Orthodontists' and laypersons' perception of mandibular asymmetries

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Abstract

Objective: To analyze orthodontists' and laypersons' perceptions of facial asymmetries caused by mandibular changes. **Methods:** The faces of two patients, a man and a woman, were photographed in natural head position, and additional photographs were produced with progressive mandibular shifts of 2, 4 and 6 mm from maximum habitual intercuspation (MHI). Intraclass correlation coefficients (ICC) and weighted kappa coefficients were used to test method reproducibility. The differences in scores for mandibular positions between orthodontists and lay persons were examined using Friedman analysis. All statistical analyses were performed at 95% confidence interval. **Results:** Orthodontists only perceived shifts greater than 4 mm from MHI position ($p<0.05$), and laypersons had similar results when analyzing the woman's photographs. However, when examining the man's photographs, laypersons did not perceive any change in relation to MHI. ($p>0.05$). Although median scores assigned by orthodontists were, in general, lower than those of laypersons, this difference was only significant for the 6-mm shift in both patients. **Conclusions:** Orthodontists and laypersons evaluated mandibular asymmetries differently. Orthodontists tended to be more critical when asymmetries were more severe. The evaluation of facial asymmetries also varied according to what patient was being examined, particularly among lay examiners.

Keywords: Facial asymmetries. Mandible. Perception. Orthodontics.

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INTRODUCTION

Current orthodontics has been closely associated with esthetics. Because of the subjective character of esthetic parameters, orthodontists and patients should reach a consensus to establish common treatment goals. Therefore, cephalometric data are no longer the most important element of treatment planning because patients' main demand is to be recognized as beautiful, or at least normal, by themselves and by society and to eliminate unpleasant characteristics of their smiles and faces.[15]

However, it is difficult to define esthetics; beauty may change according to several factors and, therefore, no single facial characteristic can be defined as the feature responsible for beauty.[15] A study that used standardized digital photographs found a high level of agreement in facial diagnosis between specialists, although results were not unanimous.[8] Previous studies showed that, when mandibular anteroposterior changes are added to photographs, either using image manipulation software,[9,11,16] or producing changes directly on the faces,[1,2,12] orthodontists and laypersons evaluate facial harmony differently.

Vertical and anteroposterior facial changes are associated and have been extensively studied.[9,16] However, few studies have investigated changes in facial symmetry. Facial asymmetry is a consequence of the disorderly growth of craniofacial structures, and may be triggered by genetic factors, congenital malformations, environmental factors such as habits or trauma, and functional disorders that may affect mandibular growth.[3,7] Symmetry and balance, when applied to facial morphology, describe a harmonious distribution of features. Size, shape and organization of the anatomic characteristics are balanced between opposite sides divided by a reference midplane.[13,14] However, subtle facial asymmetries may be normal and natural and, depending on their severity, may often go unnoticed by the patients or those around them.[3,5,6]

The evaluation of pairs of photographs that had been manipulated to make them perfectly symmetrical revealed that examiners were able to identify asymmetries even in faces that had been previously classified as very pleasant.[17] Moreover, clinically symmetrical and balanced faces in the studied sample had subclinical asymmetry indices detected when posteroanterior cephalograms were used.[13]

At more severe degrees, mandibular asymmetry may affect function as well as esthetics. Tooth asymmetries and several functional disorders may be treated using orthodontics. However, significant structural facial asymmetries are not easily camouflaged by orthodontic treatment, and may require controlled orthopedic correction during growth or orthognathic surgery in adulthood.[3]

The limit between "acceptable" and "unacceptable" facial asymmetries does not seem to be clear, nor easy to be established. However, it is often defined according to a clinical sense of balance and the patient's perception of imbalance.[3,17] Also, it is unclear whether this perception threshold is similar for orthodontists and laypersons. Therefore, this study evaluated whether orthodontists and laypersons perceived facial asymmetries and measured at what point asymmetry became perceptible for these two groups of examiners.

MATERIAL AND METHODS

The sample comprised a set of photographs of two patients with normal occlusion, a man (19 year old) and a woman (26 year old). Four photographs of each were produced, one in maximum habitual intercuspation (MHI) and the others with mandibular shifts of 2 mm, 4 mm and 6 mm.

The patients were photographed with their heads in natural position and the mandible in MHI using a Canon Rebel Xti camera (Canon, Osaka, Japan). After the photographs were obtained, they were manipulated to change occlusion at

progressive 2-mm shifts from the original position up to 6 mm. To guide the mandibular shifts, checkbite records were made using #7 wafer wax, and three new lateral positions were recorded at 2 mm, 4 mm and 6 mm parallel to the original position using a millimeter ruler (Fig 1). The shifts were to the right side of the patient (Figs 2 and 3).

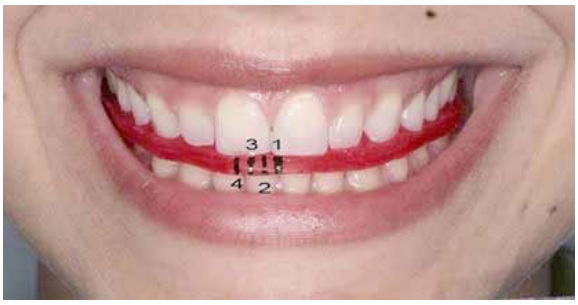

FIGURE 1 - Markings in the wafer wax record: #1 (MHI), #2 (2 mm), # 3 (4 mm) and # 4 (6 mm).

Posteroanterior radiographs of both patients were obtained to investigate pre-existing skeletal asymmetries (Figs 4 and 5).

Photographs were printed in photographic paper measuring 20 x 30 cm. Two photographs of each patient, MHI and 4 mm for the man and 2 mm and 6 mm for the woman, were chosen for replication and mixed with the others to test reproducibility of the method.

Images were examined by 30 orthodontists (11 men) registered on the Regional Board of Dentistry and with experience of, at mean, 6.3 years (1-23 years) and by 30 college-educated laypersons (13 men) with degrees in different areas but not dentistry and who had graduated a mean 10.4 years (1-32 years) before. Photographs were evaluated randomly, and the examiners were previously told to assign scores from 0 to 10 according to their perception of facial harmony considering 6 as the

FIGURE 2 - Man's photographs in MHI (M0) and with shifts of 2 mm (M2), 4 mm (M4) and 6 mm (M6).

FIGURE 3 - Woman's photographs in MHI (W0) and with shifts of 2 mm (W2), 4 mm (W4) and 6 mm (W6).

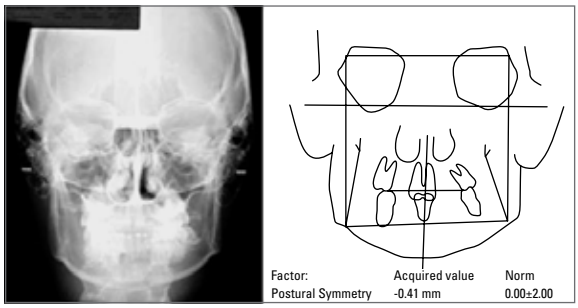

FIGURE 4 - Man's posteroanterior radiograph and cephalometric tracing.

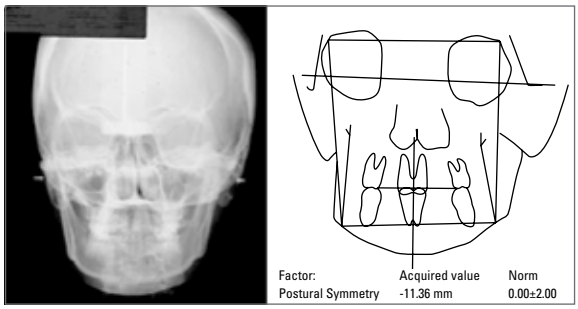

FIGURE 5 - Woman's posteroanterior radiograph and cephalometric tracing.

minimum acceptable. Each photograph was observed for up to 60 seconds, and examiners were not allowed to see the photographs again. Examiners received no other instructions or information.

To collect data about self-evaluation, the patients were asked to evaluate their own photographs after receiving the same instructions as the other examiners.

Statistical analysis

Intraclass correlation coefficients (ICC) and weighted Kappa were used to test the reproducibility of the method. The differences between orthodontists and lay examiners were compared using the Mann-Whitney test, whereas Friedman analysis was used for the differences in scores for mandibular positions (MHI, 2 mm, 4 mm and 6 mm). All statistical analyses were reported at a 95% confidence interval.

RESULTS

Method reproducibility using weighted Kappa coefficients was good to moderate for the pairs of photographs analyzed by both orthodontists and laypersons ($p<0.01$). ICC ranged from good to excellent ($p<0.01$). These results showed that the face photographs with progressive mandibular shifts had a good reproducibility, which confirmed the reliability of the method (Table 1).

The main purpose of this study was to evaluate orthodontists' and laypersons' perception of facial asymmetries. Results showed that, when evaluating the woman's face, median values assigned by both orthodontists and laypersons were higher than in MHI and decreased as the face became more asymmetrical (Figs 6 and 7). The same, however, was not seen for the evaluation of the man's photographs, in which case the scores assigned by both groups were similar for the photographs in MHI and with 2-mm shifts, but decreased progressively as the mandibular shifts increased (4 mm and 6 mm) when evaluated by orthodontists, and were not statistically different when evaluated by laypersons ($p>0.05$). Statistical analyses revealed that the orthodontists were more capable than laypersons to perceive mandibular shifts, and the only differences that they did not perceive were between the MHI position and the 2-mm shift ($p>0.05$) and between the 4-mm and 6-mm shifts ($p>0.05$) for both patients (Figs 6 and 7).

TABLE 1 - Weighted Kappa coefficients and intraclass correlation coefficients (ICC) of the scores assigned by examiners in the analysis of photograph reproducibility when the two evaluations were compared.

	Orthodontist			Layperson		
	Kappa	ICC	p value	Kappa	ICC	p value
M0A x M0B	0.58 (Mod)	0.73 (Good)	p<0.01	0.64 (Good)	0.85 (Exc)	p<0.01
M4A x M4B	0.63 (Good)	0.82 (Exc)	p<0.01	0.67 (Good)	0.82 (Exc)	p<0.01
W2A x W2B	0.54 (Mod)	0.74 (Good)	p<0.01	0.56 (Mod)	0.74 (Good)	p<0.01
W6A x W6B	0.53 (Mod)	0.67 (Good)	p<0.01	0.59 (Mod)	0.77 (Good)	p<0.01

M0 = Man, maximum habitual intercuspation; M4 = Man, 4 mm; W2 = Woman, 2 mm; W6 = Woman, 6 mm.
Mod = Moderate; Exc = Excellent.

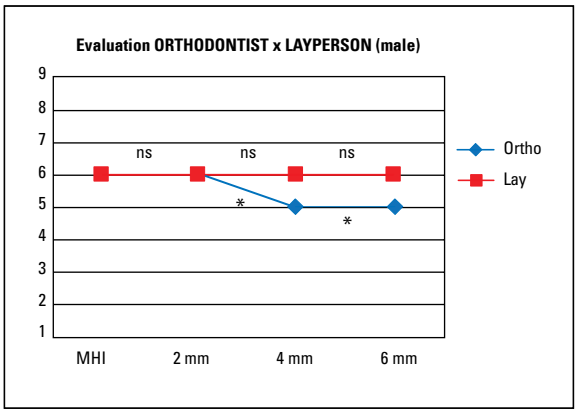

FIGURE 6 - Comparative analysis of median scores for man's evaluations by two examiner groups (Friedman analysis).

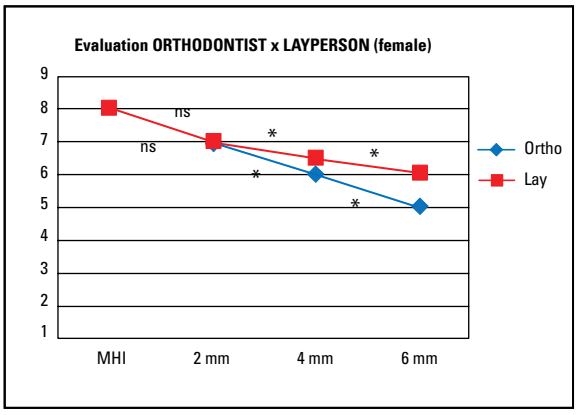

FIGURE 7 - Comparative analysis of median scores for woman's evaluation by two examiner groups (Friedman analysis).

Laypersons did not notice differences in any of the shifts for the man, and for the woman, the differences between the MHI position were only noticed when compared with 4-mm ($p<0.05$) and 6-mm ($p<0.05$) shifts.

There were no statistically significant differences in scores between the evaluation by the two groups of examiners for MHI, 2 mm and 4 mm. However, the scores for the 6-mm shift assigned by orthodontists were significantly lower than those assigned by laypersons (Table 2).

When the photographs were examined by the patients themselves, both assigned scores above the minimum acceptable (6) for all photographs, except for the photograph with the greatest degree of asymmetry (6 mm) (Fig 8).

TABLE 2 - Median (Md) and interquartile difference (IQD) of the values assigned in the evaluation of the man's and woman's photographs by the two examiner groups and the p value obtained in the comparative analysis between orthodontists and laypersons (Mann-Whitney test).

	Man			Woman		
	Ortho	Lay	p value	Ortho	Lay	p value
	Md (IQD)	Md (IQD)	Ortho x lay	Md (IQD)	Md (IQD)	Ortho x lay
MHI	6 (1)	6 (2)	0.93 (ns)	8 (1.75)	8 (1.75)	0.94 (ns)
2 mm	6 (2)	6 (2)	0.42 (ns)	7 (2)	7 (2)	0.79 (ns)
4 mm	5 (2)	6 (1)	0.24 (ns)	6 (2)	6.5 (2.75)	0.09 (ns)
6 mm	5 (1.75)	6 (1)	0.05*	5 (1.75)	6 (2)	0.03*

Ns = non-significant; *$p \leq 0.05$.

DISCUSSION

The evaluation of facial esthetic perception has fundamental importance in establishing treatment plans for orthodontic patients with skeletal discrepancies. Studies in the literature, however, have focused attention on sagittal changes of the face. Previous studies[2,9,12,16] correlated the effects of anteroposterior changes on facial esthetics and found that mandibular advances of 2-3 mm or more are perceptible by the orthodontist, but advances should be greater for the patient to perceive changes in facial esthetics.

There are no data in the literature about the perception of facial symmetry changes. This study measured 2- to 6-mm mandibular shifts using a method described on other studies.[1,2] Some studies found that the results of changes produced in the face by image manipulation software have only a reasonable degree of quality prediction.[10,11] Therefore, changes made directly on the patient's face may be more reliable than the ones obtained using computer software. In addition, the use of mandibular shifts is also justifiable because of the greater prevalence of facial asymmetries that affect the mandible rather than the maxilla.[7]

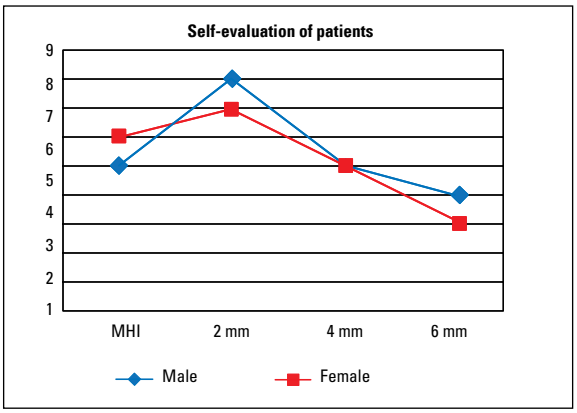

FIGURE 8 - Scores assigned by both patients to their own photographs.

Our results showed that the degree of perception of facial asymmetry was different between orthodontists and laypersons and between the patients under examination. Moreover, orthodontists and laypersons tend to have similar opinions when analyzing a face that is close to normal, and tend to have different evaluations when the severity of mandibular asymmetry that affects the face increases. In this study, laypersons were more sensitive to changes in the woman's photograph than in the man's photograph with the same change. This greater capacity to perceive changes preferentially in women has also been found in other studies that evaluated the perception of changes in profiles simulated using image manipulation software.[4,16]

In their self-evaluation, the woman assigned decreasing scores as the face became more asymmetrical, except for the photograph with a 2-mm shift when compared with the MHI photograph. The man assigned the highest score to the photograph with a 2-mm shift (score = 9), did not see differences between the MHI photograph and the photograph with a 4-mm shift (score = 6), and assigned the lowest score to the 6-mm photograph (score = 5). Although score variations were not uniform, all were classified as acceptable in the patients' self-evaluation, except the photographs with a 6-mm shift, which received scores below the acceptable level from both patients.

Asymmetry is an anomaly that may compromise the different facial planes. Therefore, a facial examination using a three-dimensional method may yield more realistic results. However, in orthodontics, three-dimensional methods have not become widely available yet, which justifies the use of two-dimensional face photographs, which are basic elements of orthodontic documentation.

Another complementary exam used to aid in the diagnosis of asymmetries is the posteroanterior radiograph. Cephalograms of both patients evaluated in this study showed a slight shift of the mandibular midline to the left, more marked in the woman. This finding confirms a study that used radiographs to evaluate 52 patients included in the sample because their faces were symmetrical and balanced. Results showed asymmetries in at least one of the variables under analysis, and the authors concluded that even in clinically symmetrical faces there is often some degree of subclinical asymmetry.[13]

Although far from unanimity, the degree of agreement between orthodontists was very high for facial diagnoses, particularly when asymmetry was analyzed. Specialists tend to make similar diagnoses of facial asymmetries. [8] In contrast, studies showed that, in some cases, orthodontists and laypersons do not agree, which confirms the results of the present study.[1,2]

Therefore, considering the risks associated with orthognathic surgery, its indication should be carefully evaluated when the objective is the correction of facial asymmetry, particularly when this is not the patient's main complaint. Based on the results of the man's photographs, this study results suggest that laypersons, often the patients themselves or their families, are not capable of perceiving shifts as large as 6 mm from the normal face, which may justify the use of limited orthodontic treatment.

This study describes an analysis of the face using statistical analyses, which may lead to certain biased conclusions. Asymmetry may, in

some cases, be more perceptible in an analysis of the individual during functional activities, such as speaking or smiling, and a dynamic analysis may be a more complete evaluation method, but, although available to the specialist in clinical practice, may be difficult to use in scientific studies.

One of the limitations of this study was the fact that it evaluated mandibular asymmetry alone, although asymmetries, even those that have a mandibular origin, do not present as isolated characteristics because asymmetrical mandibular growth compromises the muscles in the region. However, this type of facial change would be impossible to reproduce on the patients' faces.

Complementary studies should be conducted with a larger patient sample because what is perceived in an individual with certain traits and characteristics may be overlooked by the same examiner in another individual with different features. The analysis of a large patient sample, however, may demand the evaluation of more photographs, which might make it tiring for the examiner and might affect the final results of the study.

CONCLUSION

The results of this study showed that:

» Orthodontists and laypersons evaluated mandibular asymmetries differently, and orthodontists tended to be more critical when asymmetries were more severe.

» The evaluation of facial asymmetries also varies according to what patient is under examination, either man or woman, particularly among laypersons.

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