender dysphoria and that it can be more important from the patient’s psychological point of view, in terms of their psychosocial adaptation, than the sexual reassignment itself, which is related more to the patient’s personal life.

When evaluating patients who are requesting facial feminization surgery, decisions are based on...
Fig. 6. Forehead reconstruction technique sequence. (Above, left) Patient’s profile before surgery. (Above, center) Modified coronal approach, with elimination of the scalp strip. (Above, right) Coronal flap, preserving the frontal branch of the facial nerve. (Second row, left) Pericranial flap until frontonasal-orbital ridge and both frontomalar apophyses are reached. (Second row, center) Skull profile; note the protrusion of the frontal bossing. (Second row, right) Osteotomy of the anterior wall of the frontal sinus using a saw. (Third row, left) Access to the frontal sinus. The anterior wall is preserved in saline solution until shaving and repositioning. (Third row, center) Sculpture of the entire frontonasal-orbital complex, paying special attention to the frontonasal transition. (Third row, right) Sculpture of the anterior wall of the frontal sinus. (Below, left) Stable fixation of the anterior wall of the frontal sinus with osteosynthesis. (Below, center) Meticulous closure of the pericranial flap and placement of the resorbable anchors (Endotine Forehead Fixation Device) to achieve the correct repositioning of the eyebrows over the new bone structure. (Below, right) Patient’s profile after surgery.
the classic evaluation technique that divides the face into thirds,\textsuperscript{20} which makes it easier to identify the treatment needs. This article focuses on one of the facial regions whose modification results in a more significant change in terms of the identification of facial gender: the forehead.

Forehead reconstruction has been widely discussed in the scientific literature with a basically craniofacial focus. In his publication in 1991, Ortiz Monasterio proposed reconstructing the forehead region from an aesthetic point of view.\textsuperscript{16} From the perspective of facial feminization, treatment of the forehead and, in general, the frontonasal-orbital complex, receives the most attention in the scientific literature.\textsuperscript{1,2,4,6,15} Ousterhout classifies forehead treatment into three types according to the technique used: type I, recontouring using a burr; type II, reconstruction of the forehead complex using methacrylate; and type III, setting the anterior wall of the forehead sinus back.\textsuperscript{1} Lee et al. have based their research on the importance of treating the frontonasal-orbital region, a key area in the identification of facial gender, according to the authors.\textsuperscript{21} In his 2011 publication, Spiegel presents a series of 168 treatments of the forehead region using the burring technique alone, osteotomy and setback, or the “island” technique, developed by the author himself according to the characteristics of the forehead area being treated.\textsuperscript{4} Franz Hoenig supports this theory and has presented his experience performing frontonasal-orbital recontouring on 21 patients using hydroxyapatite.\textsuperscript{15} In his 2012 analysis of surgical feminization procedures, Altman provides an exhaustive review of the various techniques associated with forehead surgery, emphasizing the different possibilities for handling the frontal sinus—using a standard coronal or hairline approach when the hairline must be

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**Table 1. Questionnaire 6 Months after Surgery**

Evaluate the following aspects and mark on a scale of 1 to 5, with 1 being completely dissatisfied, 2 being dissatisfied, 3 being satisfied, 4 being very satisfied, and 5 being completely satisfied.

1. Response to questions and problem solving during the postoperative period  
2. Indicate your level of satisfaction regarding the following clinical aspects:  
   2.1. Transition between the nose and forehead  
   2.2. Eye socket openings/appearance of the eyes  
   2.3. Eyebrow position  
   2.4. General forehead appearance  
3. Degree to which the results met your expectations  
4. Level of satisfaction with the surgical team  
5. Level of overall satisfaction with your treatment

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<td>1</td>
<td>2</td>
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<td>1</td>
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**Table 2. Questionnaire Results**\textsuperscript{*}

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<th>Satisfaction</th>
<th>Points</th>
<th>No. of Patients (%)</th>
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<tr>
<td>Completely dissatisfied</td>
<td>1</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Dissatisfied</td>
<td>2</td>
<td>1 (0.6)</td>
</tr>
<tr>
<td>Satisfied</td>
<td>3</td>
<td>14 (8.1)</td>
</tr>
<tr>
<td>Very satisfied</td>
<td>4</td>
<td>45 (26.2)</td>
</tr>
<tr>
<td>Completely satisfied</td>
<td>5</td>
<td>112 (65.1)</td>
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\textsuperscript{*}n = 172 patients.
modified—and the position of the eyebrows. From our experience, we can fully corroborate what these authors have described regarding the importance of treating the frontonasal-orbital complex and its impact on facial gender identification. After evaluating a series of 172 foreheads with recontouring and reconstruction, we believe that it is not only essential to treat the forehead region and the supraorbital ridge, but that the recontouring must include the frontomalar apophyses, the upper-outer region of the orbital ridge, the supraorbital ridge on the level of the orbital cavity, the entire frontal wall, and the naso-glabellar junction. The last of these constitutes a key point in the treatment of the entire forehead region, because it conditions the transition between the nose and forehead and, therefore, the angle between both areas, which clearly differentiates the female from the male face. With regard to the surgical technique, we believe that the best way to achieve a true recontouring of the forehead is through sculpture of the anatomical regions, as discussed above, together with osteotomy and retropositioning, or setback, of the anterior wall of the frontal sinus.

Regarding the approach to the forehead region, most of the literature supports the standard coronal access or an approach through the hairline. In our experience, a modified coronal approach allows for excellent access to the frontonasal-orbital region, prevents excess secondary skin on the bone recontouring, and makes it easier to reposition the soft tissues, helping us to achieve a discrete effect with the eyebrow elevation.

Fig. 8. Intraoperative pre- and post-profiles. Reconstruction of the frontonasal-orbital complex and repositioning of the anterior wall of the frontal sinus.

Fig. 9. Preoperative and postoperative three-dimensional computed tomographic scans demonstrating forehead reconstruction (three-quarters left view).
We believe that only in specific cases is it necessary to approach through the hairline, because the concept of hairline lowering is increasingly being replaced by redesigning the hairline with follicular transplants, with excellent natural results and no significant scarring in a very visible area. We use hairline approaches only in select cases after considering the following parameters: type of hair, hairline shape and capillary volume at that point, the shape and amount of any hairline recession, the distance from the nasal root to the beginning of the hairline in the most advanced central point and, finally, the angle of the forehead slant. In both cases—modified coronal approach and hairline approach—we, like other authors, recommend oblique cutaneous incisions that preserve the greatest quantity of follicular units, resulting in better postoperative hair recovery in the scar.

This retropositioning technique mentioned makes it possible to modify the nasoglabellar angle. In our opinion, isolated burring of the forehead region has two drawbacks. First, it can perforate the anterior wall of the frontal sinus because of the weak control over the thickness of this
wall, with subsequent sinus exposure. Second, it does not allow for the correct modification of the nasoglabellar transition, which can determine the result to a large extent. Recontouring using heterologous reconstruction material, as proposed by some authors, creates a similar problem, because the transition cannot be modified correctly and there is a risk of artificial results caused by excessive overcorrection of the forehead.

**CONCLUSIONS**

Feminization surgery of the forehead makes it possible to modify specific facial features that are usually identified as masculine, using different surgical procedures based on plastic and craniomaxillofacial techniques. The frontonasal-orbital complex is one of the main facial areas that determine the identification of facial gender and which, therefore, is a prime target for modification in facial feminization surgery. By treating these regions with the different surgical procedures described in this article, masculine facial features can be modified with predictable and satisfactory results. Facial feminization surgery must be considered part of the process of treating patients with gender dysphoria, because the modification and elimination of masculine facial features allows these patients to adapt more easily to the workplace and social and family environments.

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PATIENT CONSENT

Patients provided written consent for the use of their images.

REFERENCES