Original Article

How Do Schoolchildren View Other Children Who Have Discolored Teeth?

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ABSTRACT

Objectives: Facial look and expression affect how people are viewed by others. This study aimed to evaluate how schoolchildren in the Emirate of Sharjah, United Arab Emirates view their peers who have discolored teeth. **Materials and Methods:** A cross-sectional study using randomized cluster sampling of Sharjah public schools was conducted. A previously developed and validated social attribute questionnaire was utilized to determine children's dental appearance-related judgments. Children aged 11–14 years were given photographs of subjects either with discolored teeth or without, and they were asked to rate them using six positive and five negative signifiers. The total attribute score (TAS) ranged from 11 (most negative) to 44 (most positive). A linear regression analysis and *t*-tests were performed to determine the effects of gender and age in mean TAS. **Results:** TAS was significantly lower among discolored teeth photographs when compared with photographs without teeth discoloration ($P = 0.004$). TAS was found to be significantly higher with increased age ($P = 0.035$), but gender had no significant effect. **Conclusion:** Teeth discoloration resulted in more negative social judgment between Sharjah schoolchildren and their peers.

Keywords: *Appearance, judgment, school children, teeth discoloration, total attribute score (TAS), United Arab Emirates*

Introduction

Facial look and expression affect how people are viewed by others. In the 1970s, Dion[1] reported that children who were considered "unattractive" were perceived as being less disciplined and less honest than more "attractive" children.

A multitude of studies have subsequently raised similar issues. For example, a systematic review showed that conventionally "attractive" adults and children were viewed more positively for a variety of qualities.[2] The relationship between facial esthetic and public judgments was first studied over 40 years ago by Shaw and his co-workers. A total of 42 adults and children appraised photographs of boys' and girls' faces with different incisor teeth shapes and positions including "normal," crowded, and spaced incisors or a unilateral cleft lip.[3] The results showed that children with a normally looking tooth were more positively judged in relation to popularity, intelligence, and behavior.

A more recent study in the USA used photographs of smiling adolescents, with "normal" and crowded teeth, with the aim to obtain their opinion and perceived athletic, educational capabilities, and social headship.[4] More significant positive evaluations were credited to photographs with "normal" teeth in relation to sport skills, being popular, and leadership, but not educational skills.

Furthermore, having an "ideal" and beautiful smile appears to impact on many psychological aspects that may even include occupation advancement prospects.[5] Society's prospects of having "white" teeth

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are also highly desirable in addition to the desire to have straight teeth.[6] Even individuals with naturally looking teeth may seek to have unusually white teeth, as influenced by popular culture stereotypes. As a result, individuals with an abnormal or discolored tooth may be stigmatized in some way.

Kershaw *et al.*[7] conducted a study that explored perception relating to tooth color. It was shown that individuals with discolored teeth scored lower than their counterparts for a variety of personal qualities, including academic capability, public competence, and psychosocial relationship. The investigators concluded that tooth color influenced either positively or negatively, on how an individual was perceived by others. Children and young people made negative psychosocial judgments based on enamel appearance[8] and to evidence incisor teeth traumatic injuries.[9]

To the authors' knowledge, no studies have investigated the effect of discolored teeth on social judgements in children in the Middle Eastern countries. Thus, the aim of this study was to assess how schoolchildren in the Emirate of Sharjah, United Arab Emirates (UAE) view their peers who have discolored teeth.

Materials and Methods

Study design and ethical approval

A cross-sectional study design was conducted using randomized cluster sampling of public schools in the Emirate of Sharjah, UAE. Ethical approval was received from the Research Ethics Review Committee at Mohammed Bin Rashid University of Medicine and Health Sciences (Ref no.: MBRU-IRB-2018-022). Permission to access the schools was obtained from the Ministry of Education in the UAE.

Sampling techniques and sample size calculation

In the first stage, a simple random sampling (SRS) technique of public schools in the Emirate of Sharjah was used to select participating schools. In the second stage, for each selected public school, classes of grade 6 (aged 11–12 years) and grade 8 (aged 13–14 years) were randomly selected using the same techniques of SRS. Within the selected classes, all the students were invited to participate in the study after obtaining consent from their guardians.

A previous study that used similar methods and outcome measures by Patel *et al.,*[10] who used 380 participants (190 in each year group), yielded 80% power to be able to get a significant difference in TAS between teeth with and without discoloration. In the present study, a sample size calculation that yielded at least 400 participants was required.

Questionnaire

Permission was obtained to use the social attribute questionnaire previously developed by Rodd *et al.*[9] in 2010 and later revised, tested, and used by Craig *et al.* in 2015.[8] It consists of 11 different attributes (five negative and six positive) proposed by children themselves. Participants judged a photographic subject for each of these 11 attributes using a 4-point Likert scale response format. The total attribute score (TAS) was calculated by collating participant's answers for each attribute. The positive score 4, 3, 2, or 1 is based on how strongly the participant believed the teeth photographs she/he evaluating agree with a given characteristic, and the values were reversed for the negative attributes. Hence, the possible TAS ranged from 11 being greatest negative score to a potential greatest positive score of 44. An example of the marking system adopted with permission[8] is shown in Table 1.

Cross-cultural adaptation and validation of an Arabic version

The Arabic translation of the English version was verified by two bilingual experts and back translated to English independently, and any disagreements in the translation were resolved. The terms used were culturally adapted for common terminology that is used by Emirati children. The internal consistency and reliability of the translated Arabic version of the questionnaire were determined by Cronbach's alpha.

Photographs

Four photographs were developed for the purpose of this study: a colored full-face digital photograph of a 14-year-old boy and an 11-year-old girl with optimum oral health and occlusion. The maxillary four incisors of the photographic subjects were digitally covered with a brown stain [Figure 1], using *Adobe Photoshop Cs6* (Adobe Systems Inc., San José, CA, USA, 1990–2012). Informed consent was obtained from both children and their parents for the specific purposes of this study. Neither child depicted in the photographs attended any of the schools that were included in the study.

Participants

Participants were schoolchildren from single-sex public schools in Sharjah, UAE. Information sheet and consent forms were distributed to the children and their parents/guardians of both grade 6 and grade 8 pupils, 2 weeks prior to the commencement of the study. All the parents/guardians of the children who were invited to participate in the study were asked to return the consent forms if they did not wish their child to participate. If no form was received from the parent/guardian, the choice to participate was therefore decided by the students themselves to give their assents.

Table 1: An example of the TAS marking system adopted with permission from Craig *et al.*[8]

	Strongly agree	Agree	Disagree	Strongly disagree
"This boy is naughty"		✓ (score = 2)		
"This boy is clever"			✓ (score = 2)	
"This boy is rude"				✓ (score = 4)
"This boy is kind"		✓ (score = 3)		
"This boy is honest"			✓ (score = 2)	
"This boy does not care about his appearance"	✓ (score = 1)			
"This boy is careful"		✓ (score = 3)		
"This boy is lazy"			✓ (score = 3)	
"This boy is confident"		✓ (score = 3)		
"This boy is helpful"	✓ (score = 4)			
"This boy is stupid"	✓ (score = 1			

✓ "Indicates tick placed by participant." Total attribute score = 28 in this example

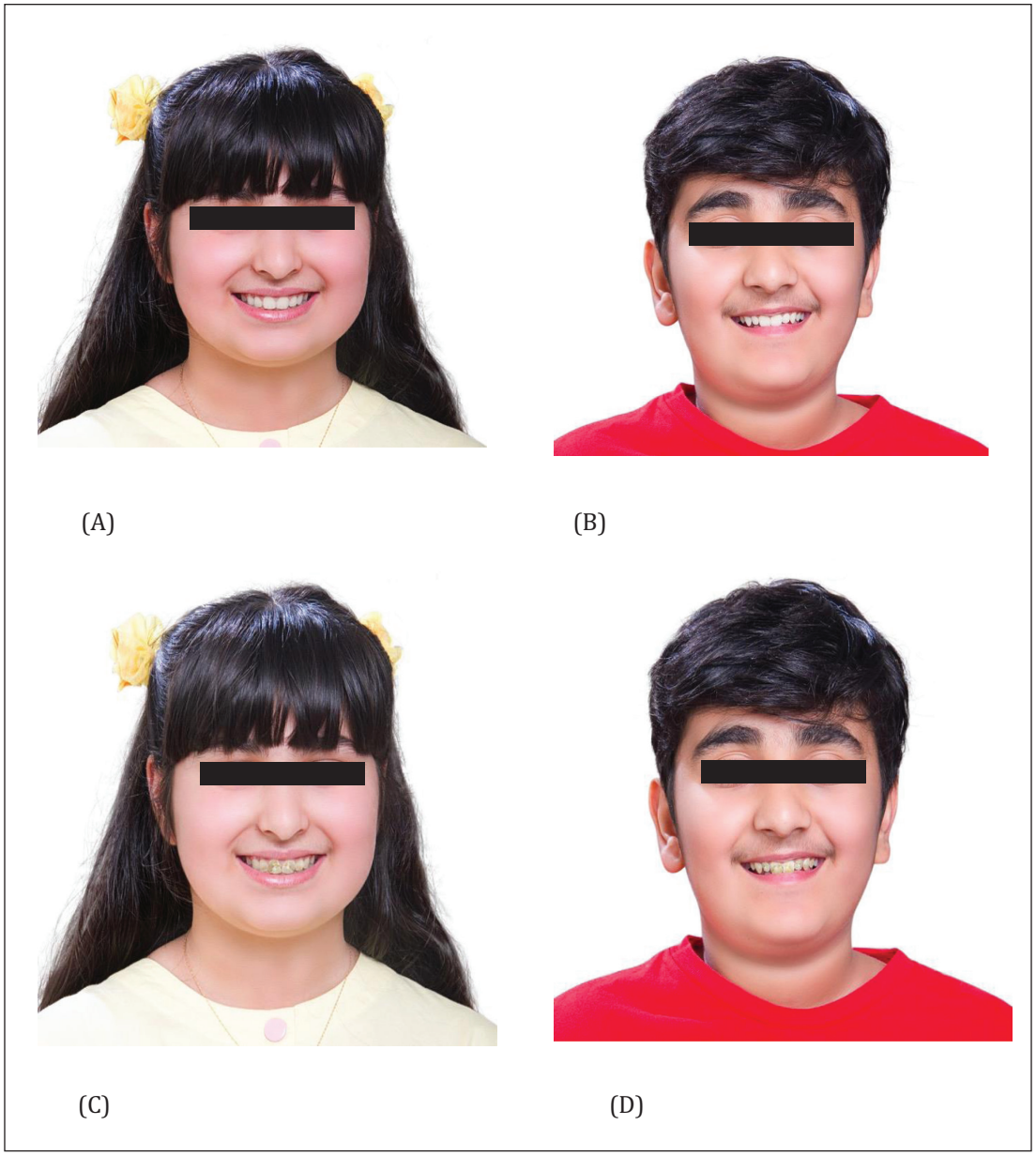

Figure 1: Photographic subjects used in the study: (A) girl without discolored teeth; (B) boy without discolored teeth; (C) girl with discolored teeth digitally superimposed on her upper incisors; (D) boy with discolored teeth digitally superimposed on his upper incisors

Each school nominated a teacher to help the principal investigator (M. A. K.) to randomly distribute the questionnaire packs with no complicity between participants. Therefore, in each class, participants were unaware that they were viewing photographic images of the same subjects.

Statistical analysis

Data were collated and analyzed using the software packaged IBM SPSS® for Windows version 23.0 (SPSS Inc., Chicago, IL, USA). The *Kolmogorov–Smirnov* test was used to confirm that data were normally distributed. An exploratory factor analysis was employed to validate the survey items for each set of photographs. Internal consistency and reliability of the questionnaire were determined using Cronbach's alpha. A linear regression analysis and *t*-test were performed to detect statistically significant differences in mean TAS and also the effects of age and gender. A $P < 0.05$ was considered statistically significant.

Results

A total of 883 participants' responses were included in the study. Five responses were excluded due to incomplete data. Therefore, a total of 878 (99.4% completion rate) responses were analyzed. All pupils were Emirati citizens in Sharjah government schools. The total number of participating girls in both sixth and eighth grades was 437, whereas the number of boys in both grades was 441. Figure 2 shows a flowchart of study participants.

The results of cross-cultural adaptation and validation of the Arabic version of the adopted questionnaire showed good internal consistency and reliability (Cronbach's $\alpha > 80\%$). In addition, by using an exploratory factor analysis, the validity was confirmed as the majority of factor loading values were greater than 0.5, indicating that each item was positively correlated to the respective items within the two principal factors (set of photographs of boys and that of girls).

There were few floor ($n = 6$, 0.7%) and ceiling ($n = 47$, 5.4%) effects noticed for the completed questionnaires. Table 2 summarizes the mean TAS for the boy's photograph and the girl's photograph, with and without the discoloration. The gender of the photographic subject was not significantly related to the mean TAS. However, the mean TAS was lower for photographs with discolored teeth in both genders when compared with those with "normal" teeth of the same gender.

Table 3 gives more detail about TAS according to the grade of the students (age). Overall, the lowest mean TAS (i.e. greatest negative assessment) was 26.20; grade 6 male participants (aged 11–12 years) view a picture of a boy with discolored teeth. The greatest TAS (i.e. highest positive assessment) was 29.07; grade 8 male participants (aged 13–14 years) view a picture of a girl without discolored teeth. Figure 3 shows the mean TAS by type of photographs and school grade for both boys and girls study participants.

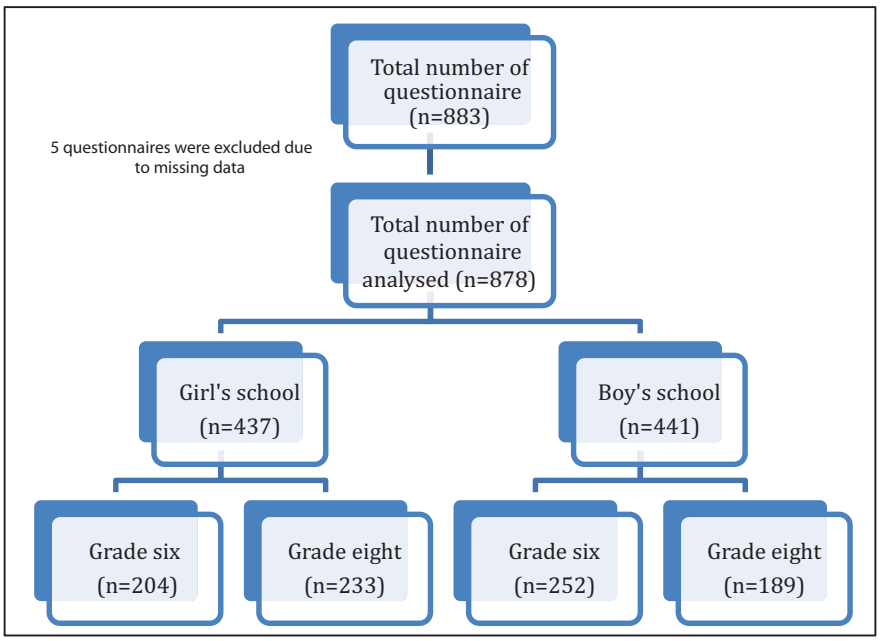

Figure 2: Flowchart of study participants

Table 2: TAS, SD, and range for photographic images with and without teeth discoloration (*P*-value = 0.004)

Schools	Mean TAS for photographs without discolored teeth					Mean TAS for photographs with discolored teeth				
	N	Boy's photograph		Girl's photograph		*N*	Boy's photograph		Girl's photograph	
		Mean (SD)	Range	Mean (SD)	Range		Mean (SD)	Range	Mean (SD)	Range
Girls	161	27.34 (±3.25)	11–35	27.87 (±2.77)	20–44	276	27.18 (±3.03)	17–38	27.80 (±3.41)	15–44
Boys	208	28.20 (±3.68)	11–44	28.70 (±3.38)	14–41	233	27.07 (±4.10)	11–36	27.30 (±4.62)	11–44
Total	369	27.75 (±3.44)	11–44	28.34 (±3.15)	14–44	509	27.21 (±3.66)	11–38	27.58 (±4.01)	11–44

Table 3: TAS for boys' and girls' photographic images, with and without discolored teeth, according to age* and gender of raters

	Without teeth discoloration					With teeth discoloration				
	N	Boy's photograph		Girl's photograph		*N*	Boy's photograph		Girl's photograph	
		Mean (SD)	Range	Mean (SD)	Range		Mean (SD)	Range	Mean (SD)	Range
Grade	Girl raters									
Grade 6	53	27.13 (±4.16)	11–35	28.51 (±3.42)	21–44	151	27.13 (±3.58)	17–38	27.85 (±3.76)	15–44
Grade 8	108	27.61 (±2.87)	20–33	27.74 (±2.95)	20–34	125	27.20 (±2.31)	20–37	27.56 (±2.35)	17–38
	Boy raters									
Grade 6	137	28.12 (±3.74)	11–44	28.50 (±3.37)	14–41	115	26.20 (±4.79)	11–34	26.25 (±5.27)	11–44
Grade 8	71	28.35 (±3.5)	23–41	29.07 (±3.38)	23–41	118	27.92 (±3.10)	18–36	28.34 (±3.62)	17–44

**t*-test (*P*-value 0.03)

A linear regression analysis was run to explore any significant differences in mean TAS as dependent variable, gender and age as independent variables, and the photographic subject (with/without discolored teeth). TAS was significantly lower among discolored teeth photographs when compared with photographs without teeth discoloration (P=0.004). For the age (grade), the value of TAS increased by the increase of the age, and this was statically significant (P=0.035). Gender, however, did not significantly influence the mean TAS.

Discussion

The present study was conducted to explore how a sub-population of UAE schoolchildren in the Emirate of Sharjah view other children who have visible tooth discoloration.

The study aimed to understand children's judgments and perceptions of each other which are aspects that could be considered under the umbrella of child bullying and peer pressure. Bullying among schoolchildren was/is taken seriously by the UAE authorities and in other countries. It is essential to draw attention to the broader psychosocial impacts on children and young people with visible dental defects. Children's dental appearance may be impacted in the way they behave, even to the point of disturbing their future development, study performance, and life opportunities.[4,11,12]

Craig *et al.*[8] found during focus teenage group discussions that photographs of individuals with visible enamel defects prompted misconceptions such as attributing laziness and carelessness to the subjects. This study is important because perception of children to other children with discolored teeth has not previously been studied in the UAE.

Five decades ago, the relation between facial appearance and social judgments was first examined.[1] In the current study, two photographs were rated by each child, either with discolored teeth or without. The results showed that the photographs of the boy and girl with discolored teeth were evaluated more negatively and given a lower score than the corresponding photographs of the boy and girl without teeth discoloration. The difference was statistically significant indicating that children with discolored teeth received more negative judgments based on their dental appearance, an outcome that was predicted to some extent. Several previous studies that were conducted using the same methodology have also shown that negative social judgments were made when teeth appearance was not within "normal" limits.[8,9,11,13] A recent study published in 2020 also concluded that children with fluoride-discolored teeth were negatively judged by their peers.[14] Rumsey and Harcourt in their wider appearance literature study highlighted that individuals with facial differences had public negative perceptions toward them.[15]

A previously developed four-point Likert response social attribute questionnaire was used in this study, which has been reported to have good internal consistency with a Cronbach's alpha of greater than 0.8.[8] To improve the fidelity of the adopted questionnaire in understanding

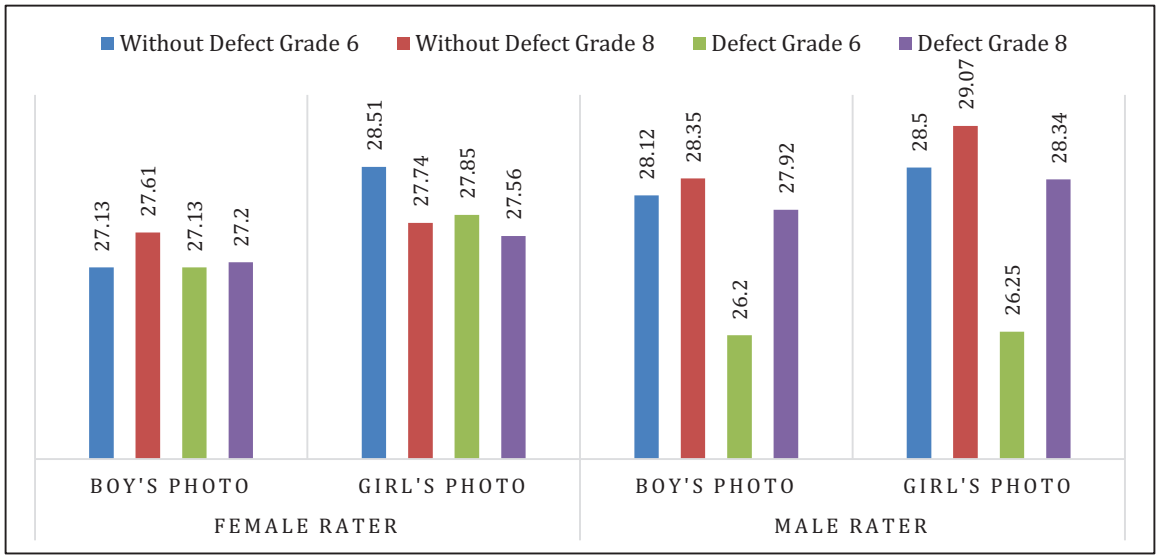

Figure 3: Average of TAS by type of photographs and school grade level for all study participants

the participating Emirati local children, cross-cultural adaptation and validation of the Arabic version were performed and showed good internal consistency and reliability (Cronbach's $\alpha > 80\%$). Further evidence for the psychometric properties of this questionnaire was demonstrated in the present study with the findings of low floor and ceiling effects. The questionnaire used in this study was also used recently in populations with different cultures.[13,14] Although odd-number 5- or 7-points' Likert scales (with a neutral point) are commonly used, the use of the middle point that is frequently present in Likert scales, formulated as "neither agree nor disagree" or "neutral," was questioned by several researchers.[16-18] While including such a middle category gives participants the leeway to communicate a "neutral" view point toward the presented question/statement, people differ in their understanding of this neutral category: some select the neutral point to show that their position or opinion falls between the two adjacent points between "agree" and "disagree"; however, other participants may choose the "neutral" category as a non-response option which indicates that they do not have (or do not want to express) an opinion regarding the statement/question.[16-18]

In this present study and many previous studies,[8,9,13,19] the elimination of the "neutral" category may have helped in avoiding the aforementioned problem and its potential effects on the results and conclusions of the study. However, it may have prevented some participants from being able to express their neutral opinion, which may be a valid answer to that particular statement/question.[20]

The final sample size of this study following exclusion of five uncompleted questionnaires was 878. It was larger than other similar studies.[8,9,19] In the current study, there was an equal gender distribution (49.8% females versus 50.2% males). In Craig *et al.*'s study,[8] the sample size was 547 with slightly more females (56%) than males. A recent similar study published in 2020 had 437 participants where 53.8% were males.[14] In the current study, all the parents agreed for their children's participation, similar to Craig *et al.*[8] who reported that only two parents withheld their consent.

In the present study, the male participants judged the discolored teeth photographs more negatively compared with their female counterparts. This finding was in agreement with previously conducted studies, in which teenaged girls gave higher scores than boys and were positive in attributing value judgements about orthodontic dental patients and those with traumatized incisor teeth.[9,10] The results of the present study agreed with those of a recent study by Siddiq *et al.*,[14] in which both gender raters had more negative social judgments about the photographs with enamel defects.

Obviously, in addition to gender, there may be other co-factors that may have prompted the pupils to make the reported social judgments. As reported by others,[8,19] we can only assume that factors such as person's beliefs, morals, dental experience, and their personal attractiveness also influenced how young individuals made appearance-related judgments about others. Ideally, to obtain a more realistic and meaningful insight into the reasons of the participants' negative judgments, the study investigators should have, as suggested by Craig *et al.*,[8] interviewed some of the participants to ask them about their responses.

It is worthwhile mentioning that although the difference in mean TAS was statistically significant, the real

mathematical difference was small (approximately 2). Previous studies that used the same methodology also reported small numerical differences between 2 and 3 in mean TAS scores.[8,9]

In some previous studies,[4,13,14] age was not a significant factor that affects raters' views of their peers, indicating that teenaged children tend to make comparable social judgments, in relation to teeth color or "non-ideal" smiles. Moreover, Henson *et al.*[4] found that rater's age was a crucial predictor of how teenaged children judge other children with "ideal" and "non-ideal" smiles. However, in this study, the age was a statistically significant factor affecting the rating where younger children inclined to give more negative social judgments. This agreed with Rodd *et al.*,[9] who reported that older children were "more likely to make a conscious and deliberate decision not to make negative judgments about subjects with traumatized incisors." In contrast, others stated that age was not a significant predictor of how teenaged children view their peers with discolored teeth.[3,13]

The utilization of photographic images to obtain social judgments, as in this current study, has been criticized as reported by other authors because it could be viewed as an unnatural approach.[3,13] People may judge others not only on their facial appearance and teeth shape and color, but also on their facial expressions and voice.[8] Rhodes *et al.*[21] compared the use of static facial photographs with video clips in rating males attractiveness. Surprisingly, there were no differences in how participants rated the photographic images versus the same subject in a video clip, and therefore they concluded that the use of facial images was valid and can be used in social science research. Another observational study utilized 2-D and 3-D rotating female facial images to find out whether these were viewed and rated differently for attractiveness by male participants.[22] The authors concluded that there was no significant difference in males' judgments and that 2-D images were valid and provided evidence similar to the 3-D images.

The findings of the present research and those from previous similar studies highlighted the wider psychosocial influences for children who have visible enamel defects/staining.[8,9,13,19] Teeth discoloration including those caused by amelogenesis imperfecta, dental fluorosis, and molar incisor hypomineralization prompted misconceptions that these young individuals were "lazy" and did not care about their teeth or their appearance. Studies conducted in Dubai, UAE showed that the prevalence of enamel defects in 5–10-year-old pre-term children and full-term control group was 58.15% and 24.2%, respectively.[23] The prevalence of molar incisor hypomineralization in Dubai, UAE children was found to be 27.2%.[24] Greater awareness and understanding of the clinical and emotional needs of young people with discolored teeth should be adopted by the general dental profession and dental services' authorities. Early referral and intervention for malocclusions is a common practice. In contrast, general dental practitioners may be more reluctant to refer or provide treatment for discolored teeth if they are unaware of this negative psychological aspect of the defects. They often suggest that growing children should wait for their esthetic treatment until they are older, thus having to face some difficult teenage years with poor dental esthetics.[8,19] There are many simple and non-invasive procedures available to improve the appearance of discolored teeth.[25,26]

Dental professionals should investigate obstacles to provision of these treatments to young people, which may include clinical concerns or financial restrictions.[27,28] It is expected that with the continued emergence of evidence-based literature relating to the relationship between oral health and children's overall wellbeing including their mental/psychological health, better child-centered dental services can be recommended and provided.

Conclusions

Discolored teeth resulted in more negative social judgments between children and their peers in Sharjah, UAE. Age was found to be a statically significant factor affecting the rating, where younger children tended to give more negative judgments compared with older children in the study population. Gender of the rater was not found to be a statically significant factor affecting the rating; however, boys' photographs with discolored teeth received more negative judgments from both girls and boys raters.

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Conflicts of interest

The authors declare that they have no conflict of interests regarding this work.

Author contributions

M. A. K., M. K., and M. A. H.: Concept design, analysis, and interpretation of literature and preparation of final manuscript; M. A. K.: collected the data; I. H., A. S., and H. R.: critically reviewed the manuscript and contributed to writing and reviewing the initial and final drafts; A. H.: performed analysis and interpretation of the data. All authors read and approved the final manuscript.

Ethical policy and institutional review board statement

The study was approved by the Research Ethics Review Committee at Mohammed Bin Rashid University of Medicine and Health Sciences in Dubai, UAE (Ref no.: MBRU-IRB-2018–022). All methods were carried out in accordance with relevant guidelines. All parents of the participants received written information about the study, and informed consent to participate was obtained from the parents and the children gave their assents to participate by submitting the completed questionnaire forms. All data were anonymized to maintain participant's privacy.

Patient declaration of consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Data availability statement

The datasets generated and/or analyzed during the current study are not publicly available because participants' (school children) privacy could be compromised but are available from the corresponding author on reasonable request.

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