24-Hour Intraocular Pressure Rhythm in Young Healthy Subjects Evaluated With Continuous Monitoring Using a Contact Lens Sensor

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ABSTRACT:

IMPORTANCE This study evaluates a new device that has been proposed to continuously monitor intraocular pressure (IOP) over 24 hours.

OBJECTIVE To evaluate 24-hour IOP rhythm reproducibility during repeated continuous 24-hour IOP monitoring with noncontact tonometry (NCT) and a contact lens sensor (CLS) in healthy participants.

DESIGN, SETTING, AND PARTICIPANTS Cross-sectional study of 12 young healthy volunteers at a referral center of chronobiology.

INTERVENTIONS Participants were housed in a sleep laboratory and underwent four 24-hour sessions of IOP measurements over a 6-month period. After initial randomized attribution, the IOP of the first eye was continuously monitored using a CLS and the IOP of the fellow eye was measured hourly using NCT. Two sessions with NCT measurements in 1 eye and CLS measurements in the fellow eye, 1 session with CLS measurements in only 1 eye, and 1 session with NCT measurements in both eyes were performed.

MAIN OUTCOMES AND MEASURES A nonlinear least squares, dual-harmonic regression analysis was used to model the 24-hour IOP rhythm. Comparison of acrophase, bathyphase, amplitude, midline estimating statistic of rhythm, IOP values, IOP changes, and agreement were evaluated in the 3 tonometry methods.

RESULTS A significant nyctohemeral IOP rhythm was found in 31 of 36 sessions (86%) using NCT and in all sessions (100%) using CLS. Hourly awakening during NCT IOP measurements did not significantly change the mean phases of the 24-hour IOP pattern evaluated using CLS in the contralateral eye. Throughout the sessions, intraclass correlation coefficients of the CLS acrophase (0.6 [95%CI, 0.0 to 0.9]; P = .03), CLS bathyphase (0.7 [95%CI, 0.1 to 0.9]; P = .01), NCT amplitude (0.7 [95%CI, 0.1 to 0.9]; P = .01), and NCT midline estimating statistic of rhythm (0.9 [95%CI, 0.9 to 1.0]; P < .01) were significant. When performing NCT measurements in 1 eye and CLS measurements in the contralateral eye, the IOP change at each point normalized from the first measurement (9 AM) was not symmetric individually or within the population.

CONCLUSIONS AND RELEVANCE The CLS is an accurate and reproducible method to characterize the nyctohemeral IOP rhythm in healthy participants but does not allow for estimating the IOP value in millimeters of mercury corresponding to the relative variation of the electrical signal measured.

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