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Examining relationship between IOP, sleep patterns using contact lens sensor

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Geneva, Switzerland—IOP patterns derived from measurements obtained with a non-invasive contact lens sensor (CLS; Triggerfish, Sensimed AG) correlate well with polysomnographic recordings of rapid eye movement (REM) sleep, according to research presented by Kaweh Mansouri, MD, and Tarek Shaarawy, MD.

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The study—conducted at the University of Geneva, Switzerland—included 12 healthy patients who had no sleep disorder, ocular hypertension, or glaucoma. The sensor's measurements were obtained as a surrogate for IOP changes, and sleep-stage monitoring was performed using a validated wireless system that collects electrophysiological signals from the forehead with a single bi-polar channel.

Data from the sensor were analyzed to identify IOP patterns.

"Nocturnal IOP has been termed 'the sleeping giant,' and so it is fundamental to improve our understanding of IOP events during the nocturnal period and their impact on glaucoma progression," said Dr. Mansouri, consultant ophthalmologist, Department of Ophthalmology, Geneva University Hospitals, and adjoint associate professor, Department of Ophthalmology, University of Colorado School of Medicine, Aurora. "The (sensor)—which is designed to provide continuous, noninvasive IOP-pattern monitoring—is being looked at for its potential to enable this research. Therefore, we are looking at different parameters to validate CLS-derived IOP data and the presence of potential artefacts on the measurements."

Further analyses examined possible correlations between the IOP patterns and sleep structure, which was divided into four stages:

1. Wake
2. Light sleep
3. Deep sleep
4. REM sleep

Ten subjects had evaluable sensor and sleep pattern data.

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The sensor data showed three different patterns: high-frequency sinusoidal, low-frequency sinusoidal, and irregular. A strong correlation was found between the irregular IOP pattern and the REM stage of sleep. In addition, the mean sensor measurement obtained during the sensor-driven REM sleep stage was significantly higher than the mean obtained during the non-REM sleep stages.

No relationships were found between the high-frequency sinusoidal or low-frequency sinusoidal sensor patterns and sleep structure.

"We are also wondering whether (this) data could replace or complement standard sleep-stage assessments," Dr. Mansouri said. "The results of this study support a possible use of combined sleep and IOP pattern monitoring in glaucoma patients."

This article is adapted from Dr. Mansouri's presentation at the 2014 meeting of the Association for Research in Vision and Ophthalmology.

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