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Measuring attentional bias in children with prominent ears: A prospective eye-tracking study

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Summary *Background and aim:* When observing new faces, most people focus their attention on the central triangle of the face containing the eyes, nose and mouth. When viewing faces with prominent ears, observers may divert their attention from the central triangle. The objective of this study was to determine whether there was an objective attentional bias to prominent ears in comparison to non-prominent ears.
Methods: A total of 24 naïve participants (13 female; mean age 22.88 years) viewed 15 photographs of children with bilateral prominent ears, unilateral prominent ears and non-prominent ears. Both pre- and post-otoplasty photographs of two patients were included. The eye movements of participants were recorded using the EyeLink 1000, a table-mounted eye-tracking device.
Results: Overall, the participants spent more time looking at the ear regions for faces with prominent ears in comparison to faces without prominent ears ($p = 0.007$, $Z = -2.688$). The attentional bias to the ear region of the patient who underwent bilateral otoplasty was significantly reduced in the post-operative photograph ($p = 0.011$, $Z = -2.534$). The patient who underwent unilateral otoplasty had no significant change in fixation times towards the ear region ($p = 0.594$, $Z = -0.533$).
Conclusions: This study presents objective data to support the notion that observers show attentional bias to the ear region when viewing faces of children with prominent ears. The scope of this finding requires further research in both extent and impact.

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Introduction

Prominent or protruding ears are among the most common congenital anomalies of the head and neck region.[1] Accordingly, the corrective surgery for this condition, otoplasty, is the most common aesthetic surgical procedure performed in children and adolescents.[2] Although there are no significant physiological consequences,[3] children with prominent ears often experience ridicule from their peers at school and other social settings.[4] The resulting distress can be associated with low self-confidence, poor school performance, low quality of life and social avoidance behaviours.[4–6]

Despite the known negative psychosocial impact, there is currently no objective understanding of how faces with prominent ears are perceived by observers. In addition, no research to date has objectively examined how faces of children with facial anomalies are perceived. This gap in the literature is surprising as it is widely recognized that faces convey crucial social information to observers.[7] Perceptions of faces are used by observers to make judgements about emotion, identity, relatedness and other important social characteristics.[8]

Within the field of visual perception, it is accepted that eye movement is a proxy for attention.[9,10] This allows researchers to track the attention of observers when they perceive a target image.[11] By using an eye-tracking device, one can record information about both rapid eye movements, called saccades, and fixations. Faces are typically scanned by observers in a predictable pattern with a focus on the eyes, nose and mouth resulting in a central triangle of fixation.[11–13] At present, it is unknown whether or not attention deviates from this central triangle when perceiving the face of an individual with prominent ears. Given the differences in facial structure, it is possible that observers pay more attention to the ear region in those individuals with prominent ears than in those without prominent ears.

In this study, an eye-tracking device was used to record attention to regions of children's faces with prominent ears. The study was conducted to determine whether attentional bias towards the ear region was present when naïve observers were viewing images of children with prominent ears. We hypothesized that participants would spend more time viewing the ear regions in photographs of children with bilateral and unilateral prominent ears than in photographs of children without prominent ears.

Materials and methods

Participants

This study included 24 adults (13 female) aged between 19 and 28 years (mean = 22.88, standard deviation (SD) = 2.40) capable of normal eye movements and naïve to the purpose of the study.

Stimuli

A total of 15 frontal colour photographs of children's faces from the authors' clinical archive were used. Five photographs of children with bilateral prominent ears, five with unilateral prominent ears and five without prominent ears (control group) were retrieved. Two children with both pre- and post-otoplasty photographs were included in the series (one unilateral case and one bilateral case). All faces were of similar size, age (4–6 years) and gender matched (m = f), and the presentation order was counterbalanced so that control group photographs were mixed with photographs of children with prominent ears.

None of the children had craniofacial syndromic features or other facial anomalies. Parents or legal guardians of the children provided consent for the photographs to be used for research and teaching purposes.

Apparatus

Eye movements were recorded using the EyeLink 1000 (SR Research Ltd., Mississauga, Ontario, Canada), a table-mounted eye-tracking device. This device was used to track the participant's right pupil in real time to allow for eye position recording.

Procedure

After providing written informed consent, participants were seated in front of a 19-inch monitor at a distance of 60 cm. This distance allowed images to be presented as life size at a conversational distance. The eye tracker was then calibrated for each participant. Following calibration, participants were instructed to look at a fixation point in the centre of the screen until the first image of a face appeared. After viewing the image and its disappearance, participants were asked to indicate, on a scale of 1–5, how "cute" the child in the photograph appeared. Participants were asked to provide this rating so that all participants were viewing the photographs with the same goal in mind. In addition, this ensured that participants remained focused on the photographs for the duration of the study. A similar approach is commonly used in face-recognition eye-tracking studies.[14] After viewing all of the images, participants were debriefed and provided with the details of the study, that the researchers wished to determine which areas of the face people attend to when viewing children's face with prominent ears. Each photograph was presented for 5 s, and the entire test lasted approximately 5 min. Similar timing has been used in previous studies.[14]

Ethics approval was obtained from the local Institutional Review Board prior to initiating the study.

Data analysis

The eye movements were recorded and analyzed using the analysis software associated with the EyeLink 1000. Time (in ms) that participants spent looking at three interest areas (eyes, nose and left and right ear) and the face as a whole (excludes time spent looking off the screen) was calculated and is henceforth referred to as dwell times.

Statistical analysis

Descriptive statistics (median, standard error, interquartile range (IQR)) were used to describe the dwell times for each