Supplemental Article

Human Acellular Dermal Matrix Grafts for Rhinoplasty

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Abstract

Rhinoplasty often relies on graft material for structural support in the form of cartilage, bone grafts, or fascia. In addition, pliable grafts are often helpful for contouring and can function as a barrier. Unfortunately, grafts carry the disadvantage of requiring an additional donor site, with associated complications. Human acellular dermal matrix (ADM) biological implants offer an exciting alternative for structural support and nonstructural implantation in rhinoplasty procedures. To examine the efficacy of ADM placement in rhinoplasty and septoplasty, the authors report the results from a series of 51 patients. In this series, there were no cases of infection, skin discoloration, seroma formation, septal perforation, significant resorption, extrusion, or other complications related to ADM placement. Therefore, the authors believe that ADM offers a safe and effective alternative to traditional grafting methods for functional and aesthetic rhinoplasty.

Keywords

dorsal augmentation, dorsum, nose, nose tip, septum, tip graft, acellular dermal matrix, ADM

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Graft materials are commonly required for cosmetic and functional rhinoplasty. Autologous materials such as septal cartilage, auricular cartilage, costal cartilage, various bone grafts, and temporalis fascia are used antigenicity, resorption, and extrusion.[1-3] However, many of these materials require a secondary harvest site, are available in only limited quantities, and add to the surgical time and cost. Permanent alloplastic materials such as silicone and expanded polytetrafluoroethylene are available off-the-shelf but are associated with higher risk of infection, mobility, and extrusion.

Both structural and nonstructural grafts are needed in rhinoplasty. For structural reconstruction of the nose (eg, major dorsal augmentation in saddle nose cases, tip grafts, columellar struts, and alar batten and spreader grafts), autologous cartilage or bone is the gold standard that provides the most stability and lower instance of extrusion. Nonstructural grafts (eg, camouflaging dorsal onlay grafts and interposition grafts between septal mucoperichondrial flaps) do not require long-term rigidity or structural support. In fact, pliability is a major asset in these cases. Previously, the senior author (DAS) favored temporalis fascia material for these situations, but it has the disadvantage of secondary donor site morbidity and added surgical time and cost. Other authors have described the placement of human acellular dermal matrix (ADM; AlloDerm, Life Cell Corp., Branchburg, New Jersey) in structural and nonstructural rhinoplasty grafting sites.[4-7] In this article, we describe the senior author's recent experience with ADM in functional and aesthetic rhinoplasty.

METHODS

The University at Buffalo Health Sciences Institutional Review Board approved our study protocol and a cowaiver of individual authorization for individual identifiable health information. A retrospective chart review was performed of 303 patients who presented to the senior author's service between 2007 and 2009. Patients were included in this study if they had documented follow-up for a minimum of one year postoperatively and had undergone a rhinoplasty procedure that utilized human ADM grafting material. There were no exclusion criteria. Patients

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were identified through an AlloDerm log book secured at Millard Fillmore Gates Circle Hospital (Buffalo, New York). Data collected during the chart review included age, sex, race, evidence of prior nasal surgery, surgical indications, physical exam, complications, treatment, and follow-up time. The data were recorded and processed with Microsoft Office Excel.

Surgical Technique

AlloDerm implants are available in a variety of thicknesses. All patients in this study received the 2- × 4-cm-thick implant. Only one layer of material was placed in all patients. Each sheet was cut to the correct shape based on the patient's anatomic needs before reconstitution in saline. For septal mucoperichondrial flap placement, the material was cut to approximately 2 × 2 cm, in a square or rounded-square shape (Figure 1A). For dorsal augmentation and camouflaging, the material was typically approximately 1 × 2.5-3.5 cm long and tapered at either end (Figure 1B). Occasionally, the material was kept longer and draped over the nasal tip. In most cases, the material was placed through an open approach, although it is just as easily placed during closed rhinoplasty. Smooth bayonet forceps facilitated precise placement (Figure 1C-1F).

The septal implants were fixed by placing sutures through-and-through into the septum itself. The ease of this closure was facilitated by not completely reconstituting the material to full pliability prior to placement. (More rigid material is easier to sew with a small Keith needle intranasally. When the material is fully reconstituted in vitro, the resultant pliability makes placing sutures difficult.) For dorsal placement, the material was fully reconstituted so that it would mold well to the dorsum and/or tip region. Dorsal implants were not fixed into place with sutures, unless the graft was extended over the nasal tip. In cases where the graft was extended over the nasal tip, 6-0 sutures were placed to fix the graft and avoid contractile shifting.

All patients in this series received cefazolin (1 g, intravenous) and dextramethasone (8 mg, intravenous) immediately preoperatively. All patients were given a methyl prednisone taper and five days of cephalexin (500 mg, by mouth) three times per day postoperatively. If a patient was allergic to cephalosporin, he or she received levofloxacin (500 mg, intravenous) at the time of surgery and levofloxacin (500 mg, by mouth) for five days postoperatively. At one month postoperatively, patients were offered at least one postoperative injection of triamcinolone acetonide (10 mg/mL; Kenalog-10, Bristol-Myers Squibb Company, Princeton, New Jersey) to the tip or supratip, with a volume ranging from 0.1 to 0.2 mL. This injection was administered to decrease supratip edema when indicated. This protocol was the same as the perioperative and postoperative protocol of care utilized by the senior surgeon in all his rhinoplasty patients.

RESULTS

Fifty-one patients fit the inclusion criteria (17%) (Table 1). The majority of patients were Caucasian females (n = 38) with a mean age of 34 years (range, 20-65). Indications for surgery included airway obstruction for septal and/or nasal valve obstruction, cosmetic deformity, septal perforation, and nasal trauma (Table 2). Most patients had more than one indication for surgery. Most of the procedures were purely cosmetic (45%), while 18% were purely functional and the remaining 37% were both (Table 3).

AlloDerm was applied to the nasal dorsum four times more often than to the nasal septum in this study. Patients were typically seen at intervals of one week, four weeks, six months, and one year postoperatively. Eighty percent of patients received at least one postoperative injection of triamcinolone acetonide to the tip or supratip. This postoperative treatment was offered to the same number of septorhinoplasty or rhinoplasty patients at the one-month visit regardless of AlloDerm placement. Of those who received an injection, 46% went on to receive at least one additional supratip injection at four to six weeks after the primary injection.

Complications were minimal and comparable to the rates in the senior author's general rhinoplasty population during the same time frame. One patient required additional surgery following septorhinoplasty with nasal valve repair and AlloDerm as an overlay graft. This patient underwent revision left nasal valve repair at 26 months postoperatively. This repair was not at the site of AlloDerm grafting. One patient was found to have a residual dorsal hump at 12 months after surgery and was offered revision, but no additional surgery has been documented to date. Two patients received nonsurgical correction of very minor imperfections of the nasal dorsum. Both underwent small-volume injections (< 0.2 mL) of Radiesse (BioForm Medical, Inc., Franksville, Wisconsin). Both patients had satisfactory results and have not sought further treatment.

All remaining patients progressed through a normal postoperative course and had satisfactory results at one year, as assessed by themselves and the senior author. A representative clinical result is shown in Figure 2. Of note, there were no cases of infection, skin discoloration, seroma formation, septal perforation, significant resorption, extrusion, or other complications related to ADM placement.

DISCUSSION

Human ADM material (AlloDerm) is an excellent choice to provide a barrier between thin or lacerated septal flaps or to provide camouflage to the nasal dorsum and tip in rhinoplasty, septorhinoplasty, and related procedures (Table 4).[4-7] Minor dorsal augmentation may also be accomplished with these ADM grafts.[6,7] In fact, the senior author employs the material in about 15% to 20% of all rhinoplasty and

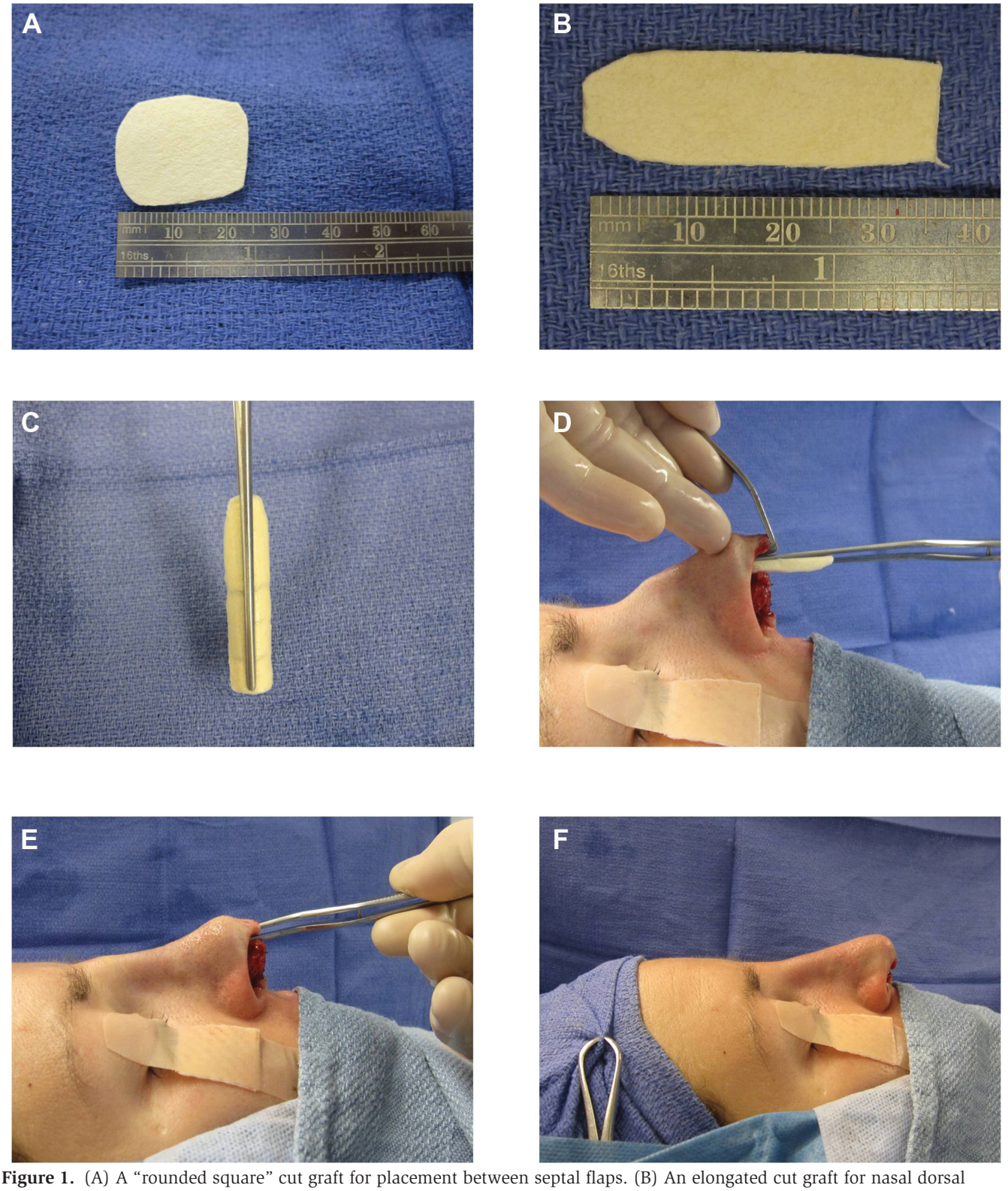

Figure 1. (A) A "rounded square" cut graft for placement between septal flaps. (B) An elongated cut graft for nasal dorsal contouring. (C) The ADM is placed through an open approach with smooth bayonet forceps. Note that the end of the implant is placed exactly at the end of the forceps. (D) Direct visualization is facilitated by the open approach. (E) The tip of the bayonet forceps indicates the superior aspect of the implant. (F) With the ADM in place, the patient is ready for closure.

Table 1. Patient Demographics of Study Group

Characteristic	n	%
Total	51	
Sex		
Male	11	22
Female	40	78
Race/Ethnicity		
Caucasian	49	96
Mediterranean	1	2
Middle Eastern	1	2
Prior nasal surgery	21	41

Table 2. Indications for Surgery

Indication	n	%
Nasal valve obstruction	26	51
Deviated septum	45	88
External nasal deformity	42	82
Septal perforation	3	6
Trauma history	8	16

Table 3. Type of Surgery

Type	n	%
Cosmetic	23	45
Functional	9	18
Both	19	37

septorhinoplasty cases. In our practice, AlloDerm has replaced the temporalis fascia and other autologous fascial grafts that we previously placed for the same indications. Of note, this material is not useful for structural support, as it provides minimal additional strength on its own. Structural grafting is still completed with autologous cartilage or bone. The ADM material can be incorporated safely and effectively in combination with autologous grafts like cartilage.

When there is concern about septal perforation during a septorhinoplasty procedure, ADM has been shown in multiple studies to provide a barrier between the mucoperichondrial flaps to prevent the long-term complication of septal perforation.[4-6] Cartilage also provides a great barrier, but many times the cartilage is required for other grafting needs at the time of the primary or revision procedure. When the septal flaps are atrophic, or lacerations in the flaps have occurred during septal surgery, ADM grafts are useful replacements to prevent septal perforation in association with septal flap repair and quilting sutures. As noted previously, quilting sutures are easier to place through the flaps and graft if the graft is not fully reconstituted. When the graft is fully reconstituted, suturing is more difficult because the graft is softer. Quilting the septal flaps back together with a 4-0 plain gut suture on a short Keith needle helps to prevent hematoma or seroma formation between septal flaps, and it holds the material in place under lacerations. The quilting suture also dispenses with the need for nasal packing postoperatively. Placing quilting sutures without nasal packing has avoided septal hematomas in all of the senior author's septal or septorhinoplasty cases (over 2500 patients). The thickening effect of the AlloDerm also helps to prevent "floppy" septal flaps by thickening the septum where cartilage has been removed.

Again, human ADM grafts should not be placed to reconstitute structural strength, as they add little or no structural support. During septal procedures, it is therefore important to maintain or reconstruct the caudal or dorsal strut of cartilage. The senior author maintains or reconstructs the strut to at least 1 cm in all cases. If septal cartilage is not available, we harvest a perpendicular plate of the ethmoid bone or rib cartilage for this purpose.

Dorsal and tip ADM grafts are useful in camouflaging minor dorsal irregularities, filling in minor saddle nose deformities, and providing a barrier over an open roof deformity.[5-7] The material is especially useful in the thin-skinned patient, where concern is greatest for possible residual dorsal deformity. Additionally, we have sometimes wrapped conchal cartilage grafts or costal cartilage grafts in a piece of AlloDerm to further soften the edges of a graft and slightly increase thickness. In those cases, we have sutured the AlloDerm directly to the cartilage with 6-0 absorbable sutures in a through-and-through technique.

We have not yet encountered any material-related complications. We have not noted dramatic resorption, but admittedly, we do not depend on the material for significant augmentation (beyond 2 mm). Other authors have witnessed some resorption in more significant augmentation cases.[6,7] Those authors have noted resorption rates of 20% to 30%, especially over the bony dorsum, in cases where the material has been used to augment up to 3 mm. However, like us, they have not noted any resorption beyond one year postoperatively.

In cases where the ADM graft is placed for functional purposes or as part of a purely functional surgery, insurance has covered the cost of the implant. When the implant is placed for cosmetic purposes, the patient is charged by the surgical facility an average of $250 to $500 for the implant and handling. This cost rates favorably when compared to the harvest of autologous materials for cosmetic purposes, which costs $1000 or more in our market and requires a secondary surgical site, leading to increased operating time and possible morbidities.

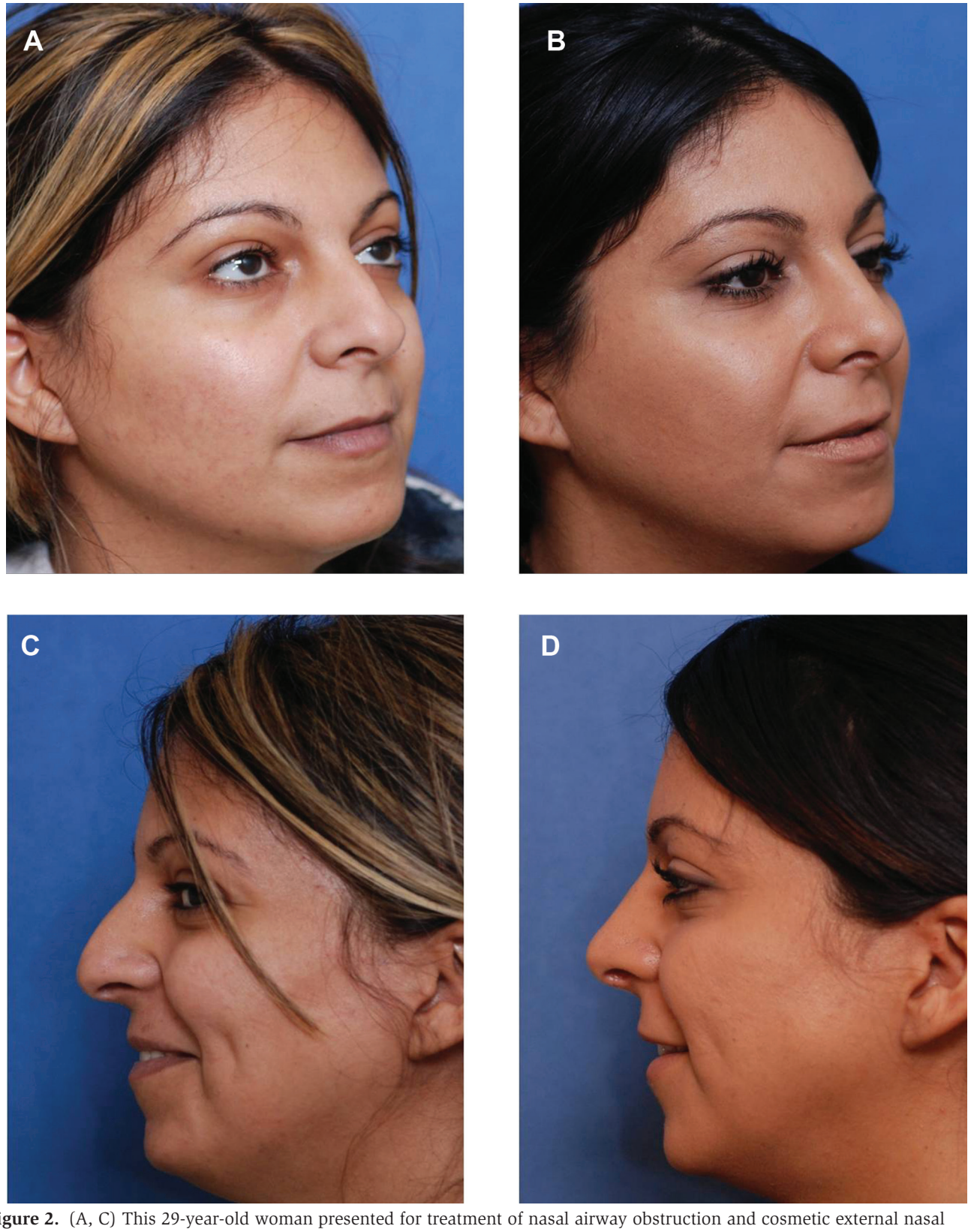

Figure 2. (A, C) This 29-year-old woman presented for treatment of nasal airway obstruction and cosmetic external nasal deformity. (B, D) One year after septorhinoplasty with nasal valve repair. During surgery, the patient received one layer of medium-thickness ADM as an onlay to the nasal dorsum, to camouflage minor dorsal irregularities and prevent sequelae of an open-roof deformity.

Table 4. Indications for AlloDerm Use in Rhinoplasty/Septorhinoplasty

Between septal flaps
Prevent perforation
Thicken atrophic flaps
Prevent floppy septum
Nasal dorsum
Camouflage minor irregularities
Thicken thin skin
Prevent painful open roof deformity
Minor dorsal augmentation

CONCLUSIONS

Based on the results from our small patient series, human ADM materials are shown to be safe, cost-effective, and useful. We believe that ADM offers a viable alternative to traditional grafting methods for functional and aesthetic rhinoplasty and should be considered by all rhinoplasty surgeons for appropriate applications.

Disclosures

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