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Septorhinoplasty for Destructed Septal L-Strut in Patients with Previously Applied Porous High-Density Polyethylene Implants (Medpor®)

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Abstract

Background Porous high-density polyethylene implants (Medpor®) have been extensively used for septal extension grafts in Asian rhinoplasty. However, studies on the long-term complications associated with Medpor® have not been reported. Therefore, the purpose of this study was to evaluate the long-term complications of septal extension grafts using Medpor® and present a reconstructive strategy for destructed septal L-struts.

Methods We conducted a 12-year retrospective medical chart review of 428 patients who visited our center for septorhinoplasty. Among 428 patients, 43 patients had Medpor® for septal extension grafts previously applied at other clinics. The quadrangular cartilage was devoid or destructed in the area where Medpor® was previously applied. Therefore, all patients underwent secondary septorhinoplasty using autogenous cartilage grafts. Patient outcome was assessed to evaluate satisfaction, hardness of nasal tip, functional nasal obstruction symptom evaluation (NOSE) scores, and pain scores. Anthropometric analyses were carried out with patients' photographs. Postoperative complications were also evaluated.

Results After septal L-strut reconstruction, 87% of patients were satisfied with their aesthetic results. Hardness of nasal tip, NOSE scores, and pain scores also improved after reconstruction. Anthropometric analyses demonstrated that increased nasal length and decreased columellar–labial angle were achieved in patients with short nose deformities. No postoperative complications related to the reconstruction were recorded for any patient.

Conclusions The devastated destruction of nasal support lines was found after the use of Medpor® for septorhinoplasty. Therefore, the use of Medpor® should be reduced. Autogenous cartilage grafts are the last resort for reconstruction of destructed septal L-struts.

Level of Evidence IV This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Complication · Destruction · Medpor · Reconstruction · Septorhinoplasty

Introduction

Asian noses are generally described as having a bulbous tip, short columella, flared nostril shape, wide alar base, acute nasolabial angle, and low dorsum [1]. The nasal dorsum and the tip are the most commonly addressed structures in Asian rhinoplasty. Therefore, nasal dorsal augmentation and nasal tip refinement are the most important aspects of Asian rhinoplasty [2]. Among several surgical techniques for Asian rhinoplasty, septal extension grafts can provide more reliable tip support for weak alar cartilages, which are common in Asian nasal tips, and are therefore used as the standard method for Asian nasal tip surgery [3].

A quadrangular cartilage has commonly been used for septal extension grafts because it lies within the operating field. In addition, the flat nature and hardness of the quadrangular cartilage make a septal extension graft an

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optimal choice [4]. However, the use of quadrangular cartilage is not always available in the Asian population because the amount of harvested quadrangular cartilage is commonly inadequate for cartilage grafting procedures [2].

Meanwhile, alloplastic implants have gained more acceptance as an alternative for septal extension grafts because they are abundant, and impart no harvest-related morbidity. As an increasing number of patients seek aesthetic improvement through minimally invasive procedures, the demand for effective and durable alloplastic materials for septal extension grafts has increased dramatically. To meet these demands, porous high-density polyethylene sheets (Medpor®) have been used for septal extension grafts, without evidence ensuring long-term patient safety [5, 6].

There is a lack of studies demonstrating long-term complications associated with Medpor® in septorhinoplasty. In addition, nasal septal complications, such as intra-septal abscesses and septal perforations, lead to disastrous results and treatment of destructed septal L-struts is difficult. Therefore, the objective of the current study was to explore long-term complications of septal extension grafts using Medpor® and introduce a reconstructive strategy for destructed septal L-struts after the use of Medpor®.

Methods

This retrospective study protocol was approved by the institutional review board and performed in full accordance with the principles of the Declaration of Helsinki.

Between January 2005 and December 2017, a total of 428 patients visited our center for septorhinoplasty due to aesthetic dissatisfaction. Among 428 patients, 187 patients underwent secondary septorhinoplasty. Of these 187 patients, 43 patients had Medpor® for septal extension grafts previously applied at other clinics. The quadrangular cartilage was devoid or destructed in the area where Medpor® was previously applied. Therefore, all patients (aged 21–49 years, 32 females, 11 males) underwent secondary septorhinoplasty using autogenous cartilage grafts (Table 1). The mean number of prior septorhinoplasties was 1.5 ± 0.7 (range, one to three). A single surgeon performed all the reconstructions. Follow-up visits were conducted every three to six months after reconstruction. Mean follow-up length after septal L-strut reconstruction was 19.2 ± 7.3 months.

Table 1 Patient demographics

Characteristics	Value (%)
Total no. of patients	43
Sex (male/female)	11:32
Age, year	
Mean ± SDs	29.9 ± 8.1
Range	21–49
Follow-up, month	
Mean ± SDs	19.2 ± 7.3
Range	6.1–31.7
Medpor® site on nasal septum	
Membranous septum only (columellar strut type)	16 (37)
Anterior septum (spreader graft type)	8 (19)
Caudal septum (septal extension graft type)	7 (16)
Anterior and caudal septum (L-strut type)	12 (28)

Patient Demographics and Complication Characteristics Associated with Medpor®

Among 43 patients, the site of a small piece of Medpor® used for columella strut was at the membranous septum in 16 (37%) patients. In 12 (28%) patients, two to five pieces of Medpor® were placed at both the anterior and caudal septa as septal extension grafts. The Medpor® was placed at the caudal septum as septal extension grafts in eight (19%) patients and the anterior septum for spreader grafts in seven (16%) patients.

Twelve patients (28%) experienced Medpor® extrusion. Among the 12 patients, the site of Medpor® extrusion was at the cartilaginous septum in eight (19%) patients and the membranous septum in four (9%) patients. Five of 12 patients presented with pus drainage at the site of Medpor® extrusion. Combined implant failures on the nasal dorsum were found in 23 (53%) patients. Nineteen (44%) and four (9%) patients presented with silicone and polytetrafluoroethylene (GoreTex®) implant failures, respectively. Four (9%) patients exhibited contracted nose deformities (Table 2).

All 43 patients underwent septal L-strut reconstruction using autogenous cartilage grafts to achieve better aesthetic nasal lines than before reconstruction. Even in patients who had a small piece of Medpor® at the membranous septum, we removed the Medpor® and performed septal L-strut reconstruction using autogenous cartilage grafts for anterior projection of the nasal tip.

Reconstruction of the septal L-strut using autogenous conchal and costal cartilages was performed in 35 (81%) and eight (19%) patients, respectively. In 13 (30%)

Table 2 Complication characteristics

Characteristics	Value (%) (N = 43)
Medpor® extrusion	12 (28)
Septal extrusion	8 (19)
Columellar extrusion	4 (9)
Puncture with pus drainage	5 (12)
Dorsal fluctuation without pus drainage	4 (9)
Nasal dorsal implant failure	25 (58)
Silicone	19 (44)
Silicone deviation	14 (33)
Combined silicone extrusion	5 (12)
GoreTex®	4 (9)
Dorsal fluctuation with mucocele	4 (9)
Contracted nose deformity	4 (9)
Nasal tip destruction	5 (12)
Nasal obstruction (NOSE score > 10)	20 (47)

patients, cavum and cymba conchal cartilages were used for anterior and caudal septal reconstructions, respectively. Cymba and cavum conchal cartilages were used in 12 (28%) patients for anterior and caudal septal reconstructions, respectively. Bilateral cymba conchal cartilages were used for anterior and caudal septal reconstruction in five (12%) patients. In five (12%) patients, quadrangular cartilage was partially preserved and this remaining quadrangular cartilage was used for anterior septal reconstruction, and a cymba conchal cartilage was used for caudal septal reconstruction (Table 3).

Operative Technique: Septal L-Strut Reconstruction Using Autogenous Cartilage Grafts

All operations were performed by an external approach under general anesthesia. Dissection of soft tissues between the bilateral medial crura allowed access to the caudal septum, where the Medpor® was found during dissection. Although Medpor® was applied on the quadrangular cartilage, the mucosa around the Medpor® tended to be adherent. Therefore, it was crucial to meticulously elevate and separate the mucosal flaps around the Medpor® to prevent damage to remaining quadrangular cartilage and bilateral mucosal flaps. The dissection was continued along the anterior septum to enable submucous meticulous detachment of the upper lateral cartilages. Quadrangular cartilage was deficient where Medpor® had been applied (Fig. 1).

Table 3 Autogenous cartilages used for reconstruction of destructed septal L-strut

Characteristics	Value (%) (N = 43)
Conchal cartilage	35 (81)
Cavum (anterior) + Cymba (caudal)	13 (30)
Cymba (anterior) + Cavum (caudal)	12 (28)
Cymba (anterior) + Cymba (caudal)	5 (12)
Septum (anterior) + Cymba (caudal)	5 (12)
Costal cartilage	8 (19)

Septal L-strut Reconstruction Using Two Conchal Cartilages

Two conchal cartilages (cymba and cavum) from the right ear were used for septal L-strut reconstruction as the primary choice. Before reconstruction, we identified whether patients had previously used conchal cartilages. When patients had small ears or did not have a cavum conchal cartilage, bilateral cymba conchal cartilages were used for reconstruction. When patients did not have bilateral conchal cartilages, costal cartilages were used for reconstruction.

Two conchal cartilages, attached by the anterior and posterior perichondrium, were harvested from the external ear. These harvested conchal cartilages were folded face to face on their concave side. Two horizontal mattress sutures were placed using 5-0 or 6-0 polypropylene. A folded conchal cartilage was placed into the anterior nasal spine (septal extension graft type) in a tongue-in-groove fashion. The folded cartilages were affixed to the perichondrium and surrounding soft tissues of the anterior nasal spine using 4–0 polydioxanone (PDS) without drill holes.

The other conchal cartilage was also folded in the same fashion and used for reconstruction of the anterior septum (spreader type) in a tongue-in-groove fashion. The graft was sutured to the remaining anterior quadrangular cartilages using multiple fixation sutures with 4–0 Vicryl and 5–0 PDS. When severe destruction at the keystone was observed, the cartilage was affixed to the nasal bones via bilateral drill holes.

Subsequently, two folded conchal cartilages were sutured together to create a de novo anterior septal angle and sutured to the middle crura of the lower lateral cartilages using 4–0 PDS (Fig. 2). In addition, a small piece of a cartilage carved from previously harvested conchal cartilage could be applied between the two folded conchal cartilages as a rafter for reinforcement. After septal L-strut reconstruction, work on the nasal tip and nasal dorsal augmentation proceeded using dermofat harvested from the intergluteal crease or superficial mastoid fascia with diced cartilages.

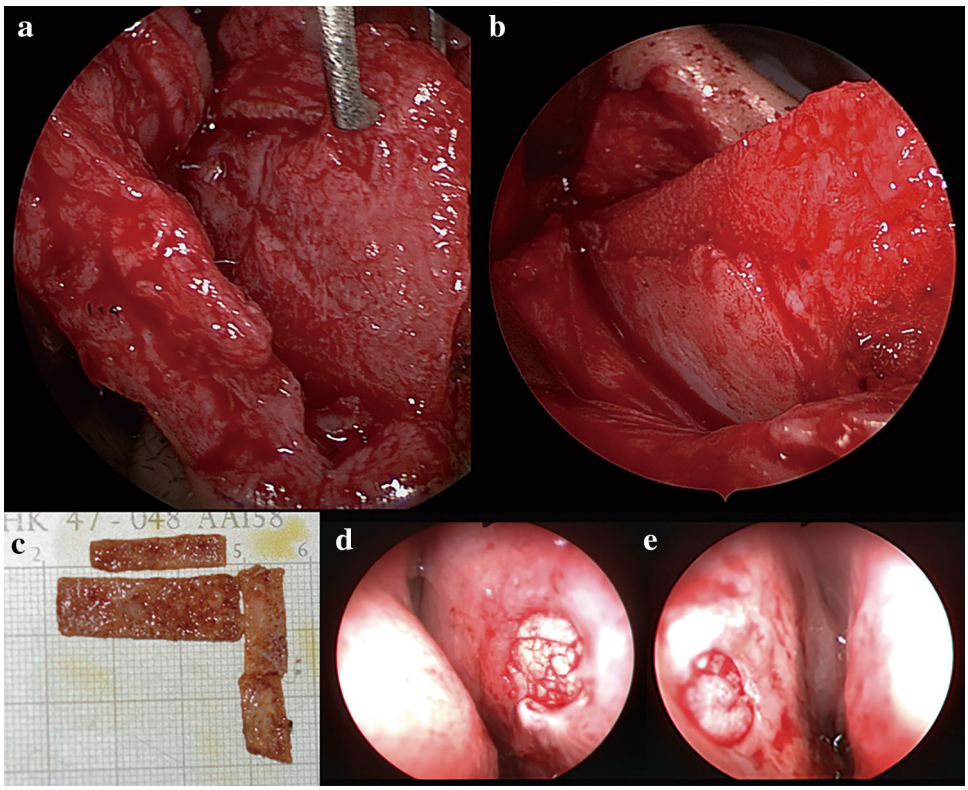

Fig. 1 Intraoperative views demonstrating destruction of a quadrangular cartilage after septal extension graft using Medpor®. **a**, **b** Endoscopic view demonstrating destruction of the nasal septal L-strut by Medpor®. **c** After removal of Medpor®. Endoscopic views in the **d** right nasal cavity and **e** left nasal cavity showing exposure of Medpor® to nasal mucosa with nasal abscess

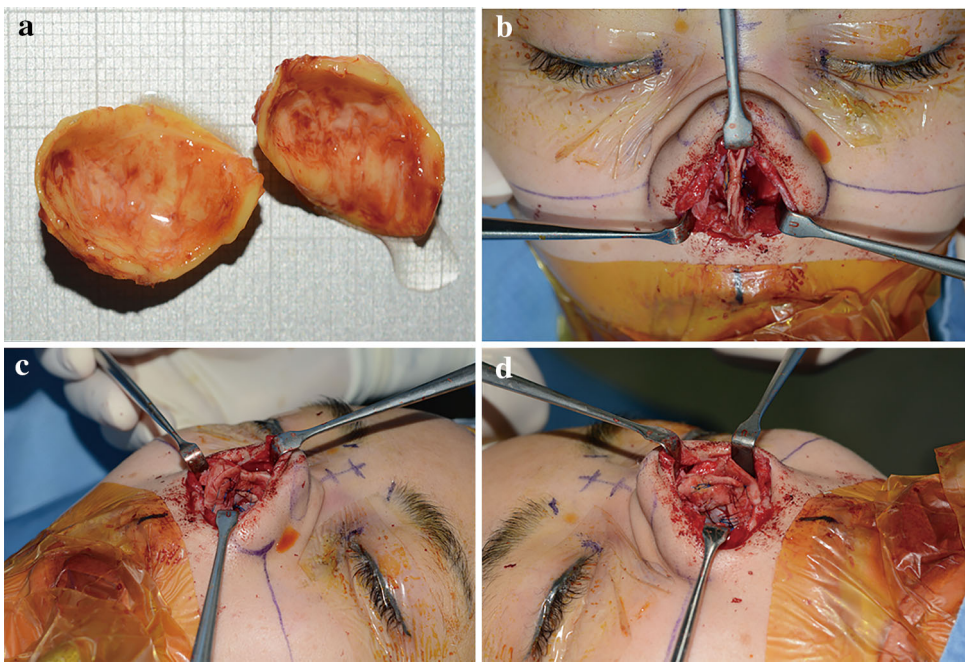

Fig. 2 Nasal septal L-strut reconstruction with conchal cartilage graft. **a** After harvest of conchal cartilages via an anterior approach. **b**–**d** Intraoperative views after reconstruction of nasal septal L-strut using conchal cartilages

Septal L-strut Reconstruction Using Sliced Costal Cartilages

For reconstruction of the septal L-strut using sliced costal cartilages, the seventh costal cartilage was generally used. The harvested costal cartilage was longitudinally carved into multiple slices with a thickness of about 1 mm. The carved cartilages were submerged in a saline-filled container for at least an hour to expose warping tendencies. Two warped costal cartilages were applied face to face on their concave side to the anterior septum. The other two warped costal cartilages were used to create a caudal

septum and sutured to the anterior septum. Rectus abdominis fascia was harvested and wrapped with diced costal cartilages. They were applied for an onlay graft to augment and smooth the nasal dorsal profile.

Evaluation

Clinical features of Medpor® and the destructed septal L-strut were evaluated using intraoperative descriptions and endoscopic photographs.

Subjective evaluation was performed through self-assessment of patients. A questionnaire was designed to evaluate the following parameters: satisfaction, hardness of nasal tip, functional nasal obstruction symptom evaluation (NOSE) scores, and pain scores. Evaluation of satisfaction levels employed a five-grade Likert scale ranging from 5 (very satisfied) to 1 (very unsatisfied). Hardness of the nasal tip was also measured on a five-grade Likert scale, ranging from 5 (very soft) to 1 (very hard). Functional NOSE scores were measured, ranging from 20 (severe problem) to 0 (not a problem). Lastly, pain scores were measured with a universal pain assessment tool, ranging from 10 (worst pain possible) to 0 (no pain). A questionnaire was completed at pre-treatment and at every 3-month visit after reconstruction.

Anthropometric analyses were also carried out to objectively assess patients' appearance in photographs. Photographs taken at pre-treatment and at the last visit were reviewed. Nasal length and columellar–labial angle were analyzed. Clinical photographic images of all patients were assessed objectively using modified MDS 3.0 software (Morpheus Inc., Seoul, Korea). Both parameters were analyzed with lateral view photographs, and seven anthropometric landmarks were placed and nasal length and columellar–labial angle were calculated on the images. Nasal length was determined as the distance between the nasion along the dorsum to the point of intersection with a line from the nasolabial angle. The columellar–labial angle was determined by drawing a line from the subnasale to the labrale superius. The angle between this line and the line from the subnasale to the lobule (the most inferior nasal tip) was considered the columellar–labial angle.

Evaluation of postoperative complications was based on external nose, endoscopic findings in the internal nose, and general health inquiries regarding any adverse events or symptoms at each follow-up visit and at the last visit.

Statistical Analyses

Data are presented as mean ± standard deviation. A one-sample t test was used for statistical analyses of satisfaction. The Wilcoxon rank-sum test was used to evaluate other evaluation items, such as hardness of nasal tip, NOSE and pain scores, nasal length, and columellar–labial angle. A P-value < 0.05 was considered statistically significant. All statistical analyses were performed using SPSS for Windows, version 12.0 (SPSS, Inc, Chicago, IL).

Results

Thirty-nine out of 43 patients completed self-assessments. Patients' average gradings of hardness of tip, NOSE score, and pain score were 2.14 ± 0.89, 11.27 ± 5.33, and 6.76 ± 1.85 at the baseline, respectively. The gradings of satisfaction, hardness of tip, NOSE score, and pain score were 4.51 ± 0.51, 3.97 ± 0.69, 7.43 ± 5.02, and 3.35 ± 1.44 at 12 months after reconstruction, respectively (Table 4; all $P < 0.001$).

Anthropometric analyses concluded that increased nasal length and decreased columellar–labial angle were achieved in patients at the last visit compared to pre-reconstruction (Figs. 3 and 4). Patients' average nasal length was 56.1 ± 5.9 at the baseline and it increased to 63.8 ± 4.5 at the last visit ($P < 0.001$). The columellar–labial angle was 104.4 ± 12.9 at the baseline and it decreased to 100.7 ± 9.0 at the last visit (Table 5; $P = 0.009$).

No postoperative complications related to septal L-strut reconstruction and donor sites were recorded in any patient during the follow-up period.

Discussion

Septorhinoplasty should be accompanied by caudal lengthening of the nasal tip in Asian rhinoplasty [7]. This caudal lengthening and anteriorly projecting nasal tip can be achieved using septal extension grafts [3]. Therefore, septal extension grafts using autogenous quadrangular cartilage play a role in the support of nasal tip projections in Asians [7].

However, the amount of harvested quadrangular cartilage is commonly insufficient for septorhinoplasty in Asians. Kim et al. [8] measured the size of harvested quadrangular cartilage intraoperatively with preservation of L-struts as 10 mm wide. The mean caudal length of the harvested quadrangular cartilage was 15 mm and the mean dorsal length was 18 mm. Kim et al. [9] measured the areas of the quadrangular cartilage using CT scanning. In Caucasians, areas of the quadrangular cartilages in men and women were 998 and 861 mm^2, respectively. In Asians, those in men and women were 962 and 750 mm^2, respectively. Quadrangular cartilage was significantly larger in female Caucasians than in female Asians. Therefore, the size and quantity of harvestable quadrangular cartilage may

Table 4 Self-assessment by patients at pre-treatment, 3, and 12 months after reconstruction

	Baseline (N = 43)	3 months (N = 43)	12 months (N = 39)	P-value
Satisfaction	–	4.11 ± 0.66	4.51 ± 0.51	< 0.001
Hardness of tip	2.14 ± 0.89	3.51 ± 0.65	3.97 ± 0.69	< 0.001
NOSE score	11.27 ± 5.33	8.76 ± 4.97	7.43 ± 5.02	< 0.001
Pain score	6.76 ± 1.85	5.49 ± 1.19	3.35 ± 1.44	< 0.001

Satisfaction, 5 (very satisfied) to 1 (very unsatisfied); hardness of nasal tip, 5 (very soft) to 1 (very hard); NOSE score, 20 (severe problem) to 0 (not a problem); pain score, 10 (worst pain possible) to 0 (no pain)

P-values indicate results between baseline and the last visit

Fig. 3 A 21-year-old female patient who underwent primary septorhinoplasty with Medpor® for septal extension graft. The patient was referred for nasal tip destruction following Medpor® implantation two years prior to reconstruction. A 5 × 5 mm Medpor® was affixed with a nasal tip. **a–c** Preoperative view. **d–f** Two years after reconstruction

be inadequate for complex rhinoplasty procedures in Asians. Furthermore, Asians have less rigid and inherent hypoplasia of the septum, compared to Caucasians [10].

Therefore, alloplastic materials are rapidly challenging and complementing the market share of aesthetic septorhinoplasty. Among several alloplastic implants, Medpor® implants are similar in hardness to cancellous bone at room temperature and demonstrate excellent thermoplastic abilities [11]. Therefore, Medpor® has been extensively used for septal extension grafts in Asia. Previous studies have suggested that Medpor® implants were effective and safe alloplastic materials for septal extension grafts [6, 7, 12]. However, these studies also demonstrated that Medpor® was associated with varying incidences of extrusion and infection. Han et al. [7] reported implant exposure through one side of the membranous septum and the middle portion of the columella was found in two out of the 58 patients during 2-year follow-up periods. Li et al. [6] also reported that one out of the 26 patients experienced implant exposure during 9-month follow-up periods. Kim et al. [12] reported six out of 151 patients showed extrusion and infection during 3-year follow-up periods.

Although the use of Medpor® is prevalent throughout Asian countries due to its convenience of administration in complicated septorhinoplasty, there have been no studies to evaluate the long-term safety of Medpor® for septal extension grafts. Although the period between the time of septorhinoplasty using Medpor® and destruction of L-struts

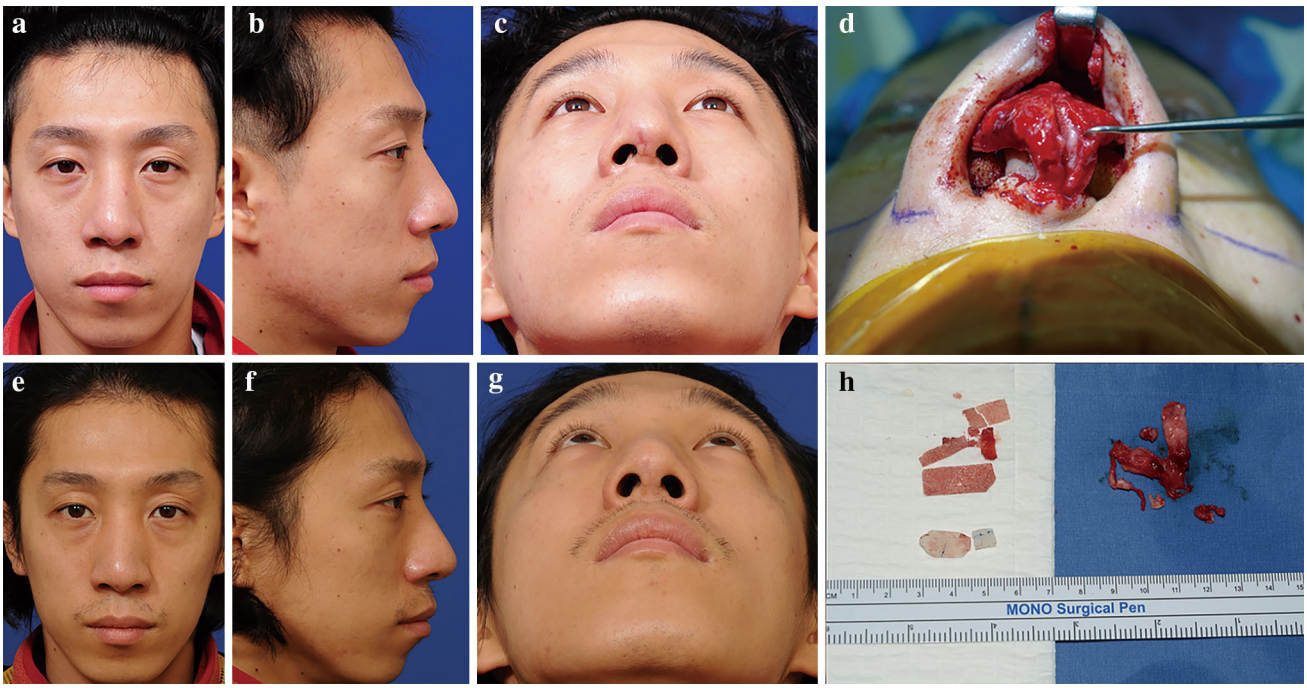

Fig. 4 A 31-year-old male patient who underwent primary septorhinoplasty with Medpor® for septal extension graft. The patient was referred for nasal tip destruction following Medpor® implantation three years prior to reconstruction. Four pieces of Medpor® were affixed with both anterior and caudal septal cartilages. **a**–**c** Preoperative view. **d** Intraoperative view after exposure of Medpor®. **e**–**g** Two years after reconstruction. **h** After removal of Medpor® and surrounding capsules

Table 5 Results of anthropometric analyses at pretreatment, 1 month after reconstruction, and at the last visit

	Baseline (N = 43)	1 month (N = 43)	Last visit (N = 43)	P-value
Nasal length	56.1 ± 5.9	65.3 ± 4.6	63.8 ± 4.5	< 0.001
Columellar–labial angle	104.4 ± 12.9	100.9 ± 10.3	100.7 ± 9.0	0.009

P-values indicate results between baseline and the last visit

varied from a year to seven years, this study may provide strong evidence of long-term complications associated with the use of Medpor® in longer follow-up periods than other studies. This is a novel and key highlight of our study.

A concern regarding Medpor® extrusion and septal infection exists [13]. In particular, the nasal septum is prone to extrusion of the material because the mucoperichondrium which surrounds the quadrangular cartilage may be easily injured during septorhinoplasty. Therefore, a devoid or severely injured mucoperichondrium may increase the risk of the Medpor® extrusion or septal infection. In addition, infection along the collapsed framework of the quadrangular cartilage may result in catastrophic complications. Most patients with severe infections, regardless of acuteness or chronicity, will develop nasal foreshortening due to destruction of the nasal septal framework [14].

In this study, 12 patients showed Medpor® extrusion and five (42%) out of 12 patients with Medpor® extrusion showed septal perforation with pus drainage. Therefore, we suggest that extrusion may increase the risk of septal perforation. However, early diagnosis of extrusion in septal mucosa is very difficult and reconstruction of the quadrangular cartilage may be delayed until infectious signs or nasal pain develops. Once Medpor® is exposed to the mucoperichondrium and infection becomes widespread, particularly in Asian patients who underwent simultaneous nasal dorsal augmentation using silicone or GoreTex® implants, infection management may be more difficult than in Caucasian patients. Complete extirpation of infected soft tissues, including the capsule, as well as vigorous irrigation, may be required to salvage the nose.

In cases of complicated infection, even after complete eradication of a septal abscess, loss of nasal support follows, and moderate to severe deformity of the nasal septum may remain. We performed surgical debridement including capsules, massive betadine irrigation, and treatment with pre- and postoperative intravenous antibiotics in such

cases. Immediate autogenous cartilage grafts for septal L-strut reconstruction were also performed. Folded conchal cartilages with or without bilateral extended spreader grafts may be a preferred reconstruction option. Autogenous grafts have relatively high biocompatibility and low risk of infection and extrusion. Furthermore, patients are psychologically more comfortable when autogenic tissues are used.

Autologous conchal and costal cartilage grafts have been commonly used for nose elongation with septal extension grafts [15–17]. Although both conchal and costal cartilages are useful for nasal reconstruction, the authors preferred to use conchal cartilage grafts for septal extension and nasal tip support as the first-line choice and only referred to costal cartilage grafts whenever the ear was not available as the donor site in this study. Conchal cartilage is more elastic, is considerably weaker, and can be harvested in a limited amount compared to costal cartilage. The latter is generally preferred for such reconstructions due to its strength and its available amount [15, 17]. The cases in this study were complicated with infection and soft tissue edema, and it might not be easy to reshape and support the nasal tip with weaker conchal cartilage grafts. The stiffness of the rib cartilage might be an advantage to provide strong support for the nasal tip and distal septum in the shape of spreader grafts. However, most young patients, particularly females in Asia, preferred inconspicuous scars, despite the camouflaging of scars under the bra or clothing, making it difficult to harvest costal cartilage as donor [7]. In addition, stiff costal cartilage may be prone to skin flap thinning and hardness and compromise vascularity after surgical removal of severe scar tissues at the nasal tip. Male patients generally had relatively thick skin at the nasal tip compared to females. Therefore, costal cartilages were mainly used in males for a strong septal L-strut to support the nasal tip.

In patients with exposed Medpor®, with or without infection which led to severe scar tissue deforming the nasal tip shape, surgical strategies should include dissection around the Medpor® and restoration of soft tissue tightness at the nasal tip. To reduce soft tissue healing problems or necrosis following reconstructions, soft tissue dissection was managed carefully with the minimal use of cautery on the nasal tip area. Subdermal dissection should be performed while preserving the subdermal plexus so as to not compromise vascularity to the nasal tip. To overcome soft tissue tightness in a severely scarred nasal tip, wide dissection and removal of scar tissue were conducted where severe scar tissues around the Medpor® were present. A concern regarding severance of the bilateral lateral nasal artery during wide dissection and removal of scar tissues at the nasal tip exists. However, we have not experienced necrosis of the nasal tip, despite severing the bilateral artery. After scar tissue removal, a superficial mastoid fascia or dermal graft onto the nasal tip might be a feasible option in patients with severe skin flap thinning at the nasal tip. Since following these principles, the authors have not experienced complications related to soft tissue healing or necrosis following reconstructions, even in patients with heavily scarred nasal tips.

The exact mechanism of complications related to Medpor® remains unknown. Gravity may cause Medpor® to continuously compress the underlying platform, adding to the pressure exerted from the surrounding soft tissues [14]. Use of Medpor® results in tissue ingrowth that is readily incorporated into the nasal skeletal framework with a lower risk of implant mobility, but these benefits come at the expense of intense fibrotic reactions. The tight adherence and scar formation around Medpor® may increase the risk of complications, such as subsequent extrusion. In an in vivo study by Thomas et al. [13], electron microscopic analyses demonstrated that all Medpor® used in rhinoplasty showed biofilm formation to various degrees, and all of them had at least some areas of severe biofilm formation. Medpor® use has been associated with a higher risk of infection due to the lack of vascular ingrowth, and hence a decreased ability to fight infections and a propensity for biofilm formation [13].

The limitations of this study were its small sample size and lack of statistical power. Cases with long-term complications related to Medpor® in this study might not represent high complication rates of Medpor®. Therefore, further investigation is required to determine long-term complication rates, such as Medpor® exposure and its correlation with infection. Despite these aforementioned limitations, the results of this study might be the first to demonstrate long-term complications of Medpor® and introduce a reconstructive strategy using autogenous cartilage grafts.

Conclusion

The devastated destruction of nasal support lines was found in all patients who underwent septal extension grafts using Medpor® for septorhinoplasty. The findings of this study provide important considerations for plastic surgeons using Medpor® for septorhinoplasty, and the use of Medpor® should be reduced for septorhinoplasty. Septal extension grafts using autogenous cartilages are the gold standard for septorhinoplasty. Autogenous cartilage grafts are the last resort for reconstruction of destructed septal L-struts following long-term complications after the use of Medpor®.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflicts of interest to disclose.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. For this retrospective study, formal consent is not required.

Informed Consent Informed consent was obtained from all individual participants included in this study.

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