Pitanguy Ligamentous Flap: A New Method to Prevent Supratip Deformity in Rhinoplasty

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Background: A supratip deformity (SD) is an iatrogenic convexity that occurs in the cephalic region of the nasal tip. SD is still a major problem after rhinoplasty surgery.

Objectives: With the method we have described a ligamentous flap was used to create a supratip transition, with adjustable sharpness, while the refinements of the tip rotation and definition were ensured. The aim of the study is to present the results of this technique, which, to the best of our knowledge, has been described here for the first time.

Methods: Our ligamentous flap technique was applied to 24 patients between August 2017 and March 2018. All of the patients were evaluated in terms of the formation of an SD, a hanging columella, tip projection, and the loss of rotation at the postoperative followups. The photos of patients were evaluated by another independent plastic surgeon and patients themselves at 3 months after the surgery.

Results: There were no early or late complications, such as an infection, excessive bleeding, or prolonged edema. Moreover, SDs, hanging columellas, tip projections, and rotational losses, which would require revisions, were not detected in any of the patients. Postoperative scores given by the patients and surgeons were significantly higher than the preoperative values ($P < 0.05$). Only 2 patients required minor revisions due to dorsal irregularities in the upper 1/3 of the nasal segment.

Conclusion: The early results of this Pitanguy composite flap technique, which can be easily applied in every case with thin or thick skin in an open rhinoplasty, are promising. However, there is a need for an evaluation of the long-term results, as well as the advantages and disadvantages in a larger case series.

Level of Evidence: Level IV.

Key Words: Flap, Pitanguy, rhinoplasty, SMAS

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A supratip deformity (SD) is an iatrogenic convexity that occurs in the region cephalad to the nasal tip, most commonly following a rhinoplasty. It is also called a "parrot beak" or "Polly-beak" deformity. An SD can lead to an aesthetically and anatomically problematic appearance, with many patients requesting revisions. Rhinoplasty associated SDs can be encountered in 9% of the primary, and 36% of the secondary patients.[1] Initially, authors proposed that SD is caused by an inadequate dorsal cartilage resection from the supratip region.[1] Guyuron et al found significant fibrosis in the histological materials obtained from supratip region in secondary nose operations in cases with SD.[1] In their study, Sheen et al suggested that after excessive cartilage resection, the redundant skin overlying the supratip region and the inability of this skin to adhere to the base were the reasons why SD occurred.[2] The most widely accepted theories regarding the mechanism of SD formation are: fibrosis in the dead space resulting from overresection in the supratip region and accumulation of the cut and retracted Pitanguy ligament, especially in noses with thick skin.[1–3]

New techniques for improving the form and function of the nose continue to be defined. As the number of these techniques increase, the expectations for the surgical results become more detailed. In addition to development of more atraumatic techniques and instruments, the details of intricate nasal anatomy have been presented in several previous studies.[3–5] The importance and contribution of the dermocartilaginous ligament to the nasal form were first defined by Pitanguy et al, who advocated excision of this ligament to create a supratip break and prevent a possible SD.[6] Çakir et al; however, advocated for the protection or repair of the ligament in the polygon rhinoplasty concept that they defined.[7]

In light of the previous studies, we believe that an SD is still a major problem after rhinoplasty surgery. With the method we have described, a soft tissue ligamentous flap between the medial crura and the caudal septal angle was used to create a supratip transition, with adjustable sharpness, while the refinements of the tip rotation and definition were ensured. We aimed to present the results of this technique, which, to the best of our knowledge, has been described here for the first time.

Anatomy

The borders of the ligamentous flap used in our study can be defined as the septal angle cranially, the medial crural-nasal mucosal inner side laterally, and the superficial musculoaponeurotic system (SMAS) caudally (Fig. 1). This ligamentous flap is connected to the depressor septi nasi muscle posterocaudally.[4] The connection between the depressor septi nasi and the Pitanguy ligament was also reported by Pitanguy et al[6,8] and de Souza Pinto et al.[9] However, Saban et al showed that the medial SMAS was divided into superficial and deep layers at the internal nasal valve level.[5] The superficial SMAS layer joins the columella immediately beneath the interdomal fat pad and above the interdomal ligament.[10] The deep SMAS layer joins the membranous septum under the interdomal ligament and in alignment with the anterior septal angle inserts to the spina nasalis anterior. Saban et al argued that the deep medial SMAS is the equivalent to or continuation of the Pitanguy ligament.[5] According to the concept of the 5-level nasal soft tissue

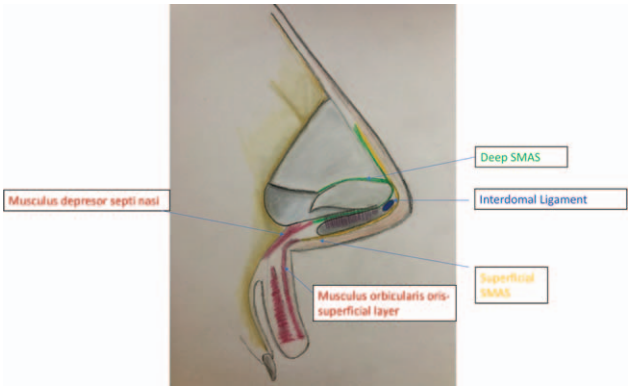

FIGURE 1. Lateral sketch of SMAS layers of nasal soft tissue. SMAS, superficial musculoaponeurotic system.

envelope, the Pitanguy ligament is not a true dermocartilaginous ligament.[11] Pitanguy et al explained that the ligament originates from the lower surface of the dermis, and that it progresses tangentially between the alar cartilages, and thus, violates the concept of 1 layer of the soft tissue envelope.[8] Although the results of the studies by Saban et al and Daniel et al did not match the anatomy defined by Pitanguy et al, we defined our ligamentous flap after Pitanguy as he was the first to define the ligament and the name is universally recognized.

METHODS

Patients

A total of 37 patients were enrolled in this study. All patients were operated between August 2017 and March 2018 by a single surgeon. The selection criteria were; patients with moderate thickness skin envelope, having been operated by the same surgeon (BSE), and those who were primary open rhinoplasties. Our Pitanguy ligamentous flap technique was used in 24 patients whereas in 13 the technique was not utilized (the patients operated before December 2017 when the technique was proposed). Patients were analyzed retrospectively. The study was conducted according to the Declaration of Helsinki on research and human rights. Preoperatively all patients provided written consent to undergo surgery and for their photographs to be used for academic purposes.

During the follow-up period, all images were captured from standard 6 views using same digital camera (OMD Mark 2; Olympus, Tokyo, Japan) and lens (14–42 mm 1:3.5–5.6 EZ MSC, Olympus, Tokyo, Japan) according to the Frankfort Horizontal Line, at a fixed distance of 1 m.

The photos were evaluated by 2 independent plastic surgeons and patients themselves at 12 months after the surgery. Evaluators observed aesthetic properties regarding supratip-tip relation, tip projection, tip rotation, and accompanying asymmetries. Evaluators were asked to score the preoperative and postoperative patient photographs from 1 to 5 (1-very bad, 2- bad, 3-acceptable, 4-good, and 5-very good).

Preoperative and postoperative images of the patients were assessed using Photoshop 2018 (Adobe, San Jose, CA). The fine-tuning and calibration of the positioning were done according to distances between lateral canthus to subnasale planes. The changes in the supratip region were assessed using the longest distance between supratip break point to the straight line drawn from nasion to tip defining point (negative values are obtained for desired supratip break, and positive values indicate a SD, the severity of which, is directly proportional to the value). This

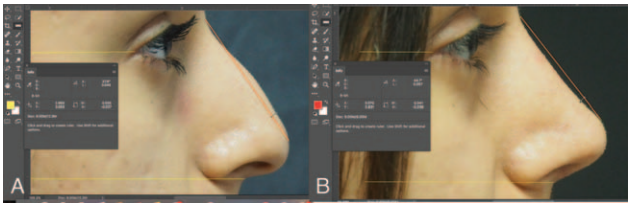

FIGURE 2. The changes in the supratip region were assessed using the longest distance between supratip break point to the straight line drawn from nasion to tip defining point.

distance is used for both preoperative and postoperative 12th month photographs (Fig. 2). The changes were compared statistically between and in the study and control groups.

The data were analyzed using the SPSS 18.0 (r) software (SPSS Inc, Chicago, IL). The *P* value was set to 0.05 to assess the statistical significance in and between the groups.

Surgical Technique

All patients underwent surgery under general anesthesia according to open rhinoplasty technique. After local anesthetic with 1/100.000 adrenaline solution infiltration to incision sites, an "inverted v" columellar incision and margin incisions were performed. In the supraperichondrial plane, we began to dissect the columellar flap.

Group 1

For the patients in group 1 the dissection was continued anterior to the interdomal ligament to the point where the deep SMAS and superficial SMAS were thought to be separated, based on anatomical studies[4] (Fig. 3). Then, with the help of hooks or Adson-Brown forceps, the medial crura were laterally spreaded. All soft tissue components in the membranous septum were dissected up to the anterior septal angle, with the medial crura perichondrium and mucosa kept intact (Fig. 4). This flap was transected near the maxillary crest, and it was separated from the anterior septal angle immediately caudal to its caudal border (Fig. 5). As a result of the dissection up to this segment, 1 columellar and 1 Pitanguy ligamentous flap free from the internal nasal valve level were obtained (Fig. 6).

The dissection then continued supraperichondrially and subperiosteally.

Group 2

For the patients in group 2, after "inverted v" incision, the dissection was continued anterior to the Pitanguy ligament. After

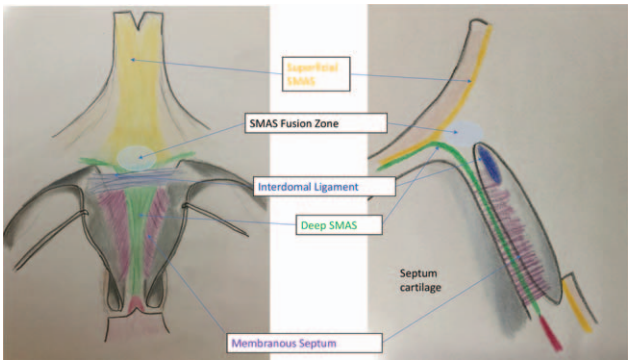

FIGURE 3. Coronal and lateral sketch of the zone where deep and superficial layers of SMAS were thought to be separated. SMAS, superficial musculoaponeurotic system.

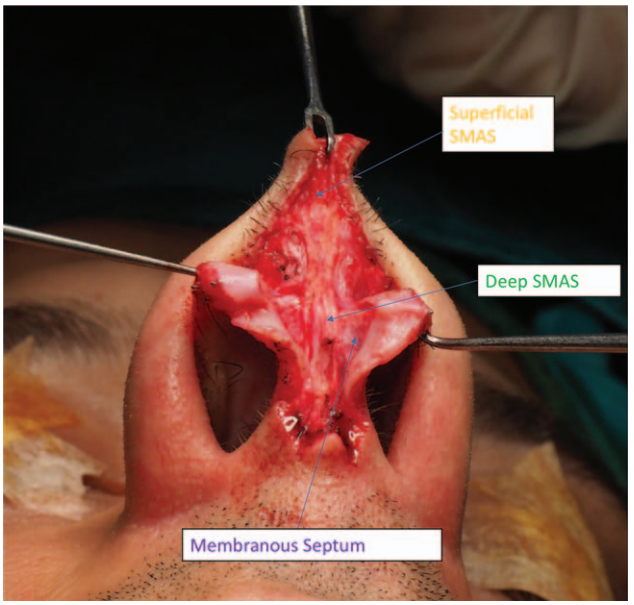

FIGURE 4. The medial crura were retracted to the laterals, and all of the soft tissue components in the membranous septum were dissected up to the anterior septal angle, with the medial crura perichondrium and mucosa kept intact.

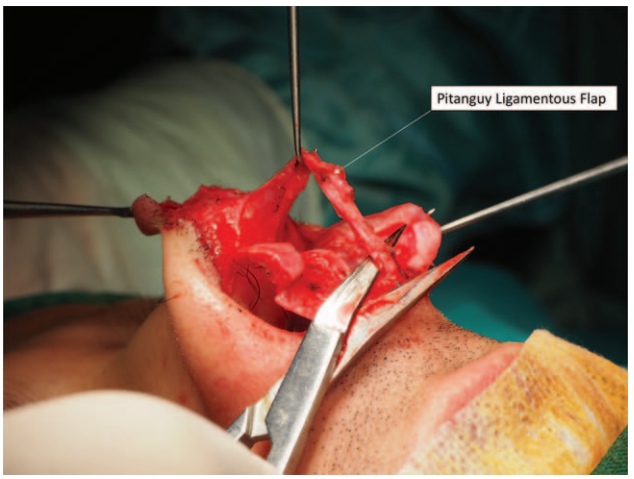

FIGURE 5. Pitanguy ligamentous flap was transected near the maxillary crest, and it was separated from immediately next to the anterior septal angle.

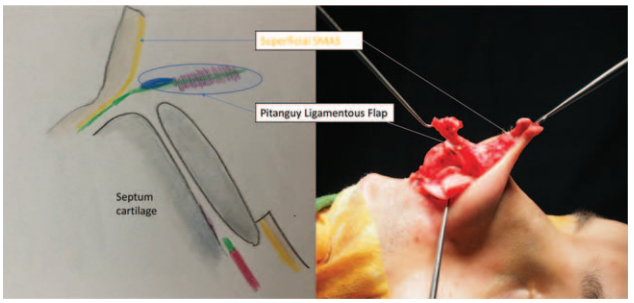

FIGURE 6. As a result of the dissection up to this segment, 1 columellar and 1 deep SMAS flap separated from the internal nasal valve level were obtained. SMAS, superficial musculoaponeurotic system.

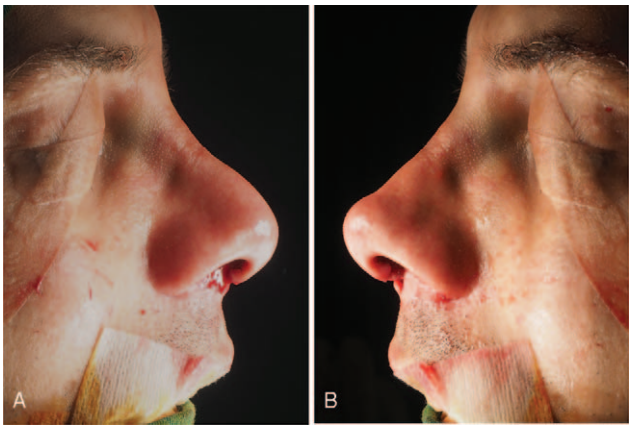

FIGURE 7. (A) Before suturing Pitanguy ligamentous flap to medial crura. (B) After suturing Pitanguy ligamentous flap to medial crura.

transecting the Pitanguy ligament the dissection continued supraperichondrially and subperiosteally.

For all the patients after dissecting the nasal skin and mucosal envelope component separation method was used for hump reduction, with upper lateral preservation. Operation was continued with caudal septal reduction, cartilage grafting with L-strut preservation, bilateral spreader flap application, sutures providing tip definition, medial crura strengthening with a columellar strut, and osteotomies. Finally, in group 1, this Pitanguy ligamentous flap, passing through and between the right or left medial crus and the columellar strut, was sutured with 2 "U" fashion 5-0 PDS (Ethicon, Inc, Somerville, NJ) stitches, with the help of mosquito clamps, to the medial crura and the columellar strut to create the desired supratip concavity (Fig. 7B) (Supplemental Digital Content, Video, http://links.lww.com/SCS/B177). In group 2 ligament was left unsutured. Then, for both groups 1 suture was placed on the superficial SMAS in the columellar flap, and the skin and mucous membranes were sutured. Intranasal splints, external packing, and a thermoplastic splint were then applied. In all of the patients, the intranasal splints were removed on the second day, and the thermoplastic splint was removed on the seventh day after the surgery. All of the patients were evaluated in terms of the formation of an SD, a hanging columella, tip projection, and the loss of rotation at the postoperative follow-ups (Figs. 8–11).

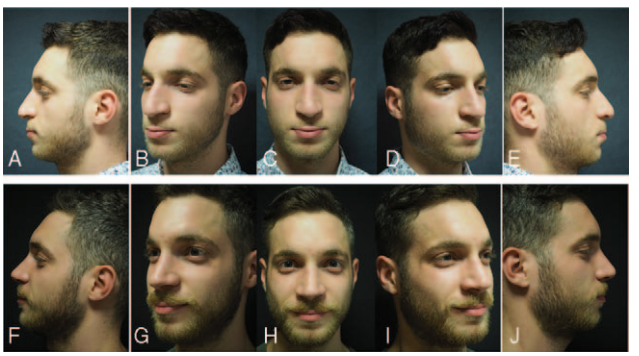

FIGURE 8. (A–E) Frontal, oblique, and lateral view of the patient preoperatively. (F–J) Frontal, oblique, and lateral view of the patient postoperatively.

FIGURE 9. (A–E) Frontal, oblique, and lateral view of the patient preoperatively. (F–J) Frontal, oblique, and lateral view of the patient postoperatively.

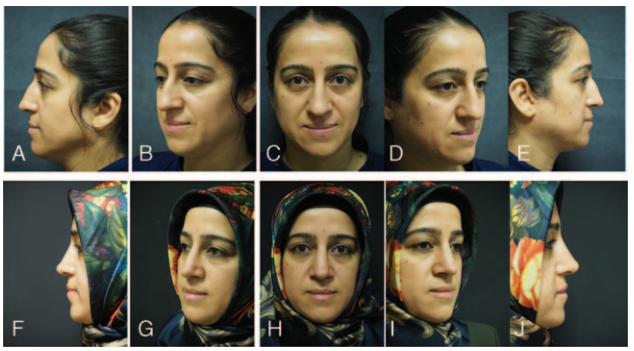

FIGURE 10. (A–E) Frontal, oblique, and lateral view of the patient preoperatively. (F–J) Frontal, oblique, and lateral view of the patient postoperatively.

RESULTS

Patient and Surgeon Scores

The median preoperative score given by the patients was 1 (min. 1, max. 2), while postoperative median score was 4 (min. 3, max. 5). The median preoperative score given by the surgeons was 1 (min. 1, max. 2), while postoperative median score was 5 (min. 4, max. 5). A 1-sample Kolmogorov-Smirnov test was carried out to prove the distribution is not normal and a decision to go on with nonparametric tests was made. Postoperative scores given by the patients were significantly higher than the preoperative values ($P < 0.05$).

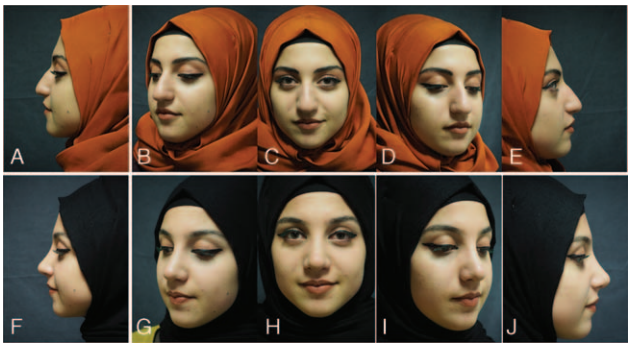

FIGURE 11. (A–E) Frontal, oblique, and lateral view of the patient preoperatively. (F–J) Frontal, oblique, and lateral view of the patient postoperatively.

Concurrently, postoperative scores given by the surgeons were significantly higher than preoperative scores ($P < 0.05$). A Spearman rho analysis was carried out to find correlation between the groups, revealing a sole significant correlation between the postoperative scores given by patients and surgeons, and nothing else ($P < 0.05$).

Supratip Distances

The mean supratip distance was 0.1045 ± 0.09077 in group 1 preoperatively, while it came to a mean -0.0864 ± 0.06760 in postoperatively. The mean amount of change was 0.1830 ± 0.07391 in.

For group 2, the mean preoperative supratip distance was 0.0908 ± 0.04331 in. Postoperative mean supratip distance for Group 2 was 0.0096 ± 0.04372 in. The mean amount of change was 0.0812 ± 0.03437 in.

Between the groups, supratip distances were not significantly different preoperatively ($P = 0.0615$).

However, there was a significant difference between the groups postoperatively ($P < 0.0001$).

For both groups, a statistically significant change was detected between preoperative and postoperative supratip distances (group 1, $P =< 0.0001$; group 2, $P < 0.0001$) (Supplementary Digital Content, Table 1, http://links.lww.com/SCS/B176).

The follow-up period for the 37 patients was between 12 and 19 months. There were no early or late complications, such as an infection, tip vascular compromise, excessive bleeding, or prolonged edema. Moreover, SDs, hanging columellar deformities, tip projection problems, and rotational losses, which would require revisions, were not detected in any of the patients. Only 2 patients in Group 2 and 1 patient in Group 1 required minor revisions due to dorsal irregularities in the upper 1/3 of the nasal segment. The operations were scheduled for these 3 patients.

DISCUSSION

The techniques that form the basis of a rhinoplasty surgery usually involve the skeletal structure of the nose, such as the cartilage and bone. Interventions directed towards the skin and soft tissues are very limited in comparison. However, even if the patient's cartilage and bone interventions and reorganizations are performed appropriately, sometimes an SD is observed.

SDs is one of the most common complications of rhinoplasties.[1,2,12–15] They may be due to the high caudal dorsum and underprojection in noses that have not undergone any nasal surgery, and they may be due to excessive scar formation in the dead space in the supratip region in secondary surgery cases.[1,2] According to Çakir et al, the main cause of SD is the accumulation of a retracted Pitanguy ligament that was cut during the rhinoplasty dissection, especially in noses with thick skin.[3] To sum it all up, the problem may be caused by the soft structures of the nose, as well as its hard structures.

According to Gunter et al, the management of primary and secondary SDs is not significantly different, but the etiology is important in the development of a treatment plan. For instance, are there anatomical structures that have been displaced? Are there structural components that have been slightly or significantly interfered with? Is there a combination of both? The appropriate surgical goals and treatment plans can be established by answering these questions. First, the displaced anatomical structures should be repositioned appropriately. Then, the absent fields should be defined. Likewise, from those regions with excess, deficient tissue should be identified and replaced, if necessary. Finally, the optimal approach method should be determined according to the general findings and the deformity itself.[16]

According to the study by Guyuron et al, it is suggested that the distance between the tip point and the caudal dorsum should be between 6 and 8 mm for thin skin and between 8 and 10 mm for thick skin to avoid SDs.[1] Pitanguy et al, in addition to identifying the ligament, advocated for the excision of this ligament in those patients who may have an SD.[6] Rohrich et al stated that for noses with thick skin in patients of Middle Eastern origin, the nasal skin in the supratip region was more easily adapted by thinning the skin, and thus, decreasing the likelihood of an SD formation.[17] However, excessive defatting and thinning may disrupt the skin circulation, leading to irreversible and catastrophic consequences, such as skin necrosis. In their study, Wright et al showed that defatting was not useful for preventing an SD.[18]

Guyuron et al advocated for suturing the supratip skin to the caudal septum by passing a subcutaneous suture to fill the dead space.[1] Moreover, Çakir et al argued that the Pitanguy ligament was very important to create a supratip brake, and they suggested a controlled transection after the subperichondrial dissection and suturation of the Pitanguy ligament at the end of the operation in an open rhinoplasty.[3] Both techniques have been tested by us; however, the suture in the supratip region could theoretically increase the incidence of fibrosis. In addition, imperfect stitching may cause an unpleasant dimpling of the supratip.

Conrad et al used fibrin glue to improve the skin's adaptation to an SD.[19] At the end of their study, all of the patients had acceptable aesthetic results; however, the fibrin glue adds an additional cost to the surgeon or the patient. Moreover, Jung et al performed an elliptical supratip skin excision to reduce extra soft tissue and the risk of scarring in the supratip area. In their work, the small linear scar that emerged as a result of this procedure was acceptable in appearance after a few months. However, an external scar in the supratip region may not be accepted by every patient.[20]

To the best of our knowledge, the Pitanguy ligamentous flap has not been used previously, and when the flap is properly sutured, there is no sharp dimpling in the supratip region. In our technique, the complex flap, which is fusiform in shape, shows continuity with the scroll ligament in the laterals. For this reason, it fills the dead space not only in the supratip region but also on the scroll line, and it gives a sharp view of the nasal cartilage lines. SDs were not observed during the postoperative period in any of the patients included in our study, and none of the patients requested revisions of the supratip region during the follow-up period. Another important feature of the ligamentous flap we created is that the suturing location and tension can be adjusted due to its fusiform anatomical structure. While it can provide a minimal rotational increase when it is sutured tightly and close to the dome, it can also be sutured closer to the nasal footplates in noses with enough rotation. Usually, in our rhinoplasty cases, because the rotation is primarily adjusted by tip suturing and caudal septal excision techniques, the flap is often sutured to the medial crura in the columellar incision line. The advantage is that this prevents the retraction of the incision line, which may be seen in open rhinoplasties, because it forms a soft tissue cluster at the base of the columellar incision line.

Many rhinoplasty surgeons have utilized the septocolumellar suture and tongue in groove techniques to prevent columellar hanging and to adjust the tip position.[21] Although temporary, the most important disadvantages of these techniques are a fixation at the tip of the nose and a loss of elasticity. In our method, the medial crura are not attached to the septum, which is static, they are connected to the skin, which is dynamic, moving, and elastic.

While many surgeons prefer supraperichondrial and subperiosteal dissections in nasal surgery, some surgeons prefer the subperichondrial-subperiosteal dissection plane because it is atraumatic.[3] Our method can be applied to both techniques, based on the surgeon's preference.

One disadvantage of this method is that the dissection requires substantial attention, and it is very important to work in a bloodless field during the dissection phase of the intercrural region. During the flap formation, especially in the dissection of the nasal mucosa on the cranial side of the medial crura, one may encounter ruptures in the mucosa. These can be overcome easily by using hypotensive anesthesia and meticulous dissection techniques. A rhinoplasty surgeon who has adequate knowledge of the nose anatomy will be a very quick learner.

This technique is easy to perform, reliable, reproducible and easily recognizable by the surgeon performing it. An obvious contraindication of the use of this technique is revision cases where the normal anatomic relations cannot be found.

The most important limitations of this study are the lack of long-term results and the low number of cases. Working with a much larger series and evaluating the long-term results will provide clearer information. For this reason, we plan to continue this study and to present the long-term results of a greater number of cases.

CONCLUSIONS

The early results of this Pitanguy ligamentous flap technique, which can be easily applied in every case with thin or thick skin in an open rhinoplasty, are promising. The most important advantages of this technique are that there is no time lost, it is easy to learn, and it is reliable. However, there is a need for an evaluation of the long-term results, as well as the advantages and disadvantages in a larger case series.

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