Long-term Changes on Nasal Tip in Rhinoplasty Patients Operated With the New Domes Technique and the Banner Technique

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Introduction: Anatomy, surgical manoeuvres, scarring, and physiologic nasal aging determine the final outcome of nasal tip on rhinoplasty patients.
Patients and method: Post-operative nasal tip changes in 182 rhinoplasty patients operated on by the same surgeon and with a minimum 1 year of follow-up were studied. A personal interview was arranged with all patients and facial photographs were taken. Nasal tip rotation, projection, and definition were measured.
Results: After multivariate analysis, surgical manoeuvres with a statistical impact on the long-term outcome of the nasal tip were dome lateralization greater than 3 mm, columellar strut, and shield graft.
Discussion and conclusions: Cartilage reshaping and tip grafting provide consistent long-lasting results in nasal tip surgery.

Key words: Rhinoplasty. New domes technique. Banner technique. Nasal tip.

Cambios a largo plazo en la punta nasal en pacientes intervenidos de rinoplastia primaria mediante las técnicas de los nuevos domos y del estandarte
Introducción: Los factores anatómicos, las maniobras quirúrgicas y el proceso de cicatrización, así como los efectos del envejecimiento nasal en la nariz, van a determinar el resultado definitivo de la punta nasal en los pacientes intervenidos de rinoplastia.
Pacientes y método: Se estudiaron los cambios postoperatorios en la punta nasal de 182 pacientes intervenidos de rinoplastia primaria por un mismo cirujano con un mínimo de 1 año de seguimiento. Se citó a los pacientes para un control en el que se tomaron fotografías y se midieron las variaciones en rotación, proyección y definición de la punta.
Resultados: Las maniobras quirúrgicas con impacto estadísticamente significativo en el resultado de la punta nasal a largo plazo, tras el análisis multivariable, fueron la lateralización de los domos > 3 mm, la colocación de un poste intercrural y la utilización del injerto de escudo.
Discusión y conclusiones: El reposicionamiento del esqueleto cartilaginoso y la utilización de injertos permiten obtener resultados consistentes y duraderos en la cirugía de la punta nasal.

Palabras clave: Rinoplastia. Técnica de los nuevos domos. Técnica del estandarte. Punta nasal.

INTRODUCTION

The nasal tip is the battle horse of every otolaryngology specialist performing rhinoplasties. The complex skeletal anatomy, with cartilaginous elements of variable geometry placed in an anti-gravitational position, poor irrigation carried out by terminal branches of 4 different arterial systems, the characteristics of the overlying soft tissue, with a skin of poor elasticity and thickness dependent on ethnic traits of the individual, and the impact the of surgical

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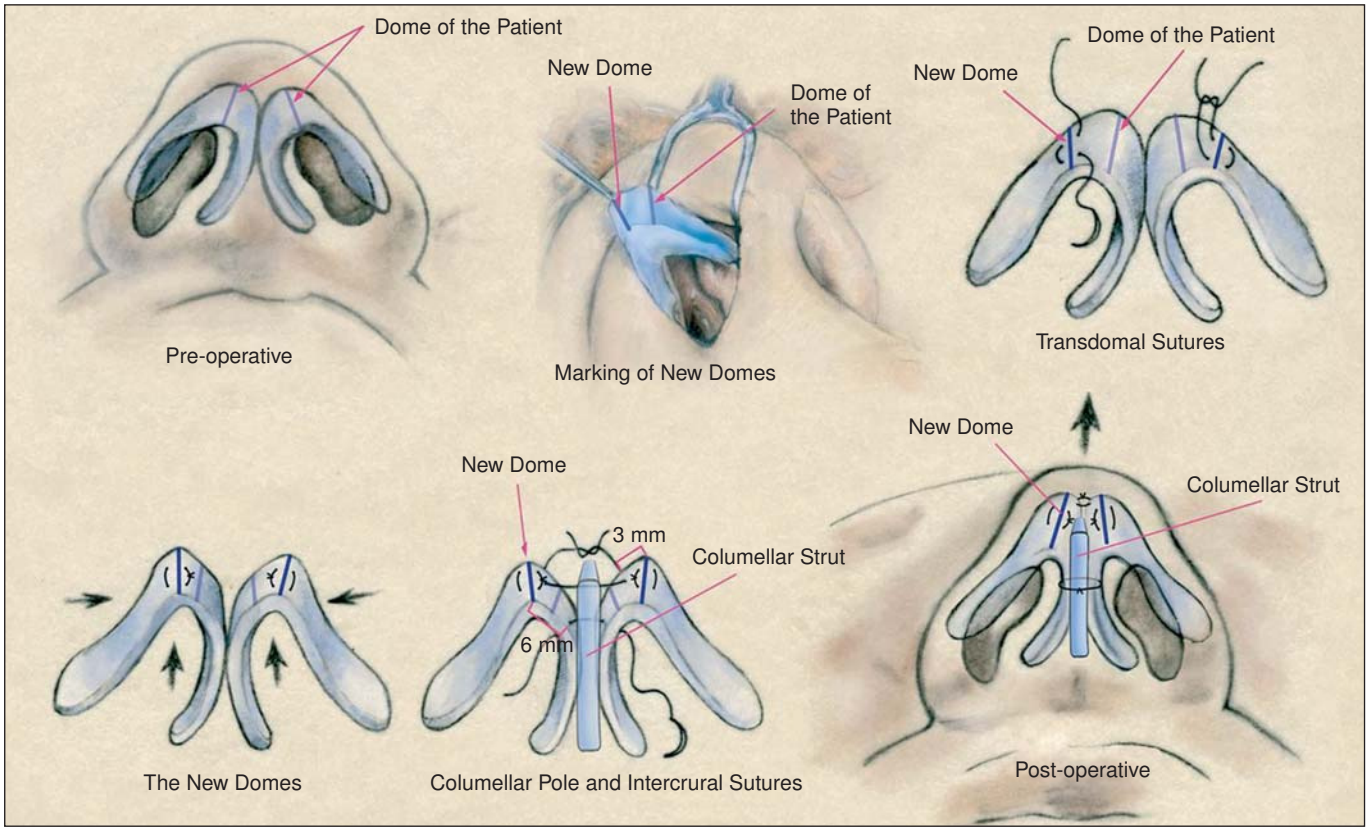

Figure 1. New domes technique.

manoeuvres on the support system make the long-term outcome of surgery on the nasal tip extremely difficult to predict for most surgeons.

The otolaryngology specialist faces the difficult problem of making high-precision surgical manoeuvres not only in terms of the immediate changes they produce, but also in terms of their long-term effect; technical excellence will not be enough to obtain good results. It is not uncommon for a successful outcome 2 months after surgery to become a sequela after 1 year. The correction of nasal problems generated by prior surgery involves a much higher degree of technical difficulty with a smaller likelihood of achieving a favourable outcome.

We carried out an investigation to determine the changes that take place in the nasal tip after rhinoplasty, depending on the anatomical characteristics of the individual and the surgical manoeuvres performed. To quantify the changes as precisely as possible, we used the parameters of rotation, projection and definition of the tip or interdomal distance.

The results obtained will facilitate decision making in rhinoplasty, thus favouring the degree of personal satisfaction of both patient and surgeon.

PATIENTS AND METHOD

More than 5000 patients were subjected to a rhinoplasty procedure in the period between 1981 and 2002; approximately 3200 (64%) of those noses were primary noses.

We performed a retrospective study on the results of 2 of the techniques for managing the nasal tip, the new domes technique and the banner technique.

The new domes technique is the combination of resection of cephalic edge of lateral crura of minor alar cartilage (always leaving a skeletal ring 5 mm wide at domal level and 7 mm wide lateral to the dome), lateralization of domes through intradomal stitches, union of domes through interdomal stitches and union of medial crura with or without interposition of a cartilage graft as an intercrural strut (Figure 1).

The banner technique, designed for thick or scarred skins and thin cartilages, is based on carrying out exactly the same manoeuvres as in the new domes technique, adding only the placement of a Sheen type graft or a shield attached to the bottom edge of the medial crura of the minor alar cartilages and the domes (Figure 2).

A septocolumellar suture is used as a complementary manoeuvre in both techniques. This suture connects the cartilaginous skeleton of the new columella with the caudal septal edge with a non reabsorbable stitch. Other manoeuvres commonly used are the resection of the caudal edge of the septal cartilage, resection of a triangle of vestibular skin, and in cases of thick skin, parallel vertical cuts with dissection scissors on the inside of the flap, to reduce its consistency and allow a more accurate adaptation to the new cartilaginous skeleton of the tip (myotomy of the SMAS of the nasal tip).

The selection criteria for the study were: patients in whom a new domes or banner grafting technique had been performed.

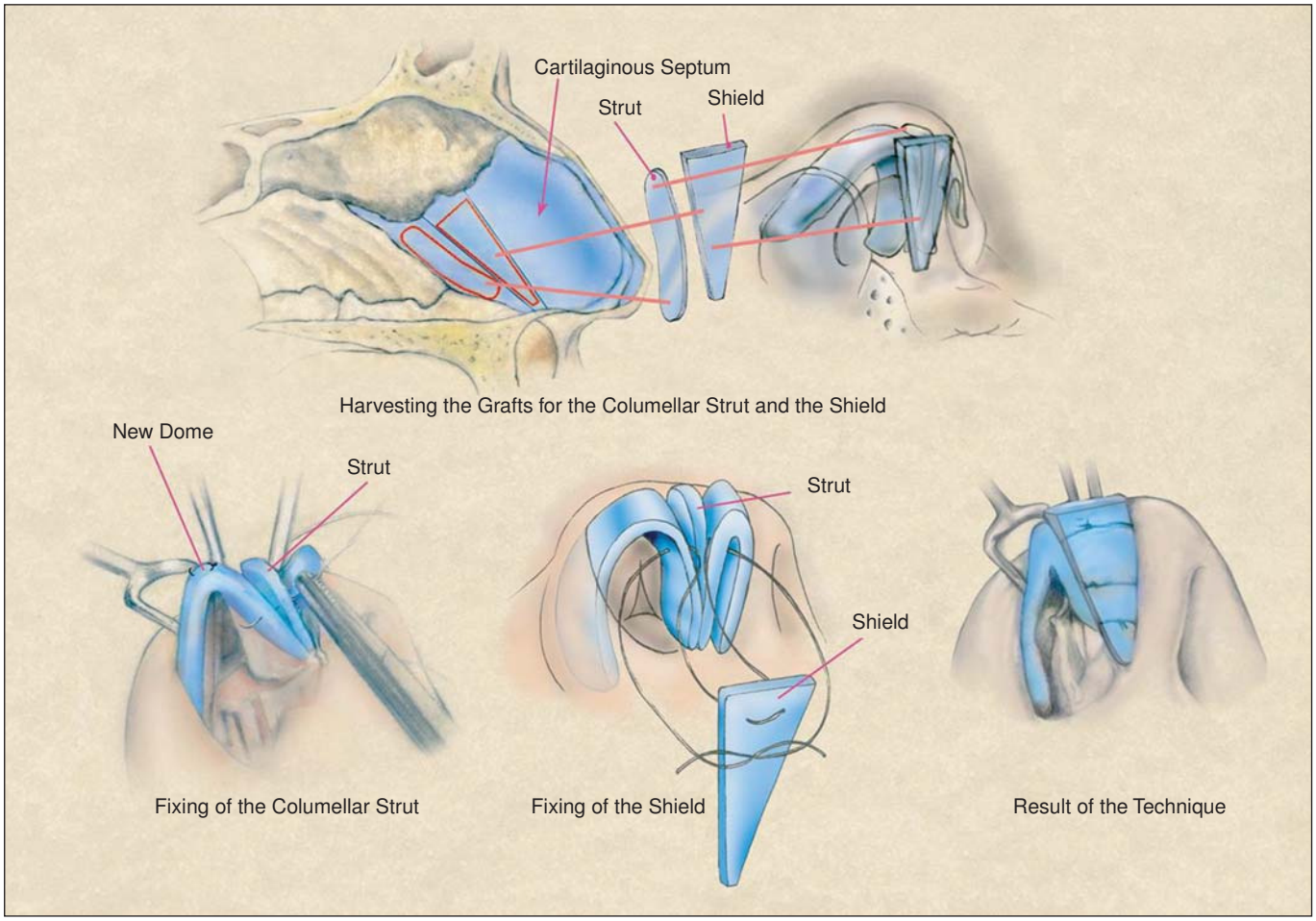

Figure 2. Banner technique.

Exclusion criteria were: less than 1 year of follow-up; refusal of the patient to participate in the study; absence of documented follow-up, age over 50 at the time of surgery; later nasal surgery; later facial surgery; later nasal trauma; degenerative disease of the skin or soft tissues, and death of the patient.

All medical records of patients undergoing primary rhinoplasty surgery between 1983 and 2002 were reviewed and 182 were selected for the study.

A review was carried out on all patients' medical history, data of facial analysis and surgical report. A database was compiled with data on their identity, any personal history that might interfere with scarring, such as smoking or diabetes mellitus, pre-operative measurements of the nasal tip (projection, rotation and definition), surgical manoeuvres on the tip (lateralization of domes, use of grafts, their measurements and their placement in relation to the domes, cutting of cephalic edge of lateral crura, interdomal and septocolumellar stitches and cutting of caudal septal edge and vestibular skin) and final results of such manoeuvres (projection, rotation, and final definition). The measurements of the external tragus-canthus distance and intercanthal distance, normally recorded in pre-surgical facial aesthetic analysis, were included in the database.

The patients were given an appointment for a follow-up consultation in which a front and profile photographic study was carried out. The control photographs, as well as the pre-operative photographic study, were taken with a Nikon FinePix S1Pro digital camera with an AF Micro Nikkor 60 mm f/2.8 D lens and fed into the Mirror Suite software programme (Canfield Clinical Systems, Fairfield, New Jersey, USA) for measurement of the parameters under study, using the intercanthal distance in the front and the external tragus-canthus distance in the profile for the calibration of the measurements (Figures 3-5).

A statistical analysis was carried out to study the association between post-operative outcome of the size of the nasal tip and the pre-operative variables and intra-operative manoeuvres.

The descriptive study was done using the mean, standard deviation (SD) and the maximum and minimum in the case of continuous variables, and proportions and frequency tables for the qualitative variables. The comparison analysis between the averages of the quantitative variables was done with Student *t* test after confirming the assumption of normality, and between qualitative variables it was conducted using Pearson's 2-tailed χ^2 test or Fisher's exact

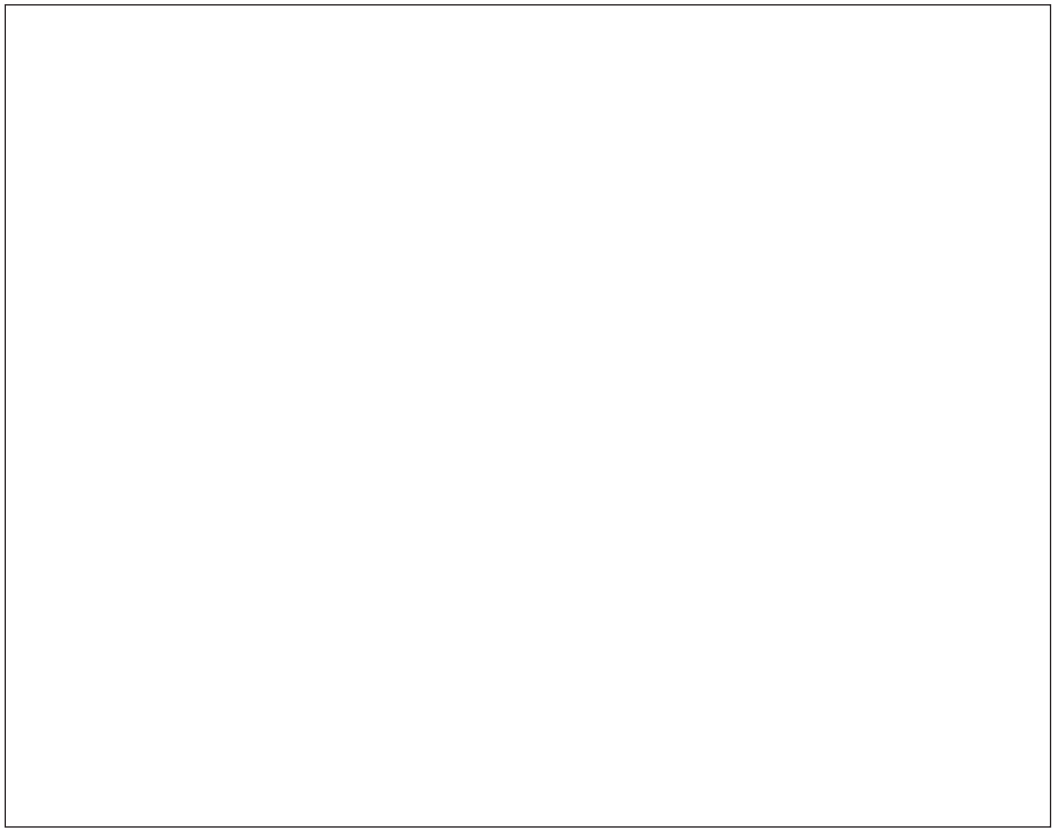

Figure 3. Measurement of nasal projection.

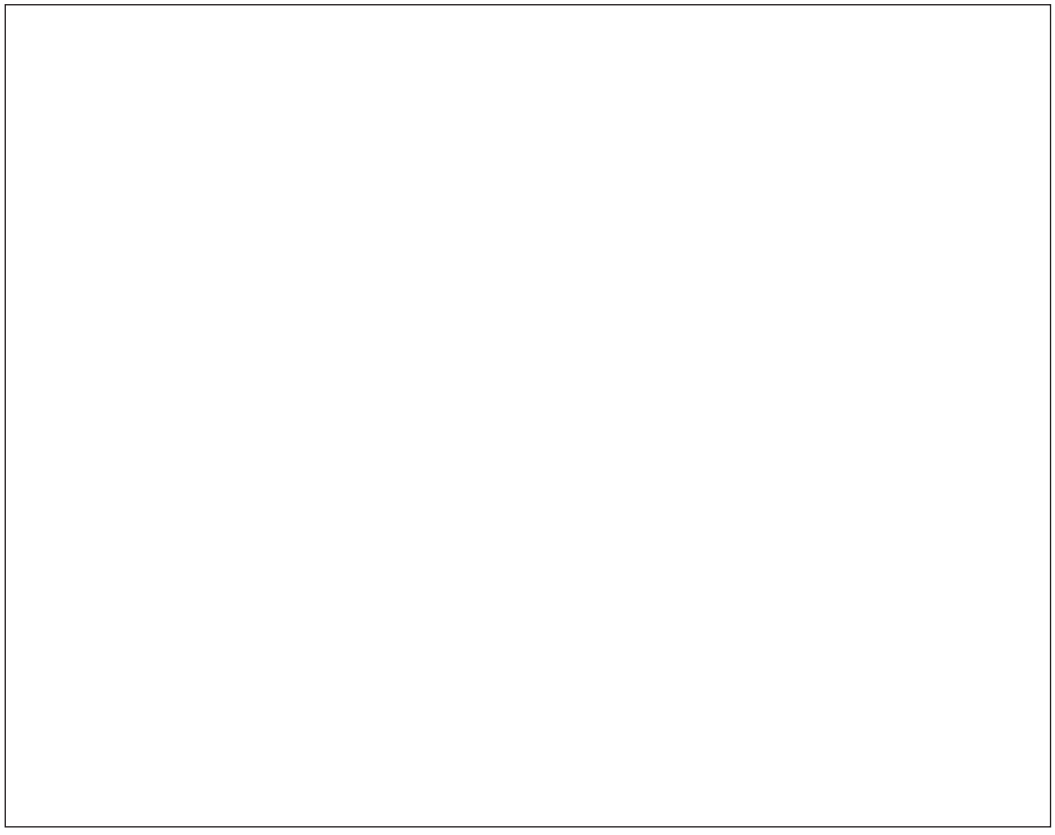

Figure 4. Measurement of nasolabial angle.

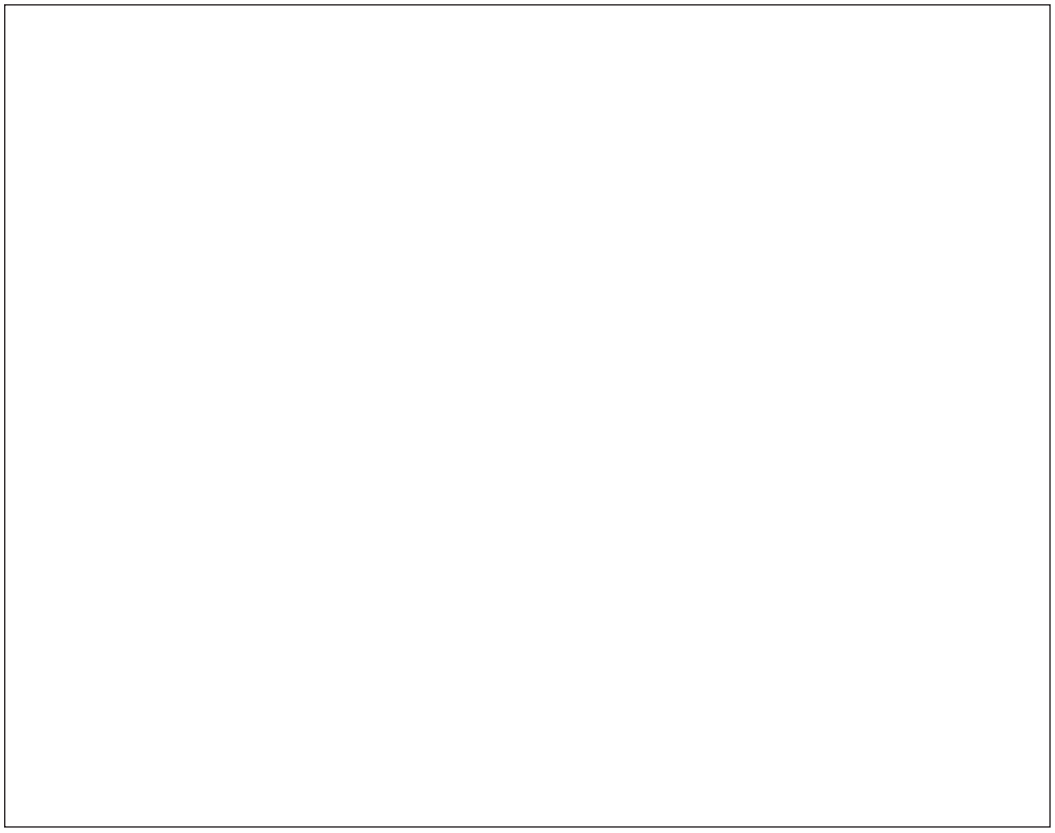

Figure 5. Measurement of interdomal distance.

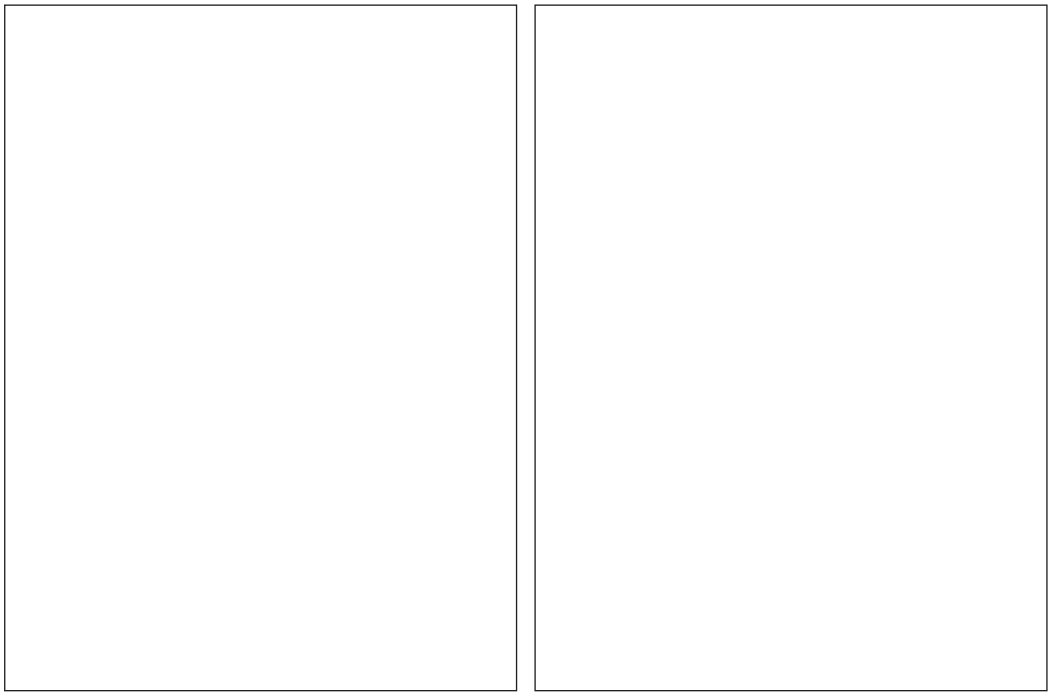

Figure 6. New domes technique. Changes in the full-face image.

test when necessary. A statistically significant value of $P<.05$ was considered for all the analyses.

Finally, a multivariable logistic regression analysis was carried out to determine the impact of each of the manoeuvres in the modification of the nasal tip parameters, adjusting for the other variables with significant effect or that may act as confusion factors. For the dependent variable, we define the manoeuvre's "success," in the case of projection, as a gain of 4 mm or more in noses with a projection of 26 mm or less; in the case of rotation, as an increase of 10° or more

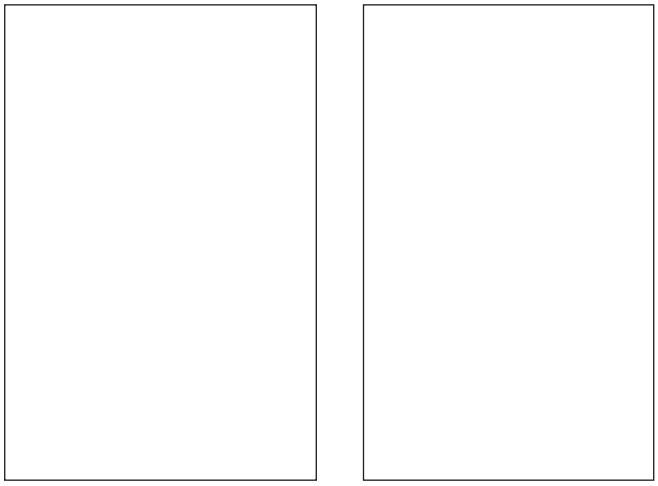

Figure 7. New domes technique. Changes in the profile.

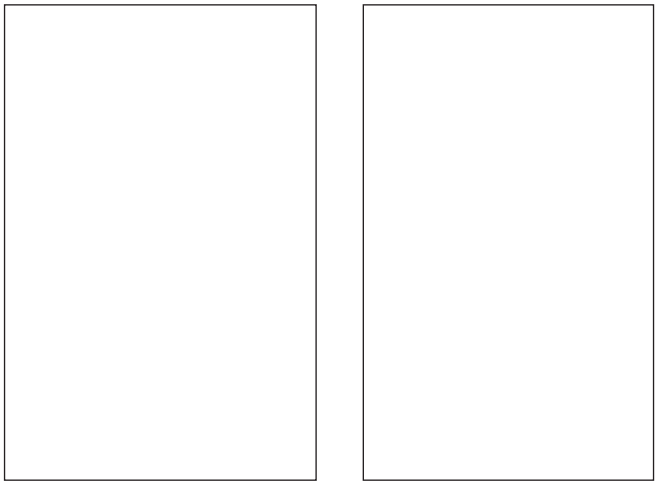

Figure 8. Banner technique. Changes in the full-face image.

in the nasolabial angle; and for definition, a decrease of 4 mm or more in the interdomal distance. The reason for choosing these particular measurements was to be able to make comparisons between the different techniques, since, for minor improvements all nasal tips reached the parameters of success regardless of the manoeuvres performed.

The data were processed with the SPSS version 10.0 statistical package (SPSS Inc. Chicago, Illinois, USA).

RESULTS

Of the 182 patients in the study, 23 (12.6%) were male and 159 (87.3%) female. The average age was 22.2 (7.9) (range, 14-50) years. The follow-up period of patients was of 3.9 (3.1) (1-17) years after surgery.

With respect to pre-operative characteristics, 28 patients (15.4%) were smokers and the remaining 154 (84.6%), non-smokers; none of the 182 patients were diabetic or had any illness that could interfere with the normal nasal tissue repair process after surgery. The vast majority of patients, 121 (66.5%), had normal skin on the nasal tip, 47 (25.8%) were thick-skinned and only 14 (7.7%) had thin skin. The skin type was the determining factor for choosing the surgical technique on the nasal tip (Table 1).

In 99 patients (54.4%) a new domes technique was conducted on the tip, including the use of an intercrural strut in 54 (54.5%). In 83 (45.6%), a banner technique was used, with an intercrural strut used in 80 of them (96.4%).

The mean length of the grafts was 18.1 (2.2) mm for the intercrural strut and 17 (2.7) mm for the Sheen, which had an average width of 7.9 (0.6) mm. In cases where a new domes technique was used, the intercrural strut was 2 mm below the new domes, while in cases where a banner technique was used, the Sheen type graft was at a variable distance of the domes which ranged between 0 and 6 mm, depending on the gain in projection sought.

Another complementary manoeuvre used in the nasal tip was myotomy of the SMAS in 23 patients (12.6%), of whom 12 (9.9%) had normal skin and 11 were thick-skinned (23.4% of patients with this type of skin). In 176 (96.7%) of the 182, an apical triangle of cartilage was resected at the level of the new domes and a pre-columellar graft was placed in 2 (1.1%).

A septocolumellar stitch was used in 144 patients (79.1%) for the septal fixation position, which varied between 0 and 5 mm above the entry into the columella. In 108 (71%), the caudal septal edge was resected, with resections between 1 and 5 mm. In addition. the vestibular skin was cut in 80 patients (43.9%) and the cut skin ranged between 2 and 5 mm. In all patients, an interdomal stitch was placed as a basic component of both techniques.

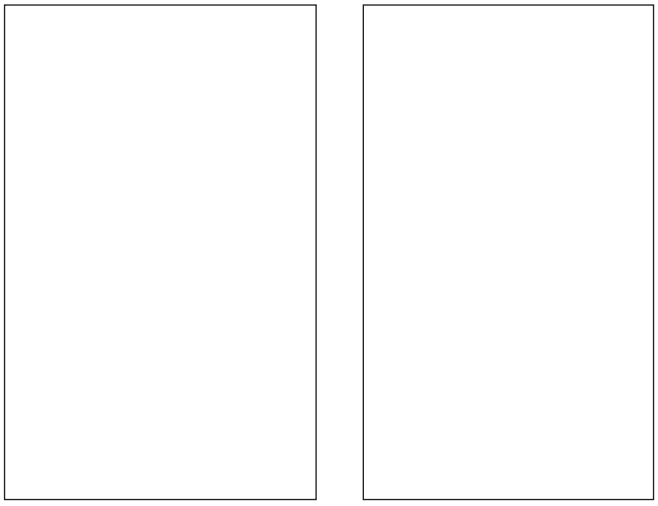

Figure 9. Banner technique. Changes in the profile.

Table 1. Selection of the Technique

	New Domes	*Banner*	*Total*
Thin skin	14	0	14
Normal skin	47	74	121
Thick skin	11	36	47

Table 2. Changes in the Nasal Tip[a]

	Nasolabial Angle, º	*Projection, mm*	*Interdomal Distance, mm*
Pre-operative	92.9 (9.3)	28.1 (2.6)	14.3 (5)
Post-operative	104.1 (7.4)	30.3 (1.5)	10.5 (1)

[a]Expressed as mean (standard deviation).

The impact of surgical manoeuvres on the projection, rotation and nasal definition was highly significant (Table 2, Figures 6-9).

Definition of the Tip

In the case of patients with normal skin, the final interdomal distance was 10.2 (0.7) mm in patients in whom a Sheen type graft was used, while the same parameter was 10.5 (0.9) mm in those on whom it was not used. This difference did not reach statistical significance (P=.14) but did show a clear trend.

In patients with thick skin, a clear impact of the SMAS myotomy appeared in the final outcome of the definition of the nasal tip, namely 10.2 (1.2) mm in those on whom it was performed and 11.1 (1.3) mm in those on whom it was not (P<.05). In patients with normal skin, the myotomy of the SMAS had no effect on the refinement of the nasal tip.

Noting the variation of the interdomal distance between the early post-operative period and the long-term follow-up, a tip refinement trend could be seen, but there was great variability in this phenomenon. The average refinement of the tip in this period was 0.6 (0.9) (-1 to 2) mm, with a greater degree in normal and thick skins, but without reaching statistical significance. It should be noted that, in patients with normal skin, the performance of SMAS myotomy caused a thickening of the nasal tip in the long term (P=.07).

Rotation of the Tip

The relationship of the rotation of the nasal tip with the lateralization of the domes was highly variable, with an average rotation by lateralized mm of 3.4º (2.4º) (-1.2º to 15.7º). We found an increase in upper rotation when the lateralization was ≥3 mm, with statistical significance (P<.01). The use of an intercrural strut has a clear influence, both in patients undergoing the new domes technique, in whom the average increase in rotation per lateralized millimetre was 3.8º (2.8º) when used and 2.6º (2º) without the strut, and also in the case of the banner technique, with an average of 3.5º (2.4º) using the strut and 2.3º (0.8º) without it (P<.001).

The use of a Sheen type graft produced a smaller long-term gain in rotation of the tip in our series, but only after stratifying the patients by use of intercrural strut, as seen in the above figures.

Septocolumellar stitches also appeared to show an impact in increasing rotation or in maintaining it in the new domes technique, but only in patients in whom an intercrural strut was not used, with an average increase of 4º (2.9º) per millimetre of lateralized dome when it was used and 3º (2.1º) when it was not.

A change was evident in the long-term rotation of the nasal tip, comparing this parameter in the early post-operative period and in the long-term follow-up. The amount of this de-rotation was 5º (4.5º), within a period greater than 1 year in all cases (P<.0001). No statistical relationship was found between this de-rotation phenomenon and the use of the banner technique or lateralization of domes with or without intercrural strut.

Projection of the Tip

The nasal tip increased its average projection in the patients in our study, as previously mentioned. The use of a Sheen type graft was a key factor in this increase in projection in patients who underwent the banner technique. The average increase in projection of the tip in these patients (banner technique) was 3.1(1.8) mm, while the increase in patients on whom the new domes technique was used was of 2.5 (1.5) mm (P<.05).

The use of the septocolumellar stitch showed no clear effectiveness in terms of increasing the projection of the tip, both in patients who underwent the new domes technique and those who underwent the banner technique. Nor did the placement of an intercrural strut show a clear influence on increasing the projection of the nasal tip in the long term.

A slight, albeit statistically significant (P<.0001), loss of projection of the nasal tip was observed in the long-term monitoring of patients, quantified at 0.6 (0.5) mm. No relationship was observed between this phenomenon and any of the factors involved in the increase and maintenance of nasal projection.

Multivariate Analysis

The impact of the Sheen type graft in the long term projection of the tip showed a trend towards statistical significance (P=.14) that did not reach the level of significance. No other manoeuvre, including the septocolumellar stitch showed statistical significance or any tendency to influence the post-surgery projection (Table 3).

The intercrural strut also was related to an increase in the rotation of the nasal tip ≥10º (P<.05). The lateralization of domes ≥3 mm was also associated with an increase of 10º in the nasolabial angle. However, the Sheen type graft was related to a loss of rotation (P<.05) and the septocolumellar stitch did not show any impact, either positive or negative (Table 4).

In the multivariate analysis, including such factors as preoperative skin type, no manoeuvre showed statistical significance for the definition of the nasal tip (Table 5).

DISCUSSION

The nasal tip is the facial structure on which facial plastic surgeons demonstrate our mastery or inability in the most palpable form. The myriad ethnic and interethnic anatomical variations, the structural complexity, the hard-to-predict scarring process and the sometimes inscrutable aesthetic concept of patients prove the aphorism "master of tips, master of noses" is absolutely true.

Structural conservation, cartilage repositioning, preservation of irrigation, intrasurgical planning and precision are the guidelines that every facial plastic surgeon should apply when approaching a nasal tip. The old remodelling techniques of the nasal tip based on excessive resection of both the skeletal support and the soft tissues have been gradually abandoned, both for their imprecision and for their disastrous long-term results.[1]

The tripod theory of Jack Anderson[2] and the domal and interdomal stitch techniques using an intercrural strut of Samuel Fomon[3] led to the new domes technique of Fernando Pedroza.[4] In our study we have demonstrated the effectiveness of the different actions of this technique in noses with thin or normal skin and with cartilages of strong or intermediate consistency.

The increase in the rotation and projection and the normalization of the interdomal distance are goals which are fully achieved by the new domes technique. It should be noted that we have shown statistically, for the first time in the literature on this subject, that the intercrural strut has a beneficial impact on the conservation of the rotation obtained through the lateralization of the domes. This fact has already been suggested by other studies on rhinoplasty, but had not previously been demonstrated with mathematical evidence.[5,6]

Work at domal level with transdomal and interdomal stitches showed its long-term effectiveness in obtaining a defined nasal tip. The lateralization of domes does not only produce rotation, but also projects the nose by increasing the length of the medial leg of the tripod formed by the union of the medial cruras of the minor alar cartilages.[7,8] Doubt is cast on the usefulness of other manoeuvres such as the septocolumellar stitch, since its statistical impact disappears in the move from bivariate to multivariate analysis. However, the use of this stitch could reduce the incidence of long-term hanging columella, a phenomenon not evaluated in this study, since the columellar skeleton is fixed to the septal caudal edge.

The post-operative phenomena of de-rotation and de-projection appear as a result of the disappearance of swelling of soft tissues after the procedure, although a certain loss of consistency of the support elements of the tip in the long term cannot be ruled out. We could not observe in our study a relationship between any of the manoeuvres in the new domes technique and the reduction of variations in the parameters mentioned in the post-operative period. Only the inadmissibility of SMAS myotomy in patients with normal skin was observed, due to a tendency towards thickening of the tip in the postoperative period. Ultimately, the maximum respect of soft tissues will have a positive impact on reducing post-operative fibrosis and the predictability of the outcome.

The mestizo nose, common in all Latin American countries, involves a series of challenges for the facial plastic surgeon aiming to obtain a satisfactory rhinoplasty result. The weakness of the minor alar cartilages and the thickness of the skin make the skeletal repositioning procedure insufficient to define and project the tip adequately. It is for this kind of nose that the banner technique was designed.

Table 3. Manoeuvres With Impact on the Projection of the Tip

	Bivariate Analysis	*Multivariate Analysis*
Use of Sheen	*P*<.05	*P*=.14
Use of intercrural strut	No	No
Septocolumellar stitch	No	No

Table 4. Manoeuvres With Impact in the Rotation of the Tip

	Bivariate Analysis	*Multivariate Analysis*
Lateralization of domes ≥3 mm	*P*<.01	*P*<.05
Use of intercrural strut	*P*<.001	*P*<.05
Septocolumellar stitch	*P*<.05	No

Table 5. Manoeuvres With Impact on the Final Definition of the Tip

	Bivariate Analysis	*Multivariate Analysis*
Use of Sheen in normal skin	*P*=.14	No
Myotomies of SMAS in thick skin	*P*<.05	No

The completion of the new nasal domes and the use of a Sheen-type shield graft[9,10] are the components of the procedure. The shield graft, unlike the original Sheen graft, is of a length that covers all the columella and helps in its shaping, not just in that of the tip of the nose.

In our study, the banner technique shows a very high degree of efficacy in defining mestizo noses which are always difficult to refine, to the point where no statistically significant difference appears in the interdomal distance between this technique and that of new domes in the long-term follow-up, bearing in mind that most of the patients for the first technique had normal or thick skin and those receiving the second had normal or thin skin. This fact is reflected in the literature on the subject.[11-13] The use of this graft in patients with normal or thin skin is associated with the risk, after the swelling of the soft tissues has declined, of the mark of the Sheen being visible through the skin,[14] which is why it is discouraged or recommended with caution.

Our study also shows a favourable impact of Sheen type grafts in increasing the projection of the nasal tip, even in cases where the graft is placed at the level of the domes. Some studies indicate that the interdomal area experiences an increase in looseness with normal ageing of the nose,[15] a phenomenon that may influence the loss of definition and projection of the tip. The use of the shield graft increases the consistency of the interdomal space and interferes with the mentioned process to maintain the projection obtained by the surgical technique.

The interdomal distance in thick skins, according to ultrasound studies, is determined by the cartilage structure.[16] This fact, coupled with the histological studies that show

that the thickness of soft tissue in these tips is at the expense of SMAS and fibrous tissue, and not of adipose tissue, and the anatomy of the lymphatic and blood circulation of the nasal tip,[17-19] contraindicate the procedures for resection of soft tissue, so popular to refine this structure in patients with thick skin.

The myotomy of SMAS is another complementary technique used in patients with thick skin. Myotomy respects the irrigation of the nasal skin on the tip; the reduction in the consistency of the subcutaneous tissue and the retraction over the cartilaginous skeleton which it induces help the new domal structure created to shape the external appearance of the nasal tip in patients with thick skin. This manoeuvre fails to show a statistically significant impact in the multivariate analysis, despite reflecting usefulness in the bivariate analysis.

The long-term negative effects of the Sheen type graft on the rotation of the nasal tip are also significant in our study. It is possible that this is only a mechanical matter. The increase in mass of the skeleton of the tip, by pure gravitational effect, favours a greater drop in the long term. It is important in these patients to strengthen the mechanisms supporting the tip of the nose. The use of the intercrural strut and a greater than usual lateralization of domes with transdomal stitch become mandatory in patients with the banner technique.

CONCLUSIONS

The new domes technique shows a high degree of efficacy when working on the nasal tip of patients with normal or thin skin and cartilage of strong or intermediate consistency; the results are stable in the long term.

The banner technique is highly effective for managing the nasal tip in patients with thick or intermediate skin and weak cartilage or cartilage of intermediate consistency; the results are stable in the long term.

In the post-operative period there is a slight drop in the tip of the nose, a small loss of projection and, occasionally, a change in its definition.

Intercrural struts help maintain the long-term rotation obtained by the lateralization of domes.

Myotomy of the SMAS is useful only in patients with thick skin; in patients with normal skin it induces a scarring process that leads to a thickening of the tip in the long term.

Maximum respect for skeletal structures, with a strategy aimed at remodelling rather than resecting, along with the careful management of soft tissues are vital to obtain satisfactory, predictable and stable long-term results.

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