Social perception of children with and without caries

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Abstract

Objectives Aim of this study was to analyse and compare the social perception of children with healthy teeth, visible dental caries and visible dental treatments by children (with and without caries experience) and their parents.

Methods Images of three children (healthy teeth; untreated dental caries; treated caries i.e. restorations and missing teeth as consequence of caries treatment) were presented to four- to nine-years-old children with (n = 92) or without caries experience (n = 88) and their parents. The social perception was measured with a standardised interview (children) and a standardised questionnaire (parents). The results were statistically analysed by Wilcoxon signed-rank, Wilcoxon rank-sum and chi-squared-tests ($p < 0.05$).

Results Dental appearance had a significant impact on social perception. Children and parents rated the child with healthy teeth most positive, while the child with visible caries was scored less favourable ($p < 0.02$). Caries experience of the children had no significant effect on their evaluation ($p \geq 0.1$). With regard to the parents neither their own nor the caries experience of their children had an impact on the evaluation ($p > 0.08$).

Conclusions Children and adults perceived children with (un)treated visible dental caries less positively than children with healthy teeth.

KEYWORDS early childhood caries, dental appearance, children, missing teeth, face perception, attractivity.

Introduction

Whether present at birth or acquired later in life, a visible difference (disfigurement) can have considerable psychological ramifications for children and adolescents. Studies have shown that attractiveness and dentofacial findings have an elementary impact on the entire life from social acceptance in childhood to education and employment. It is known, that faces with missing teeth, crowding and malocclusions are less likely judged attractive than harmonic faces. This effect is lower in faces being generally perceived "outstanding attractive" than in faces being "average attractive" or "unattractive" [Karunakaran et al. 2011; Martins et al. 2010]. Children being rated as "more attractive" are judged more positively in social concerns, make new friends easier, achieve higher marks in school and receive faster attention and help by adults than children being rated "unattractive" [Fonte et al. 2008; Linz et al. 2016; Shaw 1981; Zebrowitz and Montepare 2008]. While some affected children are able to compensate these effects, others report difficulties including adverse effects on body image, self-esteem, quality of life and difficulties due to social exclusion [Rumsey and Harcourt 2007].

This propensity was confirmed by several eye-tracking based studies: these have shown that children with cleft lip and palate or orthodontic Class III are perceived differently and rated significantly less attractive by adults compared to children with harmonic faces [Meyer-Marcotty et al. 2010a; Meyer-Marcotty et al. 2010b]. Also, children with visible caries lesions are perceived more negatively than children with healthy teeth – by adults as well as by other children [Tschammler et al. 2018, Craig et al. 2015]. However, to our knowledge, it is not known yet if the caries experience of the rater has an influence on the perception of caries-free and caries-affected children.

Thus, the aim of this study was to compare the social perception of children with healthy teeth, untreated caries and visible dental treatments between raters with and without caries experience. Children aged four to nine years and their parents were invited as raters. Null hypotheses were that there are no significant differences in the social perception between 1) children with and without caries experience; 2) parents with and without caries experience and; 3) parents of children with and without caries experience. The key driver prompting this research was to obtain data to assess the need of (early) clinical interventions for children with visible dental caries in concern of psychosocial aspects.

Methods

The present study was conducted between January and July 2019 at the University Medical Center Göttingen, Germany. Ethical approval was given by the local ethics committee (25/2/18), and the study was registered at ClinicalTrails.gov (NCT03800043). The study was conducted in accordance to the Declaration of Helsinki. Written consent was obtained from legal guardians of the children before enrolment in the study. To avoid any dental context prior or during the interview or questionnaire, participants were initially only informed that

this study aims to assess the visual perception of children's' faces. The participants were fully informed about the research hypotheses after the interview and questionnaire.

Picture selection

The pictures being presented in this study were obtained from a previous eye-tracking-study of our research group [Tschammler et al. 2018]: For the present study, one picture with a child with "healthy teeth", "visible dental caries" and "visible dental treatment" was selected. Categorisation was performed in the previous study. The photographs had been modified by cropping hair, neck, clothes and other, non-essential peripheral structures. The three selected photographs showed a Caucasian boy with similar skin type and a face of oval form with regular facial features (Figure 1). All three faces were comparable in concern of attractivity (Kruskal-Wallis test: Chi-square(2) = 2.374; p = 0.305) [Tschammler et al. 2018].

Sample size calculation

To our knowledge, this is the first study aiming to assess differences in the perception of caries-affected children between participants with and without caries experience. To generate data for sample size calculation a pre-study with each 20 children (and parents) with and without caries experience was conducted, for a total of 40 children and 40 partents in total. The calculation was performed with R (Version 3.4.0, The R Foundation for Statistical Computing; Vienna, Austria; www.r-project.org; Package WMWssp, alpha-error 5%, power 0.8, effect size 0.5) and resulted in a sample size of 170.

Study design

Children aged between four and nine years and their parents were invited to participate in the study. Exclusion criteria were children younger than four years and older than nine years, non-German speaking participants and children not accompanied by at least one parent or legal guardian.

After giving oral and written consent, the three images (high-resolution images, colored, size Din A 4) were presented to each child and one parent. Data collection was performed simultaneously to prevent mutual influence: the child was interviewed, while her/his parent/legal guardian was asked to complete the questionnaire.

The interview was based on a child-oriented interview version established by Soares et al. [2015] with two open and two closed questions per image. Therefore, the three images were shown twice. First, the children were ask to indicate their feelings about the presented picture by pointing on one image of a printed 4-point face scale (very happy, happy, sad, very sad) [Soares et al. 2015] and to give reasons for their evaluation. Then, attention was drawn to the mouth region and the same questions were asked. At the end, the children were asked for a self-assessment of their own teeth. All evaluations were performed with the same 4-point face scale [Soares et al. 2015]. All interviews were standardised and conducted by one person (K. K.).

The parent`s questionnaire was handed out in a folder along with the printed images in a random order. The questions were based on an established questionnaire [Craig et al. 2015; Rodd et al. 2010] with a 4-point-Linkert scale (strongly agree, agree, disagree, strongly disagree). The parent was asked to decide if and how strong different traits were applicated to the presented child's face ("This child is clever/ rude/ kind/ honest/ confident/ careful/ helpful/ stupid/ naughty."). Additionally, the parents were asked to express their feelings regarding their child's and their own teeth and to answer some social-demographic questions (guardian's age, child's age). As some kind of caries experience in adult populations seems likely, guardians were asked if any tooth had to be extracted due to caries.

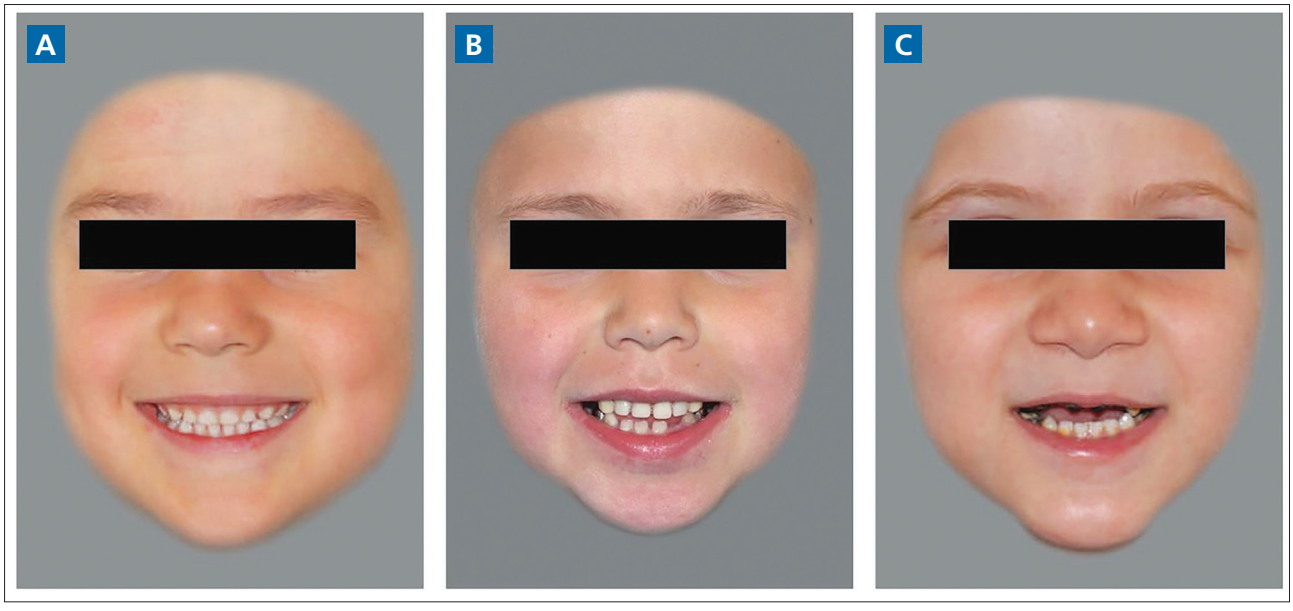

FIG.1 The three presented pictures. A) Child with healthy teeth. B) Child with dental treatment due to caries experience (denture in the upper jaw, missing tooth 72 and steel crowns on the lower first premolars). C) Child with dental caries. The images were shown without the black bars.

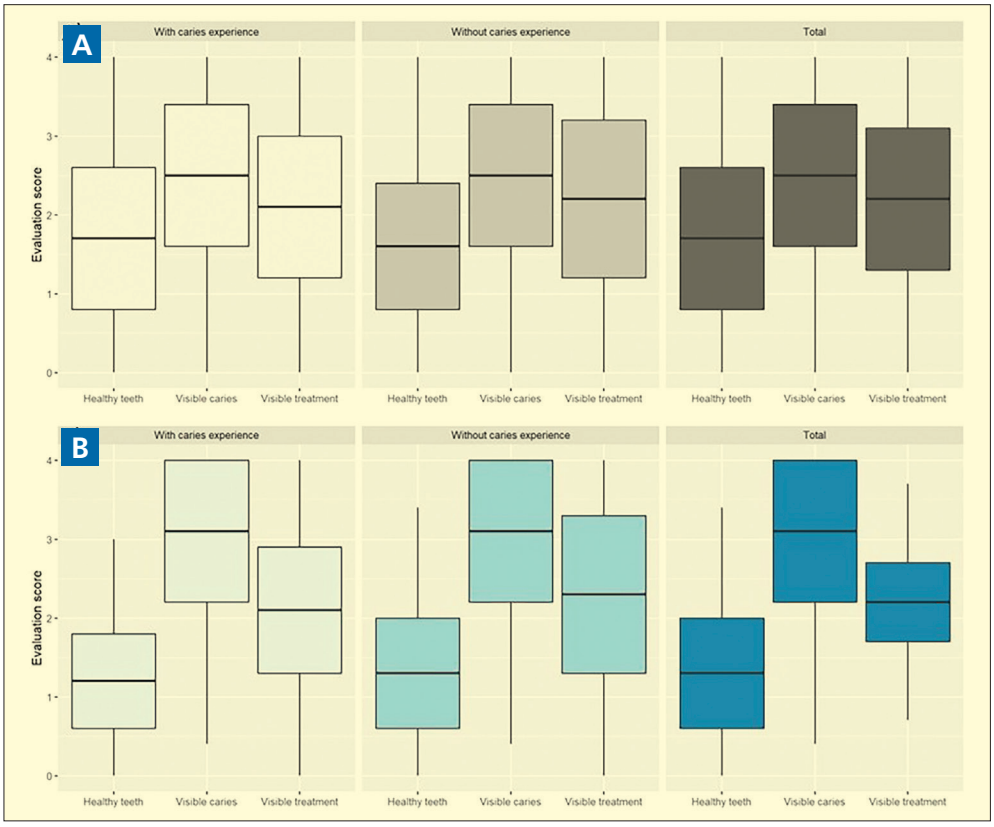

FIG. 2 Boxplot of the ratings of the children (mean ± standard deviation). Evaluation score: 1≙ very happy; 2≙ happy; 3≙ sad; 4≙ very sad. A) Children with caries experience. B) Children without caries experience. Rating of Children with caries experience revealed significantly different ratings between all three pictures ($p \leq 0.018$), while evaluation of children without caries experience showed no significant difference between the child with caries treatment and the child with visible caries ($p = 0.093$).

After the interview, a picture of the child was taken to categorise the participant as "without caries experience" (no caries experience visible at conversation distance) and "with caries experience" (caries experience visible at conversation distance). The pictures were taken as smiling portraits (teeth visible) with a digital reflex camera (Canon EOS 500D, Canon Inc., Tokyo, Japan) with macro lens (Canon EF 100 mm f/2.8 Macro USM, Canon Inc., Tokyo, Japan) and flash (Canon Speedlite 580EX II, Canon Inc., Tokyo, Japan) in manual exposure mode (1/200s, f/8.0, ISO 200).

Data analysis

The participating children were classified into children without caries experience (no caries experience visible at conversation distance) and children with caries experience (caries experience visible at conversation distance) by two paediatric dentists (professional experience > 4 years). If these dentists disagreed, the case was discussed with a third dentist (14 years or 18 years of professional experience, respectively; 27.2% of the photographs). Caries experience was defined as visible caries, restorations, crowns or dentures. Missing teeth in the front region were only considered if present for more than three months (according the parent's questionnaire).

The study documents were made and imported with EvaSys© (version 8.0, Electric Paper Evaluationssysteme GmbH, Lüneburg, Germany). Data import was controlled manually. Statistical analysis was performed with SPSS® Statistics (Version 25, IBM® Corp., Armonk, NY, USA).

Data of the children`s interview was analysed separately for children "with caries experience" and "without caries experience" and for "younger" (four to six years old) and "older" (seven to nine years old) children, respectively. Wilcoxon-rang-sum tests were performed to compare the groups. Wilcoxon-signed-rank tests were used to compare the evaluations between the photographs ("healthy teeth", "visible dental caries", "visible dental treatment/ restorations and missing teeth as consequence of caries treatment").

For statistical analysis of the parent`s interview a measured sum-score (Total-Attribute-Score, TAS) was used: therefore, the evaluations of the positive attributes were given 1 (strongly disagree) to 4 points (strongly agree), negative attributes were scored in a reversed order [Craig et al. 2015; Rodd et al. 2010]. To compare the groups (parent of a child with caries experience vs. parent of a child without caries experience and parent with caries experience vs. parent without caries experience) Wilcoxon-rang-sum tests were performed. To compare the evaluations between the images ("healthy teeth", "visible dental caries", "treated caries/restorations and missing teeth as consequence of caries treatment") Wilcoxon-signed-rank tests were used.

The level of significance was defined as $p < 5\%$. Multiple testing was controlled with Bonferroni-correction.

Results

In total, 448 children were asked to participate in the study, whereof 180 (97 male, 83 female, mean age: 6.6 ± 1.6 years) children were enrolled (40.2%). Eighty-two children were between 4 and 6 years old (45.6%) and 98 children were aged between 7 and 9 years. Main reasons for non-participation were non-compliance of the child (n = 84), lack of time, refusal to take the picture and missing presence of a legal guardian (each n = 50). About half of the participating children (n = 92, 51.1%) were classified as "with caries experience" (visible at conversation distance, while 88 children (48.9%) belonged to the group "without caries experience".

Focus on	Healthy teeth	Visible caries treatment	Visible caries
Face	0.890	0.367	0.764
Mouth	0.582	0.124	0.643

TABLE 1 P-values for comparison between children with and without caries experience.

Focus on	Healthy teeth	Visible caries treatment	Visible caries
Face	1.7%	6.7%	1.7%
Mouth	21.7%	46.1%	22.2%

TABLE 2 Relative frequencies (%) of dental reasons given by the children for their evaluation.

Parent of child	Healthy teeth	Visible caries treatment	Visible caries
With caries experience	29.6 ± 2.8 a	26.7 ± 3.1 b	23.6 ± 4.5 c
Without caries experience	29.4 ± 3.0 a	27.1 ± 2.9 b	22.8 ± 3.9 c
Total	29.5 ± 2.9	26.9 ± 3.0	23.2 ± 4.3

TABLE 3 Rating of parents (Total-Attribute-Score, mean ± standard deviation). The guardians were grouped by the caries experience of their child. Evaluation with Total-Attribute-Score from 9 (very negative) to 36 (very positive). Significant differences between the depicted photographs were indicated with different small letters.

Parent	Healthy teeth	Visible caries treatment	Visible caries
With caries experience	29.9 ± 3.1 a	26.6 ± 3.3 b	23.4 ± 4.7 c
Without caries experience	29.2 ± 2.7 a	27.1 ± 2.8 b	23.1 ± 4.0 c
Total	29.5 ± 2.9	26.9 ± 3.0	23.2 ± 4.2

TABLE 4 Rating of parents (Total-Attribute-Score, mean ± standard deviation) grouped by their own caries experience. Evaluation with Total-Attribute-Score from 9 (very negative) to 36 (very positive). Significant differences between the depicted photographs were indicated with different small letters.

Rating of children

Self-assessment revealed that most of the children were "very happy" (61.1%) or "happy" (27.2%) with their own teeth. Only 8.9% were "(very) sad" when thinking about their dental appearance, most often due to "unaesthetic appearance" or "presence of dental caries".

For both the rating of the face and the mouth region, the child with healthy teeth was rated best followed by the child with visible dental treatment and the child with visible dental caries (Figure 2). Rating of children with caries experience was significantly different between all three pictures ($p \leq 0.018$), while evaluation of children without caries experience found no significant difference between the child with caries treatment and the child with visible caries ($p = 0.093$). Overall, the evaluation results of children with and without caries experience were not significantly different (Table 1).

When looking at the whole face, children mostly stated non-dental reasons as reasons for their evaluation like "(un) friendly appearance", "funny/strange face region", negative associations or further, nonspecific statements (Table 2). After attention was drawn to the mouth region, dental reasons (e.g. "nice teeth", "yellow/dirty/silver teeth" or "bad teeth") were mentioned more often. Age had a significant impact: Dental reasons were significantly more often indicated by older children (7 to 9 years) compared to younger children, for both face and mouth region (face: $p = 0.038$; mouth: $p = 0.019$). Neither gender nor the own caries experience had a significant influence on the reasons of evaluation ($p > 5\%$, Wilcoxon-rang-sum tests).

Rating of parents/ legal guardians

Mean age of the children's legal guardians was 39.5 ± 7.9 years (caries experience due to tooth extraction: 38.9%). 68% of the adults were either very pleased or pleased with their own oral health and 78% with their child's dental health, respectively.

Like the children with caries experience, the parents rated the pictures differently: again, the child with healthy teeth was rated significantly more positively than the child with visible dental treatment and with visible caries ($p<0.001$,Table 3). However, neither the caries experience of their child ($p > 0.1$, Table 3) nor their own caries experience had a significant impact on the results of the evaluation ($p > 0.1$, Table 4).

Discussion

Concerning the external validity of the study, it should be considered that the representativity of the enrolled subjects might be limited compared to the general population as all participants were met in hospital environment, although we did not evaluate the reason for visit (patient due to medical reasons/ visiting or accompanying person). In addition, enrollment was voluntary. Volunteers can differ in behaviour from persons who decline participation. Therefore, the generalisability of this survey might be limited because of non-controlled selection bias [Rosnow and Rosenthal 1976].

The age range of the participating children was comparable to the age of the three depicted children. Therefore, it can be expected, that the chosen photographs are suitable to represent peers that children are surrounded by at home, at day care or at school. The parents enrolled in the study were aimed to represent adult care givers and contact persons. Thus, the selected participants of the study cover the typical persons in the social environment of children and should therefore be suitable to examine the potential risk of social exclusion caused by dental caries experience.

For analyses the children and their parents were grouped by caries experience. With regard to the children, caries experience was defined as dental caries, restorations, crowns, missing teeth or dentures visible at conversation distance. The underlying assumption was that children/parents who are used to visible signs of caries experience might be less bothered by similar dental findings than children/ parents without caries experience. With regard to the parents, not only the caries experience of the child might be important but also their own caries experience. As some kind of caries experience is likely in most adults, caries experience in parents was focused on tooth extraction due to caries.

Studies have shown that social perception also depends on the general attractivity of the person as well as on different other influencing factors [al Yami et al. 1998; Godoy et al. 2011; Meyer-Marcotty et al. 2011; Shaw 1981; Shaw et al. 1985]. The three depicted photographs had already been used in a preceding eye-tracking study [Tschammler et al., 2018] (Fig. 1). Thus, it had been possible to achieve a high comparability, not only in concern of attractivity, but also of age, ethnic background, valence and emotional arousal [Alpers and Gerdes 2007; Coutrot et al. 2016; Richards et al. 2015; Sheth and Pham 2008]. Nevertheless, potential effects of other facial characteristics might have impacted the perception of the faces.

All null hypotheses were accepted: although both children and their parents rated the three presented photographs differently, their own caries experience did not affect the results.

The children felt happiest while looking at the child with healthy teeth and saddest while looking at the photograph with visible dental caries. These differences even increased when the attention was drawn from the face to the mouth region. Studies in adults have shown that discolorations are more prominent than missing or fractured teeth [Rodd et al. 2010; Soares et al. 2015]. Nevertheless, the children were mostly not able to associate their ratings with the dental appearance of the depicted children. This result might be explained by studies investigating face perception: When observing a (child's) face, eye and nose regions are in the main focus [Richards et al. 2015; Tschammler et al. 2018]. The mouth region only gains attention when findings are present [Richards et al. 2015]. Therefore, rating differences are probably based on unconscious perception of the dental findings.

The rating of the parents showed similar results: the child with healthy teeth got significant more positive attributes than the other two pictures. These findings are in accordance with Shaw [1981] and Somani et al. [2010] who examined the effect of the teeth attractivity and on adults' social judgement.

The perception of children with and without visible caries experience was not different. Interestingly, an eye tracking study analysing the visual face perception of adults with unilateral cleft lip and/or palate showed differences between observers that were affected by the anomaly or not. Observers with a unilateral cleft lip and/or palate took more time on features that are anomalous on their own faces compared to observers without the anomaly [Meyer-Marcotty et al. 2011]. However, it is not known if the facial scanpath is also affected by the presence of dental anomalies, but if so, it did not affect the social perception of the participants.

The rating of the parents of children with and without caries experience was not different. Therefore, the daily contact to (a child with) caries experience does not have a significant effect on the adults' perception of other children.

Conclusion

Children and parents evaluated the picture of the child with healthy teeth more positively than the children with caries experience. In a social context, this indicates that parents of children with visible caries should be alert to negative effects on the social perception of their children.

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