Simultaneous Zygomatic Osteotomies With Reduction Mandibuloplasty – An Approach to Mid- and Lower-Facial Feminization in the Transfeminine Patient

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TECHNICAL STRATEGY

Background: Facial feminization surgery (FFS) is effective at treating gender dysphoria associated with anthropometrically masculine facial features. For many transgender women, FFS is a crucial component of the gender transition process. The purpose of this study is to report our experience with a pragmatic technique for simultaneous mid- and lower-face feminization by zygomatic osteotomy malarplasty and reduction mandibuloplasty.

Methods: The technique to perform zygomatic osteotomy malarplasty and reduction mandibuloplasty is described, utilizing harvested bone from the mandible for bone grafting the zygomatic osteotomy gap. A retrospective chart review was performed for patients who underwent simultaneous middle and lower FFS using the described technique. Independent reviewers evaluated cropped preoperative and postoperative photographs of the mid and lower face and assigned each photograph a “femininity score.”

Results: Seventeen transgender women underwent simultaneous zygomatic osteotomy malarplasty and reduction mandibuloplasty over the study period with adequate follow-up (average 11.1 months). Transient nerve weaknesses were the primary complications noted. A statistically significant improvement in femininity score was reported in postoperative photographs, compared to preoperative photographs (P < 0.01).

Conclusions: The technique described in this study is an effective application of craniofacial approaches and techniques for feminizing the facial skeleton in transgender women by utilizing harvested mandibular bone for simultaneous malarplasty.

Key Words: Facial feminization surgery, gender affirming surgery, malar augmentation, malar osteotomy, malarplasty, reduction mandibuloplasty, transgender surgery, zygomatic osteotomy

(J Craniofac Surg 2022;33: 1569–1573)

Facial feminization surgery (FFS) refers to any procedure aimed at changing masculine facial characteristics to those more associated with a feminine face. This is classically performed for a transfeminine patient seeking to have her facial appearance better align with her female gender. Of critical importance in feminizing the face is the underlying facial skeleton - there are key differences between archetypal male and female anthropometric measurements. First pioneered by Ousterhout, these surgeries have been shown to be successful in improving the quality of life.

Numerous anthropological studies have identified the facial characteristics that are determinants of gender. Arguably, the most important area for FFS is the nasal-brow complex. However, the mid and lower faces are also the key components in complementing a feminine facial shape.

In general, the masculine face is more angulated and square with a pronounced jaw and wide square-shaped chin, whereas a feminine face is rounded with fuller malar region, soft mandibular angles, and a tapered chin - resulting in a “heart” or inverted triangle shape (Fig. 1). The goal of this paper is to describe our approach to feminization of the mid and lower face by performing simultaneous reduction mandibuloplasty, as well as zygomatic osteotomies for malar augmentation.

PATIENTS AND METHODS

Institutional Review Board approval was obtained for retrospective review. Patients were thoroughly evaluated preoperatively according to World Professional Association for Transgender Health guidelines and 2 letters of support were obtained from mental health professionals before FFS. We performed a retrospective review of consecutive patients with a diagnosis of gender dysphoria who underwent simultaneous zygomatic osteotomies and reduction mandibuloplasty over a two-year period (August 2017 through December 2019) and data regarding complications and adverse outcomes was collected (Supplemental Digital Content, Table 1, http://links.lww.com/SCS/D386). Patients with follow-up duration less than 6 months were excluded from analysis.

Surgical Technique

Surgery was performed under general anesthesia using nasotracheal intubation. Patients received peri-operative clindamycin
Chin reduction was performed for wide square-chins, visualized on preoperative CT scan to not be in close relation to the occlusal plane. The width of this excision varied among patients depending on the degree of excess bone, though typically measured 10 to 15 mm in width. Lateral cortical bone to be removed via lateral corticectomy (in select patients). Reduction mandibuloplasty was performed first, which allowed for harvesting of bone graft for the zygomatic portion of the procedure (Fig. 1C-D). The mental nerve branches are carefully dissected out and protected, and a subperiosteal plane was developed to the posterior border of the mandible at the premasseteric notch to the posterior border of the mandible at the gonial angle was by performing a full thickness excision along a gently curved osteotomy line planned from approximately the premasseteric notch to the posterior border of the mandible at the occlusal plane on both sides, and the entire inferior border of the mandible. Our approach to reduction of the mandibular body was done using a reciprocating saw to remove the resulting step-off, and create a smooth contour from the chin to the newly reduced gonial angle, taking care to protect the mental nerve during this maneuver. After completion of the reduction mandibuloplasty, more than ample cortical bone was available for shaping a bone graft.

Next, zygomatic sandwich osteotomies were performed using the technique described by Mommaerts et al.\textsuperscript{23} After completion of the osteotomies using a reciprocating saw, an osteotome was used to outfrightre the zygomatic segment, resulting in enhanced malar projection. Previously, harvested mandibular bone was shaped into a rectangle of varying width (typically 6–9 mm), according to the degree of desired zygomatic augmentation. This bone graft was rigidly fixated into the resulting zygomatic defect in an interpositional fashion using titanium miniplates (Stryker Corp., Kalamazoo, MI). The mucosal incisions were closed using polyglaclin suture. Autologous fat grafting to the malar region was not utilized in any cases.

Postoperatively, the patients were maintained on a liquid diet for 48 hours and soft no-chew diet for 2 weeks. A mandibular closed-suction drain was placed through the submental region and removed the morning after surgery to reduce immediate postoperative edema. A compressive head dressing was used to support the lower facial soft tissues. Chlorhexidine mouthwash and prophylactic amoxicillin-clavulanic acid were used in all cases for 1 week.

FIGURE 1. Anthropometric sketches. (Upper left) Male face. (Upper right) Female face. (Lower left) Markings for operative technique, Frontal view. Black line - osteotomy line. Green shaded - bone to be repositioned. Red solid - full thickness bone to be removed. Orange shaded - partial thickness bone to be removed. (Lower right) Markings for operative technique, Lateral view. Red solid - full thickness bone to be removed. Orange shaded - partial thickness bone to be removed via lateral corticectomy (in select patients).

or ampicillin-sulbactum. An entirely intraoral approach was used for all cases.

Reduction mandibuloplasty was performed first, which allowed for harvesting of bone graft for the zygomatic portion of the procedure (Fig. 1C-D). The mental nerve branches are carefully dissected out and protected, and a subperiosteal plane was developed to the posterior border of the mandible at the occlusal plane on both sides, and the entire inferior border of the mandible. Our approach to reduction of the mandibular angle was by performing a full thickness excision along a gently curved osteotomy line planned from approximately the premasseteric notch to the posterior border of the mandible at the occlusal plane. The width of this excision varied among patients depending on the degree of excess bone, though typically measured 10 to 15 mm in width. Lateral cortical excision was performed when the inferior alveolar nerve was visualized on preoperative CT scan to not be in close relation to the buccal cortex, as previously described by several authors.\textsuperscript{9,20} Chin reduction was performed for wide square-shaped chins with central wedge excision osseous genioplasty using a reciprocating saw.\textsuperscript{21,22} The typical width of the excised chin segment was 10 to 14 mm. Monocortical rigid miniplate fixation of the medialized chin fragments was performed. Finally, a reduction of the inferior border of the mandibular body was done using a reciprocating saw to remove the resulting step-off, and create a smooth contour from the chin to the newly reduced gonial angle, taking care to protect the mental nerve during this maneuver. After completion of the reduction mandibuloplasty, more than ample cortical bone was available for shaping a bone graft.

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Assessment of Femininity Impact

To assess the impact of the described technique on facial femininity, independent plastic surgeons were shown a series of frontal and oblique photographs containing preoperative and postoperative photographs for 10 patients in this series who underwent simultaneous zygomatic osteotomy malarplasty and reduction mandibuloplasty. Photographs were cropped to include only the mid and lower face (nasion to menton). A total of 20 photographs (10 preoperative and 10 postoperative) were displayed in a random order. The independent reviewers were asked to provide a “femininity score” (1 = very feminine, 2 = moderately feminine, 3 = a little feminine, 4 = neutral, 5 = a little masculine, 6 = moderately masculine, 7 = very masculine) for each photograph displayed.

Responses were aggregated and analyzed for median preoperative and postoperative score. Wilcoxon signed-ranks test was used to determine the presence of a statistically significant difference in preoperative and postoperative scores, with statistical significance set at $P < 0.05$.

RESULTS

During the study period, 21 transfeminine patients underwent simultaneous zygomatic osteotomy malarplasty and reduction mandibuloplasty for facial feminization by the senior author (J.W.C., Figs. 2–6), with 4 of these having inadequate follow-up for inclusion in analysis. All patients had been on hormonal therapy and testosterone-antagonizing therapy for a minimum of 1 year. CD4 testing confirmed well-controlled HIV infection in 6 patients.

Of the 17 patients included for analysis, mean follow-up after surgery was 11.1 (range 6–24) months. Transient V3 hypoesthesia was noted in 2 (11.7%) patients. Transient marginal mandibular nerve weakness was noted in 1 (5.9%) patient, which resolved after 3 months. Visible mandibular contour asymmetry was noted in 1 (5.9%), but the patient declined revision. There were no instances of plate exposure, infection, or clinical nonunion.

Impact on Femininity

Three independent plastic surgeons reviewed the series of pre- and post-operative photographs, with a total of...
60 femininity scores collected (30 preoperative scores and 30 postoperative scores). For all reviewers, every patient in the series was rated to have an improved femininity score in the postoperative photograph. The median preoperative score was 4.83, and the median postoperative score was 1.67, with an improvement in median femininity score by 3.17 in the postoperative photograph (Supplementary Digital Content, Table 2, http://links.lww.com/SCS/D587), with a two-tailed Wilcoxon signed-ranks test indicating statistical significance ($W = 0, P < 0.01$).

**DISCUSSION**

Concurrent zygomatic and mandibular osteotomies are a natural combination of surgeries which allows an entirely intraoral approach, "recycles" harvested bone, and allows for harmonious feminization of mid- and lower-facial projections. Facial feminization surgery is a subset of craniofacial surgery,
zygomatic gaps have been previously described to be
sequenced in surgeries and avoids a separate donor site. Although
this osteotomy gap. This is the primary advantage of performing this se-
mandibuloplasty. Also underwent frontal sinus setback cranioplasty and
This avoids associated risks such as implant infection or ex-
while using cheek implants or autologous fat grafting.28,29
Our preference is to perform intraoral zygomatic sandwich os-
To avoid associated risks such as implant infection or ex-
and rigid fixation provides a stable long-term result with in-
for bone grafting needed for bone growth across the zygomatic osteot-
malplasty and reduction mandibuloplasty. Also underwent frontal sinus setback cranioplasty and
with a number of surgical techniques available to treat this
Although soft tissue alterations (browlift, rhinoplasty, lip aug-
management, etc.) are commonplace in the plastic surgeon’s ar-
Our approach to feminization of the mid and lower thirds of
from post-operative radiographs) would be insightful
This paper serves to describe our approach and experience
intragluteal harvest (ie, from post-operative radiographs) would be insightful
This study is limited by a lack of standardized patient re-
In addition, objective measurements in long-term bone move-
ments (ie, from post-operative radiographs) would be insightful and is also a planned source of future study for us. As the field
of FFS grows, technique-driven literature will undoubtedly evolve into more substantial data on the effect of these surgeries on
daily life in transgender women, and aid in classification of
as a "medically necessary" intervention.

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