

Application of a Customized Cutting Guide for Upper Facial Feminization

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INTRODUCTION

Craniofacial anatomy exhibits significant sexual dimorphism, and consequently facial feminization surgery (FFS) can lead to significant improvement in quality of life for transgender women.¹⁻³ With regard to the orbital region, transgender women may be born with masculine facial structures incongruent with their gender identity, such as archetypal increased supra-orbital bossing, more cavernous orbital structures, more acute frontonasal angles, and a steeper posterior forehead inclination.⁴ The perception of femininity, in particular, has been shown to be strongly associated with features within the upper third of the face, including eyebrows, glabellar prominence, and hairline.^{5,6}

Virtual surgical planning (VSP) is widely used as a tool to facilitate major bony osteotomies and achieve a safer, more precise, and reproducible surgical result. The use of customized cutting guides has recently been translated into use for FFS.² The obvious downside to incorporating VSP into FFS is the cost and necessity of preoperative imaging. However, a recent cadaveric study has suggested shorter operative times when using cutting guides for FFS,⁷ though a time/cost analysis has not been performed during live surgery. (See Video [online], which displays the application and use of a custom frontal sinus cutting guide for frontal bone feminization.)

CASE

A 25-year-old transgender woman with well-documented gender dysphoria was referred for facial feminization surgery (Fig. 1). On physical examination, notable frontal bossing with deep orbits and a masculine frontonasal relationship was identified. A decision was made to proceed with brow feminization and rhinoplasty. Pre-operative computed tomography (CT) scan

was performed to evaluate for frontal bone thickness, as well as sinus morphology, size, and pathology. As the first stage in facial feminization, a frontal sinus setback cranio-plasty was recommended with concurrent rhinoplasty to improve fronto-orbital–nasal harmony. A customized cutting guide (3D Systems, Littleton, CO) was created for intra-operative use to facilitate frontal sinus osteotomy.

OPERATIVE PROCEDURE

A standard coronal incision is performed to expose the supraorbital region, and neurovascular bundles are released from their respective foramina (see Video [online], which displays the application and use of a custom frontal sinus cutting guide for frontal bone feminization). The extent of the dissection is to the zygomaticofrontal suture laterally, into the superior orbits by approximately 1 cm, and to the nasofrontal junction medially.

Next, the cutting guide is positioned, and a “hand-in-glove” fit is facilitated by extensions of the guide into the superior-medial orbits. The midline marker of the guide also aids in confirming the position. The borders of the frontal sinus are marked and the osteotomy is initiated by perforating the anterior table around its circumference using a short-stop drill followed by a Sonopet ultrasonic aspirator (Stryker, Kalamazoo, MI) for any thicker areas. The osteotomy is completed using a 3-mm osteotome and the bone is freed from the underlying mucosa. Patency of the frontonasal duct is also evaluated.

The remainder of the bossing is contoured with a 5-mm burr, thus extending the reduction to the zygomaticofrontal suture laterally. The orbits are shallowed. The endpoint of the reduction is a smooth, flat contour from the forehead to the radix (evaluated from a lateral view), and to the zygomaticofrontal region (evaluated from an oblique view). The anterior table is recontoured and rigidly fixated to reconstruct the frontal sinus. Achieving the appropriate contour for the anterior table reconstruction involves making it flat from the superior to the inferior aspects of the osteotomy. For mild-to-moderate bossing, this can be achieved by removing the curved border until the anterior table lies flat across the osteotomy gap. Severe

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Fig. 1. Frontal (A) and lateral (B) pre-operative views of a 25-year-old transgender woman before upper facial feminization and rhinoplasty. Frontal (C) and lateral (D) 9-month post-operative views of the patient following frontal sinus setback cranioplasty and rhinoplasty (video) utilizing custom frontal sinus cutting guide.

bossing and/or a large sinus coupled with a thin anterior table bone will require sectioning of the anterior table itself and choosing the flattest portions to use for anterior table reconstruction. Residual visible or palpable gaps can be covered with low-profile hardware to avoid contour deformity.

The brows and forehead soft tissue are resuspended by drilling cortical bone tunnels in the parietal bones and passing a 2-0 polydioxanone suture through the bones and the coronal flap. Finally, the scalp is closed in galeal and skin layers over a closed suction drain. Patients are observed overnight post-operatively, and the closed suction drain is removed within 24 hours.

DISCUSSION

Accurate and precise osteotomy of the frontal sinus is a key component of brow feminization surgery. Other techniques described for this purpose include transillumination of the sinus, “blue-lining” the sinus borders, and free-hand measurements of the sinus borders based

on pre-surgical imaging. In our practice, we have been pleased with the simplicity, rapidity, and accuracy with which this osteotomy can be performed using a customized cutting guide. The customized cutting guide also allows for maximal preservation of bone for reconstruction of the sinus wall, and provides a means for the surgeon to pre-operatively develop a plan for contouring of the anterior table itself. During the virtual surgical planning session, it is important that the surgeon dictates the design of the cutting guide, as there is significant variability in sinus size and morphology—no two are created equal. For example, bone thickness variability may be present, and the cutting guide may not need to extend fully to the sinus borders if those regions are not contributing to bossing or if the projecting borders may simply be reduced by burring. As with any customized cutting guide, this is not a replacement for expertise in craniofacial techniques and anatomy, as well as knowledge of complication management. However, we have found the use of VSP to be an efficient tool in achieving favorable results with upper facial feminization surgery.

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PATIENT CONSENT

The patient provided written consent for the use of her image.

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