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Presentation Abstract

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Abstract Title:	**Fast Hartmann-Shack Wavefront Sensor for the Periphery**
Presentation Start/End Time:	Wednesday, May 05, 2010, 3:15 PM - 3:30 PM
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Session Title:	Ocular Aberrations: Across-field, Through-focus
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Keywords:	604 myopia, 627 optical properties, 674 refractive error development
Abstract Body:	**Purpose:** It was suggested that the peripheral refractive errors and aberrations may influence the progression of myopia. To further validate this hypothesis and to eventually develop off-axis correcting spectacles, a large database of peripheral optical measurements is necessary. This would require an instrument able to provide fast and reliable optical data in the peripheral over a large range of eccentricity in naïf subjects. **Methods:** We developed a new instrument based on a Hartmann-Shack (HS) wavefront sensor for continuous off-axis data acquisition. For measuring fast along the horizontal meridian over a large range (± 40°), the device scans instead of the subject moving his eye to fixate at different angles. The complete measuring time for a horizontal scan is around 2 seconds. The path length between the eye and the first element of the HS sensor is constant at each measuring angle. There are no moving elements in front of the subject's eye. Custom software was developed to control and synchronize the sensor movements with image acquisition and to perform data processing. The system is a combination of a moving part and a static part. The moving part uses a rotation stage, a caging system and a high speed camera (Dalsa Genie HM1024-GigE vision connection: max. 117 fps). The near infrared 780 nm measuring light is coupled onto the moving arm by means of an optical fiber. The fixed part of the instrument contains a custom made large mirror and a hot mirror in front of the subject's eye allowing the instrument to operate in open field. **Results:**

A first version of a prototype has been designed, constructed and tested on a small group of subjects. The system presents several advantages over currently existing static and scanning peripheral sensors. The instrument improved the acquisition time drastically compared to the static method, where a mere series of sampled data every 10 degrees would require at least several minutes in trained subjects. The subject only has to fixate at one target. The moving part of the instrument is placed in an opaque box. Preliminary series of measurements obtained in the test group were in good agreement with sampled data obtained with a static sensor. Further smaller adjustments will be necessary for a clinical version of the system.

Conclusions:

We designed and built a fast HS-sensor which is able to measure the peripheral image quality on the horizontal meridian over a range of ± 40° in a few seconds. The design only requires one rotational moving element without moving parts being apparent for the subject. The use of the system in large groups of subjects will contribute for a better understanding of the relationship between peripheral optical properties and myopia development.

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