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Real-time monitoring of accommodation during subjective refraction

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Abstract

Purpose : Control of accommodation is one of the main factors for a successful subjective refraction. A system for real-time monitoring of accommodation is shown in this study, as well as its validation, which can be used as an objective tool during subjective procedures.

Methods : An instrument to estimate the accommodative response in real time (every 10 ms) was designed and implemented. It is based on a Hartmann-Shack sensor, and works coupled to a phoropter to monitor the behavior of accommodation during subjective refraction from the measured spherical error and the value of the lenses set to the phoropter. The refraction process was emulated by placing in the phoropter a set of spherical lenses from +2 to -2 D with respect to the manifest subjective refraction of 87 patients with different ocular conditions: myopic and hyperopic eyes of young and old (presbyopic) healthy adults. For each step, the steady-state response of the eye was computed by considering around 100 estimations provided by the instrument.

Results : As expected, presbyopic patients presented an accommodation with a constant magnitude along the whole measured range. For myopic, emmetropic, and hyperopic young eyes with accommodation capacity, the estimated response could be divided in two main regions: one in which the accommodation remained constant (fogging), and another in which the eye accommodated to compensate for the defocus induced with the phoropter. In those cases, the measured response may be used to corroborate objectively whether the eye accommodates for the subjective refraction.

Conclusions : An instrument that works attached to a phoropter and is able of monitoring in real time not only refractive errors, but also accommodation during

subjective refractions was successfully validated in a clinical environment. The system was used to obtain the behavior of accommodation with a methodology similar to that followed during subjective refraction. The objective information given by the instrument might be very useful to support ophthalmologists and optometrists decisions since it allows corroborating if accommodation plays a role in the subjective refraction found with the phoropter. This might be of special relevance in children's prescription to avoid the use of cyclopegic drugs.

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