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Analysis of 24-Hour IOP-related Pattern Changes After Medical Therapy

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To the Editor

Hollo et al¹ present results from a case series of 9 glaucoma patients in whom 24-hour intraocular pressure (IOP) patterns before and after the introduction of prostaglandin analog eye drops were compared using a contact lens sensor (CLS). The patients underwent 1 untreated baseline session in which IOP was measured 6 times over 24 hours in the sitting position using Goldmann applanation tonometry (GAT), followed by two 24-hour CLS sessions in which IOP patterns were monitored in an ambulatory setting. The patients were then put on topical regimen of travoprost once daily and underwent 1 GAT and 1 CLS session. The authors stated that they did not find any significant changes in the CLS output after treatment introduction. However, we question whether methodological issues may have impacted the results and conclusions.

The CLS measures IOP-related changes indirectly through the detection of ocular dimensional changes at the corneoscleral junction and provides its output in electronic units of voltage (AU).^{2,3} These units are relative; therefore, presenting means and SDs may not be appropriate for the analysis of CLS measurements. Furthermore, as the device has to adjust to the eye every time it is placed, it is by default set at zero at the beginning of each session. Therefore, even if IOP changes, the CLS output may not present any difference in mean values as a result of treatment-induced IOP lowering.

We had previously proposed to analyze CLS results by looking at changes in patterns.^{2,3} While most glaucoma medications may not change 24-hour IOP patterns significantly despite a reduction in daytime IOP, prostaglandin analogs have been shown to provide a sustained IOP lowering at night.⁴ It is possible that current topical glaucoma medications only reduce absolute IOP levels without modifying the 24-hour IOP rhythm, in which case

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the CLS would not be able to detect any change. We would, therefore, encourage the authors to reexamine their data by analyzing changes in wake/sleep slopes when patients transition from the wake/upright to the sleep/recumbent state.

There are several other methodological issues, the most significant being that IOP during the GAT session was measured at 6 timepoints only (20:00, 24:00, 04:00, 08:00, 12:00, and 16:00) and always in the sitting position, whereas the CLS session was conducted with patients in their habitual body position. It is well known that sitting IOP and IOP in habitual body positions differ significantly and cannot be directly compared with each other.⁵⁻⁷ As a consequence of this design, weak correlation between the devices is expected. For a majority of patients, peak IOP occurs at night while in the recumbent position, frequently between midnight and 04:00,^{2,5,6} a period in which no data were collected during the GAT session. Thus, it is possible that both mean and SD GAT values were biased down, as the highest values were missing.

The authors further used different definitions of day and nighttime period. For GAT, daytime period was defined as 8 AM to 8 PM and nighttime period as midnight to 4 AM. For CLS, erect/sitting (wake) period was defined as the last 50-minute waking period in the evening (or the first 50 min of the morning waking period); supine (sleep) period was defined as the first 50 minutes of evening sleep (or the last 50 min sleeping period in the morning). In addition, the authors report correlations of CLS/CLS and CLS/GAT but not GAT/GAT. It would be worthwhile to have this information. It would have also been interesting if IOP was measured more than once at baseline at the GAT session, to provide data on GAT repeatability.

One interesting finding of this study warrants more attention: the authors found an increasing “time trend” of the CLS signal over 24 hours. Whether this trend is due to a signal drift or to physiological phenomena should be addressed in future studies. Larger prospective randomized studies are needed to evaluate the effect of glaucoma treatment on CLS findings.

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