Modified Endonasal Tongue-in-Groove Technique

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Abstract

Achieving stable and desirable changes in tip rotation (TR) and tip projection (TP) is among the primary goals of modern day rhinoplasty. The tongue-in-groove (TIG) technique is one technique in rhinoplasty used to improve TR and/or TP. Performing TIG endonasally using a permanent suture can be quite cumbersome as the suture needs to be buried under the skin. We describe a variation of TIG technique for endonasal rhinoplasty using a permanent suture buried in small columellar skin incisions. The technique details are described and the postoperative changes in TR and TP are analyzed for the degree of change and longevity. A retrospective review of the preoperative and postoperative photographs of 12 patients treated with the endonasal TIG technique were analyzed for changes in TR and TP. Out of 12 patients, there were seven females (58.3%) and five males (41.7%), with age ranging from 17 to 49 years. The follow-up ranged from 6 months to 53 months, with mean follow-up of 12.1 months. All patients were treated by the senior author in a major New York City hospital. Postoperative changes in TR and TP were compared by measuring the nasolabial angle as well as the Goode ratio using a photo editing software. Using a *t*-test and a *p*-value criteria of 0.05, the difference between the preoperative and postoperative TR ($p = 0.0069$) and TP ($p = 0.026$) was found to be statistically significant. None of the study patients developed any complications related to the use of a permanent suture material during the follow-up period. Our modified TIG technique is a quick, reliable, and safe option in the surgical armamentarium to achieve desired changes in TR and/or TP.

Level of evidence: 4

Keywords
- rhinoplasty
- endonasal
- tongue-in-groove
- tip projection
- tip rotation

The goals of modern day rhinoplasty include functional and aesthetic refinements of the nose. Appropriate and reliable changes in tip rotation (TR) and tip projection (TP) are invaluable components to successful rhinoplasty outcomes. TR is defined as the angle between a straight line drawn from the subnasale to the nasal tip, and from the subnasale to the vermillion border of the upper lip. In men, the normal nasolabial angle is generally accepted to be 95 to 100 degrees, whereas the accepted angle in women is between 105 and 110 degrees.[1] Patients in whom the angle is below the lower limit of normal are considered to have an underrotated tip, and those with an angle greater than the upper limit of normal are considered to have an overrotated tip. TP is defined as the anteroposterior distance between the alar root and the nasal tip. Acceptable projection is determined by calculating the Goode ratio, which is the ratio of distance between the alar base and the nasal tip to the distance between the nasion and the nasal tip; this is generally accepted to be 0.55 to 0.6. Patients with indices greater than 0.6 are considered overprojected, and those under 0.55 are considered underprojected.[2]

To understand the dynamics of the nasal tip, Anderson proposed the tripod concept of the nasal tip. This theory describes the nasal tip as a dynamic structure reliant on three support systems.[3] The first leg is composed of the combined medial crura of the lower lateral cartilages (LLCs) while the

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second and third legs each comprise a lateral crus of the LLCs. To make changes to the TR and TP, Anderson suggested making changes to the legs of the tripod.

In 1934, Rethi proposed a novel technique for improving nasal TR and TP, which he called "tongue-in-groove" (TIG).[4] Rethi had found that by performing a cephalad advancement of the medial crura and suturing them to the caudal septum, patients get a change in rotation and often times, an improvement in nasal projection as well. The technique, however, was not widely used until the popularization of open rhinoplasty in 1980s.[5] Although the TIG technique was initially performed in open rhinoplasty, it later became widely employed in closed rhinoplasty as well. Williams in 2012 described an endonasal modification of this technique for the repair of alar–columellar disharmony, primarily focusing on the repair of hanging columella and large nostrils.[6]

There are numerous techniques that can be employed to achieve desired changes in TR and TP. The most commonly used ones include columellar strut, suture modification of the LLCs such as lateral crural steal, LLC medial, or lateral crural division, and placement of the tip graft, just to name a few.[7,8] All of the aforementioned techniques have a definitive role in modern rhinoplasty surgery and, when selected appropriately, commonly lead to desired surgical outcomes. However, there are certain limitations to each of the aforementioned techniques.

Columellar strut, for example, being a free cartilage graft, is susceptible to warping, shifting, and some degree of resorption, all of which could negatively impact on long-term results. In instances of naturally weak septal cartilage and heavy nasal tip with thick skin and prominent LLCs, the strut may simply be not strong enough to withstand the gravitational forces over long period of time. LLC modification techniques, with or without cartilage splitting, are prone to asymmetries and cartilage irregularities and frequently require additional maneuvers to provide the tip with an adequate support postoperatively, such as placement of the columellar strut, TIG technique, or tip graft. Most of the aforementioned techniques commonly require a significant exposure of the nasal tip, whether via an open rhinoplasty approach or close rhinoplasty approach with LLC delivery, thus adding to the surgical time and the recovery time as well as introducing a certain risk of subcutaneous fibrosis.

The ideal technique for TR and TP changes, especially in the tips that are symmetric and don't require any improvement in definition, would include all of the following:

- Minimal time requirement.
- Minimal violation of the natural tip anatomy.
- Predictable results intraoperatively and long-term.
- Intraoperative results closely resembling long-term outcomes.
- No need for an additional grafting.
- Easy to perform.

TIG is the technique that, when used appropriately, satisfies all of the aforementioned requirements, with possibly only one caveat. While it is very technically straightforward to perform TIG using an absorbable suture, such as chromic gut or polydioxanone (PDS), by simply placing the suture through the caudal septum and columella and tying it over columellar skin, the technique becomes more cumbersome and involved if one wants to use a permanent suture. To our knowledge, there were no studies done up to date comparing long-term outcomes of permanent versus absorbable suture in TIG in terms of maintaining TP and TR over time. However, intuitively thinking, the only forces supporting TR and TP after full resorption of an absorbable suture are the forces of fibrosis, which alone may not be sufficient to withstand gravitational forces over long period of time, especially in cases of large, heavy nasal tips. In contrast, using a permanent suture would provide a surgeon with an extra level of security that the TR and TP will not significantly change over time.

In our study, we propose the use of the TIG technique in endonasal rhinoplasty using a nylon suture buried in columellar skin incisions as a sole tip changing maneuver for patients desiring only changes in TR and/or TP. This TIG technique is very time efficient, can be performed in the office under local anesthesia, and delivers predictable and lasting results. We discuss our technique, follow-up results, and advantages and limitations of this method.

Methods

Prior to beginning the project, approval was received from the Institutional Review Board of our hospital. In this study, we retrospectively identified 12 patients who were treated with the TIG technique with permanent suture via the endonasal approach. Most of these patients had other rhinoplasty components performed at the same time, such as dorsal hump reduction, osteotomies, or septoplasty, but no other tip modifying techniques were performed except TIG. There were five males (41.7%) and seven females (58.3%) in this group; all of the patients were treated by the senior author (A. O.) from 2008 to 2013 at a city hospital in New York. The patients' age ranged from 17 to 49 years, and the follow-up ranged from 3 to 53 months, with a mean follow-up of 12.1 months.

Surgical Technique

Following intubation and sterile preparation, patients were decongested using oxymetazoline-soaked pledgets. Local anesthetic using 1% lidocaine with epinephrine 1:100,000 was injected in a standard fashion. Prior to making the initial incision, the patient was examined on the operating room table to assess the nose at baseline (►**Fig. 1**). The columella was then manually advanced in a cephalad direction to assess the degree of change needed for a successful outcome. This would serve as a simulation of the projected change. A full transfixion and intercartilaginous incisions were made, exposing the caudal septum and nasal dorsum, along with the medial crura of the LLCs. Bilateral mucoperichondrial septal flaps were elevated exposing the caudal aspect of the septal cartilage. If required, dorsal refinements, osteotomies, and septoplasty were performed at this point. The intercrural pocket was then dissected between the medial crura of the LLCs using tip scissor (►**Fig. 2**). Two 2 to 3 mm incisions on each side of the lateral aspect of the columellar skin were made to bury nylon sutures (►**Fig. 3**). The medial crura were then manually inset onto the caudal cartilaginous septum in such a way as to achieve a desirable change in either the TP, TR

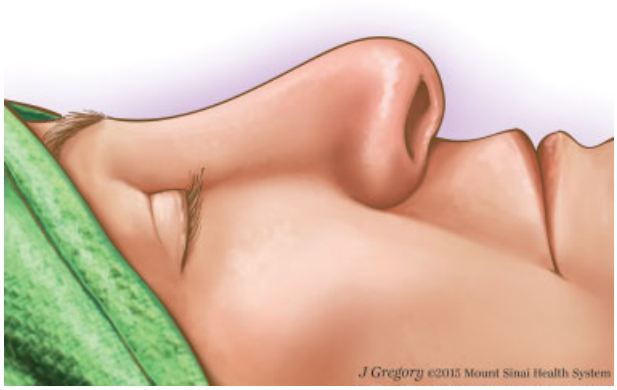

Fig. 1 Preoperative illustration of the patient prior to making incisions. (Illustration by J. K. Gregory, © 2015 Mount Sinai Health System.)

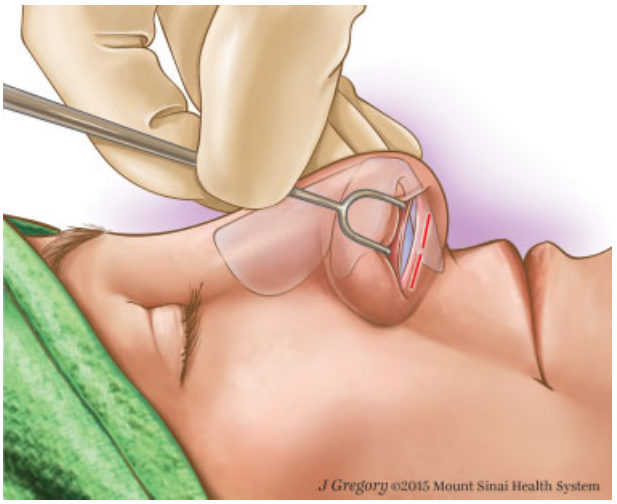

Fig. 3 Two incisions are made lateral to the columella to bury the horizontal mattress sutures after securing the medial crura onto the septum. (Illustration by J. K. Gregory, © 2015 Mount Sinai Health System.)

or both. Once the desired tip position was achieved by manually maneuvering the tip, the first nylon suture using 5–0 clear nylon on a straight needle was placed through the columellar skin incision on one side to secure both medial crura to the caudal septum while tying the knot on the ipsilateral side (►**Fig. 4**). If tip position was not satisfactory, the suture was removed and redone until the optimal result was achieved. As there were no other tip manipulations except for TIG, tip edema was not noted to be a confounding factor in judging the appearance of tip position. Once satisfied with the first suture, the second nylon suture was placed through the second set of columellar incisions in a similar fashion (►**Fig. 5**). Care was taken to ensure the symmetric placement of the mattress sutures on each side of the columella to avoid any postoperative tip asymmetries. Including the caudal septal cartilage into the mattress suture was crucial as caudal septum served as the main support for the resultant changes. This was ensured either by direct visualization of the suture passing through caudal septal cartilage or by pulling on the suture and observing for columellar mobility. Pulling on the suture that indeed passed through the caudal septal cartilage would not pull the columella away from the septum, and vice versa. Once both sutures were tightened, the resultant tip changes and symmetry were again evaluated. The excess membranous septum that commonly results from increasing TR was trimmed conservatively. Full transfixion and intercartilaginous incisions were closed using 5–0 chromic suture. The columellar incisions do not typically require any closure; however, these can be closed with 6–0 fast absorbing gut if desired. The nose is then taped and splinted with Aquaplast (Medline, Mundelein, IL) in a routine fashion (►**Fig. 6**).

Analysis

Preoperative and postoperative photographs were taken using Kodak D100 digital SLR camera (Eastman Kodak, Rochester, NY). The nasal rotation was measured on both the preoperative and postoperative photographs using computer software that calculated the nasolabial angle, which is

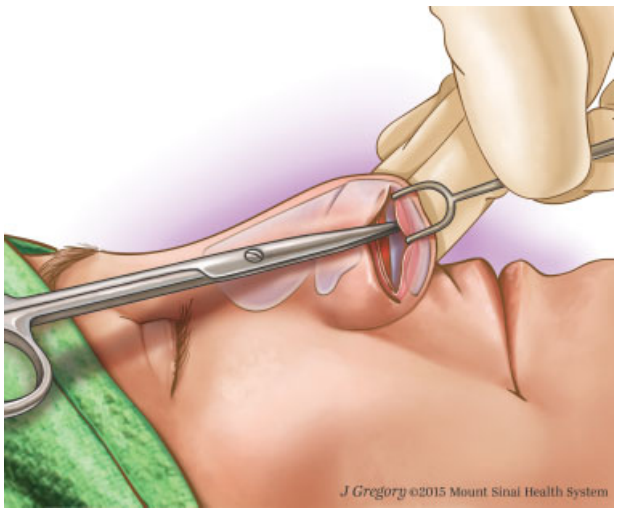

Fig. 2 Dissection of intracrural pocket following full-transfixion and intercartilaginous incisions. (Illustration by J. K. Gregory, © 2015 Mount Sinai Health System.)

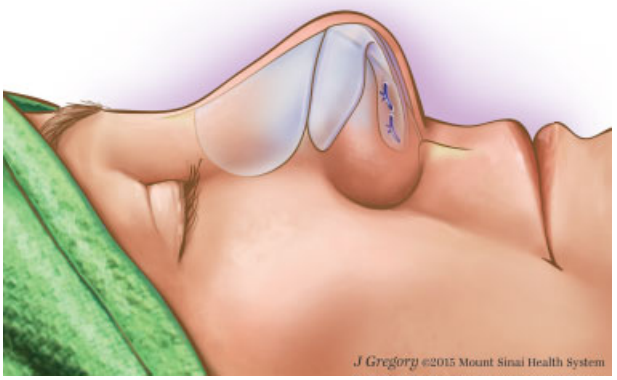

Fig. 4 Horizontal mattress suture placed to secure the medial crura onto the septum. (Illustration by J. K. Gregory, © 2015 Mount Sinai Health System.)

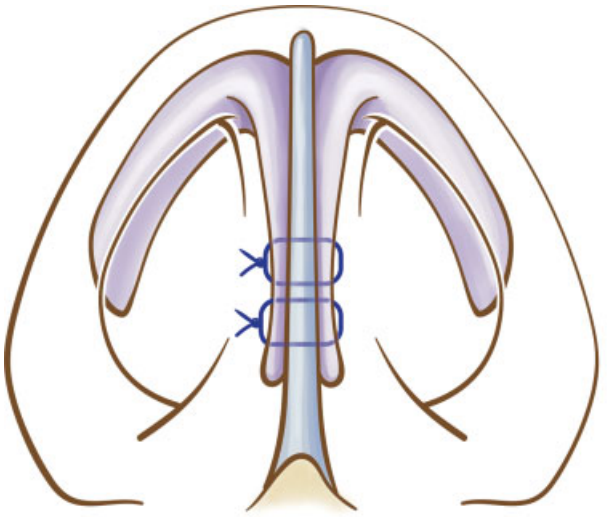

Fig. 5 View of both columellar sutures in place. (Illustration by J. K. Gregory, © 2015 Mount Sinai Health System.)

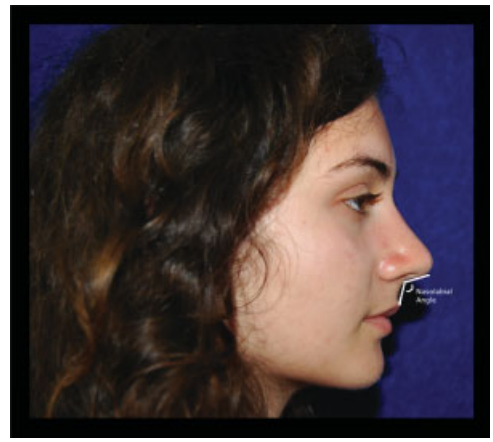

Fig. 7 Analysis of nasal tip rotation by measuring the nasolabial angle. The nasolabial angle is measured by marking a line from the subnasale to the vermillion border and from the subnasale to the nasal tip. The angle between those lines (i.e., nasolabial angle) is the measurement of tip rotation.

the angle between a line drawn from the subnasale to the vermillion border, and from the subnasale to the nasal tip (►**Fig. 7**). The nasal projection was calculated by measuring the Goode ratio (►**Fig. 8**). To calculate the Goode ratio, three points are first selected: the nasion (A), the nasal tip (B), and the alar base (C). A line is drawn from the nasion to the nasal tip (AB), and then from the nasion to the alar base (AC). An altitude is then placed from the nasal tip to the line perpendicular to AC (BC). To calculate the Goode ratio, the distance from tip to alar base (BC) is divided by the distance from nasion to nasal tip (AB).

After data were obtained, a *t*-test using a *p*-value criteria of 0.05 was employed to compare the mean of the preoperative rotation with the postoperative rotation, as well as the mean of the preoperative Goode ratio with the postoperative Goode ratio to test for statistical differences.

Results

►**Table 1** shows changes in preoperative and postoperative TR and TP. ►**Figs. 9** to **11** show selected patients from this study to highlight their preoperative and postoperative changes.

The mean preoperative TR was 87.7 degrees while the mean postoperative rotation was 94.5 degrees; with a *p*-value of 0.0069, this difference was found to be statistically significant. The mean preoperative Goode ratio was 0.64 and the mean postoperative Goode ratio was 0.68; with a p-value of 0.026, this difference was also found to be statistically significant in this group of 12 patients.

To illustrate longevity of the technique, photographs for patient 3 were obtained at a follow-up interval of 5 and 17 months postoperatively. TR and TP remained unchanged,

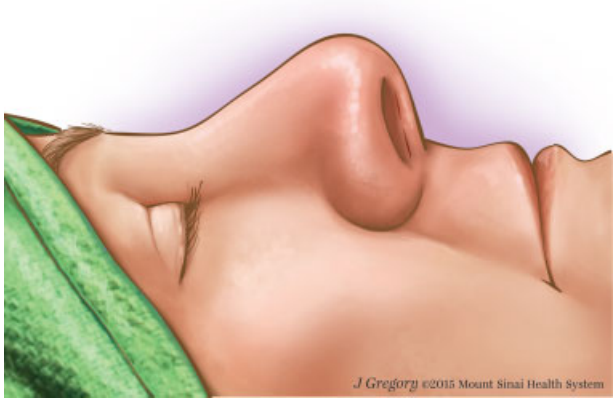

Fig. 6 Final result displayed following completion of tongue-in-groove technique. (Illustration by J. K. Gregory, © 2015 Mount Sinai Health System.)

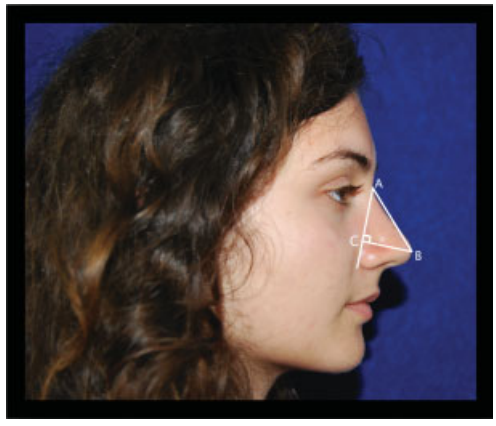

Fig. 8 Analysis of nasal tip projection by measuring the Goode ratio. To calculate the Goode ratio, the nasion (*A*), the nasal tip (*B*), and the alar base (*C*) are all identified. A line is drawn from the nasion to the nasal tip (*AB*) and then from the nasion to the alar base (*AC*). An altitude is then placed from the nasal tip to the line perpendicular to *AC* (*BC*). The ratio is calculated by taking the distance from tip to alar base (*BC*) and dividing it by the distance from nasion to nasal tip (*AB*).

Table 1 Tip rotation and projection changes

Patient	Preoperative rotation (deg)	Postoperative rotation (deg)	Net change in rotation (deg)	Preoperative Goode ratio	Postoperative Goode ratio	Net change in Goode ratio
1	85.5	87.9	2.85	0.55	0.63	0.08
2	89.6	94.3	4.7	0.66	0.71	0.05
3	89	102.2	13.2	0.66	0.67	0.01
4	89.3	92.5	3.2	0.60	0.64	0.04
5	84.2	88	3.8	0.71	0.70	0.01
6	99	92.2	6.8	0.65	0.68	0.03
7	87	102.8	15.8	0.53	0.62	0.09
8	81	92	11	0.63	0.69	0.06
9	78	92	14	0.61	0.73	0.12
10	89.5	101	11.5	0.69	0.74	0.05
11	94.6	101	6.4	0.66	0.67	0.01
12	86.3	88.9	2.6	0.66	0.70	0.04

measuring 102.2 and 0.69 degrees, both at 5 months and at 17 months after the surgery, respectively (►**Fig. 12**).

TIG part took on average 10 to 15 minutes of surgical time. There were no postoperative complications related to TIG permanent suture, such as infection, extrusion, or foreign body reaction in any of the study patients. In follow-up, all patients were satisfied with surgical results.

Discussion

The TIG technique can be safely and reliably employed in endonasal rhinoplasty to improve TR and TP, correct excessive columellar show, and improve nasal tip support.[5,9] First introduced by Rethi[4] in 1934, TIG technique fell out of favor for quite some time until it was repopularized in the late 1980s, which seemingly correlated with popularization of open rhinoplasty. Since then it has been widely used primarily in open rhinoplasty approach by a variety of rhinoplasty surgeons who enjoyed the reliability of the changes in nasal tip that this technique provided.

In 2012, Williams described the TIG in endonasal rhinoplasty for the successful correction of alar–columellar disharmony, but reported that it may not be a suitable maneuver for patients desiring significant changes in TP and TR.[6] Our results of using a nylon suture with the TIG technique has demonstrated that it can indeed be a quick and reliable method for improving nasal TR and/or TP.

The concept of TIG is not innovative. While TIG has been reported to improve projection and rotation, these parameters were not the primary aims of previous studies. Both Kridel et al and Williams have reported the use of the endonasal TIG technique to improve alar–columellar disharmony with favorable results.[5,6] Datema and Lohuis have demonstrated improvement of nasal TP by using TIG for tip deprojection.[10] Previous studies have mentioned the improvement in TP and TR, but have not advocated the use of TIG as a sole tip-changing maneuver. Our study is unique in that it advocates for the use of TIG in patients desiring changes in TR and TP without tip refinement due to the simplicity and speed of this technique. Moreover, our technique is a modification of the previously mentioned techniques in that the columellar skin incisions have not been reported

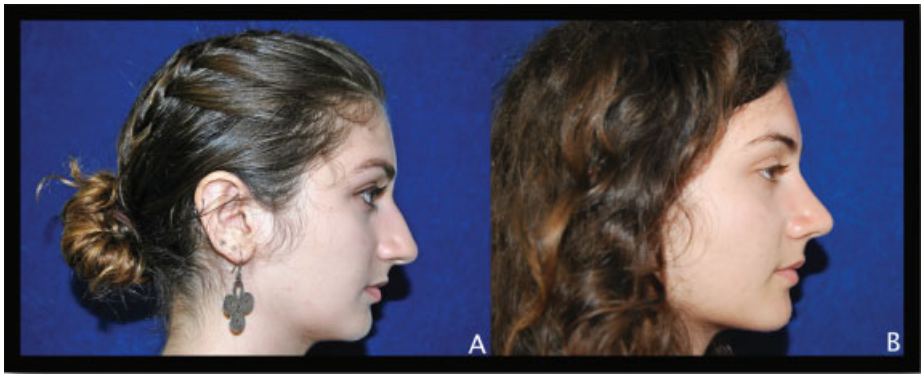

Fig. 9 (**A**) Preoperative and (**B**) postoperative photograph of patient 3. This patient's tip rotation was increased from 89 to 102.2 degrees, with a net change of 13.2 degrees. Her Goode ratio was increased from 0.61 to 0.73, with a net change of 0.12.

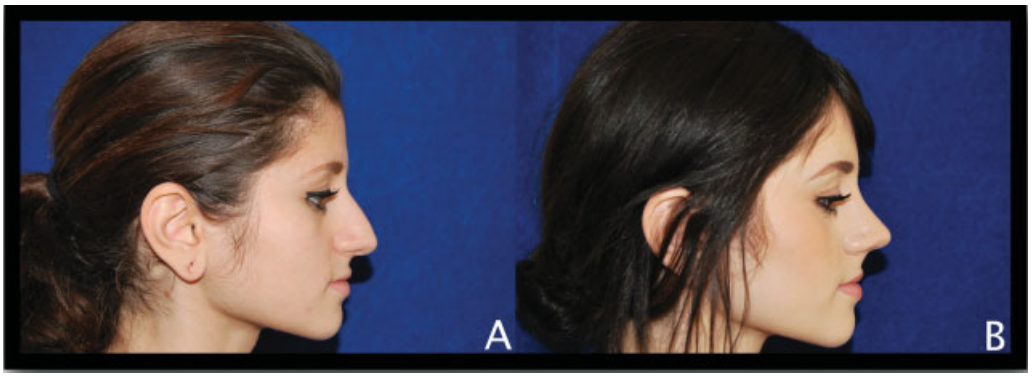

Fig. 10 (**A**) Preoperative and (**B**) postoperative photograph of patient 10. This patient's tip rotation was increased from 89.5 to 101 degrees, with a net change of 11.5 degrees. Her Goode ratio was increased from 0.69 to 0.74, with a net change of 0.05.

previously and allow for a much shortened operative time in this procedure.

When initially used in closed rhinoplasty approach, TIG technique commonly used an absorbable suture, such as PDS or chromic, to secure the columella to the caudal septal cartilage. While the placement of an absorbable suture may be a quicker way to perform this maneuver, the longevity of the changes in TR and TP was not quite definitive. Once the absorbable suture is resorbed, the only support forces remaining to maintain a new position of the tip would be the forces of the postsurgical fibrosis; however, it is definitely not certain whether these forces alone are sufficient for long term, especially in the cases involving heavy tips with large LLCs and thick skin. The avoidance of permanent suture when performing TIG in closed rhinoplasty, in our opinion, was likely related to perception of more involved technique to bury the suture as well as to the fear of potential long-term complications related to the use of permanent material, such as infection and extrusion.

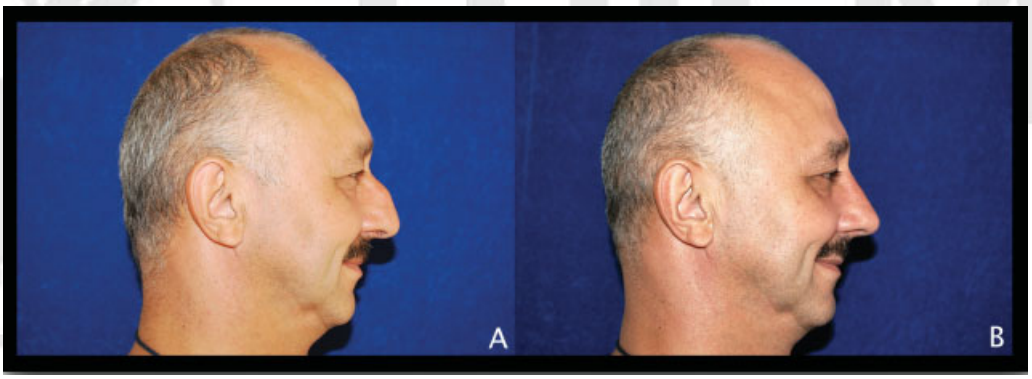

Fig. 11 (**A**) Preoperative and (**B**) postoperative photograph of patient 7. This patient's tip rotation was increased from 87 to 102.8 degrees, with a net change of 15.8 degrees. His Goode ratio was increased from 0.53 to 0.62, with a net change of 0.09.

Fig. 12 (**A**) Short-term follow-up compared with (**B**) long-term follow-up for patient 3. Short-term follow-up photograph was taken at approximately 5 months after surgery and long-term photograph was taken at approximately 17 months after surgery. The patients tip rotation remained stable at approximately 102 degrees, and the Goode ratio was comparable at 0.69.

Our study of 12 patients undergoing TIG in endonasal rhinoplasty with a permanent suture showed that long-term changes in both TR ($p = 0.0069$) and TP ($p = 0.02$) were statistically significant. It is important to note that while some patients were treated concurrently with septoplasty, dorsal hump reduction, and osteotomies, no other tip-modifying techniques were employed except for TIG. At the mean follow-up period of 1 year, all patients maintained their postoperative results and expressed satisfaction with their improved aesthetic appearance. When examining the data for patient 3, it appears that long-term follow-up yields comparable results to short-term follow-up, suggesting that patients are able to retain their changes in TR and TP. Our results suggest that in a specific group of patients desiring changes solely in TP and/or TR, the TIG maneuver may be a suitable option that successfully achieves surgical goals by means of much quicker and much less involved procedure. In addition, in cases requiring change in tip definition, TIG may be combined with other tip modifying techniques such as LLC delivery, cephalic trim of the lateral crura, and suture dome modifications.

The decreased operative time, improvement in tip support, reliability of permanent suture fixation, and predictability of postoperative results are few among many advantages of this technique. According to Kridel et al, the intraoperative appearance of the nasal tip following TIG manipulation has been reported to closely approximate long-term results.[5] Moreover, the excision of intercrural soft tissue prior to cephalic advancement of the medial crura onto the septum may decrease the width of the columellar base in patients complaining of widened columella.[5] TIG technique does not disturb the integrity of the domal area, and therefore it is especially suitable in patients with good tip definition and symmetry who only require change in rotation or projection. Lastly, this technique may be of great value in certain revision rhinoplasty cases when minimal adjustment in TR and/or TP is needed, as the medial crura and caudal septum are generally well maintained following primary rhinoplasty.[6] As to this day, we have not encountered any short- or long-term problems with permanent columellar sutures, such as infection, tearing, or extrusion. The sutures get buried very well within the columellar skin incisions, which don't routinely require any closure.

There are several caveats in using TIG technique, whether in endonasal or open rhinoplasty. The TIG requires an adequate length of caudal cartilaginous septum, otherwise it may lead to a decrease in columellar show and appearance of retracted columella. In patients with inadequate length of the caudal cartilaginous septum, the problem could be circumvented by the placement of septal extension graft. A thorough discussion of placement of septal extension grafts is beyond the scope of this paper and the reader is referred to the rhinoplasty literature for more information.

Another potential pitfall of this technique is that a significantly deviated caudal septum may cause tip deviation following TIG as the tip gets secured onto the deviated caudal septal cartilage. The caudal septal deviations must therefore be well corrected prior to attempting the TIG. Some patients may complain of tip rigidity postoperatively as a result of this technique. We routinely counsel patients preoperatively about this and have found that proper patient education and setting proper postoperative expectations help fully ameliorate any dissatisfaction with increased tip rigidity. Lastly, this technique alone does not allow for tip refinement unless combined with LLC delivery and modifications or retrograde cephalic trim, among other options.

In conclusion, the TIG technique used in endonasal rhinoplasty with a permanent suture is a quick and reliable option for achieving desired changes in TR and TP, while enhancing tip support and providing predictable postoperative outcomes. Burring nylon suture in columellar incisions has shown to streamline and technically simplify the procedure while remaining complication free for a long term.

Disclosure

There are no financial disclosures or conflict of interest to declare. All work was done with written patient consent and Institutional Review Board clearance.

Ethical Approval

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. Appropriate consent was obtained for patients' photographs in this study.

References

1 Nolst Trenite GJ, ed. Aesthetics. In: Rhinoplasty: A Practical Guide to Functional and Aesthetic Surgery of the Nose. The Hague: Kugler Publications; 1998:13–17
2 Turner F, Zanaret M, Giovanni A. Evaluation of nasal tip projection. French Otorhinolaryngol 2007;92:282–287
3 Anderson JR. The dynamics of rhinoplasty. Presented at the Proceedings of the 9th International Congress of Otorhinolaryngology, Mexico City, August 10–14. Amsterdam: Excerpta Medica; 1969
4 Rethi A. Operation to shorten an excessively long nose. Rev Chir Plast 1934;2:85–87
5 Kridel RW, Scott BA, Foda HM. The tongue-in-groove technique in septorhinoplasty. A 10-year experience. Arch Facial Plast Surg 1999;1(4):246–256, discussion 257–258
6 Williams EF. Alar-columellar disharmony using the tongue-in-groove maneuver in primary endonasal rhinoplasty. Arch Facial Plast Surg 2012;14(4):283–288
7 Patrocínio LG, Patrocínio TG, Barreto DM, Subhan YS, Patrocínio JA. Evaluation of lateral crural steal in nasal tip surgery. JAMA Facial Plast Surg 2014;16(6):400–404
8 Apaydin F. Projection and deprojection techniques in rhinoplasty. Clin Plast Surg 2016;43(1):151–168
9 Davis RE. Diagnosis and surgical management of the caudal excess nasal deformity. Arch Facial Plast Surg 2005;7(2): 124–134
10 Datema FR, Lohuis PJ. Tongue-in-groove setback of the medial crura to control nasal tip deprojection in open rhinoplasty. Aesthetic Plast Surg 2015;39(1):53–62