Correlation of Dentolabial and Facial Analyses with Aesthetic Perception

Estetik Algının Dentolabial ve Fasiyal Analizler ile Korelasyonu

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ABSTRACT

Objective: It may be necessary to systematically apply objective, measurable and repeatable rules for physicians to provide an aesthetic smile in patients and for evaluations. The aim of this study was to evaluate the consistency of the aesthetic perception of physicians with the results of objective dentolabial and facial analyses and the state of being affected by professional experience.
Methods: In the current study 4 prosthodontists, 4 research assistants and 4 intern dentists were determined as observer and they were asked to evaluate the full face and smile photographs taken from 100 volunteers in the context of 6 criteria for aesthetics. The relevant photographs were analyzed objectively in digital environment, taking into account the values determined as reference with the support of the literature. Statistically, the comparisons between subjective results of the observers and the objective reference values were determined with Cohen's Kappa test; consistency between observers were with Fleiss Kappa statistic; the comparisons of facial and dentolabial esthetic perceptions were made by Chi-square test.
Results: The results obtained by the subjective perceptions of all observers and the objective results of computer measurements were not completely compatible with each other statistically, but a great deal of agreement was achieved. The harmony of aesthetic perception with objective results was not affected by increasing professional experience and no difference was observed between the observer groups.
Conclusion: Examining not only the mouth but also the whole face analysis results in aesthetic evaluations has the potential to positively affect the success of the treatment.

Keywords: Dental Esthetics, Dentists, Face, Perception, Smile

ÖZ

Amaç: Hekimlerin hastalarda estetik bir gülümseme sağlaması ve yapılacak değerlendirmeler için nesnel, ölçülebilir ve tekrar edilebilir kuralların sistematik bir şekilde uygulanması gerekebilmektedir. Bu çalışmanın amacı, hekimlerin estetik algılarının; objektif dentolabial ve fasiyal analiz sonuçları ile olan uyumu ve mesleki tecrübeden etkilenme durumunun değerlendirilmesidir.
Yöntemler: Bu çalışmada 4 protez uzmanı, 4 protez bölümü uzmanlık öğrencisi ve 4 stajyer diş hekimi değerlendirici olarak belirlenmiş ve kendilerinden fasiyal/ dentolabial estetik değerlendirmeler için, 100 adet gönüllüden alınmış tam yüz ve gülümseme fotoğraflarını, estetik olup olmadığı yönünde 6 kriter bağlamında değerlendirmeleri istenmiştir. İlgili fotoğraflar, referans olarak belirlenen değerler göz önüne alınarak objektif olarak, dijital ortamda da incelenmiştir. İstatistiksel olarak, değerlendiricilerin subjektif sonuçları ve bu objektif referans değerler arası karşılaştırmalar Cohen's Kappa testi; değerlendiriciler arasındaki uyum Fleiss Kappa istatistiği; fasiyal ve dentolabial estetik algı değerlendirme karşılaştırmaları ise Ki-kare testi ile yapılmıştır.
Bulgular: Bütün değerlendiricilerin subjektif algılarıyla ortaya çıkan sonuçlar ile bilgisayar ölçümlerinin objektif sonuçları arasında istatistiksel olarak tamamen birbiriyle uyumlu veriler olmadığı fakat büyük oranda uyum yakalandığı gözlenmiştir. Estetik algının objektif sonuçlarla olan uyumu artan mesleki tecrübeden etkilenmemiş ve değerlendirici grupları arasında fark görülmemiştir.
Sonuç: Estetik değerlendirmelerde sadece ağız bölgesinin değil tüm yüz analiz sonuçlarının irdelenmesi, tedavi başarısını olumlu yönde etkileme potansiyeline sahiptir.

Anahtar Kelimeler: Algı, Dental estetik, Diş Hekimleri, Gülümseme, Yüz

INTRODUCTION

The word "aesthetics" derives from the Greek word "aesthesia", which means "feeling" or "state of feeling". The term aesthetics is a term that many researchers have been discussing and working on for many years. However, the framework of this expression, which is frequently used throughout history, has not been fully drawn.[1,2]

Aesthetic approaches in dentistry cover many issues such as tooth size, tooth surface features, vertical dimension, the position of the teeth in the mouth and the dental arch, smile line, gingival visibility, and the compatibility of the restoration with the patient's overall face and skin color. The teeth and mouth are complementary parts that are of great importance in the interpretation of facial aesthetics.[3,4] A physician who is knowledgeable and equipped about the main criteria of the smile can perceive the various relationships between dental, gingival, and lips, and can prepare and present the aesthetic treatment in an ideal form based on the references to facial analysis in the literature and accordance with the patient's request.[5,6]

Vertical and horizontal reference lines evaluated within the scope of facial analysis can be used to analyze the individual characteristics of the person and to determine the ideal position and proportions of the teeth in accordance with the face.[7,8] The use of facade/profile photographs, video recordings, and cephalometric criteria in addition to clinical evaluations will be useful in facial analysis evaluations. Within the scope of dentolabial analysis, determination of the incisal slope and profile appearance of the incisal edges of the teeth, and evaluation of parameters such as incisor slope and smile line are important in the aesthetic approach.

Although the perception of beauty and aesthetics is subjective, some universal provisions reveal true, real, and objective criteria for what is pleasing to the human eye. The basic universal standards mentioned above can provide physicians with the opportunity to conduct scientific, quantitative, and satisfactory studies that will increase the quality of aesthetic treatment.[9] In many aesthetic studies, it has been stated that aesthetics is developed with ratio-proportion mathematical formulas. It has been shown that objective, measurable and repeatable rules can be systematically applied for the development and evaluation of aesthetics.[10]

The aim of this study was to evaluate the compliance of subjective aesthetic perception results obtained by evaluating smile and frontal facial photographs of physicians with different professional experiences with objective dentolabial and facial analysis results from the literature and to evaluate the effect of professional experience.

METHODS

This study was approved by the Clinical Research Ethics Committee of Zonguldak Bülent Ecevit University with protocol number 2020/04 on 19/02/2020 and was conducted in accordance with the principles of the World Medical Association Declaration of Helsinki.

The current study was conducted with smile and frontal face photographs taken from 100 volunteers. The volunteers were informed about the purpose and procedure of the study and the use and purpose of the photographs to be obtained from them, their verbal and written consent was obtained, and then minimum informed consent forms were obtained. Volunteers who were aged 18 years and over, had good oral care, had no restorative treatment applied to their upper anterior teeth, did not have a smoking habit, and did not have any facial defect caused by any disease, syndrome, or trauma-related injury were included in the study. Subjects who had previously undergone orthodontic treatment, had the active gingival disease, had problems such as herpes, and acne that could change the aesthetic perception, and had tattoos, piercings, etc. on the face were not included in the study.

Within the scope of the study, one frontal face and mouth area smile pose photographs were taken from each volunteer. All photographs were taken by the same researcher (Z.A.) using the same camera (Canon EOS 7D Mark II), macro lens (Canon EF 100 mm f/2.8L Macro IS USM), twin flash (Canon Macro Twin Lite MT-24EX) and tripod (Weifeng WT 3770). Attention was paid to ensuring that the head of the volunteers participating in the study and the height of the camera from the ground was at the same level and that the same position was set for each person in each shot to ensure that the photographs were of a certain standard. Indoor areas were preferred during the photo shoots and the shoots were completed in the manual option with shutter speed of 1/125, F32, and ISO 200. The volunteer individuals who participated in the photo shoot did not have excessive make-up that could change the aesthetic perception. The photographs were numbered from 1 to 200 to be presented to the observers.

In the study, the observers were named from d1 to d12, while the reference objective computer program evaluation was named d13. Four specialist dentists (d1-d4) from the Department of Prosthodontics, four research assistants who were in the process of specialty training in the Department of Prosthodontics (d5-d8), and four dental interns (d9-d12) were assigned as observers. These observers, where gender differences were ignored, were instructed to evaluate the facial analysis criteria of interpupillary line-to-smile line parallelism (K1), the ratio of lower-middle-upper 1/3 of the face (K2), facial midline (K3) and dentolabial analysis criteria of incisor slope-to-lower lip parallelism (K4), smile line (K5), midline factors (K6) in terms of aesthetics. Literature-based objective reference analyses of all photographs in the study were conducted using Adobe Photoshop CC 2017 (San Jose, CA, USA). In this regard, in facial analysis evaluations;

✓ While examining the parallelism of the interpupillary plane-commissure line, straight lines passing through the center of the eyes and the corners of the lips were drawn and the parallelism of these two lines was examined.

✓ In the facial midline-dentolabial midline conformity examination, a straight line was drawn through the glabella, nasal tip, philtrum, and chin tip, and the midline of the central incisors was drawn. The coincidence of these two straight lines with each other was examined.

✓ While examining the ratio of the lower-middle-upper 1/3 of the face, the face was divided into three parts horizontally from the scalp line, eyebrows, nose wings, and chin tip, and the conformity between the widths of these three parts was examined.

Within the scope of dentolabial analysis evaluations;

✓ During the smile line examination, two lines were drawn through the incisive edges of the upper jaw teeth and the lower line of the upper lip, and the visibility of the teeth and gums between these borders was examined.

✓ During the midline examination, the midline of the face was determined with a line extending from the tip of the nose to the philtrum; the midline of the teeth was determined with a line extending from the middle of the two central incisors, and the space between these two lines was measured with a guide ruler created in the Photoshop program.

✓ During the examination of incisor inclination and lower lip parallelism, two lines were drawn through the incisal edges of the maxillary teeth and the upper line of the lower lip and the parallelism of these two lines was evaluated.

The data obtained from a total of 12 observers and the reference objective computer program evaluation were analyzed with IBM SPSS V23 (SPSS Inc., Chicago, IL, USA). Cohen's Kappa test was used to examine the conformity between each observer and the results of computer evaluation, Fleiss Kappa statistics were used to examine the conformity between more than two observers in categorical variables,

and the Chi-square test was used to compare categorical variables according to groups. The results of the analysis are presented as frequencies (percentages) for categorical variables and values of $P < .05$ are considered significant.

RESULTS

According to the results of Cohen's Kappa test used to examine the conformity between the observers and the results of the reference objective computer program evaluation;

The findings of the Interpupillary Plane-Comissura Line Parallelism Criterion (K1) showed statistically significant conformity between the reference objective computer evaluation (d13) and the d1 and d3 observers ($P < .05$). There was no statistically significant conformity between the computer evaluation and the other observers ($P > .05$) (Table 1). According to the findings of the Lower-Middle-Upper 1/3 of the Face Ratio Criterion (K2), there was statistically significant conformity between the computer evaluation and the d1, d3, d7, d8, d10 and d11 observers ($P < .05$) (Table 2). The findings for the Facial Midline in the Frontal Photograph Criterion (K3) showed statistically significant conformity between the computer evaluation and all observers except d7 ($P < .05$) (Table 3).

Table 1. Examining the compatibility between the computer (d13) and observers for the interpupillary plane – smile line parallelism criterion (K1).

	Not aesthetic	Aesthetic	Total	Cohen's Kappa Value	P
K1_d1					
Not aesthetic	16 (80)	35 (43.8)	51 (51)	0.229	**.004**
Aesthetic	4 (20)	45 (56.3)	49 (49)		
K1 d2					
Not aesthetic	12 (60)	31 (38.8)	43 (43)	0.148	.086
Aesthetic	8 (40)	49 (61.3)	57 (57)		
K1 d3					
Not aesthetic	5 (25)	2 (2.5)	7 (7)	0.298	**.001**
Aesthetic	15 (75)	78 (97.5)	93 (93)		
K1_d4					
Not aesthetic	8 (40)	32 (40)	40 (40)	<0.001	1.000
Aesthetic	12 (60)	48 (60)	60 (60)		
K1 d5					
Not aesthetic	10 (50)	29 (36.3)	39 (39)	0.101	.259
Aesthetic	10 (50)	51 (63.7)	61 (61)		
K1 d6					
Not aesthetic	11 (55)	32 (40)	43 (43)	0.105	.226
Aesthetic	9 (45)	48 (60)	57 (57)		
K1 d7					
Not aesthetic	10 (50)	38 (47.5)	48 (48)	0.016	.841
Aesthetic	10 (50)	42 (52.5)	52 (52)		
K1_d8					
Not aesthetic	12 (60)	37 (46.3)	49 (49)	0.089	.271
Aesthetic	8 (40)	43 (53.8)	51 (51)		
K1 d9					
Not aesthetic	11 (55)	28 (35)	39 (39)	0.147	.101
Aesthetic	9 (45)	52 (65)	61 (61)		
K1_d10					
Not aesthetic	13 (65)	33 (41.3)	46 (46)	0.160	.057
Aesthetic	7 (35)	47 (58.8)	54 (54)		
K1 d11					
Not aesthetic	14 (70)	58 (72.5)	72 (72)	-0.013	.824
Aesthetic	6 (30)	22 (27.5)	28 (28)		
K1 d12					
Not aesthetic	19 (95)	63 (78.8)	82 (82)	0.075	.091
Aesthetic	1 (5)	17 (21.3)	18 (18)		

*$P < .05$ indicates statistically significant conformity. Categorical data are shown as frequency (percentage).

According to the findings of the Incisor Inclination and Lower Lip Parallelism Criterion (K4), there is statistically significant conformity between the computer evaluation and the d7 and d10 observers ($P < .05$). There was no statistically significant conformity with the other observer groups ($P > .05$) (Table 4). The findings for the Smile Line Criterion (K5) showed statistically significant conformity between the computer evaluation and all observers except d12 ($P < .05$) (Table 5). According to the findings for the Midline Criterion in the Smile Photograph (K6), there was no statistically significant conformity between the computer evalua-

tion and observers d2, d4, d10, and d12 ($P > .05$), while the conformity with all other observers was statistically significant ($P < .05$) (Table 6).

Table 2. Examining the compatibility between the computer (d13) and observers for the ratio of lower middle-upper 1/3 of the face (K2).

	Not aesthetic	Aesthetic	Total	Cohen's Kappa Value	P
K2_d1					
Not aesthetic	22 (57.9)	20 (32.3)	42 (42)	0.251	**.012**
Aesthetic	16 (42.1)	42 (67.7)	58 (58)		
K2 d2					
Not aesthetic	17 (44.7)	23 (37.1)	40 (40)	0.076	.449
Aesthetic	21 (55.3)	39 (62.9)	60 (60)		
K2 d3					
Not aesthetic	27 (71.1)	19 (30.6)	46 (46)	0.388	**< .001**
Aesthetic	11 (28.9)	43 (69.4)	54 (54)		
K2 d4					
Not aesthetic	1 (2.6)	0 (0)	1 (1)	0.032	.199
Aesthetic	37 (97.4)	62 (100)	99 (99)		
K2 d5					
Not aesthetic	14 (36.8)	12 (19.4)	26 (26)	0.186	.053
Aesthetic	24 (63.2)	50 (80.6)	74 (74)		
K2 d6					
Not aesthetic	20 (52.6)	23 (37.1)	43 (43)	0.151	.128
Aesthetic	18 (47.4)	39 (62.9)	57 (57)		
K2 d7					
Not aesthetic	11 (28.9)	4 (6.5)	15 (15)	0.255	**.002**
Aesthetic	27 (71.1)	58 (93.5)	85 (85)		
K2 d8					
Not aesthetic	24 (63.2)	14 (22.6)	38 (38)	0.406	**< .001**
Aesthetic	14 (36.8)	48 (77.4)	62 (62)		
K2 d9					
Not aesthetic	17 (44.7)	17 (27.4)	34 (34)	0.177	.076
Aesthetic	21 (55.3)	45 (72.6)	66 (66)		
K2 d10					
Not aesthetic	20 (52.6)	20 (32.3)	40 (40)	0.202	**.044**
Aesthetic	18 (47.4)	42 (67.7)	60 (60)		
K2_d11					
Not aesthetic	21 (55,.)	12 (19.4)	33 (33)	0.368	**< .001**
Aesthetic	17 (44.7)	50 (80.6)	67 (67)		
K2 d12					
Not aesthetic	32 (84.2)	47 (75.8)	79 (79)	0.070	.317
Aesthetic	6 (15.8)	15 (24.2)	21 (21)		

*$P < .05$ indicates statistically significant conformity. Categorical data are shown as frequency (percentage).

Table 3. Examining the compatibility between the computer (d13) and the observers for the facial midline (K3) criterion in the face photograph.

	Not aesthetic	Aesthetic	Total	Cohen's Kappa Value	P
K3_d1					
Not aesthetic	20 (58.8)	17 (25.8)	37 (37)	0.324	**.001**
Aesthetic	14 (41.2)	49 (74.2)	63 (63)		
K3 d2					
Not aesthetic	18 (52.9)	13 (19.7)	31 (31)	0.340	**.001**
Aesthetic	16 (47.1)	53 (80.3)	69 (69)		
K3 d3					
Not aesthetic	7 (20.6)	3 (4.5)	10 (10)	0.194	**.011**
Aesthetic	27 (79.4)	63 (95.5)	90 (90)		
K3_d4					
Not aesthetic	7 (20.6)	2 (3)	9 (9)	0.214	**.004**
Aesthetic	27 (79.4)	64 (97)	91 (91)		
K3 d5					
Not aesthetic	25 (73.5)	35 (53)	60 (60)	0.173	**.047**
Aesthetic	9 (26.5)	31 (47)	40 (40)		
K3 d6					
Not aesthetic	23 (67.6)	25 (37.9)	48 (48)	0.271	**.005**
Aesthetic	11 (32.4)	41 (62.1)	52 (52)		
K3_d7					
Not aesthetic	14 (41.2)	17 (25.8)	31 (31)	0.158	.114
Aesthetic	20 (58.8)	49 (74.2)	69 (69)		
K3 d8					
Not aesthetic	14 (41.2)	15 (22.7)	29 (29)	0.191	.054
Aesthetic	20 (58.8)	51 (77.3)	71 (71)		
K3 d9					
Not aesthetic	11 (32.4)	12 (18.2)	23 (23)	0.154	.111
Aesthetic	23 (67.6)	54 (81.8)	77 (77)		
K3_d10					
Not aesthetic	19 (55.9)	30 (45.5)	49 (49)	0.094	.323
Aesthetic	15 (44.1)	36 (54.5)	51 (51)		
K3_d11					
Not aesthetic	22 (64.7)	24 (36.4)	46 (46)	0.261	**.007**
Aesthetic	12 (35.3)	42 (63.6)	54 (54)		
K3_d12					
Not aesthetic	28 (82.4)	50 (75.8)	78 (78)	0.050	.451
Aesthetic	6 (17.6)	16 (24.2)	22 (22)		

*$P < .05$ indicates statistically significant conformity. Categorical data are shown as frequency (percentage).

Table 4. Examination of the compatibility between the computer (d13) and the observers for the incisor slope and lower lip parallelism criterion (K4).

	Not aesthetic	Aesthetic	Total	Cohen's Kappa Value	P
K4 d1					
Not aesthetic	22 (75.9)	41 (57.7)	63 (63)	0.135	.089
Aesthetic	7 (24.1)	30 (42.3)	37 (37)		
K4 d2					
Not aesthetic	17 (58.6)	33 (46.5)	50 (50)	0.100	.271
Aesthetic	12 (41.4)	38 (53.5)	50 (50)		
K4 d3					
Not aesthetic	25 (86.2)	48 (67.6)	73 (73)	0.128	.057
Aesthetic	4 (13.8)	23 (32.4)	27 (27)		
K4 d4					
Not aesthetic	14 (48.3)	28 (39.4)	42 (42)	0.078	.416
Aesthetic	15 (51.7)	43 (60.6)	58 (58)		
K4 d5					
Not aesthetic	25 (86.2)	53 (74.6)	78 (78)	0.077	.205
Aesthetic	4 (13.8)	18 (25.4)	22 (22)		
K4 d6					
Not aesthetic	22 (75.9)	44 (62)	66 (66)	0.101	.183
Aesthetic	7 (24.1)	27 (38)	34 (34)		
K4 d7					
Not aesthetic	15 (51.7)	15 (21.1)	30 (30)	0.303	**.002**
Aesthetic	14 (48.3)	56 (78.9)	70 (70)		
K4 d8					
Not aesthetic	22 (75.9)	40 (56.3)	62 (62)	0.146	.068
Aesthetic	7 (24.1)	31 (43.7)	38 (38)		
K4 d9					
Not aesthetic	18 (62.1)	31 (43.7)	49 (49)	0.153	.095
Aesthetic	11 (37.9)	40 (56.3)	51 (51)		
K4 d10					
Not aesthetic	20 (69)	23 (32.4)	43 (43)	0.320	**.001**
Aesthetic	9 (31)	48 (67.6)	57 (57)		
K4 d11					
Not aesthetic	21 (72.4)	42 (59.2)	63 (63)	0.098	.213
Aesthetic	8 (27.6)	29 (40.8)	37 (37)		
K4 d12					
Not aesthetic	27 (93.1)	63 (88.7)	90 (90)	0.027	.509
Aesthetic	2 (6.9)	8 (11.3)	10 (10)		

*P < .05 indicates statistically significant conformity. Categorical data are shown as frequency (percentage).

Table 5. Examining the compatibility between the computer (d13) and the observers for the smile line criterion (K5).

	Not aesthetic	Aesthetic	Total	Cohen's Kappa Value	P
K5_d1					
Not aesthetic	28 (90.3)	32 (46.4)	60 (60)	0.349	**< .001**
Aesthetic	3 (9.7)	37 (53.6)	40 (40)		
K5 d2					
Not aesthetic	26 (83.9)	36 (52.2)	62 (62)	0.249	**.003**
Aesthetic	5 (16.1)	33 (47.8)	38 (38)		
K5 d3					
Not aesthetic	31 (100)	46 (66.7)	77 (77)	0.237	**< .001**
Aesthetic	0 (0)	23 (33.3)	23 (23)		
K5 d4					
Not aesthetic	27 (87.1)	23 (33.3)	50 (50)	0.460	**< .001**
Aesthetic	4 (12.9)	46 (66.7)	50 (50)		
K5 d5					
Not aesthetic	31 (100)	43 (62.3)	74 (74)	0.273	**< .001**
Aesthetic	0 (0)	26 (37.7)	26 (26)		
K 5d6					
Not aesthetic	30 (96.8)	43 (62.3)	73 (73)	0.251	**< .001**
Aesthetic	1 (3.2)	26 (37.7)	27 (27)		
K5_d7					
Not aesthetic	22 (71)	20 (29)	42 (42)	0.382	**< .001**
Aesthetic	9 (29)	49 (71)	58 (58)		
K5 d8					
Not aesthetic	30 (96.8)	22 (31.9)	52 (52)	0.547	**< .001**
Aesthetic	1 (3.2)	47 (68.1)	48 (48)		
K5 d9					
Not aesthetic	19 (61.3)	12 (17.4)	31 (31)	0.439	**< .001**
Aesthetic	12 (38.7)	57 (82.6)	69 (69)		
K5 d10					
Not aesthetic	24 (77.4)	31 (44.9)	55 (55)	0.268	**.003**
Aesthetic	7 (22.6)	38 (55.1)	45 (45)		
K5 d11					
Not aesthetic	28 (90.3)	36 (52.2)	64 (64)	0.295	**< .001**
Aesthetic	3 (9.7)	33 (47.8)	36 (36)		
K5 d12					
Not aesthetic	26 (83.9)	56 (81.2)	82 (82)	0.019	.744
Aesthetic	5 (16.1)	13 (18.8)	18 (18)		

*P < .05 indicates statistically significant conformity. Categorical data are shown as frequency (percentage).

Table 6. Examining the compatibility between the computer (d13) and the observers for the midline criterion (K6) in the smile photographs.

	Not aesthetic	Aesthetic	Total	Cohen's Kappa Value	P
K6_d1					
Not aesthetic	15 (53.6)	22 (30.6)	37 (37)	0.210	**.032**
Aesthetic	13 (46.4)	50 (69.4)	63 (63)		
K6 d2					
Not aesthetic	12 (42.9)	18 (25)	30 (30)	0.175	.080
Aesthetic	16 (57.1)	54 (75)	70 (70)		
K6 d3					
Not aesthetic	11 (39.3)	12 (16.7)	23 (23)	0.239	**.016**
Aesthetic	17 (60.7)	60 (83.3)	77 (77)		
K6 d4					
Not aesthetic	7 (25)	9 (12.5)	16 (16)	0.144	.126
Aesthetic	21 (75)	63 (87.5)	84 (84)		
K6 d5					
Not aesthetic	20 (71.4)	34 (47.2)	54 (54)	0.189	**.029**
Aesthetic	8 (28.6)	38 (52.8)	46 (46)		
K6 d6					
Not aesthetic	20 (71.4)	27 (37.5)	47 (47)	0.281	**.002**
Aesthetic	8 (28.6)	45 (62.5)	53 (53)		
K6 d7					
Not aesthetic	21 (75)	18 (25)	39 (39)	0.446	**< .001**
Aesthetic	7 (25)	54 (75)	61 (61)		
K6 d8					
Not aesthetic	12 (42.9)	14 (19.4)	26 (26)	0.239	**.017**
Aesthetic	16 (57.1)	58 (80.6)	74 (74)		
K6 d9					
Not aesthetic	13 (46.4)	17 (23.6)	30 (30)	0.223	**.025**
Aesthetic	15 (53.6)	55 (76.4)	70 (70)		
K6_d10					
Not aesthetic	13 (46.4)	25 (34.7)	38 (38)	0.106	.279
Aesthetic	15 (53.6)	47 (65.3)	62 (62)		
K6_d11					
Not aesthetic	14 (50)	20 (27.8)	34 (34)	0.209	**.035**
Aesthetic	14 (50)	52 (72.2)	66 (66)		
K6_d12					
Not aesthetic	23 (82.1)	62 (86.1)	85 (85)	-0.024	.618
Aesthetic	5 (17.9)	10 (13.9)	5 (15)		

*P < .05 indicates statistically significant conformity. Categorical data are shown as frequency (percentage).

Table 7. Comparison of the general evaluation results of smile photos (K8) according to the criteria of finding or not finding the face photo aesthetic (K7).

	General evaluation in smile photographs (K8)	General evaluation in frontal face photographs (K7)		Test statistic	P
		Not aesthetic	Aesthetic		
Prosthodontists	Not aesthetic	84 (79.2)	143 (48.6)	χ^2=29.734	**< .001**
	Aesthetic	22 (20.8)	151 (51.4)		
Research Assistants	Not aesthetic	161 (81.3)	88 (43.6)	χ^2=60.633	**< .001**
	Aesthetic	37 (18.7)	114 (56.4)		
Dental Interns	Not aesthetic	149 (74.5)	66 (33)	χ^2=69.28	**< .001**
	Aesthetic	51 (25.5)	134 (67)		

χ^2:Chi-square test. *P < .05 indicates statistically significant difference.
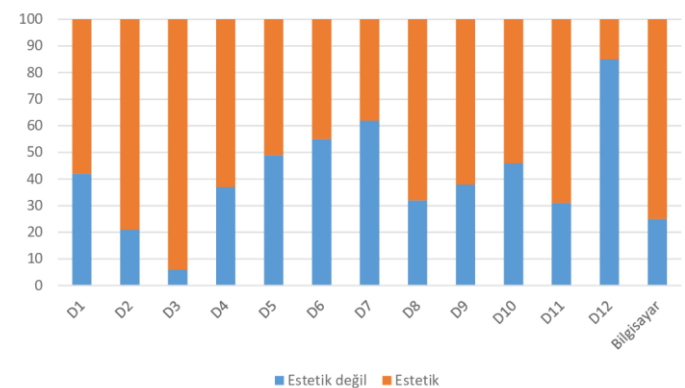

Figure 1. Frequency distribution graph of the observers in terms of the general evaluation (K7) criterion in the facade photographs.
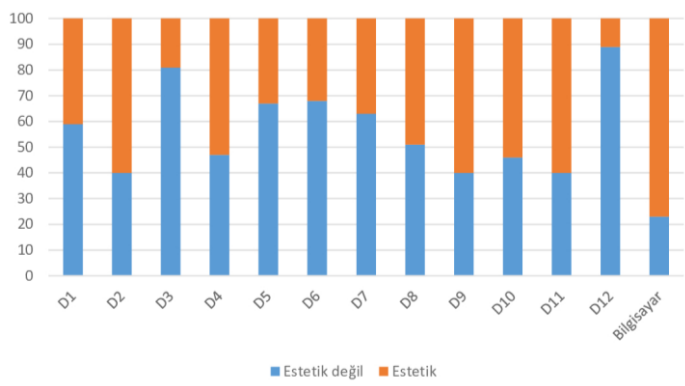
Figure 2. Frequency distribution graph of the observers in terms of the general evaluation (K8) criterion in smile photos

When the statistical findings are fully considered and the facial and dentolabial analysis criteria used in the study are examined, it was found that the observer groups were in statistical conformity with each other in subjective perception in all facial and dentolabial analysis criteria (P < .001), and the Fleiss Kappa analysis results revealed that the prosthodontist, research assistant and intern dentists' assessments were in conformity with the computer objective evaluations in all facial analyses and in all dentolabial analyses except for the midline criterion (K6). In criterion K6, the evaluations of the dental interns did not show conformity with the evaluation of the reference computer program.

According to the findings of Fleiss Kappa analysis, a statistically significant difference (P < .001) was observed in the evaluations of prosthodontists (d1-d4), research assistants (d5-d8) and dental interns (d8-d12) when the data of the general evaluation criterion in frontal face photographs (K7) and general evaluation criterion in smile photographs (K8) were analyzed (Table 7). 79.2% of prosthodontists, 81.3% of research assistants, and 75% of interns who evaluated "not aesthetic" in the general evaluation of facial photographs also evaluated "not aesthetic" in the general evaluation of smile photographs (Figures 1, 2).

DISCUSSION

The concept of aesthetics has a subjectivity that is not absolute. Dental treatment applications that are compatible with the basic knowledge of aesthetics and provide a near-natural appearance are an effective method to improve the relationship between the patient and the physician in terms of both aesthetic appearance and psychosocial status. While the perception of beauty can be determined by social, cultural, environmental and personal choices, it has been observed in studies on facial aesthetics and dental aesthetics that physicians have different opinions and views.[11,12]

Today, studies on aesthetic analysis mostly utilize intraoral images, photographic records, models obtained from patients, and cephalometric radiograph records.[13,14] Many studies have used fixed facade photographic records and video records for aesthetic evaluation.[15,16] Studies have concluded that facade images are more successful than profile photographs.[17] Pose smile and smile analysis are also utilized for aesthetic analysis and evaluations in the field of dentistry.[18] When taking a clinical facial photograph, it is critical that the individual is in a natural head position and the head is perpendicular to the ground.[19] In this context, in our study, attention was paid to the fact that the volunteer participants were in a natural head position while taking the photograph.

In accordance with aesthetic principles and within the scope of the facial horizontal perspective, the parallelism of the interpupillary and commissural lines contributes to attractiveness. The perception of aesthetic attractiveness increases with the compliance of these lines.[20] Arnett et al.[21] stated that the horizontal lines passing through the interpupillary and commissures should be parallel to each other, and this should be taken into consideration in aesthetic treatment planning. In this regard, in our study, the interpupillary line-commissure line parallelism was examined on the computer program and the face photographs that were parallel were considered aesthetic. However, according to our study results, except for two prosthodontists, the other observers could not achieve compliance with the objective results.

In our study, within the scope of facial analysis in the frontal photographs of the volunteer participants, the ratios formed by the horizontal lines passing through the hairline, the nasal base and the lowest part of the lower jaw were evaluated in accordance with the working principles of Rifkin[13] and Sarver et al.[22] and results compatible with the reference values were obtained in a similar number of people in the observer groups in the context of professional experience.

In the analysis of midline deviation, which we examined under the sub-heading of facial analysis in our study, all specialist dentists, 50% of research assistants and 25% of intern dentists achieved compliance with the objective results of the reference values we determined by accepting midline differences of less than 4 mm as aesthetic based on the literature information. Previous studies have concluded that dentists and general dental practitioners are more attentive in detecting midline deviations than non-professional observers.[23] Silva et al.[24] stated that 2 mm is the threshold limit for changes in the midline, while Kokich et al.[25] reported that midline deviations from 1 mm to 4 mm are considered aesthetic by orthodontic dentists, in their study including orthodontic specialists, general practitioner dentists, and non-professionals.

Aesthetic perception in men and women varies depending on life experience, the environment and cultural values. At the same time, the diversity of aesthetic perception is also noticeable in dentists who are particularly interested in facial and oral aesthetics and in people who are not included in this professional group.[26] When the literature is examined, it is observed that different analyses are made in studies on aesthetics. When the subjects studied in recent years were examined, it was observed that the effects of an aesthetic dentition on psychosocial and self-esteem, the psychological consequences of smiling on aesthetics, the relationship between dental beauty and standard of living, and the relationship between dental beauty and self-esteem were emphasized.[27,28]

Smiling has an important place in nonverbal communication, based on the individual's place in society and self-confidence. A beautiful smile, which is present in social life today, contributes positively to the perception of beauty and communication in daily relationships.[29] When the literature is examined, it is observed that the number of smile evaluations in clinical research is scarce. In some studies, focusing on the mouth and its surroundings, only the smile was evaluated.[25,30] In some other studies, the smile line, buccal corridor, smile arc, tooth, facial midline, occlusal plane, and the midline of the teeth of both jaws were evaluated.[30,31] In our study, smile line, midline, and incisor inclination-lower lip parallelism analyses were examined considering previous literature studies. Previous studies indicate that images with a parallelism between the arc formed by the upper border of the lower lip and the arc drawn by the incisal edges of the upper incisors are more appreciated and expressed aesthetically.[32] Most of the individuals who apply to the clinic with aesthetic needs expect the flattened incisal edges of their natural teeth that have emerged over the years and desire to maintain the same situation at the end of their new treatment.

However, an experienced clinician should explain to the patient in light of the literature that the parallelism of the incisors of the upper incisors and the lower lip curve will be more aesthetic. Furthermore, it should be explained not only aesthetically but also functionally, taking into account the anterior guidance and posterior teeth disclusion. In our study, when looking at the parallelism relationship between the incisor curve and the lower lip, the results of the literature studies to date were taken into consideration and those with parallelism between the incisor curve and the lower lip were evaluated as "aesthetic" and those with a flat or inverted relationship between the incisor curve and the lower lip were evaluated as "not aesthetic". There was no consistency between the prosthodontist dentists in the study and the reference objective evaluation. The findings of only two of the other observers were in conformity with the computer evaluation. The results showed that the importance of incisor inclination and lower lip parallelism in the ideal smile was less important for the observers in this study.

Previous studies have stated that aesthetics cannot be mentioned in cases where the amount of gingiva visible during the smile exceeds 3 mm.[33,34] In line with this fact, in our study, except for one dental intern, all the other observers stated that 3/4 of the upper jaw teeth and 2 mm of the gingiva were "aesthetic".

In the current literature, dentolabial analyses and facial analyses are usually evaluated separately, not associated with each other, and most studies have been continued with modifications made to photographs in the digital environment in studies on smile and aesthetic concepts. In the current study, a much larger number of photographic records were used compared to the aforementioned studies, and no modifications were made to the photographs obtained from the volunteers in the computer environment. Furthermore, in the current study, facial and dentolabial analyses were evaluated in accordance with the professional knowledge of dentists by using both smile and frontal facial photographs. We believe that the comparison of physicians' aesthetic perceptions with existing reference analysis values in our study will be a guide for physicians to improve their general predictions in future studies on aesthetics.

The present study has some limitations. Supporting the photographs with more dynamic data such as video recording, measuring distraction during the physicians' evaluation of the photographs with devices, and having a mechanism that stabilizes the head position of the volunteers during the photographs may add a different dimension to the study.

CONCLUSION

In the present study, in which prosthodontists, research assistants and dental interns participated as observers, similar results were obtained between subjective evaluations and objective values in all observer groups, regardless of the increase in professional experience, as a result of the evaluations made on the frontal face and smile-posed photographs obtained from 100 volunteers. Considering the evaluation criteria of facial aesthetics instead of evaluating only the oral region in a narrow framework during aesthetic treatment will have the potential to positively affect the success of treatment.

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