# EVALUATION OF FEMALE FACIAL ATTRACTIVENESS WITH DIFFERENT SKELETAL ASYMMETRY. A CROSS-SECTIONAL STUDY

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**Abstract**

**Introduction:** Facial asymmetry is a common problem that varies in severity between individuals depending on several factors and origins and affects facial beauty. Therefore, the two objectives of this study are to first determine the level of facial attractiveness in an adult female with different degrees of deviation of the chin and mandible. The second is to measure the difference in perception of the degrees of asymmetry and to judge the facial attractiveness between several evaluator groups.

**Material and Methods:** An adult female with a symmetrical face was photographed. The image was then modified using Adobe Photoshop into two series. The first was with deviation of the chin to the right generating 5 photographs. The second one was with deviation of the mandible to the right resulting in 5 other photos.

After that, the images were presented in a questionnaire to 180 evaluators. Finally only 135 rated the attractiveness of each face using the VAS scale; divided into 38 dentists, 35 orthodontists and 57 laypeople.

**Results:** In both series, orthodontists determined facial asymmetry starting from 2 mm deviation of the chin and the mandible. On the other hand, dentists noticed the asymmetry starting from 4 mm of chin deviation and 2 mm of mandibular deviation and laypeople from 4 mm of chin deviation and 2 mm of mandible deviation. For the two series, the difference was not significant between the two genders.

**Conclusion:** Orthodontists were the most sensitive to detecting asymmetry and there was no significant difference between the evaluation of dentists and laypeople.

**Keywords: Facial attractiveness, adults, chin deviation, mandible deviation, orthodontists, dentists, laypeople.**

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# *ÉVALUATION DE L'ATTRACTIVITÉ D'UN VISAGE FÉMININ AVEC DIFFÉRENTES ASYMÉTRIES SQUELETTIQUES. UNE ÉTUDE TRANSVERSALE*

**Résumé**

L'asymétrie faciale est un problème courant dont la gravité varie d'un individu à l'autre en fonction de plusieurs facteurs. Elle possède plusieurs origines et affecte la beauté du visage.

Par suite, les deux objectifs de cette étude consistent à déterminer d'abord le niveau d'attractivité faciale chez une femme adulte avec différents degrés de déviation du menton et de la mandibule. Ensuite, de mesurer la différence de perception des degrés d'asymétrie et de juger de l'attractivité faciale entre plusieurs groupes évaluateurs.

**Matériel et méthodes :** Une femme adulte au visage symétrique a été photographiée. L'image a ensuite été modifiée par le logiciel « Adobe Photoshop » en deux séries. La première était avec déviation du menton vers la droite générant 5 photographies. La seconde était avec une déviation de la mandibule vers la droite résultant en 5 autres photos.

Ensuite, les images ont été présentées dans un questionnaire à 180 évaluateurs. Seuls 135 ont évalué l'attractivité de chaque visage à l'aide de l'échelle VAS ; divisé en 38 dentistes, 35 orthodontistes et 57 profanes.

**Résultats :** Dans les deux séries, les orthodontistes ont déterminé l'asymétrie faciale à partir d'une déviation de 2 mm du menton et de la mandibule. Par contre, les dentistes ont remarqué l'asymétrie à partir de 4 mm de déviation du menton et 2 mm de déviation mandibulaire et les profanes à partir de 4 mm de déviation du menton et 2 mm de déviation mandibulaire. Pour les deux séries, la différence n'était pas significative entre les deux sexes.

**Conclusion :** Les orthodontistes étaient les plus sensibles à la détection de l'asymétrie et il n'y avait pas de différence significative entre l'évaluation des dentistes et celle des profanes.

**Mots clés : Attractivité faciale, adultes, déviation du menton, déviation de la mandibule, orthodontistes, dentistes, profanes.**

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## Introduction

Facial asymmetry is defined as the lack or absence of visible symmetry and balance of the face. Actually perfect bilateral symmetry of the face does not exist, and there are always some degrees of asymmetry between the right and the left side in the human race [1, 2]. This slight asymmetry is usually associated with facial beauty, but when it becomes severe, it influences directly the degree of facial attractiveness of the individual. Moreover, in advanced stages, it may cause depression, underestimation problems, inferiority complex in society [3] requiring therefore advanced treatments for its management [1].

According to its etiology, facial asymmetry is classified in several categories, such as pathological, traumatic, functional or developmental [4]. As reported by Haraguchi [5], it is caused by hereditary factors of prenatal origin or acquired factors of postnatal origin, and is common in the lower third of the face since the mandible is a mobile bone. It is either horizontal due to hemi-mandibular elongation or vertical associated with hemi-mandibular hyperplasia or even a combination of the two [6, 7].


Figure1: Deviation of the chin A: Initial photo of the female B: Chin deviation of 2mm C: Chin deviation of 4mm D: Chin deviation of 6mm E: Chin deviation of 8mm

Many studies have been conducted on this subject. For instance, Dalla Corte et al. worked on correcting horizontal mandibular asymmetry by deviating the mandible of an adult woman presenting asymmetry in the lower third of her face. After taking her facial picture, they edited the photography, using "Adobe Photoshop CS5" until having a symmetrical face, and presented the results to three groups of evaluators. Studying all the collected data, they concluded that orthodontists were more precise in their diagnosis of mandibular asymmetry compared to dentists and laypeople [8]. Moreover, Jarosz et al. demonstrated that dentists and orthodontists were more accurate than laypeople in their perception of transverse asymmetry of the chin in adults, male and female. In addition, they deduced that non-orthodontists and orthodontists had a similar perception when evaluating the attractiveness of the female's face based on the degree of chin deviation, whereas orthodontists were the most accurate in evaluating the attractiveness of males [9].

On the other hand, Gribel et al. found that mandibular deviation to the left side was more frequent in adult skeletal Class I patients, with no significant preference in regard to the gender [10]. Furthermore, according to Naini, when the asymmetry of the chin is less than 5mm, it is considered undetectable, whereas severe when it exceeds 10mm [6].

While regarding the study of Zamanian et al., laypeople, general practitioners, orthodontists and maxillofacial surgeons, had no significant difference in perceiving the severity of the transverse facial asymmetry [11].

To our knowledge, no study has evaluated yet the degree of attractiveness of horizontal facial asymmetry in the Lebanese population, and demonstrated the amount of deviation, in mm, from which the face is considered anesthetic requiring an adequate ortho-surgical treatment.

Therefore, the main objective of this study consists in determining the exact amount of deviation of the chin and mandible, in mm, from which the face is considered anesthetic, as judged by dentists, orthodontists and

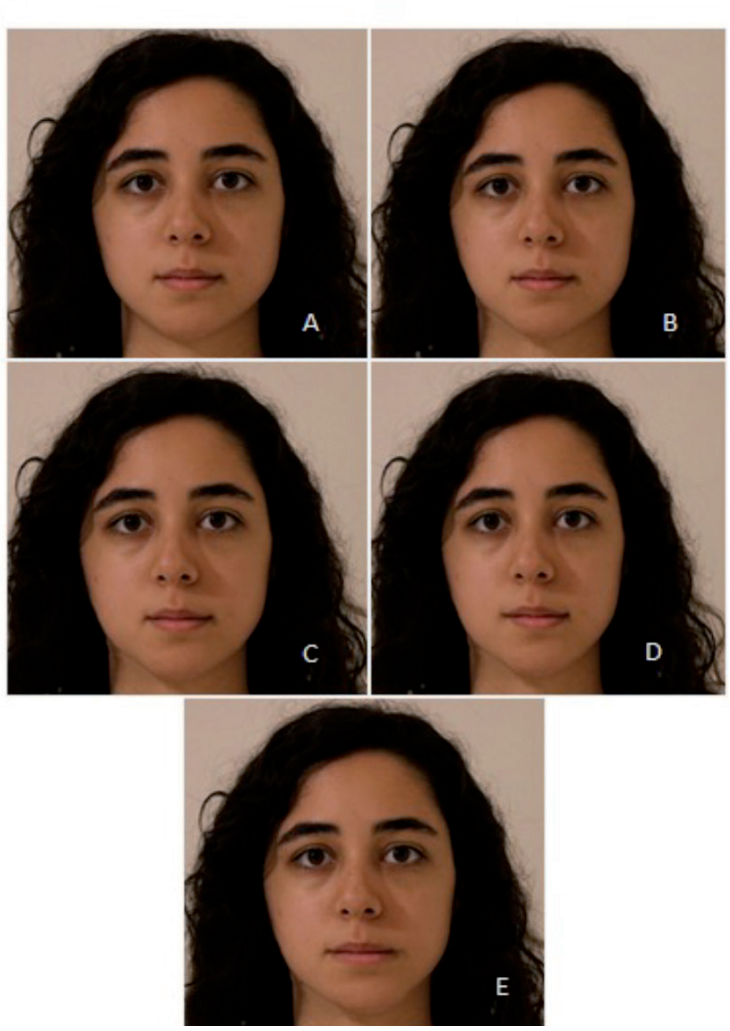


Figure 2: Deviation of the mandible A: Initial photo of the female B: Mandible deviation of 2mm C: Mandible deviation of 4mm D: Mandible deviation of 6mm E: Mandible deviation of 8mm

laypeople, requiring, thus, an adequate treatment.

The secondary objective is to detect any significant difference between orthodontists, dentists and laypeople in assessing the attractiveness of the face, in different degrees of mandible and chin deviation.

## Material and Methods

The study was approved by the ethics committee (SJ-2021-08). One Caucasian adult female (22y 08 m) presenting a symmetrical face confirmed by a frontal teleradiography, without any indication of severe facial abnormality or unusual facial features, was selected for this study. A series of face photographs based on the original ideal face of this adult female, were modified, with the aim of being evaluated by different groups of 60 orthodontists, 60 dentists and 60 laypeople [12].

The three groups of evaluators, aged between 18 and 60 years old, were selected as the following: having received an academic education, undergoing dental training or graduates in dentistry, undergoing orthodontic training or graduates in orthodontics. All reviewers presenting surgical or prior facial treatment, facial deformation, history in facial trauma or even working as health care employees were excluded.

The female seated in front of the camera was asked to hold her head in a comfortable, natural posture, with the lips gently touching, looking in her own eyes at a mirror facing her, in order to acquire the image in natural head position with neutral emotions and relaxed facial expressions. With a white background behind her, the seated woman kept a distance of 1.5m from a digital camera (Canon EOS 750D, Canon Inc. Japan), ISO 3200, with a speed of 1/160, under standard lighting conditions, without flash and with F4 as aperture of the diaphragm.

Subsequently, the image was adjusted using commercially available image processing software

(Adobe Photoshop, Adobe illustrator, Adobe Inc. California, USA) according to 2 modifications:

The first consisted in deviating the chin to the right successively by 2mm, 4mm, 6mm and 8mm, while maintaining constant the height of the two-thirds of the upper face [8]. Therefore, only one parameter was modified at the level of the lower third of the face: the chin.

This resulted in five frontal photos, differing by their degree of chin deviation (Figure1).

Concerning the second modification, the entire mandible was deflected to the right (including the chin, the lower lip and the ramus) successively by 2mm, 4mm, 6mm and 8mm [8]. Five more photos were collected with different degrees of mandibular deviation (Figure2).

However, one photo of each series (the 6mm deviation) was duplicated to ensure the reliability of the score assigned by the evaluators.

One hundred and eighty (180) potential participants were contacted through email to contribute in the study (60 dentists, 60 orthodontists, 60 lay people). Only one hundred and thirty were enrolled and signed a consent form prior to taking the survey divided into 35 orthodontists (20

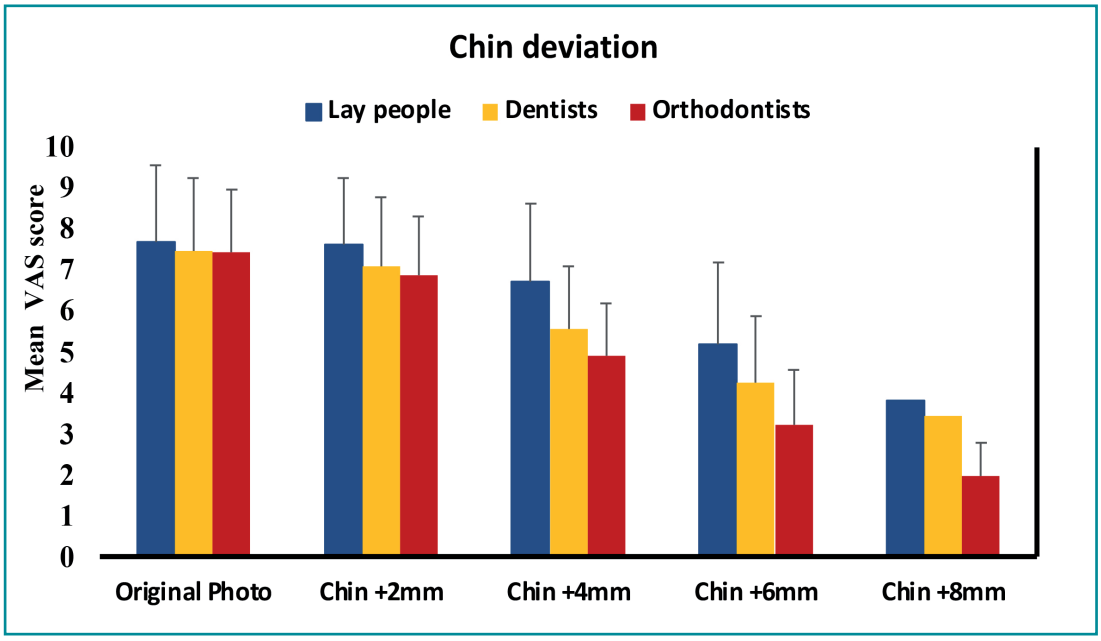


Figure 3: Variation of the mean VAS score according to chin positions and professions

| | Original | Mandible + 2mm | Mandible + 4 mm | Mandible + 6mm | Mandible + 8 mm |
|---|---|---|---|---|---|
| Laypeople | 7.49 ± 1.571* | 6.75 ± 1.902* | 5.42 ± 1.880b | 4.67 ± 2.030b | 3.26 ± 1.876b |
| Dentists | 7.45 ± 1.796* | 6.84 ± 1.620* | 5.42 ± 1.638b | 4.18 ± 1.449b | 2.76 ± 1.304a,b |
| Orthodontists | 7.20 ± 1.431* | 6.34 ± 1.533* | 4.43 ± 1.501a | 3.29 ± 1.363a | 2.23 ± 1.003a |
| -p-value | 0.684 | 0.416 | 0.016 | 0.001 | 0.008 |

a,b,c,d : different letters showing the existence of a significant difference between the photos according to the multiple comparisons.

Table1: Comparison of the mean VAS scores between professions.

female,15 male); 38 general dentists (31 female,7 male) and 57 laypeople (40 female,17 male) (n = 130). They were asked to rate the attractiveness and symmetry of the face in 12 photos using a visual analogue scale (VAS) ranging from 1 (very unattractive) to 10 (very attractive). An alphabetical letter, from A to L, was assigned to each of these twelve faces. Two images from each series were rated twice, without the raters' knowledge, in order to determine the intra-rater reliability. Participants were informed of the real objective of the research after completion of the study. Each photograph was studied for one minute and once by each evaluator without the possibility of returning to a previous photograph. The notes were then transposed into a table created in Microsoft Excel (version 15.21.1) with the aim of being analyzed by an expert in statistics.

## Statistical Analysis

IBM SPSS Statistics statistical software (version 25.0) was used to analyze the data. The alpha risk was set at 0.05.

Repeated measures analyses of variance were carried out to compare the mean scores EVA between the photos and according to professions (dentists, lay people and orthodontists); they were followed by univariate analyses and multiple Bonferroni comparisons.

Student's tests were used to compare the mean VAS scores between men and women.

In order to assess the reproducibility of the scores, all participants coded in two different steps the advanced photo of the chin of + 6mm and the advanced photo of the mandible of + 6mm. The Intra-class Correlation Coefficient (ICC) with a 95.0% confidence interval was calculated to assess the reproducibility of the VAS score. The ICC value of the advanced photo of the chin + 6mm was 0.930 with a 95% confidence interval of (0.901; 0.951). The ICC values of the +6mm advanced photo of the mandible was 0.943 with an interval of 95% confidence of (0.919; 0.959); indicating a very good reproducibility.

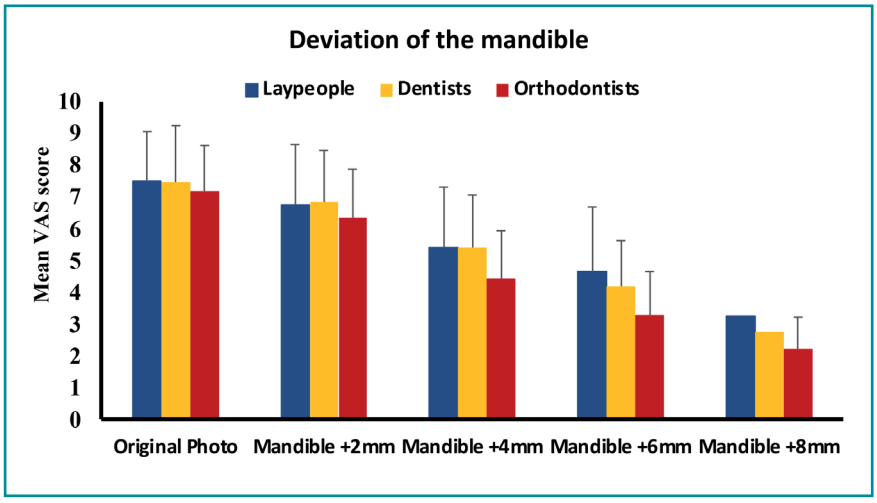


Figure 4: Variation of the mean VAS scores according to the mandible and the profession.

| | Original | Chin + 2mm | Chin + 4 mm | Chin + 6mm | Chin + 8 mm |
|---|---|---|---|---|---|
| Laypeople | 7.67 ± 1.874 | 7.61 ± 1.623 | 6.72 ± 1.906$^{c}$ | 5.19 ± 2.004$^{c}$ | 3.82 ± 2.097$^{b}$ |
| Dentists | 7.47 ± 1.767 | 7.08 ± 1.683 | 5.55 ± 1.537$^{b}$ | 4.26 ± 1.622$^{b}$ | 3.45 ± 1.826$^{b}$ |
| Orthodontists | 7.43 ± 1.539 | 6.86 ± 1.458 | 4.91 ± 1.269$^{a}$ | 3.23 ± 1.330$^{a}$ | 1.97 ± .822$^{a}$ |
| -p-value | 0.784 | 0.068 | <0.001 | <0.001 | <0.001 |

* no significant difference between the groups / a,b,c,d : different letters showing the existence of a significant difference between the photos according to the multiple comparisons.

Table 2: Comparison of the average VAS score between profession

## Results

- Comparison of the EVA scores between the photos according to the chin deviation

The mean and standard deviation of the VAS scores between the photos according to chin deviation and the participants' profession are presented in the table 1 and figure 3:

- Comparison between the photos according to laypeople

The mean VAS scores were significantly different between the 5 photos of the chin deviation (-p-value <0.001). The score was lower when the chin was deviated by + 8mm, followed by the chin's photo + 6mm, then photo + 4mm. The original photo and the one with chin deviation of +2 mm obtained significantly the highest scores, with no statistical significant difference (-p-value = 1.000).

- Comparison between the photos according to dentists

The mean VAS scores were significantly different between the 5 photos of the chin deviation (-p-value <0.001).The score was lower when the chin was deviated by + 8mm, followed by the Mandible photo + 6mm, followed by the chin photo + 4mm. The original photo and the one with the chin deviation of +2 mm obtained significantly the highest scores, but the difference was not significant between these two photos (-p-value = 0.232).

- Comparison between the photos according to orthodontists

The mean VAS scores were significantly different between the 5 photos of the chin deviation (-p-value <0.001). The score was the lowest when the chin was deviated by + 8mm, followed by the + 6mm photo, + 4mm photo then the + 2mm photo. The original photo had significantly the highest score (-p-value <0.05).

- Comparison between the professions

The mean EVA scores of the original photo (-p-value = 0.784) and of the chin photo + 2mm (-p-value =0.068) were not significantly different between the 3 professions. Regarding the chin + 4mm and chin + 6mm photos, the mean VAS score was lower according to orthodontists, intermediate among dentists and relatively higher among laypeople (-p-value <0.001). For the chin + 8mm photo, the mean EVA score was lower according to orthodontists (-p-value <0.001), and the difference was not statistically significant between dentists and laypeople (-p-value = 0.923).

- Comparison of the VAS scores between the photos according to the deviation of the mandible

| Chin deviation | | | | | |
|---|---|---|---|---|---|
| | Sex | N | Mean | Std. Deviation | -p-value |
| Original photo | Male | 39 | 7.59 | 1.371 | 0.853 |
| | Female | 91 | 7.53 | 1.894 | |
| Chin 2mm | Male | 39 | 6.92 | 1.345 | 0.128 |
| | Female | 91 | 7.40 | 1.712 | |
| Chin 4mm | Male | 39 | 5.62 | 1.680 | 0.255 |
| | Female | 91 | 6.01 | 1.859 | |
| Chin 6mm | Male | 39 | 4.18 | 1.571 | 0.406 |
| | Female | 91 | 4.48 | 2.030 | |
| Chin 8mm | Male | 39 | 3.03 | 1.646 | 0.460 |
| | Female | 91 | 3.30 | 2.014 | |
| **Mandiblular deviation** | | | | | |
| | Sex | N | Mean | Std. Deviation | -p-value |
| Original photo | Male | 39 | 6.92 | 1.579 | 0.025 |
| | Female | 91 | 7.60 | 1.570 | |
| Mandible 2mm | Male | 39 | 6.36 | 1.478 | 0.181 |
| | Female | 91 | 6.80 | 1.815 | |
| Mandible 4mm | Male | 39 | 4.90 | 1.518 | 0.278 |
| | Female | 91 | 5.26 | 1.849 | |
| Mandible 6mm | Male | 39 | 4.03 | 1.478 | 0.595 |
| | Female | 91 | 4.21 | 1.912 | |
| Mandible 8mm | Male | 39 | 2.97 | 1.367 | 0.520 |
| | Female | 91 | 2.78 | 1.652 | |

Table 3: Comparison of the mean VAS scores between females and males

The mean and standard deviation of the VAS score in photos with deviated mandible by profession are described in the table 2 and figure 4.

- Comparison between the photos according to laypeople, dentists and orthodontists

For laypeople and dentists, the VAS scores were significantly different between the 5 photos of the mandible's deviation (-p-value <0.001); the VAS score was lower when the mandible was deviated by + 8mm, followed by + 6mm photo, followed by + 4mm photo, and finally the + 2mm . The original photo had significantly the highest score for all with p-value laypeople <0.001, p-value dentists <0.05 and p-value orthodontists <0.001.

- Comparison between professions

The VAS scores in the original photo and the mandible +2mm were not significantly different between the 3 professions: -p-value = 0.684 and, -p-value = 0.416 respectively.

Regarding the mandible + 4mm photo, the mean VAS score was ranked the lowest among orthodontists (-p-value =0.016) and the difference was not significant between dentists and laypeople (-p-value =1,000).

For the mandible + 6mm photo, the mean VAS score was ranked the lowest among orthodontists (-p-value =0.001) and the difference was not significant between dentists and laypeople (-p-value =0.541).

For the mandible + 8mm photos, the mean VAS score was the lowest among orthodontists, intermediate among dentists and highest among laypeople (-p-value = 0.008).

Comparison of the VAS score between women and men

The mean and standard deviation of the VAS scores for females and males are shown in the table 3.

This study showed that the VAS score of photos was not significantly different between women and men for the deviation of the chin as well as for the deviation of the mandible (-p-value> 0.05 please put the real p-value obtained). Conversely the mean score of the original photo was significantly higher according to women (-p-value = 0.025).

## Discussion

Naturally speaking, perfect bilateral facial symmetry does not exist. A degree of deviation of a varying severity always persists, ranging from slight (unnoticeable), intermediate, to significant between two homologous structures, giving an unaesthetic

aspect [8]. When the facial disharmony is slight, it still gives a natural appearance; whereas, being accentuated, it alters the shape of the face and can cause, therefore, various psychological problems [8]. The judgment of facial attractiveness remains subjective, varying nevertheless, according to personal preferences. In order to determine and standardize the value from which the mandibular asymmetry is deemed unaesthetic, thus requiring appropriate treatment, this questionnaire was conducted using VAS. VAS is frequently used in questionnaires, as it is a simple and precise assessment tool that allows the translation of qualitative variables (such as the attractiveness of the face) into quantitative ones.The results showed that orthodontists were the most accurate in judging facial attractiveness. They noticed the facial asymmetry starting by + 2mm of the chin deviation and mandible deviation. The original photo got the highest score followed by that of the + 2mm chin deviation. Hence in agreement with the results obtained by Dalla Corte et al., scores attributed by orthodontists were the most precise, however, in this study the deviation was detected at a smaller scale similarly to the studies of Jaroz et al. and Silva [8, 9, 12]. This can be explained by the fact that the survey was diffused via an online web site authorizing the participants to use multiple devices such as mobiles, tablets or computers to complete the questionnaire, which can result in displaying the pictures with different resolutions, brightness… [9].

On the other hand, dentists did not notice the difference between the initial photo and the one with + 2mm of chin deviation, same applies for laypeople. It is from + 4mm of chin deviation as laypeople and dentists began to notice a facial abnormality. Dentists and laypeople assigned almost similar scores with no significant difference between them conversely to the results obtained by Dalla Corte, Jaroz and Wollanski in their studies, where dentists perceived chin deviations better than laypeople [6, 9, 15]. This can be explained by the fact that a large number of the laypeople who participated in this study are engineers and architects, accustomed to detecting the smallest differences and thus noticing the details, unlike the rest of the laypeople who started detecting the facial disharmony from + 6mm of chin deviation. If the sample chosen were larger and more diverse, laypeople would have more difficulty in detecting the differences. Nevertheless, the results of Dalla Corte , Jaroz and Wolanski studies do not match the conclusions of Naini et al. who demonstrated that from + 10mm of deviation, asymmetry in the chin and mandible is considered severe requiring surgical therapy, conversely to when it is imperceptible for less than + 5mm [6].

Among 91 females and 39 males who participated in this questionnaire, and regarding the judgment of the chin deviation, the results did not show a significant difference between the two genders in concordance with the results of the studies conducted by Gribel et al., and McAvinchey [10, 16]. However, for the deviation of the mandible, higher scores were ranked by females, for the original photo. This could be related to the fact that most of the participants in this survey were females.

To overcome the restrictions during this study, it will be interesting to increase the number of evaluators, especially dentists; this might help to obtain a difference in the results between them and the laypeople. It would be also interesting to use the photos of 2 people of different genders or to modify the color of the hair, the eyes or the skin [8]. Likewise, it is of great interest to obtain information regarding the level and years of experience of the dentists and orthodontists who participated in the study and to compare between the perceptions of skeletal asymmetry in resting position and when smiling.

## Conclusion

Orthodontists are the most accurate in evaluating the chin and mandible's deviation followed by dentists and laypeople. It was denoted that laypeople consider the asymmetry unpleasant from a +6mm of deviation requiring therefore a proper orthodontic-surgical treatment. No significant difference was found between genders concerning the judgment of the chin's deviation whereas females assigned higher scores regarding the mandible's deviation.

It was determined that facial attractiveness was the highest when the degree of asymmetry was the lowest and it was decreased when the asymmetry was increased. More research is needed in order to evaluate the perception of mandibular skeletal asymmetry in individuals presenting different malocclusions in both, resting and smiling position, as well as with raters from different ethnic backgrounds.

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