5 Mentoplasty: Progress to Date

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The use of implants in performing mentoplasty will usually depend upon availability and experience with a particular material. By defining indications for mentoplasty, understanding the properties of alloplastic materials, and appropriately using different implants and techniques, further improvements in the overall results of chin augmentation are possible.

INDICATIONS FOR SURGERY

The presenting deformity must be defined and the procedure selected that will most satisfactorily correct the problem. Cases of severe mandibular underdevelopment are classified as retrognathia or micrognathia. These deformities are usually accompanied by an Angle Class II malocclusion, with marked retrusion of the mandibular incisor teeth producing significant overbite or overjet, and labial incompetence. Patients presenting with this degree of deformity are best handled by osteotomy and advancement of the entire mandible, or by a repositioning of the dentoalveolar segments. A select group of patients may also present with severe mandibular retrusion, but with functional occlusion in which the maxillary and mandibular incisor teeth are in contact. These patients may be improved with a double-sliding genioplasty.[1] In the above categories, a simple mentoplasty would not obtain a cosmetically or functionally ideal result. Patients with such severe deformities, who refuse these more extensive procedures, must be made aware of the limitations of mentoplasty in improving their profile.

The vast majority of patients requiring chin augmentation usually have an underdevelopment of the mandibular symphysis (microgenia) with normal occlusion (Angle Class I). In these patients, mentoplasty alone is sufficient to provide an adequate profile.

REVIEW OF MENTOPLASTY

The types of substances that are used in mentoplasty are grafts and implants. The autograft, homograft, and heterograft, except in unusual circumstances, have largely been replaced with the newer alloplastic materials.[2–7] Problems with the use of grafts include absorption, the necessity for another surgical procedure at a donor site, rejection, and subsequent change in shape, position, and final volume.

A review of alloplastic implants in chin augmentation is well documented by Carlin.[8] Materials such as heavy metals, ivory, and paraffin were abandoned because of technical difficulties, rigidity, lack of stability, and tissue reaction.

Table 1
Plastic Polymers

Parent Compound	Derivatives
Nylon	Supramid®
Dacron	
Teflon (Polytef)	Proplast®
Polymethylmethacrylate (Acrylics)	
Polyethylene	Marlex®
Polyvinyl sponge (Ivalone®)	
Silicones	

Table 2
Total Number of Cases of Chin Augmentation Performed over Nine Years

Acrylics	26
Silicone rubber	34
Silastic sponge	235
Proplast®	69
Supramid®	5
Silicone gel-filled bag	
With Dacron	106
Without Dacron	64
Total Cases	539

The discovery of plastic polymers opened a new era in tissue implantation. The characteristics of these polymers are dependent on the various chain formations of different macromolecular monomer components. These polymers form the primary parent compounds known as nylon, Dacron, Teflon (polytef), polymethylmethacrylate (acrylics), polyethylene (Marlex®), polyvinyl sponge (Ivalone®), and silicone (Table 1).

Nylon, in its pure form, was not used as an implant due to moderate foreign body reaction. However, polyamide mesh (Supramid®), which is a nylon derivative, has recently gained popularity.[9] Teflon (Polytef; polytetraflourethylene) also gave rise to a derivative called Proplast®, used in different clinical settings.[10–12] Polyvinyl sponge (Ivalone®) was used only briefly with limited success.[8,13]

Dacron, although not used primarily for the purpose of producing bulk for augmentation, is used in conjunction with other materials to serve as an artificial stroma to allow for fibrous ingrowth, and enhance implant fixation. Polyethylene was used by Rubin and Walden[14] to augment the chin, but its use (in the form of Marlex®) became limited to the reconstruction of abdominal, thoracic, and tracheal wall defects. It also has a tendency to harden over a period of time, and is moderately reactive.

The compounds that have been used most commonly for chin augmentation are the acrylics and silicones. The silicones exist in four different forms: (1) silicone fluid, (2) solid silicone rubber, (3) silicone sponge (fine and coarse), and (4) silicone gel.

MATERIALS AND METHODS

Five hundred and thirty-nine cases of mentoplasty were retrospectively reviewed. The operations were performed over a period of nine years, using different materials and routes of insertion. The types of materials utilized in varying numbers were the acrylics, silicone rubber, fine silicone sponge, Proplast®, Supramid®, and the silicone gel-filled bag with and without dacron backing (Table 2). The properties of each implant were rated on the ability to most adequately fulfill the aesthetic and functional requirements of chin augmentations (Table 3).

Table 3
Desirable Properties of Chin Implants

						Gel-filled Bag	
	Acrylics	Silicone rubber	Silastic sponge	Proplast	Supramid	Without Dacron	With Dacron
Ease of insertion	+	++	++++	++++	++++	+++	+++
Flexibility in molding to bone	N	++	++++	++++	++++	+++	+++
Fixation	+	+	+++	++++	++++	++	++++
Lack of tissue reaction	++++	+++	+++	+++	+++	+++	+++
Compliance of implant to external trauma	N	+	++++	++++	++++	+++	+++
Stability	++++	++++	+	+	++	+++	+++
Ability to correct asymmetries	N	N	++++	++++	++++	++	++

++++ = Excellent
+++ = Good
++ = Fair
+ = Poor
N = None

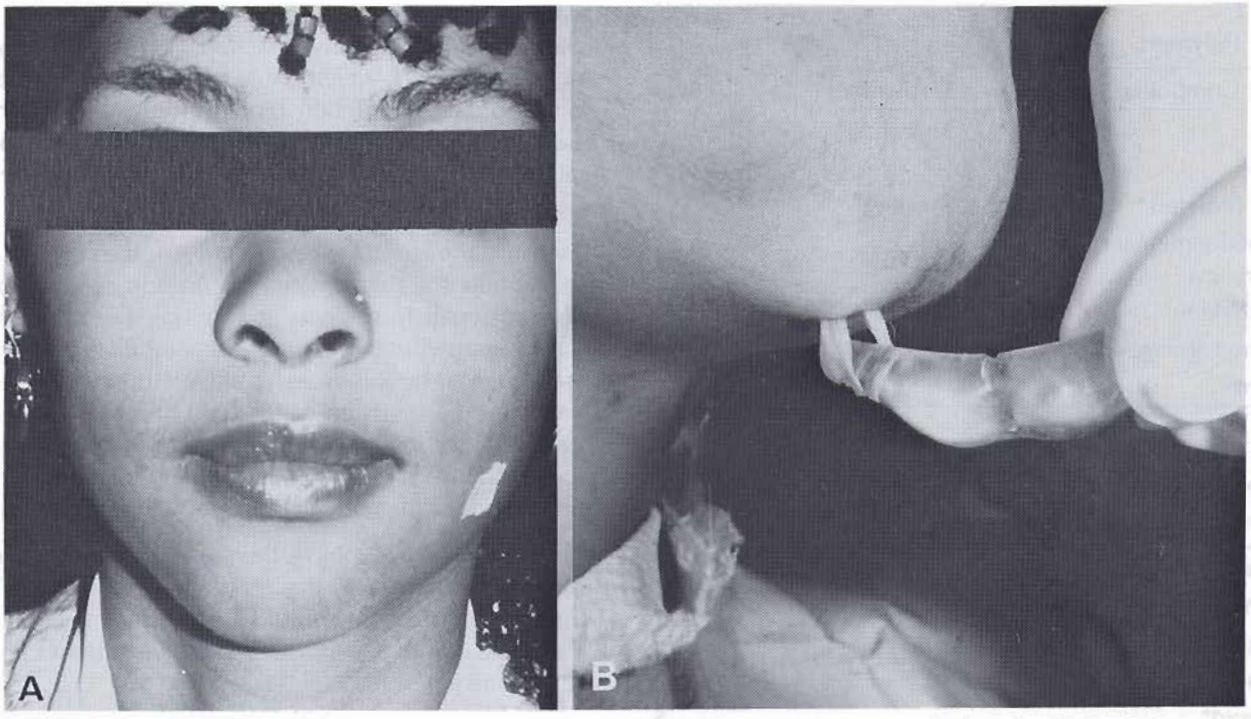

Fig. 1. (A) Asymmetric chin caused by slippage of acrylic implant. (B) Fibrous ingrowth through perforations was not enough to maintain implant fixation.

Properties of Alloplastic Materials Used for Chin Augmentation

In general, the common synthetic implants may be classified into hard, soft, and porous materials. The hard implants are the acrylics and silicone rubber. The acrylic compounds are high density, nonwettable substances. These qualities make it extremely inert and well tolerated by the body. However, its hard consistency makes it impossible to sculpt, and prevents exact conformation to the underlying bony structure. This may cause rocking of the implant over the surface of the bone, rendering a palpable margin to the implant, slippage, and asymmetry. This may occur even with perforations, which allow for ingrowth of fibrous tissues for better fixation (Fig. 1). During insertion, a larger incision is also usually required for the acrylic implant than for a more malleable one.

The silicone rubber implants were found to be easier to sculpt, and conformed more readily to the chin contour, but disadvantages of palpability and slippage were retained. In addition, they were found to have a slightly higher incidence of infection and extrusion than the acrylics.[9]

The porous or "sponge" type of implants, which include fine silicone sponge, Proplast®, and polyamide mesh (Supramid®), share common features but also retain specific problems unique to each material. The general advantages of porous implants are the ease of insertion, ability to provide a natural feel to the mandible, and enhanced capacity for fixation. Successful utilization of these implant materials in large numbers of cases has been well documented in previous reports.[9,10,15–17]

Proplast® appeared to offer advantages over silicone sponge experimentally.[11] Its wettability by body fluids allowed better tissue tolerance and fixation, but did not adhere to the surrounding soft tissues even in the face of sepsis.[12] It has a unique ability to fix to bone, and if placed subperiosteally is extremely difficult to remove.

Supramid® allows the most fibrous ingrowth and has a particular ability to blend into the surrounding tissues.[9] However, if rejection occurs, it also becomes extremely difficult to remove. We have had limited experience with this implant, and follow-up in other reports is still relatively short.[17]

Disadvantages common to silicone sponge and Proplast® are related to their unpredictability. Continued shrinkage may produce asymmetry, puckering, and a subsequent change in profile. This tendency to change shape produces a "rolling effect," more commonly found in silicone sponge, in which the edges become palpable. Changes in shape and consistency were more often found to occur when larger volumes of the implant material were used to augment a relatively severe defect. When indicated, silicone sponge or Proplast® was not difficult to remove if placed in a supraperiosteal plane.

Presently, we have found properties of the silicone gel-filled bag prosthesis better able to fulfill the requirements for chin augmentation than other implant materials.[18,19] It was further improved by adding a Dacron backing to enhance fixation.[20] As with other embedded foreign materials, however, it cannot be used in all patients, it is not free of complications,[20] and the follow-up period for definitive conclusions is still short (less than 10 years).

There are reports in the literature of minimal changes in the permeability of the capsule around silicone gel-filled breast prostheses.[21] This has allowed the inner gel to dissolve into the surrounding tissues. The clinical significance of this and its extrapolation to chin implants has not yet been determined.

SUCCESSFUL RESULTS IN MENTOPLASTY

A successful mentoplasty is related to two fundamental concepts: (1) an understanding of the factors responsible for determining the host response to the insertion of a foreign body, and (2) obtaining a desirable aesthetic and functional result.

Factors Involved In Host-Implant Interreactions

The incidence of complications in mentoplasty is determined by the reaction of the surrounding tissues to a particular implant. This may take place in the form of bone resorption, destruction of overlying skin, persistent pain and tenderness, and finally, rejection and extrusion.

Bone resorption underlying chin implants was described in 1969 by Robinson and Shuken.[22] Subperiosteal placement of hard chin implants was implicated to cause pressure resorption of alveolar bone that was stripped of its blood supply.[23] Other factors, such as the size of the implant or the occurrence of acute and chronic reaction around polyethylene foam and dacron backing were implicated in contributing to bone resorption.[24] Feuerstein[25] showed by means of xerography that a reduction in pressure by increasing the flexibility of the implant further reduces bone resorption. Other reports have shown bone resorption to occur with hard as well as soft implants placed both below and above the periosteum.[24,26] However, Bell and Spira[27,28] independently noted after approximately 12 months, that resorption appeared to be a self-limiting phenomenon.

Bone resorption may be related to position of the implant.[29] If it is placed too high, it may cause erosion of the more cancellous bone overlying the roots of the incisor teeth. This can precipitate premature loss of teeth. In our series, bone resorption did not pose a significant problem, nor did it present complications necessitating removal of the implant.

Skin slough is a rare complication, first reported to be caused by a tight immobilization pressure bandage over a hard acrylic implant.[30] It may also occur with softer implants when acute infection is combined with excessive tension and pressure of the overlying skin.[20]

Rejection of the implant may occur at any time. Early rejection is usually associated with either hematoma or infection. These may be minimized with meticulous hemostasis, aseptic techniques, and prophylactic antibiotics. In delayed rejection, a foreign body reaction takes place that clinically is manifested by either granuloma formation, draining sinus tracts, or continued pain and tenderness. In addition to the use of inert materials, the incidence of a rejection phenomenon may be further reduced through awareness of the relationships of stress, tension, degree of immobilization, shape of the implant, and route of insertion.

The forces of stress and tension are related to the size of the implant, activity of surrounding musculature, and the ability of the implant to undergo fixation to surrounding tissues. An oversized implant may cause dehiscence of the suture line and exposure of the implant. Hyperactivity of the chin musculature may also displace the implant to produce a constant source of irritation. Therefore, the need for immobilization is most important in reducing the incidence of foreign body reaction. Subperiosteal placement of harder implants enhance immobilization, but usually cause more bone resorption. In our experience the use of Dacron backing under smooth silicone implants has satisfactorily fulfilled this requirement.

The significance of implant shape can have a definite effect on tissue reactivity. Matlaga[31] experimentally demonstrated that implant polymers with more acute angles initiate the greatest tissue reaction.

Two basic approaches for insertion of a chin implant are the intraoral and the extraoral route. In the majority of cases there has been no increased rate of infection or extrusion with intraoral insertion.[15] Beekhuis,[9] however, reports a slightly higher rate of infection and extrusion with solid silicone rubber implants when placed through the intraoral route. The external approach is technically easier to perform and has less postoperative discomfort. However, the necessity for a smaller incision to decrease submental scarring offers limited exposure (Fig 2). Specific indications for extraoral insertion are patients who wear dentures and the presence of any intraoral pathology. Placement of a large implant in patients with short mandibles and a shallow labiogingival sulcus may produce excessive tension on an intraoral suture line. Both routes of insertion may obliterate the labiomental sulcus if the implant is malpositioned or is too large.

Although the qualities of alloplastic materials have improved, each one has certain deficiencies and, in particular cases, a patient may reject a newer, theoretically better implant and accept a different material.

Aesthetic and Functional Requirements for Chin Augmentation

Ultimately, a successful result requires a normal appearing chin contour and a patient without functional problems. Distortion of the chin contour after mentoplasty may be prevented by careful preoperative analysis, which will determine the type of procedure, type of implant, and route of insertion. Placement of an excessively large implant may

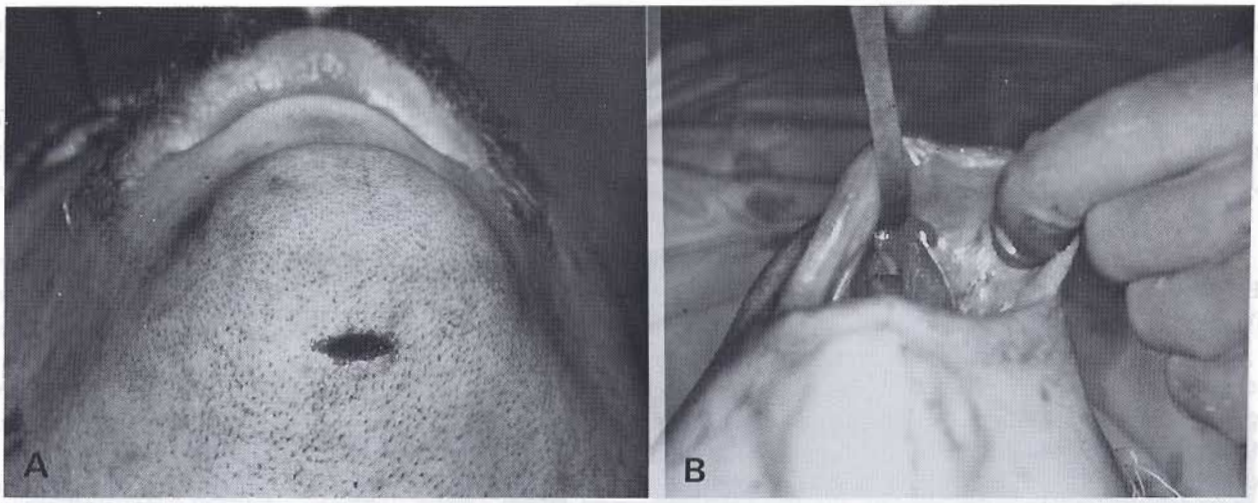

Fig. 2. (A) Only a small incision is needed in the submental area for insertion of a malleable implant. (B) Intraoral incision may be larger. Wider exposure is possible, but there is an increased chance of wound dehiscence and extrusion with larger implants.

produce an overly protuberant chin. Creating a large pocket for a small implant and the formation of scar contracture may cause shifting of the implant. Distortion may also be created when porous or soft implants are forcefully inserted into a small pocket. This may cause bunching of the implant, which may not be appreciated until after the swelling has resolved.

In asymmetric chins, utilization of a prefabricated implant may produce a larger chin, but with persistence of the deformity. Experience with silicone sponge and Proplast® has shown them to be most efficacious in the ability to compensate for mandibular asymmetries (Fig. 3). If there is a marked retrusion with asymmetry, the use of a prefabricated implant, supplemented with silicone sponge or Proplast®, works remarkably well.

The final outcome of any successful cosmetic procedure depends upon patient acceptance. Patients may complain of functional problems such as an unnatural feel to their chin, reaction to cold temperatures, mobility, and palpability of the prosthesis. These problems are more commonly found with the harder acrylic and silicone rubber prosthe-

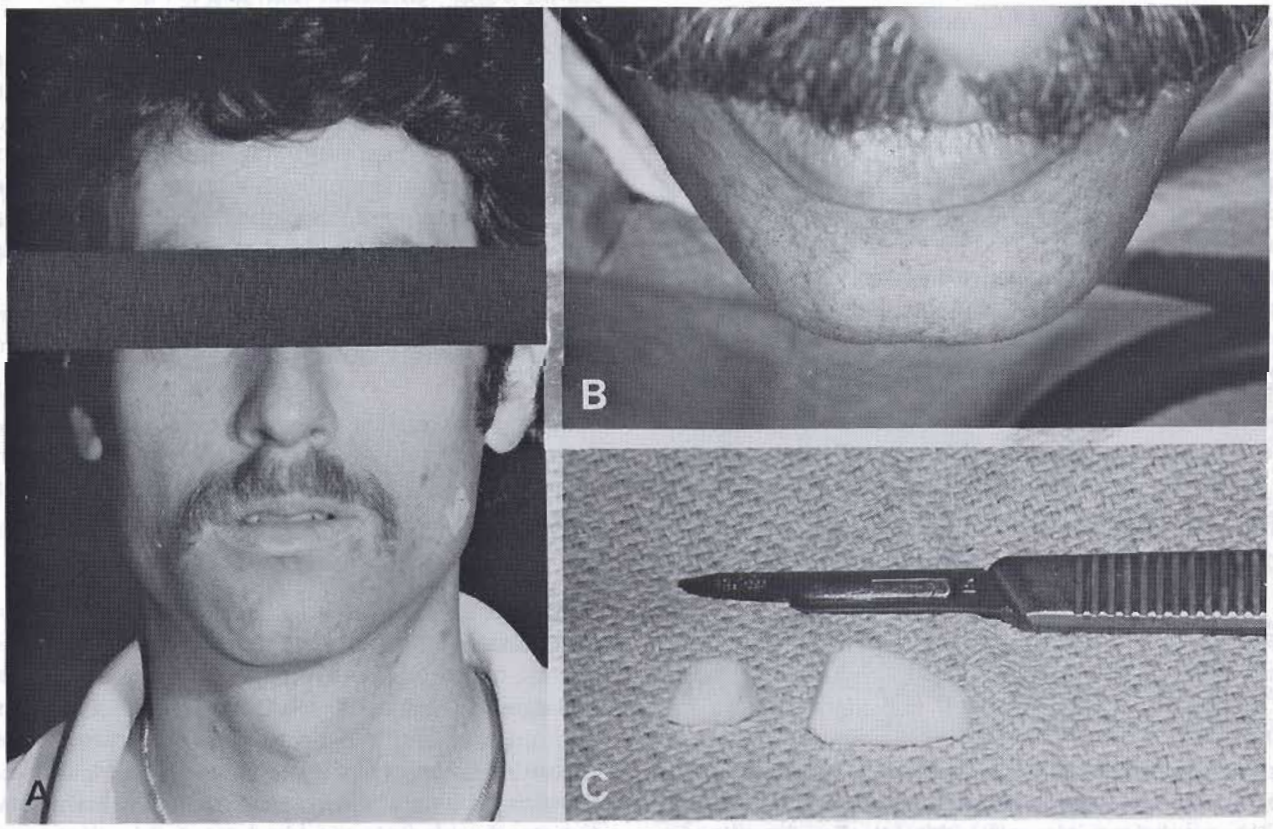

Fig. 3. (A) Example of asymmetric chin. (B) Deformity corrected with the use of two unequal pieces of silicone sponge. (C) Postoperative result.

ses. Direct trauma to the chin is more likely to result in soft tissue damage with underlying harder implants. A young patient, more active in athletics, would therefore benefit from a softer implant.

Changes in consistency to the chin can be expected when large volumes of the silicone sponge or Proplast® are used. This has not been reported to occur with polyamide mesh (Supramid®). In minor defects, which required smaller volumes of the sponge implants, there were no substantial changes in shape or consistency. In the majority of routine mentoplasties, the silicone gel-filled bag had less functional problems and greater patient satisfaction. Prolonged pain and tenderness, necessitating removal, may be seen with any of the known implants.

CONCLUSION

The ability to accurately identify the type of mandibular deformity and define the indications for mentoplasty will enable the surgeon to adapt different implant materials and techniques to achieve a more optimal result. Although the ideal implant still has not been discovered, further refinements in mentoplasty may be achieved through an understanding of the properties and limitations of the known contemporary synthetic implants. This flexibility will enable the surgeon to produce an improved aesthetic and functional result and minimize the complications of chin augmentation.

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