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Artículo de investigación científico y tecnológica

A functional classification of internal suspension sutures in rhinoplasty and the adjunctive use of pulley sutures

Clasificación funcional de las suturas de suspensión interna en rinoplastia y el uso complementario de suturas en polea

Andrés Alvo*

* Associate Professor, Faculty of Medicine. Universidad de Chile. Otolaryngology Service, Clínica Alemana de Santiago. Santiago, Chile. ORCID: <https://orcid.org/0000-0001-8672-703X>

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ABSTRACT

Purpose: Internal suspension sutures (ISS) were previously described as an adjunctive maneuver to support nasal tip position in rhinoplasty. With continued use, additional variants and indications have emerged. This communication proposes a functional classification of ISS according to the structure through which traction is applied and describes the adjunctive use of pulley sutures to refine suture trajectory and vector control. **Methods:** This technical note describes the author's iterative clinical use of ISS in structural rhinoplasty. The original concept was organized into a practical classification according to the anatomic site of force application, and a dorsal pulley suture modification is described to reduce bowstringing in selected cases. The article does not report on a consecutive patient series or a systematic assessment of effectiveness or safety. **Results:** We propose four main ISS variants: domal-ISS, shield-ISS, intercrural-ISS, and septal extension graft (SEG)-ISS. Each applies cephalic support through a different anatomic structure and may be selected according to cartilage characteristics, graft configuration, and tip geometry. Asym-

Correspondencia:

Dr. Andrés Alvo

Department of Otolaryngology, Faculty of Medicine. Universidad de Chile.

Email address: andresalvo@uchile.cl

Address: Dr. Carlos Lorca Tobar 999, Independencia. Santiago, Chile.

Phone number: +56 9 9788153

metric dorsal passage may allow minor coronal-plane adjustment, and pulley sutures may reduce bowstringing and modify the traction vector in selected cases. *Conclusion:* ISS may be understood as a flexible family of adjunctive support maneuvers rather than a single fixed technique. This article proposes a functional classification and describes pulley sutures as a technical refinement for selected cases. These maneuvers are technically feasible in the author's experience; their reproducibility, safety, clinical benefit, and long-term stability require formal evaluation.

RESUMEN

Palabras clave (DeCS):

Rinoplastia, técnicas de sutura, nariz.

Objetivo: las suturas de suspensión interna (SSI) son una maniobra adyuvante para sostener la posición de la punta nasal en la rinoplastia. Con su uso continuado, han surgido nuevas variantes e indicaciones. Se propone una clasificación funcional de las SSI según la estructura a la cual se aplica tracción, y se describe el uso complementario de suturas en polea para control del vector de tracción. *Métodos:* este artículo técnico describe el uso iterativo de las SSI por el autor en rinoplastia estructural. Fueron organizadas en una clasificación práctica según sitio anatómico de tracción. El artículo no presenta una serie consecutiva de pacientes ni una evaluación sistemática de efectividad o seguridad. *Resultados:* se proponen cuatro variantes principales de SSI: SSI-domal, SSI-escudo, SSI-intercrujal y SSI-IES (injerto de extensión septal). Cada una aplica soporte cefálico a través de una estructura anatómica diferente, pudiendo seleccionarse según características del cartilago, configuración de los injertos y geometría de la punta nasal. El paso dorsal asimétrico permite ajustes menores, y las suturas en polea pueden reducir el efecto de *bowstringing* y modificar el vector de tracción en casos seleccionados. *Conclusión:* las SSI pueden entenderse como una familia flexible de maniobras adyuvantes de soporte, más que como una técnica única y fija. Este artículo propone una clasificación funcional y describe las suturas en polea como un refinamiento técnico para casos seleccionados. Estas maniobras son técnicamente factibles según la experiencia del autor; su reproducibilidad, seguridad, beneficio clínico y estabilidad a largo plazo requieren una evaluación formal.

Introduction

Achieving predictable long-term nasal tip position remains one of the most technically demanding aspects of rhinoplasty. Structural techniques such as septal extension grafts (SEG) and columellar struts have significantly improved tip stability (1); however, loss of rotation or projection may still occur over time due to gravitational forces, scar contracture, and muscular action. Importantly, most of these forces act perpendicular to the main axis of the SEG, which functions as a cantilevered beam rather than a vertical pillar (2). The biomechanics of SEG have been extensively discussed in the literature (3).

Internal suspension sutures (ISS) were previously introduced as a technique to provide dynamic cephalic support to the nasal tip by suspending the tip complex to the cartilaginous dorsum (2). Conceptually, ISS were designed to mimic the effect of postoperative external tip taping, offering continuous support during healing without excessively rigidizing the nasal tip. This could improve resistance to postoperative derotation, particularly during early healing.

Similar concepts have been previously published, using sutures or flaps to suspend the tip (4-6). Notably, an article

by Cárdenas et al. described in 2006 an endonasal approach using needles to pass a suture from the tip to the dorsum (7). Our technique differs in the point of entry below the domes, the possibility of an open approach, the avoidance of guiding needles, and the versatility of suture placement, as will be discussed in the following sections.

With continued clinical use, the original ISS concept was expanded into a broader family of maneuvers with different points of force application and distinct technical roles. Occasional bowstringing was considered a potential technical limitation, prompting the development of an adjunctive pulley suture intended to reduce this effect. This technical note proposes a practical functional classification of ISS and describes the pulley suture as a technical refinement; nevertheless, it does not report a formal analysis of clinical outcomes.

Functional classification of internal suspension sutures

With continued clinical use, several technical variations to ISS have emerged, prompting the need for a clearer conceptual framework. We propose a functional classification of ISS based on the anatomical structure through which traction forces are applied to the nasal tip complex.

Domal-ISS

The original technique, in which the suture is passed directly through the domes of the alar cartilages before anchoring to the cartilaginous dorsum (**Figure 1A**). This variation provides direct control of tip rotation but requires careful tensioning to preserve domal geometry.

Shield-ISS

In this variation, the intermediate crura are reinforced with a shield graft, and the ISS is passed through the graft as well as through the domes (**Figure 1B**). This approach minimizes unintended changes in interdomal divergence and is particularly useful in patients with delicate or asymmetric domal cartilages.

Intercrural-ISS

In this variation, the suture is passed between the medial crura to apply traction on a columellar strut or SEG positioned in this region. This method allows modulation of the tip position without direct manipulation of the domes and is useful in cases of hanging columella or when preservation of domal anatomy is desired.

SEG-ISS

This is a simple variation in which the suture extends from the upper portion of a septal extension graft to the cartilaginous dorsum. Its primary role is not active repositioning but rather to provide additional support against postoperative derotation during healing. This biomechanical role is proposed based on the author's experience and has not yet been evaluated through systematic long-term outcome measurements in this technical note.

For classification purposes, the variant is assigned according to the primary structure through which the suspension force is transmitted before dorsal anchoring. Intercrural-ISS applies when traction is transmitted between the medial crura (already supported by a columellar strut and/or SEG) to the dorsum; SEG-ISS applies when traction is transmitted directly from the upper portion of the SEG to the cartilaginous dorsum without an intercrural course. Thus, the presence of an SEG alone does not define the SEG-ISS category.

This classification is not intended to be exhaustive, but rather practical. Together, these variations form a flexible system that allows ISS to be tailored to different anatomical configurations and surgical objectives. It should be noted that ISS and their variations are not intended to replace structural rhinoplasty techniques but rather to complement them. Their primary role is to support the nasal tip during healing and allow controlled fine-tuning in selected scenarios.

An additional benefit of this technique is the possibility of asymmetrical passage of the suture through the cartilagi-

nous dorsum, which may be used to achieve subtle correction of tip asymmetries in the coronal plane (**Figure 1C**). This maneuver should be reserved for minor adjustments and performed cautiously, to avoid unwanted distortion of the nasal cartilages.

Operative technique and technical parameters

Most ISS variants are performed through an open approach, once the procedure at the tip has been completed and the osteotomies have been performed, usually at the end of the operation and prior to closure; the exception is the SEG-ISS, which is placed immediately after securing the SEG to the septum. The preferred suture is 5-0 PDS; when choosing an absorbable material with an approximate absorption time of six months, and the rationale for this choice is to use a long-lasting suture with sufficient strength to hold the tip in place without breaking, while avoiding excessive bulk on the suture site, especially at the knot.

Domal-ISS

After placing the interdomal and transdomal sutures, the suture enters about 2 mm infradomal from caudal to cephalic at the intermediate crus on the right side; it then exits 2 mm cephalically to the dome at the lateral crus, and passes from right to left at the desired location on the cartilaginous dorsum (usually between the middle and caudal thirds). Then, the suture is passed from cephalic to caudal on the contralateral side in a similar fashion. Tension is adjusted until the tip starts to become suspended and a mild double-break effect is achieved between the lobule and the columella. Then the suture is secured with a surgeon's knot and three additional throws.

Shield-ISS

After placing the interdomal and transdomal sutures, and with a shield graft in place, the suture enters through the shield graft and about 2 mm infradomal from caudal to cephalic at the intermediate crus on the right side, it then exits 2 mm cephalically to the dome at the lateral crus, and passes from right to left at the desired location on the cartilaginous dorsum (usually between the middle and caudal thirds). Then, the suture is passed from cephalic to caudal on the contralateral side in a similar fashion. Tension is adjusted until the tip starts to become suspended and a mild double-break effect is achieved between the lobule and the columella. Then the suture is secured with a surgeon's knot and three additional throws.

Intercrural-ISS

The suture is passed between the medial crura from caudal to cephalic at the junction of the medial and intermediate crura on one side, then through the dorsum as described pre-

viously. Then, it is passed from cephalic to caudal on the contralateral side, mirroring the previous steps and engaging the columellar strut, SEG, or both. Tension is adjusted until the tip starts to become suspended and the suture is secured with a surgeon's knot and three additional throws.

SEG-ISS

The suture is introduced through the SEG, at the midpoint (or distally, if desired) between the tip and the take-off from the septum, 2-3 mm from the cephalic edge of the SEG, then it is passed through the cartilaginous dorsum as previously described and tied on the contralateral side. Tension is adjusted until the SEG becomes fixed and cannot be derotated when applying mild finger pressure. The suture is secured with a surgeon's knot and three additional throws.

Variant selection and tension endpoints

Domal-ISS

Consider this approach when direct control of tip rotation is required; avoid it when the intermediate crura or the domes are weak and easily deformed. Its principal risk is the creation of a single-dome deformity. Adequate tension should achieve mild rotation of the lobule, without deforming the structure of the tip or the lateral crura.

Shield-ISS

Consider in delicate or asymmetric domal cartilages when reinforcement is desired, especially to avoid a single-dome deformity. Its principal risk is a potential cheese-wiring effect on the shield lobule. Adequate tension should achieve mild rotation of the lobule, without deforming the structure of the tip or the lateral crura.

Intercrural-ISS

Consider this technique in case of a hanging columella or when preservation of domal anatomy is desired; avoid it in cases of a deficiency of columellar show. Its principal risk is generating a retracted columella. Adequate tension should suspend the middle crura without flattening the columella.

SEG-ISS

Consider this approach when additional support against postoperative derotation is desired when using a SEG; avoid it when the cartilage graft is fragile. Its principal risk is a potential cheese-wiring effect on the cartilage.

These selection criteria are technical guidance derived from the author's experience and have not been prospectively validated.

Pulley sutures

A limitation we have occasionally encountered with ISS is a slight bowstringing effect, in which the suture trajectory

passes several millimeters above the supratip region before engaging the cartilaginous dorsum. Although often clinically inconsequential, this configuration may theoretically create supratip dead space. Traditional solutions—such as filling the space with soft tissue remnants or diced cartilage—may risk unwanted supratip fullness in some cases.

To address this issue, we introduce the use of pulley sutures as an adjunct to ISS. This concept is analogous to the annular ligaments of the fingers, which maintain flexor tendons close to the phalanges. One or more sutures are placed through the cartilaginous dorsum to restrain the ISS, approximating it to the dorsal framework and reducing bowstringing (**Figure 1D**). Pulley sutures are applied selectively and with minimal tension, as they may modify the direction of the ISS vector.

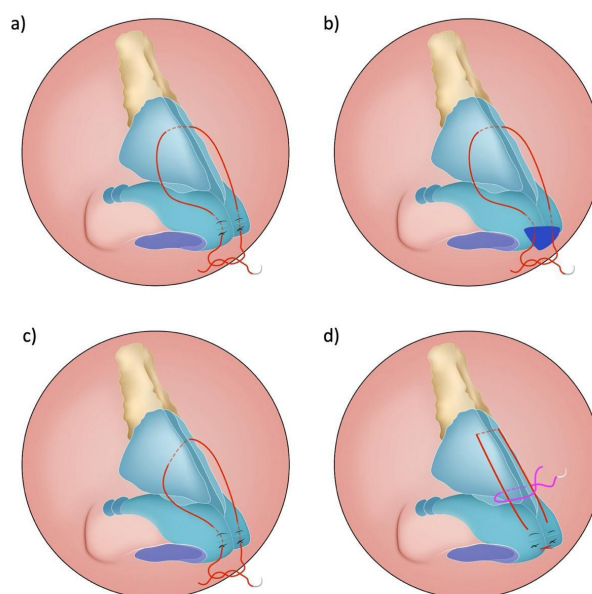


Figure 1. Graphical depiction of some ISS variants and adjunctive maneuvers. **A.** Domal-ISS; **B.** Shield-ISS; **C.** Asymmetrical passage of the ISS through the cartilaginous dorsum; **D.** Pulley suture (in purple) with an ISS already in place (in red).

Technical steps and safety considerations

After placing the ISS, the pulley suture is placed at one or more spots on the distal cartilaginous dorsum, to draw the ISS closer to its surface, using 5-0 PDS. It enters 2-3 mm below the dorsum at one side, exits contralaterally and is tied above the ISS with a surgeon's knot and three additional throws. Tension is limited until the bowstringing effect of the ISS on the overlying skin disappears, taking care that the ISS is approximated to the dorsal framework without changing the intended vector.

Potential adverse technical effects observed or anticipated with ISS and pulley sutures include an increased amount of suture material that could generate foreign body reactions; deformities of the alar cartilages, and loss of tension due to the cheese-wiring effect produced by the knot or suture material weakening. Excessive tension is suspected when the

lateral crura become distorted, or the tip becomes over-rotated. If this occurs, the recommended intraoperative response is to loosen the knot or remove the ISS entirely.

Discussion

The original ISS concept was introduced as a simple means of adding cephalic support to the nasal tip (2). The present communication expands that concept in two ways. First, it frames ISS as a functional group of maneuvers rather than as a single technical step. Second, it introduces pulley sutures as a method for improving control of suture trajectory and vector direction. From a biomechanical perspective, this framework may be useful because forces acting on the nasal tip after rhinoplasty are multidirectional, whereas many structural support maneuvers act predominantly through caudal support pathways (1-3).

ISS do not replace structural grafting; rather, they may complement it by adding dynamic cephalic support during healing. This may be particularly relevant in patients with weak cartilage, limited graft material, or heavy soft-tissue envelopes, which tend to derotate when the skin flap is sutured back at the end of surgery. Although both absorbable and non-absorbable sutures can be used for these techniques, the author has favored absorbable sutures to avoid leaving long segments of permanent suture material inside the nose.

Limitations

This article is a technical note derived from the author's iterative clinical experience and does not report a consecutive case series, a comparator, or a systematic assessment of outcomes. Consequently, the proposed classification and technical refinements should be considered conceptual and descriptive. Their reproducibility, effectiveness, safety, and long-term stability require evaluation in prospectively defined clinical studies with standardized outcome measures and follow-up.

Conclusion

ISS may be considered a family of adjunctive maneuvers that complement established structural techniques in tip rhinoplasty. This article proposes a functional classification and describes pulley suture as a technical refinement for selected cases. These maneuvers are technically feasible in the author's experience; however, their reproducibility, safety, clinical benefit, and long-term stability require formal evaluation.

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Conflicts of interest

The author declares no competing interests.

Author contributions

Conceptualization, methodology, writing, review and editing.

Ethical considerations and consent

Ethics committee approval was not required for this conceptual technical note paper.

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