

Original

## Evaluation of black spaces between maxillary central incisors by dentistry students and laypeople

Erdem Ayyıldız<sup>1)</sup>, Enes Tan<sup>1)</sup>, Hakan Keklik<sup>2)</sup>, Ahmet A. Celebi<sup>3)</sup>,  
and Matheus M. Pithon<sup>4)</sup>

<sup>1)</sup>Department of Orthodontics, Faculty of Dentistry, Kirikkale University, Kirikkale, Turkey

<sup>2)</sup>Department of Orthodontics, Center of Oral and Dental Health, Izmir, Turkey

<sup>3)</sup>Department of Orthodontics, University of Alabama at Birmingham, Birmingham, AL, USA

<sup>4)</sup>Department of Health, Southwest Bahia State University, Jequie, BA, Brazil

(Received June 17, 2016; Accepted July 28, 2016)

**Abstract:** This study aimed to compare the perception of smile esthetics and alterations among dentistry degree students and laypeople to identify differences in the esthetic perception of black spaces between the maxillary central incisors among Turkish laypeople and students in different study years. Photographs altered to include black spaces of various sizes at the midline were evaluated by 208 dentistry students in years 1-5 and 45 Turkish laypeople. Perceptual differences in different photographs were statistically significant. The students in years 2-5 were more aware of differences between photographs than year 1 students and laypeople. The proportion of participants who decided the most attractive photograph as A was highest among 3rd year students, followed by 5th year students. However, the proportion of students agreeing on the least attractive image was highest among 4th year students, followed by 3rd year students. Photographs A and H were selected as the most and least attractive, respectively, by all participants. The esthetic perception of 1st and 2nd year dentistry students was very different from that of laypeople. To increase esthetic perception among dentistry students, specific lessons with clinical photography should be included in dental education.

**Keywords:** esthetic perception; dental education; black space.

---



---

### Introduction

Patients seek orthodontic treatment to achieve a satisfactory smile to provide self-confidence and promote better social relationships. Therefore, improving facial attractiveness should be an irrevocable treatment goal for orthodontists (1-4). Although the perception of beauty is subjective, both professional orthodontists and dental students follow certain guidelines to evaluate facial esthetics. Dental education can provide aspects in esthetic evaluation to dental students that may differ from that of laypersons. That is, beauty perception of satisfactory esthetics of dental students may differ from that of laypersons.

After orthodontic treatment, black spaces sometimes occur in the gingival embrasure region of the maxillary central incisors (5). Black spaces, which negatively affect facial esthetics, can occur on the midline because of gingival recession or bone resorption.

Many studies in the literature on the perception of smile esthetics are generally intended for dental professionals, laypersons, or dental students (6-15). But a literature search retrieved only one study that compared the perception of smile esthetics and alterations among dentistry students (16). Moreover, there was no study of Turkish students and/or laypeople. Therefore, the aim of this study was to evaluate the perception of smile esthetics and alterations in dentistry degree students at the University of Kirikkale, Turkey, as compared to

---

Correspondence to Dr. Hakan Keklik, Department of Orthodontics, Center of Oral and Dental Health, Izmir, Turkey  
E-mail: hakan\_keklik42@hotmail.com

Color figures can be viewed in the online issue at J-STAGE.  
doi.org/10.2334/josnusd.16-0478  
DN/JST.JSTAGE/josnusd/16-0478

laypeople, to determine whether there are educational differences among students in different years about the effects of black spaces between the maxillary central incisors.

### Materials and Methods

An extraoral photograph of a 30-year-old woman with neutral occlusion obtained with a digital camera (Rebel XTI; Canon, Tokyo, Japan) was used with the permission of Pithon et al. (5). This photograph was clipped to show the gingiva, teeth, and lips to focus attention on the smile only. The obtained photograph was altered with Photoshop (CS3; Adobe Systems, San Jose, CA, USA) to create black spaces of various sizes in the region of the gingival embrasures at the midline, while the mandibular arch was left untouched. Eight photographs were generated: for Image 1, photograph A had no black spaces, while photographs B to H had increasing sizes of black spaces (0.5, 1, 1.5, 2, 2.5, 3, and 3.5 mm, respectively). For Image 2, the order was reversed from H to A. There is no midline deviation in the photographs (Fig. 1).

The photographs were evaluated by 208 dentistry students in five year groups (years 1-5) studying at the Faculty of Dentistry, Kirikkale University, Turkey, and 45 Turkish laypeople (Group 6) of similar ages as the dentistry students (Table 1). The study protocol was approved by the Ethics Committee of Kirikkale University (16/08/2016). None of the participants received orthodontic treatment. The photographs presented to the students and laypeople were prepared in the form of a questionnaire. The first sheet contained a series of miniature photographs (10 × 6 cm, A to H) and the study participants were instructed to choose the most and least pleasing photographs. The process was repeated using a second sheet with the photographs contained in Image 1 in reverse order to evaluate the reliability of the study. Finally, the participants were instructed to evaluate a larger size of each photographs (20 × 12 cm) of Image 1 in random order using a 10-point scale of attractiveness: 0 = not very attractive; 5 = attractive; and 10 = very attractive. The photographs were placed at eye level at a distance of 30 cm. The evaluators were not allowed to make comparisons among the photographs. The time to evaluate each photograph was limited to 10 s.

The chi-square test was performed to determine the frequencies of replies by the students in each year of the 5-year dental program and laypeople. When the expected frequency was less than 5, Fisher's exact test was used. The Kruskal-Wallis test was used to compare



**Fig. 1** Images showing black spaces between the incisors. Image 1 (left): A, without space; B, space of 0.5 mm; C, space of 1.0 mm; D, space of 1.5 mm; E, space of 2.0 mm; F, space of 2.5 mm; G, space of 3.0 mm; H, space of 3.5 mm. Image 2 (right): A, space of 3.5 mm; B, space of 3.0 mm; C, space of 2.5 mm; D, space of 2.0 mm; E, space of 1.5 mm; F, space of 1.0 mm; G, space of 0.5 mm; H, without space.

the given values of each photograph and the Mann-Whitney *U* test was used for group comparisons. A probability (*P*) value of <0.05 was considered statistically significant. All statistical analyses were performed using the SPSS software for Windows (version 20.0; SPSS Inc., Chicago, IL, USA).

### Results

Of the 253 participants in this study, 112 (44.2%) were male and 141 (55.8%) were female (Table 1). Table 2 shows the perceptions of the photographs in Image 1 of the students and laypeople. Dentistry students in years

**Table 1** Demographic data of participants

	1 <i>n</i> = 48	2 <i>n</i> = 42	3 <i>n</i> = 36	4 <i>n</i> = 37	5 <i>n</i> = 45	6 <i>n</i> = 45	Total
Sex							
Male	22 (45.8%)	17 (40.5%)	14 (38.9%)	16 (43.2%)	19 (42.2%)	24 (53.3%)	112 (44.2%)
Female	26 (54.2%)	25 (59.5%)	22 (61.1%)	21 (56.8%)	26 (57.8%)	21 (46.7%)	141 (55.8%)

**Table 2** Participant perceptions with respect to differences and preferences for Image 1

	1	2	3	4	5	6	<i>P</i> value	Expected frequency
Perceive differences							<0.001 <sup>†</sup>	6.92
Yes	25 (52.1%)	39 (92.9%)	31 (86.1%)	35 (94.6%)	38 (84.4%)	32 (71.1%)		
No	23 (47.9%)	3 (7.1%)	5 (13.9%)	2 (5.4%)	7 (15.6%)	13 (28.9%)		
Image 1 like most							<0.001 <sup>‡</sup>	0.17
A	8 (32%)	34 (87.2%)	29 (93.5%)	30 (85.7%)	34 (89.5%)	21 (65.6%)		
B	1 (4%)	1 (2.6%)	0	3 (8.6%)	3 (7.9%)	1 (3.1%)		
C	4 (16%)	0	1 (3.25%)	0	0	6 (18.8%)		
D	4 (16%)	0	0	1 (2.85%)	0	0		
E	4 (16%)	0	0	1 (2.85%)	1 (2.6%)	2 (6.2%)		
F	1 (4%)	4 (10.3%)	0	0	0	1 (3.1%)		
G	1 (4%)	0	0	0	0	0		
H	2 (8%)	0	1 (3.25%)	0	0	1 (3.1%)		
Image 1 like least							<0.001 <sup>‡</sup>	0.52
A	2 (8%)	0	1 (3.25%)	0	0	1 (3.1%)		
B	0	0	0	0	0	1 (3.1%)		
C	0	0	0	0	0	0		
D	6 (24%)	1 (2.55%)	0	0	1 (2.6%)	5 (15.6%)		
E	2 (8%)	0	1 (3.25%)	0	2 (5.25%)	1 (3.1%)		
F	1 (4%)	1 (2.55%)	0	1 (2.85%)	0	2 (6.2%)		
G	5 (20%)	5 (12.8%)	2 (6.5%)	1 (2.85%)	2 (5.25%)	5 (15.6%)		
H	9 (36%)	32 (82.1%)	27 (87.1%)	33 (94.3%)	33 (86.8%)	17 (53.1%)		

\*Answered only by those who perceived differences between the images; <sup>†</sup>Chi-square test; <sup>‡</sup>Fisher's exact test.

2-5 were significantly more aware of the differences between the photographs than those in year 1 and the laypeople. The data show that among the participants who were able to note discrepancies between the photographs, there were significant differences in the ratios for both the most and least liked photographs. The ratio of students who preferred photograph A was the highest in year 3, followed year 5. Whereas, for the least attractive photograph, students in year 4 were first, followed those in year 3.

Table 3 shows the perceptions of participants according to differences and choices concerning Image 2. Perceptual differences in different photographs were statistically significant. The students in years 2-5 were more aware of differences between the photographs than those in year 1 and laypeople. For both the most and least liked photograph, the data showed that there were significant differences in the ratios of the participants who were able to note discrepancies between the photographs, similar to Image 1 in Table 2. The proportion of students who decided that the most attractive photograph was H was the highest in year 4, followed by year 5.

However, the proportion of students who agreed on the least attractive photograph was the highest in year 3, followed by year 4.

The mean scores for each photograph in Image 1 are shown in Table 4. Photographs A and H were selected as the most and least attractive, respectively, by all participants. Photograph A received the highest score by year 3 students (8.75) and photograph H was given the lowest score (0.86) by year 4 students. There were significant differences in the scores given to all photographs among the groups. Year 3 students assigned higher scores to photographs A, B, C, and D, whereas laypeople gave the highest score to photograph E, while students in year 1 assigned the higher scores to photographs F, G and H.

There were no significant differences in the grades assigned to photographs by students in years 1 and 2 and laypeople, with the exception of a significant difference between year 2 vs. year 1 students and laypeople in regard to photograph G. Other than photographs A and B, there were significant differences in the mean scores of photographs C-H between year 4 students

**Table 3** Participant perceptions with respect to differences and preferences for Image 2

	1	2	3	4	5	6	<i>P</i> value	Expected frequency
Perceive differences							<0.001 <sup>‡</sup>	4.67
Yes	29 (60.4%)	40 (95.2%)	34 (94.4%)	36 (97.3%)	42 (93.3%)	32 (71.1%)		
No	19 (39.6%)	2 (4.8%)	2 (5.6%)	1 (2.7%)	3 (6.7%)	13 (28.9%)		
Image 2 like most							<0.001 <sup>‡</sup>	0.17
A	2 (6.9%)	0	1 (2.95%)	0	2 (4.8%)	0		
B	2 (6.9%)	0	0	0	0	3 (9.4%)		
C	1 (3.45%)	1 (2.5%)	0	0	0	0		
D	0	1 (2.5%)	0	0	1 (2.36%)	0		
E	5 (17.2%)	0	0	0	1 (2.36%)	1 (3.1%)		
F	3 (10.3%)	3 (7.5%)	1 (2.95%)	0	0	4 (12.5%)		
G	1 (3.45%)	0	3 (8.8%)	1 (2.8%)	1 (2.36%)	5 (15.6%)		
H	15 (51.7%)	35 (87.5%)	29 (85.3%)	35 (97.2%)	37 (88.1%)	19 (59.4%)		
Image 2 like least							<0.001 <sup>‡</sup>	0.17
A	9 (31.0%)	36 (90.0%)	32 (94.1%)	33 (91.7%)	38 (90.5%)	17 (53.1%)		
B	3 (10.3%)	2 (5.0%)	0	1 (2.8%)	1 (2.4%)	4 (12.5%)		
C	4 (13.8%)	0	1 (2.95%)	2 (5.6%)	0	5 (15.6%)		
D	6 (20.7%)	0	0	0	0	3 (9.4%)		
E	1 (3.43%)	2 (5.0%)	0	0	0	2 (6.3%)		
F	1 (3.43%)	0	0	0	1 (2.4%)	0		
G	1 (3.43%)	0	0	0	0	0		
H	4 (13.8%)	0	1 (2.95%)	0	2 (4.8%)	1 (3.1%)		

\*Answered only by those who perceived differences between the images; <sup>‡</sup>Chi-square test; <sup>†</sup>Fisher's exact test.

**Table 4** Mean ( $\pm$  SD) scores assigned to photographs by dental students and laypeople

Photographs	1	2	3	4	5	6	<i>P</i> value
A	6.69 (3.14) <sup>a</sup>	6.40 (3.10) <sup>a</sup>	8.75 (1.82) <sup>b</sup>	8.41 (1.65) <sup>b</sup>	8.02 (1.91) <sup>b</sup>	6.29 (2.31) <sup>a</sup>	<0.001
B	6.02 (2.42) <sup>a</sup>	5.50 (2.40) <sup>a</sup>	7.33 (1.72) <sup>b</sup>	5.14 (1.66) <sup>a</sup>	4.96 (1.99) <sup>c</sup>	5.84 (1.46) <sup>a</sup>	<0.001
C	5.60 (2.65) <sup>a</sup>	5.05 (1.96) <sup>a</sup>	6.50 (1.78) <sup>b</sup>	3.59 (1.92) <sup>c</sup>	4.22 (1.96) <sup>c</sup>	5.87 (1.19) <sup>a</sup>	<0.001
D	5.40 (2.55) <sup>a</sup>	5.21 (1.93) <sup>a</sup>	6.44 (1.66) <sup>b</sup>	3.78 (1.71) <sup>c</sup>	4.20 (1.93) <sup>c</sup>	5.38 (1.54) <sup>a</sup>	<0.001
E	5.63 (2.43) <sup>a</sup>	5.29 (1.70) <sup>a</sup>	5.69 (1.54) <sup>a</sup>	3.11 (1.72) <sup>b</sup>	3.87 (1.98) <sup>b</sup>	5.78 (1.55) <sup>a</sup>	<0.001
F	5.33 (2.39) <sup>a</sup>	4.69 (2.53) <sup>a</sup>	4.64 (1.67) <sup>a</sup>	3.46 (1.60) <sup>b</sup>	3.64 (2.14) <sup>b</sup>	4.93 (1.57) <sup>a</sup>	<0.001
G	5.44 (2.38) <sup>a</sup>	4.17 (2.65) <sup>b</sup>	4.14 (1.93) <sup>b</sup>	2.24 (1.96) <sup>c</sup>	2.80 (2.11) <sup>c</sup>	4.87 (1.93) <sup>a</sup>	<0.001
H	4.81 (2.71) <sup>a</sup>	4.17 (3.62) <sup>a</sup>	3.06 (2.15) <sup>b</sup>	0.86 (1.56) <sup>c</sup>	1.71 (2.12) <sup>d</sup>	4.42 (2.73) <sup>a</sup>	<0.001

Scores were compared using the Kruskal-Wallis test. Values with different superscript letters are significantly different (Mann-Whitney *U* test).

versus students in years 1-3 and laypeople. However, there were no significant differences in scores between students in years 4 and 5, with the exception of photographs B and H (Table 4).

## Discussion

The phenomenon of beauty and/or esthetic criteria differ among social classes, ages, laypeople, and professionals. Dentists, as a professional group, especially consider esthetic criteria. Therefore, dental education is important to improve these criteria. Dental students typically pay more attention to esthetic criteria of a patient's smile than laypeople. Dentistry study programs in European countries are generally 5-6 years of full time study. The dental education period is 5 years in Turkey. The first 2 years of dental education are dominated by basic medical sciences, while professional courses are

limited in the educational curriculum in Turkey, as in most other countries. After the second year, professional lessons dominate and dental practice, including orthodontic internship and case discussions, start. Especially, the photography lesson is presented in this year by a lecturer from the Department of Orthodontics to contribute to the development of esthetics perception.

In the current study, laypeople of similar ages as the dentistry students were chosen for comparison. Moreover, the aim of this study was to identify perceptual differences among dentistry degree students and laypeople.

At the final stage of orthodontic treatment, black spaces that influence esthetics can occur at the midline (5,9,17). According to this opinion, the aim of current study was to evaluate esthetic perceptions of the smile of patients with different sized black spaces among



dental students in different years of study and laypeople.

A visual analog scale (VAS) was used to assess esthetic perception by students and laypeople. The VAS is a simple and practical method to evaluate esthetic preferences on a scale of 0 to 10, where 0 = least attractive; 5 = attractive; and 10 = most attractive (12,18-24).

Black spaces between the upper central incisors can result from gingival retraction and bone loss due to the presence of periodontal diseases, triangular-shaped incisors, divergent orientated roots, and dispositioned brackets directing crowns mesially (7,8,20,25).

The photos obtained from the study of Pithon et al. (5) were manipulated with the Photoshop program to create eight different sized black spaces in the frontal smile of a patient with complete dentition and neutral occlusion (7,12,14,18,20,22-24,26,27). A photo album containing the manipulated photographs and a questionnaire was distributed to the study participants. No study in the literature has incorporated this scheme among dentistry students and laypeople, so the results of the present study are unprecedented.

The size of the black space was increased in photographs A to H of Image 1 and decreased in Image 2. The questionnaire consisted of the following questions: "Are there any differences between photographs A to H?" "If the answer is "yes", then which photographs are the most and least attractive?" The same questions were applied for the photographs in Image 2. The students in years 2-5 noted the black spaces more frequently than those in year 1 and laypeople. For all participants, photographs A and H in Image 1 were the most and the least pleased, respectively. For Image 2, the order of choice was reversed.

In a study by Pithon et al. (5), the same images were reviewed by laypeople of three age groups (15-19, 35-44, and 65-74 years, respectively). The results of that study showed that older people had more difficulty perceiving black spaces than the younger subjects. Therefore, photographs with larger black spaces were rated as less attractive ( $P < 0.01$ ). The results of the present study were in accordance with those reported by Pithon et al. (5). Also, a study by Van der Geld et al. (17) evaluated the perception of asymmetry of laypeople and concluded that advanced age was associated with reduced perception of the esthetic details of the smile.

Analyses of larger photographs (20 × 12 cm) of Image 1, which were scored separately, showed that photographs A (6.69, 6.40, 8.75, 8.41, 8.02, and 6.29) and H (4.81, 4.17, 3.06, 0.86, 1.71, and 4.42) were found to be the most and least attractive, respectively, by all groups. According to these data, students in

year 3 gave the highest score (8.75) to photograph A, while those in year 4 assigned the lowest score (0.86) to photograph H. There were significant differences in the scores given to all photographs among the groups. While students in year 3 awarded higher scores to photographs A, B, C, and D, laypeople gave the highest score to photograph E and the students in year 1 assigned the highest scores to photographs F, G, and H (Table 4). These results showed similar esthetic perception between laypeople and students in years 1 and 2.

Espana et al. (16) evaluated esthetic perception of dentistry students and found statistically significant differences among different study years, but found no linear improvement from year 1 to year 5. The findings of the present study were similar to those of Espana et al., with the exception of increased esthetic awareness among students after year 2 (Table 4). Dental education plays a critical role in the development of esthetic perception of dental students. The results of this study showed that students in years 3, 4, and 5 were more aware of black spaces at the midline than students in years 1 and 2, and laypeople due to more dental education. The orthodontist must be careful to prevent the occurrence of black spaces through correct bracket positioning, interproximal reduction of triangular crowns, and artistic bending. Orthodontists as well as other dental professionals should be aware of black spaces and appropriate treatments.

In conclusion, the presence of black spaces between the maxillary central incisors play a critical role in smile esthetics and must be addressed during orthodontic treatment. Esthetic perception and awareness of 1st and 2nd year dentistry students were not very different from that of laypeople. To increase esthetic perception among dentistry students, specific lessons with clinical photography should be included in dental education.

#### Conflict of interest

None declared.

#### References

1. Brook PH, Shaw WC (1989) The development of an index of orthodontic treatment priority. *Eur J Orthod* 11, 309-320.
2. Grzywacz I (2003) The value of the aesthetic component of the Index of Orthodontic Treatment Need in the assessment of subjective orthodontic treatment need. *Eur J Orthod* 25, 57-63.
3. Mugonzibwa EA, Kuijpers-Jagtman AM, Van't Hof MA, Kikwilu EN (2004) Perceptions of dental attractiveness and orthodontic treatment need among Tanzanian children. *Am J Orthod Dentofacial Orthop* 125, 426-433.
4. Klages U, Bruckner A, Guld Y, Zentner A (2005) Dental

- esthetics, orthodontic treatment, and oral-health attitudes in young adults. *Am J Orthod Dentofacial Orthop* 128, 442-449.
5. Pithon MM, Bastos GW, Miranda NS, Sampaio T, Ribeiro TP, Nascimento LE et al. (2013) Esthetic perception of black spaces between maxillary central incisors by different age groups. *Am J Orthod Dentofacial Orthop* 143, 371-375.
  6. Geron S, Atalia W (2005) Influence of sex on the perception of oral and smile esthetics with different gingival display and incisal plane inclination. *Angle Orthod* 75, 778-784.
  7. Kokich VO, Kokich VG, Kiyak HA (2006) Perceptions of dental professionals and laypersons to altered dental esthetics: asymmetric and symmetric situations. *Am J Orthod Dentofacial Orthop* 130, 141-151.
  8. Ritter DE, Gandini LG, Pinto Ados S, Locks A (2006) Esthetic influence of negative space in the buccal corridor during smiling. *Angle Orthod* 76, 198-203.
  9. Pinho S, Ciriaco C, Faber J, Lenza MA (2007) Impact of dental asymmetries on the perception of smile esthetics. *Am J Orthod Dentofacial Orthop* 132, 748-753.
  10. Martin AJ, Buschang PH, Boley JC, Taylor RW, McKinney TW (2007) The impact of buccal corridors on smile attractiveness. *Eur J Orthod* 29, 530-537.
  11. Ker AJ, Chan R, Fields HW, Beck M, Rosenstiel S (2008) Esthetics and smile characteristics from the layperson's perspective: a computer-based survey study. *J Am Dent Assoc* 139, 1318-1327.
  12. Ioi H, Nakata S, Counts AL (2010) Influence of gingival display on smile aesthetics in Japanese. *Eur J Orthod* 32, 633-637.
  13. McLeod C, Fields HW, Hechter F, Wiltshire W, Rody W Jr, Christensen J (2011) Esthetics and smile characteristics evaluated by laypersons. *Angle Orthod* 81, 198-205.
  14. Heravi F, Rashed R, Abachizadeh H (2011) Esthetic preferences for the shape of anterior teeth in a posed smile. *Am J Orthod Dentofacial Orthop* 139, 806-814.
  15. Thomas M, Reddy R, Reddy BJ (2011) Perception differences of altered dental esthetics by dental professionals and laypersons. *Indian J Dent Res* 22, 242-247.
  16. España P, Tarazona B, Paredes V (2014) Smile esthetics from odontology students' perspectives. *Angle Orthod* 84, 214-224.
  17. Van der Geld P, Oosterveld P, Van Heck G, Kuijpers-Jagtman AM (2007) Smile attractiveness. Self-perception and influence on personality. *Angle Orthod* 77, 759-765.
  18. Thomas JL, Hayes C, Zawaideh S (2003) The effect of axial midline angulation on dental esthetics. *Angle Orthod* 73, 359-364.
  19. Schlosser JB, Preston CB, Lampasso J (2005) The effects of computer-aided anteroposterior maxillary incisor movement on ratings of facial attractiveness. *Am J Orthod Dentofacial Orthop* 127, 17-24.
  20. Roden-Johnson D, Gallerano R, English J (2005) The effects of buccal corridor spaces and arch form on smile esthetics. *Am J Orthod Dentofacial Orthop* 127, 343-350.
  21. Bernabé E, Kresevic VD, Cabrejos SC, Flores-Mir F, Flores-Mir C (2006) Dental esthetic self-perception in young adults with and without previous orthodontic treatment. *Angle Orthod* 76, 412-416.
  22. Berto PM, Lima CS, Lenza MA, Faber J (2009) Esthetic effect of orthodontic appliances on a smiling face with and without a missing maxillary first premolar. *Am J Orthod Dentofacial Orthop* 135, S55-60.
  23. Schabel BJ, McNamara JA Jr, Franchi L, Baccetti T (2009) Q-sort assessment vs visual analog scale in the evaluation of smile esthetics. *Am J Orthod Dentofacial Orthop* 135, S61-71.
  24. Zange SE, Ramos AL, Cuoghi OA, de Mendonça MR, Suguino R (2011) Perceptions of laypersons and orthodontists regarding the buccal corridor in long- and short-face individuals. *Angle Orthod* 81, 86-90.
  25. Janson G, Branco NC, Fernandes TM, Sathler R, Garib D, Lauris JR (2011) Influence of orthodontic treatment, midline position, buccal corridor and smile arc on smile attractiveness. *Angle Orthod* 81, 153-161.
  26. Rodrigues Cde D, Magnani R, Machado MS, Oliveira OB (2009) The perception of smile attractiveness. *Angle Orthod* 79, 634-639.
  27. Pithon MM, Santos AM, Couto FS, da Silva Coqueiro R, de Freitas LM, de Souza RA et al. (2012) Perception of the esthetic impact of mandibular incisor extraction treatment on laypersons, dental professionals, and dental students. *Angle Orthod* 82, 732-738.