Orthodontics & Craniofacial Research

ORIGINAL ARTICLE

A. Brudnicki
E. M. Bronkhorst
R. Nada
Z. Dudkiewicz
M. Kaminek
C. Katsaros
P. S. Fudalej

Nasolabial appearance after two palatoplasty types in cleft lip and palate

Authors' affiliations:
A. Brudnicki, Department of Pediatric Surgery, Institute of Mother and Child, Warsaw, Poland
E. M. Bronkhorst, Department of Preventive and Restorative Dentistry, Radboud University Medical Centre, Nijmegen, the Netherlands
R. Nada, Department of Orthodontics and Craniofacial Biology, Radboud University Medical Centre, Nijmegen, the Netherlands
Z. Dudkiewicz, Private practice, Warsaw, Poland
M. Kaminek, P. S. Fudalej, Department of Orthodontics, Palacky University, Olomouc, Czech Republic
C. Katsaros, P. S. Fudalej, Department of Orthodontics and Dentofacial Orthopedics, University of Bern, Bern, Switzerland

Correspondence to:
P. S. Fudalej
Department of Orthodontics and Dentofacial Orthopedics
University of Bern
Freiburgstrasse 7
3010 Bern
Switzerland
E-mail: piotr.fudalej@zmk.unibe.ch

Date:
Accepted 7 December 2013

DOI: 10.1111/ocr.12039

Brudnicki A., Bronkhorst E. M., Nada R., Dudkiewicz Z., Kaminek M., Katsaros C., Fudalej P. S. Nasolabial appearance after two palatoplasty types in cleft lip and palate
Orthod Craniofac Res 2014; **17**: 124–131. © 2014 John Wiley & Sons A/S. Published by John Wiley & Sons Ltd

Structured Abstract

Background – Facial appearance is important for normal psychosocial development in children with cleft lip and palate (CLP). There is conflicting evidence on how deficient maxillary growth may affect nasolabial esthetics.

Methods – We retrospectively investigated nasolabial appearance in two groups, the *Langenback* (35 children; mean age 11.1 years; range: 7.9–13.6) and *Vomerplasty* (58 children; mean age 10.8 years; range: 7.8–14), who received unilateral CLP surgery by the same surgeon. The hard palate repair technique differed between the two groups. In the *Langenback* group, palatal bone on the non-cleft side only was left denuded, inducing scar formation and inhibiting maxillary growth. In the *Vomerplasty* group, a vomerplasty with tight closure of the soft tissues on the palate was applied. Thirteen lay judges rated nasolabial esthetics on photographs using a modified Asher-McDade's index.

Results – Nasolabial esthetics in both groups was comparable ($p > 0.1$ for each nasolabial component). Inferior view was judged as the least esthetic component and demonstrated mean scores 3.18 (SD = 0.63) and 3.13 (SD = 0.47) in the *Langenback* and *Vomerplasty* groups, respectively. Mean scores for other components were from 2.52 (SD = 0.63) to 2.81 (SD = 0.62). Regression analysis showed that vomerplasty is related with slight improvement in the nasal profile only (coefficient B = −0.287; $p = 0.043$; $R^2 = 0.096$).

Conclusions – This study demonstrates that the use of vomerplasty instead of the Langenbeck technique is weakly associated with the nasolabial appearance among pre-adolescent patients with UCLP.

Key words: appearance; cleft palate; esthetics; nasolabial; one-stage repair; palate repair; palatoplasty; unilateral cleft lip and palate; vomerplasty

Introduction

Facial attractiveness is perceived as being important in social life, because attractive persons are usually preferred over unattractive ones. Also, some positive qualities and abilities are rather attributed to attractive people than unattractive individuals (1–3). Regrettably, children with cleft lip and palate (CLP) usually present with cleft stigmata that worsen facial appearance. This may contribute to the development of psychosocial problems and may have a negative influence on quality of life (4, 5). Therefore, a good esthetic outcome is regarded as a priority in CLP therapy.

A randomized controlled clinical trial (RCT) is preferred to identify factor(s) that improve facial esthetics. Unfortunately, the Scandcleft study (6), the first RCT comparing palatal surgical techniques, is still far from completion. Other non-RCT investigations allow for general conclusions regarding the effectiveness of the whole protocol, but not its components. One can assume, however, that if a comparison includes protocols differing in only one component, for example a surgical technique, the results could be more conclusive.

In our previous study, we found that a modification of one element of the surgical protocol, that is, where a modified von Langenbeck method of hard palate repair was replaced by vomerplasty, resulted in better dental arch relationships (7). In CLP, a favorable dental arch relationship primarily results from advantageous maxillary growth. A well-developed maxilla adequately supports the upper lip and nose and, through this mechanism, may improve nasolabial esthetics. An association between occlusion and nasolabial appearance was also suggested by the Eurocleft studies, where the Eurocleft centers that ranked best for dental arch relationship also obtained the best ratings for nasal appearance (8).

A vomerplasty reduces the areas of denuded palatal bone, but leaves a denuded surface of vomer. The scar tissue developing on the vomer may, in turn, contribute to nasal deviation (9). Therefore, the purpose of this retrospective study was to test the research hypothesis that use of vomerplasty is associated with the nasolabial appearance in pre-adolescent children with a unilateral CLP operated on by the same surgeon.

Material and methods

Subjects

The nasolabial esthetics were examined in two groups of pre-adolescent children who had complete unilateral CLP (CUCLP) repaired using a one-stage simultaneous closure of the cleft. All surgeries were performed by a single high-volume surgeon (ZD) using two techniques of palatoplasty.

The *Langenback* group consisted of 35 children (22 boys and 16 girls) taken from a series of 71 consecutive non-syndromic patients operated on from April 1987 to April 1993. The only inclusion criterion was availability of good-quality extraoral photographs taken at pre-puberty, either before nose revision (NR), lip revision (LR), or alveolar bone grafting (ABG) or at least 12 months after NR, LR, or ABG. The inclusion rate was 49.3%. The details of the surgical protocol are as follows: no orthopedic treatment was carried out in infants. In one operation, the lip and hard and soft palates were closed according to the following protocol: lip closure was undertaken using a Tennison-Randall method; for hard palate repair, a modified von Langenbeck technique was employed, so that the palatal surface at the non-cleft side only was left denuded for healing. During the soft palate repair, all abnormal muscle insertions were dissected from the posterior edge of the hard palate up to the hamuli, which were always fractured; subsequently, the palatal muscles were reconstructed and sutured in the midline. No primary nose correction was performed. The mean age at surgery was 10.4 months (Table 1). ABG was carried out in 7 (23.7%) children, NR was performed in 15 (44.7%) children, and LR was carried out in 1 (2.6%) child.

The *Vomerplasty* group comprised 58 patients (40 boys and 18 girls) taken from a series of 60

children consecutively operated from May 1993 to August 1996. All patients had extraoral photographs taken either before NR, LR, or ABG or at least 12 months after these operations. The treatment outcome in this group was previously reported (10, 11). The technique of hard palate closure (an extended single-layer inferiorly based vomer flap with a tight closure of the anterior palate, resulting in complete coverage of the bony palatal surface with soft tissues; no gingivo-alveoloplasty was carried out) was the only element of surgical management that differed between the two groups. The surgical management of the lip and soft palate was the same in both groups. The mean age at surgery was 9.2 months (Table 1). ABG was carried out in 24 (43.3%) children, NR was performed in 16 (26.7%) children, and LR was carried out in 4 (6.7%) children.

Methods

The modified 5-grade esthetic index of Asher-McDade et al. (12) was used to assess nasolabial appearance. According to the original index, four nasolabial components (nasal deviation, nasal form, vermillion border, and nasal profile) are rated separately on cropped frontal and lateral images on a five-point scale (1 – very good appearance to 5 – very poor appearance). In this study, the inferior view of the nose was also evaluated.

For each patient, a set of two slides was prepared, a frontal and profile view of one patient with a random-assigned number (Fig. 1) and an inferior view of the nose labeled with the same randomly assigned number (Fig. 2). In total, 186 slides were prepared for 93 patients. To assess intrarater reliability, 20 duplicates of the frontal and lateral views and 20 duplicates of the inferior views (40 slides in total) were included in a PowerPoint presentation in a random fashion. Thus, a total of 226 slides were shown during one rating session.

Thirteen female observers (nurses, dental assistants, and receptionists employed at the dental clinic; age range, 28–64 years), without experience in the care of children with CLP, were asked to assess nasolabial esthetics. Before rating, a calibration exercise was carried out so that the raters could familiarize themselves with the rating scale. First, components presented on Fig. 1 were assessed, and then, an evaluation of an inferior view of the nose was carried out. No restriction on the time needed for evaluation of a slide was made.

Statistical analysis

Judgment of esthetics produces considerable score variations between raters (12, 13). The scores for different observers can be averaged provided there is sufficient coherence among the observers. Cronbach's alpha reliability coefficient was calculated for each individual component to evaluate interrater coherence. If an interobserver coherence was adequate (Cronbach's alpha > 0.70), the mean scores of the 13 observers were used in the results section.

Spearman's correlation coefficients were computed to establish intrarater reliability. Paired *t*-tests were run to identify systematic differences between the first and second ratings. The duplicate measurement error (DME) was

Table 1. **Age (in years) of combined lip and palate surgical closure and the time when photographic records were made in the *Langenback* (N = 35) and *Vomerplasty* groups (N = 58)**

	Langenback		*Vomerplasty*		
	Mean (SD)	Range	Mean (SD)	Range	*p* value
Age at surgery	0.87 (0.14)	0.58–1.16	0.77 (0.17)	0.50–1.32	0.006
Age at collection of records	11.13 (1.82)	7.94–14.92	10.82 (2.03)	7.46–15.15	0.470

For $p < 0.05$, the difference was statistically significant.

Fig. 1. Frontal and profile nasolabial views of a unilateral cleft lip and palate patient with the identifying case number for rating.

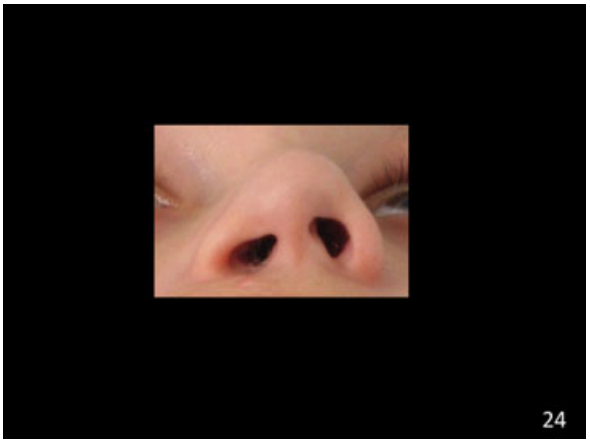

Fig. 2. Inferior nasolabial view of a unilateral cleft lip and palate patient with the identifying case number for rating.

calculated as the standard deviation of the difference between paired scores, divided by √2.

Independent *t*-tests were used to compare nasolabial esthetics between the groups.

Regression analyses were performed to investigate an association between the esthetic outcomes (dependent variables) and the type of palatal repair (*Langenback* or *Vomerplasty* group), NR, LR, ABG, age of operation, and age of photographs (independent variables).

Results

Reliability

The values of Cronbach's alpha coefficients ranged from 0.882 to 0.938 (Table 2), which indicated very good coherence among the 13 observers. Therefore, the mean scores of the 13 observers are presented in the results section.

The DME of the method was small, ranging from 0.15 for nasal form to 0.21 for the inferior view. The correlation between the first and the second assessment of the 20 duplicated slides was very good with a correlation coefficient > 0.85 (Table 2). A systematic error between the first and second rating of the inferior view was found (difference = 0.17; $p = 0.006$).

Esthetic outcome

Nasolabial esthetics in the *Langenback* and *Vomerplasty* groups were comparable (Table 3). None of the evaluated components of nasolabial appearance showed an intergroup difference ($p > 0.1$). Of the five components assessed, the inferior view was judged as the least esthetic in both groups; mean score = 3.20 (SD = 0.61) and 3.16 (SD = 0.46) for the *Langenback* and

Table 2. **The error in the esthetic ratings method**

		Paired differences				
Variable	Cronbach's alpha	DME	Mean	95% CI	*p*	Reliability
Nasal deviation	0.858	0.18	0.085	−0.038, 0.209	0.166	0.858
Nasal form	0.938	0.15	−0.056	−0.135, 0.023	0.156	0.959
Vermillion border	0.925	0.16	0.019	−0.087, 0.125	0.713	0.922
Nasal profile	0.905	0.20	0.015	−0.111, 0.142	0.802	0.924
Inferior view	0.882	0.21	−0.171	−0.287, −0.056	0.006	0.902

DME, duplicate measurement error.

Table 3. **Comparison of the five components of nasolabial appearance between the *Langenback* and *Vomerplasty* groups**

	Langenback Mean (SD)	*Vomerplasty* Mean (SD)	Difference	*p* value
Nasal deviation	2.60 (0.51)	2.62 (0.47)	0.02	0.879
Nasal form	2.78 (0.62)	2.72 (0.53)	0.06	0.662
Vermillion border	2.53 (0.57)	2.69 (0.63)	0.16	0.239
Nasal profile	2.49 (0.61)	2.66 (0.60)	0.17	0.194
Inferior view	3.20 (0.61)	3.16 (0.46)	0.04	0.708

Vomerplasty groups, respectively. Nasal form, nasal deviation, mucocutaneous junction, and profile view were judged as relatively more esthetic, and the scores ranged from 2.49 (SD = 0.61) to 2.72 (SD = 0.53) in both groups.

The regression analyses (Table 4) showed that of all the independent variables, ABG was associated with improvement in the appearance of the inferior view of the nose, NR was negatively related with the nasal form, vomerplasty was positively related with the nasal profile, and age of the patient when photographs were taken was associated with the esthetics of the nasal profile. However, the regression models explained ≤ 12.3% variability of the individual outcomes (R^2 = 0.123 for *Nasal form*; less for other nasolabial components).

Discussion

A reduction in the area of denuded *palatal* surface during a repair of CLP results in less scarring and hence better maxillofacial growth (14–16). Because children from the *Langenback* group showed greater retrusion of the maxillary dental arch than subjects from the *Vomerplasty* group (4), anteroposterior maxillary deficiency was hypothesized to be associated with the assessment of nasolabial appearance, particularly in the profile view. On the other hand, the

Table 4. **Regression models with the type of palatal repair (*Langenback* or *Vomerplasty* group), nose revision (NR), lip revision (LR), alveolar bone graft (ABG), age at the time of the operation, and age of time of photographs as independent variables and the following as the dependent variable**

	B	*p*	95% CI
(a) Nasal deviation*			
(Constant)	2.012		1.270, 2.754
Group	−0.109	0.347	−0.339, 0.120
NR (yes or no)	0.2	0.085	−0.028, 0.429
LR (yes or no)	−0.198	0.399	−0.664, 0.267
ABG (yes or no)	−0.206	0.071	−0.431, 0.018
Age of operation	0.318	0.324	−0.319, 0.954
Age of photographs	0.036	0.185	−0.017, 0.089
(b) Nasal form†			
(Constant)	1.713		0.854, 2.573
Group	−0.221	0.102	−0.487, 0.045
NR (yes or no)	0.267	**0.048**	0.003, 0.532
LR (yes or no)	−0.064	0.815	−0.603, 0.476
ABG (yes or no)	−0.231	0.081	−0.491, 0.029
Age of operation	0.527	0.159	−0.210, 1.265
Age of photographs	0.063	**0.044**	0.002, 0.124
(c) Nasal profile‡			
(Constant)	1.904		0.998, 2.810
Group	−0.287	**0.043**	−0.565, −0.010
NR (yes or no)	0.144	0.307	−0.134, 0.421
LR (yes or no)	−0.012	0.965	−0.557, 0.582
ABG (yes or no)	−0.269	0.055	−0.543, 0.005
Age of operation	0.233	0.552	−0.542, 1.008
Age of photographs	0.06	0.071	−0.005, 0.124
(d) Vermillion border§			
(Constant)	2.223		1.294, 3.153
Group	−0.209	0.151	−0.497, 0.078
NR (yes or no)	−0.092	0.524	−0.378, 0.194
LR (yes or no)	0.02	0.947	−0.564, 0.603
ABG (yes or no)	−0.126	0.375	−0.408, 0.155
Age of operation	0.394	0.329	−0.403, 1.191
Age of photographs	0.022	0.519	−0.045, 0.088
(e) Inferior view¶			
(Constant)	2.821		2.030, 3.612
Group	−0.042	0.73	−0.285, 0.201
NR (yes or no)	0.021	0.861	−0.222, 0.265
LR (yes or no)	0.106	0.672	−0.388, 0.600
ABG (yes or no)	−0.246	**0.047**	−0.490, −0.003

Table 4. **(continued)**

	B	*p*	95% CI
Age of operation	0.349	0.314	−0.336, 1.034
Age of photographs	0.014	0.631	−0.043, 0.071

*R^2 = 0.086.
†R^2 = 0.123.
‡R^2 = 0.096.
§R^2 = 0.050.
¶R^2 = 0.067.
Bold denotes statistical significance.

side effect of vomerplasty could be an increased nasal deviation owing to scar tissue developing on the denuded *vomer* surface.

In this study, a vomerplasty used for palatal repair in CUCLP showed only limited association with nasolabial appearance – it was related with slight improvement in nasal profile (Table 4c). Overall, our findings are in agreement with the results of Nollet et al. (17) and Bongaarts et al. (18) who found no relationship between nasolabial rating and dental arch relationship assessed with the Goslon Yardstick (17) or 5-year-old index (18). Also, the results of the Americleft studies demonstrated a lack of association between objective nasolabial ratings and the Goslon scores (19, 20). A possible explanation for the lack of a relationship between the dental arch relationship and esthetics of the nose and upper lip is that other features (for example, an asymmetry of the ala or shape of the nasal tip) may have a dominating influence on the rating of nasolabial appearance.

The present findings disagree with the results of a Scandinavian four-center comparative study (9) that found that the groups where vomer flaps had been used showed the greatest deviation of the nose. Methodological differences between the Scandinavian study and our study include that Enemark and colleagues measured nasal deviation directly on tracings of the frontal and inferior view photographs, whereas we rated nasal deviation on 5-point scale, which may partly explain the disagreement between the studies. Furthermore, other factors such as the surgeon's skill, timing of the operation, or surgical technique might have contributed to the increased nasal deviation found in two centers. Unfortunately, an identification of these factors was not possible through the study design used by Enemark and colleagues.

Relatively worse scores for the nasal shape assessed on the frontal and inferior view photographs were found in the *Langenback* and *Vomerplasty* groups. Our results agree with the findings of Nollet et al. (17) and Fudalej et al. (11) and indicate that the nose still remains a challenge to the surgeon in cleft lip and palate surgery.

The present results demonstrated that alveolar bone grafting improved nasal esthetics (Table 4). The objective of ABG is a provision of bony support for cleft-adjacent teeth, stabilization of the cleft maxillary segments, elimination of the notched alveolar ridge, support for the alar bases, and enabling expansion of the interpremaxillary suture (14). Three-dimensional photogrammetry demonstrated that ABG also positively influences the projection of the alar base on the cleft side and improves the symmetry of the face (21). To our knowledge, this is the first study to find that ABG has also a positive effect on nasal appearance.

Nose and/or lip revisions (secondary surgeries) are performed in some patients with CUCLP to improve the appearance and function of the nasolabial area. The present study showed little influence of secondary surgeries on facial esthetics (Table 4b). This surprising finding may result from an unclear effectiveness of nose and/or lip revisions in improving nasolabial appearance and function. For example, in the Eurocleft studies, relatively poor nasolabial esthetics was found in both the center with an extensive surgical protocol as well as in the center using less intensive treatment (8). Also, the results of the randomized, controlled, Dutchcleft clinical trial (18) did not reveal a relationship between esthetic outcome and the rate of secondary nose and lip correction. Moreover, perceived improvement of esthetics following revision surgery is highly subjective and strongly dependent on the assessor (22, 23). In the current study, a panel of laypersons assessed nasolabial appearance. Previous investigations demonstrated that judg-

ments of facial esthetics made by persons unfamiliar with cleft deformity might differ from the judgments of professionals involved treating CLP (18, 24–26). Eliason et al. (19) found a rater familiarity bias, that is, assessors familiar with management of the cleft deformity were more critical than assessors unfamiliar with them. On the other hand, Mani et al. (26) found that professional raters were less critical than lay raters. Bongaarts et al. (18), in turn, observed that lay judges scored the pictures of full faces of 4-year-olds more negatively than professional judges. However, there was no difference between lay and professional judges when full face and cropped pictures of 6-year-olds were assessed. Al-Omari et al. (25) found differences between professionals and laymen in the scoring of full faces only, whereas assessments of the nose and lip produced comparable results. Therefore, it seems that both professional and lay panels are acceptable provided they are homogenous, that is, they comprise either professional or lay assessors. Which one is selected depends on the research question and practical issues such as the ease of selecting a panel or comparability with other reports.

Still photography is a two-dimensional (2D) representation of three-dimensional (3D) structures. With the rapid development of 3D visualization techniques, an assessment of facial appearance on 3D media seems more appropriate. The available data demonstrate, however, that although anthropometric measurements performed directly and on 3D images are comparable (27), an assessment of facial esthetics on 2D and 3D images produces relatively low agreement (25, 28). Thus, before validating a 3D image as a stimulus medium, an assessment of facial esthetics based on 2D images still seems to be the method of choice. Moreover, 2D photography has some advantages in comparison with 3D photography such as ease of collecting the pictures or unchanged technique of photography, allowing comparisons of morphological details that were captured at various time periods.

Conclusions

The results of this study demonstrate that use of vomerplasty is weakly related with nasolabial appearance, because it is associated with improvement of nasal profile only. The esthetics of other nasolabial components is not related with the use of vomerplasty. However, a definitive conclusion may be made after facial growth is completed.

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