Maxillofac Plast Reconstr Surg 2014;36(5):230-236
http://dx.doi.org/10.14402/jkamprs.2014.36.5.230
ISSN 2288-8101(Print) ISSN 2288-8586(Online)
Case Report

Corrective Rhinoplasty with Combined Use of Autogenous Auricular Cartilage and Porcine Dermal Collagen in Cleft Lip Nose Deformity

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Abstract

Esthetic reconstruction of cleft lip nose deformity is a challenging task in surgical management of patients with orofacial cleft. The author reconstructed cleft lip nose deformity effectively using autogenous auricular cartilage and a relatively new graft material of porcine dermal collagen, Permacol™. After correction of the deformed lower third of the nose with patient's auricular cartilage, we applied Permacol™ to augment the entire nasal dorsum. Three patients were treated and followed for up to five years. All patients improved in nose aesthetics without any inflammatory or immunogenic reaction. The author suggests that the use of Permacol™ for nasal profile augmentation in the treatment of cleft lip nose deformity is an alternative surgical strategy with minimal surgical invasiveness. The author report long-term experience with combined use of auricular cartilage and Permacol™ in nasal reconstruction for cleft lip nose deformity.

Key words: Cleft lip nose deformity, Corrective rhinoplasty, Auricular cartilage, Porcine dermal collagen

Introduction

The nose is a central structure of the face, so attempts to reconstruct ideal form and esthetics can be complicated. The majority of patients with cleft lip nose deformity require augmentation rhinoplasty for a more balanced nasal dorsum. Traditionally, autogenous cartilages from various sites are used to correct cleft lip nose deformity. However, sometimes results of corrective rhinoplasty using auricular or septal cartilages are unsatisfactory due to the weakness of the graft material. In that case, rib cartilage could be a good material of choice for corrective rhinoplasty for cleft lip nasal deformity[1]. However, the harvesting procedure leaves a cutaneous scar that is unacceptable, especially for a young female patient. So we need to find alternative surgical options to replace the autogenous rib cartilage.

In 1998, a new biomaterial called Permacol™ (Tissue Science Laboratories plc, Aldershot, UK) was licensed in Europe for permanent implantation in human body. Permacol™ consists of acellular, cross-linked porcine dermal collagen that is resistant to degradation by collagenase. Furthermore, its structure is similar to that of human dermis. It had been widely used in general and gyneco-

RECEIVED September 1, 2014, REVISED September 12, 2014, ACCEPTED September 24, 2014

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logical surgery in the treatment of hernia[2,3] and otolaryngology surgery such as surgical closure of nasal septal perforation[4]. Recently it was described in facial contour augmentation surgery including esthetic augmentation rhinoplasty[5] and reconstruction of a post-traumatic nasal deformity[6].

The author augmented nasal dorsum after reconstruction of the lower third of the nose during corrective rhinoplasty in patients with cleft lip nasal deformity. In this report we describe three cases of rhinoplasty procedures using autogenous auricular cartilage and synthetic porcine dermal collagen with highlights of how to use it.

Case Report

1. Case 1

A 17-year-old female patient with secondary deformity due to unilateral incomplete cleft lip and palate was referred to the Department of Oral and Maxillofacial Surgery, Gangneung-Wonju National University Dental Hospital. Five years ago, she underwent autogenous bone graft on her cleft alveolus. During this time, her chief complaint was the deformed nose, so we decided upon corrective rhinoplasty and minor revision surgery on her upper vermilion. After taking standard rhinoplasty photograms, formal consent for the use of xenograft material was obtained.

The operation was performed under general anesthesia with additional anesthetics consisting of 2% lidocaine and 1:100,000 epinephrine in the planned dissection area. Via an open rhinoplasty approach with intercartilaginous and stair-shaped transcolumellar incision (Fig. 1A), the lower lateral cartilage was dissected from surrounding soft tissues and prepared a subperiosteal pocket for the xenograft on nasal bone (Fig. 1B). After harvesting auricular cartilage from right ear (Fig. 1C), we applied it as a columellar strut (Fig. 1D) and cap graft (Fig. 1E) for a prominent nasal dome. The Permacol™ sheet comes ready to use and can be cut to the desired size easily. We inserted two layers (3 mm) of Permacol™ under the dorsal skin of the nose, and fixed it to the underlying cartilages with 4-0 polydioxanone (Fig. 1F). The upper portion of the Permacol™ was engaged in the prepared subperiosteal

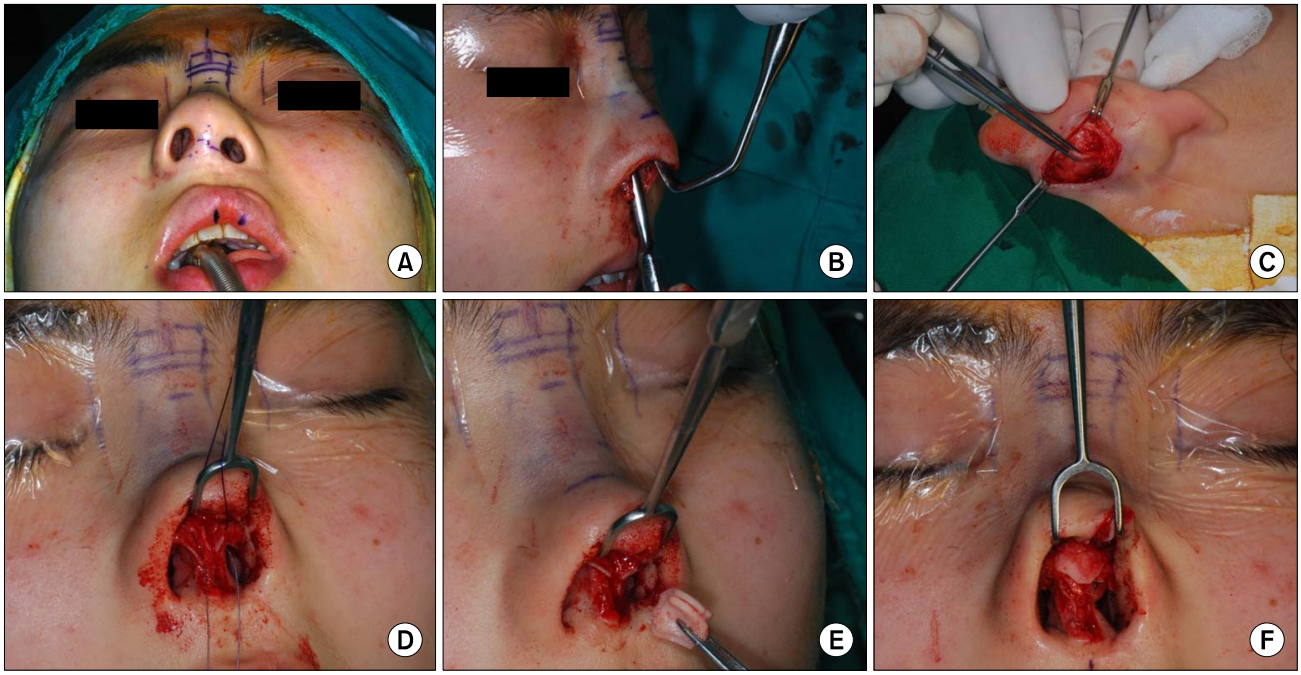

Fig. 1. Surgical procedures performed on a 17-year-old female with nasal deformity from a unilateral incomplete cleft (case 1). (A) Surgical markings for planned position of Permacol™ and stair-shaped transcolumellar incision. (B) Perichondral and subperiosteal dissection was performed to the root of nasal bone. (C) Auricular cartilage was harvested from the auricle of right ear. (D) Left lower lateral cartilage was sutured with a cartilaginous strut at its elevated position. (E) Excess auricular cartilage was used for cap graft for shaping the nasal tip. (F) After positioning of a two-layered Permacol™ sheet, cap graft was fixed with polydioxanone.

pocket. After closing the surgical wounds, we applied external nasal stent and tape for two weeks, as well as a nasal conformer for six months at night postoperatively.

Esthetic results in visits at one month, six months, and one year were satisfactory for patients and surgeon (Fig. 2). The dorsal implant was intact and did not show any resorption or displacement.

2. Case 2

A 17-year-old male patient with secondary deformity due to unilateral complete cleft lip and palate was referred to our department. He had undergone several surgeries including distraction osteogenesis for collapsed maxilla, secondary alveolar bone grafting for cleft alveolus, and pharyngoplasty by the author. On this occasion (January 25, 2009), corrective rhinoplasty was performed.

Under general anesthesia, open rhinoplasty was performed via an intercartilagenous incision, continuous with the transcolumellar incision on the line of previous scar (Fig. 3A, 3B). After harvesting auricular cartilage from right ear (Fig. 3C), we applied it as a columellar strut and gull-wing type graft (Fig. 3D) to strengthen nasal tip support. We then implanted two layers of Permacol™ (Fig. 3E), and fixed it to the grafted cartilages with monocryls (Fig. 3F). After layered sutures for wound closure, we applied an external nasal stent. Aesthetic results in follow-up visits were acceptable for the patient (Fig. 4).

3. Case 3

A 14-year-old male patient with secondary deformity due to bilateral cleft of primary palate presented to the department. His mother's chief complaint was the visible scar on upper vermilion and the compressed nose, so we decided to perform a cheilorhinoplasty.

Under general anesthesia, open rhinoplasty was done via an intercartilagenous incision inside both nostrils and the incision for scar revision (Fig. 5A). After harvesting auricular cartilage from both ears, we applied it as a columellar strut and gull-wing type graft for prominent nasal dome (Fig. 5B, 5C). We then implanted two layers of Permacol™ in the form of an onlay graft, and fixed it to the grafted auricular cartilages with monocryl sutures (Fig. 5D, 5E). Good cosmetic results were obtained without any complications (Fig. 6).

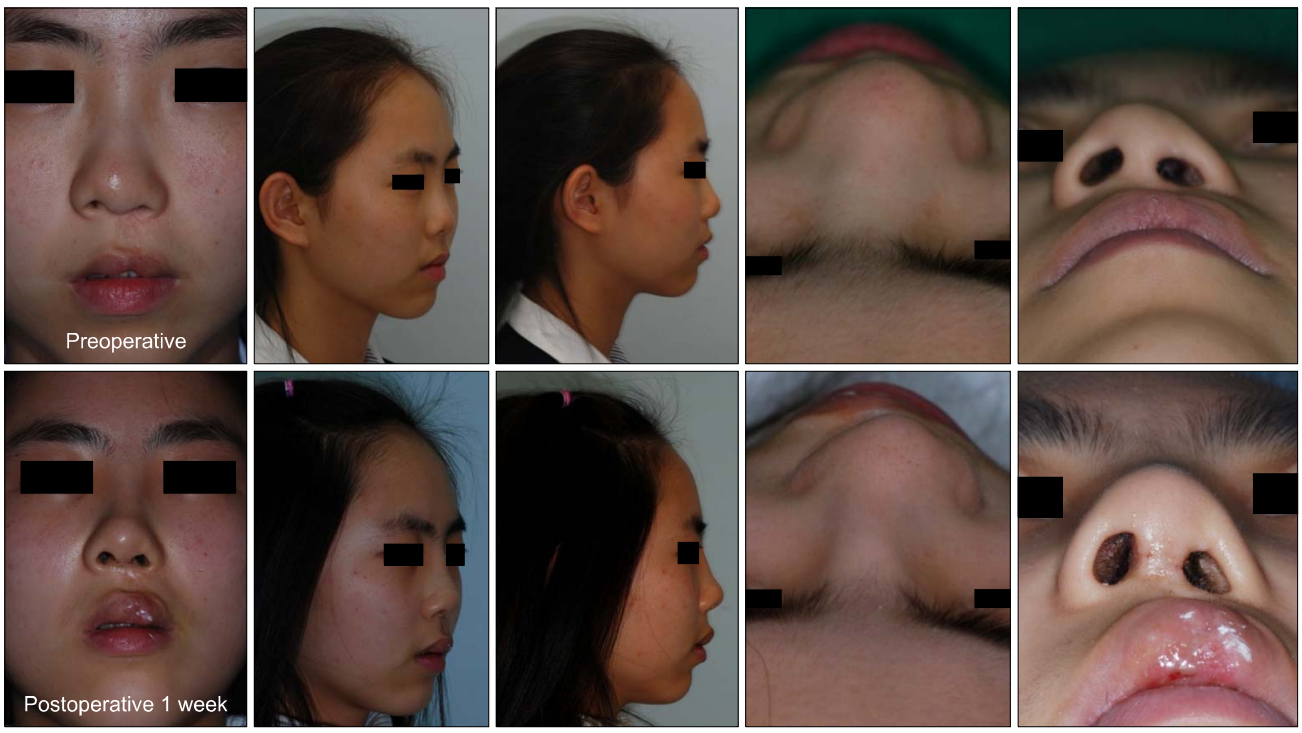

Fig. 2. Preoperative (upper panel) and postoperative (lower panel) photographs of case 1.

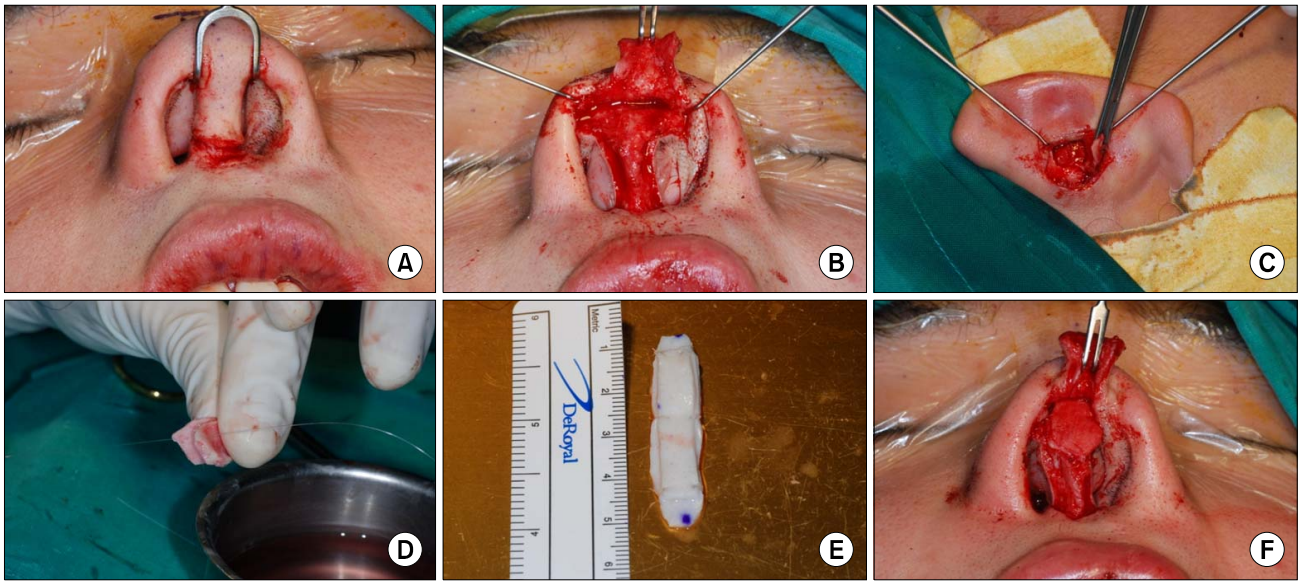

Fig. 3. Surgical procedures performed on a 17-year-old male with nasal deformity from a unilateral complete cleft (case 2). (A) Transcolumellar incision was done along the preexisting conspicuous scar. (B) Lower lateral cartilages were detached from surrounding soft tissues. (C) Auricular cartilage was harvested from the auricle of right ear. (D) Carving and shaping the harvested auricular cartilage. (E) Dimension of the double layered Permacol™. (F) Permacol™ xenograft was fixed with polydioxanone.

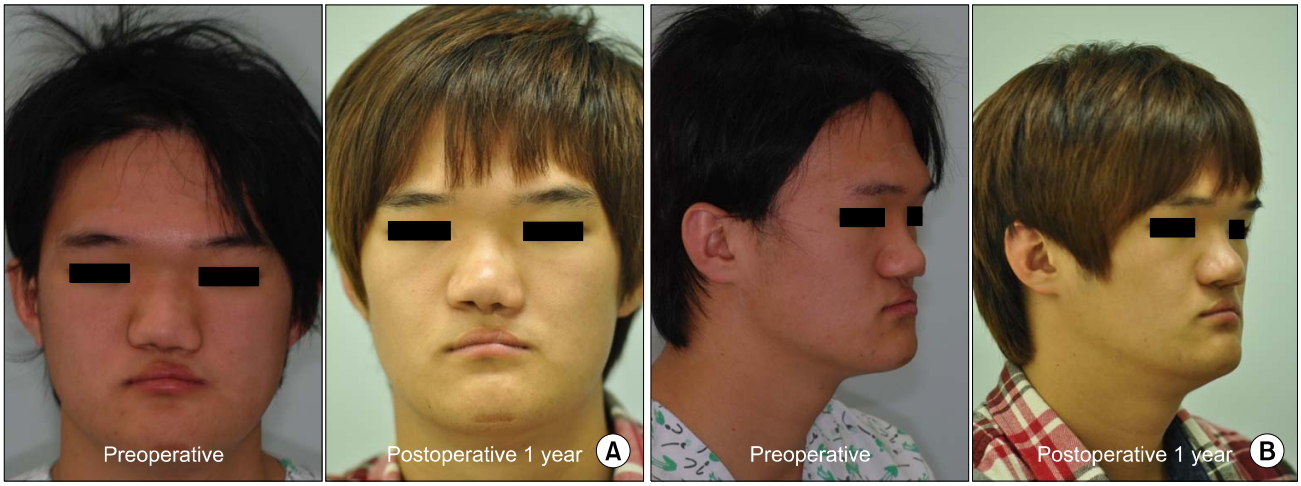

Fig. 4. Preoperative and one year postoperative frontal (A) and 45-degree lateral (B) photographs of case 2.

Discussion

There is a vast number of surgical techniques and grafting materials for cleft lip nose deformity reconstruction. In general, autogenous tissues remain the gold standard for reconstructive surgery of cleft lip nose deformity. Especially for augmentation of the nasal dorsum, autogenous septal cartilage could be the material of choice[7]. However, autogenous grafting procedures require additional surgery and donor site morbidity, and sometimes graft material is limited. Thus maxillofacial plastic and reconstructive surgeons always need to prepare allogeneic or alloplastic materials as an alternative.

Silicone[8], high-density porous polyethylene[9], expanded polytetrafluoroethylene[10], and human dermal collagen[11] are used as alloplastic materials for augmentation rhinoplasty, and have both advantages and disadvantages. Permacol™ can be a useful material for augmentation rhinoplasty because it is readily available in the required volume, it is easy to shape, and it seems to main-

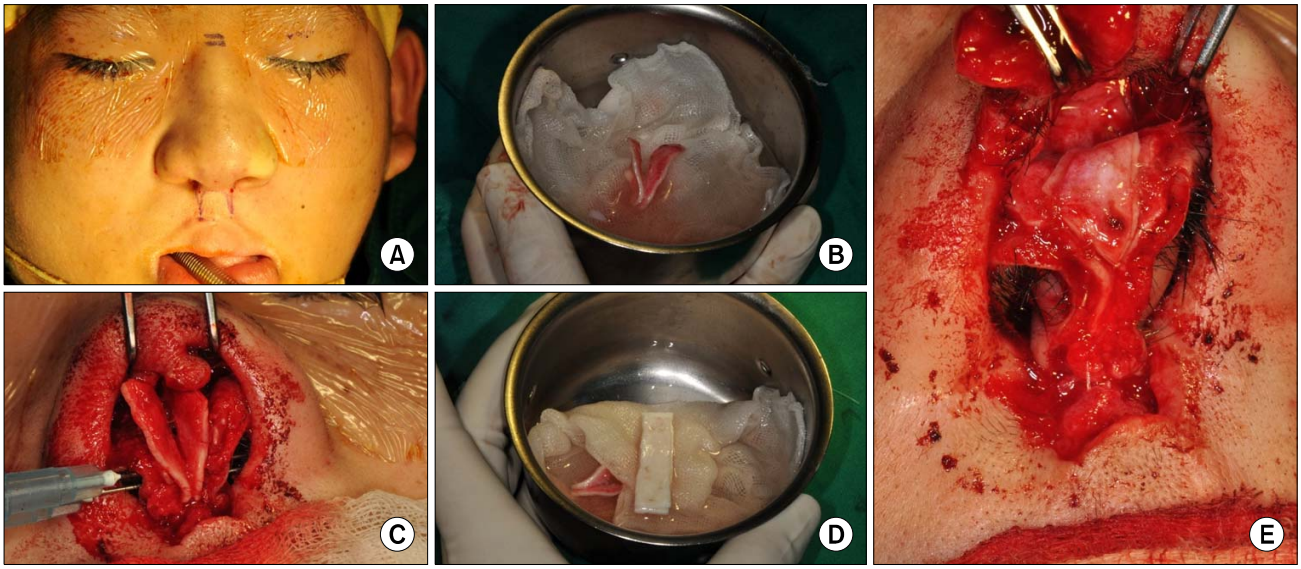

Fig. 5. Surgical procedures performed on a 14-year-old male with nasal deformity from a bilateral cleft (case 3). (A) Surgical markings for planned position of Permacol™ and incisions for open rhinoplasty. (B) Shaping of the harvested auricular cartilage. (C) Fixation of the auricular cartilage to the medial crus of the lower lateral cartilages. (D) Prepared Permacol™. (E) Permacol™ xenograft was fixed with polydioxanone.

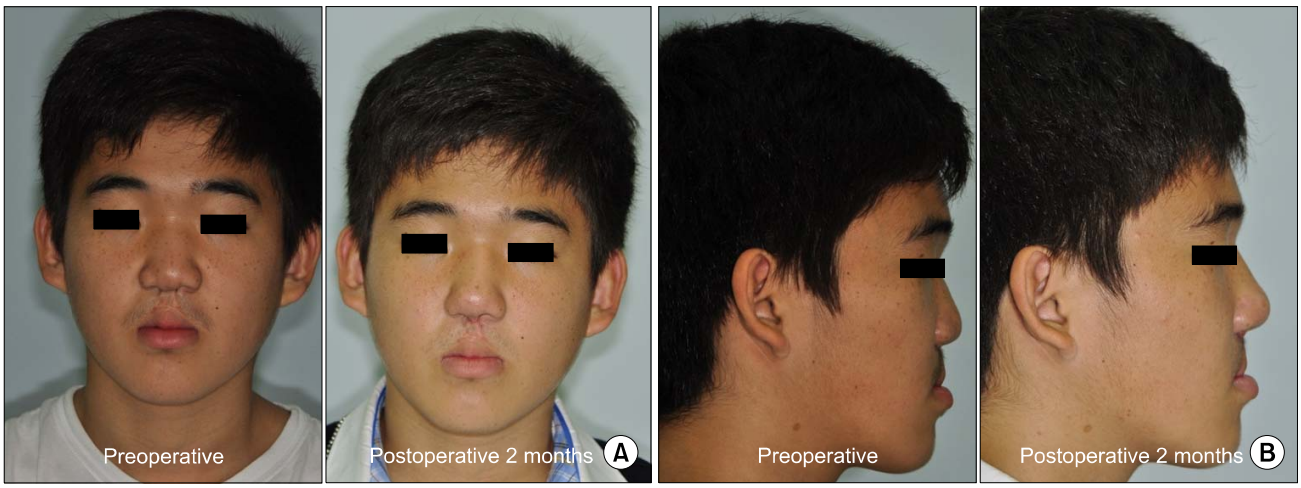

Fig. 6. Preoperative and postoperative frontal (A) and lateral (B) photographs of case 3.

tain the structural integrity of the nose.

In this study, three patients underwent corrective rhinoplasty via external approach using autogenous auricular cartilage and Permacol™ composite grafting. The original dimension of the Permacol™ sheet used was 60×30×1.5 mm, and two layers of Permacol™ were inserted into the nasal dome with customized size for each patient. If layering is required, the material can be cut into separate sheets, creating edges rather than folding or rolling, probably due to possible colonization of microorganisms. The flexible sheet immediately conforms to anatomical shapes. At the nasal tip, the auricular cartilage was covered with a double layer of Permacol™ to form the ideal nasal contour. It is easy to shape and remains without migration or displacement. Afterwards, the author felt two layers of Permacol™ was aesthetically sufficient for the patient with thin nasal skin (case 1, 3), but deficient for the patient with thick facial soft tissues (case 2).

Previous studies demonstrate that Permacol™, when implanted in human body, is readily surrounded by host tissues such as fibroblasts and vascular endothelial cells. Finally, Permacol™ becomes incorporated by tissue ingrowth and

neovascularization[12,13]. Hunter *et al.*[14] observed a Permacol™ explant 15 months post implantation, originally inserted for augmentation rhinoplasty. Macroscopically, Permacol™ was covered with a clear layer of fibrous tissue, characterized histologically by the irregular arrangement of collagen as well as the presence of some cells and elastin fibers. A specimen of Permacol™ *ex vivo* showed well organized bands of mature acellular collagen. They assumed Permacol™ was integrated or replaced with autogenous tissues. Similar results were reported in the rat model[15]. Furthermore, Hammond *et al.*[16] suggested that Permacol™ acted as a matrix into which autogenous tissue could grow. From those studies and our own limited experiences with three patients, the author think Permacol™ could be a safe and persistent graft material.

Pitkin *et al.*[17] inserted fourty-five Permacol™ implants for augmentation rhinoplasty over a 4-year period, with only one case of postoperative implant removal. They concluded that Permacol™ seemed to be a biocompatible alternative to conventional grafting materials, with minimal morbidity. Compared to the removal rate of silicone[18] and the infection rate of Gore-Tex[19], Pitkin's clinical results are encouraging. Moreover, Permacol™ can be safely used in a contaminated field[20]. In our study, immediately after the operation, no patients complained of any foreign body sensations or discomfort at usual daily activities. No acute or chronic inflammatory or immunogenic complications were noted. Fu *et al.*[21] recommended long-term follow-up for the use of Permacol™ because some graft absorption was noted in their patient, who had undergone nasal profile augmentation. The author followed three patients for more than five years, but there was no sign of graft absorption. Hopkins *et al.*[22] also report successful long-term use of Permacol™ in rhinoplasty.

In conclusion, we obtained pleasing results in reconstruction of cleft lip nose deformity with simple and safe surgical procedures. In our limited experience with three patients, the author concludes that the Permacol™ can be a reliable surgical option for patients with cleft lip nose deformity. Further studies with larger numbers of patients are required.

References

1. Hafezi F, Naghibzadeh B, Ashtiani AK, Mousavi SJ, Nouhi AH, Naghibzadeh G. Correction of cleft lip nose deformity with rib cartilage. Aesthet Surg J 2013;33:662-73.
2. Cobb LM, Hacker T, Nolan J. NAD(P)H nitroblue tetrazolium reductase levels in apparently normoxic tissues: a histochemical study correlating enzyme activity with binding of radiolabelled misonidazole. Br J Cancer 1990;61:524-9.
3. Chand B, Indeck M, Needleman B, *et al.* A retrospective study evaluating the use of Permacol™ surgical implant in incisional and ventral hernia repair. Int J Surg 2014;12:296-303.
4. Wong S, Raghavan U. Outcome of surgical closure of nasal septal perforation. J Laryngol Otol 2010;124:868-74.
5. Saray A. Porcine dermal collagen (Permacol) for facial contour augmentation: preliminary report. Aesthetic Plast Surg 2003;27:368-75.
6. Cillo JE Jr, Caloss R, Miles BA, Ellis E 3rd. An unusual response associated with cross-linked porcine dermal collagen (ENDURAGen) used for reconstruction of a post-traumatic lateral nasal wall deformity. J Oral Maxillofac Surg 2007;65:1017-22.
7. Huang J, Liu Y. A modified technique of septal extension using a septal cartilage graft for short-nose rhinoplasty in Asians. Aesthetic Plast Surg 2012;36:1028-38.
8. Wang JH, Lee BJ, Jang YJ. Use of silicone sheets for dorsal augmentation in rhinoplasty for Asian noses. Acta Otolaryngol Suppl 2007;(558):115-20.
9. Niechajev I. Porous polyethylene implants for nasal reconstruction: clinical and histologic studies. Aesthetic Plast Surg 1999;23:395-402.
10. Dong L, Hongyu X, Gao Z. Augmentation rhinoplasty with expanded polytetrafluoroethylene and prevention of complications. Arch Facial Plast Surg 2010;12:246-51.
11. Fagien S, Elson ML. Facial soft-tissue augmentation with allogeneic human tissue collagen matrix (Dermalogen and Dermaplant). Clin Plast Surg 2001;28:63-81.
12. Jarman-Smith ML, Bodamyali T, Stevens C, Howell JA, Horrocks M, Chaudhuri JB. Porcine collagen crosslinking, degradation and its capability for fibroblast adhesion and proliferation. J Mater Sci Mater Med 2004;15:925-32.
13. Parker DM, Armstrong PJ, Frizzi JD, North JH Jr. Porcine dermal collagen (Permacol) for abdominal wall reconstruction. Curr Surg 2006;63:255-8.
14. Hunter B, Hopkins C, Tharavaj S, Roberts D. Permacol in augmentation rhinoplasty. Clin Otolaryngol 2010;35:340-1.
15. Macleod TM, Williams G, Sanders R, Green CJ. Histological evaluation of Permacol as a subcutaneous implant over a 20-week period in the rat model. Br J Plast Surg 2005;58:518-32.
16. Hammond TM, Chin-Aleong J, Navsaria H, Williams NS. Human in vivo cellular response to a cross-linked acellular collagen implant. Br J Surg 2008;95:438-46.
17. Pitkin L, Rimmer J, Lo S, Hosni A. Aesthetic augmentation rhinoplasty with Permacol: how we do it. Clin Otolaryngol 2008;33:615-8.
18. Jung DH, Kim BR, Choi JY, Rho YS, Park HJ, Han WW. Gross and pathologic analysis of long-term silicone implants inserted into the human body for augmentation rhinoplasty:

221 revision cases. Plast Reconstr Surg 2007;120:1997-2003.
19. Winkler AA, Soler ZM, Leong PL, Murphy A, Wang TD, Cook TA. Complications associated with alloplastic implants in rhinoplasty. Arch Facial Plast Surg 2012;14:437-41.
20. Catena F, Ansaloni L, Gazzotti F, *et al*. Use of porcine dermal collagen graft (Permacol) for hernia repair in contaminated fields. Hernia 2007;11:57-60.
21. Fu B, Qayyum A, Frosh A. Experience with use of Permacol in reconstructing nasal deformity. Clin Otolaryngol 2008;33: 383-4.
22. Hopkins C, Walker R, Lee S, Roberts D. Permacol in augmentation rhinoplasty: how we do it. Clin Otolaryngol 2009; 34:68-75.