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Alloplastic Augmentation of the Asian Face: A Review of 215 Patients

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Abstract

Background: Asian aesthetic surgery has become increasingly popular over the last decade, especially augmentation of characteristically flattened facial features. Alloplastic implants are an option for facial augmentation, however many avoid their use due to concerns for morbidity associated with their use.

Objectives: To validate our hypothesis that when used properly, alloplastic implants have a low complication profile and provides excellent aesthetic results.

Methods: A retrospective review was performed of all Asian patients undergoing alloplastic facial augmentation between 2009 and 2013 by a single surgeon. Procedures included augmentation of the forehead, nasal dorsum, midface, and chin. Charts were reviewed for outcomes including infection, extrusion, malposition, and operative revision.

Results: Two hundred and fifteen patients had 243 implants placed. Of 141 nasal augmentations, there were 2 infections (1.4%), 1 extrusion (0.7%), 7 malpositions (4.9%), and 16 revisions (11.3%), 5 for malposition, 2 for contour irregularity, and 9 for aesthetic change. Augmentation genioplasty was performed in 40 patients with 1 malposition (2.5%) and 6 revisions (15%), 4 for under-correction and 2 for aesthetic change. Thirty-one midface and 31 forehead augmentations were performed without complications. One patient (3.2%) had forehead implant removal for aesthetic change. Overall infection and extrusion rates were 0.8% and 0.4%, respectively.

Conclusions: By utilizing surgical techniques such as creation of a precise sub-periosteal pocket, placing the implant away from the incision site, and leaving well-vascularized soft tissue coverage under minimal tension, alloplastic implants can safely be used as a first-line option for Asian facial augmentation.

Level of Evidence: 4

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In the United States, over half a million aesthetic procedures were performed on Asian Americans in 2014,[1] representing a 45% increase since 2010.[2] The rapid growth and rising income of this ethnic group has been a driving force towards increasing demand for aesthetic surgery in Asians.[3] As plastic surgeons seek to meet the increasing demand, a primary challenge is achieving the Asian patient's desired goals while at the same time preserving their ethnic identity. Rather than aspiring toward a Westernized look, most Asian patients are seeking procedures to improve and refine their existing features.

Among the most frequently sought procedures by Asians are those seeking to improve upon what many Asian cultures deem as less desirable characteristics. Cephalometric studies have been particularly instructive in distinguishing these common features. A short fronto-occiptal length and flattened back and forehead may result in a brachycephalic head shape compared to Caucasian heads.[4-6] A flattened or sloped forehead can evoke a primitive appearance and is in contrast to the rounded, full forehead that is considered desirable in Chinese physiognomy.[7] The Asian nose characteristically has a low nasal bridge and dorsum with foreshortened nose and thick, sebaceous

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skin overlying weak lower lateral cartilages.[8,9] When combined with characteristic shallow orbits, patients often present with the appearance of "pseudoproptosis," or anterior positioning of the globe relative to the orbit and nasal bridge. Additionally, broad, flattened midfaces with paranasal depression in Asians can give a gloomy, tired, and aged appearance.[10] Finally, bimaxillary protrusion with relatively decreased chin prominence is well-documented in Asian cephalometric studies and is a source of dissatisfaction for many patients.[9,11,12] Balancing these facial features by increasing the nasolabial angle and augmenting chin projection is of similar importance in Asians as well as African American and Caucasian patients.[13]

A major decision for surgeons and patients remains the choice of augmentation material to use. Autogenous tissue allows for reincorporation and revascularization of the implant, theoretically decreasing the risks of infection and extrusion. Donor site morbidity with associated increased operating room and recovery time as well as tissue resorption are the primary drawbacks of using autologous tissue. Augmentation of soft tissue with autogenous fat, which is becoming increasingly popular, leaves room for the grafted tissue to be subject to future gravitational soft tissue changes of the aging face. Alloplastic implants, on the other hand, are purported to have high rates of infection and extrusion.[14] Advantages of alloplastic implants include unlimited implant material, ease of removal when using solid silicone, lack of donor site morbidity, implant stability, and lack of resorption. Unsurprisingly, with the multiple available treatment options for facial augmentation, there is ongoing debate regarding the choice of autogenous or alloplastic materials as the first-line option.[14-16]

With the growing popularity of aesthetic surgery among Asians, it is essential to determine which techniques offer excellent, reproducible results while at the same time minimizing morbidity and the need for reoperation. For the specific indications discussed, we have found that alloplastic implants reliably meet these criteria as a first-choice option for facial augmentation. Here, we review the senior author's (E.K.) experience with alloplastic facial augmentation in a consecutive series of Asian patients over a 5-year period.

METHODS

An Institutional Review Board-approved (Weill Cornell Medical College, New York, NY) retrospective chart review was performed in January 2015 of all Asian patients undergoing alloplastic augmentation of the face between January 2009 and December 2013 by the senior author (E.K.). Patients with incomplete charts or records were excluded from the study. The remainder of patients over the 5-year period were included in the series. The studied procedures included augmentation using alloplastic implants to the forehead, nose, midface, and chin. Indications for alloplastic augmentation of these areas included flattened or sloped forehead, low nasal bridge or nasal dorsum, bimaxillary protrusion, and microgenia. Charts were reviewed for ethnicity, patient characteristics, type of implant, and implant location. Complications were considered infection, implant extrusion, or malposition. Infection was considered any patient treated with antibiotics and/or surgery for clinical signs of surgical site infection such as erythema, swelling, or fluctuance.

Outcomes were also determined by rates of operative revision or removal. Operative revision for a desired change in aesthetics (for either over- or under-augmentation at primary surgery) was not considered an operative complication, though its incidence was recorded. Statistical analysis was performed using a two-tailed Fisher's exact test for categorical variables, with statistical significance set at $P < .05$. Patient satisfaction with surgery was extracted from postoperative notes, and was considered positive when "happy with results" or "satisfied with results" were used to describe the patient in the postoperative charting.

Augmentation Rhinoplasty

Our augmentation rhinoplasty is typically performed using a closed approach. A custom-designed silicone implant is carved preoperatively from a silicone block according to the patient's nasal dimensions and desired appearance. Proper implant size and dimensions are verified preoperatively with the patient in front of a mirror by laying the implant on the nose to predict the degree of augmentation. Intraoperatively, bilateral intracartilaginous incisions are made and symmetric pockets are created from the inferior aspect of the nasal bones and carried to the nasal tip. At the level of the nasal bones, this pocket is made with a periosteal elevator and it is carried sub-periosteally and undermined in the midline to the precise width of the implant. The pocket is continued to the tip of the nose with a dissecting scissor. It is important that the pocket is away from the incision and the dissection is from both sides of the nose to eliminate the tendency of the implant to deviate toward one side. The implant pocket is irrigated with bacitracin-containing solution, and the implant is inserted into the sub-periosteal plane. Appropriate positioning of the implant in the midline is ensured and the incisions are closed in water-tight manner using absorbable sutures. If necessary, further tip work or grafting is done via a separate incision.

Chin Augmentation

We performed alloplastic chin augmentation using premade silicone implants. All implants were inserted via a gingivobuccal sulcus incision (through the lower

frenulum), which is carried centrally in a sub-periosteal plane to the inferior mandibular border. The sub-periosteal pocket is extended laterally to the precise dimensions of the implant, the pocket is irrigated with bacitracin-containing solution, and the implant inserted. The mentalis muscle and mucosa are closed with absorbable sutures.

Midface Augmentation

Patients who present with maxillary hypoplasia and midface retrusion with an unbalanced profile and over-projecting mouth are considered candidates for augmentation with a submalar or paranasal silicone implant. A determination of proper implant selection is based on physical exam – actual measurements or imaging are typically unnecessary. Analysis with the patient both smiling and in repose help identification of areas of volumetric deficiency, with particular attention paid to asymmetries. After critical analysis of the patient's facial features, implants are selected that would enhance volume and give the appearance of full, youthful cheeks.

A 1 cm incision is made in the midline of the upper frenulum and carried down to a sub-periosteal level. The soft tissues of the cheek are elevated through a narrow tunnel in the sub-periosteal plane up to the area of desired augmentation and a precise pocket is created to the dimensions of the implant. The pocket is irrigated with bacitracin-containing solution and the implant inserted. It is important that the implant sits comfortably but stably within the pocket. Stability is aided by placement in the sub-periosteal plane. The deep layers and mucosa are closed in separate layers using absorbable sutures. Along with the submalar implant, a maxillary spine implant can be added to the midline at the anterior nasal spine to further improve midface balance and increase the columella-labial angle.

Forehead Augmentation

Patients seeking increased forehead projection were offered augmentation using poly methyl-methacrylate (PMMA, Depuy Synthes, West Chester, PA) bone cement. In contrast to the use of silicone inserts for forehead contouring, preoperative measurements are typically unnecessary because PMMA cement can be easily contoured intraoperatively to the proper aesthetic result. We typically sculpt the implant in situ on the skull, which can be safely performed with augmentations up to 6 mm with minimal thermal risk to the underlying bone.[17,18]

Exposure is obtained via a coronal approach and patients desiring a concurrent brow lift have either a pre-trichial or coronal incision planned depending on the position of the preoperative hairline. Elevation of the forehead soft tissue is performed in a sub-galeal plane down to the superior orbital rims. An inferiorly-based pericranial flap is then elevated with the lateral borders of the flap at the deep temporal fascia. At this point, the frontal bone contour is exposed in a sub-periosteal plane. The PMMA cement is mixed and molded on the forehead to the desired contour and level of projection, keeping in mind that the male supraorbital rim tends to be more bossed and project an additional 2 to 4 mm anterior to the cornea when compared to the female supraorbital region.[19] Irregularities are smoothed using a rasp until an aesthetic forehead profile is achieved. The pericranial flap is used to cover the bone cement and sutured laterally to the deep temporal fascia for vascularized coverage of the cement. The scalp is then closed in layers without drains and a concurrent excision of scalp tissue is performed if a brow lift was planned.

RESULTS

A total of 230 patients were identified of Asian ethnicity who underwent alloplastic facial augmentation during the 5-year study period. Fifteen patients were excluded from study due to missing data. The remaining 215 patients met inclusion criteria, with a total of 243 implants placed. One hundred and sixty-nine were female and 46 were male. The average age was 37 years (range, 16-65 years) and the ethnic distribution of patients was 62.3% Korean (n = 134), 14.0% Chinese (n = 30), 5.6% Southeast Asian (n = 12), 0.9% Japanese (n = 2), and 0.4% Indian (n = 1). The remaining 16.8% were of unspecified Asian ethnicity (n = 36). Implants were placed for augmentation of the forehead, nasal dorsum, midface, and chin.

Overall rates of infection and extrusion for all implants were 0.8% (2 of 243 cases) and 0.4% (1 of 243 cases), respectively.

Augmentation Rhinoplasty

Dorsal nasal augmentation was performed in 141 patients, with custom-carved silicone implants used in all cases. Twenty-nine (20.6%) of these cases were secondary rhinoplasties. The average follow-up for the nasal augmentation subgroup was 4.3 months (range, 1-48 months). Complications occurred in 10 patients, which included infection (1.4%), extrusion (0.7%), and malposition (4.9%). Both incidences of infection occurred in secondary augmentation rhinoplasty cases where the primary augmentation was done by another provider. Both were treated with antibiotics and removal of the implant. Secondary augmentation rhinoplasty carried a greater risk of infection than primary cases (6.9% vs 0%, P = .041). The single case of extrusion was also treated with implant removal. There were 6 cases of malposition (4.2%), and we found no significant difference in rates of malposition between primary (4 cases, 3.6%) and secondary rhinoplasties (2 cases, 6.9%, P = .60). Operative revision was performed

in 16 total patients (11.3%); 5 for malposition, 11 for desired change in contour or aesthetics. The remainder of all patients reported satisfaction with aesthetic results (Supplementary Figure 1).

Chin Augmentation

Augmentation genioplasty was performed in 40 patients, with silicone implants used in all patients (Figure 1). The average follow-up in the genioplasty subgroup was 4.5 months (range, 1-38 months). There was one case of malposition of the implant however the patient did not desire operative correction. There were no cases of infection or extrusion despite insertion via an intra-oral approach. Reoperation was performed in six patients (15%); 4 patients for under-correction and 2 patients who desired implant removal to return to their original appearance.

Midface Augmentation

Midface augmentation via an intra-oral approach was performed in 31 patients using silicone malar, submalar, or paranasal implants in all cases (Supplementary Figure 2). The average follow-up in the midface subgroup was 4.5 months (range, 1-24 months). There were no occurrences of infection, extrusion, or malposition in this group of implants. All patients reported being satisfied with results.

Forehead Augmentation

Forehead augmentation was performed using our above technique in 31 patients (Figure 2). The average follow-up in the forehead subgroup was 3.7 months (range, 1-38 months). There were no incidences of infection, extrusion, or malposition in this patient group. Of the patients, 96.8% reported being satisfied with postoperative aesthetics. One patient was dissatisfied with her postoperative forehead contour and had operative removal of the bone cement 9 months after the initial surgery.

DISCUSSION

Use of alloplastic implants for facial augmentation is well documented.[20-23] While already commonly performed and

Figure 1. A 25-year-old woman with retrogenia before (A, C) and 12 months after (B, D) chin augmentation with a silicone implant, with improved facial harmony.

Figure 2. A 28-year-old woman with a flattened, sloped forehead before (A, C) and 12 months after (B, D) forehead augmentation with poly methyl-methacrylate.

established in Asia, there remains conflicting ideology regarding the safety profile and utility of aesthetic facial augmentation with alloplasts in the United States. More and more surgeons have opted to use autogenous tissue for augmentation purposes.[24,25] Alloplastic materials have been somewhat demonized in our community and as such have not been used widely by many Western-trained plastic surgeons. We believe, however, that alloplastic implants are an incredibly powerful tool for cosmetic improvement of the face. Alloplastic implants can reliably add height to dorsum of the nose, smooth out and add fullness to the forehead contour, and restore facial proportions and balance. Importantly, implants can be used to improve midface retrusion and the appearance of bimaxillary protrusion without the need for mandibular or maxillary osteotomies. For those who do not require malocclusion correction, this offers a shorter, simpler surgery with a quicker recovery time. This paper outlines the senior author's experience of using alloplastic facial implants over a 5-year period in which implants have been shown to be predictable and have remarkably low rates of infection and extrusion. Though our data accumulation is over a recent 5-year period, the senior author's recommendations on technique are drawn from a 20-year experience with alloplastic facial augmentation.

Numerous alloplastic materials are approved by the Food and Drug Administration for implantation, including silicone, expanded polytetrafluoroethylene, methylmethacrylate, gortex, and porous polyethylene. Our material of choice for most indications is silicone. It is easy to carve and handle prior to and during surgery. If placed properly, a capsule will form around the implant, allowing the body's natural mechanisms to provide a vascularized protective barrier.[26] If necessary, the implant can be removed easily at a future date without surrounding tissue damage. Because implants do not require harvesting of autologous material, operative time is shorter, donor site morbidity is avoided, and the procedures can often be performed using only local anesthesia with sedation.

As with any implant, facial augmentation with both alloplastic and autogenous materials is subject to postoperative movement of the implant, and we found the highest rate of implant malposition occurring with augmentation of the nasal dorsum. Malposition was the most common complication leading to reoperation in our patient series, while a

desired change in aesthetics was the most common overall reason for reoperation. Some authors propose a submental approach to genioplasty as a technique to minimize the risk of superior migration of the implant, however we prefer to avoid an external scar. Superior migration is minimized while using an intra-oral approach by separating the mentalis longitudinally without transection of the muscle, central restriction of dissection towards the inferior border of the mandible, and dissection of a precise sub-periosteal tunnel for the implant. Aside from dorsal nasal augmentation, the single malposition in our series occurred in a secondary genioplasty, which likely confers an increased risk of implant malposition due to the pocket being secondarily dissected. Similarly, proper technique is essential to minimize implant migration of methylmethacrylate used for forehead augmentation. While we have found that the implant by itself tends to adhere well to the underlying bone, securement of a periosteal flap over the methylmethacrylate after implant placement helps to stabilize the implant, and we have not observed any incidence of forehead implant migration in our series, similar to previously reported series of methylmethacrylate augmentation of the forehead for congenital etiologies as well as for feminization.[17] Thus, we do not advocate rigid titanium fixation of the implant. The superior extent of the implant material should be a minimum of 1 cm from the scalp incision to minimize the risk of implant exposure.[17]

An added advantage of alloplastic materials is that they are not subject to the warping that cartilage can undergo, which can further contribute to long-term dissatisfaction with aesthetic outcomes.[27] Furthermore, resorption of autogenous cartilage can occur in up to 50% of patients.[28] For augmentation of the midface, we favor the aesthetics provided by silicone implants over the increasingly popular fat grafting, as the implant texture more closely resembles and replaces the deficient underlying bony structure that this patient population lacks.

There have been multiple large series published on silicone facial augmentation from Asian surgeons.[21,29] Due to the relatively simple nature of surgery there has been an increase in the use of facial implants in Asia, specifically nasal implants. L-shaped implants with a columellar strut have surfaced with high rates of extrusion, which can occur through intact soft tissue secondary to tension placed at the tip of the nose.[29] To avoid this, we prefer to augment the nasal dorsum with a straight silicone implant and any further required tip augmentation may be done through a separate incision using septal cartilage. In Asia there has been an explosion of patients seeking plastic surgery, much of which goes unregulated. Often facial implants are placed by untrained practitioners seeking to partake in Asia's lucrative cosmetic industry, leading to disastrous complications and contributing to poor publicity.[30] There are also reports of these procedures being performed outside of the operative room setting in suboptimal and possibly nonsterile conditions.

On the other hand, when used properly, the outcome with alloplastic augmentation can be more predictable than autogenous materials which may be subject to warping, resorption, and gravitational changes. Despite a common misconception that there is a universal technique used amongst surgeons, the placement of alloplastic implants is practitioner-dependent. We believe that the most important factors resulting in variable outcomes are technical in nature. The senior author has personally observed many different methods of facial implant placement, some of which are doomed to fail at the onset of surgery. The importance of adhering to good technique for precise placement of an implant cannot be over emphasized. Firstly, the implant should be placed in a sub-periosteal plane which helps to ensure stable positioning and adequate soft tissue coverage of the material. Secondly, the pocket created should only minimally exceed the size of the implant to limit mobility and risk of malposition. During sub-periosteal dissection, a sharp-edged elevator such as a Joseph or Obwegeser can be utilized to achieve a precise pocket. Additionally, careful dissection should be carried out so that the implant ultimately sits away from the incision site to reduce the risk of extrusion. Finally, a well-vascularized soft tissue pocket is essential to protect the implant material. There should not be undue tension on the skin after the implant is inserted, as overaugmentation with tension on soft tissue envelopes is a likely contributor to extrusion.[29,31] We believe that the careful application of these technical points is largely responsible for the low incidence of complications in our series when compared to the literature, where extrusion has been reported to average 3% to 4% with some series as high as 22.7%.[31]

Other complications associated with silicone implants have been described in the literature and merit address. Translucency can be avoided by sub-periosteal implant placement to provide adequate soft tissue coverage of the implant. Sub-periosteal resorption can be seen particularly with augmentation genioplasty, secondary to pressure from the overlying mentalis muscle.[32] Though there are rare reports of severe bone erosion in the literature, in our experience, bone erosion is typically not clinically noticeable and is only observed on implant removal for other reasons. Nevertheless, patients with risk factors for bony resorption (high chin height, labial incompetence) should be preoperatively counseled about this potential risk.

There are several limitations to our study. One limitation is the retrospective nature of the study. In addition, our duration of follow-up is relatively short, although we believe that our reported data are representative of our long-term complication rate, as most incidences of infection and extrusion occur early in the postoperative course.[22] One prevailing reason for short follow-up duration is that patients satisfied with their result often do not return for

further follow-up appointments after the initial postoperative period. However, the senior author's recommendations are drawn from a 20-year experience with alloplastic facial augmentation and are supported by our most recent data. Further follow-up is warranted to confirm the long-term outcomes using our techniques. In addition, our method of evaluation of patient satisfaction was subjective based on postoperative notes, and have an inherent variability and possible inconsistency among patients. Patient satisfaction and outcomes would be strengthened by objective data, such as questionnaires, as well as anthropometric measurements. Lastly, our conclusions would be strengthened via comparison with a group of autogenous augmentation patients, and this is an avenue of future potential study.

Our cited low complication rate is specific to procedures performed by the senior author. There is a wide range of complication rates with alloplastic implants and we have treated many patients for secondary augmentation rhinoplasty who had poor results from other surgeons, however these complications are not reflected in our data. As previously mentioned, provider technique varies widely, and in our opinion is the most influential factor in preventing complications. We hope that our technical pearls can benefit providers less experienced with these operations.

While there is debate among authors regarding alloplastic vs autogenous facial augmentation, it is our hope that this paper provides an alternative perspective on the safety and utility of alloplastic implants for the purposes of facial augmentation, and addresses specific techniques that help to minimize morbidity.

CONCLUSION

Alloplastic facial augmentation has been avoided by many Western plastic surgeons due to concern for infection and extrusion, however we have shown that complication rates are acceptably low with proper surgical technique. Our experience with alloplastic materials suggests that their use should be revisited and that alloplastic implants may be considered a first-line option for aesthetic facial augmentation.

Supplementary Material

This article contains supplementary material located online at www.aestheticsurgeryjournal.com.

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