Thresholds of Identification and Aesthetic Perception of Simulated Alar Base Widening Among Oral and Maxillofacial Surgeons: an Online Questionnaire-Based International Study

Limiares de Identificação e Percepção Estética do Alargamento Simulado da Base Alar Entre Cirurgiões Buco-Maxilo-Faciais: um Levantamento Internacional

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Abstract

This study aimed to compare the thresholds of identification and aesthetic perception of simulated alar base widening among oral and maxillofacial (OMF) surgeons from Brazil and other countries through an online data collection form. Photographs of one male and one female model were digitally manipulated to obtain aesthetically acceptable, symmetrical faces and to gradually widen the alar base to produce six different images from each original photograph. The online questionnaire was sent to OMF surgeons of different nationalities. The results showed that the majority of Brazilian (88%) and international (89%) evaluators considered the female faces with 0 to 2 mm of alar base widening as being more pleasant. In turn, Brazilian (93%) and international (94%) respondents agreed that faces with the greatest widening (8 and 10 mm) were less pleasant. As for the male model, Brazilian (93%) and international (85%) OMF surgeons agreed that faces with none or small widening (0 and 2 mm) were more pleasant. The male face with the greatest widening (10 mm) was considered the least attractive by the respondents (93% in both groups). The findings of this study suggest that alar base widening up to the limit of 2 mm did not alter the perception of facial attractiveness. Thus, faces without alar base widening were considered the most attractive, while those with significant alterations were considered less attractive. Most importantly, despite the limitations of this study design, it seems that different cultural and professional contexts have minor influence on aesthetics analysis performed by OMF surgeons.

Keywords: Orthognathic Surgical Procedures. Esthetics. Nasal Cartilages. Rhinoplasty.

Resumo

Este estudo teve como objetivo comparar os limiares de identificação e percepção estética do alargamento simulado da base alar entre cirurgiões bucomaxilofaciais (BMF) do Brasil e de outros países por meio de um formulário de coleta de dados online. Fotografias de um modelo masculino e de uma modelo feminina foram manipuladas digitalmente para obter faces esteticamente aceitáveis e simétricas e para ampliar gradualmente a base alar produzindo seis imagens diferentes de cada fotografia original. O questionário online foi enviado aos cirurgiões BMF de diferentes nacionalidades. Os resultados mostraram que a maioria dos avaliadores brasileiros (88%) e internacionais (89%) consideraram as faces femininas com 0 a 2 mm de alargamento da base alar como mais agradáveis. Por sua vez, os entrevistados brasileiros (93%) e internacionais (94%) concordaram que os rostos com maior alargamento (8 e 10 mm) foram os menos agradáveis. Quanto ao modelo masculino, os cirurgiões brasileiros (93%) e internacionais (85%) da OMF concordaram que faces com nenhum ou pequeno alargamento (0 e 2 mm) eram mais agradáveis. A face masculina com maior alargamento (10 mm) foi considerada a menos atraente pelos entrevistados (93% em ambos os grupos). Nossos achados sugerem que o alargamento da base alar até o limite de 2 mm não alterou a percepção da atratividade facial. Assim, rostos sem alargamento da base alar foram considerados os mais atraentes, enquanto aqueles com alterações significativas foram considerados menos atraentes. Mais importante ainda, apesar das limitações, parece que diferentes contextos culturais e profissionais têm pouca influência na análise estética realizada pelos cirurgiões da OMF.

Palavras-chave: *Procedimentos Cirúrgicos Ortognáticos. Estética. Cartilagens Nasais. Rinoplastia.*

1 Introduction

Dentofacial deformities are a group of disorders, congenital or acquired, marked by dental malocclusions and facial aesthetic disharmony. Studies have shown that an astonishing 20% of the overall population show different degrees of aesthetic or functional dentofacial impairment[1]. Dentofacial deformities can affect one or both jaws and may affect multiple craniofacial structures in the vertical, horizontal or transverse facial planes[2,3].

By promoting a stable occlusion with an interarch bony relation, the association of orthognathic surgery and orthodontic treatment represents a powerful way to improve airway and masticatory functions as well as facial aesthetics in patients with dentofacial deformities[4,5]. Still, some drawbacks involving maxillary orthognathic surgery may include unwanted nasal modifications and disruption of the nasal support system following the muscle detachment necessary to perform Le Fort I osteotomy[6]. Indeed, the nature and quantity of surgical maxillary movement directly affects the soft tissue envelope of the nasolabial region[6,7].

Perception of facial beauty is amongst the topics of greater interest for professionals performing face aesthetic and reconstructive procedures. Some objective guidelines dating

back to ancient Greece were developed to standardize ideal facial proportions, particularly in the fields of sculpture and artistic painting[8,9]. Even today, those classic facial standards remain as a strong influence for the anthropometric canons used by oral and maxillofacial (OMF) and plastic surgeons, as well as orthodontists, for the necessary facial analyses that precede a sound treatment plan – surgical or not[10,11].

As mentioned above, maxilla surgical repositioning causes major aesthetic changes on the face when compared to mandibular surgery. The soft tissues of the upper lip, the paranasal region and the nose are directly affected[12]. More often so than not, the versatile Le Fort I osteotomy, which allows for the maxilla repositioning in the three planes of space, produces a clear effect on the nasolabial region[9]. For those cases in which the alar base and nostrils are excessively narrow, widening of the paranasal soft tissues may be welcomed and, therefore, must be considered in the surgical planning steps[3]. However, undesired enlargement of the alar base does occur in 6% to 10% of cases of maxillary surgical repositioning. To address such unwanted outcome, suturing techniques involving the paranasal muscles have been proposed to control and minimize unaesthetic alar base effects. Nevertheless, the effectiveness of these suturing maneuvers has been the subject of much scientific debate[13-15].

Given the concern regarding the possible negative aesthetic effects in the nasal region derived from orthognathic surgery, it is important not only to understand beyond the dichomoty between the alar base widenings as satisfactory of undesirable. It is also paramount to try to understand the impact that such alterations cause on the facial attractiveness in its different levels.

As a small contribution for the specialized literature, this experimental, online questionnaire-based study aimed to determine the thresholds of identification of simulated alar base widening and the repercussion of such widening on the perception of facial attractiveness by Brazilian and international OMF surgeons.

2 Material and Methods

In brief, a questionnaire with digitally manipulated faces images was made available to Brazilian and international OMF surgeons through the worldwide web computer network with the goals of determining thresholds of identification of simulated alar base widening and the effects of such widening on facial attractiveness.

This study was approved by the Federal University of Sergipe ethics committee on human studies under protocol 1.486.421.

The images used in the study were digital manipulations of portraits of two volunteer models (one male and one female) with balanced facial musculature, passive lip seal and without history of facial surgeries or orthodontic treatment. Both models waived the right to the use of their images for scientific purposes through an appropriate consent term.

The models were photographed in a professional studio against a white background, with a neutral facial expression and with their heads positioned so that the interpupillary line and the Frankfurt plane were parallel to the floor. Photos were standardized so as to include the whole models' face, with frontal lighting and camera height set with an adjustable tripod.

After the photographic session, symmetrical faces were digitally created by mirroring the left side of models' faces on Adobe Photoshop CS6. Afterward, digital manipulations were performed to proportionally increase the alar base width in gradual steps of two millimeters each, ranging from no widening (0 mm) to ten-millimeter width. In short, the proportional scale for manipulation was calculated through a function of the measurements made directly on the models' faces with a digital caliper and the values obtained with the ruler tool of the Photoshop CS6. Subsequently, additional image layers were created for digital edition and for placement of midfacial guiding lines for proportional and controlled digital widening. Then, the alar base area was individualized and widened in gradual increments, thus producing two unchanged, symmetrical images (one male, one female) and ten images with gradual alar base widening simulations (five for each model).

Figure 1 - Example of photographic composites for evaluation of the female (composite 1, upper panels) and male (composite 2, lower panels) model. In composite 1 (female face), the pictures represent A) 0 mm; B) 4 mm; C) 2 mm; D) 10 mm; E) 6 mm; and F) 8 mm of alar base widening. In composite 2 (male face), the pictures represent A) 6 mm; B) 8 mm; C) 2 mm; D) 4 mm; and F) 0 mm of alar base widening. Composites with the same pictures arranged in a different order were presented shortly after the first images for verification of inter-examiner consistency
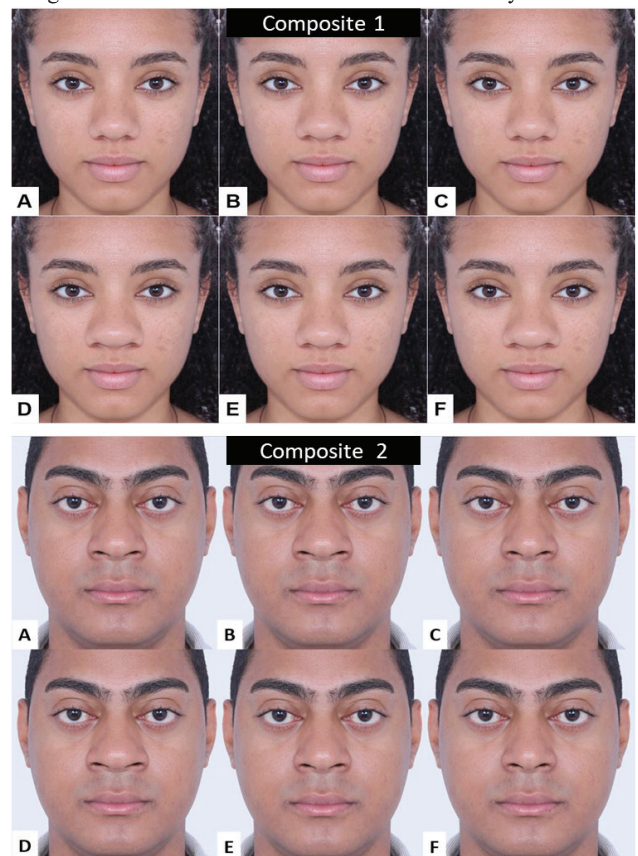
Source: The authors.

The stimulus material was then adapted to be hosted in Google Forms as an online form in English and sent to several OMF professional associations and dental schools over the six continents.

Some OMF associations kindly forwarded the stimulus material to their associated members, and the respondents formed the sample from which the data were extracted. Upon receiving the responses, Google Forms automatically generated a digital spreadsheet that can be imported into Microsoft Excel for formatting and analysis. Once the responses were gathered, two groups were created to distinguish Brazilian (BR group) and international (IN group) OMF surgeons.

Statistical analysis was performed using the R software®. A significance level of 5% was set for all the statistical tests. Pearson´s test was used to identify inter-examiner consistency. Normality was determined by means of the Shapiro-Wilk's test. ANOVA was employed to compare the mean scores within each group for each of the six stimulus faces, with Tukey's test used *post hoc*. Student's t test was used to identify statistically significant differences among the mean scores attributed by the two groups.

3 Results and Discussion

The sample of respondents in this study consisted of 86 participants distributed in Brazilian OMF surgeons (BR group, n = 40) and OMF surgeons practicing in other countries (IN group, n = 46) (Figure 2).

Figure 2 - Distribution of respondent OMF surgeons by country of practice
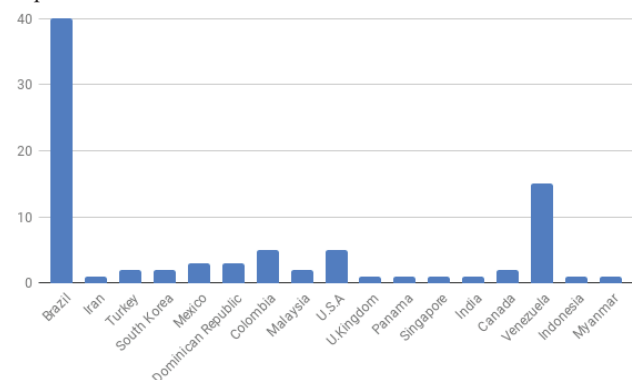
Source: The authors.

In terms of sex distribution, the BR group consisted mostly of men (68.3%). The main age group was 36-40 years. Concerning time since completion of surgical training, OMF surgeons in the BR group had completed their training less than 5 years ago, at the moment of responding the questionnaire (39.0%). The IN group was composed of OMF surgeons from different countries, mainly from Latin America. Again, most were men (87.0%) aged between 36 and 40 years. Similarly to the observed in the BR group, surgeons in the IN group had completed their professional training less than 5 years ago before answering the questionnaire (39.1%).

Regarding attractiveness of the female face, the majority

of respondents in the BR (67.3%) and IN (52.5%) groups considered more attractive the one without alar base widening (0 mm). The least attractive female face was the one with the widest (10 mm) alar base (58.6% in the IN group and 55% in the BR group).

The male face attractiveness followed a similar pattern. Respondents in the BR (70%) and IN (60.8%) groups considered the face without alar base widening as more attractive, and the one with the widest alar base as less attractive (82.5% and 82.6%, respectively).

Frequencies of choice for more and less attractive female and male faces in the two groups showed a clear reversing trend towards lower attractiveness in the interval between 4 mm and 6 mm of alar base widening (Figures 3). For the male faces, such reversing trend happened in the interval between 6mm and 8 mm (Figure 4).

Figure 3 - Frequencies of choice for more (Fem +) and less (Fem -) attractive female faces in the BR (blue and gray lines) and IN (orange and yellow lines) groups. A clear reversing trend towards considering a female face less attractive is seen in the interval between 4 mm and 6 mm of alar base widening
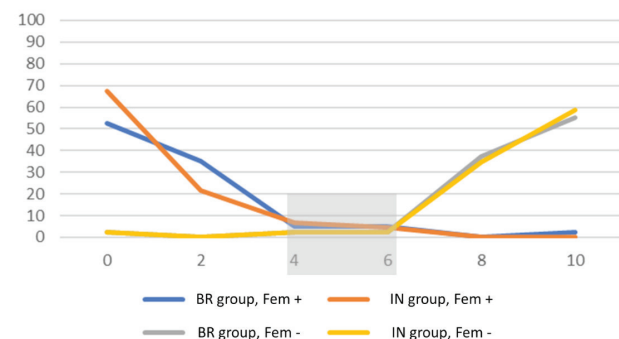
Source: The authors.

Figure 4 - Frequencies of choice for more (Male +) and less (Male -) attractive male faces in the BR (blue and gray lines) and IN (orange and yellow lines) groups. A clear reversing trend towards considering a male face less attractive is seen in the interval between 6 mm and 8 mm of alar base widening
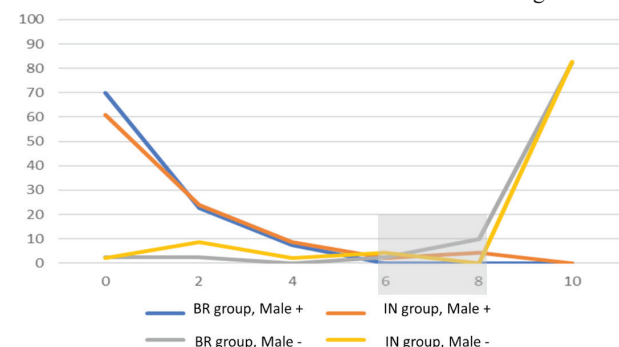
Source: The authors.

In both groups, the Pearson´s test showed moderate to strong correlations between the faces identified as more and less attractive in the first and second photographic composites, which included the same pictures, but in different random dispositions. Stronger correlations were seen for the less attractive male and female faces in the BR group (Table 1).

Table 1 - Verification of inter-examiner consistency through Pearson's Correlation Coefficient (r) for the choices of the more and less attractive faces in the BR and IN groups

	BR group		IN group	
	r	**p**	**r**	**p**
F+	0.516	*0.002	0.464	*0.001
F-	0.796	*<0.001	0.563	*<0.001
M+	0.463	*0.006	0.639	*<0.001
M-	0.862	*<0.001	0.561	*<0.001

F+, more attractive female face; F-, less attractive female face; M+, more attractive male face; M-, less attractive male face. $*p < 0.05$
Source: Resource data.

Considering the facial attractiveness scores, both groups attributed lower scores for larger widenings without intergroup statistically significant differences for female and male faces (Figure 5).

Figure 5 - Means and standard deviations of facial attractiveness scores attributed by the BR (upper graphs) and IN (lower graphs) groups to the female (right side) and male (left side) faces. Different letters indicate statistically significant difference (p ≤ 0.05) after ANOVA and Tukey's post hoc test
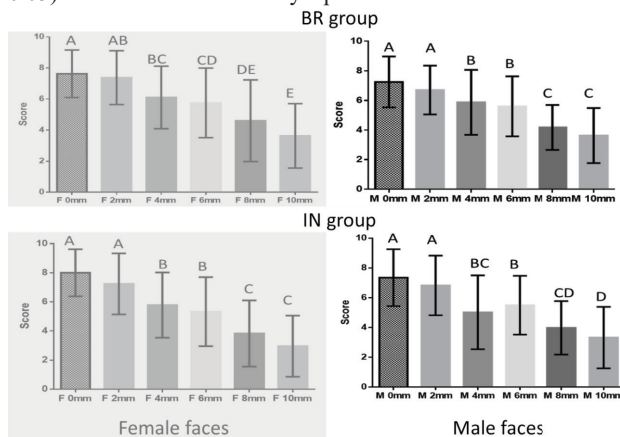
Source: The authors.

The results of this study showed that the demographic variables were similar between the Brazilian and international OMF surgeons, allowing for reasonably safe comparisons between them. In each group, the respondents were mostly white males between the ages of 36 and 40 years who had completed their surgical training less than 5 years ago before answering the questionnaire. Interestingly, female OMF surgeons were more frequent in the BR group (31.7% vs 13% in the IN group).

Factors such as anthropometric proportions, symmetry, sexual dimorphism and aging are known to influence the perception of facial attractiveness[18]. Considering the alar base width, even among faces considered beautiful there is a flexible range for this measure (up to 58%) when the classic anthropometric standards are considered.[12] Thus, facial canons deviations are frequent and not necessarily unpleasant[9,19]. In fact, the range of acceptable facial characteristics is much broader than what is ruled by the standardized norms[20,21].

The nose is a dominant structure related to facial beauty and harmony. Thus, prior to any surgical procedure involving the face, the presence of any nasal alterations must be identified.[16]

Since about 15% to 90% of rhinoplasty procedures require alar base manipulation[17], the alar base width is undoubtedly a key point for aesthetic facial balance. In terms of scoring the facial attractiveness, the expectations of this study regarding the inverse relation between the alar base widening and scores was confirmed by the results, the largest widenings received lower scores. Thus, it is fair to consider that the evaluation of facial aesthetics - despite its highly subjective nature – seems to follow the general patterns involving the perception of facial balance and harmony whereby further deviations from the standards are considered less and less attractive.

It is noteworthy that no significant difference was observed in the OMF surgeons' aesthetic perception when the faces were compared side by side or when scores were attributed to each face individually up to 2 mm of widening in both groups, regardless of the model's sex. Thus, changes within that range seemed difficult to detect, at least by the professionals in the sample herein.

The findings of this study showed that OMF surgeons from both groups were clearly prone to assign higher scores to female and male faces without or with smaller alar base widening, since mean scores attributed to each face did not differ statistically between the groups (Figures 6 and 7).

Figure 6 - Mean and standard deviation charts comparing the scores attributed by Brazilian (B) and foreign (I) specialists to female faces (F) with different levels of nasal widening (0 to 10 mm). P values according to t-test. There was no statistically significant difference between the two groups
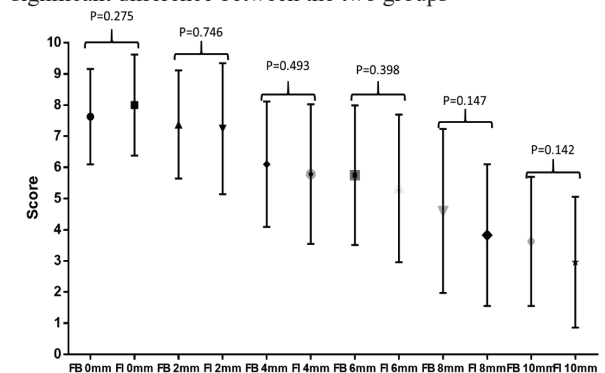
Source: The authors.

Figure 7 - Mean and standard deviation chart comparing the scores attributed by Brazilian (B) and foreign (I) specialists to male faces (M) with different levels of nasal widening (0 to 10 mm). P values according to t-test. There was no statistically significant difference between the two groups
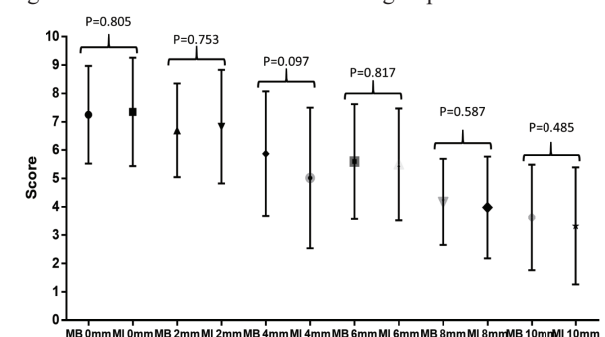
Source: The authors.

Since the post-ortognathic surgery skeletal changes produce rather complex effects on the overlying soft tissues, precise prediction of the nasolabial conformation - including alar base width - is a challenge[3,7,9,14]. In fact, the effectiveness of suturing techniques to control alar base widening such as the alar cinch technique has been contested by some[3,13,14].

The findings herein suggest that, from the OMF surgeons' point of view, a widening of the alar base of up to 2 mm may be clinically acceptable. Therefore, suturing techniques used to control such widening after maxillary surgery may be considered effective if their margin of error is within that range (Figure 5).

Given that adjunctive procedures such as rhinoplasty are frequently indicated after orthognathic surgery[7], understanding how the perception of excessive alar base widening affects one's judgment of facial attractiveness can support the treatment team in terms of determining when revision surgery is necessary and when it is not. It also contributes to a clearer, honest communication between the professional and the patient, which must be always based on realistic expectations[17,22].

When planning for surgically assisted maxillary expansion (SAME) and maxillary advancements, special attention should be given to those patients who are self-conscious of having "too wide nose" or those who prefer to preserve their morphological characteristics on the nasal region.[23] One drawback of this study, which was addressed in a previous work of the group herein, was not assessing the perception and threshold of identification of alar base widening by laypersons, which could give a fairer idea of the patients' perspective on the issue.

4 Conclusion

Minding the limitations of the design herein, OMF surgeons from Brazil and from other countries seem to agree that alar base widening of up to 2 mm does not compromise the attractiveness of male and female faces. In both groups, there was a clear trend of assigning lower attractiveness scores to faces with wider alar bases. Interestingly, it seems that, regardless of the group, OMF specialists are less likely to identify - or aremore lenient with - alar base widening in male faces.

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