

Perception of Smile Aesthetics by Dental Professionals and Laypeople of Different Age and Gender in Canine Substitution

✉ Turhan Ulutekin, ✉ Ceren Özgür, ✉ Özlem Orman

Department of Prosthetics, Baskent University Faculty of Dentistry, Ankara, Turkey

Abstract

BACKGROUND/AIMS: This study aimed to evaluate the effect of different smile patterns that may occur as a result of canine substitution for the treatment of missing lateral incisor(s) on the esthetic perception in patients of different age groups, sex, and profession (dental professionals and laypeople).

MATERIALS AND METHODS: The frontal extraoral photographs of a 28-year-old female patient were digitally modified using an image editing software program (Photoshop CC; Adobe Corp). Eight photographs were produced by simulating canine substitution with altered teeth and gingival levels. A total of 713 (317 dental professionals and 396 laypeople) respondents participated in an online survey. A numeric rating scale was used, with "0" representing the least attractive and "10", the most attractive. Kruskal-Wallis and Mann-Whitney U tests were used for comparison. Bonferroni correction was used to check type1 errors in all possible multiple comparisons.

RESULTS: In the group of dental professionals and laypeople aged 36-45, females had lower appreciation percentages compared to males ($p < 0.000625$). Dental professionals had lower appreciation percentages than laypeople ($p < 0.00056$). Male dental professionals in the 26-35 age group had lower appreciation percentages compared to the 36-45, 46-55, and 56-65 age groups ($p < 0.00156$).

CONCLUSION: While reshaping canines as lateral incisor teeth, the participants' age, sex, and whether the participant was a dentist, affected the esthetic perception. However, gingival level differences and whether the treatment was symmetrical did not cause any difference in terms of esthetic perception for any of the groups.

Keywords: Esthetics, smile design, canine substitution, lateral incisor agenesis

INTRODUCTION

Improving dental esthetics leads to a substantial increase in the quality of life underlying the psychosocial importance of a pleasing smile.¹ The analysis of smile esthetics is complicated because it is difficult to standardize a practical model and to change the variables of interest.² Additionally, it becomes more difficult to provide esthetics in the presence of dental anomalies.

The most common craniofacial developmental anomaly in humans is agenesis of the teeth. It is a number disorder specified by the absence of single or multiple teeth, which can be attributed to genetic or external factors³⁻⁶ or linked to syndromes.^{3,6} Many studies have attempted to explain the prevalence of hypodontia over the past few years. Depending on the ethnic group, the maxillary lateral incisors may have the highest⁵ or second-highest⁷ incidences. The prevalence of maxillary lateral incisor agenesis ranges from 0.8%⁸ to 2%⁹ in which females are

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ORCID IDs of the authors: T.U. 0000-0002-0912-5307; C.Ö. 0000-0002-3356-6129; Ö.O. 0000-0002-2866-1308.



Address for Correspondence: Turhan Ulutekin

E-mail: turhanulutekin@hotmail.com

ORCID ID: orcid.org/0000-0002-0912-5307

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more affected than males.¹⁰ A meta-analysis showed the prevalence of bilateral agenesis of maxillary lateral incisors to be between 50.9% and 57%,⁴ while other studies have found unilateral agenesis to be more extensive.^{9,10}

In clinical practice, the absence of the lateral incisor can cause esthetic, periodontal, and functional issues. These deficiencies compromise smile harmony and result in an unattractive facial appearance.³ There are two main treatment options for maxillary lateral incisor agenesis: orthodontic space closure with canine substitution or orthodontic space opening with prosthetic replacement.^{7,11-14} A recent systematic study has confirmed orthodontic space closure improved periodontal and esthetic parameters.¹³ Several clinical factors, such as age, sagittal occlusion, facial profile, presence or absence of crowding in both dental arches and tooth morphology,^{7,11,12} or patient-related factors, such as financial capabilities and esthetic preferences, may influence the treatment preference.¹⁵ The more a canine tooth's form, size, color, and gingival margin deviates from that of a lateral incisor, the more difficult it is to modify it to look like one.¹⁶

It is important to remember that esthetic perception may differ between dentists and patients.¹⁷ Therefore, a consensus on the best care for the patient's practical and esthetic needs has to be reached, and this should include not only dentists' but also patients' interpretations.^{3,18} Some esthetic deficiencies, such as the proportion and position of the individual teeth and gingival tissue asymmetries, may often not be noticeable to laypeople, which may question the real need for esthetic treatments. This study aimed to evaluate the effect of different smile patterns which may occur as a result of canine substitution for the treatment of missing lateral incisor(s) on esthetic perception in patients of different age groups, genders, and professions (dental professionals and laypeople). The null hypothesis was that there was no difference in esthetic perception among the different groups of profession, age, and gender.

MATERIALS AND METHODS

This study was approved by Başkent University Institutional Review Board (approval number: 94603339/050.01.08.01-04; project number: D-KA20/39, date: 08.12.2020). The frontal extraoral photographs of a 28-year-old female were used to conduct the present study. She provided informed consent for the use of her images in the survey and publication of this manuscript. The patient had no orthodontic treatment records, and her smile showed unrestored and healthy maxillary anterior teeth. This patient's dental appearance was rated as highly attractive based on the subjective concepts of ideal esthetic criteria mentioned in the literature.¹⁹

A digital camera with a tripod and macro 60 mm objective lens (10 megapixels; Canon XTI Rebel, Japan) was used to produce distinct photographs which showed the patient's face's inferior third, including the teeth, gingiva, and lips. All photographs were taken at a distance of one meter, with the subject standing at the same height as the photographer. The participant was instructed to maintain a natural head posture while focusing their eyes on an imaginary point at eye level. The original photograph was modified using Adobe Photoshop CC software (Adobe Systems Inc., San Francisco, CA, USA); however, the mandibular arch was not altered.

The photograph was altered in the anterior region of the maxillary arch, with varying compositions of distinct forms and gingival contours

of the lateral teeth. Changes were made to simulate individualized repositioning of the canine in the left or both sides in the place of the lateral incisor.

The groups of figures were divided as follows: original (reference) smile image with no canine substitution (Figure 1), original canine as lateral incisor, substituted unilaterally, original canine gingival level (Figure 2); original canine as lateral incisor, substituted unilaterally, lateral gingival level (Figure 3); reshaped canine as lateral incisor, substituted unilaterally, original canine gingival level (Figure 4); reshaped canine as lateral incisor, substituted unilaterally, lateral gingival level (Figure 5); original canine as lateral incisor, substituted bilaterally, original canine gingival level (Figure 6); original canine as lateral incisor, substituted bilaterally, lateral gingival level (Figure 7); reshaped canine as lateral



Figure 1. Original (reference) smile image with no canine substitution.



Figure 2. Original canine as lateral incisor, substituted unilaterally, original canine gingival level.



Figure 3. Original canine as lateral incisor, substituted unilaterally, lateral gingival level.

incisor, substituted bilaterally, original canine gingival level (Figure 8); reshaped canine as lateral incisor, substituted bilaterally, lateral gingival level (Figure 9).

All participants were informed that single or bilateral maxillary lateral incisor agenesis is a very common dental and esthetic problem. Positioning the canine in place of the lateral incisor is one of the treatment alternatives. This study aimed to evaluate the effect on esthetic perception of different smile models which may occur as a result of positioning the canine instead of the lateral incisor. For each of the nine smile images, participants filled out demographic details and responded to the question, “How do you evaluate the overall esthetic of this smile?” A numeric rating scale (NRS) with 0 representing “the least attractive” and 10 representing “the most attractive” was used to answer the questions.

The 713 people who answered the survey were either dentists, dental students, or laypeople. The age range of the entire sample was 20 to 65 years, and it was divided into five age groups: 20-25, 26-35, 36-45, 46-55, 56-65 years.²⁰

The survey was prepared on the internet, and the participants were provided with a link (docs.google.com/forms) to access the survey. The survey was communicated to the participants via social media.

Statistical Procedures

The Kolmogorov-Smirnov test was used to determine whether the distribution of continuous and discrete numerical variables was close to normal and whether the assumption of homogeneity of variances was achieved with the Levene test. Descriptive statistics: The median for



Figure 4. Reshaped canine as lateral incisor, substituted unilaterally, original canine gingival level.



Figure 7. Original canine as lateral incisor, substituted bilaterally, lateral gingival level.



Figure 5. Reshaped canine as lateral incisor, substituted unilaterally, lateral gingival level.



Figure 8. Reshaped canine as lateral incisor, substituted bilaterally, original canine gingival level.



Figure 6. Original canine as lateral incisor, substituted bilaterally, original canine gingival level.



Figure 9. Reshaped canine as lateral incisor, substituted bilaterally, lateral gingival level.

continuous and discrete numeric variables (25th-75th) was expressed as a percentage, while categorical variables were expressed as numbers (n) and percentages (%).

The Friedman test was used to examine the statistical difference in terms of esthetic perception levels among different smile models within each subgroup when the age groups, sex, and professional groups of the participants were held constant. If the results of the Friedman test statistics were found to be significant, the smile model(s) which caused the difference was determined using the Dunn-Bonferroni test.

The Mann-Whitney U test was used to examine whether gender and type of profession were effective on the level of esthetic perception according to smile models. The Kruskal-Wallis test was used to evaluate the statistical difference in esthetic perception levels according to age groups. If the Kruskal-Wallis test results were found to be significant, the age groups that caused the difference were determined using the Dunn-Bonferroni test.

Percentage changes in the esthetic perception level in other smile models according to the reference smile model were calculated using the following formula:

Percentage change in esthetic perception = [(esthetic perception score of the examined smile model-esthetic perception score of the reference model)/esthetic perception score of the reference model] × 100.

Statistical Analysis

Data analysis was performed using IBM SPSS Statistics (version 17.0; IBM Corporation, Armonk, NY, USA). Unless otherwise stated, results with $p < 0.05$ were considered statistically significant. However, Bonferroni correction was used to check type 1 error in all possible multiple comparisons.

RESULTS

Table 1 presents the demographic information of the participants. Table 2 shows the in-group comparisons made in terms of the level of appreciation of the figures according to the participants' age, gender, and professional groups.

Table 3 shows intergroup comparisons made in terms of the level of appreciation of the figures according to age, gender, and professional groups. There was no statistically significant difference between

males and females in terms of their appreciation levels of each figure examined by either dental professionals or laypeople, within each age group ($p > 0.00056$). In the groups of males and females aged 26-35 and 36-45, dental professionals had lower appreciation levels compared to laypeople ($p < 0.00056$). Male dental professionals in the 56-65 age group had higher appreciation levels compared to the 26-35 and 36-45 age groups ($p < 0.0014$). Female dental professionals in the 46-55 age group had higher appreciation levels compared to the 36-45 age group ($p < 0.0014$).

Table 4 shows comparisons between age, gender, and professional groups in terms of their appreciation percentages of other figures evaluated according to the reference figure. In the group of dental professionals and laypeople aged 36-45, females had lower appreciation percentages compared to males ($p < 0.000625$). Male and female dental professionals had lower appreciation percentages compared to laypeople ($p < 0.00056$). Male and female dental professionals in the 26-35 age group had lower appreciation percentages compared to the other age groups ($p < 0.00156$).

In all remaining possible multiple comparisons, no statistically significant difference was found between the groups ($p < 0.000625$).

DISCUSSION

This study aimed to reveal the esthetic perception of dental professionals and laypeople with consideration to their age and sex. To minimize anatomical differences between the canines and maxillary lateral incisors, clinical situations were simulated by changing the canine shape and gingival contour bilaterally and unilaterally. The results showed that the null hypothesis that there was no difference in aesthetic perception among different groups of age, sex and profession was rejected.

When the attractiveness of a smile was examined by gender, significant differences were observed among the dental professionals and laypeople in the 36-45 age group. The esthetic perception percentage of the female groups was significantly lower in both groups. However, no statistically significant differences were noted among the other groups (Table 4). This is partially in agreement with the findings of previous studies showing that there are differences in esthetic perception between males and females.^{21,22} In the literature, there are also contradicting results, while the female group was more critical in some studies,^{2,21} Schabel et al.²³ received more rigid assessments from the male group in their study. According to the results of the current study, although the female group pays more attention to details than males when evaluating smile photographs of some specific groups, it is still unclear whether there is a relationship between gender and esthetic smile perception.

When the attractiveness of smile was examined in terms of profession, significant differences were observed among the male and female dental professionals compared to the laypeople in the group aged 36-45 which showed significantly lower appreciation percentages of all figures with respect to the reference figure. Female dental professionals, when compared to the female laypeople in the groups aged 26-35 and 46-55, gave significantly lower appreciation percentages to most figures in comparison to the reference figure (Table 4). Similar to the results of this study, Roden-Johnson et al.²⁴ found that dentists are stricter evaluators than laypeople. This result can be rationalized by the fact that dentists are professionals, and thus can easily detect small differences in a

	Dental professionals	Laypeople	Total
Age groups			
20-25	50 (15.8%)	66 (16.7%)	116 (16.3%)
26-35	77 (24.3%)	90 (22.7%)	167 (23.4%)
36-45	96 (30.2%)	111 (28.0%)	207 (29.0%)
46-55	49 (15.5%)	72 (18.2%)	121 (17.0%)
56-65	45 (14.2%)	57 (14.4%)	102 (14.3%)
Gender			
Male	133 (42.0%)	186 (47.0%)	319 (44.7%)
Female	184 (58.0%)	210 (53.0%)	394 (55.3%)
Total	317 (44.5%)	396 (55.5%)	713 (100.0%)

Table 2. Esthetic perception levels of different smile models according to age, gender and professional groups - in-group comparisons

Age groups		20-25	26-35	36-45	46-55	56-65
Male dental professionals	Figure 1	8.0 (7.0-9.0)	8.0 (7.5-9.0)	8.0 (7.0-9.0)	9.0 (7.8-9.3)	9.0 (9.0-10.0)
	Figure 2	3.0 (3.0-6.0) ¹	3.0 (2.0-5.0) ¹	4.0 (3.0-5.0) ¹	5.5 (4.0-7.3) ¹	5.0 (4.0-6.0) ¹
	Figure 3	3.0 (3.0-5.0) ¹	3.0 (2.0-5.5) ¹	5.0 (3.0-5.0) ¹	5.5 (4.0-7.0) ¹	5.0 (4.0-6.0) ¹
	Figure 4	5.0 (4.0-8.0)	5.0 (3.0-6.5) ¹	6.0 (5.0-6.0) ^{1,2,3}	6.0 (5.8-7.5)	7.0 (5.5-8.0)
	Figure 5	7.0 (6.0-8.0)	5.0 (3.5-6.0) ¹	6.0 (5.0-7.0) ^{2,3}	6.5 (6.0-8.3)	8.0 (6.5-8.0) ^{2,3}
	Figure 6	5.0 (3.0-6.0) ¹	4.0 (1.0-6.0) ¹	4.0 (3.0-6.0) ^{1,5}	6.0 (5.0-7.3) ¹	5.0 (4.0-7.0) ^{1,5}
	Figure 7	5.0 (3.0-7.0)	3.0 (2.0-5.5) ¹	4.0 (3.0-6.0) ^{1,4,5}	6.0 (5.8-8.0) ¹	6.0 (4.0-6.5) ^{1,5}
	Figure 8	7.0 (6.0-8.0) ^{2,3}	6.0 (4.0-8.0) ^{3,6,7}	6.0 (6.0-7.3) ^{2,3,6,7}	7.5 (6.0-9.3)	8.0 (7.0-8.0) ^{2,3,6,7}
	Figure 9	8.0 (7.0-10.0) ^{2,3,6,7}	6.0 (5.0-8.0) ^{2,3,6,7}	6.0 (5.8-8.0) ^{2,3,6,7}	9.0 (6.8-9.3) ^{2,3}	8.0 (8.0-9.0) ^{2,3,6,7}
Female dental professionals	Figure 1	8.0 (7.0-9.0)	8.5 (7.0-10.0)	9.0 (8.0-9.0)	9.0 (8.0-10.0)	8.0 (7.0-10.0)
	Figure 2	5.0 (3.0-6.0) ¹	4.0 (2.0-5.0) ¹	4.0 (4.0-5.0) ¹	5.0 (4.0-7.0) ¹	5.0 (4.0-6.0) ¹
	Figure 3	5.0 (3.0-5.0) ¹	4.0 (2.0-5.0) ¹	5.0 (4.0-5.0) ¹	5.0 (4.0-6.0) ¹	5.0 (4.0-6.0) ¹
	Figure 4	5.0 (4.0-6.0) ¹	5.0 (4.0-7.0) ¹	5.0 (5.0-6.0) ¹	6.0 (5.0-7.0) ¹	6.0 (4.3-7.0)
	Figure 5	6.0 (5.0-8.0)	6.0 (4.0-7.0) ^{1,2}	6.0 (5.0-7.0) ^{1,2,3}	6.0 (5.0-8.0) ¹	6.0 (4.3-7.0)
	Figure 6	4.0 (2.0-6.0) ^{1,5}	3.0 (2.0-5.0) ^{1,5}	4.0 (4.0-5.0) ^{1,5}	5.0 (3.0-7.0) ¹	5.0 (4.0-6.0) ¹
	Figure 7	4.0 (2.0-5.0) ^{1,5}	3.0 (2.0-5.0) ^{1,5}	4.0 (3.0-5.0) ^{1,5}	5.0 (3.0-7.0) ¹	5.0 (3.3-6.0) ¹
	Figure 8	6.0 (4.0-8.0)	6.0 (4.0-8.0) ^{2,3,6,7}	7.0 (5.8-7.0) ^{1,2,3,6,7}	8.0 (6.0-10.0) ^{2,3,6,7}	7.5 (5.3-9.0) ^{2,3,6,7}
	Figure 9	7.0 (5.0-9.0) ^{2,3,6,7}	7.0 (6.0-8.8) ^{2,3,4,6,7}	8.0 (7.0-8.0) ^{2,3,4,6,7}	8.0 (6.0-10.0) ^{2,3,4,6,7}	8.0 (6.3-9.0) ^{2,3,6,7}
Male laypeople	Figure 1	8.0 (7.0-8.8)	9.0 (8.0-9.3)	8.0 (7.0-8.3)	8.0 (7.0-9.0)	8.0 (6.0-9.0)
	Figure 2	7.0 (5.0-7.8)	6.5 (5.0-8.0) ¹	7.0 (5.0-7.0) ¹	6.0 (6.0-8.0) ¹	7.0 (5.0-7.0)
	Figure 3	6.0 (4.3-7.0) ¹	6.0 (5.0-7.0) ¹	7.0 (5.0-7.0) ¹	6.0 (5.0-8.0)	7.0 (5.0-7.0)
	Figure 4	8.0 (5.3-8.0)	8.0 (7.0-9.0)	8.0 (7.8-9.0) ^{2,3}	8.0 (5.0-9.0)	8.0 (6.0-9.0)
	Figure 5	7.0 (6.0-9.0)	8.0 (7.0-9.0) ³	8.0 (7.0-8.0) ²	8.0 (6.0-9.0)	8.0 (5.0-9.0)
	Figure 6	6.0 (4.0-7.0)	6.0 (4.8-8.0) ^{1,4,5}	6.0 (5.0-7.0) ^{1,4,5}	6.0 (5.0-8.0) ^{1,5}	6.0 (5.0-7.0)
	Figure 7	6.0 (4.0-7.0) ^{1,4}	6.0 (4.0-7.3) ^{1,4,5}	6.0 (5.0-7.0) ^{1,4,5}	6.0 (5.0-8.0) ^{1,5}	6.0 (5.0-7.0)
	Figure 8	8.0 (6.0-8.0) ⁷	8.0 (8.0-9.3) ^{2,3,6,7}	8.0 (7.8-9.0) ^{2,3,6,7}	8.0 (6.0-9.0) ⁷	8.0 (5.0-9.0) ^{2,3}
	Figure 9	7.0 (6.0-8.8) ⁷	8.5 (7.0-10.0) ^{2,3,6,7}	8.0 (7.0-9.0) ^{2,3,6,7}	8.0 (6.0-9.0) ^{2,6,7}	8.0 (6.0-9.0) ^{2,3,6,7}
Female laypeople	Figure 1	8.0 (7.0-9.0)	8.0 (6.3-10.0)	8.0 (7.0-10.0)	8.0 (6.0-10.0)	8.0 (7.0-9.0)
	Figure 2	6.0 (4.0-7.3) ¹	6.0 (4.0-7.0) ¹	6.0 (5.0-7.5) ¹	6.0 (5.0-8.0)	6.0 (5.0-7.0) ¹
	Figure 3	6.0 (3.0-7.0) ¹	5.0 (4.0-7.0) ¹	6.0 (5.0-7.0) ¹	6.0 (5.0-7.0) ¹	6.0 (4.0-7.3) ¹
	Figure 4	8.0 (5.8-9.0) ^{2,3}	7.0 (6.0-8.0) ³	7.0 (6.0-9.0) ^{2,3}	8.0 (5.0-9.0) ³	7.0 (5.0-8.0)
	Figure 5	8.0 (6.8-9.0) ^{2,3}	7.0 (6.0-8.0) ^{2,3}	7.0 (6.0-8.5) ^{2,3}	7.0 (6.0-9.0) ³	7.0 (6.0-8.3)
	Figure 6	5.5 (4.0-7.3) ^{1,4,5}	6.0 (5.0-7.0) ^{1,4,5}	6.0 (5.0-7.0) ^{1,4,5}	7.0 (5.0-8.0)	6.0 (5.0-8.0) ¹
	Figure 7	5.5 (4.0-7.0) ^{1,4,5}	6.0 (4.0-7.0) ^{1,4,5}	6.0 (5.0-7.0) ^{1,4,5}	6.0 (5.0-8.0)	5.5 (5.0-7.0) ¹
	Figure 8	8.0 (6.0-9.0) ^{3,7}	8.0 (6.0-9.0) ^{2,3,6,7}	8.0 (7.0-9.0) ^{2,3,6,7}	8.0 (6.0-9.0) ³	8.0 (7.0-9.0) ^{2,3,7}
	Figure 9	8.5 (7.0-9.0) ^{2,3,6,7}	8.0 (6.0-9.0) ^{2,3,6,7}	9.0 (7.0-9.5) ^{2,3,6,7}	8.0 (6.0-9.0) ³	7.5 (7.0-8.3)

Descriptive statistics; The median (25th-75th) are shown as percentages. The results were considered statistically significant for p<0.0025 according to the Bonferroni correction. ¹The difference with Figure 1 was statistically significant (p<0.0025). ²The difference with Figure 2 was statistically significant (p<0.0025). ³The difference with Figure 3 was statistically significant (p<0.0025). ⁴The difference with Figure 4 was statistically significant (p<0.001). ⁵The difference with Figure 5 was statistically significant (p<0.0025). ⁶The difference with Figure 6 was statistically significant (p<0.0025). ⁷The difference with Figure 7 was statistically significant (p<0.001).

smile.^{22,23} On the other hand, Krishnan et al.²⁵ reported that dentists and laypeople were equally critical in their judgment.

This study also focused on whether age is an important factor in esthetic perception. For the male dental professional groups aged 36-45, 46-55, and 56-65, the esthetic perception percentage of some figures was significantly higher than the 26-35 age group. For the male laypeople group aged 36-45, the esthetic perception percentage of some figures is significantly higher than the 26-35 age group. Apart from these

groups, the esthetic perception percentage was not affected by age (Table 4). This result is partially in agreement with the findings of previous studies.²⁶⁻²⁸ Pithon et al.²⁶ reported that younger laypeople are more critical of dental esthetics than older people. A similar finding was observed in a study²⁷ which focused on the definition of smile attractiveness and its esthetic criteria differences, in which younger evaluators were more critical when evaluating smiles with diastema. Another study²⁸ also reported that age affects smile perception. On the other hand, Kokich et al.²² found that age did not affect esthetic

Table 3. Esthetic perception levels of different smile models according to age, gender and profession groups - comparisons between groups

Age groups		20-25	26-35	36-45	46-55	56-65
Male dental professionals	Figure 1	8.0 (7.0-9.0)	8.0 (7.5-9.0)	8.0 (7.0-9.0)	9.0 (7.8-9.3)	9.0 (9.0-10.0) ^A
	Figure 2	3.0 (3.0-6.0)	3.0 (2.0-5.0) ^A	4.0 (3.0-5.0) ^A	5.5 (4.0-7.3)	5.0 (4.0-6.0)
	Figure 3	3.0 (3.0-5.0)	3.0 (2.0-5.5) ^A	5.0 (3.0-5.0) ^A	5.5 (4.0-7.0)	5.0 (4.0-6.0)
	Figure 4	5.0 (4.0-8.0)	5.0 (3.0-6.5) ^A	6.0 (5.0-6.0) ^A	6.0 (5.8-7.5)	7.0 (5.5-8.0) ¹
	Figure 5	7.0 (6.0-8.0)	5.0 (3.5-6.0) ^A	6.0 (5.0-7.0) ^A	6.5 (6.0-8.3)	8.0 (6.5-8.0) ¹
	Figure 6	5.0 (3.0-6.0)	4.0 (1.0-6.0) ^A	4.0 (3.0-6.0) ^A	6.0 (5.0-7.3) ¹	5.0 (4.0-7.0)
	Figure 7	5.0 (3.0-7.0)	3.0 (2.0-5.5)	4.0 (3.0-6.0) ^A	6.0 (5.8-8.0) ¹	6.0 (4.0-6.5)
	Figure 8	7.0 (6.0-8.0)	6.0 (4.0-8.0) ^A	6.0 (6.0-7.3) ^A	7.5 (6.0-9.3)	8.0 (7.0-8.0)
	Figure 9	8.0 (7.0-10.0)	6.0 (5.0-8.0) ^A	6.0 (5.8-8.0) ^A	9.0 (6.8-9.3)	8.0 (8.0-9.0) ^{1,2}
Female dental professionals	Figure 1	8.0 (7.0-9.0)	8.5 (7.0-10.0)	9.0 (8.0-9.0)	9.0 (8.0-10.0)	8.0 (7.0-10.0)
	Figure 2	5.0 (3.0-6.0)	4.0 (2.0-5.0) ^B	4.0 (4.0-5.0) ^B	5.0 (4.0-7.0) ²	5.0 (4.0-6.0)
	Figure 3	5.0 (3.0-5.0)	4.0 (2.0-5.0)	5.0 (4.0-5.0) ^B	5.0 (4.0-6.0)	5.0 (4.0-6.0)
	Figure 4	5.0 (4.0-6.0) ^B	5.0 (4.0-7.0) ^B	5.0 (5.0-6.0) ^B	6.0 (5.0-7.0)	6.0 (4.3-7.0)
	Figure 5	6.0 (5.0-8.0)	6.0 (4.0-7.0)	6.0 (5.0-7.0) ^B	6.0 (5.0-8.0)	6.0 (4.3-7.0)
	Figure 6	4.0 (2.0-6.0)	3.0 (2.0-5.0) ^B	4.0 (4.0-5.0) ^B	5.0 (3.0-7.0)	5.0 (4.0-6.0)
	Figure 7	4.0 (2.0-5.0)	3.0 (2.0-5.0) ^B	4.0 (3.0-5.0) ^B	5.0 (3.0-7.0)	5.0 (3.3-6.0)
	Figure 8	6.0 (4.0-8.0)	6.0 (4.0-8.0)	7.0 (5.8-7.0) ^B	8.0 (6.0-10.0)	7.5 (5.3-9.0)
	Figure 9	7.0 (5.0-9.0)	7.0 (6.0-8.8)	8.0 (7.0-8.0)	8.0 (6.0-10.0)	8.0 (6.3-9.0)
Male laypeople	Figure 1	8.0 (7.0-8.8)	9.0 (8.0-9.3)	8.0 (7.0-8.3)	8.0 (7.0-9.0)	8.0 (6.0-9.0) ^A
	Figure 2	7.0 (5.0-7.8)	6.5 (5.0-8.0) ^A	7.0 (5.0-7.0) ^A	6.0 (6.0-8.0)	7.0 (5.0-7.0)
	Figure 3	6.0 (4.3-7.0)	6.0 (5.0-7.0) ^A	7.0 (5.0-7.0) ^A	6.0 (5.0-8.0)	7.0 (5.0-7.0)
	Figure 4	8.0 (5.3-8.0)	8.0 (7.0-9.0) ^A	8.0 (7.8-9.0) ^A	8.0 (5.0-9.0)	8.0 (6.0-9.0)
	Figure 5	7.0 (6.0-9.0)	8.0 (7.0-9.0) ^A	8.0 (7.0-8.0) ^A	8.0 (6.0-9.0)	8.0 (5.0-9.0)
	Figure 6	6.0 (4.0-7.0)	6.0 (4.8-8.0) ^A	6.0 (5.0-7.0) ^A	6.0 (5.0-8.0)	6.0 (5.0-7.0)
	Figure 7	6.0 (4.0-7.0)	6.0 (4.0-7.3)	6.0 (5.0-7.0) ^A	6.0 (5.0-8.0)	6.0 (5.0-7.0)
	Figure 8	8.0 (6.0-8.0)	8.0 (8.0-9.3) ^A	8.0 (7.8-9.0) ^A	8.0 (6.0-9.0)	8.0 (5.0-9.0)
	Figure 9	7.0 (6.0-8.8)	8.5 (7.0-10.0) ^A	8.0 (7.0-9.0) ^A	8.0 (6.0-9.0)	8.0 (6.0-9.0)
Female laypeople	Figure 1	8.0 (7.0-9.0)	8.0 (6.3-10.0)	8.0 (7.0-10.0)	8.0 (6.0-10.0)	8.0 (7.0-9.0)
	Figure 2	6.0 (4.0-7.3)	6.0 (4.0-7.0) ^B	6.0 (5.0-7.5) ^B	6.0 (5.0-8.0)	6.0 (5.0-7.0)
	Figure 3	6.0 (3.0-7.0)	5.0 (4.0-7.0)	6.0 (5.0-7.0) ^B	6.0 (5.0-7.0)	6.0 (4.0-7.3)
	Figure 4	8.0 (5.8-9.0) ^B	7.0 (6.0-8.0) ^B	7.0 (6.0-9.0) ^B	8.0 (5.0-9.0)	7.0 (5.0-8.0)
	Figure 5	8.0 (6.8-9.0)	7.0 (6.0-8.0)	7.0 (6.0-8.5) ^B	7.0 (6.0-9.0)	7.0 (6.0-8.3)
	Figure 6	5.5 (4.0-7.3)	6.0 (5.0-7.0) ^B	6.0 (5.0-7.0) ^B	7.0 (5.0-8.0)	6.0 (5.0-8.0)
	Figure 7	5.5 (4.0-7.0)	6.0 (4.0-7.0) ^B	6.0 (5.0-7.0) ^B	6.0 (5.0-8.0)	5.5 (5.0-7.0)
	Figure 8	8.0 (6.0-9.0)	8.0 (6.0-9.0)	8.0 (7.0-9.0) ^B	8.0 (6.0-9.0)	8.0 (7.0-9.0)
	Figure 9	8.5 (7.0-9.0)	8.0 (6.0-9.0)	9.0 (7.0-9.5)	8.0 (6.0-9.0)	7.5 (7.0-8.3)

Descriptive statistics; the median (25th-75th) are shown as percentages. ¹When the gender and profession groups were held constant, the difference was statistically significant compare to 26-35 age group ($p < 0.0014$). ²When the gender and profession group were held constant, the difference was statistically significant compare to 36-45 age group ($p < 0.0014$). ^AWhen the age group was held constant, the difference between dental professionals and laypeople group was statistically significant in male groups ($p < 0.00056$). ^BWhen the age group was held constant, the difference between dental professionals and laypeople group was statistically significant in female groups ($p < 0.00056$).

perception. This is also partially in agreement with the results of the current study since dental professionals' years of practical knowledge and laypeople evaluators' age did not affect the esthetic perception in female groups. Additionally, it is important to emphasize that younger evaluators in the male group were more critical. Therefore, it is still unclear whether there is a relationship between age and esthetic smile perception.

Space closure with canine repositioning in place of the absence of the lateral incisor might be the best treatment alternative.¹⁴ However, certain canine features must be altered for these teeth to resemble the missing lateral incisors in terms of esthetic appearance. Therefore, this study also focused on camouflaging the canine to mimic the appearance of a lateral incisor, as shown in Figures 4, 5, 8, and 9. When the attractiveness of the smile was examined according to the tooth form in all groups, except for male dentists aged 46-55 and female laypeople

Table 4. Comparisons of esthetic perception (%) according to the reference smile image among the groups of age, gender and profession

Age groups		20-25	26-35	36-45	46-55	56-65
Male dental professionals	Figure 2	-57.1 (-66.7 - -28.6)	-57.1 (-75.0 - -33.3) ¹	-44.4 (-51.4 - -39.4) ¹	-35.4 (-42.9 - -21.7)	-44.4 (-55.6 - -31.7) ¹
	Figure 3	-57.1 (-66.7 - -37.5) ¹	-62.5 (-75.0 - -33.3) ¹	-43.7 (-50.0 - -33.3) ¹	-35.4 (-42.9 - -22.2)	-44.4 (-52.8 - -33.3) ¹
	Figure 4	-33.3 (-42.9 - 0.0)	-44.4 (-62.5 - -22.2) ¹	-28.6 (-37.5 - -11.1) ¹	-23.6 (-33.3 - -11.9)	-22.2 (-36.7 - -11.8) ¹
	Figure 5	-14.3 (-25.0 - 0.0)	-37.5 (-59.0 - -25.0) ^{1,1}	-22.2 (-25.0 - 0.0) ^{1,2}	-14.3 (-33.3 - -10.8) ¹	-14.3 (-27.5 - -5.0) ²
	Figure 6	-33.3 (-62.5 - -14.3)	-55.6 (-86.6 - -29.2) ¹	-40.0 (-50.0 - -33.3) ¹	-28.6 (-33.3 - -20.0) ²	-33.3 (-55.6 - -26.8) ¹
	Figure 7	-40.0 (-62.5 - -10.0)	-62.5 (-75.0 - -37.5) ¹	-42.9 (-56.0 - -33.3) ¹	-26.8 (-33.3 - -18.6) ²	-33.3 (-55.6 - -27.5)
	Figure 8	-12.5 (-22.2 - 28.6)	-33.3 (-50.0 - -11.1) ¹	-14.3 (-33.3 - 0.0) ¹	-11.8 (-28.6 - 0.0)	-11.1 (-22.2 - -10.6)
	Figure 9	0.0 (-10.0 - 11.1)	-25.0 (-35.4 - -11.1) ¹	-17.1 (-25.0 - -7.5) ¹	0.0 (-14.3 - 0.0)	-10.0 (-15.6 - 0.0)
	Female dental professionals	Figure 2	-37.5 (-60.0 - -28.6)	-50.0 (-75.0 - -38.8) ¹	-50.0 (-55.6 - -40.0) ¹	-37.5 (-50.0 - -20.0) ¹
Figure 3		-40.0 (-60.0 - -28.6)	-47.2 (-76.2 - -30.0) ¹	-50.0 (-55.6 - -40.0) ¹	-40.0 (-50.0 - -22.2) ¹	-41.4 (-50.0 - -22.5)
Figure 4		-33.3 (-42.9 - -25.0) ¹	-38.8 (-55.6 - -20.6) ¹	-37.5 (-44.4 - -28.6) ¹	-30.0 (-50.0 - -12.5) ¹	-30.0 (-48.6 - -2.5)
Figure 5		-22.2 (-33.3 - 0.0) ¹	-25.0 (-48.6 - -11.5) ¹	-33.3 (-37.5 - -24.3) ^{1,2}	-25.0 (-40.0 - -11.1) ¹	-29.3 (-47.5 - -2.5)
Figure 6		-42.9 (-66.7 - -28.6)	-57.1 (-77.1 - -40.0) ¹	-50.0 (-55.6 - -37.5) ¹	-33.3 (-57.1 - -20.0) ¹	-40.0 (-50.0 - -22.5) ¹
Figure 7		-50.0 (-66.7 - -28.6)	-56.3 (-77.1 - -38.1) ¹	-50.0 (-63.5 - -39.4) ¹	-37.5 (-57.1 - -20.0) ¹	-43.7 (-50.0 - -28.6)
Figure 8		-28.6 (-40.0 - -10.0)	-30.0 (-50.0 - 0.0)	-22.2 (-40.0 - -11.9) ¹	-11.1 (-28.6 - 11.1)	-11.3 (-28.8 - 10.7)
Figure 9		-11.1 (-33.3 - 0.0)	-12.5 (-28.8 - 0.0)	-11.1 (-22.2 - -7.5) ¹	0.0 (-22.2 - 0.0)	0.0 (-13.8 - 14.3)
Male laypeople		Figure 2	-17.1 (-28.6 - 0.0)	-20.0 (-33.3 - -11.1) ¹	-12.5 (-25.9 - -10.0) ^{1,2}	-12.5 (-25.0 - 0.0)
	Figure 3	-22.2 (-37.5 - -10.6) ¹	-22.2 (-33.3 - -12.2) ¹	-13.4 (-22.9 - -11.1) ^{1,2}	-11.1 (-25.0 - 0.0)	-12.5 (-22.2 - 0.0) ¹
	Figure 4	-5.0 (-16.1 - 0.0)	0.0 (-22.2 - 0.0) ¹	0.0 (0.0 - 28.6) ^{1,2}	0.0 (-20.0 - 0.0)	0.0 (-10.0 - 0.0) ¹
	Figure 5	0.0 (-24.3 - 16.7)	0.0 (-22.2 - 12.5) ¹	0.0 (-11.5 - 14.3) ¹	0.0 (-11.1 - 0.0) ¹	0.0 (-11.1 - 12.5)
	Figure 6	-20.0 (-41.5 - 0.0)	-23.6 (-44.4 - -7.5) ¹	-23.6 (-30.0 - -14.3) ¹	-11.1 (-37.5 - 0.0)	-12.5 (-25.0 - 0.0) ¹
	Figure 7	-26.8 (-48.2 - -10.6)	-29.3 (-44.4 - -13.8) ¹	-22.2 (-30.8 - -12.2) ¹	-16.7 (-33.3 - 0.0)	-12.5 (-33.3 - 0.0)
	Figure 8	0.0 (-14.3 - 14.3)	0.0 (-11.1 - 2.8) ¹	0.0 (-2.5 - 21.3) ¹	0.0 (-12.5 - 0.0)	0.0 (0.0 - 11.1)
	Figure 9	-5.0 (-14.3 - 9.4)	0.0 (-20.6 - 2.8)	12.5 (-2.5 - 14.3) ¹	0.0 (-12.5 - 11.1)	0.0 (0.0 - 12.5)
	Female laypeople	Figure 2	-27.5 (-51.4 - -11.1)	-21.1 (-33.3 - -12.5) ¹	-25.0 (-40.0 - -12.5) ^{1,2}	-20.0 (-35.4 - 0.0) ¹
Figure 3		-30.0 (-55.6 - -12.2)	-30.0 (-40.0 - -12.5) ¹	-28.6 (-41.4 - -20.0) ^{1,2}	-25.0 (-33.3 - 0.0) ¹	-15.5 (-35.0 - -11.1)
Figure 4		0.0 (-22.1 - 0.0) ¹	-5.6 (-29.6 - 9.4) ¹	-10.0 (-22.2 - 0.0) ^{1,2}	0.0 (-16.7 - 12.5) ¹	-5.6 (-25.0 - 0.0)
Figure 5		0.0 (-11.5 - 12.5) ¹	0.0 (-28.8 - 0.0) ¹	-11.1 (-26.8 - 0.0) ¹	0.0 (-17.1 - 18.8) ¹	-5.0 (-13.5 - 0.0)
Figure 6		-25.4 (-51.4 - -8.3)	-26.8 (-47.5 - 0.0) ¹	-28.6 (-40.0 - -14.3) ¹	-12.5 (-30.0 - 0.0) ¹	-20.0 (-25.9 - -11.1) ¹
Figure 7		-29.3 (-47.2 - -8.3)	-25.0 (-42.1 - 0.0) ¹	-25.0 (-40.0 - -15.5) ¹	-16.7 (-27.5 - 0.0) ¹	-25.0 (-33.3 - -11.1)
Figure 8		0.0 (-30.8 - 12.5)	-10.0 (-28.6 - 0.0)	0.0 (-12.5 - 11.8) ¹	0.0 (-15.5 - 25.0)	0.0 (-11.1 - 11.5)
Figure 9		0.0 (-11.1 - 13.5)	0.0 (-13.5 - 9.4)	0.0 (-10.6 - 11.8) ¹	0.0 (-12.5 - 17.1)	0.0 (-20.6 - 11.1)

Descriptive statistics; The median (25th-75th) are shown as percentages. ¹When the gender and profession groups were held constant, the difference was statistically significant compare to 20-25 age group (p<0.00156). ²When the gender and profession groups were held constant, the difference was statistically significant compare to 26-35 age group (p<0.00156). ³When the age group was held constant, the difference between dental professionals and laypeople group was statistically significant in male groups (p<0.000625). ⁴When the age group was held constant, the difference between dental professionals and laypeople group was statistically significant in female groups (p<0.000625). ⁵When the age group was held constant, the difference between male and female within dental professionals was statistically significant (p<0.000625). ⁶When the age group was held constant, the difference between male and female within laypeople was statistically significant (p<0.000625).

aged 56-65, the lateral tooth form was shown to be significantly more attractive than the canine itself (Table 2). Consistent with this result, Rayner et al.²⁹ showed that dental professionals and laypeople found smiles significantly less attractive when canine teeth were substituted without reshaping as lateral incisors.

This study also examined the effect of two different gingival margin levels on esthetic perception. The results showed that the gingival margin level did not affect the esthetic perception of either the laypeople group or the dental professional group (Table 2). This is in agreement with the findings of Kokich et al.²² in which, by displacing 2 mm, neither dentists or non-professionals perceived the smile as

unattractive. Thierens et al.³⁰ found that the gingival margin height of the substituted canine was ranked as the least attractive when it was most apical. The difference between the findings of Thierens et al.³⁰ and those of the present study might be due to the discrepancy in gingival margin levels since the difference between the original canine gingival margin and the original lateral gingival margin was evaluated without excessive recession in the current study.

Creating dental symmetry and obtaining a good esthetic result might be more difficult when only one lateral incisor is missing than when both are missing. Dental differences in a smile are viewed as less esthetic when they are asymmetric, according to answers gained from

both dental professionals and laypeople.^{22,31} However, in the current study, regardless of whether the gingival margin level and tooth form modifications were applied unilaterally or bilaterally, participants showed similar levels of esthetic appreciation (Table 2). In accordance with the findings of this study, Rayner et al.²⁹ found no difference in unilateral or bilateral changes in their study, in which they determined the effect of canine characteristics and symmetry on perceived smile attractiveness when maxillary canines were used instead of missing lateral incisors.

The participants were asked to rank the photographs to evaluate the attractiveness of a smile because photographs are considered a proper and well-founded implement in evaluating the esthetic perception of the smile.³² A frontal view photograph of a patient was used, and all maxillary teeth were altered by using Photoshop image editing software program that has been promoted for many years due to its advanced functionality.²² In the methodology of this study, the authors pursued a method to make the images as imperceptible as possible with the aim of giving participants a natural esthetic smile visual sensation.

NRS is a numerically segmented variant of the visual analog scale (VAS). This scale is typically rated from 0 to 10 and includes user directions that help respondents to categorize the results using numbers.³³ In comparison to the VAS, the NRS can be used verbally with simpler ratings.³⁴ NRS is simple to understand³⁵ and adapt, and it allows for the simple and rapid assessment of subjective phenomena, such as esthetics.³⁶ Additionally, NRS requires the evaluator to provide less information to the respondent, reduces the time needed to obtain a response, and requires no equipment or motor skills.³⁵ Therefore, NRS was preferred for use in this study.

Study Limitations

The limitations of this study are that it only focused on criteria such as age, gender, and dental education; however, participant factors such as cultural background, socioeconomic status, and educational level, which may affect the interpretation of dental esthetics, were not balanced among the groups. A future study could investigate how participants' educational level and culture affect esthetic perception. Furthermore, the degree of alteration of the photographs could also increase or decrease the actual effects for each esthetic parameter. Another limitation is that the color and size of the photographs were not held constant since the survey was conducted over the internet. If the photographs were printed, different results might have been obtained. Another limitation of the current study was that it was not divided into further different groups, such as dentists and dental students.

CONCLUSION

It is unclear whether there is a relationship between gender and esthetic smile perception. In general, dental professionals were more critical than laypeople. In the male groups, younger males were more critical in their evaluations; however, in female groups, the assessments were not affected by age. Camouflaging the canine to mimic the appearance of a lateral incisor was appreciated more than the canine itself, while gingival level and symmetry did not make a difference. In this regard, clinicians should select treatment based on the patient's preferences.

MAIN POINTS

- Gender has to be considered during the decision-making process for treatment.

- Dental professionals and laypeople may have different perspectives on esthetics.
- In all evaluations, the reshaped canine as a lateral incisor is more appreciated than the unrestored form.
- Treatment should be chosen by the clinician based on the patient's preferences.

ETHICS

Ethics Committee Approval: This study was approved by Başkent University Institutional Review Board (approval number: 94603339/050.01.08.01-04; project number: D-KA20/39, date: 08.12.2020).

Informed Consent: She provided informed consent for the use of her images in the survey and publication of this manuscript.

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Authorship Contributions

Concept: T.U., C.Ö., Ö.O., Design: T.U., C.Ö., Ö.O., Supervision: Ö.O., Fundings: T.U., C.Ö., Materials: T.U., C.Ö., Data Collection and/or Processing: T.U., C.Ö., Analysis and/or Interpretation: T.U., C.Ö., Ö.O., Literature Search: T.U., C.Ö., Writing: T.U., C.Ö., Critical Review: Ö.O.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

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REFERENCES

1. Newton JT, Prabhu N, Robinson PG. The impact of dental appearance on the appraisal of personal characteristics. *International Journal of Prosthodontics*. 2003; 16(4): 429-34.
2. Parekh SM, Fields HW, Beck M, Rosenstiel S. Attractiveness of variations in the smile arc and buccal corridor space as judged by orthodontists and laymen. *Angle Orthod*. 2006; 76(4): 557-63.
3. Kavadia S, Papadiochou S, Papadiochos I, Zafiriadis L. Agenesis of maxillary lateral incisors: A global overview of the clinical problem. *Orthodontics (Chic)*. 2011; 12(4): 296-317.
4. Polder BJ, Van't Hof MA, Van der Linden FP, Kuijpers-Jagtman AM. A meta-analysis of the prevalence of dental agenesis of permanent teeth. *Community Dent Oral Epidemiol*. 2004; 32(3): 217-26.
5. Silva Meza R. Radiographic assessment of congenitally missing teeth in orthodontic patients. *Int J Paediatr Dent*. 2003; 13(2): 112-6.
6. Vastardis H. The genetics of human tooth agenesis: new discoveries for understanding dental anomalies. *Am J Orthod Dentofacial Orthop*. 2000; 117(6): 650-6.
7. Kokich VO Jr, Kinzer GA. Managing congenitally missing lateral incisors. Part I: Canine substitution. *J Esthet Restor Dent*. 2005; 17(1): 5-10.
8. Johannsdottir B, Wisth PJ, Magnusson TE. Prevalence of malocclusion in 6-year-old Icelandic children. *Acta Odontol Scand*. 1997; 55(6): 398-402.
9. Aasheim B, Ogaard B. Hypodontia in 9-year-old Norwegians related to need of orthodontic treatment. *Scand J Dent Res*. 1993; 101(5): 257-60.

10. Pinho T, Tavares P, Maciel P, Pollmann C. Developmental absence of maxillary lateral incisors in the Portuguese population. *Eur J Orthod*. 2005; 27(5): 443-9.
11. Kinzer GA, Kokich VO Jr. Managing congenitally missing lateral incisors. Part II: tooth-supported restorations. *J Esthet Restor Dent*. 2005; 17(2): 76-84.
12. Kinzer GA, Kokich VO Jr. Managing congenitally missing lateral incisors. Part III: single-tooth implants. *J Esthet Restor Dent*. 2005; 17(4): 202-10.
13. Silveira GS, de Almeida NV, Pereira DMT, Mattos CT, Mucha JN. Prosthetic replacement vs space closure for maxillary lateral incisor agenesis: a systematic review. *Am J Orthod Dentofacial Orthop*. 2016; 150(2): 228-37.
14. Tuverson DL. Orthodontic treatment using canines in place of missing maxillary lateral incisors. *Am J Orthod*. 1970; 58(2): 109-27.
15. Armbruster PC, Gardiner DM, Whitley JB Jr, Flerra J. The Congenitally Missing Maxillary Lateral Incisor. Part 2: assessing dentists' preferences for treatment. *World J Orthod*. 2005; 6(4): 376-81.
16. Rosa M, Zachrisson BU. Integrating space closure and esthetic dentistry in patients with missing maxillary lateral incisors. *J Clin Orthod*. 2007; 41(9): 563-73.
17. Figueiredo BA, Ribeiro JBP, Machado AW. Does the presence of unilateral gingival recession on maxillary canines influence smile esthetics? *Dental Press J Orthod*. 2020; 25(1): 56-63.
18. Rosa M, Olimpo A, Fastuca R, Caprioglio A. Perceptions of dental professionals and laypeople to altered dental esthetics in cases with congenitally missing maxillary lateral incisors. *Prog Orthod*. 2013; 14(1): 34.
19. Garber DA, Salama MA. The aesthetic smile: diagnosis and treatment. *Periodontol* 2000. 1996; 11: 18-28.
20. Jenkinson C, Coulter A, Wright L. Short form 36 (SF36) health survey questionnaire: normative data for adults of working age. *BMJ*. 1993; 306(6890): 1437-40.
21. Flores-Mir C, Silva E, Barriga MI, Lagravere MO, Major PW. Lay person's perception of smile aesthetics in dental and facial views. *J Orthod*. 2004; 31(3): 204-9; discussion 1.
22. Kokich VO, Kokich VG, Kiyak HA. Perceptions of dental professionals and laypersons to altered dental esthetics: asymmetric and symmetric situations. *Am J Orthod Dentofacial Orthop*. 2006; 130(2): 141-51.
23. Schabel BJ, McNamara JA Jr, Franchi L, Baccetti T. Q-sort assessment vs visual analog scale in the evaluation of smile esthetics. *Am J Orthod Dentofacial Orthop*. 2009; 135(4 Suppl): S61-71.
24. Roden-Johnson D, Gallerano R, English J. The effects of buccal corridor spaces and arch form on smile esthetics. *Am J Orthod Dentofacial Orthop*. 2005; 127(3): 343-50.
25. Krishnan V, Daniel ST, Lazar D, Asok A. Characterization of posed smile by using visual analog scale, smile arc, buccal corridor measures, and modified smile index. *Am J Orthod Dentofacial Orthop*. 2008; 133(4): 515-23.
26. Pithon MM, Santos AM, Viana de Andrade AC, Santos EM, Couto FS, da Silva Coqueiro R. Perception of the esthetic impact of gingival smile on laypersons, dental professionals, and dental students. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2013; 115(4): 448-54.
27. Rodrigues Cde D, Magnani R, Machado MS, Oliveira OB. The perception of smile attractiveness. *Angle Orthod*. 2009; 79(4): 634-9.
28. Sriphadungporn C, Chamnannididha N. Perception of smile esthetics by laypeople of different ages. *Prog Orthod*. 2017; 18(1): 8.
29. Rayner WJ, Barber SK, Spencer RJ. The effect of canine characteristics and symmetry on perceived smile attractiveness when canine teeth are substituted for lateral incisors. *J Orthod*. 2015; 42(1): 22-32.
30. Thierens LAM, Verhoeven B, Temmerman L, De Pauw GAM. An esthetic evaluation of unilateral canine substitution for a missing maxillary lateral incisor. *J Esthet Restor Dent*. 2017; 29(6): 442-9.
31. Pinho S, Ciriaco C, Faber J, Lenza MA. Impact of dental asymmetries on the perception of smile esthetics. *Am J Orthod Dentofacial Orthop*. 2007; 132(6): 748-53.
32. Howells DJ, Shaw WC. The validity and reliability of ratings of dental and facial attractiveness for epidemiologic use. *Am J Orthod*. 1985; 88(5): 402-8.
33. Phan NQ, Blome C, Fritz F, Gerss J, Reich A, Ebata T, et al. Assessment of pruritus intensity: prospective study on validity and reliability of the visual analogue scale, numerical rating scale and verbal rating scale in 471 patients with chronic pruritus. *Acta Derm Venereol*. 2012; 92(5): 502-7.
34. Hawker GA, Mian S, Kendzerska T, French M. Measures of adult pain: Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale for Pain (NRS Pain), McGill Pain Questionnaire (MPQ), Short-Form McGill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF-36 BPS), and Measure of Intermittent and Constant Osteoarthritis Pain (ICOAP). *Arthritis Care Res*. 2011; 63(Suppl 11): S240-S52.
35. Mohan H, Ryan J, Whelan B, Wakai A. The end of the line? The Visual Analogue Scale and Verbal Numerical Rating Scale as pain assessment tools in the emergency department. *Emerg Med J*. 2010; 27(5): 372-5.
36. Fernandes L, Pinho T. Esthetic evaluation of dental and gingival asymmetries. *Int Orthod*. 2015; 13(2): 221-31.