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The Joint Tip Graft: A Joint Support for Rim, Facet and Infratip Lobule in Rhinoplasty

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Abstract

Background The authors of this study have developed a novel graft called the 'The Joint Tip Graft' which adds support to the lateral crus, camouflages the tip grafts, supports the facet and adds volume to the nasal tip as a single graft. The aim of this study was to define and introduce the tripod graft.

Methods Thirty patients who underwent primary rhinoplasty at a tertiary academic center were included. Patients were randomly assigned into two groups according to the grafts used: group 1: Joint tip graft was additionally used, and group 2: Joint tip graft was not used. All patients were photographed by a photographer who is familiar with medical photography. Preoperative and postoperative sixth month photographs were taken for analysis. The brightest point of the infratip lobule and the darkest point of the facets were selected and analyzed with computer software. The luminance ratio of facet to infratip lobule was calculated to overcome light and head position differences.

Results Mean infratip luminance scores were 112.20 ± 5.72 and 109.73 ± 7.13 in groups 1 and 2, respectively ($p > 0.05$). Mean facet luminance scores were 101.33 ± 4.91 and 89.27 ± 5.11 in groups 1 and 2, respectively ($p < 0.05$). Facet/infratip luminance ratios were calculated for each group. Mean facet/infratip luminance ratios were 0.90 ± 0.01 and 0.82 ± 0.16 for groups 1 and 2, respectively ($p < 0.05$).

Conclusions The joint tip graft is a novel graft that is easy to harvest and apply. It spans both of the alar cartilages, supports the facet area and creates a smooth gradual light shadow transition. Additionally, it acts as a camouflage over the tip grafts.

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 Septorhinoplasty · Rhinoplasty · Joint tip graft · Tip plasty · Camouflage graft

Introduction

The nasal tip is esthetically important as it is the most prominent part of the nose. Additionally, it is closely related to breathing function as it comprises the external nasal valve. It is also considered as a challenging aspect of rhinoplasty because of the variable dynamic anatomy and the long-term effects related to would healing [1].

Various grafts and suture techniques have been defined to contour the nasal tip [2–7]. Tip grafts are mainly used to increase projection and rotation and provide structural support, contouring and camouflaging [6, 7]. Autologous cartilage grafts are the most commonly used grafts because of availability and avoiding risks of graft extrusion or infection which is more common in alloplastic grafts. However, autologous cartilage grafts may become visible especially in patients with thin skin once the postoperative

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edema has resolved [8]. This could be minimized by camouflage grafts, using fascia or fine carving of the grafts [1, 9].

The soft tissue triangle is often neglected during surgery, and as a result, deformities of this area are common postoperatively [10]. Most of the deformities are related to the iatrogenic weakening (e.g., transdomal sutures, lateral crural spanning sutures, cephalic trim) of the alar rim leading to postoperative concavity of the alar rim [10, 11]. These deformities may cause an unwanted appearance of notching, retraction, alar weakness and by changing the natural shadowing. These deformities can be corrected with a lateral crural strut or alar rim grafts [11, 12].

The authors of this study have developed a novel graft called the 'Joint Tip Graft' which adds support to the lateral crus, camouflages the tip grafts, supports the facet and adds volume to the nasal tip as a single graft. It is best used to camouflage tip grafts like cap grafts and to support the facet area in patients in whom the midline support is robust and causes relative weakness of the lateral aspects of the nasal tip tripod. The aim of this study was to define and introduce the joint tip graft. The secondary aim was to assess the additional role of joint tip grafts in droopy and noses with decreased projection.

Materials and Methods

Thirty patients who underwent primary rhinoplasty at a tertiary academic center between June 2017 and January 2018 were included. 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. It was approved by the institutional review board (approval no: 17-1.11/11). Informed consent was obtained from all of the subjects.

Patient Selection

All patients were selected from primary rhinoplasty patients who required increased tip projection. Revision cases and crooked nose patients were excluded. To standardize the patient groups, the same surgeon performed the same technique with the same skin and cartilage features in cases with droopy noses. Tip projection and rotation were increased and supported by hemidomal sutures, lateral crural steal, cap graft and columellar strut in all patients. Patients were randomly assigned to two groups according to the grafts used: group 1: Joint tip graft was additionally used, and group 2: Joint tip graft was not used.

Procedure

All patients were operated on under general anesthesia employing an open technique. The graft is harvested after dorsal skeletonization. Bilateral cephalic trimming is planned with leaving enough (approximately 6–8 mm) width of the caudal lower lateral cartilage. Bilateral incisions are made with a no. 15 blade starting from the intermediate and lateral crura (Fig. 1 a). Meticilous dissection is carried out leaving both the caudal perichondrium attached to the soft tissue in the midline (Fig. 1 b). The soft tissue over the caudal septum is resected and included in the graft. The resection is carried out anteriorly. The Pitanguy ligament is freed from the medial crura and included in the graft (Fig. 1 c). The harvested graft has two strips of cartilage attached to soft tissue (Fig. 2).

This graft is used at the end of tip plasty. The articulated cartilages are sutured to the caudal part of the intermediate and lateral cruses with 5/0 PDS suture. The soft tissue part of the graft is laid over the domes and sutured to the facet area with 5/0 Vicryl suture to prevent migration of the graft. The graft is named the 'joint tip graft' because two cartilage pieces make a joint at the soft tissue compartment and cover the nasal tip (Fig. 3 a, b).

All patients were photographed by a photographer who is familiar with medical photography in a room reserved for facial plastic surgery photography. Preoperative and postoperative sixth month photographs were taken for analysis.

Instrumentation and Analysis

Frontal, lateral, three-quarter, basal and sky views were taken preoperatively and at the sixth month by the same photographer using a 105-mm macrolens (Nikon F2.8, 105 mm Macrolens, Nikon) and two paraflashes.

Measuring shadows and bright areas on a digital image requires the help of computer software. A free software named Digital Color Meter was used to analyze the digital images on a MacOS X operating system (Apple Inc., Cupertino, California, USA). Color values of colored digital images are perceived as RGB (red–green–blue). However, if the colored images are converted to gray scale, the RGB value reflects the luminance (also intensity or brightness) of the pixel (0–255) which is the mean of these three colors. In this scale, 0 reflects black where there is no light, whereas 255 reflects white or maximum brightness. Software analysis of the pictures was made by the same otolaryngologists. Luminance values of the facets and infratip area were calculated. The brightest point of the infratip lobule and the darkest point of the facets were selected for analysis (Figs. 4, 5). The luminance ratio of the facet to infratip lobule was also calculated to overcome

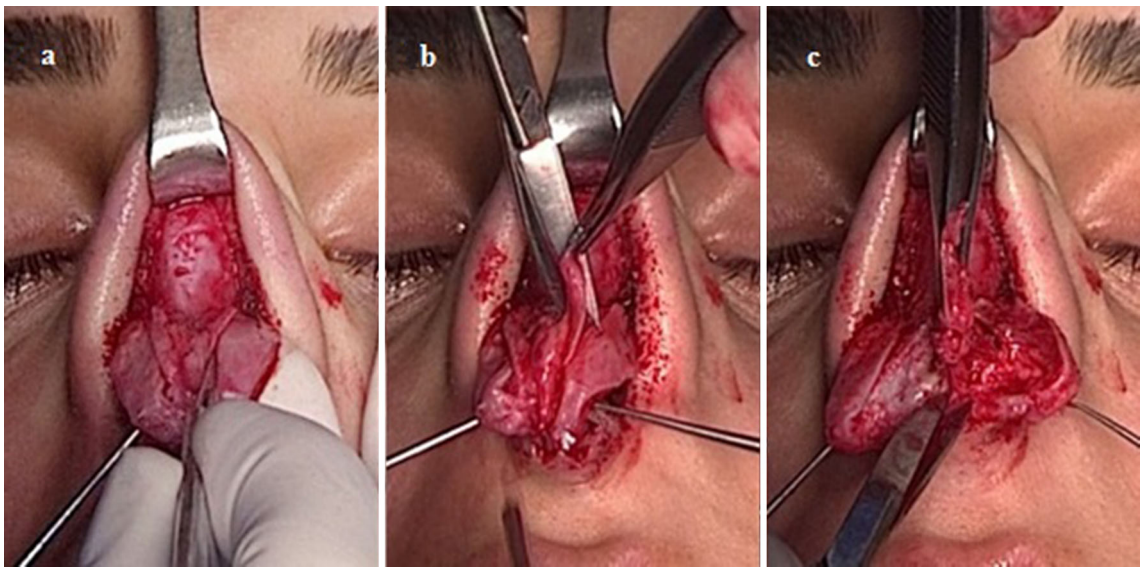

Fig. 1 **a** Incisions for cephalic trimming were made with a no. 15 blade. **b** Both cartilages are left attached to the midline soft tissue. **c** The graft is lifted with a forceps, and the Pitanguy ligament is cut inferiorly

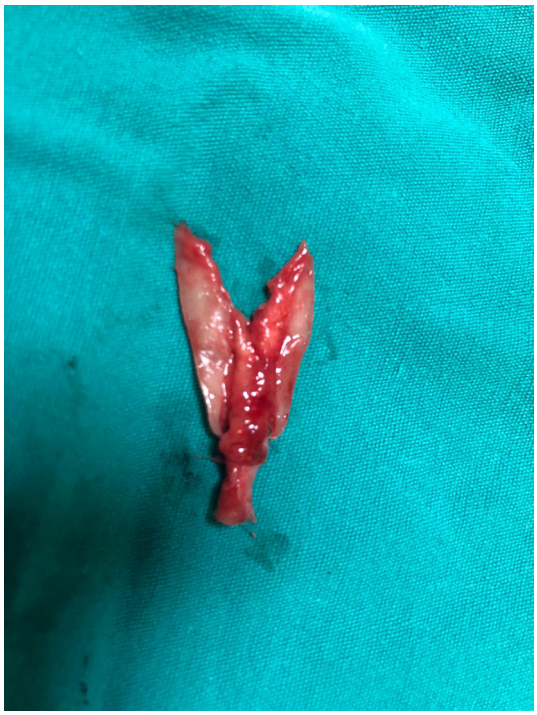

Fig. 2 Joint tip graft

light and head position differences. The lowest one of both sides was used for statistical analysis. A higher luminance ratio resembles a more subtle and smooth transition from rim to infratip lobule including the facet region.

Outcomes

Luminance values of the infratip lobule and facets regarding the two groups were analyzed and compared on postoperative sixth month pictures.

Statistical Analysis

Statistical analysis was made using computer software (SPSS version 22.0, SPSS Inc., Chicago, IL, USA). Chi-square (X2) exact tests were used for the comparison of categorical data. Independent and paired sample t tests were used for the analysis of parametric variables, whereas Wilcoxon and Mann–Whitney U tests were used for the analysis of nonparametric variables based on the distribution pattern of the data. A p value less than 0.05 was considered as statistically significant.

Results

A total of 30 patients were included in the study (group 1: 15 patients, group 2: 15 patients). The mean age of the patients was 28.17 ± 5.90 years (range 20–44 years), and mean infratip luminance scores were 112.20 ± 5.72 and 109.73 ± 7.13 in groups 1 and 2, respectively ($p > 0.05$). Mean facet luminance scores were 101.33 ± 4.91 and 89.27 ± 5.11 in groups 1 and 2, respectively ($p < 0.05$).

Facet/infratip luminance ratios were calculated for each group. Mean facet/infratip luminance ratios were 0.90 ± 0.01 and 0.82 ± 0.16 for groups 1 and 2, respectively ($p < 0.05$).

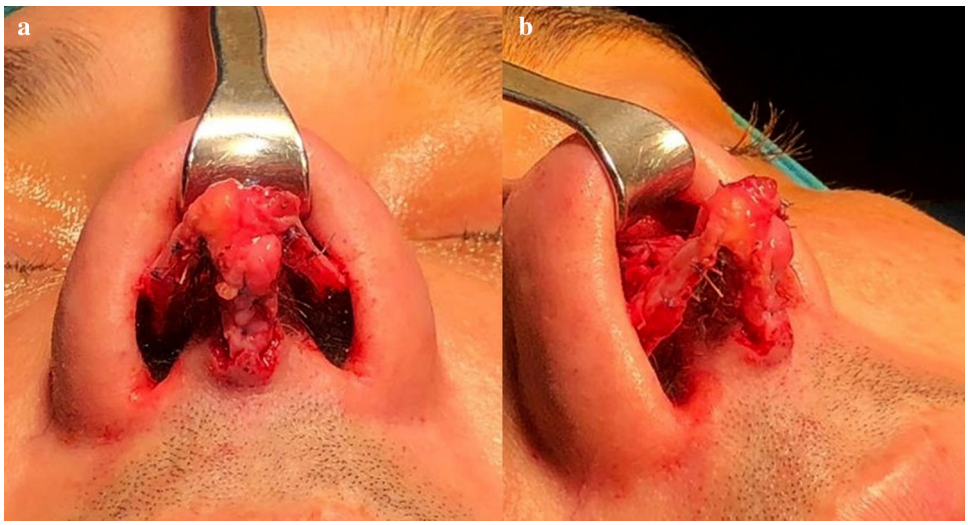

Fig. 3 Joint tip graft sutured in position

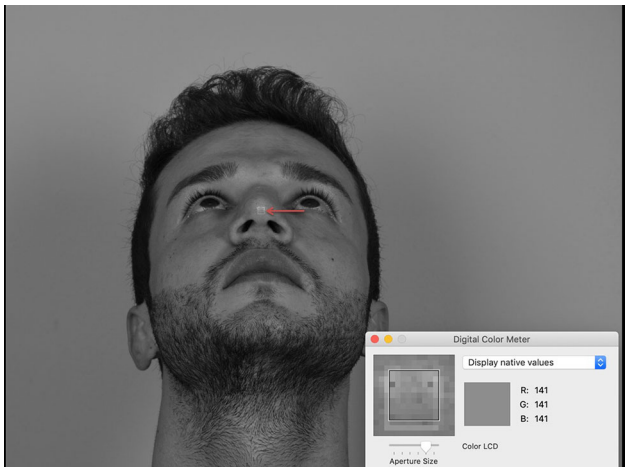

Fig. 4 Brightest point is selected and marked with a red arrow in the infratip lobule

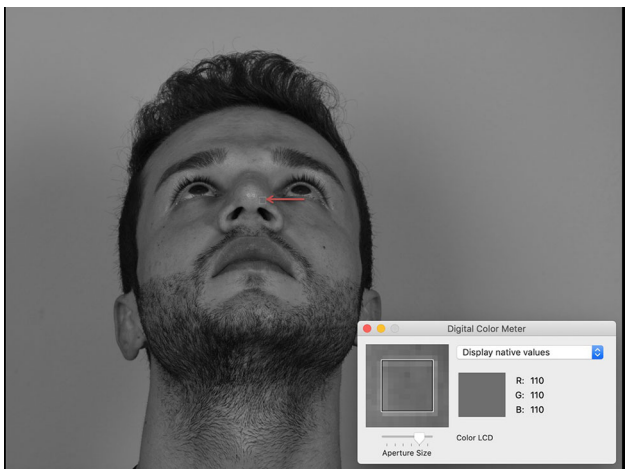

Fig. 5 Darkest point is selected and marked with a red arrow in the facet area

Discussion

Achieving a natural and esthetically attractive nose is the ultimate goal of every surgeon. Smooth light reflections and gradual transitions into shadow are hallmarks of an esthetically fine-looking nose. Deformities of the cartilaginous framework and the overlying soft tissue have an effect on the visual perception of the nose by altering the lights and shadows. The nasal tip is of utmost importance for an esthetically pleasing nose as it is the most prominent part of the nose and major parameters of nasal tip esthetics are projection, rotation and tip definition. An ideal nasal base view of the nose is defined as a triangular shape with no notching between the tip lobule and alar lobule [3].

The soft tissue triangle has a unique anatomy that lacks structure framework. The main support is the underlying soft tissue and to some extent the intermediate crura of the lower lateral cartilages. Its concave shape, lack of structural support, presence of dermis-to-dermis contact and surgical manipulation make this special region prone to notching and deformity [10]. Campbell et al. recommend placing the incision high within the vestibule of the soft tissue triangle away from the alar rim, supporting the soft tissue framework with cartilage grafts and preventing tension across the soft tissue triangle by placing closure sutures distant from the soft tissue triangle [10]. Additionally, improper tip suturing and a relatively too strong columellar strut might also cause weakness of this area. Placement of a lateral strut graft or facet graft is recommended for preventing notching of this area [12, 13].

Weakening of the lateral crus not only deteriorates breathing function by causing external nasal valve collapse, but also causes an unpleasant look related to the excessive concavity altering the alar base contour. Many techniques

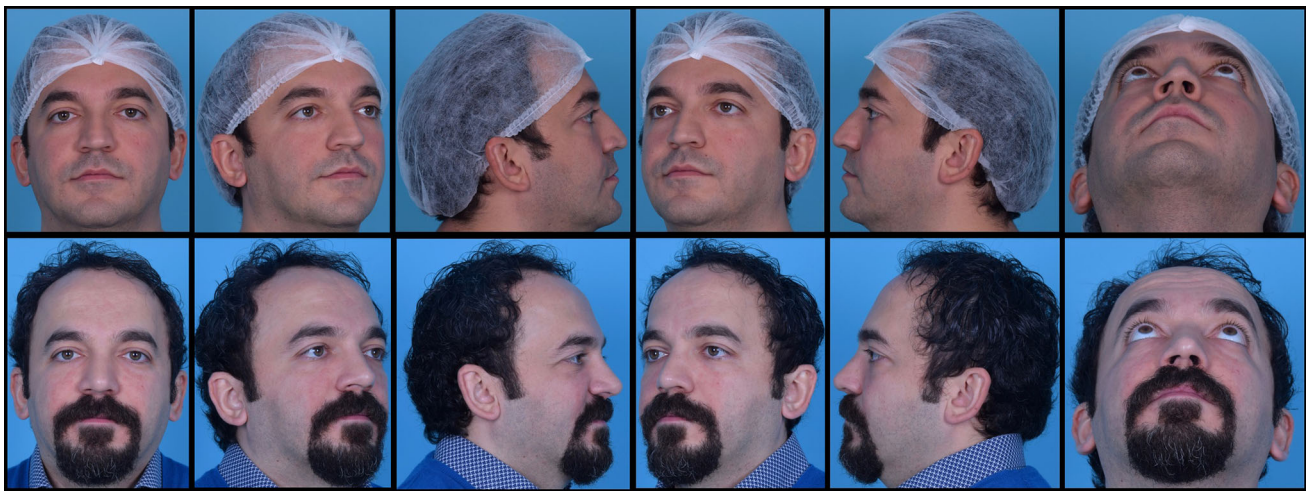

Fig. 6 Preoperative and postoperative six-month photographs of a 38-year-old male patient with joint tip graft. (Frontal, left oblique, left lateral, right oblique, right lateral and base view)

Fig. 7 Preoperative and postoperative six-month photographs of a 23-year-old female patient with joint tip graft. (Frontal, left oblique, left lateral, right oblique, right lateral and base view)

have been described to overcome this complication, most necessitating the placement of a cartilage graft [12, 14, 15].

Tip grafts are primarily used to increase projection. It is recommended to bevel all edges of the tip graft to ensure a smooth transition and to decrease the chance of graft visibility [16, 17]. Tourimi et al. recommend using soft tissue camouflage grafts if the tip graft projects more than 3 mm above the existing domes [3]. Seneldir et al. defined the camouflaging alar tip (CAT) graft for camouflaging [1]. The cephalic part of the lateral crura with soft tissue was used, and they reported that the CAT graft provides a smooth transition from the edge of the tip graft to the surrounding lateral crura with long-term satisfactory results.

The novel joint tip graft is a single graft that supports both the soft tissue triangle and lateral cruses. Additionally, it acts as a camouflage graft over the tip grafts. The columella and the infratip lobule have a robust structure because it is supported with a columellar strut, tip grafts and septal cartilage. However, the soft triangle and the alar rely on the alar cartilage and the soft tissue envelope. This structure is usually weakened in most rhinoplasty cases due to cephalic resections. Thus, the soft triangle is more prone to notching and abnormal shadowing. The joint tip graft supports both the alar cartilage and facet area with cartilage. It helps to maintain the equilateral nasal base shape and prevents alar collapse. Because the facet area is reinforced, abnormal shadowing is precluded. This was objectively supported with the results of this study. The

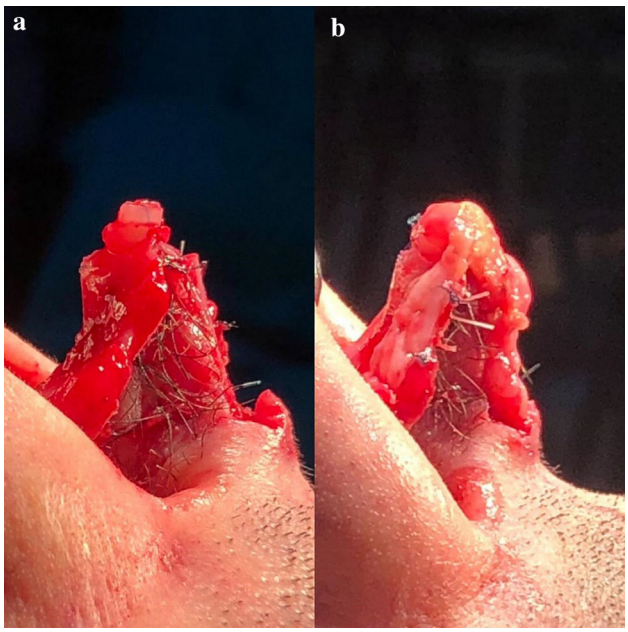

Fig. 8 **a** Columellar strut + cap graft and **b** columellar strut + cap graft + joint tip graft

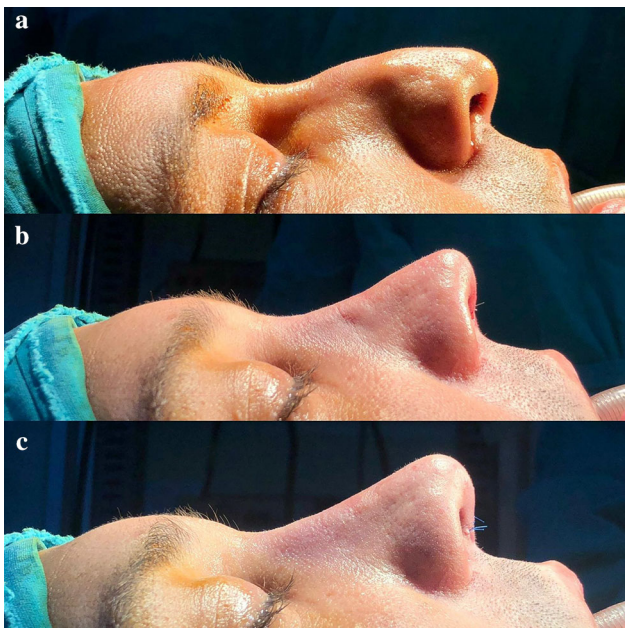

Fig. 9 Top to bottom: at the beginning of surgery, without joint tip graft (columellar strut + cap graft), with joint tip graft (columellar strut + cap graft + joint tip graft). The volume provided by the joint tip graft is prominent in the undermost picture

mean facet/infratip luminance ratios were significantly higher (0.90 ± 0.01 vs. 0.82 ± 0.16) in patients with joint tip grafts. A higher score indicates a smoother transition from light to shadows. A lower ratio may be attributed to lower structural support on the facet area. The results yielded that the structural support provided by the joint tip

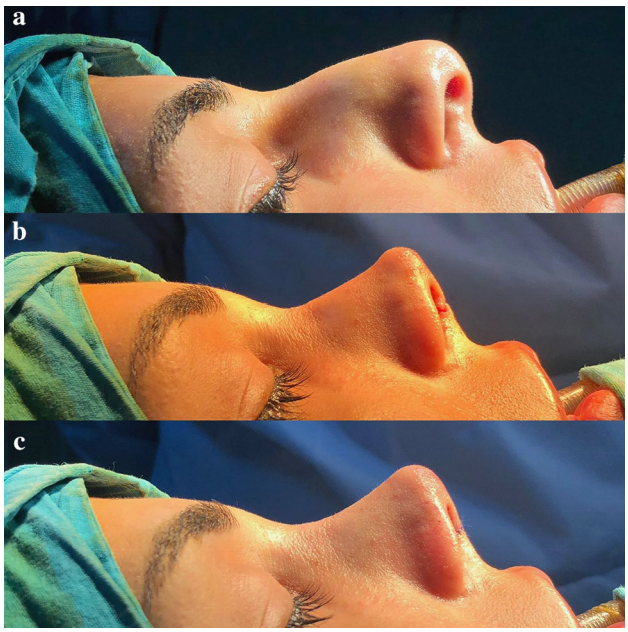

Fig. 10 Top to bottom: at the beginning of surgery, without joint tip graft, with joint tip graft. The volume provided by the joint tip graft is prominent

graft on the rim and facets creates a smooth transition and adds volume to this particularly weakened part of the nasal tip (Figs. 6, 7).

Pedroza et al. defined the tripod graft which is also articulated and covers the tripod of the nasal tip; however, this graft mandates the harvest of auricular cartilage and is reserved for revision rhinoplasty [18]. While the tripod graft is a thicker and larger graft planned for robust structural support and to bear weight in revision cases, the joint tip graft provides less structural support but adds refinement and camouflage.

The joint tip graft is easy to harvest and readily available in most primary rhinoplasty cases. Additionally, this graft can be custom-tailored according to the asymmetries of the alar cartilages. In this case, it may be applied asymmetrically or unilaterally. However, this graft may not be available in patients with very thin lower lateral cartilages or revision cases with prior cephalic resections. Long-term results are lacking, and risk of resorption is present as in all grafts. However, Seneldir et al. reported that their CAT graft has a low risk of resorption because their graft was composed of nondamaged autologous fascia, soft tissue and cartilage [1]. Since the graft defined in this study is similar to the CAT graft in terms of tissue properties, significant resorption is not expected. The joint tip graft is a joint graft that comprises the effects of rim, facet and shield grafts and additionally has tip camouflage properties. It adds volume to the structural tip complex eventually producing smoother transitions (Figs. 8, 9 and 10).

Conclusion

The joint tip graft is a novel graft that is easy to harvest and apply. It is a joint graft that comprises the effects of rim, facet and shield grafts. It spans both of the alar cartilages, supports the facet area and creates a smooth gradual light shadow transition. Additionally, it acts as camouflage over the tip grafts. A long-term study analyzing outcomes is warranted to better elucidate this graft's structural support on facets.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Human and Animal Rights 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. It was approved by the institutional review board (approval no: 17-1.11/11).

Informed Consent Written informed consent was obtained from the patients who participated in this study.

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