

Original Article

The Perception of the Severity of Facial Asymmetry among Laypersons, General Practitioners, Orthodontists, and Maxillofacial Surgeons

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KEY WORDS

Facial asymmetry;
Three-dimensional
images;
Perception;
Orthodontics;

ABSTRACT

Statement of the Problem: The degree of asymmetry perception of dental and medical practitioners is influenced by several factors. The perceived asymmetry affect the treatment plan design.

Purpose: The aim of the present study was to investigate the consistency of facial asymmetry and identify the amounts of transverse asymmetry that can be regarded as normal and might need correction.

Materials and Method: In this cross-sectional descriptive study, three-dimensional (3D) images of a man and a women volunteer were obtained. Then transverse changes were applied by ZBrush software so that for each volunteer, seven 3D images of their face with varying degrees of facial transverse asymmetry were created. Then, the images were displayed to four groups of observers including layperson, general dentists, orthodontists, and maxillofacial surgeons. Finally, the consistency of the perception of these four groups of observers with the different degrees of facial asymmetry was compared.

Results: Fourteen photographic samples were evaluated and ranked by 80 observers in four groups. The consistency of the perception of the facial transverse asymmetry was equal to 33%, which indicated a lack of consistency.

Conclusion: According to the findings of this study, there was no consistency between the groups. The perception of dental professionals and ordinary people regarding the severity of transverse facial asymmetry seems to be inconsistent.

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Introduction

Symmetry is a fundamental geometry property that influences people's aesthetic experience in familiar ways in different cultures and historical periods, but the origins of this global predilection for symmetrical patterns is ambiguous [1]. Facial asymmetry is about equality in size, shape, and fit of features on both sides of the mid-sagittal plane [2]. One of the most widely studied facial features among orthodontists is bilateral facial symmetry. Facial symmetry plays an essential role in the attractiveness of the face and its acceptance in society [3]. Severe facial malformations can be a manifestation of the craniofacial syndrome, trauma, pathology, and abnormal growth that can have significant psychologi-

cal, functional, and aesthetic consequences for patients as well as affecting self-esteem and quality of life [4-5]. On the other hand, Patcas *et al.* [6] showed that orthognathic treatments that also include correction of facial asymmetries have a beneficial effect on attractiveness in 74% of patients.

The degree of perceived asymmetry of the patient's face by the dental and medical practitioners is useful in determining the severity of the facial asymmetry and designing an effective treatment plan [7-9]. It has been suggested that gender, culture, and ethnicity may influence practitioner perceptions towards facial asymmetry [10-11]. Most cases of facial asymmetry do not essentially point out considerable structural or functional

problems. Patients seek treatments because of the impairment in their facial attractiveness [12]. Chu *et al.* showed that there should be at least 3 mm of facial asymmetry in the digitally manipulated image for an average person to recognize asymmetry [13]. Most studies in the case of the facial asymmetry perception have used two-dimensional photos [14] and some of them used typical individual images rather than fully mirrored images [15].

The aim of the present study was to evaluate the perceptions of the facial symmetry among laypersons, general dental practitioners, orthodontists and oral and maxillofacial surgeons using manipulated 3D photographs.

Materials and Method

The ethical approval of the present study was received from the Islamic Azad University Research and Ethics Committee.

Image Synthesis Deformation Simulation

First, a male and a female volunteer were selected, and they were photographed in a 3D scan room using a DSLR Canon (Canon Inc., Tokyo, Japan) camera. Then by an anatomy modeler artist, using ZBrush software (Pixologic, Inc., Los Angeles, USA), these images were modified in the transverse dimension so that there were seven models for each person's image. In the first mode, the person's image was completely symmetric. In other words, by using a mirror image option and moving one side of the face to the other and created an utterly symmetric image of the frontal view. Then, using the software, we created the transverse facial asymmetry as follows. We created 1mm transverse asymmetry on the right side, 2mm transverse asymmetry on the left side, 3 mm transverse asymmetry on the right side, 5 mm transverse asymmetry on the left side of the face, 6 mm transverse asymmetry on the right side, and 8 mm transverse asymmetry on the left side. The midsagittal line was considered as the reference line to manipulate images and to create the transverse asymmetries. Then the nose, lip, chin, and mandibular angle were moved using ZBrush software to create varying degrees of asymmetry from 1 mm to 8 mm.

Asymmetry Perception Assessment

The frontal view of the volunteers was used to assess the severity of facial asymmetry. We had seven photo-

graphs of each volunteer (Figure 1) with various transverse facial asymmetries.

The 3D images were randomly presented to each of the four groups of observers (n = 20), including laypersons, general dental practitioners, orthodontists, and oral and maxillofacial surgeons, within a limited time (10 seconds). We asked the participants to determine the magnitude of asymmetry in each image based on the three options in the questionnaire (“completely symmetrical”, “non-symmetrical but aesthetically acceptable”, “non-symmetrical and requiring treatment”). Then, the responses of these four groups of observers on the extent of the transverse facial deformity were compared.

For the assessment of the accuracy of each group responses, we considered the responses of the observers to be “completely symmetrical” in the 0 to 1mm interval, “non-symmetrical, but aesthetically acceptable”, in the 2 to 4mm interval, and “non-symmetrical and requiring treatment” in the 6 to 8 mm interval to be correct answers.

Statistical Analysis

The rate of compliance was defined in three categories as acceptable (above 75%), moderate (between 40-75%), and non-compliance (below 40%). In the present study, we used Pearson's chi-squared test for comparing study groups using Statistical Package for the Social Sciences software version 19 (Chicago, IL, USA). A *P-value* of less than 0.05 was considered significant.

Results

Fourteen photographic images were taken, and then 80 individuals in four groups (including orthodontists, maxillofacial surgeons, general dentists, and laypersons) assessed the severity of transverse asymmetry. The subjects included 50 men and 30 women with a mean age of 34 ± 8.59 years.

Reliability Analysis

For reliability analysis, the subjects' answers to the questionnaire were compared (Table 1). Our findings showed that the consistency of transverse facial asymmetry diagnosis among all groups was equal to 33 percent. As it was less than 40 percent, it can be concluded there was an inconsistency among the observers answer.

Perceived Asymmetry Among Each Group

Laypersons chose “completely symmetrical” for images with varying intensities of transverse asymmetry more

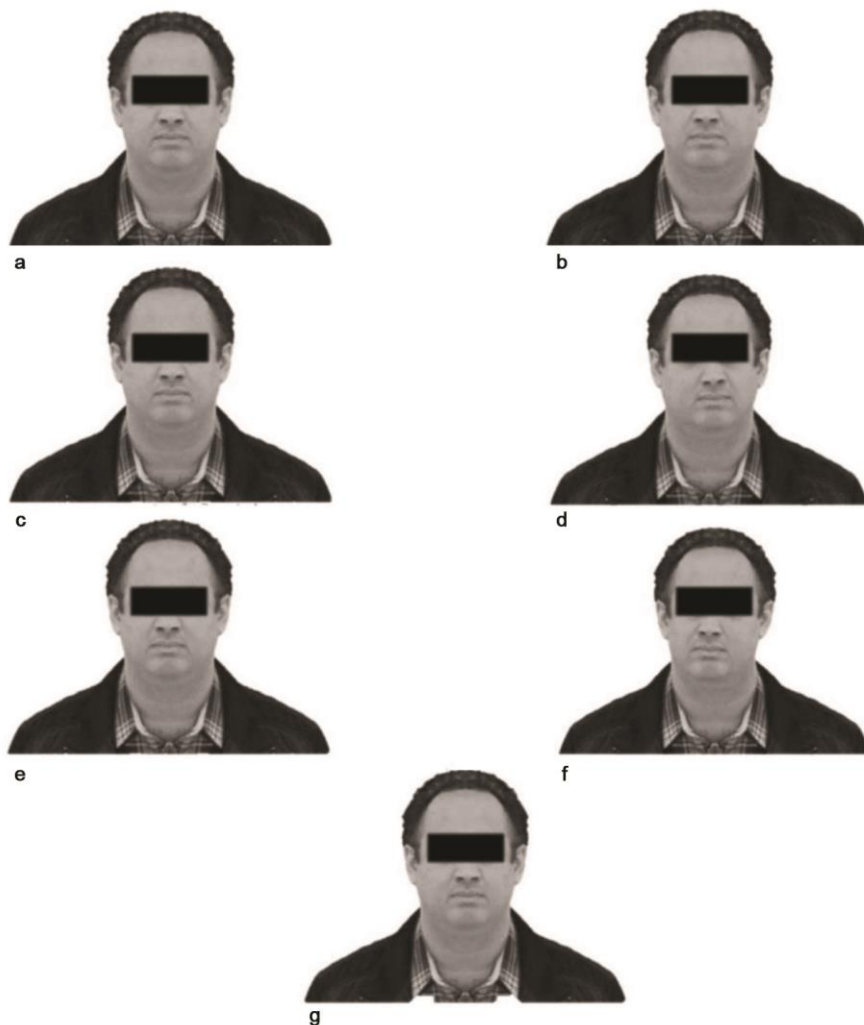


Figure 1: Examples of male volunteer faces with various levels of asymmetry. **a:** symmetric face; **b:** 4mm asymmetry to the right; **c:** 1mm asymmetry to the left; **d:** 6mm asymmetry to the left; **e:** 2mm asymmetry to the right; **f:** 8mm asymmetry to the right; **g:** 3mm asymmetry to the left

Table 1: Comparison of facial asymmetry perception between the observer groups

	Symmetric	Partially Symmetric	Asymmetric
Laypersons	562	568	550
Dentists	526	541	613
Surgeons	514	526	640
Orthodontists	550	568	562

than any other groups. On the other, maxillofacial surgeons selected “completely symmetrical” less than other groups. There was a statistically significant difference between the laypeople and the maxillofacial surgeons in choosing this option ($p= 0.003$). The highest number of “non-symmetrical and requiring treatment” option selection belonged to the maxillofacial surgeons, and the lowest number belonged to laypeople. However, there was no significant difference in among various groups (Table 1). The selection of “completely symmetrical” choice of various groups of observers at different inten-

sities of asymmetry is given in Figure 2. In case of a perfectly mirrored image, the most accurate diagnosis of facial symmetry belonged to orthodontists. At the interval of 0 mm to 3 mm asymmetry, more than half of laypersons did not report any asymmetry. However, when asymmetry reached 4 mm, laypeople could detect asymmetry like other study groups.

The Effect of patient Gender in the Perception of Asymmetry

The selection of “completely symmetrical” choice at different intensities of asymmetry was used to test for differences in perception according to the gender of the volunteer’s manipulated photos (Figure 3). Although there was a slight difference between asymmetry perception in case of gender, there were no statically significant differences.

Evaluation of Observers’ Responses

According to Table 2, general dentists gave the least

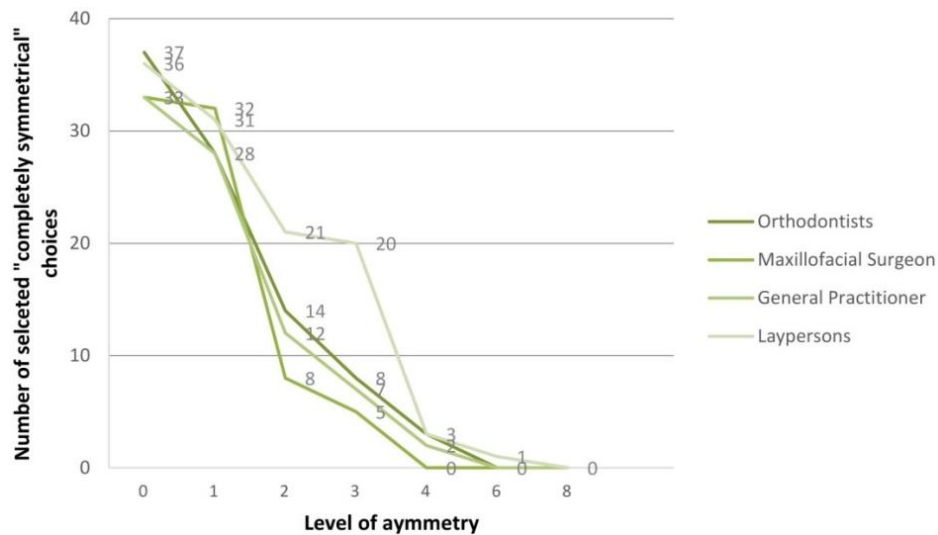


Figure 2: The total number of “completely symmetrical” choice selection of various groups of observers at different intensities of symmetry.

number of correct answers in the interval of 0 to 1 mm. In the case of 2 to 4 mm asymmetry, orthodontist had the highest number of correct answers, and laypeople had the highest number of wrong answers. Furthermore, it has been observed that maxillofacial surgeons were most likely to treat these patients. Finally, in 6 to 8 mm interval, all groups answered correctly in 91 to 97.5 percent of cases.

Discussion

Facial asymmetry means inequalities on both sides of the midsagittal axis that affects the attractiveness of individuals and leads to functional problems. Congenital disorders, acquired diseases, trauma, and developmental deformities can cause facial asymmetry [3]. Since there

is no specific standard for the diagnosis of facial asymmetry [16], the present study aimed to present such information to the treatment team, including maxillofacial surgeons and orthodontists.

In this study, three-dimensional photographic images were used to assess the perception of transverse facial asymmetries. The use of 3D images of male and female volunteers while preserving the natural color and structure of the face made the modeling to be closer to the actual face of the person. Given that each person's face naturally has various degrees of asymmetry [17], the mirror imaging option was used in this study to move one side of the volunteer face to the other and create a complete mirror image for the samples.

This study showed that there were no significant dif-

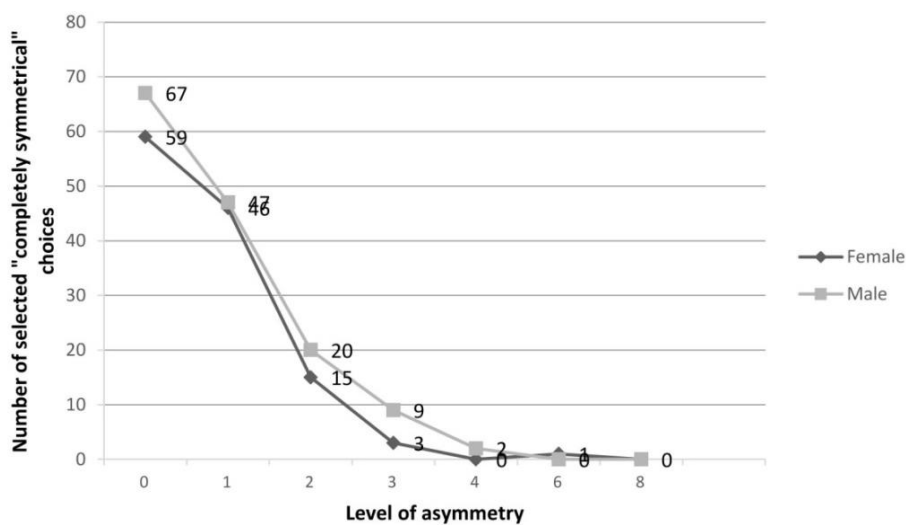


Figure 3: The total number of “completely symmetrical” choice selection from various genders of manipulated images at different intensities of asymmetry.

Table 2: Number of correct answers in various groups in different intervals of asymmetry

Study Group		Laypersons	Dentists	Surgeons	Orthodontists
0 mm to 1 mm Transverse Asymmetry	Correct Answers	67 (83.5%)	61 (76%)	65 (81%)	65 (81%)
	Wrong Answers; “non-symmetrical but aesthetically acceptable”	12 (15%)	19 (24%)	14 (17.5%)	15 (19%)
	Wrong Answers; “non-symmetrical and requiring treatment”	1 (1.5%)	0	1 (1.5%)	0
2 mm to 4 mm Transverse Asymmetry	Correct Answers	61 (76%)	63 (52.5%)	66 (55%)	77 (64%)
	Wrong Answers; “completely symmetrical”	44 (36.5%)	21 (17.5%)	13 (11%)	25 (20%)
	Wrong Answers; “non-symmetrical and requiring treatment”	15 (12.5%)	36 (30%)	41 (34%)	18 (16%)
6 mm to 8 mm Transverse Asymmetry	Correct Answers	73 (91%)	75 (94%)	78 (97.5%)	76 (95%)
	Wrong Answers; “completely symmetrical”	1 (1.5%)	0	0	0
	Wrong Answers; “non-symmetrical but aesthetically acceptable”	6 (7.5%)	5 (6%)	2 (2.5%)	4 (5%)

ferences in the perception of transverse asymmetry between laypersons, general dentists, and orthodontists. However, we concluded that the perception of dentists and ordinary people about the severity of asymmetry is inconsistent. Our results are consistent with Meyer-Marcotty *et al.* study [15], which suggested there was no significant difference in the perception of facial asymmetry by dental professionals and the laypersons. However, Bispo de Carvalho Barbosa *et al.* [11] suggested that laypersons are less sensitive in the perception of facial asymmetry. In case of accuracy of perception, similar to previous studies conducted by Jarosz *et al.* [18], Pinho *et al.* [19], and Kokich *et al.* [20], orthodontists were the most accurate group in detecting various degrees of transverse asymmetry. Dong *et al.* [21] used 3D images to assess the influence of chin asymmetry on perceived facial esthetic among orthodontists, general dentists, and laypersons and suggested that the reason for the orthodontists to be the most accurate group is that they receive rigorous training and have more diagnostic experience. Therefore, the professionals know where to focus and more likely to focus on details [21].

In this study, 3D images of a male face and a female face were made to detect facial asymmetry in the nose and chin. McAvinchey *et al.* [7] conducted a similar study in the diagnosis of chin asymmetry. In their study, orthodontists showed the most sensitivity to diagnosis of asymmetry; there was a significant difference in diagnosis of asymmetry between dentists and the laypeople. However, the manipulation of the images was just on the chin region, which is a reason for their findings to be inconsistent with the results obtained in our study.

In addition, Jarosz *et al.* [18] used an online website

for their survey on detecting chin asymmetry, which allowed survey takers to respond on mobile devices, tablets, and home computers. These equipments have varying monitor sizes, resolution and brightness, all of which could have affected the visual interpretations and perceptions of the chin asymmetries. In our study, we have controlled this issue by using a standardized digital display and all of our survey takers observe the photographs on the same device.

Another outcome of the current study was the difference in the perception of transverse facial asymmetry between laypersons and maxillofacial surgeons. The main reason for this difference in understanding can be the experience and knowledge of maxillofacial surgeons compared to laypeople. Another reason may be that each person's face is generally one of the revealing parts of his body. Most people focus their attention on the central part of the face (eyes) at first glance to the new individual face [17]. Another finding in the present study was that orthodontists were more likely to choose asymmetric but aesthetically acceptable option compared to surgeons, indicating that this group is acting more conservative in the case of facial asymmetry. However, maxillofacial surgeons chose the need of surgery option more than other groups. This finding indicates that this group is willing to undergo surgical intervention regardless of the apparent malformation. A probable reason might be their profession and higher standards for facial esthetics, which make them, prefer surgical treatments even when the asymmetry is esthetically acceptable.

Other factors that were considered in the diagnosis of facial asymmetry were the gender of the patients. It has been reported that various factors can influence the

perception of transverse facial asymmetry, including the level of observers' education and their gender [7]. Our study showed that there was no significant difference between male and female patients. McAvinchey *et al.* [7] also showed similar results concerning the gender of the patients.

Though an assessment of asymmetry in the transverse plane was performed here, the asymmetry in vertical plane, the role of distribution of other structures of the face like nose versus chin or eye asymmetries may affect the perception of overall asymmetry, deserving further evaluation. In a recent work by Chou *et al.* [22], a panel of young children as observers was included in the study. Interestingly, the results showed that pre-adolescent raters presented a similar or higher perception of facial asymmetry than adult raters. In such studies in the future, it is important to respect and to consider other categories of professionals and lay persons especially those involved with treating or affected by facial asymmetries as the group of observers.

Conclusion

The results of the current study imply that the perception of dentists and ordinary people about the severity of transverse facial asymmetry appears to be inconsistent. This study was performed based on images and manipulated models, and they cannot be a complete replacement for the actual face condition, and muscles play an essential role in this case, that requires further researches.

Conflicts of Interest

None declared.

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