

# The Utilization of Fresh Frozen Cartilage in Asian Rhinoplasty – A New Approach

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## INTRODUCTION

Rhinoplasty is one of the most popular plastic surgeries in the US and worldwide[1]. But given that individuals and ethnic groups have as much variation in nasal anatomy as they do nasal beauty standards, rhinoplasty remains a challenge, particularly Asian rhinoplasty[2]. The Asian nose is often characterized with a low dorsum, weak lower lateral cartilages, a bulbous nose tip, and a wide alar base[1,3]. Typically, Asian patients desire augmentation rather than reduction procedures[3]. Therefore, in order to achieve the optimal outcome of a typical Asian rhinoplasty, a large amount of grafting material is often required[2].

Many surgeons turned to alloplastic implants for augmentation rhinoplasty, primarily silicone implants. Patients with implants are more likely to develop complications including extrusion, thinning of the skin, displacement, and translucency of the implant[4]. Autologous cartilages are widely considered the most ideal material for a rhinoplasty, particularly septal cartilage, given its location and convenience[1]. However, Asian patients often don't have an abundant quantity of supplemental septal cartilages[3]. Moreover, Asian patients who seek a revision Asian rhinoplasty would have less available septal cartilage than during their primary procedures[5]. Autologous rib cartilage is a better option for an Asian patient who needs a large amount of cartilage for augmentation, but it is associated with prolonged operative time, hypertrophic scars, possible pneumothorax, pain, additional surgical expenses, and complications including warping and infection[6]. Because of the innate qualities of an Asian nose and the limitations of existing grafts, it is also widely accepted to use both alloplastic and autologous grafts for Asian patients[1]. Achieving a tip projection using autologous costal cartilages and making a structural onlay graft using silicone in one surgery are common in Asian rhinoplasties[1].

The fresh frozen cadaveric allograft from the Musculoskeletal Transplant Foundation (Edison, N.J.) is a novel choice for Asian rhinoplasty. It can provide the advantages of both alloplastic and autologous materials. The use of it has been published in a few studies on revision rhinoplasty,[5,7] but its use in Asian rhinoplasty has never been reported. Here, the Asian rhinoplasty cases that have used such evolving costal cadaveric cartilage are presented to show its potential benefits for Asian patients.

## MATERIALS AND METHODS

This case series is part of a prospective clinical trial comparing the use of allografts and autologous rib in rhinoplasty patients. Patients of Eastern Asian ethnicity from the clinical trial were further evaluated and discussed in this case series. Institutional Review Board approval and patients' informed consents were obtained.

Fresh frozen cartilages were harvested from the seventh to the ninth ribs of the donors[4]. Traditionally, cartilage allografts were processed and sterilized using irradiation. The cartilages that we used in this case series had a process of sterilization without irradiation. The cadaveric cartilages were stored in frozen conditions (-40°C to -80°C), and temperature was maintained using dry ice during shipment. 4 Before use for the implantation, cartilage tissue would need to be thawed.

Patients were followed up for an average of 14.2 months (12 months to 20 months). The senior author performed rhinoplasty for all five Asian patients in the case series. Photos were taken during the procure and operative notes were reviewed. Postoperative complications were recorded, including infection, deviation, resorption, warping, and/or necessity for revision surgeries. Before and after photos of the patients were taken in a standard photo room in our clinic with the same lighting and camera. Anthropometric measurements on standard 2-D photos were collected. Four measurements were taken and dorsal height, dorsal length, tip projection, and tip rotation were evaluated. Patient-reported outcomes were assessed by Face-Q scales.

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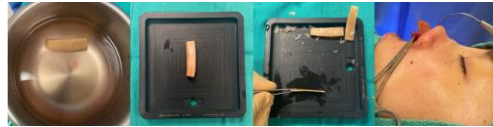
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## Methods Ctd

We used fresh frozen cartilage for spreader graft, columellar strut, nasal tip graft, septal extension graft and dorsal onlay graft. This cartilage is a powerful and efficient material to support and control nasal tip projection and rotation in Asian rhinoplasty.



**Fig. 1** A full-thickness segment of fresh frozen costal cartilage was thawed and fashioned into rhinoplasty grafts. A septal extension graft was placed to the patient on the right for an Asian rhinoplasty.

**Table 1. Patient demographics and medical history**

	Patient no.				
	1	2	3	4	5
Age at surgery (years)	21	41	23	30	22
Current smoking status	no	no	e-cigarettes	no	no
Medical history	left cleft lip	no	no	revision	no
Types of grafts made from the fresh frozen cartilage					
Spreader graft					✓
Columellar strut	✓	✓			✓
Tip elevation graft			✓	✓	
Septal extension graft	✓		✓	✓	
Dorsal onlay graft		✓	✓	✓	✓
Duration of follow-up (months)	12	14	20	13	12
Complications	no	no	no	minor scar	no

**Table 2. Patient Measurements**

		Before surgery	2-4 months after surgery	8-20 months after surgery
Subject 1	Nasofrontal Angle	137.948	132.182	*
	Nasofacial Angle	42.397	43.182	*
	Nasolabial Angle	81.183	83.803	*
	Goode Ratio	0.496	0.444	*
Subject 2	Nasofrontal Angle	152.14	148.435	148.174
	Nasofacial Angle	31.176	29.238	30.659
	Nasolabial Angle	107.343	102.151	102.095
	Goode Ratio	0.329	0.33	0.34
Subject 3	Nasofrontal Angle	147.573	150.437	150.563
	Nasofacial Angle	29.116	33.947	39.119
	Nasolabial Angle	82.079	92.184	93.127
	Goode Ratio	0.386	0.524	0.503
Subject 4	Nasofrontal Angle	150.523	144.527	144.513
	Nasofacial Angle	27.28	31.805	29.424
	Nasolabial Angle	95.915	102.69	100.909
	Goode Ratio	0.374	0.412	0.471
Subject 5	Nasofrontal Angle	132.566	139.054	140.45
	Nasofacial Angle	32.179	43.865	46.532
	Nasolabial Angle	109.661	93.372	93.434
	Goode Ratio	0.599	0.586	0.523

\*Subject 1 lost to photo follow-up, but she showed satisfaction on her Face-Q questionnaire 1 year after the surgery.

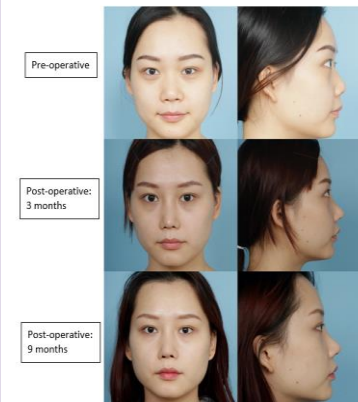
## RESULTS

The senior author has performed five Asian rhinoplasties using fresh frozen cartilage allografts. Patients' demographics and medical history are presented in **Table 1**.

Surgeries were performed between May 2018 and January 2020. There were no major adverse events or complications among any patients. One patient complained about an incision scar 6 months after the surgery that was resolved with continuous massage. No resorption or warping were recorded at time points one year or more after their rhinoplasties. In order to assess the surgical outcomes objectively, we performed anthropometric measurements and analysis on the facial profile of the standard 2D photos from all five patients. On follow-up, the measurements of the nasofrontal, nasofacial and nasolabial angles and the Goode ratio (the ratio of the line from the alar-facial groove to the nasion to the nasal tip) were taken. This data can be found in **Table 2**.

At the time of the six-month follow-up, mean FACE-Q Satisfaction With Nose, and Satisfaction With Nostrils scores improved from  $35.2 \pm 10.06$  to  $66 \pm 18.23$  ( $P = 0.0107$ ), and  $42.6 \pm 20.31$  to  $61.4 \pm 38.29$  ( $P = 0.36$ ), respectively. At the time of the 1-year follow-up, mean FACE-Q Satisfaction With Nose, and Satisfaction With Nostrils scores improved from  $35.2 \pm 10.06$  to  $60 \pm 15.48$  ( $P = 0.0002$ ), and  $42.6 \pm 20.31$  to  $59.8 \pm 38.21$  ( $P = 0.12$ ), respectively.

## DISCUSSION



**Fig. 2** Comparing 3-month and 9-month postoperative photos, there was no infection, warping or resorption.

Allographic cadaveric cartilage overcomes the shortcomings of alloplastic materials as well as autologous cartilage. Previous concerns on cadaveric cartilage are high resorption and infection rates, because irradiation was applied to sterilize the costal cartilage[8,9]. During the process of irradiation, the chondrocyte viability and the integrity of the cartilage were reduced[4]. Many studies have proved that irradiated cartilage allografts are more likely to be resorbed and cause warping and undesired long-term results[8,9]. The novel allograft provided by Musculoskeletal Transplant Foundation (Edison, N.J.) is processed by high-quality sterility standards without irradiation[4]. Compared with synthetic implants, it is biocompatible and compared with the autologous costal cartilage it is able to avoid chest wall deformity, pneumothorax, pain, and scarring. More importantly, it solves the problem of resorption of irradiated grafts. Other advantages include an adequate amount of cartilage, lower costs, and shorter operative time[4].

## CONCLUSIONS

Fresh frozen cadaveric cartilage is an excellent option for Asian rhinoplasty. It has the advantage over current standards of more abundant supply, no donor site morbidity, shorter operative time, and lower surgical costs. Our case series also proved the safety and satisfying surgical outcomes using fresh frozen cartilage allografts. Further investigation involving a greater number of patients and longer follow-up time is needed.

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