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Research article

The perception of smile attractiveness according to the degree of training in the field of dental aesthetics

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Abstract: (1) Background: Since ancient times, people have been concerned with the aesthetics and attractiveness of their own person. The present study aims to analyze the beauty of the smile according to the level of training in the field of dental aesthetics of the respondents.; (2) Methods: To test this hypothesis, a questionnaire with 22 questions was applied to which 306 participants voluntarily answered; (3) Results Several variables related to dental aesthetics were analyzed based on digitally modified facial photographs; (4) Conclusions: The study showed that the degree of training of the patients is a factor that influences the perception of the smile.

Keywords: dentistry; aesthetic; aesthetic perception; diastema; gingival asymmetry; Buccal corridors; dental colour; symmetry; smile line

Introduction

From ancient times, people have been concerned with aesthetics and the attractiveness of their person. Each individual is born with the ability to perceive and evaluate beauty, still this concept of aesthetic or beauty can take on varied dimensions depending on culture, level of education, religious canons, environment of origin, gender, and so on. Therefore, what is aesthetic and pleasing to one person can naturally appear unsatisfactory to another; this isn't a matter of right or wrong, but rather about different ways of perceiving beauty [1].

Studies have shown that there is a correlation between the level of attractiveness of a person and how they are perceived by society [2]. Furthermore, it has been demonstrated that the facial appearance of women is observed more closely and criticized more harshly by society compared to men [3].

Goleman and Goleman have shown that attractive individuals find friends and life partners more easily and higher-paying positions, and have significantly higher chances of promotion. Additionally, they demonstrated that teachers tend to be less strict with students who are perceived as attractive, with these students being seen as more intelligent, better, and more capable by both peers and educators [4]. Considering these aspects, it is understandable why there is a growing demand and interest in aesthetic treatments.

According to Paetzer, the face assumes a pivotal role in determining overall attractiveness, with specific facial elements playing varying roles. The mouth and teeth emerge as primary contributors to perceived beauty, followed by the eyes, facial structures, hair, and nose [4].

Understanding that each patient possesses a unique perception of their aesthetic appearance underscores the importance of precise communication of impressions and

desires, both pre and post-treatment. Introducing aesthetic questionnaires becomes crucial in facilitating effective communication between healthcare professionals and patients. These questionnaires empower patients to self-analyze, articulate dissatisfactions, and articulate expectations for future treatments. In addition, employing digital smile design, creating mock-ups or wax-ups, and using provisional prosthetics provide patients with visual aids for previewing and potentially refining treatment outcomes, ensuring a successful aesthetic intervention [4].

Grounded in the premise that knowledge in dental aesthetics shapes the perception of smile attractiveness, this study endeavors to explore and test this hypothesis. By administering a comprehensive questionnaire, aesthetic preferences are meticulously compared based on the respondents' level of education, offering nuanced insights into the intricate interplay between education and aesthetic perception within the realm of dental aesthetics.

This study sought to evaluate the aesthetic perceptions of both individuals trained in dental aesthetics and those untrained in this field. Utilizing digitally modified photographs, the study involved 306 participants and aimed to comparatively analyze their attitudes towards the attractiveness of diastema, vertically shifted gingival lines at the central incisors, and buccal corridors of varying dimensions. Additionally, the study investigated respondents' aesthetic perceptions of lower arch symmetry, discolorations, and smiles exhibiting variations in dental color or smile line levels. The questionnaire was designed to reflect respondents' satisfaction with the aesthetics of their own smiles, providing a comprehensive overview of how trained and untrained individuals in dental aesthetics appreciate smile aesthetics.

2. Results

When asked about the level of satisfaction regarding the aesthetics of their own smile,the majority of respondents declared themselves to be satisfied. It can be observed that trained individuals are more confident than those who are not educated in the dentistry field, and also that men are more confident with the appearance of their teeth than women (Figure 1). The figures indicate the exact number of participants divided by gender and level of education in the field of aesthetics.

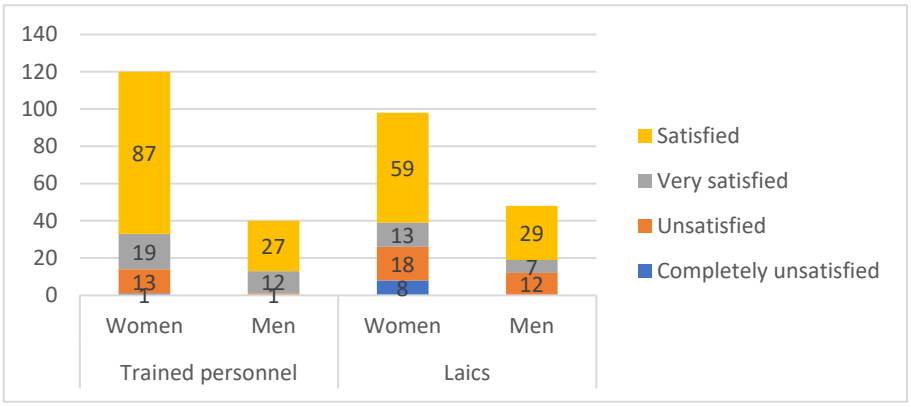


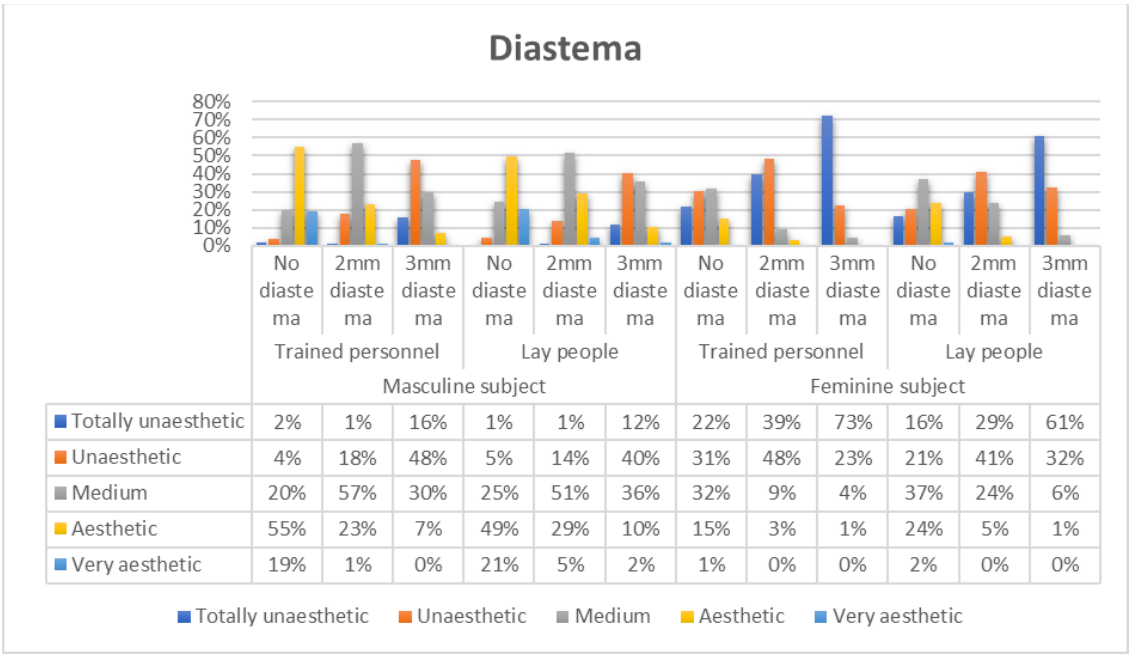
Figure 1. The level of satisfaction regarding the aesthetics of respondents'smile.

In response to the question that quantifies the elements that the participants find bothersome about their smile, it can be observed that most of educated and uneducated women in the field of aesthetics are bothered by the color and alignment of their teeth. Additionally, educated women appear to pay more attention to the gingival smile than uneducated women. Educated men are primarily bothered by the alignment of their

teeth, while lay men are bothered by the tooth color. The complete results can be found in Figure 2.

Figure 2. The most bothering element regarding the respondent's smile

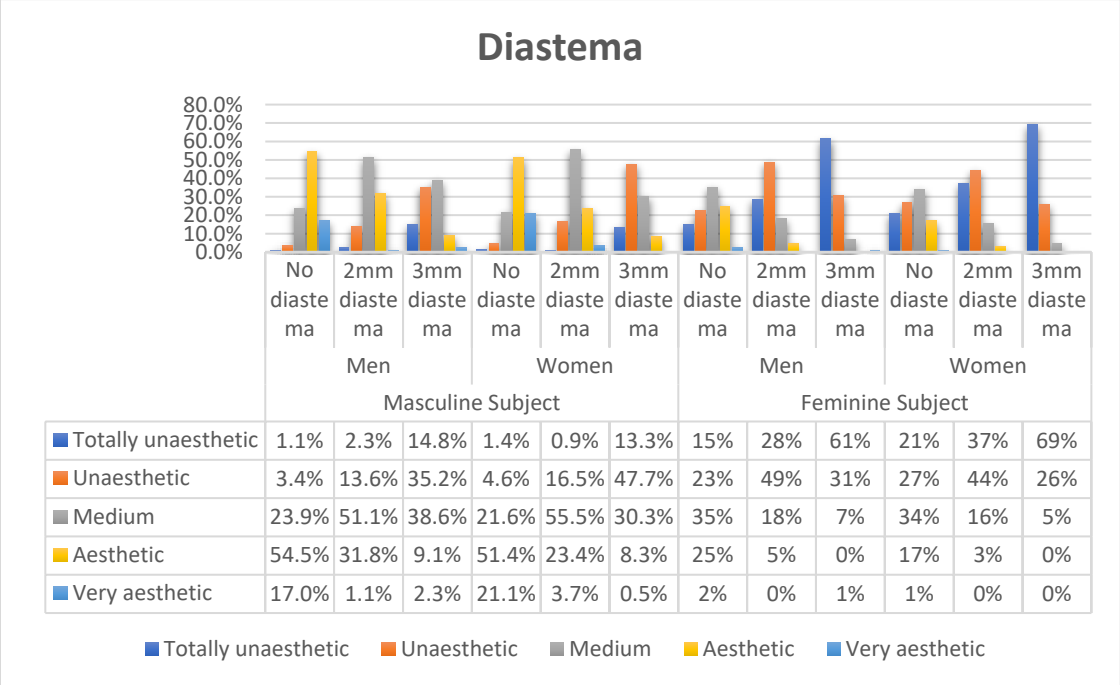
In response to the question evaluating the aesthetics of smiles with a diastema, most respondents considered the absence of the diastema to be more aesthetically pleasing for both subjects. The image without a gap of the masculine subject was deemed aesthetic by 55% and very aesthetic by 19% of the trained personnel. In comparison, the lay persons found this image to be very aesthetic in proportions of 21%, and aesthetically pleasing in proportions of 49%. The picture of the female subject was evaluated as aesthetic by untrained individuals at a rate of 24%, whereas the trained individuals gave the same rating at 15%. This gap-free smile was deemed very aesthetic by only 1% of the trained and 2% of the untrained participants. The complete results can be found in Figure 3.



	No diastema	2mm diastema	3mm diastema	No diastema	2mm diastema	3mm diastema	No diastema	2mm diastema	3mm diastema	No diastema	2mm diastema	3mm diastema
	Trained personnel			Lay people			Trained personnel			Lay people		
	Masculine subject						Feminine subject					
Totally unaesthetic	2%	1%	16%	1%	1%	12%	22%	39%	73%	16%	29%	61%
Unaesthetic	4%	18%	48%	5%	14%	40%	31%	48%	23%	21%	41%	32%
Medium	20%	57%	30%	25%	51%	36%	32%	9%	4%	37%	24%	6%
Aesthetic	55%	23%	7%	49%	29%	10%	15%	3%	1%	24%	5%	1%
Very aesthetic	19%	1%	0%	21%	5%	2%	1%	0%	0%	2%	0%	0%

Figure 3. Diastema. Comparison between trained personnel and lay people

The most appreciated image by both women and men is that both subjects have no diastema. It can be observed that as the size of the gap increases, the given ratings become progressively less appreciative. However, we also note that more critical ratings are given to the female subject compared to the male one (Figure 4).



	Masculine Subject						Feminine Subject					
	Men			Women			Men			Women		
	No diastema	2mm diastema	3mm diastema	No diastema	2mm diastema	3mm diastema	No diastema	2mm diastema	3mm diastema	No diastema	2mm diastema	3mm diastema
Totally unaesthetic	1.1%	2.3%	14.8%	1.4%	0.9%	13.3%	15%	28%	61%	21%	37%	69%
Unaesthetic	3.4%	13.6%	35.2%	4.6%	16.5%	47.7%	23%	49%	31%	27%	44%	26%
Medium	23.9%	51.1%	38.6%	21.6%	55.5%	30.3%	35%	18%	7%	34%	16%	5%
Aesthetic	54.5%	31.8%	9.1%	51.4%	23.4%	8.3%	25%	5%	0%	17%	3%	0%
Very aesthetic	17.0%	1.1%	2.3%	21.1%	3.7%	0.5%	2%	0%	1%	1%	0%	0%

Figure 4. Diastema. Comparison between women and men

The group of trained participants evaluated the discrepancy between the gingival margins of the central incisors with a score of 1 in a proportion of 14%, and with a score of 2 in a proportion of 31%. Most representatives from this group opted for a score of 3 (44%), and 11% chose a score of 4. None of those with knowledge of dental aesthetics were awarded the maximum score. The group of untrained participants decided a score of 1 in a proportion of 3% and a score of 2 in a proportion of 11%. Score 3 was predominant in this case as well, chosen by 43% of respondents, and score 4 was assigned by 38% of participants. This smile received the maximum score from 4% of the untrained individuals.

The aesthetic of the female smile with varying levels of gingival margin was appreciated by 48% of the trained personnel and 29% of the untrained personnel, with a score of 1. Score 2 was given by 38% and 36% of the representatives from the first and second groups, respectively. Score 3 was attributed to 13% of those knowledgeable in aesthetics and 29% without such knowledge. Score 4 was chosen by 1% of the trained individuals and 5% of the untrained ones. None of the study participants awarded the highest rating to this smile.

The majority of women and men gave a score of 3 to the image of the male subject, with a discrepancy in the positioning of the gingival margins of the central incisors. The female subject was predominantly rated with a score of 1 by women and 2 by men. Once again, a more critical attitude of women towards aesthetics can be observed. The complete results can be observed in Figure 5.

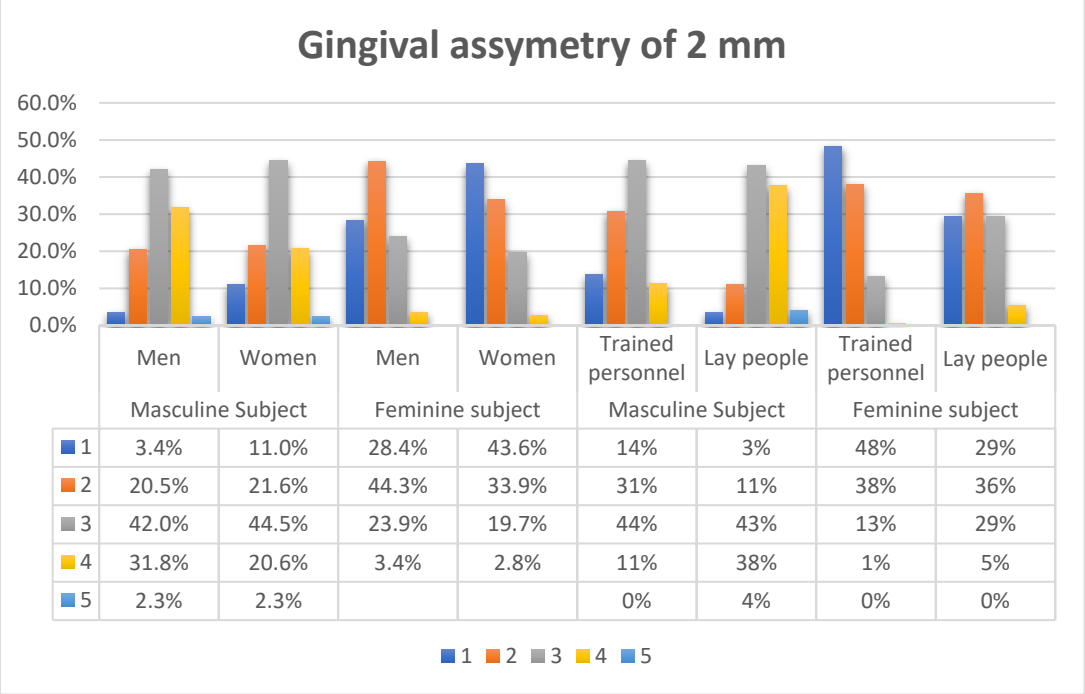


Figure 5. Gingival assimetry of 2 mm

In the case of the male subject, corridors of medium dimensions were the most appreciated (considered aesthetic by 48% of the trained individuals and 42% of the untrained ones), followed by narrow corridors and then large corridors. For the female subject, corridors of medium dimensions were also the most appreciated, as in the previous case. This time, they were followed by large corridors and then small corridors. (Figure 6)

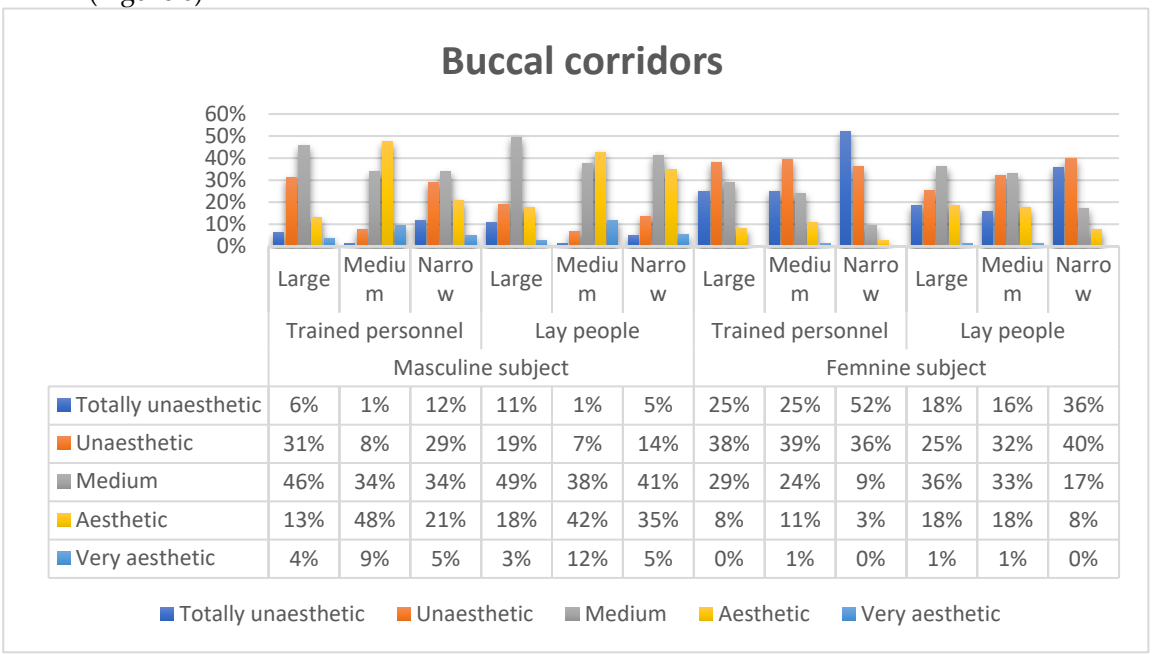
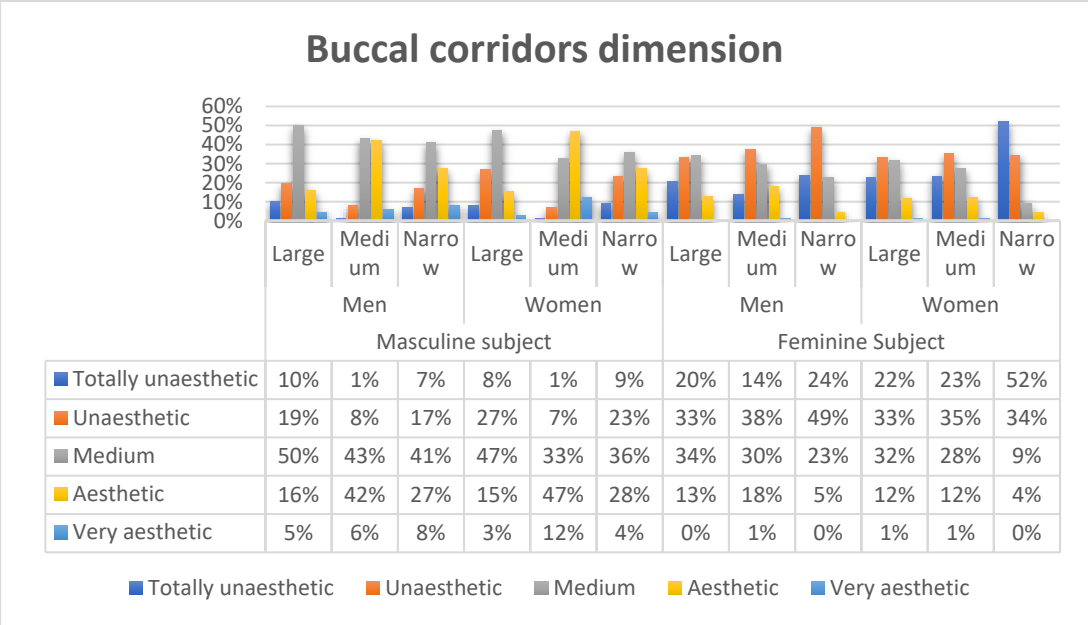


Figure 6. Buccal corridors. Comparison between trained personnel and lay people.

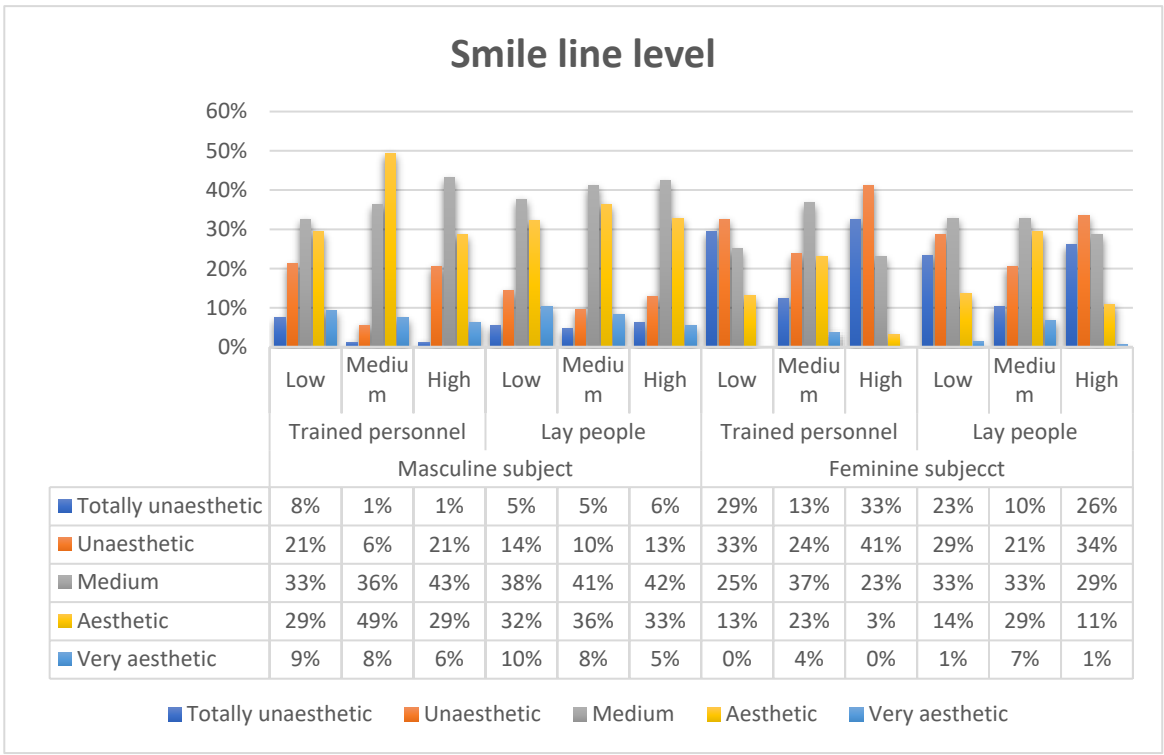
In the case of the male subject, both men and women consider medium buccal corridors to be the most aesthetic. In the case of the female subject, both genders preferred images with large buccal corridors (Figure 7).



	Masculine subject						Feminine Subject					
	Men			Women			Men			Women		
	Large	Medium	Narrow	Large	Medium	Narrow	Large	Medium	Narrow	Large	Medium	Narrow
Totally unaesthetic	10%	1%	7%	8%	1%	9%	20%	14%	24%	22%	23%	52%
Unaesthetic	19%	8%	17%	27%	7%	23%	33%	38%	49%	33%	35%	34%
Medium	50%	43%	41%	47%	33%	36%	34%	30%	23%	32%	28%	9%
Aesthetic	16%	42%	27%	15%	47%	28%	13%	18%	5%	12%	12%	4%
Very aesthetic	5%	6%	8%	3%	12%	4%	0%	1%	0%	1%	1%	0%

Figure 7. Buccal corridors. Comparison between women and men.

For the male subject, the average smile line is considered the most aesthetic by the majority of study participants, trained personnel and lay people, followed by the one where only 75% of the dental surface is exposed and the gingival smile. In the case of the female subject, the results are similar in that the average smile line is considered the most aesthetic, followed by the low smile line and then the gingival smile (Figure 8)



	Masculine subject						Feminine subjecct					
	Trained personnel			Lay people			Trained personnel			Lay people		
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Totally unaesthetic	8%	1%	1%	5%	5%	6%	29%	13%	33%	23%	10%	26%
Unaesthetic	21%	6%	21%	14%	10%	13%	33%	24%	41%	29%	21%	34%
Medium	33%	36%	43%	38%	41%	42%	25%	37%	23%	33%	33%	29%
Aesthetic	29%	49%	29%	32%	36%	33%	13%	23%	3%	14%	29%	11%
Very aesthetic	9%	8%	6%	10%	8%	5%	0%	4%	0%	1%	7%	1%

Figure 8. Smile line level—comparison between trained personnel and lay people.

From the perspective of both genders, the average smile line is the most aesthetic in for both subjects. A more critical attitude of women towards the aesthetics of the female subject can be observed compared to men (Figure 9).

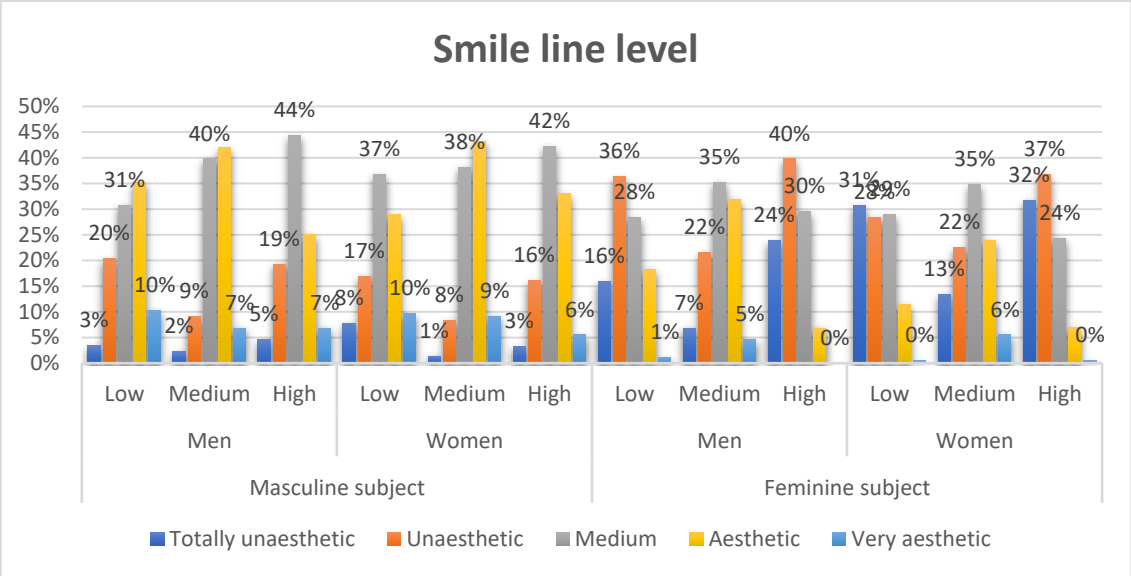


Figure 9. Smile line level. Comparison between women and men.

When dividing the total number of study participants based on their level of education, concerning dental color for the male subject, the third image, showing the whitest and brightest teeth, was preferred. Following in the preferences was the first picture, in wich the smile had also undergone digital teeth whitening (Figure 10). The figures depicted in figure 10 indicate the exact number of participants, divided by gender and level of education in the field of aesthetics.

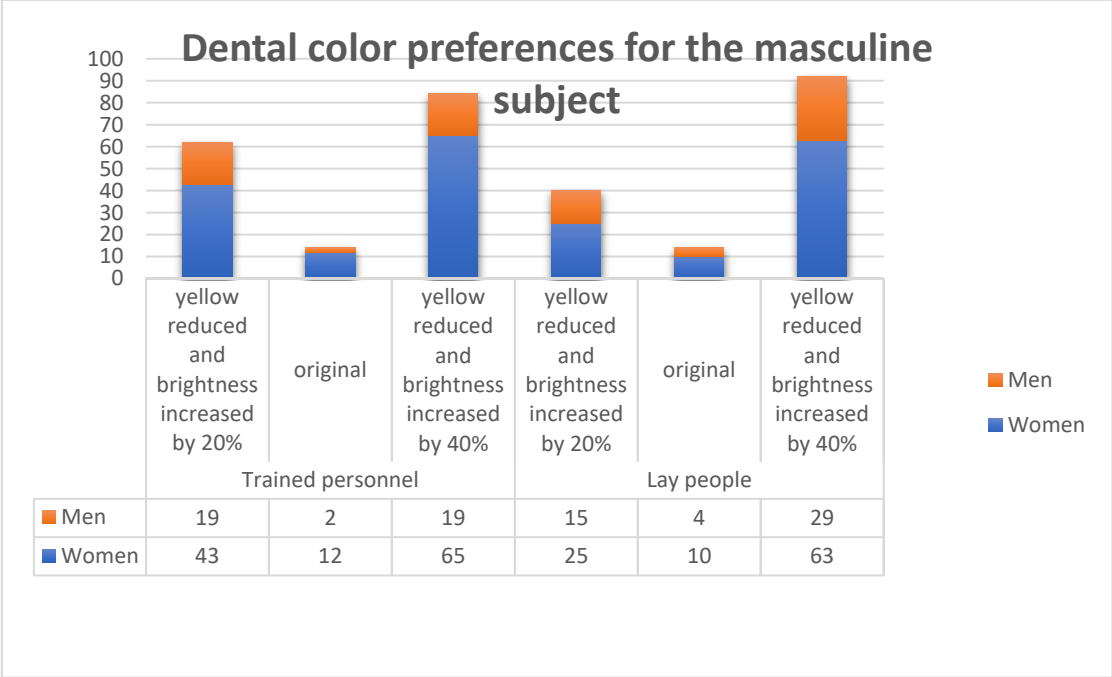
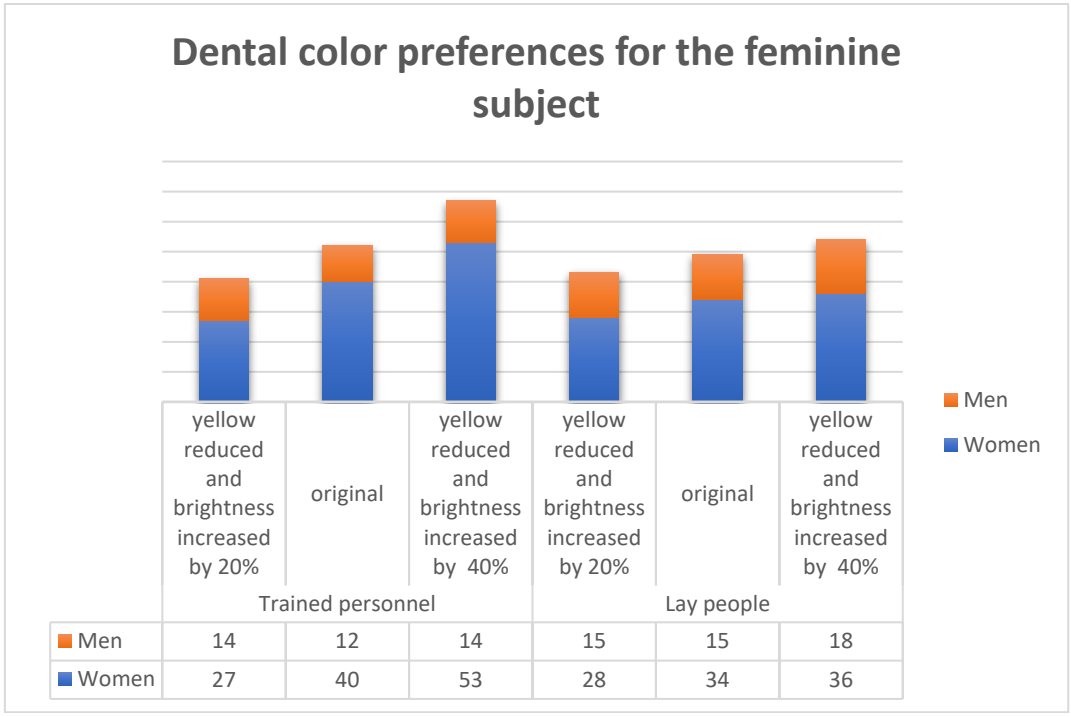


Figure 10. Dental color preferences for the masculine subject.

In the case of the female subject, the whitest teeth were most appreciated by representatives from all groups, educated and uneducated individuals, women and men. The first image also ranked second for the female subject, with this smile having

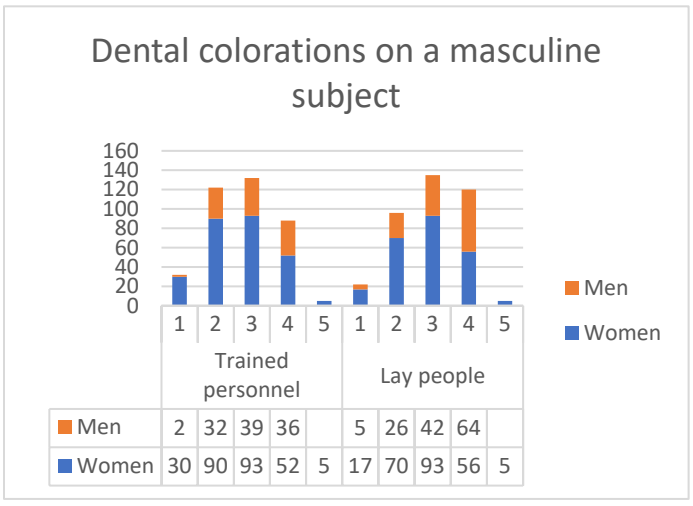
undergone dental whitening but to a lesser degree than the smile in the last image (Figure 11).



	Trained personnel			Lay people		
	yellow reduced and brightness increased by 20%	original	yellow reduced and brightness increased by 40%	yellow reduced and brightness increased by 20%	original	yellow reduced and brightness increased by 40%
Men	14	12	14	15	15	18
Women	27	40	53	28	34	36

Figure 11. Dental color preferences for the feminine subject.

The majority of respondents gave a score of 3 to the image of the male smile with dental pigmentation and discoloration. The image of the female subject was predominantly rated 2 by the educated individuals and with a score of 3 by the uneducated ones (Figure 12, 13).



	Trained personnel					Lay people				
	1	2	3	4	5	1	2	3	4	5
Men	2	32	39	36		5	26	42	64	
Women	30	90	93	52	5	17	70	93	56	5

Figure 12. Dental colorations masculine subject

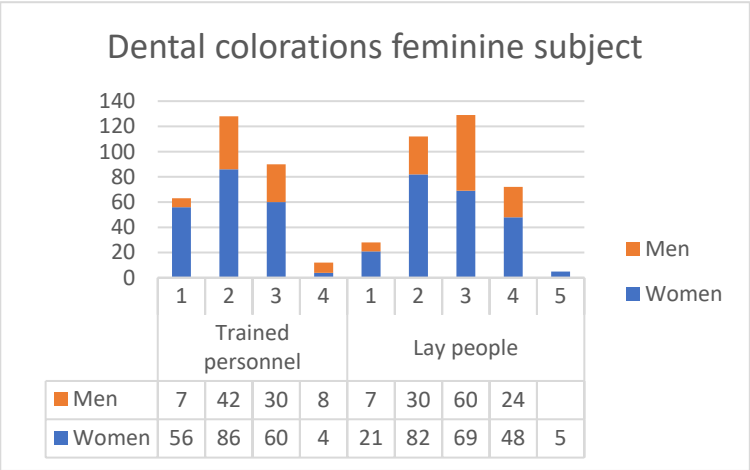


Figure 13. Dental colorations feminine subject

In the case of the male subject, the first image was preferred, whose symmetry was achieved based on the right half of the face, by the majority of educated and uneducated individuals women, and men. In the case of the female subject most respondents considered the image with perfect symmetry to be the most attractive, followed by the unaltered image (Figure 14, Figure 15).

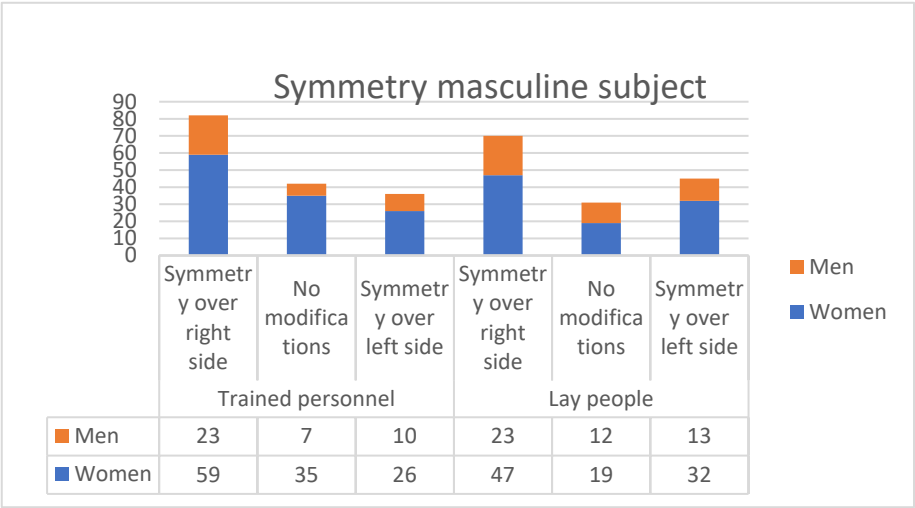


Figure 14. Symmetry masculine subject

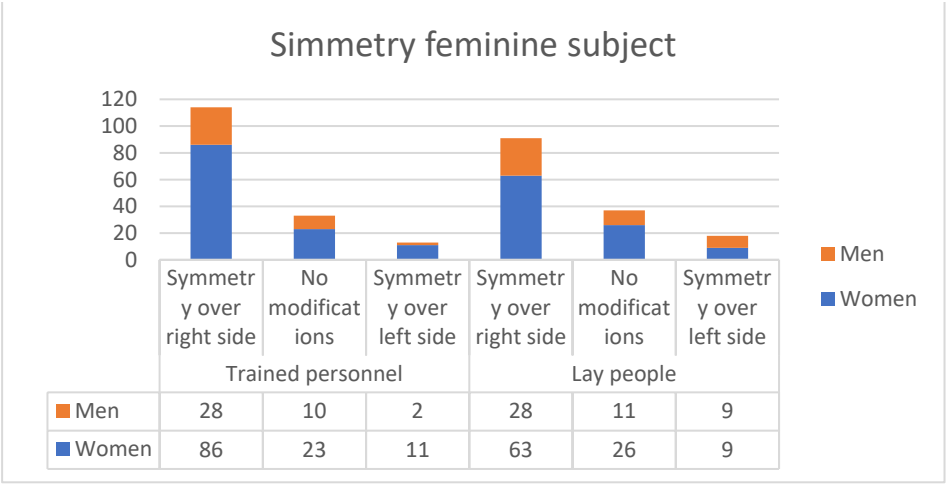


Figure 15. Symmetry feminine subject

3. Discussion

The purpose of this study was to evaluate to what extent the level of training in dental aesthetics influences the perception of smile attractiveness. The analysis focused on seven aspects of dental aesthetics: diastema, gingival line level, buccal corridor dimensions, smile line height, tooth color, dental discolorations, and lower arch symmetry.

The results of the two groups, those trained and untrained in dental aesthetics, while similar, reveal a more critical attitude among the trained individuals in evaluating dental aesthetics than the untrained individuals. This confirms the hypothesis that the level of training in dental aesthetics influences the perception of smile attractiveness.

Based on the results, a respondent profile can be outlined. The majority of study participants were women (71% of the total), aged between 20 and 30 years old (55.9% of the total), and from urban areas (93% of the total respondents). This can be explained by the fact that women are more active on social media and more responsive to questionnaires than men [5]. The predominance of female participants in this study aligns with findings from previous research [5].

The broad distribution of respondents within the age range of 20 to 30 years can be attributed to the pronounced activity of this age group on social media, their higher compliance with questionnaires, and the greater interest that younger subjects show in aesthetics [5,6]. The emphasis on the age group of 20 to 30 years, driven by social media activity, resonates with studies by Thompson et al. and Garcia et al. [5,6]. This emphasizes the impact of social media on participant recruitment and preferences in aesthetic studies.

The low number of respondents from rural areas can be attributed to limited internet access in some rural areas or to the lower interest that rural residents have in dental aesthetics and related studies. This could influence the study as the interest in dental aesthetics and accessibility to dental services tend to be lower in rural areas than urban areas. The underrepresentation of rural participants corresponds with findings by Johnson and Smith, emphasizing the challenge of ensuring rural inclusivity in online surveys [7,8]. Limited internet access in rural areas remains a significant factor in shaping study demographics.

Analyzing the level of satisfaction for their smile, it was observed that most study respondents were satisfied, rating their smiles as 7, 8, or 9. Studies have shown that women are generally more interested and confident with the appearance of their smiles [9,10].

However, the influence of mass media on respondents' aesthetic perception should also be mentioned. Through daily exposure to nearly perfect models, mass media has led to increased self-expectations, simultaneously exerting excessive pressure on some respondents who, though satisfied with their appearance, refrain from awarding the highest score. Similar to the study by Wang et al., the observed satisfaction bias in self-reports emphasizes the impact of societal expectations and media influences on self-perception. This aligns with the broader discourse on beauty standards perpetuated by mass media [11].

The findings of the study suggest that individuals with training in dental aesthetics express greater satisfaction with their smile aesthetics compared to those without such training. This difference in satisfaction may also arise from the heightened interest that the trained individuals have in aesthetics, oral health, current aesthetic demands, and greater accessibility to dental services for this category [12]. The heightened aesthetic concerns among trained individuals resonate with studies by Samorodnitzky-Naveh et al., emphasizing that professionals often exhibit greater sensitivity to dental aesthetics [12]. This consistency supports the notion that professional knowledge influences aesthetic perception.

Samorodnitzky-Naveh and colleagues conducted a study analyzing factors influencing patient's satisfaction with their smiles. The study results showed that 89.3% of respondents were dissatisfied with tooth color, and the next most concerning factor in

their dental aesthetics was tooth alignment [12]. These results are reflected in the analysis of questionnaire responses in this study, where most participants expressed dissatisfaction with tooth color (49.3%), followed by tooth alignment as the second most dissatisfactory parameter (44.1%).

Furthermore, it was observed that educated individuals pay the most attention to teeth alignment, color and degree of tooth and gingival exposure. At the same time lay people are more concerned with tooth color, teeth alignment, and the presence of cavities, discolorations, or dental fractures. These results are supported by Samorodnitzky-Naveh et al., who, in a study, demonstrated that the factors with the most significant influence on smile aesthetics according to patients are dental color, cavities in the front teeth, and teeth alignment. [12].

Following the evaluation of results based on phictures, it was noted that the female subject generally achieved less aesthetic results in all photographs compared to the male subject. This could be due to the presence of a gingival smile, which might have negatively influenced respondents' opinions [13,14]. The absence of diastema was considered by most respondents in this study to be the most aesthetic option for both the female and male subjects. These findings are supported by literature indicating that diastema harms the smile aesthetics [15,16].

The obtained results do not suggest a marked difference in the perception of a diastema smile between the group of educated individuals and the group of participants who are not educated in dental aesthetics, but rather a slightly higher demand within the first group. A study conducted by N. Talic et al. based on two groups of 30 individuals educated and uneducated in dental aesthetics also demonstrated that a diastema is similarly perceived as unattractive by those who have and those who do not know dental aesthetics [17].

According to the literature, vertical changes in the gingival line at the level of central incisors can be detected by educated personnel if they have a value equal to or greater than 0.5 mm, becoming more unattractive and bothersome as this value increases. The same changes are perceived and can influence smile aesthetics according to uneducated personnel if they have a value of 2 mm or greater[18]. Therefore, the present study aligns with literature norms, demonstrating that lay people are less or much less bothered by changes in the gingival line compared to educated personnel.

Reduced buccal corridors were less appreciated for the female subject. The reason could be due to the fact thet the female subject has gummy smile, as well as the false teeth appearance that small buccal corridors can create [19]. Studies have shown a preference for small or nonexistent buccal corridors among educated and uneducated individuals [20,21]. On the other hand, authors like Parekh et al. argue that buccal corridor size does not influence smile aesthetics [19].

The study showed a preference for medium buccal corridors for smiles with exposure of 10 teeth (PM2-PM2), similar to the results obtained by Gracco et al. [22] and Nascimento et al [23]. The presence of different smile lines—low, medium, and high—was similarly evaluated by both educated and uneducated personnel for both male and female subjects. The most attractive smile for both male and female participants in both groups was the one in which the entire dental crown and 1 mm of the gingival margin were exposed. This smile was followed by the one with 75% exposure of the dental crown, while the gingival smile with 4 mm exposure was the least appreciated. These results align with literature confirming that revealing the entire dental crown and 1-2 mm of the gingiva during a smile provides the most pleasing aesthetic aspect for both genders [24].

With age, a decrease in the visibility of the upper frontal teeth during smiling was observed, so a low smile line with up to 75% exposure of the clinical crown of the front teeth is considered less aesthetic, and associated with an aged smile. Additionally, studies reveal that more than 3 mm of gingival exposure during smiling is perceived as unaesthetic by those with knowledge of dental aesthetics and those without such knowledge [13,14].

The findings on buccal corridors and smile lines align with studies by Parekh et al., Gracco et al., and Nascimento et al., demonstrating shared preferences for specific dental features among different populations [19-23].

Regarding dental color, a greater affinity towards whiter and brighter dental units was observed among both educated and uneducated participants in dental aesthetics. This preference can be attributed to current aesthetic standards and mass media promoting dental whitening, as well as the association of white and bright teeth with youth, professional and personal success, and overall health [25]. This affinity is supported by Di Murro et al., who demonstrated that lighter and brighter teeth are perceived as more aesthetic regardless of gender and skin tone, compared to teeth with darker shades and lower brightness [26]

The questionnaire results revealed a generally negative attitude among study participants towards the presence of dental discolorations and colorations in the front teeth, classifying these smiles as unaesthetic or average despite other qualities they possess. It is clear that the public places great importance on dental color and its uniformity, which becomes more critical than teeth alignment, their shape, and the degree of exposure [12]. Although the presence of dental discolorations harms the smile, it was observed that uneducated personnel are less bothered by the existence of dental colorations than educated personnel, who judge the presence of these flaws more harshly. However, specialized literature demonstrates that while educated personnel exhibit greater sensitivity towards dental discolorations, both those with and without knowledge of dental aesthetics tend to underestimate the personality traits, social competence, and intellectual capacity of an individual with dental discolorations. The negative perception of dental discolorations and colorations is in line with existing literature, highlighting the significant influence of dental color uniformity on aesthetic judgments [12,27,28].

In the case of both the female and male subjects, one of the images displaying perfect symmetry of the lower arch was preferred by representatives of both groups. It is well known that perfect natural facial symmetry does not exist, and each person presents structural anomalies of varying dimensions, locations, and intensity. By mirroring one half to achieve perfect symmetry, these slight deviations from symmetry present in the original image can combine and give rise to structural anomalies of greater intensity, which, in end, can contribute to the formation of symmetrical images with different aesthetic levels. Thus, this explains why, even though the respondents could choose between two perfectly balanced images, one of them was distinctly selected as the most aesthetic by representatives of both groups, while the other was the least appreciated.

Therefore, the results of the present study demonstrate the affinity of respondents from both groups for symmetrical smiles, both in the case of the male and female subjects. The preference for symmetrical smiles aligns with the work of Grammer & Thornhill, Jones & Hill, and Zebrowitz et al., indicating a universal inclination towards symmetry associated with attractiveness [29-31]. Additionally, Rhodes et al. demonstrated that perfectly symmetrical faces, although not remarkably beautiful, are preferred over faces with lower levels of symmetry [32]. However, the level of attractiveness of perfect symmetry is challenged by authors like Kowner, who argues that natural proportion asymmetries are much more aesthetic [33].

For all images, the smile of the female subject was judged more critically than that of the male subject. This could be due to the gingival smile that the female model possesses, but also because women and men have higher aesthetic expectations for the appearance of the female gender compared to the male gender [34]. The observed gender-based variations in smile critiques resonate with Nurfitrah et al.'s work, emphasizing higher aesthetic expectations for the female gender [35].

In summary, the study's findings exhibit both consistency and divergence from existing literature. While reaffirming certain established patterns, such as gender-based aesthetic expectations and the impact of mass media, the study introduces unique insights into the interplay between dental aesthetics, education, and societal influences. The

nuanced comparison enhances the contextual understanding of where this study contributes to the broader body of research in dental aesthetics.

While the findings of this study contribute valuable insights into the perception of smile attractiveness based on the level of education in dental aesthetics, it is essential to acknowledge several limitations. These limitations may affect the generalizability and robustness of the results.

1. Sampling Bias: The study sample predominantly comprised women (71.2%). This gender imbalance could introduce a sampling bias, as women are known to be more active on social media and may have different aesthetic expectations compared to men.

The distribution method through social media may also contribute to this bias, as women tend to be more responsive to online surveys.

2. Age Distribution: The dominant age group in the study was between 20 and 30 years old. While this aligns with the active demographic on social media, it may not capture the perspectives of older age groups.

3. Urban Bias: The study's urban-centric sample (94% educated and 92% uneducated) may not represent the diversity of individuals residing in rural areas. Limited internet access in rural regions could have contributed to this bias.

4. Self-Reported Satisfaction: The self-reported satisfaction with one's own smile may be influenced by social desirability bias. Respondents might provide more positive ratings due to societal expectations or reluctance to express dissatisfaction.

5. Online Questionnaire Limitations: The distribution of the questionnaire online may exclude individuals without internet access, potentially leading to underrepresentation of certain demographics.

6. Influence of Mass Media: The study recognizes the influence of mass media on aesthetic perception. Daily exposure to idealized images in media may contribute to heightened aesthetic expectations, impacting respondents' evaluations.

In addition to the presented findings, delving into the practical implications of these results can provide valuable insights for the field of dental aesthetics. The identified patterns and trends can serve as a foundation for informed decision-making in various professional contexts.

From a practical standpoint, dental practitioners and aesthetic professionals can use these findings to tailor their services to better meet the preferences and expectations of their target demographic. Understanding the prevalence of certain preferences among different age groups, educational backgrounds, or geographic locations can guide practitioners in offering more personalized and effective treatments.

Furthermore, these insights can contribute to the development of educational programs in dental aesthetics. Institutions and educators can use the data to design curricula that address the specific needs and preferences of aspiring professionals, ensuring that they are well-equipped to meet the demands of diverse patient populations.

Recommendations for future research in the field could include exploring the reasons behind certain aesthetic preferences, investigating the impact of cultural influences on dental aesthetic choices, or examining the evolving trends over time. Additionally, longitudinal studies could provide a deeper understanding of how preferences change over different life stages.

Practitioners and researchers alike may also benefit from exploring the intersectionality of factors such as age, education, and geographic location to uncover more nuanced insights. This approach can lead to a comprehensive understanding of the multifaceted nature of dental aesthetic preferences.

In conclusion, the implications of these findings extend beyond the immediate scope of the study. By considering the practical applications and offering recommendations for future research, we can contribute to the continual improvement and advancement of the field of dental aesthetics.

4. Materials and Methods

To assess the aesthetic perception of the smile, a questionnaire was administered using the Google Docs platform. The questionnaire was directed at individuals with knowledge of dental aesthetics and those untrained in this field, and it remained available online for 4 days. A total of 306 anonymous responses were recorded. The questionnaire consisted of 22 single-answer questions and one multiple-choice question. The first six questions aimed to gather general information about the respondents and allowed for further analysis and grouping of study participants based on gender, background, age category, and level of education in dental aesthetics (Table 1: Distribution of respondents).

Table 1. Distribution of respondents

Age	<20	20-29	30-49	50-70	Grand Total
Trained personnel		**92**	**61**	**7**	**160**
Women		71	42	7	120
Men		21	19		40
Lay people	**3**	**79**	**19**	**45**	**146**
Women	3	62	7	26	98
Men		17	12	19	48
Grand Total	**3**	**171**	**80**	**52**	**306**

The total of 306 questionnaire respondents was divided into two groups based on their level of knowledge in the field of dental aesthetics, as follows: the trained personnel in dental aesthetics comprising 52.3% of the total study participants, and the second group, the laypeople, consisting of 47.7%, comprised of individuals who do not possess knowledge of dental aesthetics. All recorded responses were taken into account. Dentists, dental technicians, and final-year students from the Faculty of Dental Medicine were included in the trained personnel category. The rest of the participants were assigned to the group of laypeople. Among the respondents, 93.1% come from urban environments. The detailed origin environments of the two groups can be observed in Figure 16.

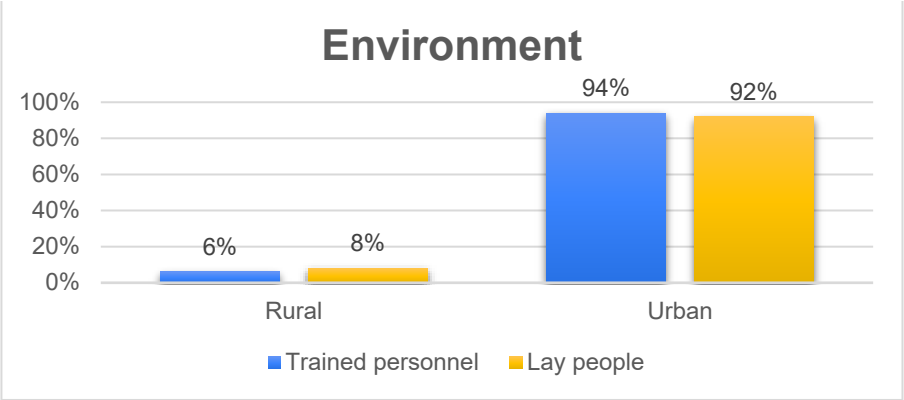


Figure 16. Environment

Study participants were divided into five age categories (Fig. 17). The majority of respondents, belong to the age group between 20 and 29 years old.

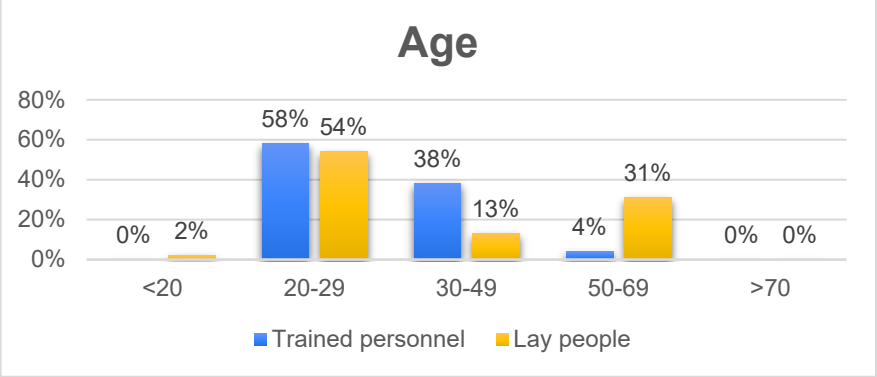


Figure 17. Age

The majority of respondents are those who have completed university, followed by those with high school, master's, and Ph.D. studies. The distribution of participants based on the level of education is detailed in Figure 18.

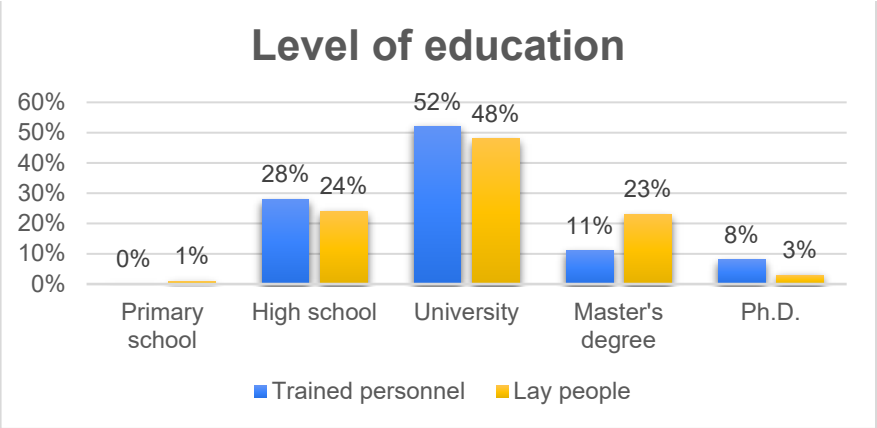


Figure 18. Level of education

Self-perception and satisfaction regarding the aesthetics of respondents' dental arches were evaluated based on the following 3 questions from the questionnaire. The degree of satisfaction of each respondent with their smile was quantified, as well as which of the following factors (color, shape, alignment, cavities, discolorations, fractures, missing teeth, diastemas, the visibility of teeth and gums during smiling) respondents wish to be modified for achieving a more aesthetically pleasing smile.

The following 14 questions were constructed based on portrait-type images captured while smiling, depicting the lower part of the face (between the Subnasal and Gnathion points) of a female subject and a male subject (Figure 16). The photographs repeat in sets of seven for each of the subjects. The questions relying on images evaluate how participants perceive the aesthetic appeal of the smiles of both a female and a male subject. Each of the seven questions contains one to three photographs, some digitally altered. The questions have single-answer options and involve assigning a rating (not aesthetic at all, slightly aesthetic, moderate, aesthetic, and very aesthetic), providing a grade, or choosing

the image that describes the preferred smile. These fourteen questions aim to evaluate the differences in dental aesthetics perception between respondents with knowledge of dental aesthetics and respondents untrained in this field.

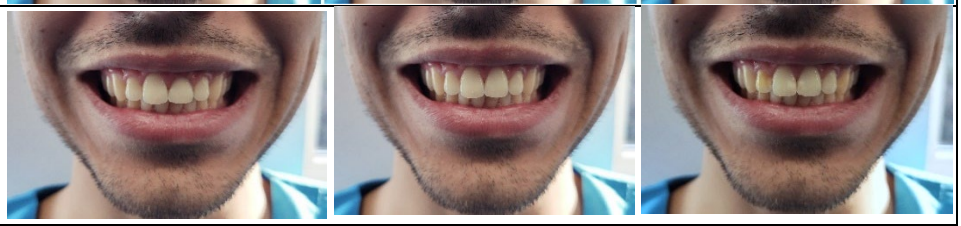
(a) (b)

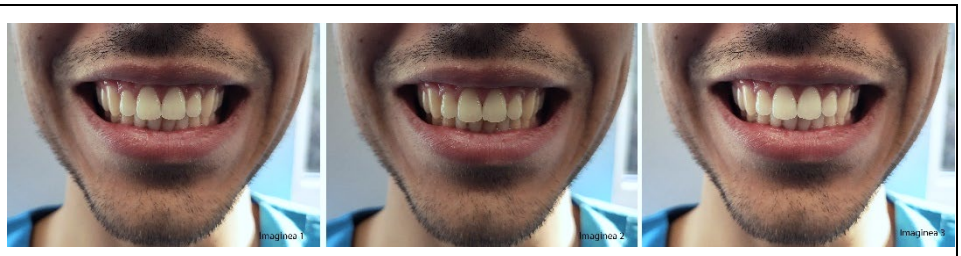
Figure 16. (a) Original picture of the feminine subject; (b) Original picture of the masculine subject

The portrayal was limited to the lower facial region, avoiding the presentation of other facial structures and features to minimize the number of variables that could have diverted respondents' attention from the pure aesthetics of the smile.

The smile features of the two subjects were digitally altered using Adobe Photoshop CC 2020 software (Adobe Systems Inc., San Jose, California, USA). Each subject is associated with seventeen photographs. The same modifications were made for both study participants. For each subject, five sets of three photographs each were compiled, along with two individual photographs. Each set consisted of the subject's original photo and two other images showing similar alterations. Questionnaire respondents were informed about the existence of digital modifications in the images but were not provided details about the nature and location of the alterations, nor were they shown or signaled the original photograph beforehand. The same alterations were made for each subject, and all the respondents evaluated the feminine and the masculine subject's aesthetics. Table 2 contains the images belonging to the male subject to exemplify and explain the modifications made to each photograph.

Table 2. Modifications made to each photograph

Diastema of 2mm (Img 2) and 3mm (Img.3)	
Gingival asymmetry of 2mm at tooth 1.1 (Img.1), dental discolorations (Img.3)	
Buccal corridors: wide- the arch was narrowed by 10% (Img.1) and narrow- widening the arch by 7% (Img.2).	
Gingival and dental exposure: Low 75% (Img.1) exposure of the dental crown, medium- the upper lip's edge is at the level of the zenith point of the central incisors, and a high (Img.3): gingival exposure of 4mm.	

Dental color: Img.1, the saturation of yellow was reduced, and brightness increased by 20% Img.3, the saturation of yellow was reduced, and brightness increased by 40%	
Symmetry: Img.1 perfect symmetry based on the right and left hemiface (Img.3).	

5. Conclusions

This study offers valuable insights into the perception of smile attractiveness based on the level of education in dental aesthetics. The key findings can be succinctly summarized to highlight their significance, implications, and contribution to the existing body of knowledge in dental aesthetics.

Key Findings:

Influence of Education on Aesthetic Perception:

Educated individuals demonstrated a more critical attitude in evaluating dental aesthetics compared to their untrained counterparts. This validates the hypothesis that the level of training in dental aesthetics influences the perception of smile attractiveness.

Gender and Demographic Patterns:

No significant gender-based differences in aesthetic perception were observed, although a notable 71.2% female participation highlighted women's heightened interest in dental aesthetics.

The study reinforced established patterns, such as higher aesthetic expectations for women and the influence of social media, particularly among the 20 to 30 age group.

Demographic Characteristics:

The study's demographic profile skewed towards individuals aged 20 to 30, urban dwellers, and a higher representation of educated participants, possibly influenced by the online survey's distribution.

The urban-centric sample highlighted potential disparities in internet access, impacting the study's demographic representation.

Professional Background and Aesthetic Sensitivity:

Dental professionals exhibited heightened aesthetic concerns, emphasizing the role of education in shaping aesthetic sensitivity.

Dissatisfaction Factors:

Educated individuals expressed dissatisfaction primarily with teeth alignment, color, and gingival visibility, while uneducated participants were more concerned with tooth color, alignment, and general oral health.

Aesthetic Preferences:

Preferences for a diastema-free appearance, medium buccal corridors, and a medium smile line were shared by both educated and uneducated groups, highlighting common aesthetic ideals.

Impact of Dental Discolorations:

Dental discolorations significantly impaired smile aesthetics for respondents, underscoring the importance of color uniformity in perceived attractiveness.

Aesthetic Preferences and Symmetry:

Consistent with existing literature, the preference for symmetrical smiles and specific dental features, such as whiter brighter coloured teeth emerged as universal themes.

Critical Analysis of Female Model:

A heightened demand for aesthetics, particularly regarding the female subject, revealed a more critical assessment, emphasizing the nuanced nature of aesthetic preferences.

Implications:

Clinical Practice and Education:

The study underscores the importance of tailoring dental services based on the demographic and educational background of patients. It also informs the design of educational programs to address the specific needs of aspiring dental professionals.

Media Literacy and Aesthetic Expectations:

Recognizing the influence of mass media on aesthetic expectations highlights the importance of media literacy in shaping a more realistic understanding of dental aesthetics.

Professional Development:

The heightened aesthetic concerns among trained individuals emphasize the need for continuous professional development to align with evolving aesthetic demands.

Contribution to Existing Knowledge:

This study contributes nuanced insights into the interplay between dental aesthetics, education, and societal influences. It reaffirms established trends while introducing unique perspectives, enriching the existing body of knowledge in dental aesthetics.

In conclusion, the study not only confirms the influence of education on aesthetic perception but also provides practical implications for clinical practice and education. By bridging gaps in existing literature, this research enhances our understanding of how demographic and educational factors shape the perception of smile attractiveness in the field of dental aesthetics.

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