

Columella Elongation Surgery Outcome in Complete Bilateral Cleft Lip and Palate

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Background: The evaluation of surgical outcomes is needed to achieve excellence in nasal reconstruction of patients with complete bilateral cleft lip and palate (BCLP). The study objective is to evaluate the quality of nasal aesthetics after the columella elongation surgery.

Methods: The sample of this study consisted of 70 patients with complete BCLP, operated on columella elongation surgery and analyzed at 6 to 12 years. The system for evaluation of nasal appearance after the columella elongation surgery was performed by objective and subjective analyses.

Anthropometric Measurements: Four anthropometric nose measurements were performed directly on the faces, and the same was performed in control group (60 children without oral clefts), paired by age and sex with the experimental group. The measurements were repeated 3 times (triplicate).

Subjective Analysis: Scores to evaluate nasal width, nasal tip projection, and length of the columella were applied before and after the columella elongation surgery by 5 raters from the rehabilitation team. Interrater and intrarater agreement was calculated by means of the kappa test.

Results: Nasal width in BCLP group was higher when compared to the control group ($P < 0.05$). Nasal tip projection (subnasal–pronasal) and columella length (subnasal–columella) were decreased in BCLP group compared to that of the controls ($P < 0.05$). Columella width was similar in both study groups ($P > 0.05$). All scores of nasal aesthetics significantly improved after the columella elongation surgery.

Conclusions: Nose of the patients with BCLP is wider, is less projected, and has the shorter columella compared to that of the noncleft subjects. After secondary columella elongation surgery in BCLP, nasal width, nasal projection, and columella length significantly improved. (*Plast Reconstr Surg Glob Open* 2019;7:e2147; doi: 10.1097/GOX.0000000000002147; Published online 25 March 2019.)

INTRODUCTION

The short columella, flattening of the nasal tip, broad floor of nostrils, and expansion of alar bases are features commonly demonstrated by patients with operated com-

plete bilateral cleft lip and palate (BCLP).¹⁻⁴ Columella elongation surgery might be necessary after lip repair to elongate the short columella and reconstruct the nasal tip in the anterior direction to promote nose projection.¹ However, the outcomes of this secondary surgery are not always satisfactory due to resulting deformations such as flattening and nasal extending, short columella, and large scars.^{1,5}

Many techniques for the columella elongation surgery have been described in the literature.⁶ It seems to have no surgical procedure that has yet achieved superiority in the plastic surgery field. Similar divergence is found in relation to age at surgical correction.⁷ The nasal deformity as a rule is corrected before school age, around 5 years for the columella elongation surgery.⁷⁻⁹ In contrast, some centers perform this surgery earlier coupled with the primary lip repair in a single procedure.^{3,4,10}

Previous studies^{5,11-14} observed that the measure of nasal width in patients with complete BCLP operated on columella elongation surgery was significantly higher

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Received for publication July 16, 2018; accepted December 18, 2018.

Presented at the International Association for Dental Research (IADR) 2014, Cape Town, South Africa.

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DOI: 10.1097/GOX.0000000000002147

Disclosure: The authors have no financial interest to declare in relation to the content of this article.

when compared with that in the control group. Regarding the projection of the nose tip and columella length, studies have shown that even after the columella elongation surgery, the nasal tip projection has not been reestablished.^{5,12,15}

Thus, the correction of nasal deformities in patients with complete BCLP reconstruction of the columella and the nasal tip remains a major challenge for plastic surgeons. A satisfactory aesthetic result is difficult to achieve.² Also, with so many surgical techniques described in the previous studies, it is clear that the evaluation of results is required to achieve excellence in nasal reconstruction of patients with complete BCLP. Based on the aforementioned problems, the objective of this study is to evaluate the nasal appearance in patients with complete BCLP before and after the secondary columella elongation surgery.

MATERIALS AND METHODS

This retrospective study was approved by Ethics Committee in Research of the Hospital of Rehabilitation of Craniofacial Anomalies, University of São Paulo, number 232.157. The sample of this study consisted of 70 patients with complete BCLP, operated by columella elongation surgery with a mean age of 5 years by Cronin (41 patients)

and Millard (29 patients) techniques, in the Hospital of Rehabilitation of Craniofacial Anomalies, University of São Paulo (Fig. 1). The exclusion criterion was the presence of syndromes. The BCLP group was composed of 70 patients (49 males and 21 females) and was analyzed at 6 to 12 years. The system for evaluation of nasal appearance after the columella elongation surgery was performed by objective and subjective analysis.

Anthropometric Measurements

The objective analysis was performed using 4 anthropometric measurements: nasal tip projection (distance between the nasal tip and the base of the columella, pronasal–subnasal), nasal width (distance by alar, alar–alar), length of columella (distance between the base of the columella and the connection level from the tip of the nostrils, subnasal–columella), and the width of the columella (distance between the average points of nostrils; Fig. 2), measured with a digital caliper during consultation by a single examiner. The same was performed in the control group (60 children without oral clefts), paired by age and sex with the experimental group. The measurements were repeated 3 times at the same consultation.

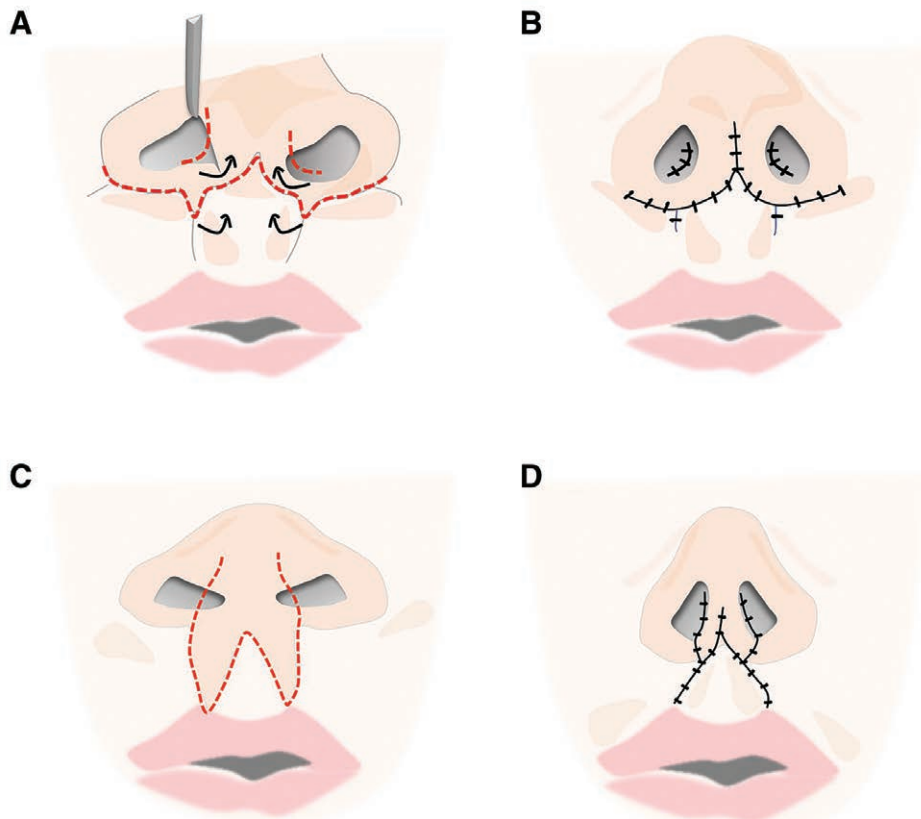


Fig. 1. Surgical procedures of Cronin and Millard techniques. A, Cronin technique; incisions create the bipedicle flaps; an external perialar incision and an internal incision in the membranous septum. Arrows indicate the direction of rotation toward the nasal tip. B, After advancement and closure in Cronin technique. C, Millard used fork flap incisions, including old scars in the upper lip and an internal incision in the membranous septum (red dotted line). D, Millard technique after closure.

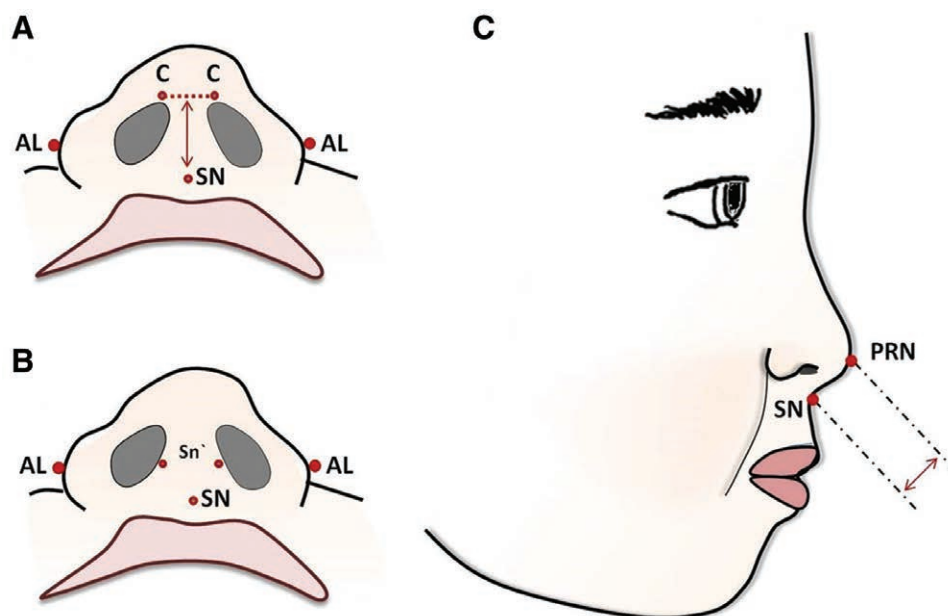


Fig. 2. Anthropometric points. A, Nasal width, columella length. B, Columella width (Sn' - Sn' , midpoint of the nostrils). C, Projection of the nasal tip.

Subjective Analysis

Before and after surgery, digital photographs of the nose in front, lateral, and submental view were performed using 100-mm lens on a 35-mm film from a distance of 120 cm. All photographs were prepared following the study by Kuijpers-Jagtman et al.,¹⁶ assigning scores from 1 to 5 (Fig. 3). The 3 aspects that were evaluated subjectively were nasal width (frontal view), nasal tip projection (lateral view), and length of the columella (submental view). Submental evaluation was needed for the evaluation of the columella length. The subjective aesthetic analysis was performed before and after the columella elongation surgery by 5 raters from the rehabilitation team (3 orthodontists and 2 plastic surgeons). The photographs were presented to the examiners in Microsoft Office PowerPoint 2007 (Microsoft, Redmond, Wash.).

Statistical Analyses

Intergroup comparisons were performed using Student's *t* test, and more than 2 groups were evaluated by analysis of variance, followed by Tukey's honestly significant difference test. Interphase changes for nasal appearance were evaluated using Mann-Whitney test. The interrater and intrarater agreements were calculated using kappa test. Statistical analyses were performed using GraphPad InStat and GraphPad Prism5 (GraphPad Software, San Diego, Calif.). The results were regarded at a significance level of 5%.

RESULTS

Anthropometric Measurements

Nasal width [alar-alar (AL-AL)] in patients with BCLP operated on the columella elongation surgery was

significantly higher when compared to that in the control group (Table 1). Similarly, the measures related to the projection of the nasal tip [subnasal-pronasal (SN-PRN)] and the columella length [subnasal-columella (SN-C)] were decreased in patients with complete BCLP compared to that in the control group (Table 1). Columella width (Sn' - Sn') was similar in both groups (Table 1). When comparing patients operated on Cronin and Millard techniques, the results demonstrated that nasal width (AL-AL) was significantly lower in patients operated on Cronin technique. Projection of the nasal tip (SN-PRN) and columella length (SN-C) presented no significant difference between both techniques. Nasal width (Sn' - Sn') was similar in all groups (Table 2).

Subjective Analysis

Intraexaminer agreement was good to very good with kappa values ranging from 0.55 to 0.89. Interexaminer agreement was moderate with kappa values ranging from 0.36 to 0.54. After surgery, nasal width, nasal tip projection, and columella length had a significant change from bad to regular appearance (Table 3 and Fig. 4). Frequencies of each score before and after surgery are shown in Figure 5.

DISCUSSION

The present study has as differential an anthropometric nose measurements evaluation directly on the face patients with BCLP and in a control group of noncleft patients, reducing the bias of nasal measurements in different ethnicities. Moreover, this study carried out a subjective analysis of scores, which was rarely performed in the previous studies that evaluated the nasal aesthetic appearance of individuals with BCLP.

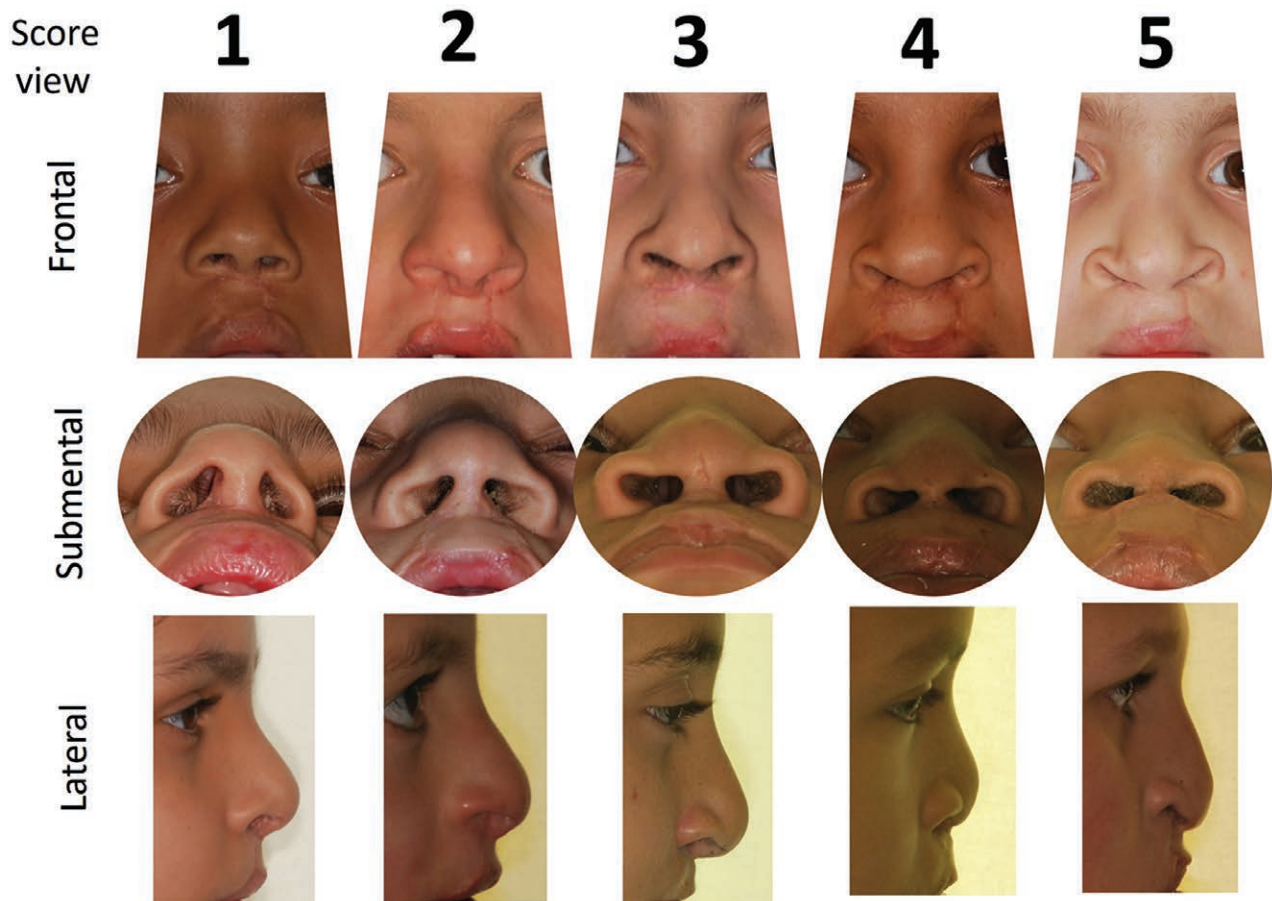


Fig. 3. Grading of subjective aesthetic evaluation in different views. Scores 1 + 2, very good and good appearance; score 3, regular appearance; scores 4 + 5, bad and very bad appearance.

Table 1. Comparisons between Operated BCLP and Nonleft Patients (Student's *t* test)

Group	Control, Mean ± DP (n)	Operated, Mean ± DP (n)	CI	<i>P</i>
Nasal width (AL-AL)				
Total	30.72±0.2698 (n = 60)	37.42±0.4369 (n = 70)	-7.7 to -5.6	<0.0001
6 to 9 years	30.51±0.2980 (n = 48)	36.59±0.4140 (n = 55)	-7.1 to -5.0	<0.0001
10 to 12 years	31.54±0.5994 (n = 12)	40.45±1.064 (n = 15)	-11.6 to -6.2	<0.0001
Projection of the nasal tip (SN-PRN)				
Total	14.36±0.2253 (n = 60)	12.80±0.2891 (n = 70)	0.8 to 2.3	<0.0001
6 to 9 years	13.91±0.2192 (n = 48)	11.96±0.2489 (n = 55)	1.2 to 2.6	<0.0001
10 to 12 years	16.18±0.4069 (n = 12)	15.88±0.4244 (n = 15)	-0.9 to 1.5	0.6286
Columella length (SN-C)				
Total	8.621±0.1699 (n = 60)	7.291±0.2119 (n = 70)	0.7 to 1.8	<0.0001
6 to 9 years	8.418±0.1819 (n = 48)	7.143±0.2226 (n = 55)	0.6 to 1.8	<0.0001
10 to 12 years	9.430±0.3659 (n = 12)	7.831±0.5526 (n = 15)	0.1 to 3.0	<0.05
Columella width (Sn`-Sn`)				
Total	5.288±0.08011 (n = 60)	5.339±0.1116 (n = 70)	-0.3 to 0.2	0.717
6 to 9 years	5.242±0.09289 (n = 48)	5.214±0.1199 (n = 55)	-0.2 to 0.3	0.860
10 to 12 years	5.472±0.1441 (n = 12)	5.796±0.2539 (n = 15)	-0.9 to 0.3	0.309

Our results showed that even after nasal repair, the alar base (AL-AL) remained enlarged in BCLP. These results are similar to the previous antropometric studies, demonstrating that the interalar distance was still excessively increased when compared to that in the control group.^{5,11-14} The possible explanation for these results is that no single surgical procedure contemplates all criteria for an ideal nasal repair in patients with BCLP.

After the columella elongation surgery, the nasal tip projection (SN-PRN) was shorter in BCLP compared to that in the control group. However, in the patients operated at from 10 to 12 years of age, this measure was similar to the values of the control group. These findings might be explained by the influence of alveolar bone graft surgery performed after 9 years of age in BCLP. Alveolar bone graft seems to have an influence on the nasal projection

Table 2. Analysis of Nasal Measurements of Patients Operated on Cronin and Millard Techniques

Group	Control, Mean ± DP (n = 60)	Cronin, Mean ± DP (n = 41)	Milliard, Mean ± DP (n = 29)
Nasal width (AL-AL)	30.71±2.09 (a)	36.32±2.94 (b)	39.52±4.69 (c)
Projection of nasal tip (SN-PRN)	14.36±1.74 (a)	12.44±2.12 (b)	13.78±2.41 (a, b)
Columella length (SN-C)	8.62±1.31 (a)	7.78±1.64 (b)	6.96±1.71 (b)
Columella width (Sn`-Sn`)	5.28±0.62 (a)	5.09±0.83 (a)	5.52±1.10 (a)

Data are presented as mean ± SD. Different italic low case letters represent statistically significant differences among groups in the same anthropometric measures ($P < 0.05$; one-way ANOVA). ANOVA, analysis of variance.

Table 3. Interphase Changes for Nasal Appearance Scores (Mann–Whitney Test)

	Presurgery, Mean ± DP)	Postsurgery, Mean ± DP	P
Nasal width (n = 57)	4±0.9	3±1.1	<0.001
Nasal tip projection (n = 34)	4±0.9	3±1.0	<0.001
Columella length (n = 54)	4±0.8	3±1.0	<0.001

since it provides a greater support for nasal base.¹⁷ The columella length (SN-C) was also shorter after nasal surgical repair. Elongation surgery is limited to correct severe cases that demonstrate insufficient tissue or retraction of the upper lip.¹⁸ In these cases, a rhinoseptoplasty can be performed later for complete columella morphology.^{9,19,20} The width of the columella (Sn`-Sn`) was adequately corrected after surgery. Previous studies also showed that the

columella width is restored after the columella elongation surgery.^{12–14} Therefore, there are surgical challenges to rehabilitate alar base width, nasal tip projection, and columella length in BCLP. These limitations decreased after alveolar bone graft surgery. Parents and patients should be warned about these limitations before surgery. Results in BCLP are not potentially satisfactory. Thus, the future intercenter studies should compare the results of different surgical techniques for patients with BCLP.

In this way, our study demonstrates that Cronin technique appears to restore nasal width closer to normal when compared to Millard technique. Indeed, similar results showed that most patients had nasal width corrected by Cronin technique.^{8,14} The projection of the nasal tip presented better results by Millard technique. The technique is chosen through nasal width. When the nasal base is very wide, the Cronin technique is chosen because it produces a more aesthetic nasal base. When the nose has a

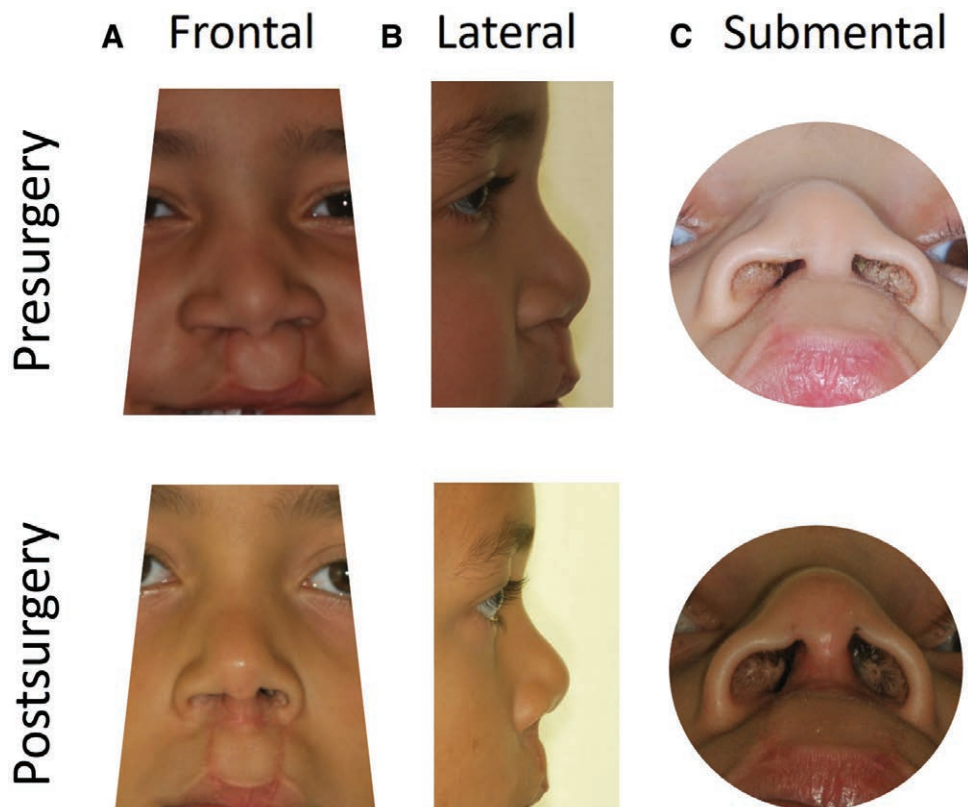


Fig. 4. Appearance before and after columella elongation surgery in (A) frontal, (B) lateral, and (C) submental views.

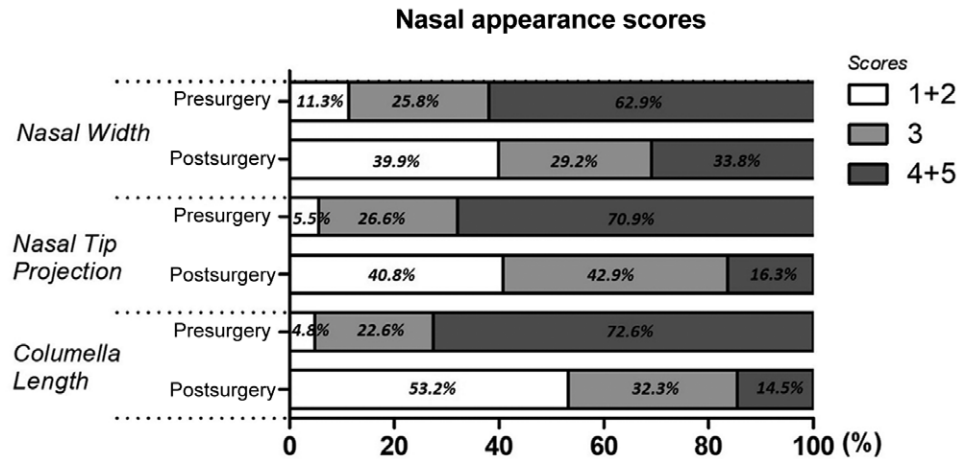


Fig. 5. Frequencies of each score before and after surgery. Scores 1 + 2, very good and good appearance; score 3, regular appearance; scores 4 + 5, bad and very bad appearance.

suitable width, it is chosen by Millard technique. However, the rehabilitation team of patients with oral clefts should elect a golden protocol based on the best results.

Nasolabial appearance rating can be performed reliably using a panel of judges and obtaining the mean scores of all observers.²¹ Presurgical nasal deformity was severe in patients with BCLP considering the very low scores for good or very good appearance of the nose. After the columella elongation surgery, although improvement was observed for nasal width and nasal tip projection scores, more than 50% of patients still received regular, bad, or very bad scores. Columella length scored good and very good in approximately 50% of the sample after surgery. In other words, limited aesthetical outcomes were found after the columella elongation surgery by a panel of raters. A previous study that used the scores for the nasal appearance found 55.6% of patients with good nasal shape using Cronin technique and the 37.5% for Millard forked flap technique.⁹ In this study, the same techniques were used for columella elongation.

The aesthetic result of nasal surgeries performed during childhood is dependent on a number of variable factors, such as the quality of the scars, the position of the maxillary segments, occlusion, experience of the surgeon, surgical procedure, and the severity of nasolabial appearance.²² Thus, not all patients will be able to have a completely restored nasal appearance after the columella elongation surgery. This justifies the high frequency of rhinoseptoplasty surgery performed later for complete nasal correction in large rehabilitation centers in BCLP. However, early columella elongation surgery decreases the need for complex rhinoseptoplasty, which can bring poor results, requiring minimal corrections.

The limitation of this study was the absence of anthropometric measurements in patients with BCLP before columella surgery, which should be addressed in future studies.

CONCLUSIONS

Patients with BCLP demonstrated a wider and less projected nose with a shorter columella compared to

noncleft subjects. After the columella elongation surgery in BCLP, nasal width, nasal projection, and columella length significantly improved. However, limited aesthetical outcomes were found after the columella elongation surgery.

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