Estimating implant size in chin augmentation: A simplified approach

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A receding chin, colloquially known as a weak chin, is a significant aesthetic impediment to a pleasing face. Multiple techniques exist to evaluate the poorly projecting chin, but most are imprecise when it comes to choosing the proper implant size. This choice is further complicated by the impracticality of commercially available chin implants. Most implant manufacturers offer only three to four categories of implants (small, medium, large, etc) that differ in size from one company to another, making the choice of the proper implant size a real challenge.

The present paper discusses a new approach to precise sizing of the chin implant, based primarily on the degree of chin convexity (curvature of the chin pad) in the profile view. Examples of mentoplasties performed using the chin convexity principle are presented.

Key Words: Chin augmentation; Convexity; Curvature; Implant size

L'évaluation de la dimension de l'implant en cas d'augmentation du menton : Une démarche simplifiée

Un menton fuyant est un obstacle esthétique important à un visage agréable. Il existe de multiples techniques pour évaluer cette mauvaise projection du menton, mais la plupart sont imprécises lorsqu'il s'agit de choisir un implant de bonne dimension. Ce choix est compliqué par le caractère peu pratique des implants de menton mis en marché. En effet, la plupart des fabricants n'offrent que trois ou quatre catégories d'implants (petit, moyen, grand, etc.), dont la dimension varie d'un fabricant à l'autre, ce qui transforme lp=e choix du bon implant en véritable défi. Le présent article présente une nouvelle démarche pour établir la dimension exacte de l'implant du menton, fondée principalement sur le degré de convexité du menton (la courbe du coussinet du menton) selon une vue de profil. Des exemples de mentoplasties exécutées selon le principe de convexité du menton sont présentés.

The recessed chin, often referred to as a weak chin, poses an aesthetic problem by disrupting the balance of the face. Several authors (1-8) have proposed various methods to determine the degree of chin recession and subsequent augmentation, while others have placed an emphasis on the choice of material rather than the shape and volume of the implant.

Conventionally, the ideal chin is thought to be one that extends to just behind a vertical plane dropped from the vermilion border of the lower lip in the profile view (1-3) (Figure 1A). A chin that fails to do so is considered to be deficient, requiring augmentation.

We propose a method of chin evaluation that reaches beyond the traditional approaches of implant sizing, by taking into account what we feel is the key factor in preoperative planning: the degree of chin convexity (curvature of the chin pad) in the profile view.

DIAGNOSING THE WEAK CHIN

When analysing the appearance of the chin, two questions need to be addressed: is the chin in fact weak in terms of its projection? If yes, how large need the implant be to correct this lack of projection?

A weak chin in the profile view can be defined as one that lacks the ideal degree of projection to attain proper aesthetic harmony. According to a popular preoperative evaluation technique, the ideal chin profile is 1 mm to 3 mm posterior to a vertical line dropped from the vermilion border of the lower lip, as seen in the profile view with a horizontal Frankfort line. If the chin profile is posterior to that, it is considered to suffer from inadequate projection.

In correcting the deficiency, one might assume that the size of the chin implant should simply equal the difference between the ideal projection and the present deficient one. However, in practice, this calculation is unpredictable if used alone. Merely increasing the size of the chin to a level 1 mm to 3 mm posterior to the vermilion vertical line may create an exaggerated projection if the lip-chin sulcus is deep preoperatively (Figure 1B). Accordingly, the authors propose a novel approach to assess the degree of correction and the size of implant needed: the evaluation of the chin convexity when the chin pad is viewed in profile.

The relation between chin convexity and implant size

The insertion of a chin implant has two main effects on the chin appearance: increasing its projection and its convexity in the profile view. Most of the past literature has focussed on calculating the missing projection as the basis for implant sizing. However, the main limiting factor affecting the choice of the implant size is the preoperative chin convexity, or lack of it. As Figure 1 has demonstrated, there is a limit on the number of millimetres that may be added to the different chin profiles. A fully convex chin preoperatively may accept an implant of up

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Figure 1) A Conventionally, the ideal chin is one that extends to few millimeters behind a vertical plane dropped from the vermilion of the lower lip; **B** However, a potentially exaggerated projection may result in the case of a deep lip-chin sulcus with a convex chin

to approximately 4 mm of central thickness, because a thicker implant will increase the convexity of that chin beyond an acceptable aesthetic prominence, even if the chin is still far behind the vertical vermilion line. On the other hand, a chin lacking convexity preoperatively portrays a flat vertical or even posteriorly angulated profile, allowing the use of progressively thicker implants that will enhance chin projection, as well as increase its curvature to the maximum acceptable convexity.

Chin convexity classification

The degree of chin convexity in the profile view may be assigned to one of three categories (Figure 2):

- 1. Convex, with the chin profile presenting mostly as a fully convex line;
- 2. Vertical, with the chin profile presenting mostly as a vertical line; or
- Diagonal, with the chin profile presenting mostly as a very diagonal (posteriorly angled) line.

Implant sizing based on the chin convexity classification

When determining the size of the required chin implant, the chin must be categorised as one of the three previously discussed possibilities: convex, vertical or diagonal (Figure 2). If the chin profile is fully convex (type 1), a relatively thin implant of about 4 mm thickness (projection or anterior to posterior dimension) at the midline should be used. The vertical category of chin (type 2), in which the chin profile is mostly a vertical line, requires a moderately thick implant measuring about 8 mm at the midline. Finally, in the diagonal category chin profile (type 3), where the chin profile is markedly angled backwards, a larger implant measuring around 12 mm in thickness at its centre is indicated.

It is important to note that it is the thickness at the centre of the implant (ie, the projection of the implant) that has the greatest impact on the final result. The length and width of the implant contribute less to the outcome. Most chin implant manufacturers do not follow this theory. Their 'small' size implants are small in all dimensions (pro-



Figure 2) Chin classification based on the chin convexity: convex, vertical and very diagonal, with the corresponding suggested midline projection (thickness) of the chin implant

jection, height and length), while their larger implants are magnified in all dimensions as well. To confuse things further, the same category chin implants (eg, small) of the various companies are usually very different in measurement. For the surgeon, making a choice between the different sizes and different companies is somewhat of a guessing game. The use of an extended implant (longer bilaterally) may be helpful in some cases of narrow chins or recessed perichin areas. However, the decision to extend or not to extend the implant does not affect the decision on the required implant central thickness.

While the projection, or maximum central thickness of the implant, may range from 4 mm to 12 mm or more as discussed, its length, or horizontal dimension, may run from between 4.5 to 7 cm (depending on the central thickness and on whether the implant is extended or not), and its height (vertical dimension) may vary between 10 mm to 12 mm.

It is very important to note that in many instances, the chin curvature may fall in between two of these three categories. For example, a chin with a very mild convexity is classified between types 1 and 2, therefore requiring an implant measuring about 6 mm in central thickness. As well, a chin that is moderately diagonal behind the vertical plane may be placed between types 2 and 3, therefore requiring an implant measuring approximately 10 mm in maximum thickness.

Implant material and placement

The intent of the present paper is not to suggest a specific implant material, but rather to discuss the sizing of the chin implant. This being said, several different implant materials from a variety of commercial manufacturers are available. The choice of the implant material (eg, gortex, silastic, medpor, mersilene, etc) depends on the surgeon's individual preference. The senior author uses custom-made silastic implants (Implantech, Ventura, California,USA).

It is important to emphasize that the surgeon may still opt to use the standard sizes (small, medium and large) provided by commercial manufacturers. In that case, the surgeon, using a Number 11 or Number 15 blade, can adjust the projection, length and width of the implant, guided by the chin convexity rule.



Figure 3) A and B Preoperative view of an almost vertical chin (type 2); C and D Postoperative result eight months later after using an 8 mm thick implant. This size is the most commonly used one



Figure 4) A and B Preoperative view of a case falling in between type 2 and type 3. The chin contour has a moderately diagonal element. The patient also has a slightly inadequate lower facial height, but was not interested in osteotomies; B and C Postoperative result 17 months following the use of a 10 mm implant. This size is the second most commonly used implant

With respect to surgical technique, an intraoral or a submental incision may be used to develop a subperiosteal or a supraperiosteal pocket, depending on the surgeon's individual preference. The authors prefer a submental approach with a subperiosteal dissection. A drain may or may not be used (the authors use the plastic sheath of an 18 gauge angiocatheter). The wound is then closed in two layers.

Figures 3 to 6 demonstrate preoperative and postoperative examples of chin augmentations based primarily on the chin curvature theory.

DISCUSSION

The main topic of this article is to suggest a modified approach to implant sizing that focuses on the preoperative evaluation of the implant projection, incorporating the chin convexity principle, as well as on the relative importance of implant projection (central thickness) versus length and width.

The indications, choice of implant material and choice of surgical approach for this technique are no different than the ones known for any chin augmentation. The use of alloplastic and autologous materials has been extensively studied. In terms of cartilage and bone as potential materials, although readily available and autologous in nature, they are subject to potential resorption (9) and require a second harvesting procedure.

On the other hand, the use of implant materials, such as silastic, proplast and others, has its advantages and disadvantages as well. In terms of its advantages, alloplastic implantation is a relatively simple procedure and can be done on an outpatient basis. The disadvantages include the potential for bony erosion underneath the implant, implant displacement, extrusion or infection.

Patient selection is the same as in any other approach to chin augmentation, and is critical to reach optimal cosmetic results. Patients with considerable orthognathic issues, such as long face syndrome, severe microgenia or inadequate vertical facial height are not ideal candidates for simple augmentation (8). The same is true of patients with considerable malocclusion (9). These patients may benefit more from initial corrective orthognatic procedures (8-12). As such, while patients are



Figure 5) A and B Preoperative view of a markedly diagonal chin profile type 3; C and D Postoperative result seven months later. A silastic implant with a 12 mm midline thickness was used



Figure 6) A and B Preoperative view of a 30-year-old patient with a deep lip-chin sulcus and a slighty convex chin profile of type 1 to 2; C and D Postoperative result two years and nine months following the use of an exteded 6 mm implant (NB: if the chin convexity was a little more prominent, it would have been considered as a type 1, therefore limiting the implant size to 4 mm. On the other hand, if the lip-chin groove was shallower or absent, the same patient would have had a flat vertical or somewhat diagonal profile and would have benefited from an extended 8 mm (type 2) or 10 mm (type 2 to 3) implant

preliminarily evaluated for chin convexity, they should be analyzed as well for chin-nose, lower lip, labiomental fold and chin-pad thickness analysis as described by Zide et al (8). It should be noted that the use of alloplastic augmentation may have a role in certain patients with a limited increase in vertical chin height (10), especially in cases where patients are not interested in undergoing maxillofacial surgery. By augmenting the chin, an illusion of shortening the vertical height can be created. As well, important orthodontic issues should be corrected before attempting chin augmentation.

The main intent of the present article is to suggest a simple and reliable way to choose the proper size of a chin implant. This article does not suggest new indications and does not give preference to any autogenous or alloplastic augmentation material.

CONCLUSIONS

A recessed chin is a source of asymmetry in the human face. In addition to being an aesthetic detractor, it is also associated with a perceived weak personality. With a properly sized implant, chin augmentation offers an easy and effective means of correcting the deficiency.

To properly augment the chin, the degree of convexity of the patient's chin in the profile view needs to be evaluated. The main goal of this approach is to estimate more accurately, almost to the millimeter, the best projection (midline thickness) of the chin implant, rather than guess and choose between the usual three commercially available but widely variable choices (small, medium and large).

Like in any other chin augmentation procedure, criteria such as orthognatic problems, long face syndrome or orthodontic problems should be considered.

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