Abstract

Introduction:

Current ocular prosthetics incorporate a static eye image onto an acrylic or glass shell. Insufficient prosthetic rotation combined with a lack of pupillary responses leads to negative body image among users. We hypothesize that digital microscreen technology can be utilized for more realistic ocular prosthetics. Our recent proof of concept project used a video camera with facial detection software to capture and produce an image of a healthy eye. Here was design, create, and test a secondary prototype of a digital prosthetic eye (DPE) featuring a microscreen with real time display of the conjugate movements captured by a microcamera.

Methods:

A microcamera embedded into the frame of eyeglass spectacles tracks the healthy eye. Using facial detection and pupil tracking software, a coded algorithm identifies pupil location and shape. This information is relayed to a microcontroller embedded within the frame where digital noise is filtered and data is prepared for wireless transmission. A Bluetooth transmitter within the frame is paired to a corresponding receiver housed within the digital prosthesis. The receiver passes the information onto the prosthesis' microcontroller to process and output information to a liquid crystal display (LCD). The microcamera with microcontroller and Bluetooth transmitter are powered by a small rechargeable battery. This battery connects via a micro USB port to any USB power source.

Results:

The system was able to capture and wirelessly transmit healthy eye movements and pupil diameter change to a DPE. This transmission occurred with high fidelity and minimal latency. A corresponding digital image of a contralateral eye was displayed on a mini LCD screen. This image moved in the same direction and with the same speed as the biological eye.

Conclusion:

The use of microcameras, real time image processing and a mini LCD screen based digital prosthesis allowed for the creation of a prototype DPE feasible for use in unilateral anophthalmia. Further miniaturization of prosthetic size and refinement of shape with custom hardware designs and alternatives to USB based battery power are proposed within for the ICTS pilot grant program.