

Children's Social Perception of Peers' Dento-Facial Condition: A Cross-Sectional Study

Sunil Babu Kotha^{1*}, Ayah AlMenawi¹, Reem Abdullah AlKhalaf¹, Alhanouf Khalid Binhezaim², Turki Hamdan AlHarbi¹

¹Preventive Dentistry, Riyadh Elm University (REU), Riyadh, Saudi Arabia; ²Pediatric Dentistry, Armed Forces Hospital, Riyadh, Saudi Arabia

Abstract

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***Correspondence:** Sunil Babu Kotha. Preventive dentistry, Riyadh Elm University (REU), Riyadh, Saudi Arabia. E-mail: sunil.babu1606@gmail.com

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AIMS: This study aimed to compare the participant's perceptions about their peers' dento-facial condition with different incisal appearances (intact, discoloured, fractured, and avulsed incisors).

MATERIALS AND METHODS: A cross-sectional study was conducted among schoolchildren of both primary (8-11 years) and secondary (12-14 years) levels. Each participant was asked to judge photographs with one intact and three digitally modified central incisors giving the appearance of a traumatised tooth. Data on perceptions were collected for each condition using 12 attributes (8 positive and 4 negative; scored on a 4 point Likert scale). The positive, negative and total attribute scores were analysed separately by unpaired Student's t-test. Repeated Measures ANOVA and Bonferroni post hoc analysis was also used.

RESULTS: A group of 587 children participated in the study. The perception for intact and traumatised incisors about demographic factors is well appreciated. Among the gender delineation, girls showed a significant difference in judgment between discoloured and fractured incisors. In comparison to intact incisors, positive and total attributable scores were found to be significantly higher ($P < 0.001$), whereas negative attribute scores were significantly lower ($P < 0.001$) for traumatised incisors. Pairwise comparison showed high significance ($p < 0.001$) between the intact and traumatised incisor conditions.

CONCLUSION: The results demonstrated that visible dental trauma influenced the psychosocial judgment given by children towards their peers. This judgment would, in turn, affect their level of acceptance towards such appearances. Therefore, these conditions ought to be redressed as swiftly as possible.

CLINICAL SIGNIFICANCE: The primary purpose of this study was to highlight the psychosocial perceptions of children in judging their peers, regarding not only attractiveness but also intelligence, friendliness, confidence, outgoing nature, etc.

Introduction

The human face nowadays is drawing attention by playing a very significant role in judging a person for their interpersonal relation [1] [2]. It is safe to assume that the appearance of teeth in judging a person plays a major role. Teeth not only help in functional fulfilment like chewing and speech but also plays a very important role in esthetics regarding attractiveness, which creates a positive impression for the individual who is interacting. Any disturbance in these anterior teeth due to dental trauma affects not only the functional ability but also the self-esteem of the child [3] [4] [5] [6].

During social judgments in face-to-face situations, the eyes and the area of the mouth are most frequently observed [7]. People judged as more enticing, are considered to be more successful and have greater self-esteem than less enticing people [8][9]. This oral appearance, marred by unsightly oral trauma by a child is psychologically influenced by the social judgments made by their peers [10]. Thus, the smile is the most important aspect for a casting better impression. This proposes the difficulty for a child with unappealing teeth to smile [11] [12].

Anterior dental trauma in very young individuals between 2-3 years is mainly due to accidents as their motor coordination is developing, and later during 6-12 years involving the permanent

anterior teeth leading to instability in their functions, aesthetics and most importantly their psychology [13]. The prevalence of dental trauma to permanent incisors is stated to be high worldwide, 15-23% among American teenagers [14], 23-35% among European [15], while in Asian juveniles it was reported to occur in a range of 4-35% [16]. Moreover, the prevalence of dental trauma in Saudi Arabia is reported to be 33% among 5-6 years old boys, 34% among 12-14 years old boys [17], and 31% among 12-15 years old girls [18].

The present paper encompasses the evaluation of children's social perception of their peers' dento-facial condition.

The present study was carried out to compare children's perceptions about their peer's dento-facial condition (visible incisor condition) by using the digitally modified photographs of a single child and to investigate the effect of gender, level of education and nationality on their perception.

The prespecified hypothesis of the present project is to extend previous research by testing the hypothesis that visible dental trauma influences the children in judging their peers and in turn affect their level of acceptance.

Materials and Methods

Riyadh being the capital city of Saudi Arabia has a population from various origins found to be the appropriate site for doing a study on the perception of peers' dento-facial condition.

The participants were divided into two groups.

Group 1: Primary school (8-11 years)

Group 2: Secondary school (12-14 years)

The study sample size of 579 participants was calculated by using a level of precision formula $n = (z_{\alpha} + z_{\beta})^2 pq/d^2$ ($z_{\alpha}:1.96$; $z_{\beta}:0.82$; $p:25\%$; $q:75\%$ and $d:5\%$). Sample size estimation was done a setting power of 80% with a confidence interval of 95%. Simple random sampling was employed for selection of participants. The estimated required sample size of 587 participants was overshoot during data collection to further warrant for dropouts owing to incomplete questionnaires.

To obtain the appropriate sample, schools in Riyadh city were divided into three sections: north, south-east and south-west. The process of cluster sampling was used in which each unit is having more than 300 school children were listed according to three sections followed by a table of random allocation used to select 40 schools randomly. Since schools in the north were not as highly populated as, south-east and south-west, the chosen sampling ratio for the

schools was 1:2:2; for every school selected from the north, two schools were selected from south-east and south-west. It was planned that approximately 20 (10 each from primary and secondary school) children were examined in each school, giving a predicted sample of 800. Though our estimated size of sample required for our study (as per the equation) was only around 580, we have taken more children (800) expecting some dropouts.

After the Research board, Riyadh Elm University, Riyadh, KSA approved the study, permission was obtained from the Ministry of Education to conduct the survey in the specified schools.

The investigators explained to the children the purpose of the survey and assured them of confidentiality.

Standardized full-face with visible sound teeth colour photographs (A5 portrait) of a primary school and secondary school child each, were taken. Each of these photographs was digitally manipulated using Adobe Photoshop software to include different trauma conditions, i.e. crown fractures, avulsion and non-vital discoloured incisor (Figure 1). A digitally manipulated approach was adopted to prevent the potential confounding effects of a different smile or hairstyle on an overall appearance.

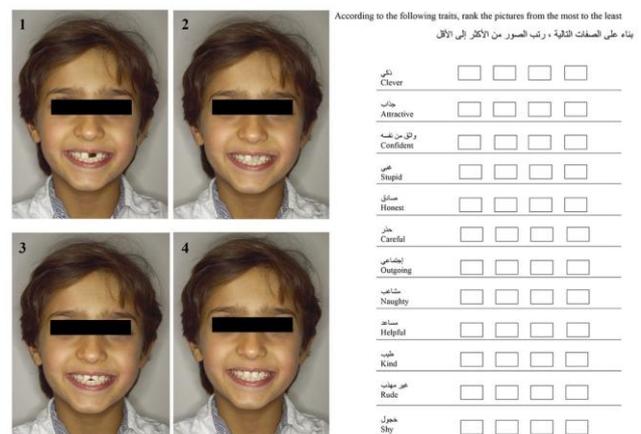


Figure 1: Full face photographs of the different incisal conditions in a single child

Consent was taken from the two volunteers' parents to permit the utilisation of their photographs with digital manipulation for the specific purposes of this study. The specific aim of the study was carefully concealed from the participants during the entire data collecting process.

The survey comprised a two-part self-administered questionnaire. The first section involved demographic data about nationality, age, gender and level of education. The second section included the 4 pictures (intact incisors, fractured, discoloured and avulsed incisor) of the same child and 12 modified descriptors (eight positive and four negative attributes)

included in the validated questionnaire [19] [20].

To avoid an inappropriate scoring by the children who were not well acquainted with English, an English-Arabic version of the questionnaire was formulated. The concept of translation was to obtain an instrument with conceptual equivalence in a different cultural group. The original English questionnaire was translated into the Arabic language by a bilingual native Arabic speaker and after that blindly back-translated by another bilingual native Arabic speaker. Through these rigorous cycles of translation and back translation, it was confirmed that the original meaning of the questionnaire was maintained. A pilot study was carried out using this bilingual instrument with children to ensure equivalence, clarity and comprehension.

Consent was obtained from all participants' parents/guardians one week before the questionnaires were distributed; also, children were given an option not to participate.

The children who participated in this study were schoolchildren of both primary (8-11 years) and secondary (12-14 years) levels who were mentally and physically fit and with the absence of any obvious dental or facial anomalies.

Participants were initially told that the researcher was assessing "the way we look at other people". This mild deception was deemed appropriate to mask the true intention of the research. A brief description of the questionnaire was given to the children to make them understand how to fill out the survey forms. Each participant was asked to judge the personal characteristics of a single subject's photograph with intact and three traumatic conditions (i.e., discolouration, fracture and avulsion) and rank them based on the attributes (8 positives, 4 negative) given in the validated questionnaire. Care was taken not to reveal the fact that how their judgment was going to be assessed later on. Once the questionnaires were distributed among the children, about 15 minutes were allotted to complete them.

Questionnaires with more than 30% of missing data were not considered and the ones with less than 30% missing data, the median value for the individual attribute (from analysis of the whole data set) were replaced for the missing values [19]

The primary outcome was to analyse positive and negative attributes separately and by summing up to examine the aggregate score. The picture, which was ranked one, was given a score of four and the ranking of 4 was given the score of one. Consequently, the positive attribute score (PAS) ranged between 32 (most positive) to 8 (least positive) and the negative attribute score (NAS) ranged between 16 (most negative) to 4 (least negative). The total attribute score (TAS) was also calculated by adding up the scores in which the negative attributes were scored in reverse showing the TAS range from

36 (maximum) to 12 (minimum).

The data acquired was deemed appropriate to carry out the parametric tests since the results were normally distributed. The use of unpaired t-test, repeated measure ANOVA and post hoc analysis using Bonferroni adjustment with the help of the Statistical Software SPSS 24.0 was carried out on the data collected from 587 children. Each subject was a unit of analysis.

A repeated-measures ANOVA placed each on an equal footing in the partitioning of the total variation showing a significant difference between trauma groups ($P < 0.001$). Post hoc analysis using Bonferroni adjustment analysis for pairwise comparisons revealed that children displaying normal intact incisors gained the most favourable ratings compared to the ones with any of the traumatised conditions of the incisors.

Results

Figure 2 summarised the details of expected and the final number of participants in the study. In spite of having the potential number of participants, there was a slight lowering due to various reasons. In primary school children, though the explanation was given on a one-to-one basis, some of them were not able to complete the questionnaire (27.7%). This might have been due to the fatigue involved in correlating and ranking pictures at this primary school level. In contrast to this, the secondary school children had only 9 improper entries.

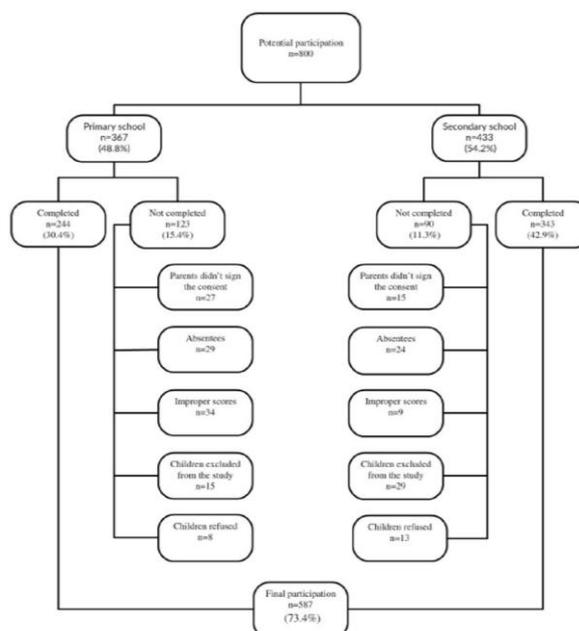


Figure 2: Flowchart outlining the number of participants in the study

Table 1 summarised the distribution and perception of scores about the visible dental condition and the demographic variables. Overall, the demographics of gender, level of education and nationality showed a significant perception difference between intact and traumatised conditions.

Table 1: Distribution and Perceptions scale score variation of incisal condition concerning the demographic factors.

S. No	Demographic Factors	Groups	Total Number (n= 587) with distribution	Dento-Facial Condition				p-value [†]	Post hoc [‡]
				Avulsion (1) Mean±SD	Discoloration (2) Mean±SD	Fracture (3) Mean±SD	Intact (4) Mean±SD		
2	Gender	Boys	368 (62.7)	28.16±4.46	29.70±3.17	29.49±3.49	32.57±3.86	<0.001	4>3>2>1
		Girls	219 (37.3)	26.38±4.06	28.8±3.51	30.80±3.13	34.03±4.23	<0.001	4>3>2>1
				p-value [†]	<0.001	<0.001	<0.001		
3	School grade	Primary	244 (41.6)	27.97±4.4	28.89±3.6	29.8±3.4	33.0±3.8	<0.001	4>3>2>1
		Secondary	343 (58.4)	27.16±4.3	29.71±3.0	30.1±3.4	32.98±4.2	<0.001	4>3>2>1
				p-value [†]	0.029	0.003	0.29	0.359	
4	Nationality	Arabs	419 (71.4)	27.85±4.45	29.43±3.39	29.99±3.5	32.67±4.02	<0.001	4>3>2>1
		Non-Arabs	168 (28.6)	26.61±4.16	29.19±3.15	29.96±3.1	34.21±3.96	<0.001	4>3>2>1
				p-value [†]	0.002	0.423	0.945	<0.001	

† - Unpaired t-test; ‡ - Repeated Measure ANOVA; § - Bonferroni Post hoc analysis.

Girls showed a significant perception difference between all the 4 groups of the photographs with specific importance between discoloured and fractured teeth (Fig. 3). Primary school children showed no specific inter-differentiation between the 3 trauma conditions. Secondary school children, irrespective of gender or nationality, showed a specific differentiation between avulsed and discoloured incisors with a negative influence towards avulsed teeth and so the same within the nationality (Fig. 3).

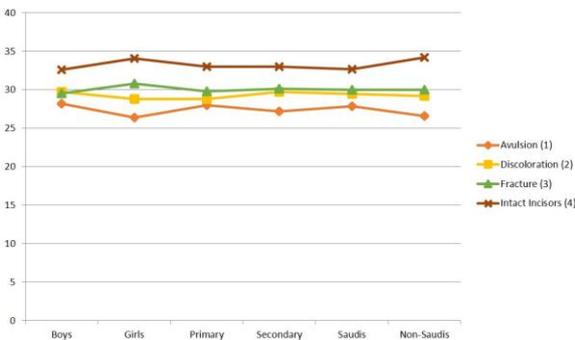


Figure 3: Variation of incisal condition concerning the demographic factors

Table 2 showed that PAS and TAS were significantly varying among the traumatic conditions with intact incisor condition showing significantly higher positive scores compared to others.

Table 2: Perceptions scale positive, negative and total score variation about different clinical situations using Repeated Measures ANOVA with Bonferroni post hoc analysis[†] for pairwise comparisons

Score variation	Situation	Avulsion (1)	Discoloration (2)	Fracture (3)	Intact (4)	df	F	p value [†]	Post hoc [‡]
Positive	Mean ± SD	15.45±4.655	19.33±3.693	19.23±3.279	25.95±4.495	3	507.458	<0.0001	1<2=3<4
Negative	Mean ± SD	12.04±2.215	10.03±1.944	10.75±1.966	7.16±2.277	3	425.383	<0.0001	1>3>2>4
Total	Mean ± SD	27.50±4.404	29.36±3.328	29.98±3.421	33.11±4.068	3	164.189	<0.0001	1<2<3<4

† - Repeated Measure ANOVA; ‡ - Bonferroni Post hoc analysis.

Post hoc analysis showed that PAS significantly differed between all groups except

fractured and discoloured conditions. NAS was also significantly varying among the traumatic conditions with intact incisor condition by showing significantly lesser negative scores compared to others (Fig. 4).

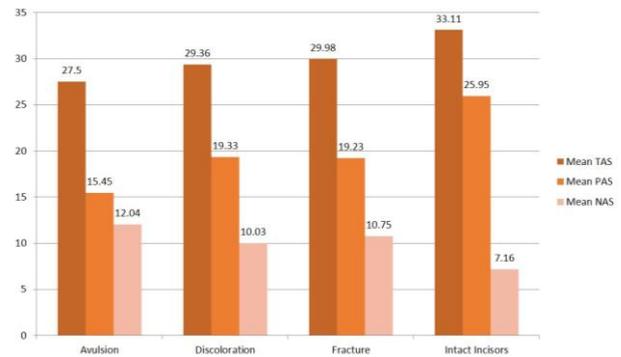


Figure 4: Variation of mean PAS, NAS and TAS perceptions in different clinical situations

Post hoc analysis showed that NAS significantly differ between individual conditions having least score for intact and the highest score for avulsion.

Discussion

Within the acknowledged restrictions of this study, the findings point out that children do make judgments about their peers on the premise of their dental appearance based on the condition of visible anterior teeth. To a certain extent, the outcome of the present study, as predicted, had shown that the negative social judgment to visible incisor defects among children was on par with past studies [19] [20] [21] [22] [23] [24]. The current research incorporated certain methodological changes, wherein defects like discolouration, fracture and avulsion were independently considered for comparison against a control group, unlike previous studies that focused on incorporating a generalised concept of clubbing different types of trauma and comparing them with the normal [20].

The study at hand showed that both primary and secondary school children gave negative judgments towards their peers who had an avulsed tooth, yet had no significantly different judgment for conditions of fractured or discoloured teeth. This could be attributed to the fact that the children were aware that the trauma of a tooth is common at this age and they deliberately chose not to make negative judgments for the same. The avulsion of a tooth, on the other hand, gives an unsightly or unnatural appearance of something missing and is probably why it showed statistical significance. Similar ideas were also proposed by previous studies [20] [21].

It was also seen among the secondary school children in this study that they possessed a more negative judgment towards a discoloured tooth than towards a fractured tooth, which was in concurrence with previous studies [25] [26]. According to Jean Piaget's Cognitive developmental theory [27], some children give negative judgments about visible dental trauma most likely because, during this adolescent age, children are more governed by self-perception. In contradiction, however, Grosfosky et al. [28] stated that tooth shade does not influence the perception of attractiveness.

Surprisingly in the present study, it was found that girls were significantly more negative in their social judgments in comparison with their male counterparts considering any of the traumatic condition; boys gave negative judgments only towards their peers having avulsed tooth. This finding opposes that of previous studies [19] [20] [29], where female adolescents were more positive than males in judging their peers with incisor trauma. However, these results cannot generalise these perceptions, as there are many other factors to be accounted for like the individual's beliefs, values, past dental experience, and their dental attractiveness.

Ethnicity, like in the previous studies [19] [30] [31], showed no significance in judgments towards visual dental trauma related.

It might be debated that photographs provide a judgment without the added parameters of voice, attire, direct view in person, etc., all of which could play an important role in one's perception of a person. On a related matter, certain previous studies comparing the judgment between static 2D images and dynamic video clips showed no significance concluding that these 2D images are suitable for social science research [19] [32] [33].

1. The researchers did not have a verbal discussion with the participants after they finished filling their survey forms as to what reasons governed their responses. This might give a better understanding of a child's perspective while making social judgments.

2. The actual numerical distinction in mean scores of TAS was found to be around 3-4. Larger sample size would have provided a larger numerical distinction, which would change the statistical significance of certain parameters measured.

In conclusion, within the limitations of this study, it was demonstrated that visible dental trauma influenced the psychosocial judgment given by children towards their peers. This judgment would, in turn, affect their level of acceptance towards such appearances. Therefore, these conditions ought to be redressed as swiftly as possible, and it is advisable that parents and caregivers ought to consider these issues genuinely for better social relations and

academic performances of their wards. This study provided the quantitative evidence to dental professionals that their peers based on any visible dental trauma negatively judge children. Therefore, it would be prudent and in the best interest of a child's healthy emotional and physical growth, that such visible dental defects are not neglected.

The primary purpose of this study was to highlight the psychosocial perceptions of children in judging their peers, regarding not only attractiveness but also intelligence, friendliness, confidence, outgoing nature, etc. These factors usually make most children conscious about their visible incisal trauma affecting them emotionally and psychologically for their long-term development in life [19] [30]. So greater awareness should be created amongst dental professionals to try and correct small esthetic dental defects by performing non-invasive techniques like simple composite restorations or microabrasions to improve the confidence of the child, rather than by just convincing children to wait till they become older for cosmetic correction. Thus, we must question ourselves regarding clinical, financial and legal concerns while treating children for these visible traumatic incisors for overall wellbeing.

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References

1. Little AC, Jones BC, DeBruine LM. Facial attractiveness: evolutionary based research. *Philos Trans R Soc Lond B Biol Sci.* 2011; 366:1638–1659. <https://doi.org/10.1098/rstb.2010.0404> PMID:21536551 PMCID:PMC3130383
2. Kissler J, Bäuml KH. Effects of the beholder's age on the perception of facial attractiveness. *Acta Psychol (Amst).* 2000; 104:145–166. [https://doi.org/10.1016/S0001-6918\(00\)00018-4](https://doi.org/10.1016/S0001-6918(00)00018-4)
3. Golai S, Nimbeni B, Patil SD, Baali P, Kumar H. Impact of untreated traumatic injuries to anterior teeth on the oral health related quality of life as assessed by video based smiling patterns in children. *J Clin Diagn Res.* 2015; 9:ZC16–ZC19. <https://doi.org/10.7860/JCDR/2015/13169.6039>
4. Meyer E, Jacobson WE, Edgerton MT, Canter A. Motivational patterns in patients seeking elective plastic surgery: I. Women Who Seek Rhinoplasty. *Psycho Med.* 1960; 22:193–201. <https://doi.org/10.1097/00006842-196005000-00004>
5. Crowell NT, Sazima MJ, Elder ST. Survey of patients' attitudes

- after surgical correction of prognathism: Survey of 33 patients. *J Oral Surg.* 1970; 28:818–822. PMID:5273806
6. Traebert J, Lacerda JT, Foster Page LA, Thomson WM, Bortoluzzi MC. Impact of traumatic dental injuries on the quality of life of schoolchildren. *Dent Traumatol.* 2012; 28:423–428. <https://doi.org/10.1111/j.1600-9657.2012.01114.x> PMID:22276554
7. Miller AC. Role of physical attractiveness in impression formation. *Psychon Sci.* 1970; 19:231–234. <https://doi.org/10.3758/BF03328797>
8. Dion K, Berscheid E, Walster E. What is beautiful is good. *J Pers Soc Psychol.* 1972; 24:285–290. <https://doi.org/10.1037/h0033731> PMID:4655540
9. Loh ES. The economic effects of physical appearance. *Soc Sci Q.* 1993; 74:420–438.
10. Jeremiah HG, Bister D, Newton JT. Social perceptions of adults wearing orthodontic appliances: a cross-sectional study. *Eur J Orthod.* 2011; 33:476–482. <https://doi.org/10.1093/ejo/cjq069> PMID:20651044
11. Ellwood RP, O'Mullane D. Enamel opacities and dental esthetics. *J Public Health Dent.* 1995; 55:171–176. <https://doi.org/10.1111/j.1752-7325.1995.tb02362.x> PMID:7562731
12. Naumann LP, Vazire S, Rentfrow PJ, Gosling SD. Personality judgments based on physical appearance. *Pers Soc Psychol Bull.* 2009; 35:1661–1671. <https://doi.org/10.1177/0146167209346309> PMID:19762717
13. Guidelines for the management of anterior dental trauma, American Academy of Pediatric Dentistry (reference manual). 2001; 34:12–31.
14. Marcenes W, Alessi ON, Traebert J. Causes and prevalence of traumatic injuries to the permanent incisors of school children aged 12 years in Jaragua do Sul, Brazil. *Int Dent J.* 2000; 50:87–92. <https://doi.org/10.1002/j.1875-595X.2000.tb00804.x> PMID:10945187
15. Soriano EP, Caldas AF, Go'es PSA. Risk factors related to traumatic dental injuries in Brazilian school children. *Dent Traumatol.* 2004; 20:246–250. <https://doi.org/10.1111/j.1600-9657.2004.00246.x> PMID:15355382
16. Nik-Hussein NN. Traumatic injuries to anterior teeth among schoolchildren in Malaysia. *Dent Traumatol.* 2001; 17:149–152. <https://doi.org/10.1034/j.1600-9657.2001.170402.x> PMID:11585139
17. Al-Majed I, Murray JJ, Maguire A. Prevalence of dental trauma in 5-6- and 12-14-year-old boys in Riyadh, Saudi Arabia. *Dent Traumatol.* 2001; 17:153–158. <https://doi.org/10.1034/j.1600-9657.2001.170403.x> PMID:11585140
18. Al-Majed I. Dental trauma among 12–15 year-old schoolgirls in Riyadh, Saudi Arabia. *J Pak Dent Assoc.* 2011; 20:29–34.
19. Craig SA, Baker SR, Rodd HD. How do children view other children who have visible enamel defects? *Int J Paediatr Dent.* 2014; 25:399–408. <https://doi.org/10.1111/ipd.12146> PMID:25511447
20. Rodd HD, Barker C, Baker SR, Marshman Z, Robinson PG. Social judgements made by children in relation to visible incisor trauma. *Dent Traumatol.* 2010; 26:2–8. <https://doi.org/10.1111/j.1600-9657.2009.00849.x> PMID:20089056
21. Awooda, EM, Ali YAH. Social judgments made by children (10–15 year old) in relation to visible incisors trauma: School-based cross-sectional study in Khartoum state, Sudan. *J Int Soc Prev Community Dent.* 2015; 5:425–431. <https://doi.org/10.4103/2231-0762.165931> PMID:26539397 PMCid:PMC4606609
22. Newton JT, Prabhu N, Robinson PG. The impact of dental appearance on the appraisal of personal characteristics. *Int J Prosthodont.* 2003; 16:429–434. PMID:12956500
23. Feng XP, Newton JT, Robinson PG. The impact of dental appearance on perceptions of personal characteristics among Chinese people in the United Kingdom. *Int Dent J.* 2001; 51:282–286. <https://doi.org/10.1002/j.1875-595X.2001.tb00839.x> PMID:11570543
24. Eli I, Bar-Tal Y, Kostovetzki I. At first glance: Social meanings of dental appearance. *J Pub Health Dent.* 2001; 61:150–154. <https://doi.org/10.1111/j.1752-7325.2001.tb03382.x>
25. Dunn WJ, Murchison DF, Broome JC. Esthetics: Patients' perceptions of dental attractiveness. *J Prosthodont.* 1996; 5:166–171. <https://doi.org/10.1111/j.1532-849X.1996.tb00292.x> PMID:9028220
26. Montero J, Gómez-Polo C, Santos JA, Portillo M, Lorenzo MC, Albaladejo A. Contributions of dental colour to the physical attractiveness stereotype. *J Oral Rehabil.* 2014; 41:768–782. <https://doi.org/10.1111/joor.12194> PMID:24905467
27. Casamassimo PS, Fields HW, McTigue D, Nowak AJ. Pediatric Dentistry: Infancy Through Adolescence. IN: Fields HW, Adair SM eds. *The Dynamics of Change.* 5th Edn. Elsevier Inc. 2013; 416–417.
28. Grosfosky A, Adkins S, Bastholm R, Meyer L, Krueger L, Meyer J, Torma P. Tooth color: effects on judgments of attractiveness and age. *Percept Mot Skills.* 2003; 96:43–48. <https://doi.org/10.2466/pms.2003.96.1.43> PMID:12705508
29. Patel A, Rodd HD, Baker SR, Marshman Z, Robinson PG, Benson PE. Are social judgements made by children in relation to orthodontic appliances? *J Orthod.* 2010; 37:93–99. <https://doi.org/10.1179/14653121042948> PMID:20567032
30. Henson ST, Lindauer SJ, Gardner WG, Shroff B, Tufekci E, Best AM. Influence of dental esthetics on social perceptions of adolescents judged by peers. *Am J Orthod Dentofacial Orthop.* 2011; 140: 389–395. <https://doi.org/10.1016/j.ajodo.2010.07.026> PMID:21889084
31. Xu F, Wu D, Toriyama R, Ma F, Itakura S, Lee K. Similarities and differences in Chinese and Caucasian adults' use of facial cues for trustworthiness judgments. *PLoS One.* 2012; 7:e34859. <https://doi.org/10.1371/journal.pone.0034859> PMID:22514680 PMCid:PMC3325928
32. Rhodes G, Lie H C, Thevaraja N, Taylor L, Iredell N, Curran C, Tan S Q C, Carnemolla P, Simmons L W. Facial attractiveness ratings from video-clips and static images tell the same story. *PLoS One.* 2011; 6:e26653. <https://doi.org/10.1371/journal.pone.0026653> PMID:22096491 PMCid:PMC3214014
33. Tigue CC, Pisanski K, O'Connor JJ, Fraccaro PJ, Feinberg DR. Men's judgments of women's facial attractiveness from two- and three-dimensional images are similar. *Journal of vision.* 2012; 12(12):3. <https://doi.org/10.1167/12.12.3> PMID:23132932