Binocular Remote Gaze Estimation System for Infants (M. Eizenman[1,2], E.D. Guestrin[1], C.A. Westall[1,2]) [1]IBBME; [2]Dept. Ophthalmology, University of Toronto, Canada.

Purpose

The forced choice preferential looking technique is a standard technique to evaluate visual acuity in infants. This technique is based on infants' preference to look at patterns rather than homogenous fields. This study describes a novel remote gaze estimation system that records infants' visual scanning patterns for objective determination of infants' preference when viewing simultaneously presented patterned and homogeneous fields.

Methods

By using at least 2 video cameras to record images of the subject's eyes and at least 2 light sources to illuminate the eyes, it is possible to estimate the point-of-gaze in the presence of head movements after completing a simple *single-point* calibration procedure. The point-of-gaze is estimated from the coordinates of the centers of the pupil and corneal reflections extracted from the video images. A system with 2 cameras and 4 light sources was implemented and optimized for the estimation of infants' point-of-gaze. For the calibration procedure, the system presented a bright looming stimulus for about 3 seconds to attract the infant's attention.

Results

The accuracy of the system was evaluated first monocularly with 3 adult subjects who fixated on 25 points on a computer screen at 5 different head positions (head positions were within a volume of 10*8*10 cm^3). The RMS point-of-gaze estimation errors for the 3 subjects were 6.6 mm (~0.6°), 6.7 mm and 11.2 mm (~1°). The overall system performance was then evaluated binocularly with two infants (6 and 7 months old) who, while seating on their parent's lap, viewed a looming stimulus that was presented at several random positions on the computer screen. Whenever the infants looked at the visual stimulus, the point-of-gaze estimates were within ~30 mm (~2.6°) from the center of the stimulus.

Conclusion

This remote gaze estimation system, which requires a *single-point* calibration, can be used to record infants' visual scanning patterns. The accuracy of the system supports robust computation of parameters (e.g. order and duration of fixations) that can be used for the objective determination of infants' looking preference.