Jaw Reduction Surgery

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KEYWORDS

• Facial feminization surgery • Jaw reduction surgery • Transgender patients
• Genioplasty

KEY POINTS

- There is a significant difference in male and female facial features, which can be surgically altered during facial feminization surgery (FFS).
- Jaw reduction surgery is a critical component of FFS.
- We discuss our techniques and pearls of jaw reduction surgery based on our experience of more than 3000 patients.

INTRODUCTION: HISTORY OF JAW CONTOURING

Craniofacial surgery, which includes operating on facial bones, was developed by pioneers in plastic surgery such as Dr Paul Tessier and others around the 1940s. It was not until a few decades later that esthetic surgical correction of facial bones developed as a subspecialty within plastic surgery.[1] However, facial bone contouring surgery really came of age with the introduction and popularization of mandible reduction by Baek.[2] In Asian countries, facial bone surgery and chin and jaw contouring esthetic procedures gathered steam during the past few decades and are relatively common procedures nowadays. In Asia, many women patients, who have a round chin and square jaw, seek a softer and more feminine impression.[3] Techniques that are used in Asian facial bone contouring surgeries have been incorporated in the FFS and are the cornerstone of these procedures. Concomitant with advances in surgical techniques, improved anesthesia techniques and usage of devices such as oscillating saws greatly improved the quality of mandible contouring surgery. Both surgical time and blood loss significantly decreased for such cases. As a result, patients who would be required to spend their postoperative day in an ICU could be operated on an outpatient basis. All these factors furthered the popularity of facial bone contouring surgery.

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JAW REDUCTION AS A PART OF FACIAL FEMINIZATION SURGERY

FFS began in 1982 when Dr Ed Falces who performed gender reassignment surgeries on transgender patients, approached Dr Douglas Ousterhout, a protégé of Dr Tessier, with a request from a transgender patient to make her face more feminine because people reacted to her as though she were a man. Up until then, Dr Ousterhout's practice predominantly involved craniofacial reconstruction of patients with birth defects, accidents, or other injuries. He conducted extensive research to identify which facial features would be identified as more feminine. He derived measurements defining those features from a series of cephalograms taken in the 1970s, and then worked with a set of several hundred skulls to determine if he could consistently differentiate women from men using those measurements only. He then began working out surgical techniques and materials in order to transform and feminize the male face.[4]

FFS, as a subspecialty of plastic surgery, was further revolutionized, and it became mainstream with refinement and improvement of techniques by the leaders and innovators of this field such as the senior author, Dr Harrison Lee. With his background as an oral maxillofacial surgeon coupled with ENT and Facial Plastic Surgery training, Dr Lee was uniquely placed to further the techniques of FFS. FFS performed on famous celebrity patients such as Caitlyn Jenner and Nikita Dragun by our senior author (HHL) also added to the popularity of this procedure.[5] In many of the cases, it is the first surgery undertaken by the patients who are transitioning from male to female. Our senior author (HHL) has extensive experience with FFS and has performed surgeries on more than 3000 patients during the past 20 years.

FFS necessitates a series of surgeries involving bone and soft tissue to alter the masculine features into a softer feminine appearance.[6] Jaw reduction is an integral and critical component of FFS. It is indicated for any transgender as well cis gender patients desiring a dramatic result by softening the square masculine jaw and prominent chin. In this article, we will focus on Jaw contouring procedures that are associated with FFS.

OVERALL DIFFERENCE IN MALE AND FEMALE JAW SKELETAL DIMENSIONS

The face plays a significant role in gender dysphoria seen in transgender patients. Gender dysphoria is currently diagnosed as per the World Professional Association for Transgender Health standard of care version 7.[7] It occurs in 1 in 30,000 male-assigned births and 1 in 100,000 female-assigned births.[8] There are prominent differences between the male and female facial anatomy, which can be altered surgically to alter the visual perception of the face.[9–11] In general, the biological male population has a wider, more square, and angular jaw. The masseter muscle tends to be more defined resulting in a strong jaw angle. The jaw line drops down and turns sharply giving a square appearance to the jaw. In women, it curves gently from earlobes to the chin.

JAW REDUCTION TECHNIQUE

It is highly recommended to get radiographic imaging as a part of the surgical planning. Besides Panorex X-ray, we also obtain a PA and lateral cephalogram routinely (**Fig. 1**). A 3D CT scan of the face can be obtained in lieu of or in addition to the plain films. Positioning of the mental nerve is noted in the imaging. The images are also carefully reviewed for any impacted teeth, any plates or screws from prior surgeries. An impacted tooth might need to be removed before the jaw reduction surgery.

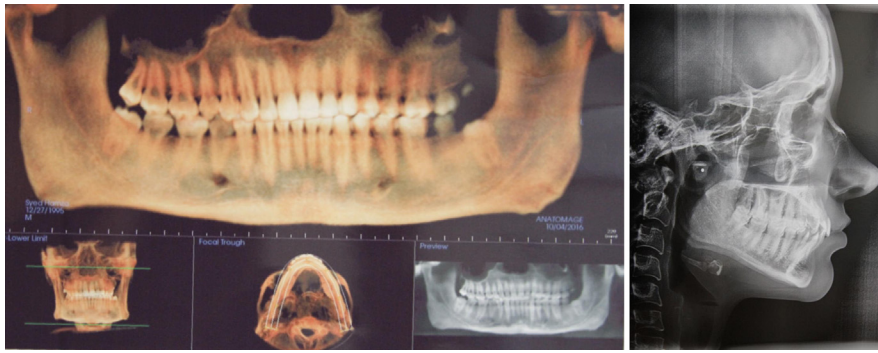

Fig. 1. Panorex X-rays and PA and Lateral Cephalogram of Jaw as a part of preoperative work up.

Our technique of jaw reduction involves sagittal resection of the mandible using a saw from the angle of the jaw to the mental nerve region (Fig. 2). This creates a smooth transition from the ramus to the chin and also retains the integrity of the inner portion of the mandible (Fig. 3). The anatomy of the gonial angle also plays a role in determining the extent of jaw reduction. If the gonial angle is flaring out, then the sagittal resection needs to go all the way to the angle of the mandible to address the gonial angle flaring. If the gonial angle is flaring inward, then it is possible to achieve optimal jaw contouring without aggressive resection. Specific attention is also given to the masseter muscle. It is not uncommon in biological male patients to have excessive or hypertrophied masseter muscle. Such patients benefit from concomitant resection of masseter muscles using electrocautery and bipolar to achieve an optimal result.

Another key point is addressing the soft tissue laxity that might arise from jaw reduction surgeries. With mandible resection, especially in patients with outward flaring gonial angle and hypertrophied masseter muscles, there is a significant risk of soft tissue laxity that might arise due to loss of bone structural support. Failure to address this can have an adverse effect on the overall outcome of the surgery. We, typically, combine these procedures with a neck lift and even, facelift depending on the extent of resection and the age and preoperative neck laxity of the patient. The extent of facelift and neck lift depends on the age and preop skin laxity of the patient and also depends on the extent of planned jaw reduction.

Fig. 2. Sagittal resection of mandible from the angle of the jaw to the mental nerve region for jaw reduction surgery.

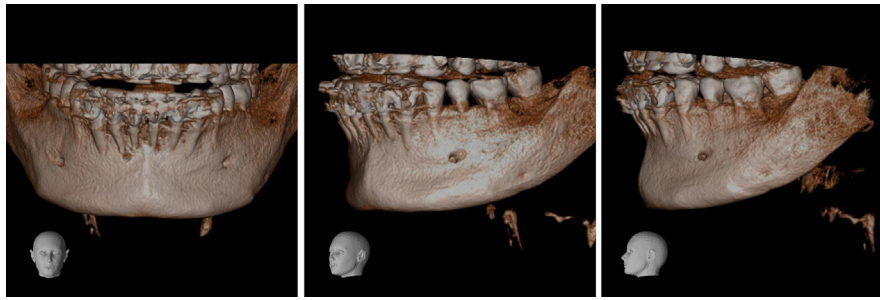

Fig. 3. Postoperative 3D CT scan after jaw reduction demonstrating a smooth transition from the mandible angle to the chin.

In our experience, we do not adhere to the usage of surgical templates. They tend to be inaccurate in dealing with the body of the mandible. They can be overly rigid and do not afford any artistic or surgical freedom. The template also does not guide with regards to soft tissue such as masseter muscle. In our purview, the gonial angle resection must be tailored to the individual patients and should not be the same for every patient. We will discuss a patient complication concerning template use in a subsequent portion of the article.

CHIN CONTOURING

Genioplasty and other chin contouring techniques have already been discussed in a separate article. However, our discussion of jaw reduction would be incomplete without a brief discussion on chin contouring. There are various ways to contour and soften the masculine chin. The chin can be shaved with a burr in selected cases. However, our preferred method for chin contouring is T-genioplasty. Male chin seems to be boxy, and a T-genioplasty technique with about 4 to 12 mm reduction of the central chin in the transverse direction can transform a boxy masculine chin into a softer feminine chin.

For T-genioplasty technique, we first mark the midline of the chin. If the facial midline is off from the chin midline, the facial midline needs to be transcribed to the chin midline. We then resect a predetermined amount of bone from the center of the chin as a part of the T-genioplasty, perform a horizontal osteotomy to mobilize the chin, remove the central portion, and then rigidly fix the chin with plates and screws (Fig. 4).

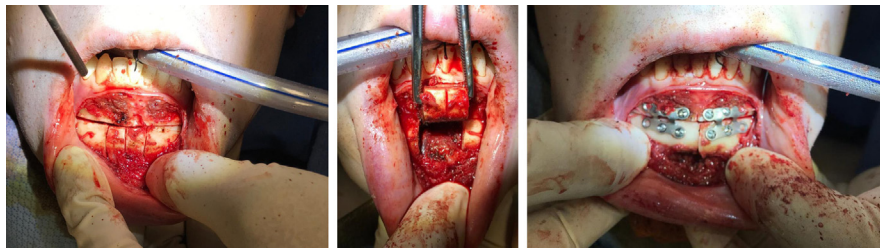

Fig. 4. Demonstration of T-genioplasty including resection of central chin and mobilization of chin components with plates and screws.

Fig. 5. Steiner S line and Ricketts E line to assess the A-P projection of the chin.

In terms of the A-P Projection of the chin, Steiner S Line and Ricketts E line can be used as a good reference (Fig. 5). Steiner S line connects the midpoint of the columella to the soft tissue pogonion. In an ideal projection, the upper and the lower lips should fall on this line and any deviation shows prominence or flatness of the chin. Ricketts E line is drawn from the nasal tip to the soft tissue pogonion. Ideally, the upper lip should be 5 mm behind and the lower lip should be 3 mm behind this line.

Another aspect of chin contouring involves alteration of the vertical proportion of the lower face. Ideally, the ratio of the upper lip length (Subnasale—upper lip stomion): the lower lip length (Lower lip stomion—menton) should be 1:2. As seen in this patient, the ratio is 1:2.6 (Fig. 6) with excess lower lip/chin length, which would need to be shortened to achieve ideal proportions.

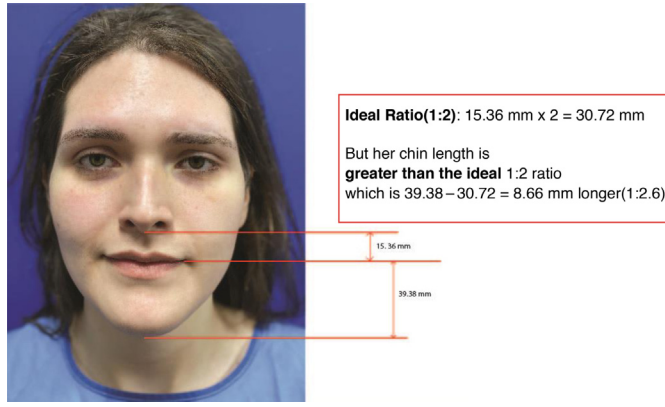

Fig. 6. Ideal ration of upper and lower lip to assess vertical excess/deficiency of the chin.

GENERAL COMPLICATIONS

Overall, both jaw and chin contouring surgery are very safe with very low risks of complications when done correctly. However, there can be a myriad of potential complications that can arise from the surgery. Paresthesia or anesthesia along the distribution of inferior alveolar and mental nerve can be disconcerting to the patient. This is generally temporary but can be permanent in rare cases. Extreme care should be taken to avoid disruption of the mental nerve either due to traction injury or due to physical avulsion of the nerve during the surgery. We strongly recommend leaving a cuff of soft tissue around the mental nerve. Skeletonizing the mental nerve can make it prone to traction injury as well as increase the risk of avulsion injury. Damage to the marginal mandibular nerve can be of more significant concern and can occur when the periosteum is violated. We, therefore, very strongly recommend maintaining the surgery within the periosteal envelope. Violating the periosteal envelope posteriorly can also result in perforation of the retromandibular vein and more anteriorly—the facial vessels. Asymmetry of the jaw and the chin can be due to asymmetrical reduction or due to inability to address the preoperative asymmetry, based on clinical or radiological measurements, with differential reduction. Fracture of the mandible can occur as a complication during or after the surgery. Devitalization of the teeth can occur especially if you are too close to the root of the teeth. Another debilitating complication that can arise is ptosis of the chin a.k.a witch's chin. This is due to the failure to reapproximate mentalis muscle appropriately. Mentalis should always be reapproximated and realigned to avoid this complication.

Overresection of the mandible, chin, and masseter muscle can result in loss of soft tissue support. Integrity of soft tissue structures should always be assessed when performing jaw and chin reduction surgery. To address this, we perform submental and jaw line liposuction at the very minimum. However, we commonly add neck lift or facelift even in younger patients undergoing jaw reduction to address the loss of soft tissue support from the jaw reduction.

RESULTS

We have operated on more than 3000 patients during the past 20 years for FFS. Overall, our patients are extremely happy with their outcomes. We have included a few representative patients who underwent a combination of genioplasty and jaw reduction (**Fig. 7**). These pictures were taken between 3 and 24 months postoperative follow-up period. In our experience, jaw reduction surgery in combination with genioplasty is a very powerful tool to achieve optimal, precise, and reproducible results.

CASE STUDIES

We are also including 2 case studies of patients who were initially operated on by a different surgeon and required revision surgeries for varied reasons. We believe that there are major learning points in each case that would be very useful to the readers of this article.

Patient 1

The patient is a 39-year-old transgender female who underwent a T-genioplasty by another surgeon who used a preoperative surgical template to perform the surgery. Unfortunately, due to excessive narrowing of the chin with the template, the patient

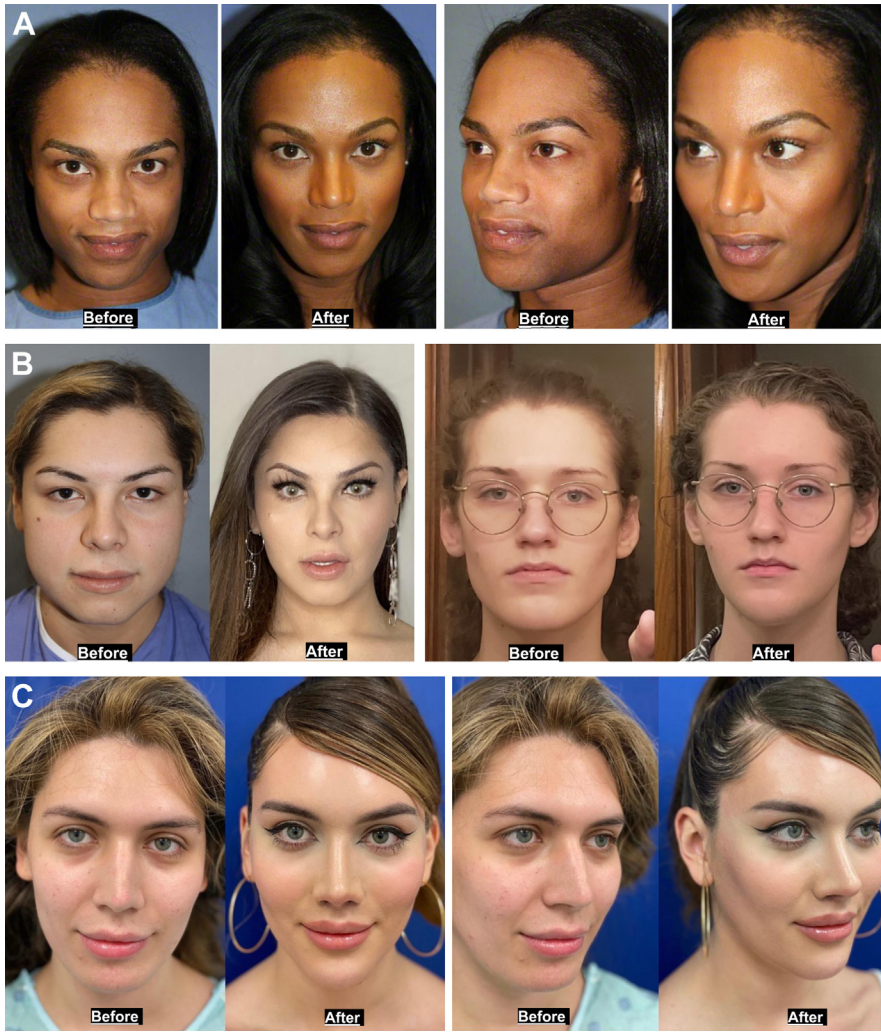

Fig. 7. (*A–C*): Postoperative outcomes of representative patients undergoing jaw reduction surgery and T-genioplasty as part of FFS. The average follow-up for these pictures are from 3 to 24 months.

developed an extremely narrow chin. She also had excess forward movement of the chin segments resulting in irregularities of the body of the mandible (Fig. 8). She was overall very unhappy with the results and sought revision surgery.

Her surgical correction included the removal of existing hardware, recreate the osteotomies to free up the chin segments, widen the chin complex with insertion of a cadaveric iliac crest graft, and lateralize the posterior aspects of the respective chin segments to align with the body of the mandible. We also resected step defect created by the genioplasty (Fig. 9). This resulted in significantly smooth transition from the chin to the jaw and significantly improved the appearance of the chin (Fig. 10). The biggest take away from this case is potential complications due to

Fig. 8. Postoperative images and radiographic images of patient 1 after the initial surgery using surgical templates.

overreliance on templates. Although templates may serve as a guide for surgical planning, they cannot be used as a replacement for surgical expertise, assessment, and judgment.

Patient 2

The patient is a 31-year-old transgender female who underwent FFS by another surgeon. Unfortunately, her surgery involved overresection of mandible, chin, and masseter muscle. This resulted in loss of soft tissue support causing chin ptosis and neck laxity (Fig. 11). For her revision surgery, we did T-genioplasty to reapproximate her chin and suspended the chin pad to provide soft tissue support. We also added jaw angle implants to recreate her jaw angle and supported her cheeks with a cheek implant. Finally, face and neck lifts were done to address the laxity of her face and neck (Fig. 12). This resulted in significant smoothening of her chin and jaw line along with the improvement of neck laxity and chin ptosis.

There are multiple takeaways from this case. We should be extremely careful of being overzealous with bone and soft tissue resection. This can create a 2-fold problem. First, overresection can overcorrect the existing bone and soft tissue deformity and might require revision surgery. Second, careful attention should be given to neck and face laxity that might arise with jaw reduction. If this is not addressed appropriately, it results in significant neck laxity that would adversely affect the overall outcome.

Fig. 9. Two months postoperative images of patient 1 after revision surgery at our center.

Fig. 10. Comparison of frontal view of the chin after the revision surgery when compared with the initial surgery. The patient has significantly improved appearance of the chin symmetry and transition from chin to jaw.

Fig. 11. Comparison of frontal and oblique view of patient 2 after initial surgery when compared with her preoperative pictures. She has loss of soft tissue support causing chin ptosis and neck laxity.

Fig. 12. Comparison of frontal view of patient 2 after the revision surgery when compared with initial surgery. She has significant smoothening of her chin and jaw line along with improvement of neck laxity and chin ptosis.

SUMMARY

Jaw reduction surgery, in combination with genioplasty, is a very powerful tool to alter the visual perception of the face. Our technique of jaw reduction involves sagittal resection of the mandible from the angle of the jaw to the mental nerve region. This creates a smooth transition from the ramus to the chin and also retains the integrity of the inner portion of the mandible. We have operated on more than 3000 patients during the past 20 years for FFS. Overall, our patients are extremely happy with their outcomes.

CLINICS CARE POINTS

- We strongly recommend a panorex X-ray, PA and Lateral cephalogram, and/or a 3D CT face for preoperative planning of jaw reduction surgery.
- Our technique of jaw reduction involves sagittal resection of mandible from the angle of the jaw to the mental nerve region.
- Our preferred method of chin contouring is T-genioplasty, which is generally done in combination with jaw reduction.
- We recommend to leave a cuff of soft tissue around the mental nerve during surgical dissection to minimize the risk of mental nerve injury.
- We very strongly recommend to maintain the surgery within the periosteal envelope to minimize the risk of injury to the retromandibular vein, facial vessels, and marginal mandibular nerve.
- Overresection of the mandible, chin, and soft tissue can result in the loss of soft tissue support and should be avoided.
- Consider a facelift/neck lift if there is concern of neck/face laxity secondary to jaw reduction. At minimum, liposuction of neck and chin should be performed in these cases.
- Overreliance on preoperative surgical templates can be deceptive and can lead to suboptimal outcomes.

DISCLOSURE

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