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Lay Person's Perception of Interdental Black Triangle Between Maxillary Central Incisors in the Local Population

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Abstract

Introduction: Smile esthetics are key component of general facial esthetics and thus require constant updating keeping in view of current trends and population preferences. Several components can affect smile esthetics and they should be in perfect harmony to obtain an esthetically pleasing smile such as tooth color, shape, size, position, smile arc, black triangles, gingival show, facio-dental midlines, incisor width/height ratio, the inclination of incisors, incisal edge discrepancy, overbite, occlusal plane and many others. The objective was to evaluate lay person's perception of interdental black triangle between maxillary central incisors in the local population

Materials and Methods: 150 patients from OPD of Punjab Dental Hospital, Lahore were included in the study. 8 images were modified with the help of software and patients were asked to score these images on visual analogue score.

Results: Mean age and standard deviation of a sample size n=150 patients was 40.53 ± 15.23 years. Males were 44.7%, while females were 55.3%. Image A-F had progressive increase in the size of black triangles and results showed that increasing the size of black triangle leads to decrease mean attractive score for that image.

Conclusions: Out of 150 participants, images without black triangles were perceived as more esthetic and images with largest black triangles (3.5mm) were perceived as least esthetic.

Keywords: Esthetic; Perception; Black Triangles

Introduction

An attractive face has been linked with many social benefits including popularity, acceptance and social competence. One of the motivation for patients and their parents to get orthodontic treatment done is the improvement of dentofacial esthetics leading to more popularity and social acceptance.[1] Second most significant component of facial attributes after eyes is smile.[2] This states the value of having an attractive smile.

The idea of an ideal smile is based not only on the standardized smile design but also on the patient's individual preferences as well as the artistic skill of the clinician. Successful treatment planning addresses both the esthetic as well as functional concerns of the patients.[3,4] Achieving ideal smile esthetics needs a very minute understanding of the balance between teeth, gingival scaffolding, and adjacent facial soft tissue.[5]

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Black triangles are the open gingival embrasures present cervically to the interproximal contact and are devoid of gingival tissue. These triangles have been rendered as esthetic concern; whereby many patients need them to be corrected. They also facilitate the retention of food, thereby compromising the oral health. Both dentists and laypersons consider black triangles more than 3mm unesthetic. Consequently, black triangles leads to complex esthetic and functional problems.[6,7] There are many causes of black triangles, which include aging, periodontal disease, excessive brushing, atypical dental crown shape, bone loss, accentuated dental tipping, length of embrasure area, and position of contact point/ area.[8]

Black triangles are found in about 18 percent of the population under 20 but these are more common in adults about 67 percent. Adults with bone loss are at more risk of developing black triangles. The patients with black triangles are frequently dissatisfied with their smiles and rate them as the third most concerning issue after caries and dark crown contours.[9]

With the advent of the soft tissue paradigm in orthodontics, there is now more emphasis on managing soft tissues and their impact on the esthetics of patients concerning perioral tissues.[10] Using digitally modifying photographs to assess individuals' perceptions is well documented in orthodontics.[11-13] Visual analog scale (VAS) is a simple tool to access the esthetic perception of the populations.[14] The VAS is commonly used in orthodontics literature to evaluate esthetics.[15-18].

Orthodontists usually emphasize the improvement of dento-skeletal relationships, but the improvement of the smile is usually the foremost concern of the patient. Patients frequently seek orthodontic treatment to improve their facial esthetics.[19] Therefore, it is crucial to have the patient's perception of what is considered more attractive or satisfactory as it might differ from the orthodontist's perception.[20] The current research focus more on the perception of orthodontists and dental professional on smile esthetics. Our research aims to provide insight into patient/laypersons perception of interdental black triangles between maxillary central incisors in the local population.

Material and Methods

This study used the software altered computer generated smile and visual analog scale to assess laypersons' perceptions of black triangles. It is a cross-sectional survey of the layperson (i.e., untreated patients and attendants who reported to the hospital).

An extra-oral smiling photograph of a female subject was used with teeth occluded, healthy gums, and no dental-related problems taken with a digital camera (Rebel XTI; Canon, Tokyo, Japan). This colored photograph fulfilled the concept of the ideal smile in terms of teeth geometry, tooth shade, healthy hard and soft tissues and gingival contours.[21] In the first step using Adobe Photoshop CS3 (San Jose, California, USA),the photograph was cropped to include only lips gingiva and maxillary teeth. In the second step using the same software, black triangles of varying sizes were introduced between maxillary central incisors. In this way eight photographic images depicting black triangles from 0mm to 3.5 mm at an interval of 0.5 mm were obtained. (Figure 1) The edited photographs were resized to represent the actual size of the teeth, then these photographs were printed to the middle of A4 size paper and marked A-H. These images were collected in the form of a booklet. 8 Visual analog Scales (VAS) of 10cm length were printed on a separate sheet of paper with no A-H representing each photograph. The VAS was scored 0-10, with 0 representing the least attractive smile and 10 representing the most attractive smile. All the participating patients and attendants were explained about the scoring before the survey.

A sample size of 150 is calculated at a 5% level of significance and 1% margin of error

with expected mean score of the black triangle (31.7±26.8).

Inclusion criteria comprised of laypersons recruited from OPD of Punjab Dental Hospital/ de' Montmorency) who did not have any knowledge of dentistry or dentistry-related work. Both males and females falling in the age range of 15-65 years were included. Any person with a mental disability and visual impairment was excluded from the study.

Laypersons (patients or their attendants) were selected from outpatients at Punjab Dental Hospital, Lahore. The study, as well as the research protocol, was explained to all participants. Demographic information like name, age, gender and telephone was obtained. A questionnaire was given to the participants with a picture booklet and grading scale printed alongside. The scoring was explained to them and they were asked to score the attractiveness of each smile without any help on a visual analog scale of 0 to 10 (with 0 being least attractive and 10 being very attractive). Participants were forbidden from comparing pictures on different pages. This was ensured through a maximum of 60 seconds evaluation time per picture.

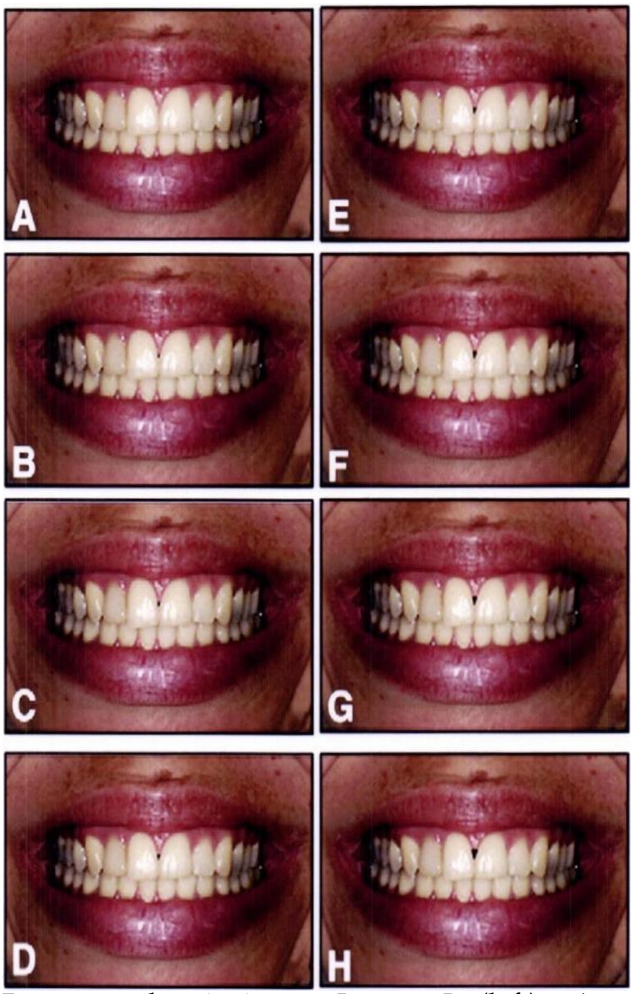
Data Analysis

Data was entered and analyzed in SPSS version 21.0. Quantitative assessment included mean & SD. Data was stratified for effect modifiers like age, gender and educational status to see if these variables affect the perception of black triangles. Post stratification t-test was used and P-value of <0.05 is considered as significant.

Results

150 laypersons participated in this study with the minimum age of 15 years to maximum age of 65 years with average age being 40.53±15.23. Males numbered 67/150 (44.7%), while females numbered 83/150 (55.3%). The minimum analog score of image A (0mm length) for not having black triangle was 5, and the maximum was 10 with mean and SD as 8.90±1.45. The minimum analog scale of Image B (0.5mm length of black triangle) was 5, and the maximum was 10 with mean and SD as 8.68±1.51. The minimum analog scale of Image C (1mm length of black triangle) was 3, and the maximum was 10 with mean and SD as 8.31±1.61.

The minimum analog scale of Image D (1.5mm length of black triangle) was 4, and the maximum was 10 with mean and SD as 7.70±1.55. The minimum analog scale of Image E (2mm length of black triangle) was 2, and the maximum was 8 with mean and SD as 4.22±1.43. The minimum analog scale of Image F (2.5mm length of black triangle) was 1, and the maximum was 6 with mean and SD as 4.30±1.15.



Between the incisors. Image I (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.

The minimum analog scale of Image G (3mm length of black triangle) was 0, and the maximum was 6 with mean and SD as 3.96±1.45. The minimum analog scale of Image H (3.5mm length of black triangle) was 0, and the maximum was 5 with mean and SD as 0.83±1.36. (Table I)

Using t-test, the mean attractive scores of black triangles for all images were found to be significant regarding age except for image H which was found not to be attractive by both age groups.(Table II) Using t-test, the mean attractive score of any black triangle was not found as significant regarding gender.(Table III) Using a t-test, the mean attractive score of any black triangle was not found as significant regarding educational status.(Table IV)

Table I: Average VAS Score for each image

Images according to size of black triangle between central incisors	Minimum	Maximum	Mean	Std. Deviation
Size of black triangle Image A (0mm)	5.00	10.00	8.90	1.45
Size of black triangle Image B (0.5mm)	5.00	10.00	8.68	1.51
Size of black triangle Image C (1mm)	3.00	10.00	8.31	1.61
Size of black triangle Image D (1.5mm)	4.00	10.00	7.70	1.55
Size of black triangle Image E (2mm)	2.00	8.00	4.22	1.43
Size of black triangle Image F (2.5mm)	1.00	6.00	4.30	1.15
Size of black triangle Image G (3mm)	0	6.00	3.96	1.45
Size of black triangle Image H (3.5mm)	0	5.00	0.83	1.36

Table II: Effect of Age on Perception of Black triangle

Sizes of black triangles	Age groups	N	Scores mean±SD	P-value
Image A (0mm)	≥40 years	71	9.3662±0.94475	.000
	< 40 years	79	8.4810±1.70114	
Image B (0.5mm)	≥ 40 years	71	8.9718±1.28699	.016
	< 40 years	79	8.4177±1.65334	
Image C (1mm)	≥ 40 years	71	8.8873±0.87095	.000
	< 40 years	79	7.7975±1.93735	
Image D (1.5mm)	≥ 40 years	71	7.9155±1.27331	.000
	< 40 years	79	7.5190±1.75310	
Image E (2mm)	≥ 40 years	71	4.0563±1.68936	.001
	< 40 years	79	4.3797±1.15807	
Image F (2.5mm)	≥ 40 years	71	4.0423±1.40851	.000
	< 40 years	79	4.5316±0.79800	
Image G (3mm)	≥40 years	71	4.2254±1.09801	.002
	< 40 years	79	3.7215±1.68657	
Image H (3.5mm)	≥ 40 years	71	.8310±1.44406	.573
	< 40 years	79	.8354±1.30512	

P-value<0.05 = Significant

Table III: Effect of gender on the Perception of Black triangles

Sizes of black triangles	Gender	N		P-Value
Image A (0mm)	Male	67	9.134±1.289	0.077
	Female	83	8.710±1.565	
Image B (0.5mm)	Male	67	8.716±1.475	0.792
	Female	83	8.650±1.549	
Image C (1mm)	Male	67	8.552±1.351	0.105
	Female	83	8.120±1.790	
Image D (1.5mm)	Male	67	7.791±1.692	0.552
	Female	83	7.638±1.436	
Image E (2mm)	Male	67	4.029±1.546	0.133
	Female	83	4.385±1.332	
Image F (2.5mm)	Male	67	4.223±1.165	0.469
	Female	83	4.361±1.143	
Image G (3mm)	Male	67	4.119±1.285	0.229
	Female	83	3.831±1.575	
Image H (3.5mm)	Male	67	0.850±1.384	0.889
	Female	83	0.819±1.362	

P-value<0.05 = Significant

Table IV: Effect of Education on the Perception of Black triangles

Sizes of black triangles	Educational status	N	Mean±SD	P-Value
Image A (0mm)	< Bachelors	77	8.909±15.23	0.938
	≥ Bachelors	73	8.890±14.00	
Image B (0.5mm)	< Bachelors	77	8.571±16.09	0.368
	≥ Bachelors	73	8.794±14.03	
Image C (1mm)	< Bachelors	77	8.272±16.59	0.753
	≥ Bachelors	73	8.356±15.84	
Image D (1.5mm)	< Bachelors	77	7.857±14.93	0.224
	≥ Bachelors	73	7.547±16.07	
Image E (2mm)	< Bachelors	77	4.350±13.15	0.280
	≥ Bachelors	73	4.095±15.56	
Image F (2.5mm)	< Bachelors	77	4.116±12.56	0.156
	≥ Bachelors	73	4.493±10.01	
Image G (3mm)	< Bachelors	77	3.857±13.34	0.376
	≥ Bachelors	73	4.068±15.75	
Image H (3.5mm)	< Bachelors	77	0.792±13.31	0.707
	≥ Bachelors	73	0.8767±14.13	

P-value<0.05 = Significant

Discussion

In this study, 150 patients were selected after fulfilling the selection criteria. The age range was from 15-65 years with an average of 40.53 ± 15.23 years. Males were 44.7%, while females were 55.3%.

In one of the published study Almorai and his colleagues rated the attractiveness of the different smile parameters among the different dental specialties and lay persons. They compared black triangles position of zenith of gingiva, color and pigmentation of gingiva, occlusal cant and gingival positions. The result of the study indicated that black triangle was the most negatively perceived smile character overall. Our study showed similar results which showed that presence of black triangles and size is negatively perceived by lay persons with increase in size led to lower score on visual analogue scale.[22]

Similarly, Sriphadungporn calculated differences between the age groups regarding tolerance of black triangles in laypersons. It was found that older population was more tolerant of black triangles as opposed to younger papulation. 2mm and 2.5 mmm black triangles received least score in their study while images without black triangles were rated highest. In our study, all the scores between age groups were significant, with younger population being more critical towards black triangles. Image H (3.5mm in length) was scored worse for having a black triangle with no significant differences between age groups. [23]

In another study comparing the images with or without black triangles, 98 percent of the laypersons preferred images with interdental papilla present. In contrast, in the treatment of black triangles, 70 percent of persons preferred the presence of interdental papilla as opposed to the extended contact area. Our study showed the same results with interdental papilla perceived as the most esthetic.[24]

Regarding the age-related changes in smile, three variables associated with anterior maxillary teeth esthetics have received substantial attention including the incisal edge position of the maxillary central incisors[25-27], the gingival display of maxillary arch[28-31] and the maxillary central incisor black triangle presence. Regarding the presence of black triangles, these were found to be more acceptable by older age group than younger age group.[8,32-34] Our study has taken care of the esthetic perception of back triangles in laypersons which is one of the components of smile esthetics. In future esthetic perception of other smile parameters should also be studied for the better understanding of laypersons preferences for ideal smile.

Conclusion

1. Increasing size of black triangles was associated with increasingly more unattractive smile on visual analogue scale.
2. From 150 patients, by using t-test, the Mean Attractive scores of all black triangles were found as significant regarding age with younger population group being more intolerant of black triangles as opposed to older population group.
3. The effect of gender and educational background was found to be insignificant on mean attractiveness score.

Ethical Approval

The study was approved by the Institutional Review Board of de'Montmorency college of Dentistry, Lahore.

Conflict of Interest

No conflict of interest

Authors' Contribution

AI: Main author
AH: Supervisor
NE: Data collection/ Corresponding Author
FR: Data collection/ Statistics
SA: Data collection/ Statistics
ZM: Data collection/ Statistics

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