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Effect of Midline Deviation and Crown Width Disproportion on Perception of Smile Esthetics

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ABSTRACT

Objectives: To evaluate the effect of maxillary midline deviation and crown width disproportion on the perception of smile attractiveness through full-face images among dentists and laypeople.

Methods and Materials: A full portrait image of a smiling 25-year-old female, exhibiting good dental alignment, midline position, and tooth size symmetry, was selected as a model for the present study. The original image was digitally modified using photo editing software (Photoshop CC, Version 25.12.0; Adobe) to simulate three different case scenarios of varying levels: Midline deviation (1–4 mm), single crown width disproportion, separately for central incisor, lateral incisor, and canine (1 and 2 mm), and crown width disproportions distributed to anterior teeth (1–4 mm). In total, 15 modified images were displayed randomly to 180 observers (90 laypeople and 90 dentists) including the original image that served as a control. Each observer scored the level of smile esthetics for each image using a visual analog scale ranging from point 0 (unattractive) to 100 (attractive). Bonferroni Test and Partial Eta Squared were utilized for the statistical data analyses ($\alpha < 0.05$).

Results: Attractiveness scores were significantly lower for the modified smiles with the single crown width disproportion than distributed crown width disproportion and midline deviation ($p < 0.001$ for each), of which two presented statistically similar attractiveness ($p = 0.278$). The highest attractiveness scores were obtained for the control image (90.35 ± 5.56^{A}), midline deviation of 1 mm (88.89 ± 5.93^{AB}), 2 mm (86.80 ± 6.70^{ABC}), and distributed disproportion of crown width of 1 mm (87.75 ± 6.70^{AB}). A single central incisor disproportion of 2 mm (45.51 ± 11.94^{I}) was perceived significantly less attractive, followed by a midline deviation of 4 mm (57.51 ± 12.58^{H}) and a distributed disproportion of crown width of 4 mm (59.11 ± 9.72^{H}). Modified images were perceived as significantly more attractive by laypeople and male observers compared to dentists and female observers ($p < 0.001$ for each). Older observers between 35 and 50 years old scored significantly higher than younger observers ($p = 0.001$).

Conclusions: Dentofacial midline discrepancy had less effect on smile attractiveness compared to crown width disproportions. Midline deviations up to 2 mm were not noticeable for both laypeople and dentists. The deviations of 3 mm were noticeable but still more attractive than the deviations of 4 mm, which were considered the least attractive. A single crown width disproportion was less perceived when moving from the central incisor toward the canine. Distributing the crown width disproportions among anterior teeth can be beneficial for smile attractiveness compared to non-distributed cases.

Clinical Significance: Generating symmetrical crown width proportions of the anterior teeth seems more important for smile esthetics than dentofacial midline harmony. Distribution of crown width disproportions among the anterior teeth can enhance smile esthetics.

1 | Introduction

Patients seek facially driven dental treatments, aiming to improve their dentofacial esthetics as well as their quality of life [1, 2]. A proper treatment plan has to generate esthetic, functional, and healthy outcomes that meet the patient's expectations [3]. Effective communication between the involved dental disciplines, through an interdisciplinary treatment plan, is paramount for a successful outcome [4, 5]. Dentists have to be aware of the perception of smile esthetics, as they are perceived by laypersons to be able to provide an acceptable esthetic outcome in combination with biological and functional principles.

The checklist for esthetic restorative success consists of several parameters such as gingival health, interdental closure, gingival level, emergence profile, zenith, level of interdental contact, embrasure inclinations, dental midline, golden proportions, tooth form, tooth vertical axis, relative tooth dimensions, dental color characterization, internal mamelons, surface texture, incisal edge levels, upper and lower lip lines, canting of the arches, and smile symmetry [5]. Moreover, smile attractiveness depends not only on the optimum harmony between the teeth and the lips but also on their integration with the rest of the face [6]. A clinician should take all these parameters and their interactions into consideration during the restorative treatment planning to achieve the best esthetic outcome.

Perception of smile esthetics was previously investigated by altering specific dental parameters [5, 7]. Tooths crown size (width and length), midline deviation, gingival embrasure, incisal plane symmetry, buccal corridor space, and tooth color are among the parameters that have been investigated in previous studies [1, 7–9]. In general, symmetrical smiles were considered esthetically more pleasant [8, 10, 11]. Additionally, specific dental esthetic parameters were perceived differently between dentists and laypeople [8, 12]. However, studies that evaluate smile esthetics through a full-face visual analysis are scarce, and the esthetic effect of the smile was considered diluted when presented in a full face [7, 8, 12, 13]. Moreover, the investigated parameters have been isolated in most research, underestimating the effect of interrelated variables. There is a lack of studies that comparatively assess midline deviation and disproportion of anterior tooth crowns [7, 10].

The present research aimed to evaluate the effect of maxillary midline deviation and crown width disproportions on the perception of smile esthetics, through full-face images, between laypeople and dentists. The null hypotheses of the study were that there was no difference in the perception of smile esthetics (I) between the midline deviation and crown width disproportions, (II) among the different levels of midline deviation, (III) among the single crown width disproportions (central incisor, lateral incisor, or canine), (IV) between individual and distributed crown width disproportions, and (V) for observers' type (laypeople and dentists).

2 | Materials and Methods

The present study was designed and conducted in the restorative dentistry clinic of Marmara University between June and December of 2023. The study was approved by the local ethical committee of Marmara University Faculty of Dentistry (protocol number: 2023/152, 25.05.2023) and registered in the U.S. National Library of Medicine (ClinicalTrials.gov Identifier: NCT06280027). Written informed consent was obtained before the photograph shooting of the female model. Digital modifications of a single full-face portrait image were used for the present study. Power analysis indicated that a minimum sample size of 2679 assessments was necessary for the study for an effect size of $f = 0.101$ at a confidence level $(1-\alpha)$ of 0.95 and desired power $(1-\beta)$ of 0.95. Half of the observers ($n = 90$) were patients of the university clinic, and the remaining half were dentists with at least 3 years of clinical experience. The observers had to be ≥ 18 and ≤ 70 years old.

A frontal view full-face portrait image of a 25-year-old female was selected as a model for the study. Her smile exhibited a good dental alignment, a coincidence of facial and dental midline, and tooth size symmetry. A perfectly symmetrical face was not demanded, as human faces are usually considered not symmetrical. [14, 15] The frontal smiling image was captured using a DSLR full-frame camera (D750; Nikon), a macro lens (105 mm VR Nikkor; Nikon), and a dual softbox (VL400; Visico) (Figure 1). The resolution of the original image (.RAW format) was 300 pixels per inch (PPI).

The original (control) image was digitally modified using a photo editing software program (Photoshop CC, Version 25.12.0 for Mac; Adobe). The image modifications were performed following the tooth crown length calibration (Figure 2). In total, three different case scenarios were simulated. The first one was a deviation between facial and dental midlines. The dental midline was digitally shifted to the right side of the patient by transferring the whole maxillary arch 1–4 mm gradually, simulating four different deviation levels (Figure 3A–D). The second clinical scenario was created by manipulating the width of the crown of the left central incisor, lateral incisor, and canine separately. The mesiodistal width of each tooth was digitally decreased gradually, while the width of the respective tooth on the contralateral side was simultaneously increased. Two disproportion levels (1 mm and 2 mm) were digitally generated for each tooth (Figures 4–6). For instance, to achieve 1 mm of disproportion on the central incisor, the left central incisor width was decreased by 0.5 mm, while the right central incisor width was increased by 0.5 mm. In this clinical scenario, the dental midline remained at its original position, without a deviation. In the third clinical scenario, the disproportion was distributed among the anterior teeth by manipulating the crown widths. The sum of the mesiodistal width of the left central incisor, lateral incisor, and canine was decreased by an equal distribution to each tooth, while the total width of the respective teeth on the contralateral side was simultaneously increased. In this way, four distributed disproportion levels varying from 1 to 4 mm were

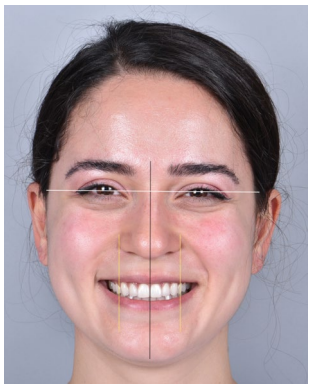

FIGURE 1 | Frontal view of full-face portrait image (original image), with a good dental alignment, midline position, and bilateral symmetry.

digitally generated (Figure 7A–D). For instance, to achieve 1 mm of distributed disproportion, the sum of the mesiodistal width of the left central incisor, lateral incisor, and canine was decreased by 0.5 mm, while the total width on the right side was increased by 0.5 mm. The midline remained at its original position.

An online survey was generated to evaluate the perceived attractiveness. A total of 180 different observers declared their profession, age, and gender at the beginning of the survey. Fifteen full-face images, including the original image, were presented to each observer on a digitally calibrated monitor (iPad Pro 12.9″; Apple Inc.) to minimize standardization limitations. The distance between the observer and the screen was approximately 60 cm, which corresponds to the typical distance during social contact. The images were displayed in a random sequence, the observers

FIGURE 2 | Length calibration in photo editing software (Photoshop CC, Version 25.12.0).

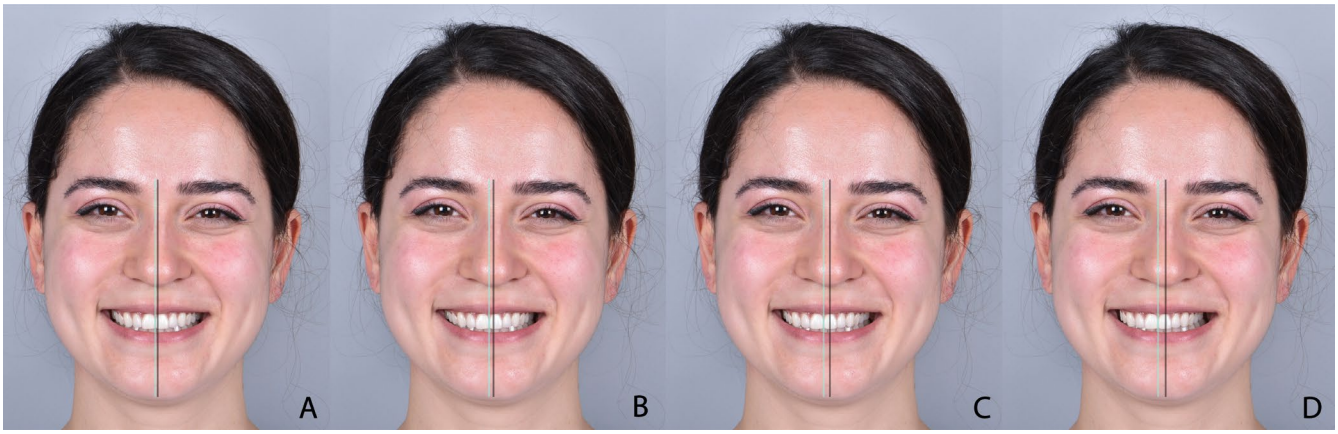

FIGURE 3 | Digitally generated midline deviations by computer-aided clinical image manipulation. (A) 1 mm, (B) 2 mm, (C) 3 mm, and (D) 4 mm.

FIGURE 4 | Digitally generated, crown width disproportion of central incisors: (A) 1 mm and (B) 2 mm.

FIGURE 5 | Digitally generated, crown width disproportion of lateral incisors: (A) 1 mm and (B) 2 mm.

FIGURE 6 | Digitally generated, crown width disproportion of canines: (A) 1 mm and (B) 2 mm.

were not informed about the digital manipulations, and they were not able to magnify the images. They evaluated the smile esthetics of each randomly displayed image by using a visual analog scale (VAS), ranging from point 0 (unattractive) to 100 (attractive), based on their perception of the attractiveness of the presented smile [1, 7] (Figure 8). The scorings were carried out during midday (at 12:00 PM), under standardized artificial lighting conditions, without exposing the monitor directly to the sunlight.

The data were analyzed using statistical software (SPSS V23; IBM). The general linear model was used to calculate the average scores regarding the effects and the interactions of gender, age, observer, and case. Multiple comparisons were performed with the Bonferroni Test. Partial Eta Squared was used to investigate the effect of each factor. The results were presented as means, along with their standard deviations. The level of significance was set at $\alpha < 0.05$.

3 | Results

Gender ($p < 0.001$), age ($p = 0.001$), observer type ($p < 0.001$), and simulated case scenario ($p < 0.001$) were all considered individually as significant factors for the perception of smile attractiveness. The observer's type was the most effective factor, as lower smile attractiveness awareness was considered for laypeople compared to dentists (Table 1).

Regarding midline deviation (78.07), significant differences were found ($p < 0.001$) compared to single crown width disproportion (73.28). Attractiveness scores were significantly higher for all the evaluated midline deviations compared to single tooth crown width disproportions ($p < 0.001$). Distributed tooth crown disproportion scores were significantly higher compared to scores in the cases of a single crown disproportion ($p = 0.001$). No statistical difference was found in smile attractiveness scores among midline deviation and distributed tooth width disproportions ($p = 0.278$).

Regarding the evaluation of the different clinical case scenarios, the control image received the highest attractiveness scores (90.35 ± 5.56^{A}). However, no significant differences were found among the scores of the control image, midline deviation of 1 mm (88.89 ± 5.93^{AB}), midline deviation of 2 mm (86.80 ± 6.70^{ABC}), and distributed disproportion of tooth crown width of 1 mm (87.75 ± 6.70^{AB}). The lowest attractiveness score was observed for the simulated single disproportion of 2 mm between the central incisors (45.51 ± 11.94^{I}), followed by the deviation of the dental midline by 4 mm (57.51 ± 12.58^{H}) and the distributed disproportion of tooth crown width by 4 mm (59.11 ± 9.72^{H}; Table 2).

Dentists' and laypeople' scores were found similar for the control image (89.82 ± 5.28^{ab} and 91.41 ± 5.98^{a}), 1 mm midline deviation (88.33 ± 5.56^{abc} and 89.99 ± 6.51^{ab}), 2 mm midline deviation (86.3 ± 6.41^{abcde} and 87.8 ± 7.18^{abcde}), 1 mm canine width disproportion (84.09 ± 7.03^{cde} and 87.77 ± 7.56^{abcd}), 1 mm distributed disproportion (86.97 ± 6.47^{abcde} and 89.32 ± 6.92^{abc}), and 2 mm distributed disproportion (83.42 ± 7.57^{def} and 83.81 ± 8.21^{bcdef}). Significantly, the lowest score was observed for central incisor disproportion of 2 mm in dentists' scores (40.55 ± 9.13^{k}). Dentists' scores for midline discrepancy of 4 mm (52.97 ± 8.54^{j}), laypeople's scores for central incisor disproportion of 2 mm (55.42 ± 10.71^{j}), and dentists' scores for the distributed disproportion of 4 mm (56.32 ± 6.74^{j}) received significantly the second-lowest scores with no difference between them.

Regardless of gender, laypeople significantly scored higher esthetic perception scores (79.81 ± 13.8) than dentists

FIGURE 7 | Distributed crown width disproportion, by altering the crown width on the right and left side of the mouth by (A) 1 mm, (B) 2 mm, (C) 3 mm, and (D) 4 mm.

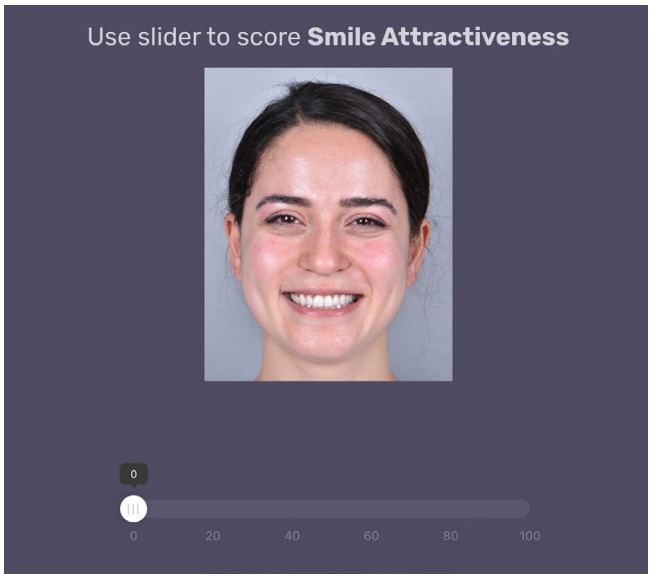

FIGURE 8 | Evaluation of the attractiveness of the smile via visual analog scale, using a slider ranging from point 0 (unattractive) to point 100 (attractive).

(72.71 ± 16.07) ($p < 0.001$; Table 3). In addition, the male observer's scores (76.74 ± 15.35) were significantly higher than the female observer's scores (74.37 ± 15.81) ($p < 0.001$). Regarding the multiple comparisons for gender and type of observers, male laypeople's scores were significantly higher (81.86 ± 12.66[a]), while male dentists' scores (73.21 ± 16.04[c]) and female dentists' scores were significantly the lowest (72.53 ± 16.08[c]), with no significant difference between them (Table 3).

The observers at the age of 35–50 had significantly higher smile perception scores (77.29 ± 15.49) among the other age groups, regardless of gender, which makes them less critical in smile attractiveness perception compared to younger observers ($p = 0.001$; Table 4). Regarding the multiple comparisons for age and gender, significantly the highest esthetic perception scores were obtained from male observers at the age of 35–50 (79.95 ± 14.77[a]) and of 25–35 (76.5 ± 15.14[ab]). The lowest scores were obtained from female observers at the age of 25–35 (73.64 ± 15.87[c]).

TABLE 1 | Effect and associations for the investigated groups.

Source	*F*-value	*p*	PES
Gender	16.950	**< 0.001**	0.007
Age	5.850	**0.001**	0.007
Observer	360.020	**< 0.001**	0.128
Case	275.600	**< 0.001**	0.611
Gender*Age	2.680	**0.046**	0.003
Gender*Observer	10.610	**0.001**	0.004
Gender*Case	0.560	0.901	0.003
Age*Observer	0.610	0.609	0.001
Age*Case	0.770	0.856	0.013
Observer*Case	11.530	**< 0.001**	0.062
Gender*Age*Observer	2.790	**0.039**	0.003
Gender*Age*Case	0.510	0.996	0.009
Gender*Observer*Case	0.470	0.951	0.003
Age*Observer*Case	0.890	0.673	0.015
Gender*Age*Observer*Case	0.640	0.968	0.011

Note: The significant bold values represents $p < 0.050$.
Abbreviation: PES: partial eta squared.

4 | Discussion

Several parameters of smile esthetics such as the size, shape, and position of teeth are considered effective when evaluating an esthetically pleasing smile [16]. During the treatment plan, from a restorative as well as from an orthodontic point of view, the position of the dental midline to the facial midline constitutes an important pre-evaluating factor [5, 11, 17]. However, most frequently, a restorative dentist cares more about the proportions of the anterior crowns on the right and the left side of the dental midline [17, 18]. The lack of a consensus regarding the priorities in smile esthetics can cause conflicts in the treatment plan. Evaluating the advantages and disadvantages by considering the priorities of all the dental disciplines should be the way to achieve minimally invasive dentistry goals.

TABLE 2 | Mean smile attractiveness scores based on the visual analog scale for each case and observer type.

Case	Observer		
	Dentist	**Laypeople**	**Total**
Original image	89.82 ± 5.28^{ab}	91.41 ± 5.98^{a}	90.35 ± 5.56^{A}
Midline deviation of 1 mm	88.33 ± 5.56^{abc}	89.99 ± 6.51^{ab}	88.89 ± 5.93^{AB}
Midline deviation of 2 mm	86.3 ± 6.41^{abcde}	87.8 ± 7.18^{abcde}	86.80 ± 6.70^{ABC}
Midline deviation of 3 mm	68.27 ± 9.1^{i}	82.04 ± 10.86^{efgh}	72.86 ± 11.67^{F}
Midline deviation of 4 mm	52.97 ± 8.54^{j}	66.59 ± 14.41^{i}	57.51 ± 12.58^{H}
Central incisor disproportion of 1 mm	66.96 ± 5.81^{i}	78.03 ± 7.71^{fgh}	70.65 ± 8.33^{FG}
Central incisor disproportion of 2 mm	40.55 ± 9.13^{k}	55.42 ± 10.71^{j}	45.51 ± 11.94^{I}
Lateral incisor disproportion of 1 mm	77.66 ± 7.56^{gh}	84.84 ± 9.24^{abcde}	80.06 ± 8.81^{DE}
Lateral incisor disproportion of 2 mm	65.17 ± 8.72^{i}	76.62 ± 11.56^{gh}	68.98 ± 11.13^{G}
Canine incisor disproportion of 1 mm	84.09 ± 7.03^{cde}	87.77 ± 7.56^{abcd}	85.31 ± 7.40^{BC}
Canine incisor disproportion of 2 mm	76.66 ± 8.59^{h}	81.98 ± 8.83^{defg}	78.43 ± 9.01^{E}
Distributed disproportion of 1 mm	86.97 ± 6.47^{abcde}	89.32 ± 6.92^{abc}	87.75 ± 6.70^{AB}
Distributed disproportion of 2 mm	83.42 ± 7.57^{def}	83.81 ± 8.21^{bcdef}	83.55 ± 7.77^{CD}
Distributed disproportion of 3 mm	67.21 ± 7.82^{i}	76.91 ± 10.18^{gh}	70.44 ± 9.79^{FG}
Distributed disproportion of 4 mm	56.32 ± 6.74^{j}	64.67 ± 12.17^{i}	59.11 ± 9.72^{H}
Total	72.71 ± 16.07	79.81 ± 13.8	75.08 ± 15.71

Note: The superscript letters (a–i) indicate significant differences in three-way comparisons between the observer types (dentist and laypeople) and the case interactions. The superscript letters (A–I) indicate significant differences in two-way comparisons between the observer (total) and the case interactions ($p < 0.050$).

TABLE 3 | Mean smile attractiveness scores based on the visual analog scale for each gender and observer type.

Observer	Male	Female	Total
Dentist	73.21 ± 16.04^{a}	72.53 ± 16.08^{a}	72.71 ± 16.07
Laypeople	81.86 ± 12.66^{b}	78.63 ± 14.3^{c}	79.81 ± 13.8
Total	76.74 ± 15.35	74.37 ± 15.81	75.08 ± 15.71

Note: Different superscript letters (a–c) in each row and column indicate significant differences ($p < 0.050$).

TABLE 4 | Mean smile attractiveness scores, based on the visual analog scale for each gender and age group.

Age	Male	Female	Total
18–25	74.28 ± 15.17^{bc}	74.75 ± 16.02^{bc}	74.63 ± 15.79
25–35	76.5 ± 15.14^{ab}	73.64 ± 15.87^{c}	74.34 ± 15.74
35–50	79.95 ± 14.77^{a}	75.1 ± 15.75^{bc}	77.29 ± 15.49
50+	75.1 ± 16.03^{bc}	75.36 ± 15.42^{bc}	75.27 ± 15.61
Total	76.74 ± 15.35	74.37 ± 15.81	75.08 ± 15.71

Note: Different superscript letters (a–c) in each row and column indicate significant differences ($p < 0.050$).

Most studies in the literature focus on smile perception of isolated dental parameters such as tooth size, width, color, midline deviation, buccal corridor size, and gingival contour [1, 7, 4, 9, 16, 19–22]. However, the present study investigated one of the most common clinical debates, which is the interaction and comparative importance of midline discrepancy and bilateral crown width disproportions on smile perception. Additionally, evaluations were performed through full-face smiling images to provide a more realistic assessment [1, 7, 8].

Facial and dental symmetry are considered important factors influencing total smile esthetics [22]. Achieving optimal esthetics often involves aligning the facial midline with the midlines of the maxillary and even of the mandibular central incisors. This alignment theoretically can enhance the overall symmetry and harmony of the face. However, the human face is not perfectly symmetrical, and the aforementioned reference points usually do not coincide [11].

A proper orientation of the facial midline with reliable reference points, during the prosthetic treatments to evaluate and correct the dental midline discrepancy, can be challenging [23–25]. Philtrum was mentioned as a reliable anatomical formation for assessing the facial midline with less risk of asymmetry [25–27]. Concerning the previous reports, the philtrum was selected as the reference point of the facial midline to evaluate the dental midline in the present study.

According to the results of the present study, midline deviation is generally considered less noticeable and therefore has less effect on smile esthetics compared to the individual disproportions of the anterior teeth ($p < 0.001$). Therefore, the first hypothesis of the present study was rejected. Moreover, similar levels

of attractiveness were observed for the reference original image and the midline deviation of 1 mm and 2 mm, rendering midline deviations up to 2 mm not noticeable both for laypersons and dentists, which is consistent with the statement of a previous systematic review [28]. This result is also consistent with the findings of many considering midline discrepancies attractive up to 2 mm [29–31]. A midline deviation of 3 mm was considered noticeable in the present study but still received a relatively high attractive rating, which is compatible with the previous report of Ker et al. [32] considering dental midline deviations up to 3 mm attractive. However, a midline deviation of 4 mm obtained the second-lowest score and was considered esthetically the second least attractive case, supporting the findings of Ker et al. [32] This result is inconsistent with the report of Kokich et al. [8] who considered that midline deviations up to 4 mm are also attractive for laypeople, dentists, and even orthodontists, as well as with Pinho et al. [33] who considered laypersons cannot notice even a deviation of 4 mm. This disagreement might be due to the differences in the methodology that Kokich et al. [8] followed using only close-ups rather than full-face images. Also, the quality of the modified images presented in the mentioned study was quite low. Therefore, the perception of the observers might have been affected. Due to the significant differences in esthetic perception for midline deviation at different levels, the second hypothesis of the study was rejected.

Studies evaluating the effect of crown width disproportion on smile attractiveness have focused mainly on simulating a unilateral disproportion of a lateral incisor or bilaterally by widening or narrowing both the right and left sides simultaneously [8, 12, 28, 33]. However, in the present study, the increase in width of a single anterior tooth was compensated by a similar amount of decrease of the respective tooth on the contralateral side, generating a width difference of 1 mm each time. Alhammadi et al. [12] revealed that the asymmetric crown width discrepancy between maxillary lateral incisors is esthetic when 1 mm but less attractive when 2 mm, while it was 2.5 mm according to Ngoc et al. [34] The results of the present study agree with these findings that the lateral incisor disproportion of 1 mm was more attractive than the midline deviation of 3 mm. Both 1 mm and 2 mm lateral incisor disproportions were considered noticeable but more attractive in the present study compared to the central incisors' disproportions, which is also inconsistent with Kokich et al. [8] From the results of the present study, it can be interpreted that canine disproportions have less visual weight in smile attractiveness compared to lateral incisor disproportions, which were also less than the disproportion of the central incisor. This result is consistent with Magne et al. [11] claiming that maxillary central incisors have a major role in determining smile esthetics. Therefore, it might be better to select maxillary canines instead of lateral or central incisors when disproportion needs to be addressed through a restorative approach. Accordingly, the third hypothesis of the study was rejected.

The present study is the first study in the literature aiming to evaluate the esthetic perception of bilateral single or multiple (distributed) crown width disproportions in terms of restorative planning. The distribution of an anterior crown width disproportion was previously considered a good option to mask and thereby overcome significant proportional discrepancies in a minimally invasive way [5, 17]. In agreement with these reports, this study revealed that, when the disproportions were distributed among the anterior teeth, the smile was perceived as more attractive compared to the non-distributed clinical case scenarios, both for laypeople and for the dentists. Thus, the fourth hypothesis of the study was rejected. Additionally, the obtained attractiveness scores for the distributed crown width disproportion were similar to the represented midline deviation ($p = 0.278$). However, clinicians are better off not distributing a crown width disproportion of 4 mm or more, as based on the results of the present study, it is going to be considered the least attractive esthetically. Whereas the esthetic result would still be more acceptable than a single 2 mm disproportion of the central incisor.

One of the noteworthy findings of the present study was the influence of the observer's type on esthetic perception. The results revealed that laypeople had lower esthetic awareness for the simulated cases compared to dentists. The attractiveness level by the dentists was significantly lower compared to the laypeople for 1 up to 2 mm of central incisor and lateral incisor disproportion, and 1 mm for canine disproportion. Although some previous findings reported no difference between dentists and laypeople in the perception of smile attractiveness, the opposite is claimed by several studies that are in agreement with the present study [1, 4, 7, 8, 20, 21, 35, 36]. Therefore, the fifth hypothesis of the study was also rejected.

Gender was considered an effective factor in the present study for the laypeople group, which is inconsistent with some previous reports [4, 18, 37]. This conflict might be due to the differences in observer groups and different dental esthetic parameters that were evaluated by the previous studies. However, when female observers were considered, the results were supported by previous findings, as their perception of smile attractiveness was more critical compared to male observers [9, 21, 36]. Considering the group of dentists, the level of esthetic perception was similar for the male and female dentists, which is consistent with the results of Ntovas et al. [7] who mentioned that gender did not have a significant effect on smile perception, only the dentists' group. This might be related to the education of dentists regarding esthetic perception.

When the age of the observers was considered, participants at the age of 35–50 were less critical than the younger individuals in esthetic perception, supporting the previous reports [1, 7, 35, 36]. Changes in esthetic expectations with aging can be considered as the explanation for the lower esthetic scores of the younger observers.

Finally, it is important to emphasize the limitations of the present study. The other parameters and their interactions related to smile attractiveness should be investigated to obtain more illustrative outcomes. The observers of the current survey represented laypeople and dentists, but not specific disciplines of dentistry, such as orthodontists and restorative dentists. Laypeople's preferences from different cultures were not represented. Although full-face images were used for the survey, the static in vitro representation of the face presents a limited view compared to the 3-dimensional dynamic nature of the smile, as it can be assessed during social interactions.

Using only the smile of a female model is another limitation that could influence the way that the observers perceive the smile attractiveness of the evaluated images. Future studies should focus on overcoming these limitations by implementing models with a variety of ages, genders, and skin colors, in different locations around the world, to verify the results of the present research.

5 | Conclusions

Dentofacial midline discrepancy had less effect on smile attractiveness compared to crown width disproportions of anterior teeth. Midline deviations up to 2 mm were not noticeable either for laypeople or dentists. The deviations of 3 mm were noticeable but still more attractive than the deviations of 4 mm, which were considered the least attractive. A single crown width disproportion was less perceived when moving from the central incisor toward the canine. Distributing the crown width disproportions among anterior teeth can be beneficial for smile attractiveness compared to non-distributed cases. Deviations were perceived less by laypeople than by dentists and less by men than by women.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Research data not shared.

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