ISSNe 2178-1990

10.35699/2178-1990.2021.25127

ARQUIVOS EM ODONTOLOGIA

The midline from the perspective of the layperson and dental surgeon

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Aim: The objective of this research was to evaluate the midline from the perspectives of the layperson and the dental surgeon.

Methods: The survey was conducted from August to December 2018 in Parnaíba, PI, Brazil. An image of a female smile was used, in which changes were made in the upper dental midline, every 1 mm up to 4 mm, and in the incisal angulation, every 5 degrees up to 15 degrees, to the left side. The images were cut and formed into two groups, one showing a smile with no lip filter (G1) and another with a smile with a lip filter (G2). These were then shown to 334 lay people and 25 dentists for evaluation with scores from 0 to 10, with scores from 0 to 5.9 for an unacceptable smile and from 6 to 10 for an acceptable smile.

Results: Dental surgeons were more critical when analyzing the images and detected deviations from 1mm and 5 degrees in both groups G1 and G2. Laypeople noticed deviations from 2mm and 15 degrees on G1 and deviations from 3mm and 10 degrees on G2.

Conclusion: Dental surgeons and laypeople are able to assess midline deviations with the minimum deviation present. Dentists were more critical in detecting midline deviation when analyzing photos.

Uniterms: Esthetics, dental. Smiling. Orthodontics.

Submetido: 02/09/2020
Aceito: 21/01/2021

INTRODUCTION

The midline is drawn vertically and imaginatively between the upper central incisors. It is drawn from the glabella, running through the tip of the nose and the philtrum of the upper lip, and closing in on the chin. This imaginary tracing helps diagnose whether or not dental and facial midline deviation is present[1].

The meeting of the vertical line with the horizontal planes of the aforementioned structures generates a T-shaped structure, where it is possible to evidence asymmetries between the right and left sides of the face, as well as in the smile[1].

The midline of the face, esthetically, is important in the morphological analysis of the smile. Dental midlines coinciding with the facial midline are important functional components of occlusion, contributing to the similarity of dental and facial positioning. Although a subtle midline asymmetry is within acceptable limits, some authors have found that differences of up to 4 mm between upper and lower dental midlines are unperceivable to laypeople[1,2].

Symmetry is an essential component in the perception of dental esthetics, and the midline correctly positioned in the arches contributes to the balance and harmony effect of the dental arrangement, which is an important factor in an attractive smile[3].

Midline deviations occur due to dental asymmetry, usually due to the absence of one or more teeth, early loss of deciduous teeth, crowding, and deleterious habits, such as finger sucking[4]. Such changes may be corrected, for example, by using an orthodontic appliance. For patients, having an esthetically attractive smile is a major

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concern, often becoming the primary complaint of individuals seeking orthodontic treatment[5,6].

The morphological concept of the midline is not well defined in practice, which hinders the evaluative capacity of dentists and laypeople to diagnose their deviations, especially the impact of these changes on esthetic attractiveness. Due to the subjective aspect of esthetics, there are differences in taste and opinion, making the standardization of the normal questionable when analyzed by different people. Therefore, an orthodontic specialist may look at a patient's face differently than another professional or layperson would[2].

Midsize disproportion is not the main point. The important issue is the correction of posterior malocclusion related to more severe midline deviations. When malocclusion is corrected, the midlines will often coincide as well[7].

Dentists are supposed to have a better esthetic perception than laypeople to identify midline deviation, being able to identify small deviations from the midline, because esthetic criteria and perceptions of beauty vary from one person to another, as well as among experts in esthetic assessment and laypeople.

Assessing the perceptions of the dentist and layperson in relation to the midline consists of investigating whether the perfect coincidence of the upper and lower midlines is essential during the completion of orthodontic treatment. The contribution to clinical practice is to determine how much millimeter or angular variation between the upper and lower incisors is acceptable for the lay population, emphasizing the safety margin of midline deviation, so that dentists can complete their esthetic treatments.

Because it is a problem that directly affects people's self-esteem and well-being, the aim of this research was to evaluate people's perceptions of the midline.

The objective of this research was to evaluate the midline from the perspectives of the layperson and the dental surgeon.

MATERIAL AND METHOD

This was a cross-sectional, quantitative study for which the following descriptors were used: esthetics, dental, smiling, and orthodontics. According to the objective of the present work, the sample size was calculated based on an estimate from a survey conducted by the Brazilian Institute of Geography and Statistics, considering only students in their third year of high school, estimating 2,500 people from the population target of the city of Parnaíba, PI, Brazil, which has a general population of 138,485 inhabitants and an HDI of 0.687, considered in the mid-range (between 0.600 and 0.699). Thus, it was possible to apply the sample size formula, resulting in a number of 334. This minimum number of participants is considered satisfactory, considering the proposed analyses, a sample error of 5%, and a 95% confidence level, indicating that the probability of mistakes made in the survey does not exceed 5%[8].

The survey was conducted from August to December 2018. The test was applied to 334 laypeople, students in their third year of high school (called the L group), and all 25 dental surgeons (DSs) working in the Basic Health Units (BHUs) in the Family Health Strategy in Parnaíba, PI.

ETHICAL STATEMENT

This study was approved by the Research Ethics Committee of the State University of Piauí - CEP/UESPI, logged under number 2.583.5335. The researchers were provided with a letter of consent from the principals of the municipal high schools, chosen by lot, who authorized the development of the research after ethical approval was obtained. A photograph of the smile of a 23-year-old patient was used in the research after the patient signed an authorization form for the use of her image in research. Students and dentists signed a consent form.

EXAMINER TRAINING AND CALIBRATION

The researchers were trained at the Clinical School of Dentistry (CSD) of the State University of Piauí through calibration exercises. Twenty students, who had received dental care at the CSD during a routine operation to identify normal occlusion and malocclusion, did not participate in the sampling plan. This analysis was in accordance with the methodology described by Peres et al.[9].

PILOT STUDY

The pilot study was carried out using the photograph of the smile of a female patient, 18 years old, with completed orthodontic treatment, who was not participating in the research. Eighteen figures were generated using the same computer program used in the research and viewed in PowerPoint by the researchers to test the proposed methodology. As a result, its viability was observed, without need for adjustments. To measure the intra and inter-examiner diagnostic

reproducibility, the visualization of the figures was performed twice by each of the examiners, with the Kappa coefficients for intra and inter-examiner agreement being 0.88 and 0.89, respectively.

STUDY DESIGN AND SAMPLE SELECTION

Inclusion criteria were students who were in the third year of public high school and dental surgeons who worked at Parnaíba BHUs. Exclusion criteria were students unable to understand and respond to the questionnaires, such as those with cognitive impairment, and dental surgeons who did not work at BHUs.

The photograph of the smile of a 23-year-old female patient with completed orthodontic treatment was used. The photograph encompassed the base of the nose and the chin. A millimeter ruler was incorporated into the image to be used for the actual measurement in millimeters of midline discrepancy. The full-size photograph was cropped into two groups: In the first (G1), only the occlusion and lips were presented (Figure 1), while the other (G2) showed the occlusion, lips, lip philtrum, and the base of the nose (Figure 2).

Figure 1 - Original photo showing the occlusion and lips prior to the displacement of the upper arch to the left side from 0 to 4mm and from 0 to 15 degrees to G1

Figure 2 - Original photo showing the occlusion, lips, lip filter and base of the nose prior to the displacement of the upper arch to the left side from 0 to 4 mm and from 0 to 15 degrees to G2

No changes were made to the original dimensions of the initial photograph. In the manipulated photos, the entire upper dental arch was deviated and the anatomy of the posterior teeth recomposed to compensate for the spaces left by the movement. Only the teeth were moved, whereas the soft tissues remained unchanged[10].

Dental changes in millimeters and angular to the left side were performed in both Figure 1 and Figure 2. Among the 18 originated and examined photographs from Figures 1 and 2, 4 were determined to be normal, with 0 mm (photos 1 and 10 in Figure 3) and 0° (photo 6 in Figure 4 and photo 15 in Figure 4), respectively, which was considered the control group (CG), in which there was no change in the midline. The remaining 14 photographs were altered, using the computer program Adobe Photoshop 7.0. Among the photographs that were manipulated in the research, in 8, changes were made in the millimeter to the left (photos 2, 3, 4, and 5 for G1 in Figure 3, and photos 11, 12, 13, and 14 for G2 in Figure 4) deviating from the dental midline every 1 mm (from 0 mm to 4 mm). In the remaining 6 photos, changes were made in degrees of inclination (photos 7, 8, and 9 for G1 in Figure 3, and 16, 17, and 18 for G2 in Figure 4), with deviation of the incisal angulation of 5° to 5° (from 0° to 15°), also to the left[10].

Figure 3 - Photos 1 to 9 corresponding to tooth displacement to the left in millimeters (photos from 2 to 5) and angled (photos from 7 to 9) for the G1, with photos 1 and 6 of the CG (control group)

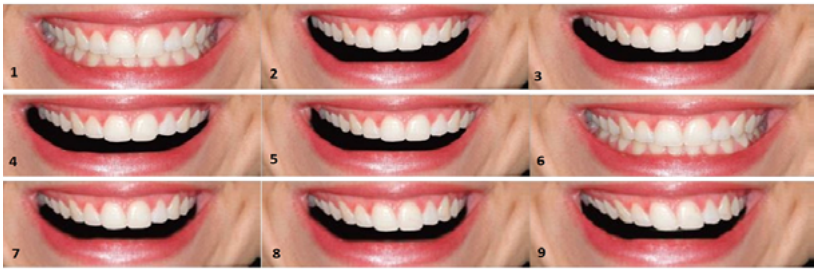
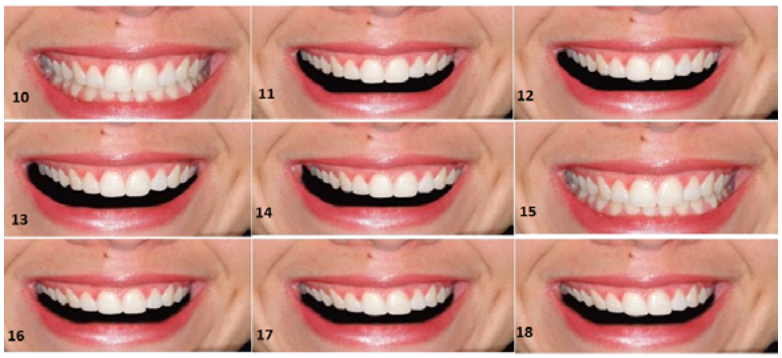


Figure 4 - Photos 10 to 18 corresponding to tooth displacement to the left in millimeters (photos from 11 to 14) and angled (photos from 16 to 18) for the G2, with photos 10 and 15 of the CG (control group)



Each photograph was individually exposed on a PowerPoint slide at a distance of 30 cm between the evaluator and the numbered photographs, with photos 1 to 9 corresponding to G1 and photos 10 to 18 corresponding to G2. Only the researchers knew what manipulation had been performed on the image being examined. The DS and L groups evaluated all images. Examiners were asked to rate each smile with scores from 0 to 10, directing them to use grades from 0 to 5.9 for a less attractive smile and from 6 to 10 for a more attractive smile. We first evaluated the randomly arranged photos of G1 and then those of G2, with no ascending or descending order and without the participants knowing which would be from the CG. Only the researchers knew the numbering of each photograph[10].

The 18 photographs were individually evaluated, with a time of at most one minute to examine each one. The grades awarded were noted on a pre-prepared form[10].

DATA ANALYSIS

The results were stored in the Excel Windows 2010 Microsoft® database and arranged in graphs and tables for better interpretation and discussion, after applying the appropriate statistical analysis. Means, dispersion, and Student's *t*-test were applied to compare the results of G1 and G2 between L and C, using the Statistical Package for the Social Sciences (SPSS), version 25.

RESULTS

Table 1 - Note description of G1 photos for total sample (L +DS)*

Photos	**1**	2	3	4	5	**6**	7	8	9
Average	7.09	5.86	5.20	5.02	4.34	6.64	5.61	5.38	4.85
Standard deviation	1.84	1.88	1.86	1.99	1.88	1.97	1.80	1.97	2.05
Minimum	1	0	0	0	0	0	0	0	0
Maximum	10	10	10	10	10	1	10	10	10

*Footnote: Mean, dispersion test; dental surgeons (DS group); students in their third year of high school (L group); G1 - Full-size photograph was cropped into two groups: in the first (G1) only the occlusion and lips were presented.

First, descriptive and dispersion statistics were calculated to characterize the evaluation of the total sample in relation to the photos presented. The following tables show the results. To summarize the findings for the total sample, a table was created that presents the averages and variations in each photo. In Table 1, the average grades for G1, from photos 1 to 9 (Figure 3), are shown, with the CG corresponding to attractive smiles (photos 1 and 6 in Figure 3).

Except for the CG (photos 1 and 6), which had the highest average, in G1, photo 2 had the highest average (with 1 mm deviation from the midline), followed by photo 7 (with 5° of deviation from the midline) (Figure 3).

The results for G2 are presented in Table 2. The average grades of photos 10 to 18 (Figure 4) are provided, with the CG corresponding to attractive smiles (photos 10 and 15 in Figure 4).

Table 2 - Note description of G2 photos for total sample (L + DS)

Photos	**10**	11	12	13	14	**15**	16	17	18
Average	6.51	5.73	5.18	3.41	3.54	6.44	5.76	4.65	3.54
Standard deviation	2.05	1.94	1.89	2.10	2.01	1.96	1.93	2.03	2.0
Minimum	0	0	0	0	0	0	0	0	0
Maximum	10.00	10.00	10.00	9.00	9.00	10.00	10.00	10.00	10.00

*Footnote: Mean, dispersion test; dental surgeons (DS group); students in their third year of high school (L group); G2 - Full-size photograph was cropped into two groups: the G2 showed the occlusion, lips, lip-philtrum, and the base of the nose.

Except for the CG (photos 10 and 15), which had the highest average, in G2, photo 11 had the highest average (with 1 mm deviation from the midline), followed by photo 16 (with 5° of deviation from the midline) (Figure 4).

We sought to verify the grades assigned to the photos when comparing two groups: L x DS. The mean, standard deviation, and significance determined by the Student's *t*-test of G1 photos are shown in Table 3.

Table 3 - Comparison of notes between the DS and L groups regarding the photos in G1

Photos	Groups	Average	Standard deviation	P-value
1	DS	6.98	1.84	0.001
	L	8.52	1.01	
2	DS	5.75	1.88	0.001
	L	7.40	1.29	
3	DS	5.23	1.88	0.36
	L	4.88	1.56	
4	DS	5.06	2.01	0.16
	L	4.48	1.66	
5	DS	4.39	1.87	0.05
	L	3.64	1.82	
6	DS	6.54	1.95	0.01
	L	7.88	1.92	
7	DS	5.52	1.80	0.001
	L	6.72	1.42	
8	DS	5.33	1.97	0.05
	L	6.12	1.85	
9	DS	4.90	2.05	0.06

Footnote: Student *T* test, dental surgeons (DS group); students in their third year of high school (L group); G1 - Full-size photograph was cropped into two groups: in the first (G1) only the occlusion and lips were presented.

As seen in Table 3, for photos 1, 2, 6, 7, and 8, the L group attributed higher marks than did the DS group, and for photos 3, 4, 5, and 9, the L group attributed lower marks. However, the *t*-test enabled verification of a significant difference ($p < 0.05$) in photos 1, 2, 5, 6, 7, and 8 between both groups. The same comparison was made with the photos of group G2, as seen in Table 4.

Table 4 - Comparison of notes between DS and L groups regarding the photos in G2

Photos	Groups	Average	Standard deviation	P-value
10	DS	6.40	2.06	0.001
	L	8.01	1.15	
11	DS	5.63	1.92	0.001
	L	7.08	1.75	
12	DS	5.09	1.87	0.001
	L	6.48	1.68	
13	DS	3.40	2.09	0.59
	L	3.64	2.23	
14	DS	3.51	1.98	0.33
	L	3.92	2.43	
15	DS	6.32	1.95	0.001
	L	8.04	1.30	
16	DS	5.67	1.90	0.01
	L	7.04	1.90	
17	DS	4.59	2.01	0.04
	L	5.48	2.14	
18	DS	3.51	2.04	0.35
	L	3.92	2.32	

Footnote: Student *T* test, dental surgeons (DS group); students in their third year of high school (L group); G2 - Full-size photograph was cropped into two groups: the G2 showed the occlusion, lips, lip-philtrum, and the base of the nose.

For the G2 photos, the DS group gave lower grades when compared to the L group, with a significant statistical difference indicated by the *t*-tests (photos 10, 11, 12, 15, 16, and 17).

DISCUSSION

Tables 1 and 2 show that the evaluators knew how to identify the more attractive smile by identifying the CG. However, many photos showed average grades of less attractive smiles. This was probably due to the fact that the averages of the G1 and G2 scores of the DS and L groups were computed together. It should be noted that the L group was greater in number and was not trained to easily identify midline deviations as professionals of dentistry.

According to some authors, deviations from 2 mm are noticeable by dentists[11-14]. This research revealed that the DS group diagnosed midline changes from 1 mm (photos 2 and 11) and 5° of deviation (photos 7 and 16) in both G1 and G2 (Tables 3 and 4).

Group L, when analyzing G1 photos, could only perceive midline deviation from 2 mm (photo 3) and 15° (photo 9). Regarding G2, midline deviation was perceived from 3 mm (photo 13) and 10° (photo 17), corroborating the findings of Ferreira et al.[10] that laypersons evaluated the upper dental midline more critically in photos with deviation from 3 mm when the lip philtrum was present.

Laypeople were able to observe deviations from 2 mm above the upper dental midline. Photos that included only a smile and lips received lower grades, indicating that the closer the smile appears in the photo, the more critical the assessment will be[15]. A similar fact was observed in another study[10], whose results showed that laypeople were able to detect midline deviations from 2 mm when anatomical details did not appear in the photographs. These studies corroborate the current research because in G1, where the smile and lip appeared, group L was more critical with their grades, analyzing deviations from 2 mm.

Research using the laity as evaluators in smile esthetics proved that they could not detect deviations from the 4 mm midline[14]. Another study confirmed that 4 mm deviations were unperceivable to laypeople and that dental midline deviations were of low clinical relevance from an esthetic point of view[16]. Therefore, these studies do not attest to the current research.

Some authors[16-19] found that facial structures close to the dentition influence the asymmetry assessment process. Soft tissue characteristics, such as face width, mandibular

angle, and upper incisor shapes may affect the esthetic perception of midline deviation. Thus, in photographs in which the above variables appeared, the evaluators could only be more critical of deviations that were larger than 2 mm. The studies agree with this research, because the L group, when evaluating the G2 photos (which showed the base of the nose, lip philtrum, and chin), considered deviations from 3 mm unacceptable.

In this study, the DS group was more critical than was the L group. The first group was more sensitive to small deviations than was the second group. This suggests that laypersons and dentists make different diagnoses when analyzing smiles that have different midline deviation values (Tables 3 and 4).

The current research corroborates that of other authors[10,15-18,20] in observing that DCs are more sensitive in perceiving the angular changes of the upper central incisors than are laypeople. This diverges from research that indicated no significant differences when laypeople and dentists evaluated changes in the angulations in the crown of the upper incisors[14].

According to some authors[20], midline discrepancies are the most obvious occlusal asymmetries from the patient's point of view. They found that increasing the axial maxillary midline angulation consistently decreases the attractiveness of a smile. Discrepancies of 10° were less attractive according to 68% of orthodontists and 41% of laypeople. Axial midline angulations of 10° or greater are generally less attractive and should be assessed for orthodontic treatment.

The DS and L groups evaluated photos 1, 10, 6, and 15, corresponding to the CG, as more attractive, with a score higher than 6. It should be noted that although the DS group assigned acceptable grades, it was more judicious when compared to the L group, which was expected to have acquired knowledge during graduate studies. The current research corroborates that of other authors[20], who observed that DCs are more sensitive in perceiving the angular changes of the upper central incisors than are laypeople.

The divergence of opinion occurs because dentists have an academic background and a lifelong learning curve. In addition, a layperson might have less discernment than a professional when it comes to evaluating the dentilabial esthetic components[19].

This study is clinically important to the extent that it provides scientific data that enable professionals to better understand patients' esthetic expectations and desires.

Some limitations inherent in this research should be considered when interpreting the results. For example, the study was carried out in only one city, and the sample was not representative of the state. Future studies on evaluation of the midline from the perspectives of laypeople and dental surgeons are important.

CONCLUSION

Dental surgeons and laypeople were able to assess midline deviation with the least deviation present. Dentists were more critical than laypeople in detecting midline deviation when analyzing photos.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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A linha média na perspectiva do leigo e do cirurgião-dentista

Objetivo: Avaliar a linha média sob a ótica do leigo e do cirurgião-dentista.

Métodos: A pesquisa foi realizada de agosto a dezembro de 2018 em Parnaíba, Piauí, Brasil. Foi utilizada uma imagem de sorriso feminino, na qual foram feitas alterações na linha média dentária superior, de 1 em 1 mm, até 4 mm, e na angulação incisal, 5 em 5 graus, até 15 graus, para o lado esquerdo. As imagens foram recortadas e formadas em dois grupos, um com sorriso sem filtro labial (G1) e outro com sorriso com filtro labial (G2). Em seguida, foram apresentados a 334 leigos e 25 dentistas para avaliação, com pontuação de 0 a 10, com pontuação de 0 a 5,9 para sorriso inaceitável e de 6 a 10 para sorriso aceitável.

Resultados: Os cirurgiões-dentistas foram mais críticos na análise das imagens e detectaram desvios de 1mm e 5 graus nos dois grupos G1 e G2. Os leigos notaram desvios de 2mm e 15 graus no G1 e desvios de 3mm e 10 graus no G2.

Conclusão: O cirurgião-dentista e o leigo são capazes de avaliar o desvio da linha média com o desvio mínimo presente. Os dentistas são mais críticos na detecção do desvio de linha média quando analisaram as fotos.

Descritores: Estética dentária. Sorriso. Ortodontia.