Egypt, J. Plast. Reconstr. Surg., Vol. 46, No. 2, April: 137-141, 2022

L-Shaped Costal Cartilage Grafts for Para-Nasal and Alar Base Augmentation in Cleft Patients

MOHAMMED A. HUSSEIN, M.D. and OMAR A. ELSHARKAWY, M.D.

The Department of Plastic & Reconstructive Surgery, Faculty of Medicine, Cairo University

ABSTRACT

Background: A concave pyriform area is a common finding in cleft patients. The effect of pyriform aperture deficiency is extended to the alar base as well as the lower later cartilage. Paranasal augmentation is a useful procedure in those patients, which simulate the visual effect of Le fort I osteotomy.

Methods: In 15 patients (3 males & 12 females) with unilateral cleft deformity the 6th costal cartilage was used to create L-shaped paranasal graft which was inserted through limited upper buccal sulcus incision on the cleft side. The graft was fixed to its ideal location using mini-screws. The residual part of the costal cartilage was subcutaneously banked through the same infra-mammary incision for later rhinoplasty.

Results: The graft thickness ranged from 3 to 6mm. The dimensions of the graft were 2.5 x 2.5cm in both vertical and transverse dimensions. In 10 patients, unilateral paranasal augmentation was done while bilateral grafts were done in 5 unilateral cleft patients when bilateral pyriform deficiency was noticed. In 13 patients, grafts were felt in place with adequate height during the 2nd stage rhinoplasty, while partial graft resorption was notice in two patients.

Conclusions: Medially extended L shaped paranasal cartilage graft is a good modality for correction of the pyriform aperture as well as the alar base in cleft patients. The donor site morbidity could be used for both paranasal augmentation as well as later rhinoplasty grafts.

Key Words: *Alveolar cleft – Costal cartilage – Graft.*

Disclosure: None of the authors have any conflicts of interest or financial interest in any of the products that had been used or mentioned in this article.

INTRODUCTION

Cleft patients usually have paranasal volume deficiency with localized concavity at the pyriform aperture, which can be manifested clinically as a flattened facial profile, depressed as well as laterally displaced alar base, and compressed nasolabial angle **[1]**. Many surgical procedures had been described for correction of such deficiency that can be ranging from simple paranasal augmentation, up to Le Fort I osteotomy in severe maxillary hypoplasia **[2]**. Usually, the paranasal augmentation can be used to camouflage the paranasal deficiency when the dental occlusion is normal and there is no need for aggressive osteotomies that might negatively affect patients' palatal length. This can be done with either alloplastic materials or autogenous graft **[3]**.

The aim of this study was to evaluate the effect of medially extended L-shaped costal cartilage graft for paranasal augmentation on the pyriform aperture and nasal base in patients with unilateral cleft.

PATIENTS AND METHODS

Following institutional ethical committee approval, Patients with unilateral complete cleft lip or complete cleft lip & palate who were presented for corrective rhinoplasty between September 2019 & October 2021 were reviewed. Fifteen cleft patients (3 males & 12 females) with paranasal volume deficiency were included in our study. Patients were included provided that they have acceptable dental occlusion and they are not warranting orthognathic surgery, and provided that they didn't have previous surgeries for correction of paranasal area or for the nose. A written informed consent has been obtained from all patients.

For all patients 2 stages surgeries were done with 6 months interval. During the first stage costal cartilage harvesting (6th rib) through direct inframammary approach according to technique published Gaba, et al., **[4]** this graft had been used for both paranasal augmentation grafts and the residual cartilage was banked subcutaneously through the same incision for later rhinoplasty. During the 1st stage lip revisions, oro-nasal fistulae closure, alar rim repositioning or fat grafting for the scarred lip could be added when needed. During the 2nd stage, the previously banked costal cartilage was used to graft different components during rhinoplasty like

strut, alar rim and tip grafts. Harvesting the 6th costal cartilage graft gives easily the ideal extended medially L-shaped paranasal graft form the most lateral portion while the straight medial portion of the costal cartilage can be used to harvest different rhinoplasty grafts. (Fig. 1).

Through upper gingivobuccal sulcus incision extended from the central incisor to the canine to allow exposure of the pyriform area. Dissection was carried in the sub-periosteal plane. Dissection should be limited upward and lateral to avoid unnecessary facial oedema, while dissection was carried medially and inferiorly along the bony rim of the nostril to create an ample space for the graft. Then the grafts were contoured to adapt the shape of nostril and the depressed recipient site. The graft was then secured to the pyriform area and fixed by 10-mm mini-screw, to prevent migration of the graft. A 2-0 prolene alar cinch suture was done before closure the wound with 0-3 absorbable vicryl sutures.

Bilateral paranasal augmentation was done in some patients with unilateral cleft when bilateral pyriform deficiencies were noticed, however the thickness of grafts were adjusted to symmetrize the results. Also, the same concept could be applied to bilateral cleft cases. Patients had been followed-up for 6-12 months post rhinoplasty (12-18 months post paranasal augmentation). (Fig. 2).

Fig. (1): Costal cartilage grafts after being divided into two para-nasal grafts for each side with the straight graft being banked subcutaneously for later rhinoplasty.

Fig. (2): Intra-operative photography of the upper buccal area following fixation of bilateral paranasal augmentation grafts in a unilateral cleft patient. It is noticeable that both grafts are asymmetrical and shaped according to the desired shape. Both grafts are fixed to their ideal location using mini-screws.

RESULTS

Fifteen patients (3 males & 12 females) presented to the plastic surgery department were included in our study who met our inclusion criteria (Table 1). Patients' age ranged between 16 and 28 years old at the time operation. In all patients, the 6th costal cartilage graft was harvested from the osteo-chondral junction laterally to the sterno-chondral junction medially. The lateral angulated part of the graft was used for para-nasal augmentation graft while the straight medial part was banked for lateral stage rhinoplasty. The graft thickness ranged from 3 to 6mm, depending on the degree pyriform deficiencies. While the dimensions of the graft were 2.5 x 2.5cm in both vertical and transverse dimensions. 5 patients' bilateral paranasal augmentation was done. Patient follow-up ranged from 12 to 18 months post-operative.

Overall, the aesthetic outcomes were satisfactory for all patients. There was adequate improvement of the nasolabial folds when compared pre-operatively and 6-month post-operative photographs. From the basal view, there was adequate elevation of the alar rim on the cleft side with adequate medialization which become resampling the normal side (Figs. 3,4,5). Partial graft resorption was notice in two patients on long term follow-up which was confirmed during rhinoplasty. In those 2 patients' exploration of the lower edge of the graft was done and the thickness was measure using a caliber which revealed graft thickness less than 2.5mm in both patients.

Fig. (3): Pre-operative photography “Rt. Side” of 17 years old patient with Rt unilateral complete cleft lip & palate and 8 months post-operative photography (Lt side) following Rt sided paranasal augmentation.

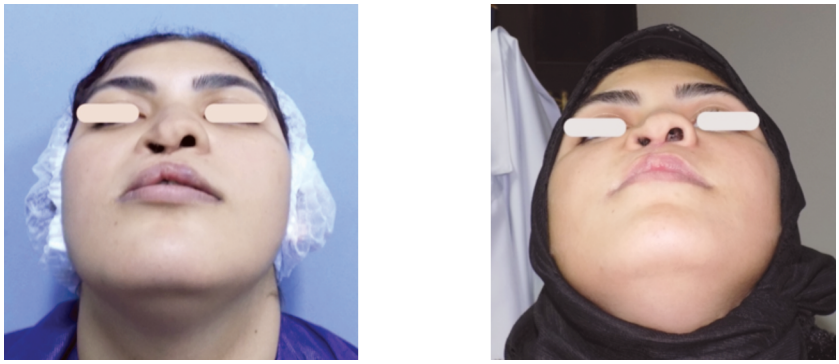

Fig. (4): Pre-operative photography “Lt. Side” of 24 years old patient with Rt unilateral complete cleft lip & palate and 4 months post-operative photography (Rt side) following Rt sided paranasal augmentation.

Fig. (5): Pre-operative photography “upper raw” of 24 years old patient with Rt unilateral complete cleft lip & palate. Intra-operative photography “down raw-left side” following bilateral paranasal augmentation and alar sinching suture and one month post-operative photography (Down raw-Rt side and central) following rhinoplasty.

Table (1): Demographic distribution of the study group.

Patient	Age	Cleft side	Association		Costal Cartilage Graft		
			Deformity	Treatment	Paranasal grafting	Thickness	Resorption*
1	24	LT	Short lip	Abbe flap	Bilateral	6mm	–
2	26	RT	Short lip	Abbe flap	Bilateral	5	–
3	28	LT	Vermilion asymmetry	Z-plasty	unilateral	6	–
4	27	LT	Naso-alveolar fistula	Closure + Alveolar bone graft	Unilateral	3	–
5	19	LT	Scarred lip	Lip revision	Bilateral	5	–
6	22	RT	Short lip	Lip revision	Unilateral	6	–
7	20	RT	Vermilion asymmetry	Z-plasty	Bilateral	5	–
8	24	LT	Naso-alveolar fistula	Closure + Alveolar bone graft	Unilateral	5	–
9	16	RT	Naso-alveolar fistula	Closure + Alveolar bone graft	Unilateral	4	–
10	32	LT	whistle deformity	Lip revision	Unilateral	6	2 mm
11	25	LT	Abnormal scarring	Lip revision	Unilateral	5	2.5 mm
12	18	RT	whistle deformity	Lip revision	Unilateral	6	–
13	29	LT	Naso-alveolar fistula	Closure + Alveolar bone graft	Bilateral	4	–
14	34	RT	Wide lip	Lip revision	Unilateral	4	–
15	25	LT	Naso-alveolar fistula	Closure + Alveolar bone graft	Unilateral	5	

*Graft thickness at the time of rhinoplasty.

DISCUSSION

Midface hypoplasia is a common aesthetic complaint among cleft patients. The severity of the deformity ranging from simple pyriform aperture deficiency with normal occlusion to the severest form in which there is mid face deficiency with class III malocclusion **[5]**. The selection of the appropriate surgical procedure depends on the patients' dental occlusion. In patients with midface concavity without malocclusion paranasal augmentation is a useful procedure, which simulate the visual effect of Le fort I osteotomy. Alloplastic implants including porous polyethylene, medpor & silicone implants are nowadays considered the gold standard technique in non-cleft patients **[6]**. It has many advantages that had been descripted in literature, however, the most obvious advantage is the avoidance of the donor site morbidity **[7]**.

In cleft patients the lower midface deficiency is pretty common deformity due to both intrinsic maxillary growth abnormality or soft tissue scarring and alteration of soft tissue following palatal repair which might also restrict maxillary growth. Many authors had reported that staged palatal closure (Closure of soft palate at 6 months and closure of hard palate not before the age of 15 months) has less effect on maxillary growth and development. However, other authors reported that primary palatal closure that require large flaps displacement generate great scars burden that affect more the maxillary growth. The maxillary hypoplasia not only alter the facial convexity but also affects the shape and projection of the nose. There is usually anatomical asymmetry affecting all nasal subunits with depression of the alar rim on the affected. Which necessities augmentation of the alar base & pyriform aperture to achieve proper elevation and repositioning of the alar rim. Yen et al., reported that raising the nasal alar base not only correct the midface deficiency but also improve overall rhinoplasty results and patient satisfaction **[5]**.

Up to date, there is not gold standard technique for correction of paranasal & alar base depression in cleft patient **[1]**. Only few publications discussed the effect of autologous grafts or synthetic implants for paranasal augmentation only. Among all grafts, medpor was the most widely used, because its good biocompatibility, easily shaped, no donor site morbidity with shorter operation time **[6]**. However, some studies had showed increased the risk of infection particularly in patients with naso-alveolar fistula at the time of surgery **[8]**. Autologous grafts include iliac grafts, coronoid process, blocked & diced cartilage grafts. However, the donor site morbidity was always the main drawback. The advantage of bone graft over the cartilage graft is the slower resorption rate, however shaping of the graft is a difficult task **[9]**. In our study we overcome the donor site morbidity by using the costal cartilage grafts which is usually planned to be used for the later stage rhinoplasty, thus single donor site for two procedures. On the other hand, reshaping of the graft was very easy and can be adjusted well to the nostril and alar base. It had been reported

in literature that the cartilage grafts have the tendency shift with facial muscle action **[1]**, in our study we used titanium mini-screws to fix the grafts to its desired location. On long term follow-up we didn't notice any significant graft resorption on basal & lateral views of colored photographs.

Paranasal augmentation is usually a useful adjunct to later rhinoplasty, it also improves the relationship between the paranasal area and upper lip as well as the naso- labial angle **[5]**. The medially extended portion of the graft improves the alar base on the affected side. Another finding during our study that the nasal tip projection as well as rotation improved and this made the lateral rhinoplasty tip work much easier. For the banked part of the costal cartilage, 6 months was enough time for warping to occur, thus the grafts harvested at the time of rhinoplasty were straight grafts.

However, our study had some limitations; the small sample size, lack of quantitively measurements comparing the pre-operative & post-operative photographs, also the short term follows-up of the patients since many authors reported the cartilage resorption on longer follow-up.

Conclusion:

Medially extended paranasal graft is a good modality for correction of the pyriform aperture as well as the alar base in cleft patients. The donor site morbidity could be used for both paranasal augmentation as well as later rhinoplasty.

REFERENCES

1- Dong W., Xu Y., Han R., Zheng R. and Fan F.: Paranasal Augmentation Using Diced Costal Cartilage for Midface Concavity: A Retrospective Study of 68 Patients. Aesth. Plast. Surg., 2021, https://doi.org/10.1007/s00266-021-02593-w

2- Kim J.H., Jung M.S., Lee B.H., Jeong H.S., Suh I.S. and Ahn D.K.: Silicone Implant-Based Paranasal Augmentation for Mild Midface Concavity. Arch. Craniofac. Surg., 7 (1): 20, 2016.

3- Yaremchuk M.J. and Israeli D.: Paranasal implants for correction of midface concavity. Vol. 102, Plast. Recon. Surg., 102 (5): 1676, 1998.

4- Gaba S., Gupta R., Mishra B. and Sahni D.: Harvesting split thickness costal cartilage graft. Indian J. Plast. Surg., 50 (1): 79, 2017.

5- Yen C.I., Chen R.F., Zelken J., Chang C.S., Yang S.Y., Chen H.C., et al.: The influence of paranasal augmentation on the measurement of the nose for the treatment of midfacial concavity. Aesth. Plast. Surg., 38 (3): 241, 2018.

6- You J-S., Kim S-G., Oh J-S., Lim K-S., Shin S-M. and Kim C-M.: Paranasal augmentation using Medpor® implant and changes in lateral profile. Oral Biology Research, 37 (2): 125, 2013.

7- Yen C.I., Chang C.S., Chen H.C., Yang S.Y., Chang S.Y., Yang J.Y., et al.: Paranasal Augmentation with Composite Graft Transfer in Over resection of Alar Base and Nostril Contracture. Ann. Plast. Surg., 86 (2): 133, 2021.

8- Kim S.K., Yoon C.M., Kim M.H., Kim M.S. and Lee K.C.: Considerations for the management of cryptotia based on the experience of 34 patients. Arch. Plast. Surg., 39 (6): 601, 2012.

9- Liang Y. and Wang X.: Application of Diced Autologous Rib Cartilage for Paranasal Augmentation in Cleft Nose. Aesth. Plast. Surg., 45 (3): 1169, 2021.