Evaluation of Perceptions of Smile Esthetics by Dental Students

SUMMARY

Background/Aim: The aim of this study was to investigate in the esthetic perceptions of 2nd grade dental students before and after training. **Material and Methods:** A total of 16 photographs which contain golden ratio, buccal corridor, midline deviation, incisal embrasure, lip line, midline diastema, dark triangles and smile arc were shown to 78 dental students (33 male, 45 female). Immediately after the training about the smile esthetics, the same photos were shown again. The effect of gender on esthetic perception was also examined, in addition to assessing the effects of education on esthetic perception. Pearson Chi-square, Fisher's Exact test and McNemar test were used in the analysis of the results. **Results:** According to the results of the analysis, it was found that the answers of the smile arc before and after the education were statistically significant ($p < 0.05$). Accordingly, the rate of correct answers of women is statistically higher than that of men. A statistically significant difference was found between the responses to the gingival appearance in the smile before and after the education ($p < 0.05$). **Conclusions:** Based on the limited results of this study, professional dental education may affect the esthetic evaluation of smile. There were differences in the esthetic perception of women and men.

Key words: Dental Students, Esthetics, Perception, Prosthodontics, Smile Arc.

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Introduction

Esthetics, which is often used interchangeably with beauty, is a combination of qualities that influences an observer's perception. The attractiveness of a smile can have an effect on social relationships^{1,2}. Esthetic dentistry plays a significant role in the professional practice of dentists as well as in the lives of patients. This is particularly relevant these days because the media

encourages attractiveness in pretty faces and flawless smiles, which are both connected to good health and physical and mental well-being^{3,4}. Since beauty is a highly debatable concept, the esthetic appearance of a patient's smile largely depends on what a clinician characterizes as attractive⁵.

Esthetic smile design is a dynamic process that involves a multidisciplinary approach^{6,7}. Clinicians should evaluate the variables of smile design, such as

dental, gingival, and facial esthetics⁸ because esthetics depends on harmony among these parameters. In an effort to understand the roles of the various circumstances of esthetics in the perception of attractiveness, guidelines for the reconstruction of facial and dental esthetics were developed⁹. The establishment of esthetic parameters may significantly reduce unnecessary treatment and misunderstanding with patients⁵. Therefore, dentists should consider the patient's hopes and expectations during the first visit⁷.

In recent years, research has concentrated on quantifying facial and dental esthetics to improve the quality of prosthodontic, orthodontic, and periodontal treatment. For this reason, clinicians have started to incorporate esthetic parameters into their practices¹⁰. Esthetic parameters, such as buccal corridor, smile line, smile arc, midline shift, angulation of teeth, midline diastema, golden ratio, incisal embrasure, dark triangles, vertical lip thickness, maxillary central incisor symmetry and ratio, tooth angulation, connector space, and contact areas, make up the guidelines that have been developed through various research^{8,11–15}.

Vertical anterior dental disorder is one of the most important aspects of facial and dental esthetics. Therefore, gingival and dental disorders and asymmetries need to be carefully analyzed⁶. A balanced and symmetrical composition of teeth, incisal contact and embrasures, golden ratio, buccal corridors, visible and healthy gingiva, smile arc, and lips is substantial for an esthetic and satisfying smile according to the concepts of visual perception^{8,11–13,16}.

Esthetic perception is a major concern of clinicians¹⁴. Many studies have compared the perspectives of laypersons with those of orthodontists in order to evaluate the parameters of smile esthetics. They concluded that technical preparation and guidance will improve an individual's esthetic perception. Thus, it is necessary to further examine the outcome of undergraduate and postgraduate dental education about the standards of smile esthetics on the perception of beauty and esthetic judgement by clinicians¹⁷.

The aim of this study was to determine the esthetic perceptions of second-grade dental students with respect to golden ratio, buccal corridor, midline shift, incisal embrasure, smile line (lip line), midline diastema, dark triangles, and smile arc in order to evaluate their understanding of smile esthetics before and after esthetic dental training.

Material and Methods

Study population

This cross-sectional study, which was performed in November 2019 at the Faculty of Dentistry, Usak

University, Turkey, included 78 (33 male and 45 female) second-grade dental students. All of the participants provided verbal consent to take part in this study.

Photo manipulation

Figures containing smile components with a 600- pixel resolution were designed using with Adobe Photoshop CS3 (Adobe Systems Inc., San José, CA, USA). The modification included eight smile components, namely the golden ratio (Figure 1), buccal corridor (Figure 2), midline shift (Figure 3), incisal embrasure (Figure 4), smile or lip line (Figure 5), midline diastema (Figure 6), dark triangles (Figure 7), and smile arc (Figure 8). The images were converted to black and white during presentation to prevent the misleading influence of color on the perception of the observers¹⁸.

Figure 1. Ideal esthetic appearance (upper) and (lower) altered golden ratio

Figure 2. Ideal esthetic appearance (upper) and (lower) altered buccal corridor

Figure 3. Ideal esthetic appearance (upper) and (lower) altered midline shift

Figure 4. Ideal esthetic appearance (upper) and (lower) altered incisal embrasure

Figure 5. Ideal esthetic appearance (upper) and altered smile or lip line (lower)

Figure 6. Ideal esthetic appearance (upper) and altered diastema (lower)

Figure 7. Ideal esthetic appearance (upper) and altered dark triangles (lower)

Figure 8. Ideal esthetic appearance (upper) and altered smile arc (lower)

Data collection

The manipulated images were presented in the form of a PowerPoint presentation to the students in their classroom. A total of 16 photographs containing

smile esthetic components were shown. After each slide, the students were asked: "Which of the pictures below is the most esthetic from your perspective?" The participants were asked to state their gender and answer the question about the slides on pre-designed answer sheets. Immediately after receiving their education about smile esthetics, the same photos were shown and the same question was asked again.

Statistical analysis

Data were processed and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25.0 (IBM Corporation, Armonk, NY, USA). Descriptive statistics (frequency and percentage) of the data were obtained for analysis. Pearson's chi-square test was used to examine the relationship between independent categorical data. If the number of samples found in these independent categorical data was insufficient, Fisher's exact test was applied. McNemar inverse sampling was used to examine the differences between the frequencies of dependent categorical data. A p value < 0.05 was considered statistically significant.

Results

There were 78 students in the study, including 45 (55.1%) females and 33 (44.9%) males. No statistically significant differences were found in responses before and after training for golden ratio, buccal corridor, midline shift, incisal embrasure, midline diastema, dark triangles, and smile arc ($p > 0.05$). The only parameter that had a statistically significant difference in responses before and after training was smile or lip line ($p < 0.05$) (Table 1). There was a statistically significant relationship between gender and the answers given to the smile arc question before and after training ($p < 0.05$). Female participants were 5.217 times more likely to answer correctly before training (odds ratio= 5.217) and 3.478 times more likely to answer correctly after training compared to the male participants (Table 2, odds ratio= 3.478).

Table 1. All parameters are seen as correct and incorrect percentages before and after training

			N	%	p*
Golden Ratio	Before Training	Incorrect	33	42.3	0.383
		Correct	45	57.7	
	After Training	Incorrect	28	35.9	
		Correct	50	64.1	
Buccal Corridor	Before Training	Incorrect	28	35.9	0.585
		Correct	50	64.1	
	After Training	Incorrect	32	41.0	
		Correct	46	59.0	
Midline Shift	Before Training	Incorrect	7	9.0	1.000
		Correct	71	91.0	
	After Training	Incorrect	7	9.0	
		Correct	71	91.0	
Incisal Embrasure	Before Training	Incorrect	30	38.5	0.711
		Correct	48	61.5	
	After Training	Incorrect	27	34.6	
		Correct	51	65.4	
Lip Line	Before Training	Incorrect	43	55.1	0.000*
		Correct	35	44.9	
	After Training	Incorrect	20	25.6	
		Correct	58	74.4	
Midline Diastema	Before Training	Incorrect	3	3.8	0.625
		Correct	75	96.2	
	After Training	Incorrect	3	3.8	
		Correct	75	96.2	
Dark Tri-angle	Before Training	Incorrect	0	0.0	0.625
		Correct	78	100.0	
	After Training	Incorrect	0	0.0	
		Correct	78	100.0	
Smile Arc	Before Training	Incorrect	53	67.9	0.625
		Correct	25	32.1	
	After Training	Incorrect	51	65.4	
		Correct	27	34.6	

($p < 0.05$)

Table 2. All parameters are seen as correct and incorrect percentages before and after training according to the gender

			Incorrect	Correct	Test Value	p*
Golden Ratio	Before Training	Female	19 (%54.3)	16 (%45.7)	3.732	0.053
		Male	14 (%32.6)	29 (%67.4)		
	After Training	Female	16 (%45.7)	19 (%54.3)	2.659	0.103
		Male	12 (%27.9)	31 (%72.1)		
Buccal Corridor	Before Training	Female	13 (%37.1)	22 (%62.9)	0.043	0.836
		Male	15 (%34.9)	28 (%65.1)		
	After Training	Female	17 (%48.6)	18 (%51.4)	1.494	0.222
		Male	15 (%34.9)	28 (%65.1)		
Midline Shift	Before Training	Female	4 (%11.4)	31 (%88.6)	-	0.694
		Male	3 (%7.0)	40 (%93.0)		
	After Training	Female	3 (%9.3)	32 (%91.4)	-	1.000
		Male	4 (%9.3)	39 (%90.7)		
Incisal Embrasure	Before Training	Female	17 (%48.6)	18 (%51.4)	2.742	0.098
		Male	13 (%30.2)	30 (%69.8)		
	After Training	Female	13 (%37.1)	22 (%62.9)	0.179	0.672
		Male	14 (%32.6)	29 (%67.4)		
Lip Line	Before Training	Female	19 (%54.3)	16 (%45.7)	0.018	0.893
		Male	24 (%55.8)	19 (%44.2)		
	After Training	Female	8 (%22.9)	27 (%77.1)	0.258	0.611
		Male	12 (%27.9)	31 (%72.1)		
Midline Diastema	Before Training	Female	2 (%5.7)	33 (%94.3)	-	-
		Male	1 (%2.3)	42 (%97.7)		
	After Training	Female	4 (%11.4)	31 (%88.6)	-	-
		Male	1 (%2.3)	42 (%97.7)		
Dark Triangle	Before Training	Female	0 (%0.0)	35 (%100.0)	-	-
		Male	0 (%0.0)	43 (%100.0)		
	After Training	Female	0 (%0.0)	35 (%100.0)	-	-
		Male	0 (%0.0)	43 (%100.0)		
Smile Arc	Before Training	Female	30 (%85.7)	5 (%14.3)	9.201	0.002*
		Male	23 (%53.5)	20 (%46.5)		
	After Training	Female	28 (%80.0)	7 (%20.0)	5.992	0.014*
		Male	23 (%53.5)	20 (%46.5)		

(p<0.05)

Discussion

Society places a strong emphasis on physical appearance, and the smile is a key factor in facial attractiveness. An ideal smile is a feature that can have a significant impact on some aspects of a person's life. This can create professional and social disadvantages for people with unattractive smiles¹⁹. In the past few years, the number of patients requiring cosmetic dental procedures to obtain the perfect smile has greatly increased⁸. To optimize smile esthetics, it is necessary for the modern clinician to appreciate the factors of a smile so that it can be improved^{8,19}. This requires a comprehensive understanding of the complex relationship between the teeth, the gingival scaffold, and the lips⁸.

The architecture of gingival tissue has to be factored in when planning esthetic rehabilitation. The terms “red esthetics” and “pink esthetics” have been used to describe the ideal smiling gingival contour. An ideal smile arc has a slight contouring of the lower lip by the maxillary incisal edges¹². The smile arc can be classified as convex, curved, consonant, or deep plate-shaped, among others^{12,16}. Yin *et al.* reported that young adults' smile esthetic perceptions were also significant and affected by gender and psychiatric personality traits²⁰. In conformity with this study, there was a statistically significant relationship between gender and the answers given to the smile arc question before and after training ($p < 0.05$). Female students had a 5.217-fold higher likelihood of choosing the ideal smile arc before training and a 3.478-fold higher likelihood of answering correctly after training.

The appearance of the gums and teeth during smiling, the skeletal shape, and the length and mobility of the upper lip affect the size and position of the anterior maxillary teeth. According to the literature, the smile line (lip line) is classified as low, medium, and high⁸. When there is a high lip line, a large part of the soft tissue that extends from the lower edge of the upper lip to the gingiva is apparent, which gives the appearance of what is called a gummy smile⁸. According to previous research, gum appearance alone is not the most critical esthetic factor; however, teeth and lips arranged according to this soft tissue may cause esthetic anxiety. The components of the smile that lie within the boundaries of the lip line should be arranged to be balanced and harmonious²¹.

Pausch *et al.* noted that when there is none or very little maxillary teeth apparent during smiling, which is typically seen in elderly persons, the appearance is the very unattractive²². Cracel-Nogueira *et al.* determined that the medium smile was the most admired smile, while the high smile was deemed the least esthetically appealing¹¹. Sadrhaghghi *et al.* reported that education can affect the perception and assessment of smile components by observers¹⁷. In this study, the only question that had a statistically significant difference in responses before and after training was the smile or lip line question ($p <$

0.05). Thirty-five students preferred the ideal gum view before training, while 58 participants did after training. Along with the training, students' awareness of gingival appearance increased.

Dark triangles play a key role in esthetic perception. Periodontitis, root angulation, improper dental treatment, and interproximal contact are the factors that cause dark triangles to form²³. In this study, all dental students decided that dark triangles were not attractive.

A practical approach to positioning the midline of the facial references uses two anatomical landmarks. The first point is the nasion between the brows. The second is the philtrum base, which is also called “cupid's bow”, in the upper lip center. A line drawn between these landmarks not only delineates the facial midline location but also defines the midline direction²⁴. The midline between the maxillary central incisors should be coincidental with the midline of the nose whenever possible^{24,25}. According to various studies, midline shift was the least noticeable component of an ideal smile^{11,12}. However, in the current study, 91.0% of students did not find the midline shift attractive.

The midline diastema in the esthetic zone has been widely discussed in the literature. According to Machado, the diastemas are unesthetic, and all dental diastemas should be closed. Also, the size of the diastema and its proximity to the midline are inversely proportional to esthetic appeal¹². Nogueira *et al.* reported that dental diastemas were considered unesthetic by both laypersons and clinicians, especially among young people¹¹. Similarly, in this study, 96.2% of students did not find the midline diastema esthetically appealing.

Buccal corridors are defined as the area between the posterior teeth and the commissura when the patient is smiling^{12,26}. According to Machado, the buccal corridor is not a significant factor in smile esthetics¹². Moore *et al.* reported that there was no significant difference between perception of the buccal corridor and gender²⁷. In this study, there was no statistically significant difference between the buccal corridor before and after training or with respect to gender.

Incisal embrasure is an important feature to improve esthetics and give a younger look to the smile¹². Incisal embrasure areas are approximately in an inverse “V” shape, and as they move away from the midline, their size and volume increase⁸. Foulger *et al.* found that a lack of space for incisal embrasure has a negative effect on smile esthetics²⁸. Parekh *et al.* reported that the majority of participants favored natural embrasures²⁹. However, in this study, there was no statistically significant difference in responses to the incisal embrasure question before and after training, and there was no correlation between the incisal embrasure question and gender.

Several studies have reported guidelines regarding anterior esthetics in order to achieve excellent results. The “Golden Proportion” value is one of the most significant guidelines³⁰. However, in the present study, there was

no statistically significant difference in responses to the golden ratio question before and after training. The latter observation is consistent with the findings of Kokich *et al.* who found that symmetrical narrow lateral incisors may be acceptable in some situations¹³.

One of the main limitations of this study is that it only included second-grade dental students. Therefore, the participant population may need to be increased for future studies. Also, only eight smile esthetic components were studied, which may need to be increased in the future. Another limitation is that between¹⁶ images were presented to students at once in a single classroom. This could skew the responses of the students based on their location in the classroom. Based on the location of the screen, students at the front, sides, and rear may not have had similar vantage points.

Conclusions

Based on the limited results of this study, professional education may affect dental students' overall perception when evaluating smile esthetics. There was a difference in esthetic perception between males and females. Female dental students had better awareness of the smile arc component of smile esthetics. Successful esthetic results can be achieved by clinicians when they know and apply guidelines and pay attention to the components of smile esthetics. Therefore, dental students should learn these factors during their professional education.

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