



ORIGINAL ARTICLE

Perception of Smile Esthetics by Orthodontists and Laypersons: Full Face and A Localized View of The Social and Spontaneous Smiles

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ABSTRACT

Objective: The aim of the study was to evaluate the parameters that might affect the esthetic perception of localized and full-face views of social and spontaneous smiles.

Methods: Video records of 40 individuals were used. Further, 200 images of each individual were captured for social and spontaneous smiles with and without calibration glasses. Full-face images of social smile (SSF) and spontaneous smile (smile of joy) (JSF) were obtained. Furthermore, the mouth-area images of the same social (SSM) and spontaneous (JSM) smiles from each subject were acquired. Here 160 images were evaluated by orthodontists and laypersons using the Q-sort method. The data were analyzed with logistic regression and independent samples t-test.

Results: From the orthodontic perspective, upper lip thickness ($p=0.004$), lip curtain over incisors ($p=0.016$), maxillary incisor display ($p=0.01$), and buccal corridor ratio ($p=0.006$) were significant to determine attractive and unattractive images when viewing localized social smiles. Laypersons identified no particular parameter to explain the variation in preferences for all the image groups ($p>0.05$).

Conclusion: Upper lip thickness and maxillary incisor display during smiling were found to be effective for distinguishing images as attractive and unattractive by orthodontists. No objective evaluations for the attractiveness were made by laypersons.

Keywords: Smile esthetics, social smile, spontaneous smile

INTRODUCTION

Smile esthetics is the central concern for patients because it might be the primary reason for seeking orthodontic treatment (1). Most orthodontic patients evaluate their outcome and effectiveness of treatment by a mirrored smile assessment or by asking social evaluations of their smiles. Even though orthodontists aim to achieve ideal esthetic outcomes by treating to average soft tissue values determined by cephalometric analyses, soft, and hard tissue interactions differing from those averages can be more esthetic (2).

Smiles come in two forms: a spontaneous smile and a social smile (3,4). A social smile is a voluntary smile that is used in social situations or when posing for a photograph. A spontaneous smile is an involuntary smile and represents the emotion being experienced (5,6).

Most reported studies have subjectively evaluated the smile by the visualization of only the mouth area (3,7-12). The full-face perspective mimics a view normally encountered in contrast to the lower face and oral views. The wider perspective could dilute or de-emphasize the attention to the characteristics of the smile. Further, the integrity of the smile with the other components of the face might affect the complete appreciation of the person in social life. Flores-Mir et al. (13) indicated that anterior dental occlusion was less important for esthetics in full-face images when compared with oral views. Individuals with a malocclusion may camouflage an unattractive oral area by other facial features. Havens et al. (14) concluded that the full-face views of a malocclusion were more attractive than oral views alone. Shaw et al. (15) stated that overall facial attractiveness was more important than dental esthetics in overall facial esthetic appreciation. It is considered that the attractiveness of a face alters the

smile characteristics and must be accounted for and controlled so that inadvertent assessment bias is not created. We hypothesized that there is no parameter to determine the attractiveness of full-faced and localized view of social and spontaneous smiles. The aim of the present study was to evaluate the parameters that might affect the esthetic perception of localized and full-face view of social and spontaneous smiles using videography. The esthetic evaluations would be provided by orthodontists and laypersons.

METHODS

This prospective study included 40 video records of Caucasian subjects (19 males and 21 females) who were Ege University School of Dentistry employees and patients' relatives. The mean age of the subjects was 29.2 years (range: 24.5–38.2 years). The study is approved by the ethical committee of Ege University School of Medicine. Informed consent was obtained from the participants who agreed to participate in this study.

The inclusion criteria for the subjects were as follows: (1) no missing teeth or prosthetic restorations in the smile area; (2) maximum crowding of 3 mm in the lower and upper dental arches; (3) no evident facial asymmetry or deformity; (4) no evident staining, hypoplasia, or deformity in the dental area and no wear abrasion or fractures; and (5) no scars or discoloration of the face. The cases were excluded when unstrained social and spontaneous smiles could not be captured in the natural head position. The observational groups comprised orthodontists (9 males and 11 females; mean age: 40.4 years; range: 30.4–59.1 years) and laypersons (10 males and 10 females; mean age: 42.2 years; range: 25.5–58.3 years). Each group consisted of 20 Caucasian people.

The clinical experiences of the orthodontists were between 4.4 and 28.4 years.

For the recording process, a digital video camera was located 60 cm from the subject. The lens was adjusted to be at the same level as the subject's mouth and oriented perpendicular to the floor. Attention was paid to ensure that the lens was parallel to the subject's estimated vertical plane. In order to standardize the lighting conditions, the records were taken in natural daylight. Social and spontaneous smiles were recorded with and without calibration glasses as two separate procedures on the same day for each subject. The first step required the placement of calibration glasses to allow an objective evaluation, following which a recording was made without the calibration glasses in order to avoid any influence on esthetic perception. Similar humorous phrases were told to all the subjects by the same investigator to reveal their spontaneous smiles. However, the phrases used to record spontaneous smiles were different for the first and second steps of the recording process for the same subject. When recording the social smile, subjects were told to "give me a nice and big smile in which I can see your teeth" (5,16). In this way, 50 social smile and spontaneous smile images from each of the first and second steps and a total of 200 images were captured from each video. Four images from each subject, with and without calibration glasses, were obtained by choosing the most unforced natural images.

The parametric measurements on the images were conducted using Dolphin Imaging software (v. 10.5, Dolphin Imaging; Chatsworth, CA, USA). After standardization with the calibration glasses, the measurements shown in Table 1 were generated on the social and spontaneous smile images (Figure 1a, b).

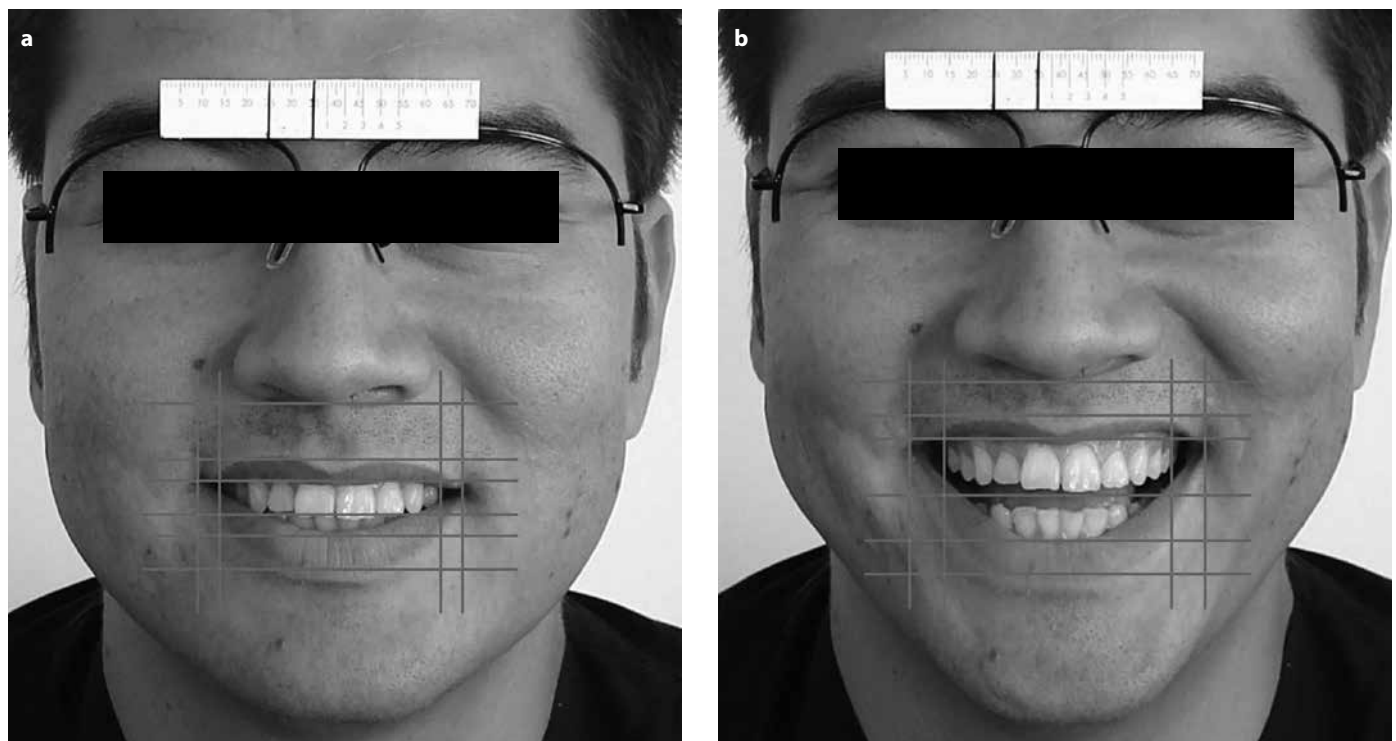


Figure 1. a, b. Measurements involving the social smile (a) and spontaneous smile (b) images: Upper lip length, upper lip thickness, maxillary incisor display, smile width, intercommissural width, left and right buccal corridors, maxillary gingival display, lower lip thickness, Sn to maxillary incisor distance, smile height, lower lip to maxillary incisor distance, and visible dentition width

Table 1. Parameters that were measured in social and spontaneous smile images

Parameters	Description
Smile Width	Intercommissure width as measured by distance between left cheilion to right cheilion during smiling
Visible Dentition Width	Distance from the most lateral aspect of the most visible maxillary posterior tooth on the right and left sides
Visible Dentition Width/Smile Width	Visible dentition width divided by smile width
Smile Height	Interlabial gap as measured by distance from upper stomion to lower stomion during smiling
Smile Index	Smile width divided by smile height
Upper Lip Length during Smiling	Distance from subnasale to inferior border of upper lip during smiling
Upper Lip Thickness	Vertical distance from the most superior margin of the upper lip to the most inferior portion of the tubercle of the upper lip
Sn to Incision Distance	Distance from subnasale to incisal edge of maxillary central incisor
Upper Lip Length during Smiling/Sn to Incision Distance	Lip curtain over incisors during smiling: upper lip length during smiling divided by subnasale to incision distance
Maxillary Incisor Display during Smiling	Distance measured between most superior and inferior points on maxillary central incisor crowns during smiling
Maxillary Gingival Display	Amount of vertical display of the maxillary central incisors during Smiling
Inner Intercommissural Width	Horizontal distance between right inner commissure to left inner commissure
Buccal Corridor Ratio	Difference between visible maxillary dentition width and inner commissure width divided by inner commissure width.
Lower Lip Thickness	Vertical distance from the deepest midline portion of the superior margin of the lower lip to the most inferior portion of the lower lip
Lower Lip to Maxillary Incisor Distance	Vertical distance from the incisal edge of the maxillary right central incisor to the deepest midline point on the superior margin of the lower lip.
Buccal Corridor Right	Horizontal distance from the most lateral aspect of the right most posterior visible tooth to the right inner commissure
Buccal Corridor Left	Horizontal distance from the most lateral aspect of the left most posterior visible tooth to the left inner commissure

Facial structures including the forehead, zygomas, temples, and posterior parts of the cheeks had to be clearly visible in the images, which were then used for subjective evaluation. The conversion of color images to black and white was important because this evened the skin tones and reduced the number of confounding factors involved. Social smile full-face images (SSF) and spontaneous smile (smile of joy) full-face images (JSF) were printed on individual cardboards. Further, smiles from the full-face images of both the smile types were cut out in 3×5 inch rectangles and printed on cardboards as well. This yielded the mouth-area images of the social smile (SSM) and spontaneous smile (smile of joy) (JSM). Finally, a total of 160 images (40 images in each group) were prepared (Figure 2a, b).

The Latin square method was used to evaluate the 4 different image groups. In this method, the order of the stimuli provided to the first subject was changed for the second, third, and fourth subjects. This allowed interaction and transfer effects to be eliminated and intra-group half anti-compensation was made (17).

The images were compared using the Q-sort method (18). Seven columns were planned for a sample size of 40, and subjects

were asked to order the images in accordance with the attractiveness of the smile. The number of columns that the image was selected in was the score received by the image. The first column represented the least attractive images and seventh column represented the most attractive images. Subjects were subsequently asked to select the 2 most and least attractive images out of the 40, followed by the 5 most and least attractive images out of the remaining 36; 8 additional images were selected in the same manner. The remaining 10 images after this selection procedure were considered to be neutral. The subject's selections were transferred to tables and the scores of the images were noted. The subjects were asked to assign their attractiveness limits between any two columns from the distribution to determine their attractiveness limit. By this process, the number of attractive images identified was determined regardless of the Q-sort distribution. A mean Q-sort score was determined for each image identified by the different participants. The same procedure was applied to attractiveness limits, and the mean limit values were obtained for orthodontists and laypersons. Images were ordered according to their mean values from the most to least favored for each participant group in each of the 4 image groups.

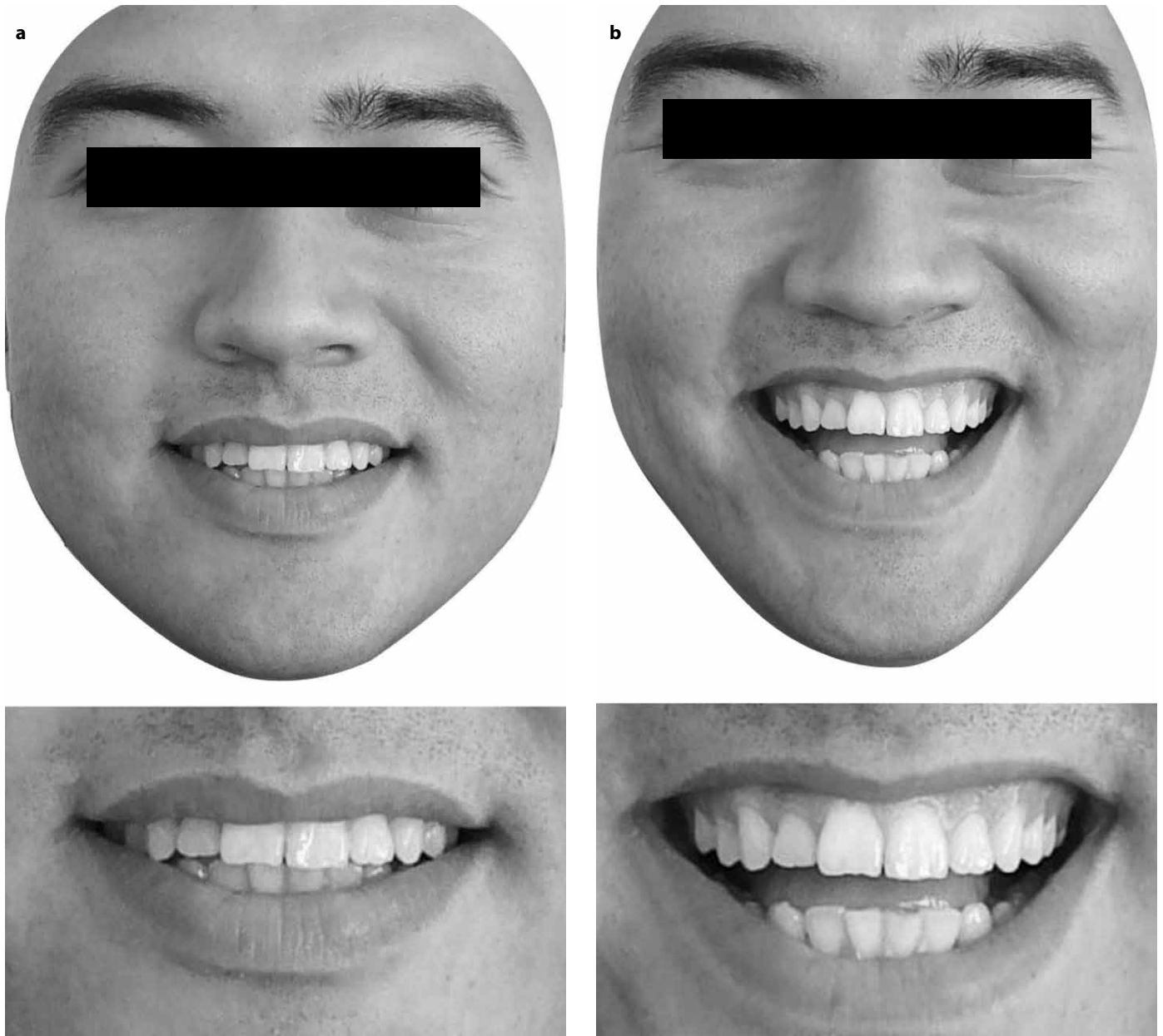


Figure 2. a, b. A total of 160 images from 4 different image groups were prepared: Social smile full-face image (SSF) and localized view of the same smile (SSM) (a); spontaneous smile (smile of joy) full-face image (JSF) and localized view of the same smile (JSM) (b)

Statistical Analysis

The normality test of Shapiro-Wilks and the Levene's variance homogeneity test were conducted. Independent samples t-test was performed to assess the equality of means for the attractiveness limits for each pair of subject groups. To determine the parameters that showed significant differences between attractive and unattractive images obtained according to the mean attractiveness limits, t-tests were employed. The equality of means for each parameter was tested between attractive and unattractive images. This has been done for each image group-subject group pair. Further, independent samples t-test was performed to evaluate the objective differences between the most and least attractive 15 images - the images remaining after excluding 10 neutral images. Logistic regression analysis was conducted to determine the parameters that might affect the order of images according to their attractiveness scores. One examiner made the

measurements again in randomly selected 20 subjects 1 month later. The intra-examiner reliability was tested using intra-class correlation coefficient (ICC). All the analyses were performed using the SPSS software (version 19, IBM Corp.; Armonk, NY, USA). The null hypothesis of normality was accepted at the 5% level of significance.

RESULTS

The ICC values for the measurements were highly acceptable, ranging from 0.96 to 0.99. The mean attractiveness limits of laypersons were lower than orthodontists in all the image groups (Table 2). This implies that a larger number of images were considered to be attractive by laypersons than orthodontists (Table 3). Especially when the full face view of the smiles considered the difference was statistically significant ($p < 0.05$). The descriptive statistics of the

Table 2. Mean attractiveness limit values determined by orthodontists and laypersons

	Orthodontists		Laypersons		p
	Mean	SD	Mean	SD	
SSM	4.08	0.79	3.91	1.24	0.710
SSF	4.25	0.62	2.75	1.13	0.002
JSM	4.04	1.11	3.58	1.31	0.366
JSF	4.33	0.93	3.50	1.04	0.040

SSM: social smile mouth-area image; SSF: social smile full-face image; JSM: spontaneous smile mouth-area image; JSF: spontaneous smile full-face image

Table 3. Number and percentage of images determined as attractive and unattractive by orthodontists and laypersons

	Orthodontists		Laypersons	
	Attractive	Unattractive	Attractive	Unattractive
	N (%)	N (%)	N (%)	N (%)
SSM	6 (15)	34 (85)	10 (25)	30 (75)
SSF	5 (12.5)	35 (87.5)	25 (62.5)	15 (37.5)
JSM	8 (20)	32 (80)	14 (35)	26 (65)
JSF	6 (15)	34 (85)	16 (40)	24 (60)

SSM: social smile mouth-area image; SSF: social smile full-face image; JSM: spontaneous smile mouth-area image; JSF: spontaneous smile full-face image

measurements made on social and spontaneous smiles is presented in Table 4. The results of the statistical analysis performed to determine the parameters that might affect the attractiveness of the 4 image groups with orthodontists and laypersons are presented in Tables 5 and 6, respectively.

From the orthodontic perspective, upper lip thickness ($p=0.004$), lip curtain over incisors during smiling ($p=0.016$), maxillary incisor display during smiling ($p=0.01$), and buccal corridor ratio ($p=0.006$) were statistically significant between attractive and unattractive images when viewing localized social smiles. In the SSF group of the same smiles, upper lip length during smiling ($p=0.04$), upper lip thickness ($p=0.04$), lip curtain over incisors during smiling ($p=0.006$), and maxillary incisor display during smiling ($p=0.018$) were found to be statistically significant. In the JSM and JSF groups, upper lip thickness ($p=0.02$ and $p=0.009$, respectively) and maxillary incisor display during smiling ($p=0.007$ and $p=0.009$, respectively) were statistically significant.

Laypersons identified no particular parameter to explain the variation in preferences for the 4 image groups.

The results of the regression analysis revealed that no parameter was effective to predict the order of the full-face or localized smiles based on their mean attractiveness scores. This result was valid for both smile types ($p>0.05$). The difference of parameters between the most and least attractive 15 images were not statistically significant for both full-face and mouth-area images of social and spontaneous smiles ($p>0.05$) (Table 7, 8).

Table 4. Descriptive statistics of variables measured in social and spontaneous smile images

Variables	Social Smile				Spontaneous Smile			
	Mean	SD	Minimum	Maximum	Mean	SD	Minimum	Maximum
Smile width (mm)	61.31	5.90	48.70	74.80	65.81	5.32	54.80	77.80
Visible dentition width (mm)	48.64	3.93	43.90	60.90	52.31	3.83	44.20	61.30
Visible dentition width/smile width	0.79	0.53	0.70	0.91	0.79	0.05	0.68	0.90
Smile height (mm)	8.97	2.28	5.60	14.80	15.46	3.87	9.30	24.10
Smile Index	7.24	1.80	3.86	10.17	4.56	1.34	2.72	7.57
Upper lip length during smiling (mm)	16.26	2.65	10.90	24.10	13.87	2.38	8.90	19.40
Upper lip thickness (mm)	4.78	1.36	1.65	8.95	4.10	1.22	0.90	6.50
Sn to maxillary incisor distance (mm)	23.52	2.83	18.90	29.60	23.71	2.82	17.70	30.0
Upper lip length during smiling/Sn to maxillary incisor distance	0.69	0.07	0.54	0.86	0.58	0.076	0.42	0.76
Maxillary incisor display during smiling (mm)	7.09	1.87	3.60	12.15	9.02	1.36	5.35	12.15
Maxillary gingival display (mm)	0.45	0.28	0	1.80	1.07	1.33	0	4.70
Intercommissural width (mm)	53.44	4.15	45.30	64.80	56.22	3.85	48.30	64.4
Buccal corridor ratio	0.08	0.03	0	0.16	0.06	0.03	0	0.16
Lower lip thickness (mm)	8.55	1.18	6.10	11.80	7.62	0.99	5.20	9.30
Lower lip to maxillary incisor distance (mm)	2.14	2.31	0	12.0	6.96	3.94	0.10	15.60
Buccal corridor right (mm)	2.57	1.24	0	5.50	1.94	1.46	0	6.40
Buccal corridor left (mm)	2.31	1.30	0	4.90	1.82	1.38	0	5.80

Table 5. Comparison of parameters between attractive and unattractive images determined by orthodontists using mean attractiveness limits

Parameters	Orthodontists											
	SSM			SSF			JSM			JSF		
	Mean difference	%95 CI	p	Mean difference	%95 CI	p	Mean difference	%95 CI	p	Mean difference	%95 CI	p
Smile Width (mm)	-0.93	-4.96, 3.09	0.693	-2.04	-5.27, 3.18	0.373	-1.65	-4.16, 2.86	0.463	-1.34	-5.11, 2.43	0.327
Visible Dentition Width (mm)	-1.47	-4.79, 1.85	0.264	-1.46	-5.29, 2.19	0.445	-1.94	-3.15, 1.56	0.227	-1.79	-4.14, 2.57	0.102
Visible Dentition Width / Smile Width	-0.013	-0.06, 0.03	0.551	0.007	-0.04, 0.06	0.770	-0.008	-0.05, 0.03	0.723	-0.01	-0.06, 0.03	0.573
Smile Height (mm)	-0.83	-2.76, 1.09	0.297	-0.94	-3.16, 1.27	0.393	-0.60	-3.9, 2.70	0.714	-2.61	-6.03, 0.80	0.129
Smile Index (mm)	0.76	-0.75, 2.27	0.257	0.59	-1.17, 2.34	0.503	0.39	-0.74, 1.53	0.490	0.79	-0.40, 1.98	0.188
Upper Lip Length during Smiling (mm)	1.85	-0.32, 4.04	0.090	2.83	0.1, 5.03	0.040	0.51	-1.50, 1.54	0.875	0.93	-1.30, 2.99	0.429
Upper Lip Thickness (mm)	-1.52	-2.32, -0.21	0.004	-1.33	-2.49, -0.02	0.040	-1.25	-2.09, -0.18	0.020	-1.59	-2.51, -0.37	0.009
Sn to Incision Distance (mm)	0.49	-1.92, 2.90	0.682	0.82	-1.94, 3.59	0.551	-0.75	-3.14, 1.64	0.530	-1.04	-3.58, 1.49	0.409
Upper Lip Length during Smiling/ Sn to Incision Distance	0.07	0.01, 0.12	0.016	0.08	0.02, 0.15	0.006	0.04	-0.02, 0.106	0.183	0.05	-0.03, 0.12	0.198
Maxillary Incisor Display during Smiling (mm)	-1.93	-3.37, -0.40	0.010	-2.22	-3.81, -0.37	0.010	-1.63	-2.47, -0.41	0.007	-1.55	-2.54, -0.31	0.009
Maxillary Gingival Display (mm)	0.05	-0.19, 0.30	0.324	0.05	-0.22, 0.33	0.710	0.27	-0.86, 1.41	0.623	-0.24	-1.46, 0.96	0.681
Inner Intercommissural Width (mm)	0.69	-2.84, 3.23	0.617	0.23	-3.84, 3.30	0.854	-1.65	-4.9, 1.59	0.309	-1.46	-4.93, 2.00	0.398
Buccal Corridor Ratio	0.05	0.01, 0.06	0.006	0.03	-0.002, 0.06	0.060	0.006	-0.02, 0.03	0.701	0.02	-0.009, 0.06	0.142
Lower Lip Thickness (mm)	-0.10	-1.12, 0.90	0.832	0.29	-0.87, 1.45	0.614	-0.02	-0.87, 0.82	0.964	-0.30	-1.19, 0.60	0.501
Lower Lip to Maxillary Incisor Distance (mm)	1.15	-0.78, 3.09	0.232	1.51	-0.70, 3.72	0.174	0.78	-2.57, 4.14	0.639	-0.67	-2.25, 2.90	0.704
Buccal Corridor Right (mm)	0.37	-0.67, 1.43	0.469	-0.01	-1.22, 1.20	0.984	0.25	-0.93, 1.43	0.672	0.37	-0.87, 1.63	0.547
Buccal Corridor Left (mm)	0.72	-0.35, 1.81	0.182	0.93	-0.30, 2.17	0.136	0.43	-0.80, 1.67	0.477	0.95	-0.33, 2.24	0.140

CI: confidence interval; SSM: social smile mouth-area image; SSF: social smile full-face image; JSM: spontaneous smile mouth-area image; JSF: spontaneous smile full-face image

DISCUSSION

Although micro and mini esthetic components are very important for the overall esthetic perception following orthodontic treatment, the determination of how the interaction of these elements and other facial structures is perceived by different participant groups determines the actual perception of a smile in social life. According to Hickman et al. (19), an observer's eye was fixed the most frequent and the longest on the other's eye, nose, mouth, ear, and chin, in that order. The mouth (and even the smiling mouth) received less than 10% of the viewer's visual attention. In a study about facial attractiveness, Terry and Brady (20) reported that the eyes and mouth area were followed by the hair, nose, and other facial structures when evaluating the entire face. According to Tatarunaite et al. (21) and Hickman et al. (19), all the facial structures are important in the consideration of facial attractiveness, and an evaluation cannot be made by a single facial structure. In the present study, smile esthetics was evaluated using mouth-area images and the full-face images of the same smiles in an interaction with other facial structures. Subjective evaluations provided by orthodontists and laypersons were analyzed, as well as objective evaluations for both mouth-area view and full-face images.

The number of images that were deemed attractive by orthodontists was almost the same in all the image groups. This may be interpreted as evidence of a more localized approach to smile appreciation by orthodontists. Laypersons preferred the full-face smiling images rather than mouth-area images. This finding provides evidence that laypersons evaluate the attractiveness of a smile by taking the entire face into account. McNamara et al. (22) reported that orthodontists and laypersons showed a strong correlation in the subjective evaluation of smile esthetics. In a study reporting the subjective evaluation of the social smile on mouth-area images of 48 orthodontically treated individuals, Schabel et al. (12) could not find any difference in the evaluations of orthodontists and laypersons. They also stated that no objective measure of the smile could subjectively predict attractive or unattractive smiles (11).

Parameters that determined attractiveness were analyzed for orthodontists and laypersons. Regression analyses showed that the attractiveness of smiles could not be predicted by the parameters used in this study, regardless of these features being shown as localized or full faced to both orthodontists and laypersons. A comparison of 15 smiles considered the

Table 6. Comparison of parameters between attractive and unattractive images determined by laypersons using mean attractiveness limits

Parameters	Laypersons											
	SSM			SSF			JSM			JSF		
	Mean difference	%95 CI	p	Mean difference	%95 CI	p	Mean difference	%95 CI	p	Mean difference	%95 CI	p
Smile Width (mm)	-0.15	-4.57, 4.26	0.896	1.85	-2.00, 5.71	0.337	0.92	-4.86, 2.82	0.620	-1.99	-5.41, 1.34	0.405
Visible Dentition Width (mm)	-0.17	-3.11, 2.77	0.807	1.7	-2.09, 4.24	0.184	0.05	-2.66, 2.76	0.970	-0.49	-3.02, 2.03	0.695
Visible Dentition Width / Smile Width	-0.001	-0.041, 0.04	0.912	0.001	-0.03, 0.04	0.917	0.01	-0.02, 0.05	0.501	0.02	-0.005, 0.06	0.09
Smile Height (mm)	-0.13	-1.84, 1.58	0.875	1.28	-0.17, 2.73	0.08	-0.1	-2.84, 2.63	0.938	1.07	-1.46, 3.62	0.395
Smile Index (mm)	0.31	-1.03, 1.65	0.640	-0.61	-1.80, 0.55	0.295	0.01	-0.94, 0.96	0.980	-0.56	-1.44, 0.30	0.195
Upper Lip Length during Smiling (mm)	1.27	-0.67, 3.21	0.194	1.10	-0.70, 2.75	0.234	0.19	-1.48, 1.87	0.815	1.73	-0.90, 3.10	0.256
Upper Lip Thickness (mm)	-0.45	-1.51, 0.61	0.216	-0.33	-1.33, 0.62	0.557	-0.10	-0.97, 0.85	0.889	-0.01	-0.87, 0.84	0.972
Sn to Incision Distance (mm)	0.61	-1.50, 2.72	0.560	1.59	-0.21, 3.39	0.08	-0.08	-2.07, 1.91	0.935	1.36	-0.45, 3.17	0.137
Upper Lip Length during Smiling / Sn to Incision Distance	0.03	-0.01, 0.09	0.148	0.003	-0.04, 0.05	0.872	0.01	-0.04, 0.06	0.706	0.03	-0.01, 0.08	0.121
Maxillary Incisor Display during Smiling (mm)	-1.16	-1.52, 0.21	0.07	0.37	-0.93, 1.56	0.610	-0.65	-1.64, 0.34	0.129	-0.55	-1.29, 0.44	0.330
Maxillary Gingival Display (mm)	0.06	-0.15, 0.27	0.570	0.11	-0.07, 0.29	0.225	0.69	-0.22, 1.61	0.131	0.45	-0.42, 1.32	0.299
Inner Intercommissural Width (mm)	1.25	-1.83, 4.34	0.419	2.31	-0.33, 4.95	0.09	-0.27	-2.99, 2.46	0.844	-1.23	-3.75, 1.28	0.328
Buccal Corridor Ratio	0.02	-0.002, 0.05	0.101	0.008	-0.015, 0.03	0.463	-0.006	-0.033, 0.02	0.640	-0.01	-0.03, 0.01	0.312
Lower Lip Thickness (mm)	-0.03	-0.91, 0.86	0.964	-0.11	-0.90, 0.67	0.773	0.11	-0.59, 0.81	0.751	0.19	-0.46, 0.84	0.556
Lower Lip to Maxillary Incisor Distance (mm)	0.003	-1.72, 1.73	0.996	0.64	-0.86, 2.16	0.392	0.76	-2.01, 3.54	0.581	1.51	-1.04, 4.08	0.238
Buccal Corridor Right (mm)	0.09	-0.83, 1.02	0.839	-0.21	-1.02, 0.60	0.605	-0.78	-1.73, 0.16	0.104	-0.94	-1.81, 0.22	0.101
Buccal Corridor Left (mm)	0.44	-0.51, 1.41	0.353	-0.17	-1.03, 0.69	0.689	0.06	-0.97, 1.10	0.894	-0.10	-1.07, 0.85	0.812

CI: confidence interval; SSM: social smile mouth-area image; SSF: social smile full-face image; JSM: spontaneous smile mouth-area image; JSF: spontaneous smile full-face image

most and least attractive revealed no significant differences in all the image groups for orthodontists and laypersons. When the parameters were compared between attractive and unattractive images, some parameters were found to be statistically significant. In all the image groups, 2 parameters, namely, upper lip thickness and maxillary incisor display during smiling were found to be effective for distinguishing images as being attractive and unattractive by orthodontists. McNamara et al. (22) reported that the lip thickness was the most important indicator of smile esthetics for laypersons and orthodontists. This led to the acceptance that full lips were more preferred in attractive smiles. Orthodontists did not prefer a decrease in the upper lip thickness and a decrease in the maxillary incisor display during smiling. This is generally associated with an older look (23). An increase in the buccal corridor ratio negatively affected the attractiveness only in a localized view of social smiles. This parameter was not effective in the selection of attractive and unattractive images in full-face view of the same smiles. This supports the findings of Springer et al. (24) who concluded that full-face assessors favored a smaller buccal corridor than lower-face assessors. Further, an increase in the upper lip length determined attractiveness and unattractiveness in the SSF group.

No objective evaluations for the attractiveness in both the groups were made by laypersons. This might suggest that laypersons evaluate smile esthetics more superficially than orthodontists. In contrast with some previous studies (10,25,26) differences were found between the orthodontists' and layperson's subjective and objective evaluations. Parekh et al. (26) reported that there were no significant differences in the evaluation of attractiveness between laypersons and orthodontists, and both groups disapproved of broad buccal corridors. In a study that examined mouth-area and SSM images, Ritter et al. (27) reported that there were no differences in the buccal corridor evaluations between these groups. Moore et al. (28) employed laypersons to study the full-face images with digitally altered buccal corridor widths and reported that an increase in buccal corridors had a negative effect on attractiveness. Roden-Johnson et al. (29) concluded that orthodontists and laypersons evaluated the smile differently, but both groups indicated that an increased width of the buccal corridors did not have a negative effect on attractiveness. The buccal corridor effect was more pronounced in the orthodontist's perception of attractiveness when smiles were evaluated using mouth-area images. The standards of attractiveness may vary between individuals according to racial and socioeconomic backgrounds (30). Although it is impossible to ex-

Table 7. Descriptive statistics and comparison of parameters between the most and least attractive 15 social and spontaneous smile images determined by orthodontists

Parameters	SSM			SSF			JSM			JSF		
	Attractive Mean (SD)	Unattractive Mean (SD)	p	Attractive Mean (SD)	Unattractive Mean (SD)	p	Attractive Mean (SD)	Unattractive Mean (SD)	p	Attractive Mean (SD)	Unattractive Mean (SD)	p
Smile Width (mm)	61.52 (5.26)	59.46 (7.30)	0.382	62.77 (5.00)	62.44 (6.83)	0.882	66.96 (4.88)	63.94 (5.58)	0.126	67.02 (5.18)	64.69 (6.07)	0.270
Visible Dentition Width (mm)	48.73 (3.03)	47.88 (4.05)	0.563	49.11 (2.72)	49.70 (3.19)	0.701	52.60 (4.53)	51.26 (3.26)	0.358	52.32 (4.39)	51.63 (3.40)	0.632
Visible Dentition Width / Smile Width	0.79 (0.05)	0.80 (0.05)	0.488	0.78 (0.05)	0.79 (0.05)	0.533	0.79 (0.05)	0.80 (0.05)	0.380	0.78 (0.05)	0.80 (0.06)	0.366
Smile Height (mm)	9.26 (2.30)	9.28 (2.26)	0.983	8.67 (1.73)	9.31 (2.21)	0.418	15.22 (3.79)	15.59 (3.62)	0.788	14.99 (3.94)	15.93 (3.78)	0.511
Smile Index (mm)	7.01 (1.78)	6.93 (2.06)	0.906	7.53 (1.68)	7.17 (2.02)	0.601	4.67 (1.26)	4.36 (1.31)	0.517	4.78 (1.41)	4.33 (1.29)	0.362
Upper Lip Length during Smiling (mm)	16.54 (2.44)	17.38 (2.73)	0.786	15.14 (2.29)	16.52 (2.34)	0.114	14.58 (2.11)	15.04 (2.29)	0.546	13.94 (2.06)	14.60 (1.97)	0.531
Upper Lip Thickness (mm)	5.11 (1.73)	4.69 (0.96)	0.243	4.90 (1.19)	4.43 (1.26)	0.307	4.38 (1.17)	4.57 (1.26)	0.678	4.31 (1.09)	4.40 (1.29)	0.844
Sn to Incision Distance (mm)	23.31 (2.49)	24.54 (3.14)	0.246	22.74 (1.88)	24.0 (2.14)	0.217	23.36 (2.24)	24.72 (2.82)	0.153	23.75 (2.18)	24.24 (2.47)	0.345
Upper Lip Length during Smiling/Sn to Incision Distance	0.66 (0.06)	0.71 (0.08)	0.102	0.66 (0.06)	0.69 (0.07)	0.260	0.56 (0.06)	0.61 (0.08)	0.128	0.56 (0.06)	0.59 (0.07)	0.269
Maxillary Incisor Display during Smiling (mm)	7.82 (1.54)	6.77 (2.02)	0.176	7.40 (1.52)	7.20 (1.90)	0.774	9.42 (1.07)	8.80 (1.50)	0.265	9.40 (1.13)	8.96 (1.28)	0.336
Maxillary Gingival Display (mm)	0	0.12 (0.46)	0.325	0	0.11 (0.22)	0.334	0.77 (0.84)	1.14 (1.48)	0.414	0.79 (0.86)	1.68 (1.60)	0.134
Inner Intercommissural Width (mm)	53.22 (3.09)	52.22 (5.09)	0.523	53.87 (2.94)	54.37 (5.23)	0.750	56.64 (3.99)	54.77 (4.02)	0.212	56.35 (3.92)	55.62 (4.37)	0.635
Buccal Corridor Ratio	0.08 (0.03)	0.08 (0.03)	0.933	0.08 (0.04)	0.08 (0.03)	0.929	0.07 (0.03)	0.06 (0.03)	0.554	0.07 (0.03)	0.07 (0.03)	0.927
Lower Lip Thickness (mm)	8.71 (1.35)	8.76 (1.19)	0.909	8.45 (0.94)	8.38 (1.15)	0.851	7.71 (0.88)	7.55 (1.07)	0.660	7.52 (0.99)	7.80 (0.93)	0.422
Lower Lip to Maxillary Incisor Distance (mm)	2.12 (3.11)	2.50 (1.93)	0.691	1.15 (1.23)	1.99 (1.13)	0.103	5.74 (3.15)	7.60 (4.24)	0.183	5.56 (3.31)	6.92 (4.34)	0.344
Buccal Corridor Right (mm)	2.60 (1.40)	2.30 (1.11)	0.530	2.90 (1.52)	2.23 (0.81)	0.141	2.18 (1.57)	1.35 (1.19)	0.115	2.09 (1.48)	1.56 (1.20)	0.288
Buccal Corridor Left (mm)	2.22 (1.21)	1.95 (1.26)	0.540	2.42 (1.52)	2.32 (1.36)	0.851	1.98 (1.58)	1.79 (1.53)	0.736	1.92 (1.62)	2.21 (1.60)	0.621

SSM: social smile mouth-area image; SSF: social smile full-face image; JSM: spontaneous smile mouth-area image; JSF: spontaneous smile full-face image

plain attractiveness with great precision, the results of the study showed that different participant groups might exhibit different esthetic perceptions.

In the current study, the videographic method was used due to its effectiveness in obtaining a natural social smile and its ability to include spontaneous smiles in treatment planning and ease of functional assessment. It is clinically possible to record natural and reproducible social and spontaneous smiles by using videographic methods. Hence, increases in consistency and ease of recording using spontaneous smiles facilitate treatment planning (4,7,31). The reproducibility of social and spontaneous smiles was evaluated using several studies in the literature. Social smile was found to be reproducible. Walder et al. (32) stated that a social smile can be reliably reproduced, whether captured by videography or still photography. Van der Geld et al. (33,34) mentioned that a spontaneous smile could be measured by videography. According to the authors, both social and spontaneous smiles could be reproducibly captured using video recordings. Houstis et al. (35) assessed the reproducibility of facial expressions including social and spontaneous smiles (in two-week intervals)

using videography. They concluded that social and spontaneous smiles were two of the most reproducible expressions by using videography.

When using the Visual Analogue Scale (VAS), average scores are usually selected. The Q-sort method is superior to the other methods because it allows the use of outliers and is simple to apply (12,36-38). Schabel et al. (12) compared the VAS and Q-sort methods and reported that the latter was more reliable than the former for evaluating smile esthetics.

CONCLUSION

The hypothesis of the study was partially rejected. Although there was no parameter to predict the order of images from the most to least attractive, upper lip thickness, and maxillary incisor display during smiling were found to be effective for distinguishing images as attractive and unattractive for orthodontists in localized and full-face views of the same smiles. No objective evaluations for the attractiveness in both social and spontaneous smile image groups were made by laypersons.

Table 8. Descriptive statistics and comparison of parameters between the most and least attractive 15 social and spontaneous smile images determined by laypersons

Parameters	SSM			SSF			JSM			JSF		
	Attractive Mean (SD)	Unattractive Mean (SD)	p	Attractive Mean (SD)	Unattractive Mean (SD)	p	Attractive Mean (SD)	Unattractive Mean (SD)	p	Attractive Mean (SD)	Unattractive Mean (SD)	p
Smile Width (mm)	61.84 (4.99)	61.64 (5.02)	0.928	62.25 (5.16)	62.12 (4.82)	0.954	66.55 (5.46)	64.23 (5.21)	0.278	67.06 (4.85)	64.55 (5.44)	0.198
Visible Dentition Width (mm)	48.70 (2.98)	48.59 (3.98)	0.943	48.52 (2.77)	49.69 (3.86)	0.442	52.16 (4.36)	51.60 (3.45)	0.703	52.86 (4.11)	52.37 (4.22)	0.751
Visible Dentition Width / Smile Width	0.80 (0.05)	0.80 (0.05)	0.976	0.79 (0.06)	0.80 (0.05)	0.338	0.78 (0.05)	0.80 (0.06)	0.325	0.77 (0.05)	0.81 (0.06)	0.101
Smile Height (mm)	8.57 (1.76)	9.32 (2.70)	0.374	8.56 (1.68)	9.32 (2.01)	0.342	14.93 (3.55)	15.83 (4.14)	0.528	14.46 (3.76)	16.51 (4.35)	0.266
Smile Index (mm)	7.50 (1.62)	7.16 (2.19)	0.641	7.52 (1.54)	7.08 (1.92)	0.493	4.75 (1.41)	4.38 (1.43)	0.480	5.02 (1.41)	4.33 (1.46)	0.199
Upper Lip Length during Smiling (mm)	15.15 (2.40)	16.39 (2.18)	0.150	15.57 (2.16)	16.83 (2.28)	0.132	13.47 (1.70)	14.60 (1.99)	0.105	13.88 (2.19)	14.96 (2.07)	0.196
Upper Lip Thickness (mm)	4.87 (1.33)	4.14 (1.10)	0.116	4.91 (1.25)	4.62 (1.19)	0.864	4.20 (1.17)	4.37 (1.21)	0.577	4.28 (1.10)	4.19 (1.34)	0.848
Sn to Incision Distance (mm)	22.63 (1.95)	23.40 (2.92)	0.407	22.78 (1.75)	22.24 (2.16)	0.119	23.19 (2.01)	24.43 (2.26)	0.129	23.85 (2.31)	25.0 (2.65)	0.194
Upper Lip Length during Smiling/Sn to Incision Distance	0.66 (0.06)	0.70 (0.07)	0.178	0.68 (0.06)	0.69 (0.07)	0.591	0.58 (0.05)	0.60 (0.08)	0.465	0.56 (0.06)	0.60 (0.09)	0.190
Maxillary Incisor Display during Smiling (mm)	7.52 (1.62)	6.72 (2.27)	0.297	7.12 (1.49)	7.20 (1.42)	0.901	9.34 (1.04)	8.66 (1.29)	0.135	9.18 (1.31)	8.94 (1.47)	0.636
Maxillary Gingival Display (mm)	0	0.12 (0.46)	0.334	0	0.14 (0.31)	0.325	0.51 (0.69)	1.13 (1.62)	0.103	0.85 (1.09)	1.45 (1.71)	0.262
Inner Intercommissural Width (mm)	53.03 (2.78)	53.62 (4.12)	0.697	53.21 (2.74)	54.47 (4.11)	0.407	56.50 (3.94)	55.25 (4.26)	0.403	57.06 (3.54)	55.92 (4.58)	0.452
Buccal Corridor Ratio	0.08 (0.03)	0.09 (0.03)	0.363	0.08 (0.04)	0.08 (0.03)	0.984	0.07 (0.03)	0.06 (0.04)	0.380	0.07 (0.03)	0.06 (0.04)	0.455
Lower Lip Thickness (mm)	8.38 (1.11)	8.44 (1.27)	0.891	8.43 (0.99)	8.30 (1.10)	0.744	7.56 (0.81)	7.52 (1.09)	0.910	7.50 (1.02)	7.78 (0.99)	0.461
Lower Lip to Maxillary Incisor Distance (mm)	1.72 (3.01)	2.61 (1.79)	0.337	2.06 (1.15)	2.22 (1.35)	0.865	5.96 (3.52)	7.72 (4.54)	0.246	5.67 (3.54)	7.98 (4.28)	0.119
Buccal Corridor Right (mm)	2.62 (1.42)	2.49 (0.99)	0.768	2.69 (1.53)	2.35 (1.06)	0.487	2.11 (1.14)	2.37 (1.44)	0.675	1.94 (1.28)	2.27 (1.60)	0.618
Buccal Corridor Left (mm)	2.24 (1.32)	2.34 (1.30)	0.838	2.50 (1.37)	2.24 (1.34)	0.604	1.84 (1.56)	2.09 (1.49)	0.661	1.95 (1.42)	2.02 (1.45)	0.893

SSM: social smile mouth-area image; SSF: social smile full-face image; JSM: spontaneous smile mouth-area image; JSF: spontaneous smile full-face image

Ethics Committee Approval: Ethics committee approval for this study was received from the Ethics Committee of Ege University School of Medicine, İzmir, Turkey.

Informed Consent: Verbal and written consent was obtained from all subjects who participated in this study.

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