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Role of New Intercartilaginous Suturing Technique in Maintaining Nasal Tip Support Mechanism Following Rhinoplasty

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ABSTRACT

Background: Nasal tip support mechanism plays an important role in maintaining tip in its position and preventing drooping of nasal tip and nasal lengthening. In rhinoplasty surgery, this mechanism can be excised or detached during different steps of rhinoplasty, in our practice we detach three attachments which play an important role in tip support; attachment in-between the caudal septum and foot plates of medial crura which can be replaced by medial crural septal suture, interdomal attachment also can be replaced by interdomal suturing, while the attachment in-between upper and lower lateral cartilages, which is usually detached during cephalic trimming of the lower lateral cartilage, is not replaced by any type of suturing technique. In this study, we described a new intercartilaginous suturing technique to reattach this attachment with the remaining part of lower lateral cartilage. We aimed to analyze the log-term effect of re-attachment of the ligament between upper and lower lateral cartilages on tip support, projection and rotation.

Material and Methods: Twenty four patients were included in this study; group I included 12 patients had underwent aesthetic rhinoplasty surgery without applying intercartilaginous suture, while in group II, the new suture was applied in 12 patients during rhinoplasty. In both groups, nasolabial angle and projection/ nasal length ratio in the profile view of patients' photographs were measured at 1.5, 3 and 6 months post-operatively as well as, patient's satisfaction regarding aesthetic outcome was subjectively evaluated by a questionnaire at 6 months post-operatively.

Results: The study revealed that nasal tip position was maintained in group II more than group I in a period of 6 months following rhinoplasty surgery with more patient satisfaction score in group II of patients as well.

Key Words: *Primary rhinoplasty – Open rhinoplasty – Nasal tip support.*

INTRODUCTION

Rhinoplasty is one of the most demanding aesthetic plastic surgeries due to the complex anatomy of the nose and the need to achieve both aesthetic and functional results **[1]**. It was said that who can manipulate the nasal tip can master rhinoplasty **[2]**. Maintaining nasal tip support plays an important role in achieving long-lasting aesthetic and functional results as it prevents sagging of the nasal tip which usually appears one to two months post-operative as a supra tip hump or even droopy nose like a parrot's beak **[3]**.

Since the proposal of tripod theory by Anderson in 19694, many anatomical studies have been made to investigate the unique nasal tip anatomy. In 1971, Janeke and Wright introduce the concept of “nasal tip support mechanisms” after their anatomical study on twenty cadavers. They stated that there are four major tip support structures including the ligament between the upper and lower lateral cartilages, the interdomal ligament, the attachment between foot plate of medial crura and the caudal septum and the sesamoid complex which support the lateral crura to the pyriform aperture **[3]**. This was followed by more detailed anatomical description of nasal tip support mechanisms as major and minor mechanisms by Tardy and Brown in their textbook “Surgical anatomy of the nose” **[5]**.

These anatomical studies led to a paradigm shift in rhinoplasty tip surgery. Moving from radical excision and alteration of nasal tip to more conservative cartilage-sparing methods **[6]**. The problem is that to correct nasal tip deformities, it is crucial to alter the tip support mechanisms of the nose. Disruption of these support mechanisms will affect the long-term results of rhinoplasty operation, so it is crucial for any surgeon to reconstruct them to counteract the deforming forces of healing process **[1]**.

Many surgical procedures have been prescribed to restore the anatomical support of the nasal tip.

For instance, tongue in groove technique which corrects excess columellar show along with restoring the anatomical tip support between the foot plate of the medial crura and the caudal septum [7]. Interdomal sutures which reconstruct the served interdomal ligament during open rhinoplasty [8].

Thorough literature review revealed that no previous study has addressed the issue of reconstructing the attachment between lower lateral ad upper lateral cartilages which is meant to be one of the major nasal tip support mechanisms.

Aim of this study was to analyze the log-term effect of re-attachment of the ligament between upper and lower lateral cartilages on tip support, projection and rotation.

PATIENTS AND METHODS

24 patients were included in this cohort prospective study from April 2016 to October 2019 in El-Demerdash, Ain Shams University Hospital. We included patients seeking for primary rhinoplasty with age range from 19 to 45 years (mean 30.6±7.7 years), 8 males (33.3%) and 16 females (66.7%). Patients with previous nasal surgeries or nasal dysfunction were excluded from study.

Patients were subdivided into 2 groups; group I, cephalic trimming of the lower lateral cartilage was performed without re-attachment of ligament in-between upper and lower lateral cartilage while in group II, the new inter-cartilaginous running suture was applied to reattach the detached ligament in-between upper and lower lateral cartilages with the remaining part the lower lateral cartilage.

Surgical technique:

All patients were operated upon by using open rhinoplasty technique. All needed rhinoplasty steps were done according to patients' needs. The standard of rhinoplasty care was performed to optimize aesthetic outcome.

The procedure was exclusively performed with the patient under general anesthesia. Nose was injected with lidocaine containing 1:200,000 epinephrine circumferentially to ensure sufficient vasoconstriction. The soft tissues along the lateral and medial surface of the nasal bones were injected too. The columella and the dorsal portion of the septum were injected bilaterally. The septum was injected along the floor of the nose as far posteriorly and caudally as possible to reduce bleeding during surgery. A stair-step incision was made in the columella that was continued along the caudal margin of the medial and lateral crura of the lower lateral cartilages. Using a baby Metzenbaum scissors and a spread and cut technique, the soft tissues overlying the medial crura and the domes were dissected. The dissection was continued cephalically to expose the lateral crura and along the dorsum until nasal bones were reached.

At this point, the Obwegeser periosteal elevator was used to maintain the dissection in the subperiosteal plane. Dorsal reduction, lateral osteotomy, spreader grafts, excision of the cephalic part of the lower lateral cartilage, alar rim graft, tip suturing and grafting, and nostril reduction were done according to patients' needs independent of this study. When necessary, septoplasty and turbinectomy were performed.

Cephalic trimming of the lower lateral cartilage was performed maintaining about 5mm width of the lower lateral cartilage anteriorly and 6mm or more posteriorly, the excess portion of the cartilage was dissected sub-perichondrial with the attachment in-between both upper and lower cartilages, this excess cartilage was removed by scissors preserving the attachment running 5/0 Proline suture was applied bilaterally to reattach the detached ligament in-between upper and lower lateral cartilages with the remaining part the lower lateral cartilage and to restore the inter-cartilaginous support (Fig. 1).

The columellar incision was then repaired by using 6/0 proline suture while closure of intranasal incisions was made by 4/0 vicryle sutures. Finally intranasal packs and dressing of the nose was done by using Steri-Strips and dorsal splint was applied over Steri-Strips.

Post-operatively, intranasal packs were removed 48 hours following surgery, splint and columellar sutures were left in place for 7 days. Administration of systemic first generation cyclosporine was continued for 7 days. Patients were prohibited from heavy physical activities for 3 weeks and from wearing glasses for 5 weeks.

Clinical assessment; Nasolabial Angle (NLA) and projection/nasal length ratio (P/L Ratio) in the profile view of patients' photographs were measured at 1.5, 3 and 6 months post-operatively (Fig. 2). At 1.5 and 3 months differences in nasolabial angle and projection/nasal length were calculated and analyzed, the same was done at 6 months post-operatively to reveal 3 and 6 months differences in these measurements.

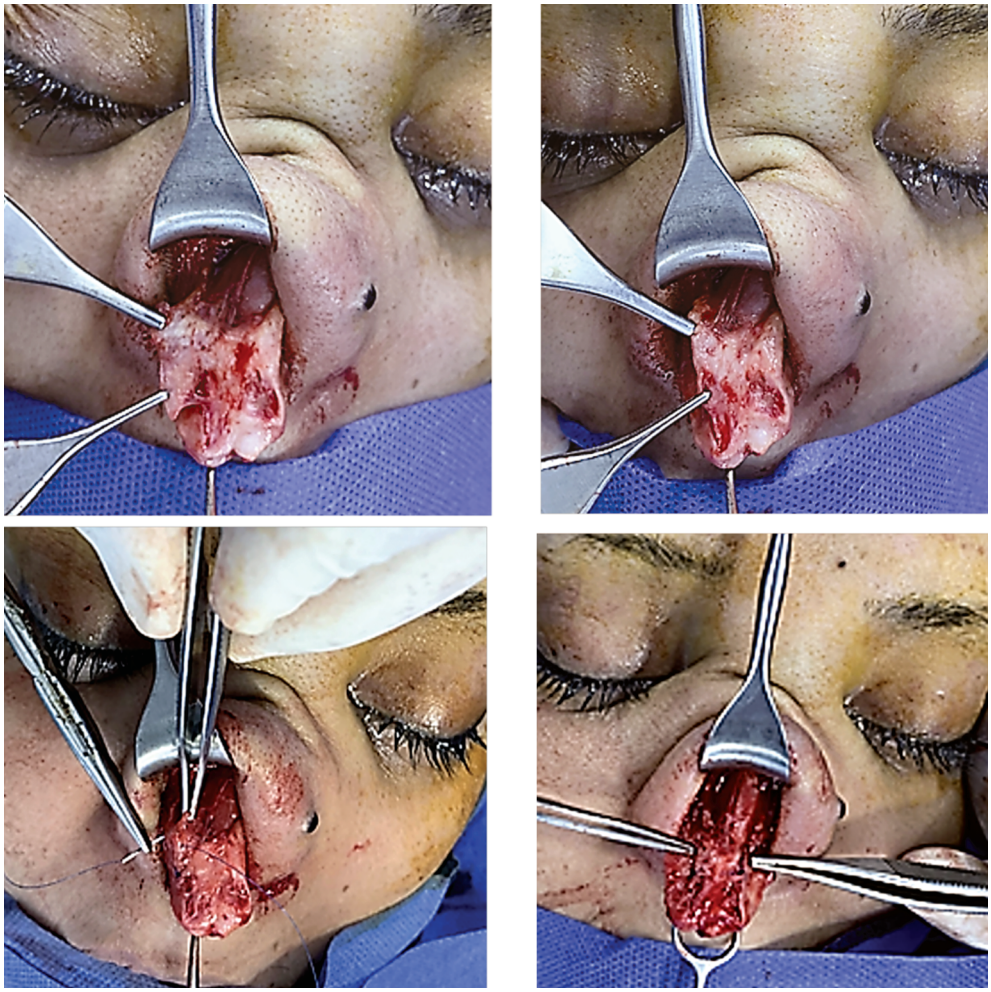

Fig. (1): Upper raw: Dissecting LLC and intercartilaginous attachment and preserving intercartilaginous attachment. Lower raw: Re-attachment by running proline sutures and bilateral reattachment of intercartilaginous ligament.

Fig. (2): NLA and P/L ratio.

Patient's satisfaction at 6 months was subjectively evaluated for both groups by using Rhinoplasty Outcomes Evaluation (ROE) **[9]** (Fig. 3). All these data was calculated, tabulated and analyzed.

Rhinoplasty outcomes evaluation (ROE)

This questionnaire is designed to assist your surgeon in determining the best patient outcomes following rhinoplasty surgery. Your comments are confidential and may be used to reline surgical procedures for future patients. Please circle the number that best characterizes your current opinion regarding the following questions:

1- How well do you like the appearance of your nose?

Not at all	Somewhat	Moderately	Very much	Completely
0	1	2	3	4

2- How well are you able to breathe through your nose?

Not at all	Somewhat	Moderately	Very much	Completely
0	1	2	3	4

3- How much do you feel your friends and loved ones like your nose?

Not at all	Somewhat	Moderately	Very much	Completely
0	1	2	3	4

4- Do you think your current nasal appearance limits you social or professional activities?

Always	Usually	Sometimes	Rarely	Never
0	1	2	3	4

5- How confident are you that yout nasal appearance is the best that it can be?

Not at all	Somewhat	Moderately	Very much	Completely
0	1	2	3	4

6- Would you like to surgically alter the appearance or function of your nose?

Definitely	Most likely	Possibly	Probably not	No
0	1	2	3	4

Fig. (3): Rhinoplasty Outcomes Evaluation (ROE) **[9]**.

RESULTS

This cohort prospective study included 24 patients that had undergone aesthetic rhinoplasty operations for different indications, 16 females (66.67%) and 8 males (33.33%) with mean age (30.6±7.7) years and age range (19-45) years (Diagram 1).

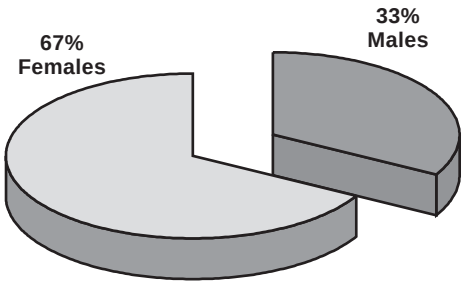

Diagram (1): Age percentage in both groups.

In group I, 12 patients had underwent aesthetic rhinoplasty surgery without applying intercartilaginous suture, 9 females (75%) and 3 males (25%) with mean age (30.6±7.7) and age range (19-42). While in group II, 12 patients had underwent aesthetic rhinoplasty surgery with applying inter-cartilaginous suture, 7 females (58.3%) and 5 males (41.7%) with mean age (30.7±8.4) and age range (19-45).

In both groups of patients, nasolabial angle was measured at 1.5 months, 3 months and 6 months post-operatively. Differences at 3 months and 6 months post-operatively were calculated and analyzed. NLA in group I showed reduction of the mean of NLA by (–2.6±0.5) and (–1.5±0.5) respectively, while measurements in group II showed reduction at 3 months by (–1.8±0.8) and more reduction at 6 months post-operatively by (–1.25± 0.5) (Diagrams 2-4).

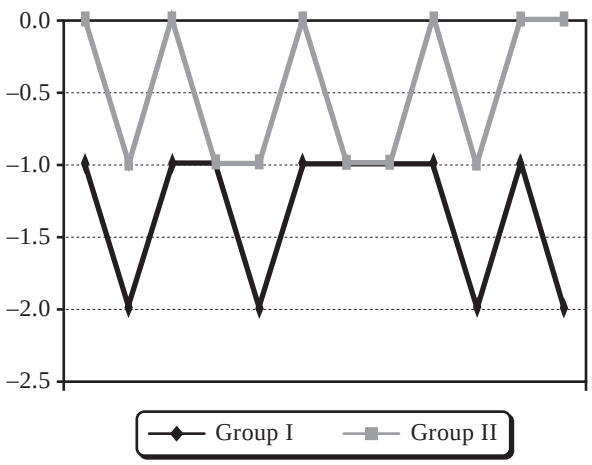

Diagram (2): Reduction in NLA measurements in both groups at 3 months, *p*-value=0.0005 (HS).

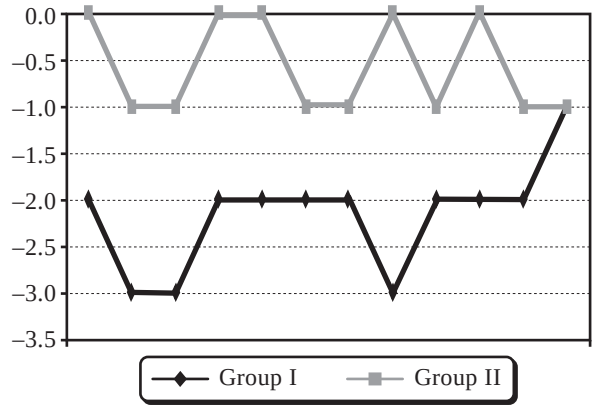

Diagram (3): Reduction in NLA measurements in both groups at 6 months, post-operatively, *p*-value=0.0006 (HS).

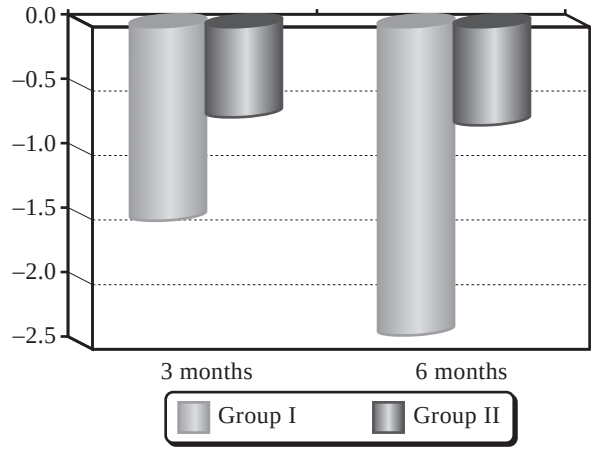

Diagram (4): Mean reduction in NLA in both groups at 3 and 6 months.

Projection/nasal length ratio was measured in both groups of patients at 1.5, 3, 6 months. Differences at 3 and 6 months in both groups were calculated and analyzed, in group I, projection/nasal length ratio showed reduction by (–0.027±0.01) at 3 months and more reduction at 6 months by (–0.015±0.01) while in group II, post-operative 3 and 6 months ratio differences showed reduction by (–0.018±0.01) and (–0.012±0.003) respectively (Diagrams 5-7).

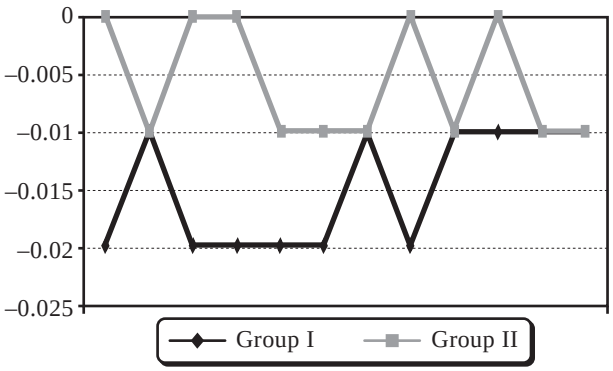

Diagram (5): Reduction in projection/nasal length ratio in both groups at 3 months, post-operatively, *p*-value=0.002 (HS)

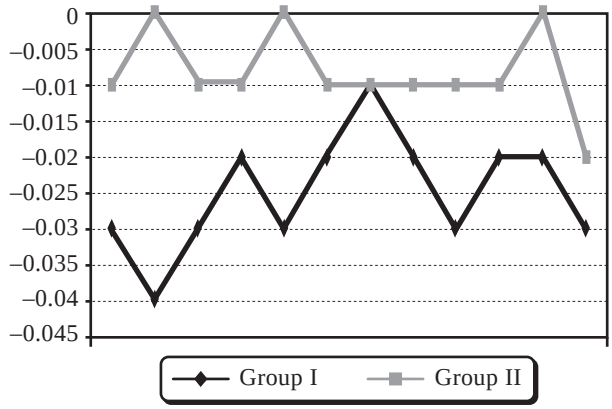

Diagram (6): Reduction in projection/nasal length ratio in both groups at 6 months, post-operatively, *p*-value=0.004 (HS).

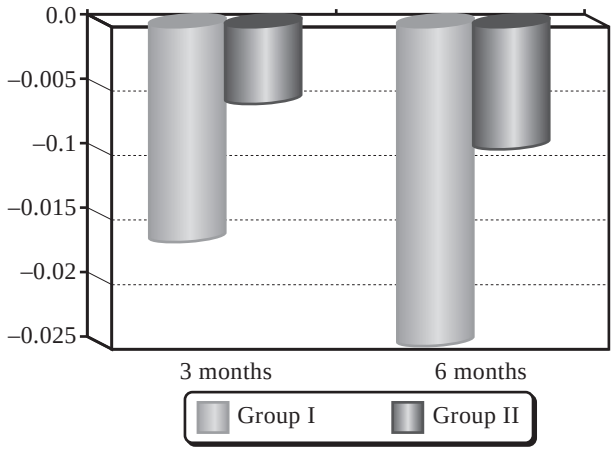

Diagram (7): Mean reduction in projection/nasal length ratio in both groups at 3 and 6 months post-operatively.

In both groups, patient's satisfaction data at 6 months were evaluated and analyzed by using (ROE), mean of patient's satisfaction was (mean 17.75±1.2) in group I of patients while it showed more satisfaction in group II of patients (mean 20±1.1) (Diagram 8).

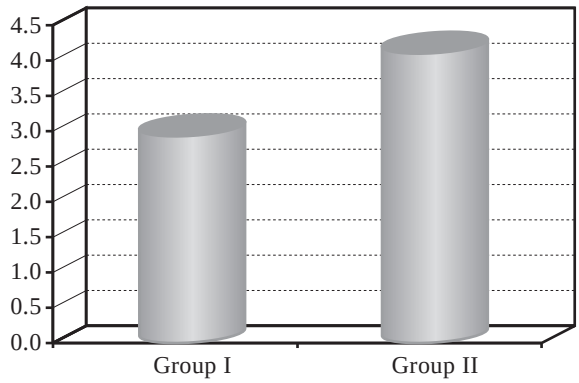

Diagram (8): Mean of patients satisfaction in both groups at 6 months post-operatively.

Clinical cases and pre and post-operative results are shown in Figs. (4-7).

Group I

Fig. (4): Female patient, 26 years old, lateral view photography showing: (Upper raw): Right side pre-operative, left side 3 months post-operative. (Lower raw): Right side 6 months post-operative, left side 9 months post-operative.

Fig. (5): Male patient, 35 years old, lateral view photography showing: (Upper raw): Right side pre-operative, left side 3 months post-operative. (Lower raw): Right side 6 months post-operative, left side 9 months post-operative.

Group II

Fig. (6): Female patient, 23 years old, lateral view photography showing: (Upper raw): Right side pre-operative, left side 3 months post-operative. (Lower raw): Right side 6 months post-operative, left side 9 months post-operative.

Fig. (7): Male patient, 20 years old lateral view photography showing: (Upper raw): Right side pre-operative, left side 3 months post-operative. (Lower raw): Right side 6 months post-operative, left side 9 months post-operative.

DISCUSSION

Tip support mechanism plays an important role in stability and positioning of nasal tip. Different previous studies demonstrated the crucial factors of nasal tip support mechanism. In 1971, Jeneke and Wright published the theory that the ligament in-between the upper and lower cartilage plays a major role in nasal tip support mechanism **[3]**, while in 1984; Anderson described the tripod theory of nasal tip support **[9]**. In addition to this theory, Farrior in 1999 described that the lower lateral crus has a scroll relationship that overlapping the upper lateral cartilage and revealed that this relationship is one of the crucial factors that maintain nasal tip support and projection **[10]**. Many other studies focused on the importance of the ligamentous attachment in-between upper and lower lateral cartilages in nasal tip support and added that any disruption of this attachment during rhinoplasty surgery could result in loss of nasal tip support **[11-16]**.

Although all these previous studies that focused on the importance of this ligamentous attachment between the upper and lower nasal cartilages, there was no study described any method to reconstruct this area following cephalic trimming, so in this current study we described a new suturing technique to re-attach the intercartilaginous ligament again with the remaining part of the lower lateral cartilage. In order to evaluate the efficacy of this new intercartilaginous suture on the long standing results on nasal tip support, we compared measurements of both nasolabial angles and projection/nasal length ratios in two groups of patients. The intercartilaginous suture was applied in group II only.

This study revealed that the mean of post-operative measurements of nasolabial angle was reduced in group I of patients by (1.3±0.5) at 3 months and (2.2±0.6) at 6 months, while there was less reduction in the mean of nasolabial angle measurements in group II, (0.5±0.52) at 3 months and (0.6±0.5) at 6 months post-operatively. These results revealed that the new intercartilaginous suture helps to maintain nasolabial angle and hence maintaining nasal tip position and support by minimizing the caudal rotation of the nasal tip post-operatively.

Mean of post-operative measurements of projection/nasal length ratio in both groups conducted that these ratio showed reduction in group I of patients by (0.015±0.01) at 3 moths and more reduction at 6 months by (0.025±0.01) in the same group, while in group II of patients, the post-operative 3 and 6 months ratio differences showed also less reduction by (0.005±0.01) and (0.008± 0.01) respectively. This explains that the new suturing technique minimizing any alteration in the nasal length and projection post-operatively and hence drooping of nasal tip.

Therefore this study revealed that the new intercartilaginous suture helps to maintain the nasal tip support mechanism following rhinoplasty surgery, as it adds more support by reattachment of the intercartilaginous ligament again to the lower lateral cartilage, which is proved by minimal changes in measurements of nasolabial angle, nasal length and tip projection. Patient satisfaction score at 6 months post-operatively confirmed our results as it showed more patient satisfaction score in group II (mean 4.1±0.8) rather than that of group I which showed less patients satisfaction score (3±0.7).

Conclusion and Recommendations:

This study revealed that the new intercartilaginous suture which applied in-between upper and lower lateral cartilages helps to maintain the nasal tip support mechanism, as the nasal tip position was maintained in group II more than group I in a period of 6 months following rhinoplasty surgery with more patient satisfaction score in group II of patients as well, and hence we recommend the use of intercartilaginous suture as a routine suture following the step of cephalic trimming in rhinoplasty surgery.

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