The achievement of successful results in rhinoplasty may require the use of autografts, homografts, or alloplastic materials. Among the alloplasts, Dacron is an easily handled and manipulated synthetic material, readily applicable to nasal augmentation. The following represents the indications, surgical technique, outcome results, and analysis of our experience with Dacron mesh implants to the nasal tip, dorsum, and lateral walls in 136 patients.

Dacron implants have been extensively used in cardiovascular surgery, with the results of many long-term follow-up studies reported in the medical literature. Dacron fabric (Cooley) is a polyethylene terephthalate woven into a tight nonresorbable mesh. It is a multifilament fabric supplied as a white fabric sheet. Its design allows minimal tissue ingrowth that is enough to maintain the implant position. The multifilament arrangement makes the implant not slippery during surgery; therefore, it stays wherever it is placed and almost sticks to its bed or to the overlying skin. In addition, this implant may be handled, cut, and shaped easily while retaining a certain degree of body. It does not shred, as encountered with other Dacron-type materials, such as Mersilene mesh. In addition, its soft nature makes it difficult to detect by skin palpation or visual inspection, even years after being implanted.

One of us (N.F.) reported his experience with 98 cases of tip augmentation using Dacron mesh (Mersilene mesh) in 1991. Subsequent to this, our use of Dacron has moved from the looser mesh form (Mersilene) to the fabric form (Cooley) because of the latter’s further ease of intraoperative manipulation and minimal shredding. However, this advantage of the fabric form is minimal. As far as clinical results are concerned, both Dacron materials are identical.
PATIENTS AND METHODS

PATIENTS

A retrospective analysis was performed, reviewing the results in 136 patients who underwent rhinoplasty with augmentation using Dacron implants. The indications for dorsum augmentation were a deep nasofrontal angle, a saddle deformity of the dorsum, or a depressed supratip area. Dorsal saddle deformity was the most common indication of dorsal correction.

Indications for tip augmentation were previously detailed.2 The 2 most common indications were a recessed tip and a wide tip.

The implant may also be used in the lateral wall to augment a depression, typically in cases of side-to-side nasal pyramid deviation.

All patients included in this study were asked several months postoperatively to rate their degree of satisfaction with the cosmetic result. The results were graded as very happy (n=68), happy (n=59), satisfied (n=4), and dissatisfied (n=5). The surgeon, at that same time, rated his own assessment of the aesthetic result. The different grades were very good (n=64), good (n=40), satisfactory (n=24), and unsatisfactory (n=8).

TECHNIQUE

Tip Augmentation

The technique used for tip implantation was previously described in detail2,7 by one of us (N.F.). Several critical points and some minor modifications will be emphasized. The fabric material (Cooley) is first folded onto itself to form a pad that is 2 to 8 layers thick and approximately 1 cm in width (from left to right) and 8 mm in height (from superior to inferior). The thickness of each layer is approximately 0.5 mm. Therefore, a 2-layer implant is approximately 1 mm thick, and an 8-layer implant is approximately 4 mm thick. The implant is shaped like either a lozenge (10 mm in width × 7 mm in height) (Figure 1A) or a triangle (10 mm [base] × 5 mm × 5 mm, with the apex pointing downward). The triangular shape is used often in cases of thick nasal skin with poor definition. Depending on the degree of tip recession, 2 to 8 layers (1-4 mm) may be used. Typically, the most common thickness used is 4 to 6 layers. A central through-and-through catgut suture is used to hold the layers together.

After outlining the position of the implant on the nasal tip preoperatively (Figure 1A), a rim incision of 1.0 to 1.5 cm is made along the caudal border of the right alar cartilage (Figure 1B). Dissection of a subcutaneous pocket, slightly larger than the size of the implant, is then performed (Figure 1C). The implant, soaked in bacitracin solution, is held horizontally with a curved mosquito clamp, making sure that the end of the mosquito clamp is horizontally placed across the implant and that the tip of the instrument is on the left end of the implant (Figure 1D). The implant is then inserted while pulling the right alar rim up using a double-sharp hook and while pushing the alar cartilages down with blunt scissors. The tip of the curved mosquito clamp is positioned at point b under the skin (Figure 1E), and the implant is aligned horizontally over the line ab. The upper and lower parts of the implant are then stabilized gently, with the fingers placed above and below the curved mosquito clamp over the skin; then, the mosquito clamp is widely opened and slowly withdrawn. One 6-0 catgut suture is placed at the midpoint of the incision for approximation.

Dorsum Augmentation

The superior and inferior ends of the long axis of the implant are marked superiorly and inferiorly on the skin.

RESULTS

This series consisted of 92 women and 44 men, for a male-female ratio of 1:2.1. The mean ± SD age of the patients was 26.5 ± 7.5 years for men and 28.9 ± 9.4 years for women. All rhinoplasties were performed by the same surgeon (N.F.). In 88 (65%) of the 136 procedures, only the tip was augmented, while in 45 (33%) of the patients, the tip and the dorsum or lateral walls were augmented. In 3 instances (2%), Dacron was used on the dorsum only.

All patients were prescribed intraoperative antibiotics: intravenous cefazolin, 1 g, when an allergy to penicillin was ruled out or intravenous erythromycin in the case of penicillin allergy. All patients were treated with oral antibiotics (such as erythromycin) for 1 week postoperatively for further prophylactic coverage.

The follow-up ranged from 7 months to 12 years (average, 37 months). The same operating surgeon (N.F.) performed the follow-up and assessment. Figures 4, 5, 6, 7, 8, 9, and 10 show examples of preoperative and postoperative results of Dacron implantations in various patients (lateral wall implants in Figure 4; dorsum and supratip implants in Figure 5; implants in a patients who underwent revision rhinoplasty in Figure 6; dorsal implant thickest at the nasofrontal angle superiorly in Figure 7; dorsal implant of equal thickness in Figure 8; tip implant only, representing the most common implant indication, in Figure 9; and long-term results in Figure 10).

The most significant complication was infection, which occurred in 9 (6.6%) of the patients. In all cases, the patient was immediately given oral antibiotics on diagnosis of the infection, and the implant was removed under local anesthesia as soon as possible. Removal of the implant was always performed without difficulty because there was little tissue infiltration or fibrous attachment in all of the patients with infection. In the case of a tip implant, a curved mosquito clamp is used to retrieve the implant through a small rim incision. In the case of a dorsal or lateral wall implant infection, the same technique is used through an intercartilaginous incision, but more dissection is required. It is important to accurately count the number of layers removed to ensure complete removal of the implant.

Ten implants were removed in these 9 patients. Eight were tip implants, and 2 were dorsal implants. In a single
of the nose along the midline (Figure 2). In the event
the dorsal depression is deeper on one area (typically the
middle of the dorsum at the level of the rhinion), a third
mark is placed on the skin at that site to identify the area
of maximum implant thickness. In general, the length of
the implant varies from 2.5 to 3.5 cm, the width from 8
to 10 mm, and the thickness from 2 to 6 layers (1-3
mm). In some instances, the thickness may be greater
than 6 layers. The implant may be uniform in thickness
or may have an area of greater thickness, as previously
indicated. The implant is then shaped in the following
manner: the upper and lower ends of the implant are
made triangular to ensure a gradual tapering of the
implant ends. This avoids an abrupt step deformity after
the swelling subsides postoperatively. Also, the implant
sides, namely, the left and right borders, are tapered
(angled) for the same purpose. If one area of the implant
(eg, the central third) is thicker than the rest, a second
implant is calculated, measured, and tapered like the
first main implant. The shorter implant is then placed
under the longer one, and an additional through-and-
through catgut suture is used to attach both implants
together.

If the dorsal dissection has not been completed, a
1.5-cm incision is made on the medial end of the right
intercartilaginous incision at the area of the septal angle
(Figure 2). A subcutaneous or supraperichondrial supra-
periosteal pocket is dissected along the dorsum. The lay-
ers of the prepared dorsal implant are usually sutured
about the center or at both ends with 4-0 chromic trans-
fixion sutures to hold the layers together (Figure 2).
The implant is then placed between the 2 sides of an angled
nasal bayonet forceps, ensuring that the superior end of
the implant is exactly at the closed tip of the angled for-
ceps. An Aufricht dorsal retractor is used to elevate the
dorsal nasal skin, while a curved mosquito clamp is used
to retrieve and pull down on the lower edge of the inter-
cartilaginous incision for better entry (Figure 3). The angled forceps embracing the implant is then introduced
slowly within the dorsal skin pocket, sliding against the
Aufricht elevator (rather than against the dorsum), until
it reaches the upper mark on the nasal skin. The
Aufricht retractor is then moved slowly backward and
removed. The fingers of the left hand are placed gently
on either side of the implant. The angled forceps is
opened widely and then slowly retraced backwards,
using a gentle rocking motion to avoid implant retrac-
tion or displacement during this maneuver. The incision
is then inspected to ensure that the lower end of the
implant is positioned at least 4 mm away from the clo-
sure site. A single 4-0 chromic suture is then used to
close the incision.

**Lateral Wall Augmentation**

An incision is made through one or both intercartilagi-
nous folds, depending on whether the depression is uni-
lateral or bilateral. The implant marking, preparation, and
insertion are similar to that described for the dorsum. How-
ever, the implant is typically much thinner, varying be-
tween 1 and 2 layers (0.5-1.0 mm). For lateral wall aug-
mentation, 50% undercorrection is the rule, as the slightest
overcorrection will be extremely noticeable a few months
postoperatively. The shape is again triangular and tapered
if more than one layer is used.

In rare cases, when the lateral wall depression ex-
tends inferiorly beyond the lower border of the upper lat-
ter cartilage, the access incision may be made intracarti-
laginous through the alar cartilage. This is because the
incision to the pocket has to be at least 4 mm inferior to
the implant.

instance, tip and dorsum implants were removed. In all
patients, the infection resolved within days of implant
removal. Of the 9 patients, 6 underwent another proce-
dure during which a second Dacron implant was in-
serted. The remaining 3 patients declined a second sur-
gery. (It has been our experience that after implant
removal, the area previously receiving the implant seems
to retain a mild degree of augmentation. We have no ex-
planation as to why this happens, but it could theoretically
be due to granulation tissue formation as a reac-
tion to the implant or the infection.)

A diagnosis of implant infection was based on
purulent discharge at the site of the pocket incision, in
addition to one or more of the following signs: swell-
ing, tenderness, redness, or extrusion. The presence of
discharge is definite proof of implant infection. In the
absence of discharge, the patient is given antibiotics
and checked almost daily to rule out the small possi-
bility of a limited skin infection (eg, furuncle) not
involving the implant.

Two patients underwent revision because of an un-
satisfactory aesthetic result, where a tip implant had mi-
grated slightly to the right and a dorsal implant was too
thick. This was remedied under local anesthesia by trim-
mimg a portion of the implant, a somewhat tedious pro-
cedure. The noninfected implant is usually well at-
tached to the skin and underlying structures. Dissecting
the implant off the overlying skin is easier than freeing
it from the underlying cartilage or bone. The surgeon may
choose 1 of 3 approaches: (1) trim the excess (the hard-
est to do, because the implant is well integrated and the
Cooley fabric is difficult to cut when invaded with granu-
lation tissue); (2) remove the entire implant and replace
it with a brand new one (the easiest approach); or
(3) remove the implant, reshape it, and reinsert it (the
only problem is fixing it in place, because it tends to be
slippery).

**COMMENT**

Dacron fabric allografts are among the myriad of op-
tions available in rhinoplastic surgery. Although poten-
tial postoperative infection is a disadvantage, Dacron fab-
ric implants are particularly desirable to use in many cases
of augmentation rhinoplasty. In terms of the aesthetic re-
result, they have several advantages, the most important
of which is having an impressive natural appearance and
feel that are hard to detect by either visual examination
or manual palpation. They display no tendencies for curl-
ing or resorption over time8,11 and are unlikely to un-
Dacron is not without its drawbacks, the most significant of which is infection. Others include asymmetry and incorrect implant volume, both mostly related to the surgeon’s experience using the material. This experience is quickly acquired if the guidelines suggested earlier in this article, regarding the implant’s thickness range, shape, tapered edges, access incision, and insertion technique, are rigorously followed. The incision needs to be large enough (1.5 cm) to allow good exposure, dissection of a pocket, and easy implant introduction. It should be closed loosely to allow any serous discharge or bleeding to drain, rather than remain confined within the pocket and progress to abscess formation. The pocket needs to be approximately 50% larger than the size of the implant because it will eventually contract. If it is not sufficiently large, it will result in subsequent implant infection or extrusion.

Our complication rate of infection is comparable to previously reported rates of 4% to 9%. However, this drawback is tempered by the many advantages associated with the use of this material. The high cosmetic reliability and quality of the result are often understated in the literature. Although cartilage grafts are rarely infected, they have cosmetic problems, including resorption, displacement, curling, and sharp edges. The longer the postoperative follow-up, the more evident some of these problems will become, especially those related to curling and sharp edges and those in medium- to thin-skinned patients.
Figure 4. A and B, Preoperative views of a 29-year-old man with a narrow bony bridge and concave upper lateral walls more on the left side than on the right, a recessed upper dorsum, thick redundant skin at the supratip and tip areas, and a drooping nasal tip. C and D, Postoperative result 2 years 4 months following a rhinoplasty with lateral wall implants (just 1 layer on the right and 2 on the left) and dorsal and tip implants.

Figure 5. A and B, Preoperative views of a 29-year-old woman with a low dorsum and thick skin at the tip and supratip. C and D, Postoperative results 11 months following rhinoplasty with a dorsal implant thickest at the supratip area because of a resistant skin concavity at that area. A tip implant was also used.
Figure 6. A and B, Preoperative photographs of a 20-year-old man with a history of 3 previous septorhinoplasties. He presented with a turned-up asymmetrical tip, a recessed dorsum, and lateral wall depressions, more obvious on the left. C and D, Postoperative results 7 years 2 months following a revision rhinoplasty with dorsal, tip, and left lateral wall Dacron (Ethicon Inc, Somerville, NJ) implants.

Figure 7. A and B, Preoperative photograph of a 33-year-old man with a recessed ill-defined nasal tip, a low upper dorsum, and very thick nasal skin. C and D, Postoperative results 2 years 10 months following a rhinoplasty with a dorsal implant (thicker at the root of the nose) and a nasal tip implant.
Figure 8. A and B, Preoperative photographs of a 27-year-old man with a projecting tip and a low dorsum. C and D, Postoperative results 12 months following a rhinoplasty with a dorsal implant of uniform thickness and a tip implant.

Figure 9. A and B, Preoperative views of a 22-year-old woman who is a typical example of a nose surgery candidate with a dorsal hump and a somewhat wide nasal tip. C and D, Postoperative photographs 15 months after a regular rhinoplasty combined with the placement of a tip implant to achieve a well-defined yet natural-looking nasal tip. This case is a typical example of the use of the Dacron (Ethicon Inc, Somerville, NJ) nasal tip implant, which is more often used in the nasal tip than in the dorsum or lateral walls.
Accepted for publication January 22, 2002.

We thank Ildico Horvath, medical artist, for her assistance in preparing the figures; Robert Derval, medical photographer, for his photographic contributions; Barbara Armbruster, MA, for her help in editing; Lucie Roy and Stephanie Luetticken, MBA, for organizing the manuscript; and Jackie Griguolo and Derya Atilgan for their typing assistance.

Corresponding author and reprints: Nabil Fanous, MD, FRCSC, Department of Otolaryngology–Head and Neck Surgery, McGill University, 1 Westmount Sq, Suite 1380, Montreal, Quebec, Canada H3Z 2P9.

REFERENCES