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Novel head-mounted auto-perimetry vs. the Humphrey field analyzer: Which is better?

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Visual field (VF) assessment is crucial for diagnosing and monitoring glaucoma, which is a leading cause of irreversible blindness. The Humphrey field analyzer (HFA), developed by Carl Zeiss Meditec, is widely regarded as the gold standard for static perimetry tests, and it is frequently used in clinical and research settings to track the progression of VF diseases. However, the HFA is limited by its stationary nature and the need for patients to maintain fixation and attentiveness on a target for extended periods. These limitations could compromise result accuracy and limit its use in certain populations, such as bedridden patients or those with impaired mobility.

Recently, new portable perimetry devices have been introduced to address these limitations, including the *IMO* (CREWT Medical Systems) and the *Toronto portable perimeter* (TPP). These devices have garnered attention for their portability and ability to conduct VF tests without a dark room, making them more adaptable for settings where mobility is essential. In a study by Matsumoto et al. (2016), the *IMO* demonstrated significant correlations with the HFA, with correlation coefficients for mean deviation (MD) ranging from 0.82 to 0.83. Thus, the IMO is a viable alternative to the HFA in clinical environments with space and mobility restrictions.

Another study by Ahmed et al. (2022) on the TPP, a virtual reality-based device that only requires a smartphone for monitoring, showed a comparable correlation with the HFA, achieving a correlation coefficient for MD of 0.83. However, the use of the TPP remains limited by a lack of regulatory approval and challenges in detecting low-sensitivity areas due to the limited brightness of smartphone displays. These limitations constrain the TPP's applicability in clinical settings, particularly for precise diagnostic needs.

The *Gaze analyzing perimeter* (GAP) has emerged as an innovative device that uses eye-tracking technology to assess target visibility. Unlike the HFA, which relies on patients manually pressing the button, the GAP automatically determines target visibility on the basis of gaze movement. Thus, the GAP offers a more objective measure than the HFA. In a study by Miyake et al. (2024), the GAP findings demonstrated a strong agreement with the HFA findings, with a correlation coefficient for MD of 0.811 and reduced testing time in patients with minimal VF impairment. In addition, the GAP demonstrated advantages in portability and speed, making it a promising alternative to HFA for patients with mild VF loss. In this context, the study by Miyake et al. aimed to evaluate the agreement between the VF test results obtained using the novel GAP and those obtained using the widely recognized HFA. The researchers compared the two approaches to assess their accuracy in measuring VF sensitivity, specifically in patients with suspected or confirmed VF loss.

The study was conducted at Kyoto University Hospital and involved 47 eyes from 47 patients who underwent GAP and HFA tests during the same visit. The study participants had suspected or confirmed VF loss, primarily due to glaucoma. The inclusion criteria were reliable data from both testing methods, while the ex-

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clusion criteria were patients aged ≥90 years, those with frequent blinking, or those with unreliable HFA data. All participants underwent VF testing with the HFA, followed by testing with the GAP. Both tests were performed on the same eye. The GAP utilizes a head-mounted technology that tracks eye movements to assess VF sensitivity. This approach differs from the HFA, which relies on the patient's manual button presses when they detect visual stimuli. The GAP measures target visibility by analyzing whether the patient's gaze moves linearly toward the presented target. The study employed the Bland–Altman analysis to compare the results from both testing methods. Additionally, two ophthalmologists reviewed the gaze data to determine if patients' gaze moved linearly toward the target in patients in whom GAP exhibited higher sensitivity than HFA.

A good agreement was observed between the GAP and HFA results, with a correlation coefficient for MD of 0.811. The Bland–Altman analysis demonstrated that the mean difference between the two methods was minimal (–0.63 dB), indicating similar levels of accuracy. Notably, the testing time was shorter for GAP than for HFA in patients with minimal VF impairment. Eleven patients (23.4%) were tested within 200 s using GAP. However, there was no such rapid completion with HFA. On the basis of examination, the correlation coefficient between the two devices was 0.691, suggesting a reasonable agreement for sensitivity at individual examination points. In patients in whom discrepancies were observed, the GAP was more likely to exhibit higher sensitivity values than the HFA, particularly when the HFA recorded 0 dB, which suggests potential false negatives in the HFA measurements. In 70.2% of the patients in whom the GAP measurement exceeded that of the HFA by >10 dB, the gaze data confirmed linear movement toward the target, indicating that the GAP might be more accurate in certain scenarios.

Some of the advantages of GAP are as follows: 1) Portability: Unlike the stationary HFA, the GAP is a head-mounted device, making it suitable for bedside evaluations; 2) Objective measurement: The GAP relies on eye-tracking technology, which removes the subjectivity associated with manual button presses required with the HFA; 3) Shorter examination time: GAP exhibited reduced testing time in patients with minimal VF impairment, potentially improving patient comfort.

The GAP also possess some limitations such as the difficulty in assessing patients with severe central VF impairment, because target capture is necessary for accurate measurement. Patients with excessive blinking or narrow palpebral fissures may also face challenges with the GAP because these factors impede proper eye-tracking. Finally, the study sample was relatively small, and the generalizability of the study results to patients with more severe VF defects requires further exploration.

The study concluded that the GAP provides VF assessment outcomes comparable to those of the HFA, with notable advantages such as shorter testing time and portability. The ability of GAP to record eye movements during the examination allows for objective assessment and retrospective validation of results, making it a promising tool for VF testing. The current findings collectively suggest that the GAP may be a useful alternative to traditional perimetry devices, particularly in settings requiring quick and portable VF assessments.