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Original Research Article

Cartilage dorsum augmentation with composite soft-tissue coverage in thick-skinned rhinoplasty

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ABSTRACT

Background: Thick-skinned noses often exhibit a combination of diminished dorsal height, reduced structural definition, inadequate radix projection, and a short overall nasal length. The dense soft-tissue envelope conceals underlying cartilaginous detail and frequently restricts refinement, especially in cases requiring dorsal augmentation. Achieving a smooth, natural dorsal contour in these patients can be difficult due to variability in envelope thickness and the tendency for cartilage edges to become visible beneath the skin. The objective was to evaluate the functional and aesthetic outcomes of dorsal augmentation using autologous cartilage combined with selective use of the native nasal composite soft-tissue layer as dorsal coverage.
Methods: Eighty-two patients with thick-skinned nasal anatomy underwent autologous cartilage dorsal augmentation with composite soft-tissue coverage. The composite layer was harvested as a single continuous sheet from the tip region. It was applied over layered or structured cartilage grafts to enhance dorsal contour smoothness and reduce graft visibility. Outcomes were assessed through long-term clinical examination, standardized photographic analysis, and validated patient-reported outcome measures including rhinoplasty outcomes evaluation (ROE) and Nasal Obstruction Symptom Evaluation (NOSE) scores.
Results: Dorsal contour smoothness, aesthetic-line continuity, and tip definition improved in all patients. No cases of infection, graft visibility, graft displacement, or vascular compromise were observed. Mild transient supratip edema occurred in 11% of patients and resolved with conservative management. ROE scores increased significantly after surgery, and NOSE scores demonstrated meaningful functional improvement. Long-term follow-up demonstrated stable results.
Conclusions: This technique provides a reliable method for managing the unique challenges of thick-skinned, low dorsum, or short nose anatomy.

Keywords: Thick, Skin, Dorsum, Augmentation, Nose

INTRODUCTION

Thick-skinned noses present unique challenges in aesthetic rhinoplasty because the dense soft-tissue envelope can obscure underlying structural detail, blunt dorsal contour visibility, and limit the impact of cartilage-based refinement. In many patients, this characteristic thickness is accompanied by additional anatomic deficiencies such

as a low dorsum, inadequate radix projection, and a short overall nasal length. These combined features reduce nasal definition and disrupt aesthetic-line continuity, often requiring dorsal augmentation to restore proportion, improve support, and create a more balanced profile.[1] A major factor contributing to poor definition in thick-skinned noses is the substantial volume of soft tissue situated between the dermis and the underlying cartilaginous framework. This excess bulk may dampen the visual impact of tip suturing, cartilage shaping, or dorsal grafting, even when the underlying structural work is carefully executed. Selective reduction of this layer can therefore improve tip visibility and refinement. Previous studies have emphasized the role of soft-tissue envelope thickness in determining postoperative outcomes and demonstrated that controlled thinning improves tip contour and enhances definition while maintaining vascular integrity.[2]

Simultaneously, dorsal augmentation in thick-skinned or low-radix patients requires a reliable method for achieving a smooth and natural surface contour. Autologous cartilage remains the preferred material for dorsal augmentation due to its stability, biocompatibility, and long-term resistance to resorption.[3,4] However, cartilage alone may yield visible edges or subtle irregularities beneath a thick yet uneven soft-tissue envelope.

The application of a biologic covering layer has been shown to improve dorsal smoothness and reduce palpability, as demonstrated in studies utilizing temporalis fascia and other autologous coverings.[5,6] These findings highlight the importance of incorporating a biologically compatible interface between the cartilage graft and the skin envelope to enhance contour stability.

The technique evaluated in this study combines these principles by harvesting the native nasal composite soft-tissue layer as a single continuous sheet and using it for two complementary purposes. First, its removal from the tip region reduces soft-tissue bulk, allowing the skin to redrape more directly onto the underlying framework and improving tip definition. Second, the same composite layer, composed of SMAS, subcutaneous fat, and perichondrial and ligamentous elements, is redeployed as a dorsal covering over the autologous cartilage construct. This dual application offers a unified strategy that enhances both dorsal and tip aesthetics while maintaining native vascularity and avoiding donor-site morbidity.

The current study examines the clinical, aesthetic, and patient-reported outcomes associated with this combined approach in patients with thick-skinned nasal anatomy requiring dorsal augmentation. Specific attention is given to dorsal contour stability, tip refinement, graft visibility, aesthetic-line continuity, and overall patient satisfaction. This method seeks to address the multifactorial challenges of thick-skin rhinoplasty through an anatomically grounded and autologous strategy that integrates soft-tissue modification with structural augmentation.

METHODS

This retrospective single center study was conducted at King Saud University Medical City in Riyadh, Saudi Arabia. All cases of primary open rhinoplasty performed between February 2024 and February 2025 that required dorsal augmentation using autologous cartilage combined with a native composite nasal soft-tissue coverage were reviewed. The operative objective was uniform across all cases which was to increase dorsal height and improve surface regularity by pairing a sculpted autologous cartilage soft-tissue layer harvested from the patient's own nasal envelope. All procedures were performed by a single facial plastic surgeon using a standardized operative protocol.

Eligible patients were adults undergoing primary open rhinoplasty who demonstrated clinically thick nasal skin defined by reduced mobility on palation, limited visualization of the lower lateral cartilage and a bulky soft-tissue envelop. Patients were included when dorsal augmentation was indicated for low dorsum, inadequate radix projection, short nasal length, or combined deformities that resulted in poor dorsal definition. Patients who had undergone rhinoplasty or other nasal procedures within twelve months, those requiring non autologous dorsal grafting materials, patients' active infection, keloid tendency, significant medical contraindications, or inability to complete scheduled follow-up were excluded from the study. All operations were carried out under general anesthesia using an open rhinoplasty approach through a transcolumellar incision extended into marginal incisions. A subcutaneous elevation plan was used to expose the native nasal composite layer without compromising dermal thickness or vascularity. This layer consisted of nasal SMAS, subcutaneous fat, perichondrial tissue over the lower lateral cartilages, and ligamentous structures including Pitanguy's ligament, interdomal and intercrural fibers, and supratip soft tissue. Sharp dissection under direct visualization separated the composite layer from the deep surface of the dermis while preserving the superficial vascular plexus. The composite remained attached to the nasal skeleton until it was elevated as a single continuous sheet.

Structural dorsal augmentation was performed after complete exposure of the osseocartilaginous dorsum. Autologous cartilage was harvested primarily from the septum, with auricular cartilage used when septal cartilage was insufficient. Cartilage was sculpted in layered or tubular configuration depending on the required dorsal height, radix support and brow-tip line continuity. All edges were beveled to reduce the possibility of postoperative visibility or palpability. The cartilage was secured to the soft-tissue graft using 5/0 vicryl rapide sutures and the entire composite graft was inserted into a controlled dorsal pocket. Additional stabilization was obtained when required using absorbable sutures to the septum or upper lateral cartilages or with fishhook fixation at the radix. The harvested composite soft-tissue sheet was

re draped as a biologic resurfacing layer over the sculpted cartilage construct. This resurfacing step provided a continuous autologous cover designed to improve dorsal smoothness, minimize graft visibility and enhance long term contour stability. The same composite harvest also reduced soft-tissue bulk at the tip and supratip region and allowed closer redraping of the envelope over the refined cartilage framework. Tip support maneuvers including lower lateral cartilage suturing, lateral crural modification, columellar strut placement or shield grafts were performed according to the anatomic needs of each patient. Ethical approval was obtained from the Insititutional Review Board of King Saud University under protocol E 24 8674. All patients provided written informed consent for surgery and use of anonymized clinical data and photographs.

All data were analyzed descriptively. Continuous variables were reported as means with standard deviations and categorical variables as frequencies and percentages. Preoperative and postoperative values for Nasal Obstruction Symptom Evaluation (NOSE) scores, rhinoplasty outcomes evaluation (ROE) scores, visual analogue scale satisfaction ratings and dorsal contour assessment were compared based on within subject change at twelve months. Statistical analysis was performed using IBM statistical package for the social sciences (SPSS) software version 28.

RESULTS

A total of 82 patients met the inclusion criteria and underwent dorsal augmentation rhinoplasty using autologous cartilage combined with a harvested nasal composite soft tissue layer. The demographic characteristics, rhinoplasty type distribution, indications for surgery, and graft parameters are summarized in Table 1, which provides a comprehensive overview of baseline features relevant to both surgical planning and outcome interpretation. The cohort consisted of 19 men (23.2%) and 63 women (76.8%) with a mean age of 29.4 years and an age range of 18 to 47 years. All patients exhibited clinically thick nasal skin identified by limited envelope mobility, poor visibility of lower lateral cartilages, blunted supratip contour, and variable SMAS and adipose composition. Many also presented with low dorsal height, shallow radix, short nasal length, or deficient dorsal aesthetic lines requiring structural augmentation and surface refinement.

Primary rhinoplasty accounted for 56 procedures (68.3%), while 26 procedures (31.7%) were performed in the revision setting. Thick skin with poor tip definition was the most frequent indication for composite graft use, present in 41 patients (50%). Additional indications included low dorsum or radix requiring augmentation in 28 patients (34.1%), short nasal length requiring dorsal extension support in 7 patients (8.5%), irregularity camouflage in 4 patients (4.9 %), and revision camouflage in 2 patients (2.4%). These indications correspond directly to the variables reported in Table 1 and demonstrate the applicability of the composite coverage technique across diverse anatomic challenges. The composite soft tissue graft was positioned over the dorsum alone in 71 patients (86.6%), over the dorsum and radix in 6 patients (7.3%), and over the dorsum with supratip extension in 5 patients (6.1%). Graft length ranged from 2.1 to 5.4 centimeters with a mean of 3.42±0.74 centimeters, and graft thickness ranged between 2 and 4 millimeters depending on intrinsic tissue properties. These graft site distributions and dimensions are detailed in Table 1.

Table 1: Patient demographics and graft characteristics.

Variables	Value (%)
Number of patients	82
Male	19 (23.2)
Female	63 (76.8)
Mean age (years)	29.4
Age range (years)	18-47
Primary rhinoplasty	56 (68.3)
Secondary rhinoplasty	26 (31.7)
Main indication: thick skin/poor tip def.	41 (50)
Low dorsum/radix deficiency	28 (34.1)
Short nose/dorsal extension	7 (8.5)
Camouflage of irregularities	4 (4.9)
Revision camouflage	2 (2.4)
Graft site: dorsum only	71 (86.6)
Graft site: dorsum+radix	6 (7.3)
Graft site: dorsum+supratip	5 (6.1)
Graft length (cm), mean±SD	3.42±0.74
Graft length range (cm)	2.1–5.4
Graft thickness (mm), typical	2–4

No major postoperative complications occurred. There were no cases of infection, graft displacement, cartilage exposure, graft visibility, or vascular compromise. One patient (1.2%) developed a small donor site hematoma that resolved with compression. Mild supratip edema occurred in 9 patients (11%) and resolved with routine postoperative care. No patient demonstrated dorsal contour irregularities or step offs, and palpation revealed consistent smoothing provided by the composite soft tissue layer. Clinical outcomes and complications are listed in Table 2.

Aesthetic and functional outcomes demonstrated significant postoperative improvement, as summarized in Table 2. ROE scores increased from a preoperative mean of 10.22±2.1 to 19.87±2.8 at 12 months. NOSE scores improved from 29.8±6.2 to 13.4±4.8, reflecting substantial improvement in subjective nasal function. Overall satisfaction measured by visual analogue scale (VAS) increased from 4.1±0.9 to 8.7±0.8. All changes were statistically significant with $p>0.001$. Subgroup analysis of factors influencing postoperative ROE outcomes is provided in Table 3. No significant difference was observed between men and women. Patients older than 40

years demonstrated the highest postoperative ROE improvement, with progressively lower but still substantial improvement among younger groups. Differences across age groups were not statistically significant. Patients receiving dorsum plus radix resurfacing demonstrated slightly higher ROE scores compared with dorsum only and dorsum with supratip extension, although this trend was not statistically significant. Indication based analysis showed that patients treated for thick skin with poor tip definition achieved the highest postoperative ROE scores, followed by low dorsum or radix deficiencies, short nasal length, dorsal irregularity camouflage, and revision camouflage. These indications related differences reached statistical significance, as shown in Table 3. Primary rhinoplasty patients demonstrated significantly higher ROE improvement than secondary rhinoplasty patients, consistent with the reduced fibrosis and improved tissue response seen in primary cases. Correlation analysis revealed no relationship between graft length and postoperative ROE score, a finding also summarized in Table 3.

Table 2: Clinical outcomes and complications.

Outcome measures	Preoperative	Postoperative
ROE score (mean±SD)	10.22±2.1	19.87±2.8
NOSE score (mean±SD)	29.8±6.2	13.4±4.8
VAS satisfaction (mean±SD)	4.1±0.9	8.7±0.8
Dorsal irregularity (clinical)	-	0
Graft visibility/palpability	-	0
Recipient-site complications	-	0
Donor-site hematoma	-	1 (resolved)
Supratip edema	-	9 (transient)
Graft displacement	-	0
Infection	-	0

Table 3: Predictor variables versus postoperative ROE scores.

Category/comparison	Postop ROE (mean)	P value
Gender		
Male	20.14	
Female	19.82	
Overall comparison (male versus female)		>0.05
Age group (years)		
<20	18.90	
20–29	19.70	
30–40	20.10	
>40	20.40	
Overall comparison (all age groups)		>0.05
Graft site		
Dorsum only	19.94	
Dorsum+radix	20.38	
Dorsum supratip	19.61	
Overall comparison (all graft sites)		>0.05
Indication for surgery		
Thick skin/poor tip definition	20.31	
Low dorsum/radix deficiency	19.78	
Short nose/extension	19.12	
Irregularities	18.92	
Revision camouflage	17.44	
Overall comparison (all indications)		<0.05
Rhinoplasty type		
Primary	20.42	
Secondary	18.74	
Overall comparison (primary versus secondary)		<0.05

*No significant correlation between graft length and postoperative ROE score (correlation analysis)

At 12 month follow up, all patients maintained smooth dorsal aesthetic lines with no evidence of graft resorption, thinning, late visibility, or contour deterioration. The composite graft continued to provide a natural, uniform surface over the dorsal construct, with stable integration into the nasal envelope. Removal of the composite layer from the tip region consistently decreased soft tissue bulk, leading to improved tip definition, projection, and a more refined supratip transition. These improvements were preserved throughout long term follow up and remained consistent across photographic, clinical, and patient reported assessments.

The overall findings demonstrate that autologous cartilage dorsal augmentation combined with composite nasal soft tissue coverage provides consistent dorsal smoothness, reliable masking of cartilage edges, enhanced tip definition through controlled soft tissue reduction, and high long term patient satisfaction. The detailed data presented in Tables 1-3 collectively support the stability, safety, and aesthetic reliability of this technique in thick skinned rhinoplasty patients.

DISCUSSION

Thick-skinned noses remain among the most challenging rhinoplasty subtypes because the dense soft-tissue envelope diminishes structural visibility, attenuates refinements made to the cartilaginous framework, and limits the expression of dorsal and tip definition. The combination of a heavy envelope with an inherently low dorsum, shallow radix, short nasal length, or poorly defined dorsal aesthetic lines further complicates outcomes. These features frequently coexist and require a coordinated dorsal augmentation strategy to restore projection, improve proportion, and reestablish strong brow–tip aesthetic lines. The technique analyzed in this study addresses these challenges by pairing autologous cartilage dorsal augmentation with resurfacing of the dorsum using a native composite nasal soft-tissue layer harvested as a single continuous sheet. This dual-component construct provides firm dorsal structural support while supplying a biologically matched soft-tissue interface that enhances contour regularity and minimizes graft visibility.[1]

The findings from this study confirm the reliability of this combined method for restoring dorsal height and achieving uniform dorsal contouring in thick-skinned patients. The significant improvements in postoperative ROE, NOSE, and VAS scores demonstrate the effectiveness of integrating structural augmentation with controlled resurfacing using a tissue layer already anatomically adapted to the nasal framework. Because the harvested composite layer consists of SMAS, subcutaneous fat, and perichondrial–ligamentous elements, it conforms naturally to the augmented dorsum and eliminates the need for distant donor sites. The tissue's inherent thickness gradient and biologic pliability allow it to drape smoothly over the sculpted cartilage, providing uniform masking of edges, smoothing of transitions, and enhancement of dorsal aesthetic-line clarity.

The conceptual rationale for this approach is strongly supported by existing literature. Hudise et al reported excellent dorsal camouflage with temporalis fascia used as a tubed covering, emphasizing the importance of a biologic soft-tissue layer in concealing underlying graft edges.[5] Park et al demonstrated the long-term stability and pliability of deep temporal fascia for dorsal smoothing, while Dresner and Hilger documented low visibility and palpability when fascia is used to envelop dorsal grafts.[3,6] The present method reinforces these established principles but avoids the morbidity of fascia harvest by utilizing tissue already present in the operative field. The composite nasal layer, with its combination of SMAS and perichondrial elements, provides a natural contouring interface with the additional advantage of preserving the native biomechanical behavior of the nasal envelope.

The superiority of autologous soft-tissue interfaces over acellular or alloplastic materials is demonstrated in comparative studies. Heidari et al reported fewer complications and better dorsal smoothness with temporal fascia compared with Alloderm.[5] Meta-analyses by Wells et al and Keyhan et al confirmed favorable outcomes when autologous fascia was used to wrap diced cartilage constructs.[8] Although the present study does not utilize diced cartilage, the biologic rationale is parallel. The composite nasal layer provides an autologous, vascular-friendly interface that enhances integration and reduces irregularity, similar to fascia-wrapped constructs.

Effective management of thick nasal skin also requires reduction of excessive envelope bulk to improve tip definition and midvault refinement. Davis and Wayne emphasized the contour-enhancing value of SMAS manipulation while Chu and Davis demonstrated that targeted SMAS defatting improves aesthetic definition in thick-skinned patients.[9,10] These principles align with the composite-layer harvest method used in this study, in which the layer is separated from the dermis while preserving dermal vascularity. Removing the composite layer from the tip region decreases soft-tissue thickness, allowing the skin to redrape more closely over the modified cartilaginous framework. This effect is consistent with findings from Dey et al, who reported aesthetic improvements after modulating soft-tissue bulk.[11] and Mohebbi et al, who described durable refinement following targeted soft-tissue reduction.[2] In the current cohort, this reduction consistently enhanced tip and supratip definition, complementing the dorsal augmentation.

Autologous cartilage remains the core structural material for long-term dorsal augmentation because of its durability, adaptability, and resistance to resorption. Nikparto et al reviewed contemporary dorsal augmentation

strategies and highlighted the need to integrate structural projection with surface refinement to achieve optimal outcomes.[4] Bohluli et al underscored the importance of brow–tip line continuity in radix augmentation ,and Cohen and Pearlman demonstrated the value of radix grafting for achieving stable dorsal definition.[12,13] The present technique builds upon these foundational concepts by combining precise cartilage framework construction with controlled resurfacing using the harvested composite nasal layer. This integration provided consistent dorsal height, predictable radix support, and smooth surface quality across all patients in the cohort.

Biomechanical studies also support the use of autologous covering tissues. Chi et al demonstrated that deep temporal fascia possesses tensile properties that allow predictable soft-tissue behavior, while Li et al showed enhanced cartilage survival when wrapped in autologous fascia due to improved vascular integration.[14,15] Although structurally different, the composite nasal layer used in this study provides analogous biologic advantages by offering a vascular-responsive, pliable interface that improves dorsal stability and reduces the risk of late visibility or contour irregularity.

Taken together, the surgical and biomechanical principles in existing literature support the combined cartilage and composite-layer technique used in this study. The cartilage construct establishes dorsal projection, structural height, and proportion, while the composite layer provides a natural autologous resurfacing interface. This combination is particularly beneficial in thick-skinned patients, patients with short noses requiring controlled elongation, low radix cases requiring proportional support, and individuals with dorsal irregularities requiring precise contouring. The present findings demonstrate excellent reproducibility, a low complication profile, and stable long-term outcomes across all these clinical scenarios.

The technique also avoids the morbidity associated with secondary donor-site harvest while allowing simultaneous reduction of excessive tip bulk, a feature that contributes significantly to the final aesthetic result in thick-skinned rhinoplasty. The integration of dorsal augmentation and targeted tip soft-tissue reduction provides a comprehensive solution that addresses the two major anatomical obstacles to refinement in this population: insufficient dorsal height and an excessively thick envelope.

Future work may include prospective comparisons with temporalis fascia, Alloderm, diced cartilage–fascia constructs, and layered dorsal grafting methods to delineate the relative merits of each material and to evaluate long-term structural behavior. Ultrasound or radiologic measurement of soft-tissue thickness before and after composite-layer harvest may further quantify the contribution of envelope reduction to aesthetic improvement.

Overall, the combination of autologous cartilage dorsal augmentation with composite nasal soft-tissue resurfacing offers a biologically favorable, anatomically grounded, and clinically effective method for dorsal augmentation in thick-skinned rhinoplasty.

CONCLUSION

Combined autologous cartilage dorsal augmentation with native composite nasal soft-tissue coverage provides a coherent, single-site autologous solution for thick-skinned rhinoplasty. The technique reliably increases dorsal height, improve contour regularity and dorsal aesthetic-line continuity and minimizes graft visibility while avoiding morbidity from secondary donor sites. Use of some composite layer at tip and supratip region reduced envelope bulk and facilitates better tip definition without compromising vascularity. In this series, dorsal contour remained smooth and stable at 12 months, NOSE, ROE, and global satisfaction scores improved significantly with no major complications or graft-related failures. These findings suggest that integrating structural cartilage support with composite soft-tissue resurfacing is a practical and reproducible option for dorsal augmentation in thick-skinned, short-nose, or low-radix patients, although larger prospective and comparative studies are warranted to further define its relative advantages over other dorsal augmentation methods.

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