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Assessment of the Smile Perception with Different Incisal Relationships among Saudi Female Adolescents

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ABSTRACT

Background: Facial appearance plays a major role in deciding the overall attractiveness of the individual and his social acceptance by others.

Aims: Assess the perception of smile with different incisal relationships in dental and facial views by female adolescents in Riyadh and evaluate the influence of these smiles on social aspects of adolescents.

Methods: One hundred twenty female adolescents (12-14 years) participated in the study. Photographs of (dental view and facial view) with (normal, increased over jet, increased overbite and open bite) relationships of a female adolescent used. VAS was used to smile attractiveness in both dental and facial views while SPQ12-14 used to evaluate the influence of smiles on social aspects. Descriptive statistics were used for quantitative and ordinal variables and Spearman rank correlation to assess the reliability of the responses.

Results: The comparison of responses towards the 4 dental views assessed by VAS showed the normal smile has higher mean rank value (470) and there was no statistically significant difference ($p<0.001$) among the mean rank values of the (over jet: 240, overbite: 205 and open bite: 200) views. The responses to the SPQ12-14 showed no statistically significant difference ($p<0.0001$) in the mean values of the 4 domains (Pleasantness, Honesty/dishonesty, Selfishness; Personal happiness; Intelligence) and global score across the (over jet, overbite and open bite) views.

Conclusion: Normal incisal relationship has favourable effect on the adolescent's acceptance by others. Further studies are recommended to test smile components that may affect facial attractiveness.

Key words: Facial attractiveness, Incisal relationships, Adolescents, Perception, Social life

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INTRODUCTION

Facial appearance plays a major role in deciding the overall attractiveness of the individual and his social acceptance by others [1]. Smile aesthetics of an adolescent is affected by personal experiences, peer influences and social environment. Further factors like the educational and social status, cultural differences can have an impact on perception of smile [2]. Also, Facial attractiveness contributes as a major role in social interaction for both children and adults [3]. Furthermore, a significant correlation between the attractiveness of the smile and the smiling face verified by adults and children [4]. Irregularities in the dentition as abnormal incisal relationships affects adult's [5] and child's [6] facial aesthetics, social interactions, may lead to the feeling of inferiority [7] and may cause: (1) unpleasant appearance, (2) speech problems, (3) increased susceptibility to trauma, (4) and periodontal disease [8]. Malocclusion has a psychological impact in adolescents and this impact increases with the severity of malocclusion [9]. Mugonzibwa et al. evaluated the perception of dental attractiveness in Tanzanian children between the ages of 9-18 years old. They found that (85%) viewed well-aligned teeth as an important characteristic for the overall facial appearance [10]. Moreover, Bernabe et al., have found that the anterior occlusal characteristics play an important role in dental aesthetics in young adults. They reported that increased over jet had the most negative impact on self- perceived dental aesthetics [11]. In addition, Rodrigues et al. (2009) evaluated the smile attractiveness in adults by showing actual and manipulated pictures of a smiling man in facial view. The ideal smile according to the norms has received a good evaluation from the participants. However, even the smiles with different variations from ideal (midline deviation, deviation of the long axes of lateral incisors) have received a good evaluation too. They concluded that these variations do not spoil the attractiveness of the smile and can be left with no orthodontic intervention to correct them [12].

Barakati et al. assessed the distribution of malocclusion problems in a sample of Saudi adolescent and adult females seeking orthodontic treatment in the Eastern Region of Saudi Arabia. The sample was 330 females divided as follows: adolescents (12-17 years) and adults (18-35 years). Each patient was clinically examined, and the type of malocclusion was recorded including Angle's classification, over jet, over bite, open bite, cross bite, scissors bite, crowding and spacing. They reported that (77%) of their sample were adolescents between the ages (12-17 years). Moreover, (17%) of the adolescents had moderate over bite in which the upper incisors cover (40-60%) of the lower incisors, (15%) of them had moderate over jet (4-6 mm), and (3%) had anterior open bite that is measured by the space between upper and lower incisors as (1 mm or more). Additionally, the study revealed (255) adolescents soke orthodontic treatment which is considered of a large proportion compared to (75) adults. They concluded that the majority of the sample were from the adolescent age group and found that the moderate over jet and over bite were more frequent findings in adolescents, being the second priority for seeking orthodontic treatment in this age group [13].

Additionally, Henson et al. (2011) evaluated the effect of dental esthetics on the perceptions of teens when judging a peer's athletic, social, leadership, and academic abilities. They concluded that ratings for the ideal smile images in perceived athletic, social, and leadership skills were 10% higher than those given for images with noni deal smile [14]. Also, Verdecchia et al. showed that when 8-10 years old children viewed their peers with good anterior dental alignment, they considered them as more happy, honest and intelligent [15]. Lombardo et al. (2012) assessed the sensation and perception of children between the ages of 8-10 years old for the anterior dental alignment. They found that the participating children preferred the normal dental alignment views of the children's smiles in both frames (whole face and lower third of the face) and it was considered as the most attractive for them, while the smiles with protruding incisors was considered as the least attractive [16]. Lin et al. (2016) investigated the self-perceptions of dental esthetics in adults and adolescents who sought orthodontic treatment to assess the psychological role of dental esthetics on seeking orthodontic treatment. Among the 748 participants examined 247 accepted to be treated. They concluded that the psychosocial impact of dental esthetics increased with the severity of the malocclusion, and the psychosocial impact of dental esthetics played an important role in seeking orthodontic treatment [17].

In Saudi Arabia, it was reported that 40%–62.4% of the population had soke orthodontic treatment [18-20]. Alhummayani et al. conducted a cross-sectional study on 670 participants, whose ages ranged from 12-19 years to evaluate the orthodontic treatment needs in Saudi young adults and reported that 24.3% of the participants needed severe/extreme need for orthodontic treatment and 54.3% needed no/slight orthodontic treatment [21]. Alharbi (2020) mentioned that the number of individuals who seek orthodontic treatment rose in Saudi Arabia in the last two decades because of the gained knowledge of the positive effect of orthodontic treatment in regard to self-esteem. Furthermore, he mentioned that malocclusion during adolescence affects the psychological well-being and social relationships of the children negatively and is linked to bullying and compromises self-esteem among teenagers [22].

The aims of this study are to assess the perception of smile by Saudi female adolescents in different incisal relationships in dental and facial views by a sample of (12-14 year-old) Saudi female adolescents in Riyadh city and to evaluate the influence of these smiles on the social aspects of female adolescents in the same age.

MATERIALS AND METHODS

Participants

A cross-sectional study was conducted to assess the perception of smile with different incisal relationships in dental and facial views by female adolescents in Riyadh, Saudi Arabia. This study was reviewed and approved by Institutional Review Board of the College of Dentistry Research Center (no. IR 0167) of King Saud University in Riyadh, KSA. The study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Moreover, informed consent was sent to the parents of the participants and signed before the commencement of the survey.

A power analysis was done to specify the appropriate sample size. To achieve a significance level at the 95th percentile confidence level and power of 80 percent, with 0.5 estimated effect sizes, the sample size was calculated to be 100 subjects.

A sampling frame of a list of Riyadh intermediate public schools was used to randomly select 120 Saudi healthy female adolescents (12-14 year-old) from 4 public intermediate schools out of the 5 regions in Riyadh city to participate in this study. Thirty students were selected randomly from each school using attending students' school list. Ten students from each level of the three intermediate levels (levels: 7,8,9) were randomly selected to participate.

The reasons for selecting this age group are: (1) Children in this age give more valid responses due to the ability to comprehend the questions better when they are given questionnaires than younger age groups, (2) in this age group, female children are generally more considerate about their body appearance, especially their facial aesthetics, (3) orthodontic treatment is usually soaked by children and their guardians at this age.

Exclusion criteria were: Female adolescents less than 12 and older than 14 years old, students who were absent, and students with medical conditions that would affect their abilities to participate in the study.

Smile recording

In order to assess the perception of smile with different incisal relationships and the influence of these smiles on the social aspects by the selected sample and after obtaining a consent form from the mother, a 13-year-old Saudi healthy female was examined in the dental clinic and measurements were taken for the teeth incisal relationship as follows: over jet (2-3 mm): measured with millimetre ruler as the distance from the most labial point of the incisal edge of the maxillary incisors to the most labial surface of the corresponding mandibular incisor [8]. Over bite (4-5 mm) (20-30 %): The vertical overlap of incisors measured to the nearest half millimetre vertically from the incisal edge of the maxillary right central incisor to the incisal edge of the corresponding mandibular right incisor [8]. Photos were taken by a trained technician for the face of the child while smiling. The child's smile was edited by Photoshop CC (Adobe, CA, USA) into three smiles with different incisal relationships: a. moderate increase in over jet (over jet), b. moderate increase in over bite (overbite) and c. anterior open bite (open bite).

Assessment tools

The study conducted in the regular classroom set of the participants' schools. To ensure reliability of the responses the same participants were shown the same photographs twice with one week period apart. The two groups of photographs were displayed to the participants respectively: the first group composed of the dental views of the smile with different incisal relationships:

Normal incisal relationship, b. moderate increased over jet, c. Moderate increased over bite and d. anterior open bite (Figure 1). The second group composed of the facial views (same smiles showed previously but with the entire face of the model) (Figure 2). The visual analogue scale (VAS) used to evaluate the smile attractiveness in dental and views (Figure 3). The participants will be shown each dental view and asked to rank the smile from 0-10 where 0 indicates (not attractive) and 10 indicated (most attractive). While, the smile perception questionnaire (SPQ12-14) was used for facial views as a second assessment tool to evaluate the influence of these smiles on the different social aspects of the adolescents in the same age group [16] (Figure 4). The SPQ12-14 questionnaire is composed of 13 questions that have been translated into the Arabic language, which is the native language of the children. It was divided in five area of interest (1) pleasantness/unpleasantness shown in questions 1,5, and 8; (2) honesty and altruism versus dishonesty and selfishness in questions 2,4, and 6; (3) extroversion/introversion in questions 3,7, and 12; (4) personal happiness in questions 9,10, and 13; (5) intelligence in question 11. Each question is a multiple choice question in which the participant will choose one of the followings based on the question after she sees the facial view (a lot, much, so-so, not much, not at all).

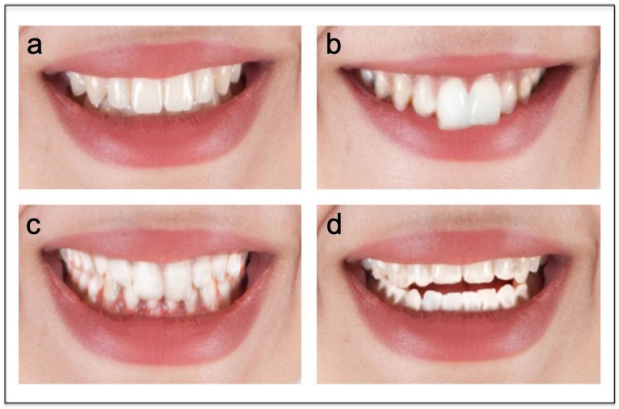

Figure 1: Images of a female adolescent's smile with different incisal relationships. (a) Ideal incisal relationship, (b) Moderate increased over jet, (c) Moderate increased overbite, (d) Moderate anterior open bite.

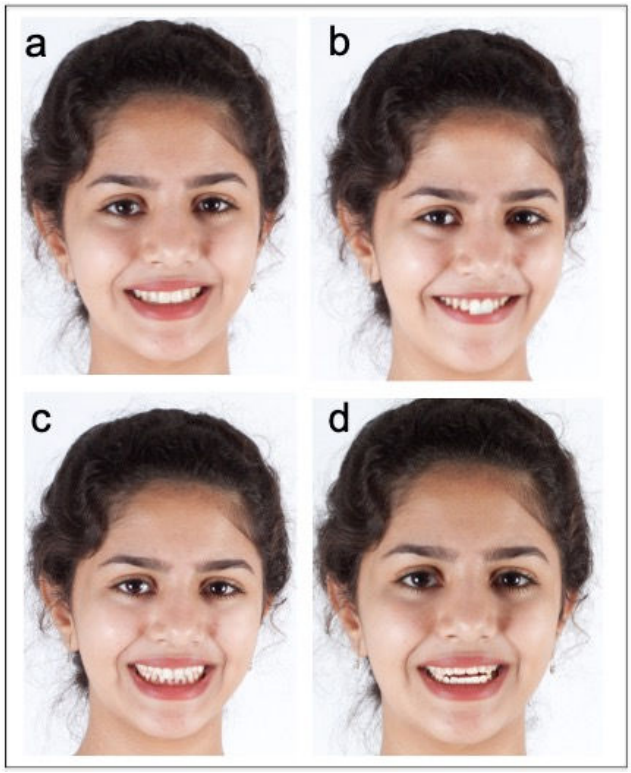

Figure 2: Images of a female adolescent's smile in the facial view with different incisal relationships. (a) Ideal incisal relationship, (b) Moderate increased over jet, (c) Moderate increased overbite, (d) Moderate anterior open bite.

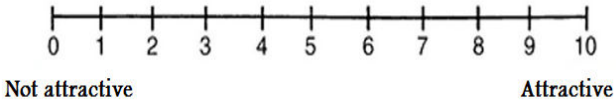

Figure 3: Visual analogue scale (VAS).

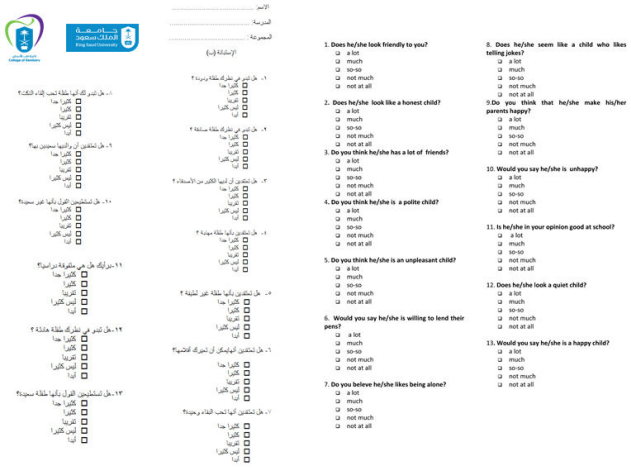

Figure 4: Smile perception questionnaire 12-14 (SPQ12-14).

Statistical analysis

Data were analyzed using SPSS PC+ 21.0 version statistical software. Descriptive statistics (mean, standard deviation, median and inter quartile range) were used for the five domains of smile perception questionnaire for the four types of facial views (Normal smile, over jet, Overbite and Open bite) (Table 1). The SPQ12-14 questionnaire was used to collect data for the following five domains: (1) pleasantness/unpleasantness questions (1,5, and 8); (2) honesty and altruism versus dishonesty and selfishness questions (2,4, and 6); (3) extroversion/introversion questions (3,7, and 12); (4) personal happiness questions (9,10, and 13) and for (5) intelligence question (11).

Spearman rank correlation was used to assess the reliability of the responses which were observed in two settings. Krushkal Wallis test was used to compare the mean ranks of the responses of the visual analogue scale across the 4 types of dental views (normal smile over jet, overbite and open bite). One-way analysis of variance was used to compare the mean values of global score and scores of 5 domains of smile perception questionnaire across the 4 types of facial views (normal smile, over jet, overbite and open bite), followed by Tukey's test to observe the pair wise differences. A p-value of <0.05 was considered to report the statistically significance of the results.

Table 1: Descriptive Statistics of five factors of smile perception questionnaire for the four types of facial views (Normal smile, over jet, Overbite and Open bite) assessed by female school children school children.

Factors of SPQ	Normal smile	Over jet	Over bite	Open bite
Pleasantness/unpleasantness	7.42(2.1)	6.35(2.8)	5.37(2.3)	5.15(2.4)
Honesty, altruism/ dishonesty, selfishness	7.41(2.5)	4.51(2.9)	4.85(2.6)	4.44(2.7)
Extroversion /introversion	6.71(2.1)	7.24(2.2)	6.34(2.0)	6.51(2.2)
Personal happiness	8.98(2.4)	7.12(2.6)	6.69(2.5)	6.35(2.5)
Intelligence	2.73(1.0)	1.67(1.1)	1.98(1.1)	1.68(1.2)
Global score	33.24(6.8)	26.88(7.5)	25.22(7.0)	24.13(7.1)

RESULTS

Among the 120 healthy Saudi female adolescents the results showed the following:

VAS: there is highly statistically significant (p< 0.001) positive correlation in the values of visual analogue scale, between initial and second sitting which were used to assess the dental view of normal smile, over jet, overbite and open bite by the paticipants.

SPQ12-14: there is highly statistically significant (p< 0.001) positive correlation in the responses of the 13 questions of smile perception questionnaire, which was used to evaluate the facial views of normal smile, over jet, overbite and open bite by the participants. These correlations and their p-values indicate the good reliability of the scales used in the study. (Tables 2 and 3).

Table 2: Test-retest reliability of visual analogue scale to assess the dental view of normal smile, over jet, overbite and open bite.

Type of dental view	Correlation between initial and second sitting	p-value
Normal smile	0.853	<0.001
Over jet	0.886	<0.001
Over bite	0.921	<0.001
Open bite	0.894	<0.001

Table 3: Test-retest reliability of the smile perception questionnaire (SPQ) to evaluate facial views of normal smile, over jet, overbite and open bite.

Question	Normal smile		Over Jet		Over bite		Open bite	
	Correlation between initial and 2nd sitting	p-value	Correlation between initial and 2nd sitting	p-value	Correlation between initial and 2nd sitting	p-value	Correlation between initial and 2nd sitting	p-value
1	0.953	<0.001	0.888	<0.001	0.93	<0.001	0.931	<0.001
2	0.879	<0.001	0.94	<0.001	0.898	<0.001	0.851	<0.001
3	0.967	<0.001	0.881	<0.001	0.952	<0.001	0.702	<0.001
4	0.923	<0.001	0.994	<0.001	0.742	<0.001	0.803	<0.001
5	0.941	<0.001	0.911	<0.001	0.875	<0.001	0.615	<0.001
6	0.748	<0.001	0.882	<0.001	0.945	<0.001	0.9	<0.001
7	0.849	<0.001	0.845	<0.001	0.98	<0.001	0.976	<0.001
8	0.986	<0.001	0.956	<0.001	0.98	<0.001	0.943	<0.001
9	0.979	<0.001	0.964	<0.001	0.98	<0.001	0.98	<0.001
10	0.749	<0.001	0.877	<0.001	0.997	<0.001	0.985	<0.001
11	0.795	<0.001	0.912	<0.001	0.921	<0.001	0.866	<0.001
12	0.698	<0.001	0.946	<0.001	0.973	<0.001	0.878	<0.001
13	0.913	<0.001	0.916	<0.001	0.98	<0.001	0.991	<0.001

The comparison of responses towards 4 types of dental views (normal smile, over jet, overbite and open bite), which were assessed on 0 to 10 point ordinal visual analogue scale, showed statistically significant difference ($p<0.001$) in the mean rank values. That is the mean rank value of 'normal smile' dental view are statistically significantly higher than the other three types of dental view (over jet, overbite and open bite). The study subjects have scored higher values (470) on the analogue scale towards 'normal smile' than the other three types of dental views. There is no statistically significant difference ($p> 0.05$) among the mean ranks of three dental views (over jet: 240, overbite: 204.5 and open bite: 199.6) (Table 4).

Table 4: Comparison of mean ranks of visual analogue scale among the four types of dental view (normal smile, over jet, overbite and open bite).

Type of dental view	Median (IQR)	Mean ranks	p-value
Normal smile	9(3)	469.86	<0.001*
Over jet	1(3)	240	
Overbite	1(2)	204.53	>0.05†
Open bite	0(2)	199.61	
*Comparing the mean ranks of normal smile with the other three smiles (over jet, overbite and open bite)			
† Comparing the mean ranks between the three smiles (over jet, overbite and open bite)			

There is highly statistically significant difference ($p< 0.001$) in the mean values of all the 5 domains and global score of smile perceptions questionnaire, which was used to evaluate the facial views of normal smile, over jet, overbite and open bite.

The mean values of 4 domains (pleasantness/ unpleasantness, honesty, altruism /dishonesty, selfishness; personal happiness, intelligence) and global score of 'normal smile' facial view are statistically significantly ($p< 0.001$) higher than the mean values of these 4 dimensions and global score of the other three types of facial views (over jet, overbite and open bite). By Tukey's test, it was evident there is no statistically significant difference in the mean values of 4 domains and global score across the three types of facial views.

Whereas, the mean value of 'extroversion/ introversion' domain of 'normal view' and 'over jet' facial views are statistically significantly higher than other the two facial views 'overbite' and 'open bite'. However, there is no significant difference either between 'normal views' and 'over jet' or between 'overbite' and 'open bite' facial views (Table 5).

Table 5: Comparison of mean values of five domains of smile perception questionnaire for the four types of facial views (normal smile, over jet, overbite and open bite).

Factors of SPQ	Normal smile	Over jet	Over bite	Open bite	F-value	p-value
Pleasantness/ unpleasantness	7.42*	6.35	5.37	5.15	25.25	<0.001
Honesty, altruism/ dishonesty, selfishness	7.41*	4.51	4.85	4.44	38.7	<0.001
Extroversion / introversion	6.71†	7.24†	6.34	6.51	4.6	0.003
Personal happiness	8.98*	7.12	6.69	6.35	29.86	<0.001
Intelligence	2.73*	1.67	1.98	1.68	26.36	<0.001
Global score	33.24*	26.88	25.22	24.13	45.5	<0.001
By using Tukey's test:						
* Significantly higher than 'over jet', 'over bite' & 'open bite' for pleasantness, honesty, personal happiness, intelligence & global score.						
† Significantly higher than 'over bite' & 'open bite' but no difference between 'normal smile' and 'over						

DISCUSSION

The aims of this study were to assess the perception of smile with different incisal relationships in dental and facial views by a sample of (12-14 year-old) Saudi female adolescents in Riyadh city and to evaluate the influence of these smiles on social aspects of female adolescents in the same age. Previous studies conducted to assess children or adults perception about their smiles or by their peers or parents showed variations in the perception of attractive smile [10,11,16].

Different factors affect the perception of the smile other than teeth alignments. However, because anterior teeth are one of the most important components of the smile, many studies have been done using them as a major key role in smile perception, assessment and evaluation by laypersons or dental professionals [23-25].

Visual analogue scale (VAS) is a simple and reliable scale, where in the current study it showed high correlation between initial and second setting to assess the dental view of the smile with different incisal relationships (normal smile:0.85, over jet: 0.82, overbite:0.9 and open bite:0.89). Moreover, The SPQ12-14 shows substantial evidence of reliability (Raine, 1991) that has been shown in our study where the test-retest reliability test has high correlation between the initial and second sitting in the responses of the 13 questions for evaluating the facial views of the smile with different incisal relationships ranging from (0.7-0.9).

In the current study the normal incisal relationship smile showed higher mean values (470) than the other three types in the dental views. The normal smile in the facial view in the following domains (pleasantness/ unpleasantness, honesty/ altruism/dishonesty, extroversion/ introversion, personal happiness, intelligence) and global score had the highest mean ranks (7.4, 7.4, 6.7, 8.9, 2.7, 33.2) respectively of the smile perception questionnaire, which suggest that adolescents are able to distinguish normal incisal relationships that develops with cognitive development and growth [15]. However, responses for the extroversion/introversion domain for normal smile was (6.7) and for the over jet was (7.2) showing that there is no statistically significance difference between their mean values. This could be due to: (a) the 2-D images limitations in showing the sagittal plane view of the increased over jet and (b) the overall facial beauty affects the degree of social attraction positively with features such as extroversion which is indicated by Shaw (1981) in a study of 11-13 year-old (c) and it is not possible to make a direct comparison due to the different study methods used [26]. While, Lombardo et al. (2012) reported no different evaluations in all domains caused by variations in the dental alignment in all the fields of analysis, it was found in our study that the normal smile has statistically significant ($p< 0.001$) higher mean values than the other 3 types [16]. This could be attributed to the different study methods used in which they used photographs for two subjects a male and a female where any two neighboring participants wouldn't receive the same photographs at the same time to reduce sampling bias.

Kokich et al. (2006) found that alterations in the normal relationship of the teeth (alterations that involved crown length, crown width, midline diastema, papilla height, and gingiva-to-lip relationship of the maxillary anterior teeth) make the teeth more unattractive, which is in agreement with our study where the participants responded to the normal smile as the most attractive in comparison to the other three views [24]. Moreover, Van der Geld et al. (2007) concluded that the position and visibility of the teeth played an important role in the participants' decision of choosing the attractive smile, indicating that the teeth are one of the important components for smile attractiveness [3]. Flores-Mir et al. (2004) their evaluators were randomly selected from persons accompanying patients to the University Dental Clinic and from the neighbourhood around the University Dental Clinic. They concluded that the aesthetic impact of dental view decreased in a full facial smile view and intra-photograph effects (bite type, photographed subject and view) influenced the aesthetic perception of smile [23]. In contrast to this study where the normal smile had the highest mean rank in both dental and facial views. The differences might be due to different photographed subjects and viewing conditions, which might alter the

perception of the smiles in their study. Moreover, Taibah and Alhummayani et al. assessed relationships between self-esteem and malocclusion in adolescents. They concluded that malocclusion affected self-esteem negatively in which spacing, crowding, and over jet had the greatest negative effects on self-esteem [27] which agrees with the current study results of the normal smile dental and facial views having the highest rank among all other views.

Tristão et al. who evaluated the relationship between malocclusion and bullying in children and adolescents suggested that malocclusion may be related to the occurrence of bullying among children and adolescents [28] which agrees with our study in which the extroversion/introversion domain showed to have higher mean values in (normal view) and (over jet) than (overbite) and (open bite) indicating that adolescents with malocclusion may have their social life aspects affected.

The limitations of the current study are: (a) the 2-D photographs, which don't show the sagittal plane made the editing of the normal smile to appear as a moderately increased over jet difficult. The photograph was edited by elongating the two maxillary central incisors so they give a protruded appearance of the increased over jet. In spite of this limitation, the 2-D photographs are helpful and simple tool to use in studies assessing and evaluating the smile esthetics, (b) the study is based on the first impression, but not further interactions and it is known that first impressions are made very fast. However, the photographs have been seen twice by the participants in a week period apart and showed good reliability of the scales used in the study (c) the smile photographs are static while studies have shown that dynamic stimuli gives better emotion discrimination than the static ones [29], so the pictures used were for an average Saudi adolescent, coloured and with white background to reduce the amount of distraction.

This study shows that attractive smile for female adolescents are the smile with normal incisal relationships contributing to better facial esthetics and social interactions of the individual.

CONCLUSION

It has been concluded that normal incisal relationship has favourable effect on the adolescent's acceptance by others and alterations in the normal incisal relationships contribute in decreasing the facial esthetics of the individual leading to a negative impact on the social life aspects.

It's recommended to perform further studies to test other smile components and their effect on facial attractiveness in this age group using the dynamic photographs in addition to the static ones. As well, children/adolescents quality of life is one of the parents/ guardians priorities in which they should seek professional help if they notice any dental or facial deformities in their children.

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N/A.

CONFLICTS OF INTEREST

The author has no conflicts of interest to declare.

AVAILABILITY OF DATA AND MATERIAL

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

CODE AVAILABILITY

Not applicable.

ETHICS APPROVAL

This study was reviewed and approved by Institutional Review Board of the College of Dentistry Research Center (no. IR 0167) of King Saud University in Riyadh, KSA. The study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

CONSENT TO PARTICIPATE

Informed consent has been sent to the participants' parents to be signed before the commencement of the survey.

CONSENT FOR PUBLICATION

The parent of the participating model signed the consent form for publication.

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