Importance of Chin Evaluation and Treatment to Optimizing Neck Rejuvenation Surgery

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ABSTRACT

The chin is the keystone linking the aesthetics of the face and neck but is often neglected in the analysis. Procedures related to the chin play an important role in defining neck anatomy. Alloplastic implants can provide the illusion of a longer jaw line in a patient with retrogenia. Even greater anatomic changes to the neck result when a sliding genioplasty is performed. This effect is primarily due to the digastric attachments from the mentum and mastoid. Advancing the mentum may have a more direct effect of elevating the position of the hyoid, which sharpens the angle between the jaw and neck. Finally, the diagnosis of a witch's chin is also discussed for the patients who present for aging neck surgery.

KEYWORDS: Chin implant, genioplasty, witch's chin

Obtaining a favorable result in facial rejuvenation surgery is predicated upon identifying areas that can benefit from improvement and treatment. As already mentioned in this issue, many methods for rejuvenating the neck have merit when used appropriately. A key to this improvement is thorough facial analysis and a correct diagnosis. An aesthetically attractive neck is characterized by a subtle yet sharply defined cervical mental angle and a long sweeping jawline that is in harmony with the upper two thirds of the face. Commonly, a patient seeking facial rejuvenation surgery desires an improvement of a blunted cervical mental angle. Patients are often unaware that a short jaw line and an unfavorable chin position accentuate their obuse and redundant neckline. Patient satisfaction demands an understanding of their desires and meeting their needs. However, the patient seeking facial rejuvenation surgery is often unsure as to what is the best method for reaching his or her goals.

The chin is the keystone structure linking the face and neck. Accordingly, evaluation of the chin is essential to formulating the appropriate neck rejuvenation treatment plan. Following facelift surgery, a neglected ptotic chin pad can lead to an accentuated submental crease. Neck surgery designed to recreate a favorable cervical mental angle will be handicapped by an untreated hypoplastic mentum. In this article we address commonly identified variations in chin position, such as retrogenia and chin pad ptosis, discuss relevant anatomy, and detail diagnosis and treatment options for treating the chin in relationship to the neck. In our practices, we have been very impressed by the benefits augmenting the chin has to the appearance of the cervical mental angle. Similar to rhinoplasty, management

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and treatment of the disproportional chin may be the fundamental difference between a good outcome and a better one. It is requisite upon the facial plastic surgeon to evaluate and consider the chin position in rhytidectomy and cervicoplasty surgery.

**DIAGNOSIS**

Anthropometric chin measurements are useful in helping to determine chin position. Generally a desirable relationship of the chin and cervical mental angle is one in which the angle defined by a vertical tangent drawn from the glabella to the pogonion intersects with a second horizontal tangent drawn from the cervical point through the menton, creating a point known as the gnathion. An acute angle measuring 75 to 90 degrees between these two tangents is desirable (Fig. 1). A helpful shortcut used to define the ideal chin position is to drop an imaginary tangent line down from the lower lip. Generally, it is desirable for the most projecting feature of the chin (pogonion) to be at or near this tangent. If not, then we consider chin augmentation. However, it is important to also evaluate the depth of the mentalobial sulcus. An overaggressive chin augmentation, in the setting of a natively prominent mentalobial sulcus, may lead to an undesirably overemphasized sulcus.

Anthropometric exercises can also aid in identifying a ptotic chin pad. Soft tissues of the chin may become dependant with aging. Loosening of attachments of the musculature of the chin (the mentalis and depressor labii inferioris muscles) leads to the senile chin deformity. To diagnose this condition a horizontal tangent parallel to the Frankfort horizontal is drawn from the most dependent portion of the chin (menton) posteriorly, and this line should be flush with the submental neck. If it is below the posterior structures then we diagnose the chin pad as ptotic.

Although it may be quite obvious for the observant physician to identify these areas in need of repair, they are often less apparent to the patient. Frequently, patients are unaware of the importance the chin plays in the essential balance of the face. In our practices we have found video-imaging during consultation to be a valuable tool for communicating the areas of repair needed and demonstrating the improved facial balance expected following chin treatment. It is rare for the patient to have any doubt following this exercise.

**RELEVANT ANATOMY**

Understanding submental and chin anatomy is prerequisite to performing mental augmentation procedures, particularly when performing sliding genioplasty in which the relevant neck anatomy may be altered.

The mentalis muscle lies just below the subcutaneous tissue of the chin. This muscle, which contributes to the external appearance of the chin, functions to elevate and protrude the lower lip. The platysma muscle arises over the clavicle and travels upward, over the jaw, toward the lateral angle of the mouth to blend with the depressors of the lower lip. In the cheek area, it becomes the superficial musculocutaneous system (SMAS). Just deep to the platysma and mentalis muscles is the mandibular periosteal layer, which nourishes the bone. The mandible is a biconcave bone providing insertion for the muscle of mastication along with a bed for dentition. Through a medullary canal courses the inferior alveolar nerve, a branch of the fifth cranial nerve. This nerve enters the mandible proximally at the mandibular foramen on the medial surface of the mandible and exits distally at the mental foramen just inferior to the first premolar. The mental nerve provides sensation to the chin and lower lip and should be recognized and preserved during chin augmentation procedures. Along the internal portion of the mandibular arch, opposite the symphysis, the geniohyoid muscles insert into the genial tubercle. As its name indicates, this muscle runs from the mandible to the body of the hyoid. Two other muscles relevant to defining the cervical mental angle insert on both the mandible and hyoid. The mylohyoid, a fan-shaped muscle that forms the muscular floor of the mouth arises from the mylohyoid line of the mandible and inserts into the body of the hyoid bone. Directly inferior to the mylohyoid is the anterior belly of the digastric. The anterior

![Figure 1](image1.png)
digastic muscle originates at the digastic fossa of the mandible, narrows to an intermediate tendon, and runs through a fibrous loop connecting it to the hyoid. The posterior belly of the digastic arises from the mastoid notch and, like its anterior belly counterpart, inserts into the hyoid, forming a muscular sling.

The hyoid is typically located at the level of the third or fourth cervical vertebrae (C₃ or C₄). A hyoid located near C₂ or C₃ favors a well-defined jaw line. Conversely, a hyoid near C₄ or C₅ gives the appearance of a sloping neck and a poorly defined jaw line.

**CLINICAL RELEVANCE**

The mandibular hyoid relationship is important to consider prior to approaching chin augmentation procedures that are performed in conjunction with submentoplasty. Patients with modest retrogenia, a poorly defined jaw line, and a favorable hyoid position may benefit from the placement of an alloplastic implants in addition to submentoplasty. Alloplastic augmentation provides the appearance of a lengthened mandibular profile (Fig. 2).

In severely retrogenic patients, a poor mandibular line, and a low set hyoid position, a sliding genioplasty may provide a sharper cervical mental angle and a better outcome (Fig. 3). A sliding genioplasty may advance forward the muscular insertions and may have the secondary effect of raising the hyoid through its submental muscular attachments (Fig. 4). This results in a sharper cervical mental angle and an aesthetically more pleasing neck profile.

**TARGETED CHIN TREATMENTS**

Alloplastic augmentation is frequently utilized to enhance chin projection. Many materials are championed for augmentation, such as silicone, mersilene mesh, and expanded polytetrafluoroethylene (Gore S.A.M., Flagstaff, AZ). Augmenting implants can be placed either through an intraoral or a submental subcutaneous incision. The submental approach eliminates the risk of intraoral contamination, although some of the authors who utilize the intraoral approach have not found an increased rate of wound infection.

Implants lend to the perception of jaw line lengthening by increasing mental projection, although usually not as pronounced as those seen after a sliding genioplasty, the cervical mental angle appears to benefit following alloplastic. Therefore, this is a technically simpler procedure intended for those patients undergoing neck rejuvenation procedures who have an appropriate hyoid position and modest retrogenia. One drawback to this procedure is that lower facial height cannot be altered to any significant degree. Alloplastic chin augmentation is a commonly performed procedure by

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**Figure 2** Pre-and postoperative photos of a patient who underwent an alloplastic implant. (A) Preoperative view of a patient who presented with retrogenia, jowling, and submental laxity. (B) Same patient following mersilene mesh chin augmentation in conjunction with rhytidectomy.
Figure 3  Pre- and postoperative photos of a patient who underwent a sliding genioplasty. Upper and lower left, preoperative views of a patient who presented with retrogenia. Upper and lower right, same patient following sliding genioplasty.

Figure 4  Changes in the anatomy of the upper neck during genioplasty. (A) Line drawing demonstrating obtuse cervical mental angle associated with retrogenia. (B) Advancement of the mandibular segment elevates the hyoid and sharpens the cervical mental angle.
facial plastic surgeons, and many excellent publications discuss the technical details of chin implantation.2-4

SLIDING GENIOPLASTY
For the patient with severe retrogenia and a poor hyoid position, sliding genioplasty provides a better option for obtaining a balanced chin position and ideal cervical mental angle. Patients who have chin asymmetries are also good candidates for a genioplasty because an alloplast may actually accent the asymmetry. Some of the authors also favor this method in patients who are younger who would need to retain an implant for a longer duration. Sliding genioplasty also avoids the inherent risk of implant infection. Patients opposed to foreign body augmentation may prefer this method. Because sliding genioplasty is a less often performed procedure, and may not be familiar to most facial plastic surgeons, we have detailed a method successful in our hands.

Sliding genioplasty is usually accomplished with the patient under general anesthesia. One percent lidocaine containing 1:100,000 epinephrine is injected into the gingival-labial sulcus of the lower lip. A 15-blade sharply incises through the mucosa, followed by electrocautery to cut through the muscle layer and the periosteum. A periosteal elevator aids elevation of the periosteum off the mentum. Both mental nerves are identified exiting from their foramen. Vertical reference lines are cut in the bone with a side-cutting burr. Calipers are used to verify symmetry of the planned cuts. Starting in the midline and progressing laterally, a reciprocating saw is used to make an osteotomy. Brisk bleeding is often encountered at the time of osteotomy; however, it predictably dissipates without active intervention. Once the osteotomy is completed, the loose segment is advanced forward with a bone clamp. The mobile segment is fixated by either a 24-gauge wire or a prebent stairstep-shaped plate of varying lengths. We prefer the prebent plates because they fixate the bone in a more precise manner. Following fixation, the incision is closed with a 4-0 resorbable for the deep layers and a running 4-0 locking chromic for the mucosal closure.

PTOTIC CHIN (WITCH'S CHIN)
A dependent chin pad can create a misrepresented appearance of meanness and anger. Caricatures of witches are drawn with such features and are undesirable to most. In facelift surgery an overlooked ptotic chin pad can lead to an unfavorable depression in the submental crease and a bad outcome. Chin pad ptosis is best addressed at the time of cervicoplasty. The following section describes a technique conceptually simple and one in which we have executed with good success.

Technique
Through a 2-cm curvilinear submental incision, a skin flap is elevated over the dependent chin soft tissues. Using electrocautery, an incision is made through the platysma-mentalis muscle down to the inferior border of the mandible and through the periosteum (Fig. 5). A subperiosteal flap is elevated superiorly off the

Figure 5 Repair of a witch's chin deformity. Through a curvilinear submental incision electrocautery is performed through the mentalis muscle down to the periosteum. A subcutaneous and subperiosteal flap is elevated off the mandible.
mandible. If a chin implant is being placed, it can be done at this time. A midline triangular wedge of soft tissue is excised sharply from the elevated mentalis muscle tissues (Fig. 6). The free edges are plicated with a buried absorbable suture. Following this maneuver a modest increase in chin projection can be appreciated. The plicated periosteal/mentalis muscle flap tissues are advanced inferiorly and posteriorly and sutured down with a deep layer of buried absorbable sutures. The free edge of the flap is secured further distally over the platysma in a “vest over pants” maneuver with interrupted absorbable sutures (Fig. 7). A smooth contoured chin pad creates harmony with the remainder of the neck (Fig. 8). After the submentoplasty the skin incision is closed. Conservatism is the rule with skin removal. Excess skin resection leads to skin dimpling and cutaneous cone deformities.

Figure 6  After excision of midline muscular wedge free edges are plicated.

Figure 7  Plicated muscle is advanced over platysma and sutured down in a “vest over pants” maneuver.

Figure 8  Pre- and postoperative photos of a witch’s chin deformity. (A) Patient who presents with a senile chin deformity. (B) Same patient following repair of a witch’s chin deformity using the technique shown in Figures 5 to 7.
CONCLUSION
Successful rejuvenation of the neck begins by assessing the neck and its relationship to adjacent structures. One of the key associated structures is the chin. Just as changes to the chin in a patient with retrogenia can improve the overall results in a rhinoplasty patient, these same changes can have an equally dramatic change on the neck profile. Alloplastic implants give the illusion of a longer sweeping jaw line in appropriately selected patients. However, a sliding genioplasty can also accomplish this change by elevating the position of the hyoid and sharpening the cervical-mental angle. A witch’s chin deformity must be excluded in those patients who present for aging face and neck rejuvenation. We have detailed the diagnostic and technical methods of correction so that a more optimal result in neck rejuvenation procedures can be obtained.

REFERENCES