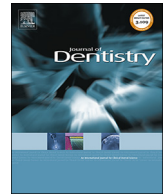




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## Perception of children with visible untreated and treated caries

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### ABSTRACT

**Objectives:** This study aimed to analyse if children with untreated or treated caries (restorations/missing teeth) are perceived differently compared to children with healthy teeth and to explore possible differences in the perception by laypersons and dental experts.

**Methods:** Eye movements of female experts (n = 20) and laypersons (n = 18) were recorded by eye-tracking while paired images (neutral expression/teeth not visible; emotional expression/smiling, teeth visible) of children with healthy teeth, with visible untreated or treated caries (restorations/missing teeth as a consequence of caries treatment), each n = 13, were presented. First fixation, total fixation time and number of fixations on the areas of interest (eyes, nose, mouth) in the first two seconds of presentation were determined. Furthermore, the images were rated regarding arousal, valence and attractivity. Statistical analysis was performed using Mann-Whitney-U- and Kruskal-Wallis-tests ( $\alpha = 0.05$ ).

**Results:** Generally, laypersons spent more time exploring and fixating the eye region than the mouth, while dental experts more often first percept and longer and more often fixated the mouth region, especially in images with emotional expression. Dental experts, but not laypersons, were significantly longer fixating the mouth of children with untreated caries than the mouth of children with healthy teeth in images with emotional expression. When evaluating images with emotional expression, both dental experts and laypersons rated children with healthy teeth to be more attractive, pleasant and calm than children with untreated or treated caries.

**Conclusions:** Children with visible treated and untreated caries were differently perceived by laypersons and dental experts than children with healthy teeth.

### 1. Introduction

Caries in primary teeth, especially early childhood caries, is a common disease which negatively impacts the quality of life of children and their parents/caretakers by affecting functional, psychological and social well-being. Among other effects on social life, visible caries is assumed to impair social interactions, for instance as children might be teased or bullied because of esthetic or phonetic problems [1,2].

Several studies have shown that beside visible dentofacial anomalies [3,4] and missing teeth [5], visible caries may also affect observers subjective ratings of peoples' facial attractiveness and provoke negative social judgements. When presenting computer-modified photographs of adults with or without caries lesions of the anterior teeth, subjects with caries were rated to be less socially and intellectually competent [6,7]. Karunakaran et al. showed that the presence of visible caries resulted in lower rating of attractiveness, but did not affect social judgements [8].

So far, no information is available on how children with untreated caries are perceived by their social environment. It is known that children from early infancy to six years of age are generally judged to be more likeable or attractive than adult faces, most probably as the so-called "baby schema" evokes positive reactions of adult raters [9]. Children attractiveness influences the social interaction with adults, e.g. attractive children were perceived as more competent and more pleasant [10,11].

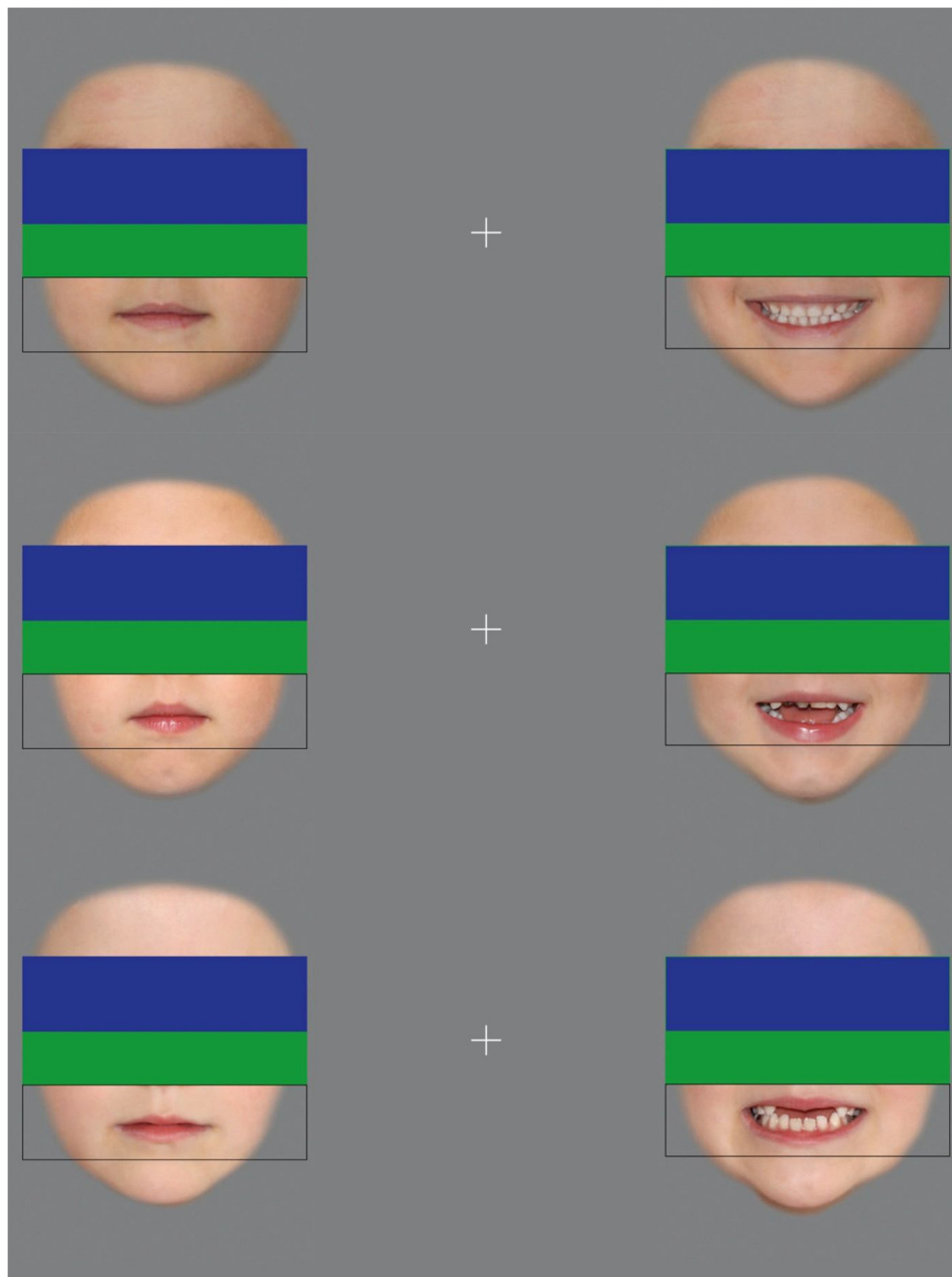
As children faces are more positively perceived than adult faces, it is questionable whether the presence of visible caries affects the perception and, thus the overall attractiveness compared to children with healthy teeth. Therefore, the present study aimed to analyse if children with visible untreated or treated caries (e.g. stainless steel crowns, missing teeth) are perceived differently compared to children with healthy teeth and to determine possible differences in the perception by laypersons and dental experts.

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**Fig. 1.** Example of images with neutral (left) and emotional (right) expression of children with healthy teeth (top), untreated caries of anterior teeth (middle) and treated caries (missing teeth due to extraction, down). Eyes, nose and mouth are marked as areas of interest (AOI).

Recording the movements of participants' eyes allows to analyse participants' attentional focus and cognitive information processing while perceiving visual stimuli [12]. Therefore, the eye tracking technology was used in the present study to precisely determine involuntary eye movements and fixations to understand the initial stage of perception of children with untreated or treated caries to children with healthy teeth. Moreover, image rating was used as a subjective measurement to evaluate attractiveness, valence and arousal.

The null hypotheses for both eye tracking and image rating data were 1) that children with visible untreated or treated caries were not differently perceived and 2) that perceptions of laypersons and dental experts were not significantly different.

## 2. Materials and methods

The study was approved by the local ethics committee (36/2/16)

and previously registered at ClinicalTrials.gov (NCT02899273).

### 2.1. Participants

Female participants with or without professional dental experience were recruited from the University Medical Center in Göttingen (dental students, experts) and the Institute of Psychology in Hildesheim (psychology students, laypersons), Germany. Inclusion criteria were female [13] undergraduate students (for dental students: in the clinical curriculum), > 18 years [13], right hander [14], without glasses, without diseases or medication altering perception or neurophysiological stimulus processing [15]. Dental students had to have performed at least one patient-treatment course with focus on Operative Dentistry including Pediatric Dentistry.

As this was the first study analysing the perception of ECC by eye-tracking, the sample size could not be calculated on the basis of prior

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