Expanded Polytetrafluoroethylene as Dorsal Augmentation Material in Rhinoplasty on Southeast Asian Noses

Three-Year Experience

Eduardo C. Yap, MD, FPSO-HNS; Sherwin S. Abubakar, MD; Mildred B. Olveda, MD, FPSO-HNS

Objective: To describe the outcomes of dorsal augmentation rhinoplasty with expanded polytetrafluoroethylene (ePTFE) implants in Southeast Asian patients from the Philippines.

Methods: Retrospective review of 1054 patients.

Results: Of the 1054 patients, 90.61% were women and 9.39% were men. One thousand eight patients (95.64%) underwent primary rhinoplasty; 46 (4.36%), secondary or revision rhinoplasty. One thousand thirty (97.72%) had desirable and 24 (2.28%) had undesirable outcomes. The most common undesirable outcome was implant deviation (1.04%), followed by a visible ePTFE implant (0.47%). Implant infection occurred in 0.38% of the patients, and 0.38% of the patients were not satisfied with their aesthetic outcome because of the presence of a high nasal bridge.

Conclusions: We find ePTFE to be an excellent synthetic material with proven outcomes for augmenting the dorsum in rhinoplasty of the Southeast Asian patient. However, prudent use of this material is warranted to avoid undesirable outcomes.

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A COMMON RHINOPLASTY procedure for the Southeast Asian nose is augmentation of the dorsum. Several varieties of materials are used to augment this region. The standard choice is autologous cartilage. Unfortunately, the amount available is usually inadequate to augment the dorsum, hence the use of alloplastic materials.

Silicone is the most commonly used alloplastic material to augment the nose. This synthetic material is inexpensive, often comes in prefabricated form, and can be easily shaped and carved to the desired height and contour of the nasal bridge.

Expanded polytetrafluoroethylene (ePTFE) is a good alternative alloplastic material. It was invented in 1969 and is used in a wide range of products, including fabrics and industrial materials. Its successful application in the medical field, specifically for soft-tissue patches in vascular and hernia operations during the past 30 years, naturally led to its use as an application rhinoplasty implant.

Expanded PTFE was studied by Neel in 1983 for facial soft-tissue augmentation and showed characteristics that rendered it less susceptible to inflammation and less prone to foreign body reactions. In this study, we describe the outcomes of augmentation rhinoplasty using ePTFE implants in 1054 patients of Southeast Asian origin.

All procedures were performed by a single surgeon (E.C.Y.). An endonasal approach was used in most patients. Standard rhinoplasty techniques were applied, such as columellar struts and shield and onlay grafts. Septal extension grafts were used in noses when the tip needed major repositioning (eg, for a short upturned nose). The general surgical technique used in this study was ePTFE implant for the dorsum plus lower lateral cartilage trimming and suturing with cartilage grafting if necessary. Expanded PTFE was never used for the tip.

Sheets of ePTFE were used in all patients. The sheets come in 2- or 3-mm thickness. They were cut into 13- to 14-mm-wide strips, 7 cm long. Each strip is individually packed and autoclaved for sterility purposes. The ePTFE sheets were attached using nylon 5-0 polydioxanone sutures, then carved to achieve the desired appearance of the new dorsum. The usual dimension of the implant is from the new radix (level of the eyelashes on forward gaze) to the supratip area. Implants mea-
sured 37 to 42 mm long, 10 to 12 mm wide, and 2 to 6 mm thick (Figure 1). The shaped implant was soaked in gentamicin solution before insertion.

Adhesive skin closure strips were applied at the external nasal area postoperatively to secure the newly positioned implant in place, supported by a thermoplastic nasal splint. All patients were given oral antibiotics for 1 week or more if deemed necessary. Initial follow-up was on the fifth to seventh postoperative day. Successive follow-up visits occurred 2 weeks, 6 months, and 1 year after surgery.

On follow-up visits, each patient was assessed for the presence of any erythema of the nose, swelling, discharge at the incision site, deviation of the implant from the midline, height of the bridge, and the overall appearance of the nose.

RESULTS

A total of 1054 patients were included in the study with ages ranging from 15 to 72 years, with a mean (SD) age of 34 (2) years. Most of our patients were aged 20 to 50 years, with the greatest proportion aged 20 to 29 years (45.35%), followed by those aged 30 to 39 years (30.93%) and 40 to 49 years (11.57%). Women constituted 90.61% (955) of our patients, whereas only 9.39% (99) were men.

Primary augmentation rhinoplasty was performed in 1008 patients (95.64%), compared with secondary rhinoplasty in 46 (4.36%).

The clinical outcomes of augmentation rhinoplasty using ePTFE implants are shown in (Table 1). Desirable outcomes were noted in 1030 patients (97.72%), whereas 24 (2.28%) had an undesirable outcome. Of the 24 patients with undesirable outcomes, 23 were women. Patients with undesirable outcomes were aged 20 to 49 years, with about 60% of the patients aged 20 to 29 years (data not shown).

Most of the patients with undesirable outcomes (21 of 24) underwent primary augmentation rhinoplasty; only 3 underwent secondary augmentation rhinoplasty. However, the percentage of undesirable outcomes was higher in patients who underwent secondary rhinoplasty (6.52%) vs 2.08% in patients who had primary augmentation rhinoplasty (Table 2).

Among the 24 patients with undesirable outcomes, 11 (46%) had implant deviation. The implant was visible in 5 of the 24 patients (21%), 4 (17%) had infection, and the remaining 4 (17%) had an inappropriately large implant over the nasal bridge area.

The rate of undesirable outcomes in the group undergoing augmentation rhinoplasty using an ePTFE implant was relatively low (2.28%) (Table 3). Implant deviation had the highest rate of occurrence (1.04%) compared with the other outcomes. The rate of undesirable outcome was higher among patients undergoing secondary augmentation rhinoplasty (3 of 46 [6.52%]) compared with primary augmentation rhinoplasty (21 of 1008 [2.08%]). The infection rate was higher in secondary augmentation rhinoplasty (3 of 46 patients [6.52%]) compared with primary augmentation rhinoplasty (1 of 1008 patients [0.10%]). However, the overall infection rate among the 1054 patients was low (0.38%).

Figure 1. Expanded polytetrafluoroethylene dorsal implant design, approximately 37 to 42 mm long, 10 to 12 mm wide, and 2 to 6 mm thick.

COMMENT

Alloplastic materials encompass synthetic and semisynthetic implants, such as ePTFE, polyamide mesh (Supramid; Ethicon, Somerville, New Jersey), Teflon (Proplast; Vitek, Inc, Houston, Texas), polyester fiber mesh (Mersilene; Ethicon), and silicone. Alloplastic materials are often used instead of autologous materials because of their commercial availability, their inherent strength and elasticity, and the ease with which they can be shaped. Hence, surgical time is shortened and there is no associated donor site morbidity.

Of all the alloplastic materials, silicone has gained the widest acceptance, particularly in Asia. Despite being widely criticized in the literature, silicone implants remain popular because of their low expense and ease of use in the event of infection and extrusion. However, there are well-known disadvantages to silicone use. A 10-year retrospective study by Deva et al3 in 422 patients revealed a 5.5% complication rate that required removal of the implant within 30 days of surgery. These complications included implant displacement, prominence, hemorrhage, and excessive pressure in addition to obvious supratip deformity. Other problems reported included the high incidence of thinning of the overlying skin, resulting in an unnatural glassy appearance and the possibility of implant distortion from postoperative calcification. As a result, surgeons have chosen to use other types of alloplastic materials.

Expanded PTFE is now favored by most surgeons as an alternative to autologous implants or silicone. It was used extensively in vascular grafting during the early 1970s and more recently as a facial implant. The vas-
cular grafts have been observed to have good strength, excellent handling characteristics, good biocompatibility, and a high suture-holding capacity that resists pull-out. Thus, ePTFE is considered safe for use in facial plastic and reconstructive surgery. It also has the main advantage of creating a natural look (Figure 2). Healing is by tissue adhesion and not through encapsulation (Figure 3 and Figure 4).

Several other studies have been conducted to prove the safety and effectiveness of ePTFE. A 17-year study by Conrad et al.4 in 521 patients found that only 1.9% of the subjects needed reoperation due to infection, soft-tissue swelling, migration, or extrusion. Peled et al.5 reviewed available literature on alloplastic implants from 1966 to September 2005 and concluded that these materials have acceptable complication rates and can be used when autologous materials are unavailable or insufficient. Dong et al.6 described their technique in 1700 patients in China who underwent augmentation with ePTFE and concluded that adherence to their operative principles reduced the rate of complications.

In the present study, we reviewed the clinical records of 1054 patients who underwent augmentation rhinoplasty using ePTFE implants. The outcome in our patients was generally excellent, meaning that it was considered desirable by both the surgeon and the patient. These results are consistent with other studies using ePTFE as augmentation implant material. In a 10-year study with 309 patients, Godin et al.7 found that only 3.2% of the patients with an implant infection ultimately required implant removal.

The most common undesirable outcome we encountered was implant deviation (Figure 5). This was seen in 11 of 24 patients. Implant deviation was noted as early as 1 to 2 months after surgery. These individuals underwent revision surgery to correct the problem. If the implant deviation was severe, the whole ePTFE implant was removed and replaced with a new one. Possible reasons for this problem include excessive length of the implant with abutting against the lower lateral cartilages, un-

### Table 1. Clinical Outcome of Expanded Polytetrafluoroethylene Augmentation Rhinoplasty in Relation to Age

<table>
<thead>
<tr>
<th>Outcome by Age, y</th>
<th>Desirable</th>
<th>Undesirable</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male sex</td>
<td>98</td>
<td>0</td>
<td>99</td>
</tr>
<tr>
<td>Female sex</td>
<td>878</td>
<td>54</td>
<td>955</td>
</tr>
<tr>
<td>Subtotal</td>
<td>976</td>
<td>54</td>
<td>1054</td>
</tr>
<tr>
<td>Total, No. (%)</td>
<td>1030 (97.72)</td>
<td>24 (2.28)</td>
<td>1054</td>
</tr>
</tbody>
</table>

*a Unless otherwise indicated, data are expressed as numbers of patients. Distribution of patients according to specific age group is shown in Table 2.

### Table 2. Clinical Outcome of Expanded Polytetrafluoroethylene Augmentation Rhinoplasty According to Type of Surgery

<table>
<thead>
<tr>
<th>Type of Augmentation</th>
<th>Outcome, No. (%) of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Desirable</td>
</tr>
<tr>
<td>Primary</td>
<td>987 (97.92)</td>
</tr>
<tr>
<td>Secondary</td>
<td>43 (93.48)</td>
</tr>
<tr>
<td>Total</td>
<td>1030 (97.72)</td>
</tr>
</tbody>
</table>

### Table 3. Undesirable Outcomes in Relation to Type of Operation

<table>
<thead>
<tr>
<th>Type of Undesirable Outcome</th>
<th>Type of Augmentation Rhinoplasty, No. of Patients</th>
<th>Rate of Occurrence, % (N=1054)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implant deviation</td>
<td>Primary: 11 Secondary: 0</td>
<td>1.04</td>
</tr>
<tr>
<td>Visible implant</td>
<td>Primary: 5 Secondary: 0</td>
<td>0.47</td>
</tr>
<tr>
<td>Infection</td>
<td>Primary: 1 Secondary: 3</td>
<td>0.38</td>
</tr>
<tr>
<td>Bridge too high</td>
<td>Primary: 4 Secondary: 0</td>
<td>0.38</td>
</tr>
<tr>
<td>Total</td>
<td>Primary: 21 Secondary: 3</td>
<td>2.28</td>
</tr>
</tbody>
</table>

Figure 2. Typical favorable outcomes of expanded polytetrafluoroethylene augmentation rhinoplasty. Frontal view of the patient before (A) and after (B) rhinoplasty. Lateral view of the patient before (C) and after (D) rhinoplasty.
even sculpting of the implant sides, trapping of the implant in a previous silicone implant capsule, or inadequate nasal splinting after the operation.

A visible ePTFE implant (Figure 6) is defined as a noticeable appearance or prominence of the contours of the implant on the nasal dorsum, especially at the supratip area, after an augmentation rhinoplasty procedure. Our 5 patients with this outcome underwent surgery using temporalis fascia as a camouflage graft along the supratip.

Four patients were noted to have prominent radix caused by oversized implants on the nasal bridge area (bridge too high). These patients underwent revision surgery for removal of the large implant and replacement with a smaller one.

The remaining 4 patients developed infection (Figure 7) and required removal of the implant. Three of these patients (75%) were from the group who underwent secondary rhinoplasty. All 3 infections occurred within 1 month of surgery. The fourth patient underwent primary augmentation rhinoplasty, and the implant was removed 2 months after the surgery owing to persistent erythema and tenderness. This patient did not undergo revision surgery. The other 3 patients underwent revision surgery using dermofat as dorsal augmentation material 4 weeks after removal of the implant.

The infection rate in this study was 0.38%. However, the infection rate was higher (3 of 46 patients [6.52%]) among patients who underwent secondary augmentation rhinoplasty compared with those who underwent primary augmentation rhinoplasty (1 of 1008 [0.10%]). In contrast, Jin et al found a 2.1% infection rate among 853 Asian patients (9 patients with primary augmentation rhinoplasty and 9 patients with secondary augmentation rhinoplasty). In a similar study by Godin et al, the infection rate was at 2.2%. Excessive bridge height was another acknowledged problem in the present study, and we speculate that the implant was oversized. Overall, the rate of undesirable outcome in this study was 2.28%.

CONCLUSIONS

Thorough assessment of the nose should be completed before any rhinoplasty procedure. To prevent implant de-
violation, the implant should be carefully sculpted in a symmetrical fashion. Avoidance of placing an implant that is too large or too long is essential in preventing a visible implant. The implant should be tapered and placed approximately at the level of the radix to the supratip. The caudal edge of the implant should end at the cephalic border of the lower lateral cartilage. Use of a thermoplastic splint may prevent displacement during the immediate postoperative course.

Infection is considered the most morbid complication and can be prevented by observing sterile technique in the operative field. Careful attention to repair of tears in the mucosa and skin is warranted in cases of secondary rhinoplasty because of the fibrotic nature of the surgical field. Expanded PTFE implants should not be used in an infected field. Other possible methods to prevent infection of the implant include preparing the ePTFE as individual strips, each sterilized by gas or autoclave. Implants should be soaked in an antibiotic solution, such as gentamycin, during surgery and before insertion. Contamination of the implant with operative sponge material or ointment should be avoided. Sutures, 5-0 nylon or 5-0 polydioxanone, should be used to bind implant sheets together instead of polystrand sutures, which can trap impurities. Care must be observed when performing medial osteotomy and while splitting the upper cartilages to avoid mucosal tears that may serve as entrance for infection. When performing a silicone-extracting rhinoplasty, the silicone capsule must be removed because they can be a future nidus of infection.

In general, ePTFE is an excellent synthetic material with proven outcomes for augmentation rhinoplasty in the Southeast Asian patient. However, prudent use of this material is warranted because undesirable outcomes can occur.

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Correspondence: Eduardo C. Yap, MD, FPSO-HNS, Belo Medical Group, Ste 901, Medical Plaza, Makati, Amorsolo Corner Dela Rosa Street, Makati City 1200, Philippines (edcyap88@gmail.com).

Author Contributions: Study concept and design: Yap and Olveda. Acquisition of data: Yap and Abubakar. Analysis and interpretation of data: Yap and Olveda. Drafting of the manuscript: Yap, Abubakar, and Olveda. Critical revision of the manuscript for important intellectual content: Yap. Statistical analysis: Yap, Abubakar, and Olveda. Administrative, technical, and material support: Yap.

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