Research Square

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Vertical Step Detection in Optic Chiasmal Lesions: Comparison of Head-Mounted and Standard Automated Perimetry

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Abstract

Purpose: To compare vertical step detection and visual field measurements obtained using a handheld switch-type gaze-analyzing perimeter (GAP; FINDEX) and a Humphrey Field Analyzer (HFA; Carl Zeiss Meditec) for patients with chiasmal lesions.

Methods: Patients referred from the Department of Neurosurgery to the Department of Ophthalmology at Kyoto University Hospital for visual function assessment of chiasmal lesions from July 1, 2025, to June 30, 2026, were included. Cases that underwent both handheld switch-type GAP30-2 and HFA30-2 examinations before treatment were analyzed. Vertical step detection and visual field parameters were compared across the devices.

Results: Fifty-eight eyes of 30 patients were assessed. Overall agreement for vertical step detection was substantial at 82.8% (Cohen's κ = 0.66; 95% CI, 0.46–0.83), although the detection rates of the devices differed (McNemar's test, p = 0.0046). The examination duration was significantly shorter with the handheld switch-type GAP30-2 than with the HFA30-2 (332.6 ± 86.1 vs. 460.6 ± 83.2 s, p < 0.001). The mean deviation values showed a strong correlation across devices (r = 0.92, p < 0.001), with a small but significant difference (−7.5 ± 7.8 vs. −6.1 ± 7.8 dB, p = 0.0073). Sensitivity analysis using predefined reliability criteria yielded similar results.

Conclusions: The handheld switch-type GAP 30-2 showed substantial agreement with the HFA 30-2 for vertical step detection and strong correlation for mean deviation, with a significantly shorter examination duration. These findings support the use of visual field assessments for patients with chiasmal lesions.

Key Message

What is known

- Chiasmal lesions can cause bitemporal hemianopia, and early recognition is important because visual field loss may be irreversible. The vertical step is a sensitive sign for detecting temporal hemianopia. Head-mounted perimetry offers portable visual field testing without a conventional dark room, potentially facilitating assessment in patients who have difficulty undergoing standard automated perimetry.

What is new

- Vertical step detection showed substantial agreement between the handheld switch-type GAP30-2 and the HFA30-2.
- The GAP30-2 required significantly shorter examination time, with strong correlation in mean deviation values between devices despite a small systematic difference.
- The portability of the head-mounted GAP may facilitate bedside visual field assessment in patients who have difficulty undergoing conventional perimetry.

Introduction

Chiasmal tumors, such as pituitary neuroendocrine tumors (PitNETs), suprasellar meningiomas, craniopharyngiomas, Rathke's cleft cysts, and germinomas, compress the optic chiasm and often cause bitemporal hemianopia. Chiasmal compression can result in visual dysfunction through several mechanisms, including metabolic, ischemic, and mechanical insults[1–3]. Chiasmal lesions are sometimes detected as a result of visual field testing performed during ophthalmic examinations. As delayed diagnosis may result in irreversible visual field loss, early detection of chiasmal visual defects is clinically important. Both kinetic and static perimetry can detect visual field impairment, although automated perimetry may be more sensitive in detecting early visual field abnormalities caused by pituitary tumors[3, 4]. Assessing the vertical step provides high sensitivity for detecting temporal hemianopia[4], making it a valuable tool for early detection of chiasmal lesions. Therefore, automated perimetry is important not only in glaucoma care but also in the diagnosis and follow-up of neuro-ophthalmic disorders.

In recent years, visual field tests using head-mounted displays have been increasingly used in clinical settings. Head-mounted perimeters allow visual field testing without a conventional dark room. This portability may be advantageous for patients with intracranial diseases who have limited mobility or difficulty in maintaining a seated position, potentially facilitating visual field assessment when conventional perimetry is challenging. Conventional head-mounted perimeters typically weigh more than 1.5 kg, and this may increase the physical burden on patients. However, the newly developed Gaze Analyzing Perimeter (GAP; FINDEX Co., Ltd., Ehime, Japan) is substantially lighter, weighing only 400 g.

For patients with glaucoma, the GAP, a gaze-guided visual field analyzer, has demonstrated a high correlation with the Humphrey Field Analyzer (HFA) 24 − 2 (Carl Zeiss Meditec, Dublin, CA, USA) for mean deviation (MD)[5].

However, the performance of handheld switch-type GAP for patients with visual field defects caused by intracranial lesions has not yet been established. This study aimed to compare vertical step detection and visual field test results obtained using a handheld switch-type GAP30-2 with those obtained using HFA30-2 for patients with visual field defects secondary to chiasmal lesions.

Methods

This prospective study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board and Ethics Committee of Kyoto University Graduate School of Medicine (R0134). Written informed consent was obtained from all participants.

Inclusion Criteria and Exclusion Criteria

Patients who visited Kyoto University Hospital between July 1, 2025, and June 30, 2026, and were referred from the Department of Neurosurgery to the Department of Ophthalmology for visual function

assessment of chiasmal lesions were eligible for inclusion. We enrolled patients who had undergone both handheld switch-type GAP30-2 and HFA30-2 examinations before treatment initiation. HFA30-2 testing was performed using the Swedish Interactive Thresholding Algorithm (SITA) standard strategy. The diagnosis was established based on histopathological findings after surgery or biopsy; for patients who did not undergo surgery, diagnosis was based on brain MRI findings interpreted by the Department of Radiology.

Gaze-Analyzing Perimetry

The GAP is an automated perimetry instrument based on a novel measurement principle that determines target visibility based on gaze movement or handheld switch activation. The handheld switch method was used for all participants in this study. It uses a head-mounted display and dedicated software that has received marketing approval in Japan (38B2X10003000002, 38B2X10003000003) and Europe (Basic UDI-DI: 458251532GAPH00001M5)[5].

The weight of the head-mounted display is 400 g, rendering it lighter than the 1.8-kg imo® perimeter (Fig. 1). Spherical refractive power can be adjusted within the range of − 10.0 to + 10.0 D, and cylindrical refractive power is tunable up to 6 D by the included corrective lens.[5] The target size, peak luminance of 10,000 apostilbs, and background luminance of 31.5 apostilbs are identical to the testing conditions of the HFA. The specialized software is typically installed on a Windows PC with a graphics board compatible with DirectX.

Data Collection

Data on age, sex, and best-corrected visual acuity (BCVA) measured using a Landolt chart at 5 m were collected on the same day as the visual field tests. BCVA was converted from decimal visual acuity to logMAR. A vertical step associated with bitemporal hemianopia was defined as a reduction in sensitivity on the temporal side along the vertical meridian of 2 dB or greater for four or more consecutive pairs of points or 3 dB or greater for three or more consecutive pairs of points (Fig. 2)[4, 6]. The vertical step assessment was performed visually by a single investigator (M.I.) who was blinded to the MRI findings. The handheld switch-type GAP30-2 tests were performed within 1 month of performing the HFA30-2 tests. For both perimeters, the elapsed time was defined as the time from the start to completion of each visual field examination.

Statistical Analyses

To evaluate the agreement on the presence or absence of a vertical step between the two tests, percent agreement and Cohen’s kappa coefficient were calculated, with 95% confidence intervals estimated using a patient-level cluster bootstrap to account for inter-eye correlation. A clustered McNemar test accounting for inter-eye correlation was used to compare the detection rates between the two tests.

Scatter and box plots were constructed alongside the respective MD values to visualize both agreement and disagreement in vertical step detection.

We compared the continuous parameters, including the MD value, Pattern Standard Deviation, elapsed time, false-positive and negative rates, and poor fixation rate of the two perimeters using generalized estimating equations (GEE). The correlations between these measurements were evaluated using repeated-measures correlation coefficients. We also performed Bland–Altman plot analysis to detect any proportional bias between the handheld switch-type GAP30-2 and HFA30-2 results across varying degrees of MD values severity. Furthermore, multivariable linear regression analysis was performed to identify the specific factors influencing the elapsed time for both the handheld switch-type GAP30-2 and HFA30-2. For analyses involving both eyes, patient ID was used as the clustering variable in the GEE and as the participant variable in the repeated-measures correlation analysis to account for within-patient correlations between the eyes. Statistical significance was set at $p < 0.05$. All analyses were performed using R version 4.4.1 (R Foundation for Statistical Computing, Vienna, Austria).

Reliability criteria and sensitivity analysis

All eligible eyes were included in the primary analysis, regardless of the reliability indices of the visual field examinations. To assess the robustness of the findings for visual field reliability, a sensitivity analysis was performed using predefined reliability criteria based on previously reported criteria for automated perimetry. One eye was excluded from the sensitivity analysis if the handheld switch-type GAP30-2 or HFA30-2 examination showed poor fixation (> 20%), false-positive responses (> 15%), or false-negative responses (> 33%). Sensitivity analysis focused on the principal visual field outcomes of the study, including MD value, test duration, and vertical step detection.

Results

Patient Characteristics

The patient characteristics are summarized in Table 1.

Table 1
Patient Characteristics

Patient Characteristics	
Patients / Eyes	30 / 58
Age, years	51.6 ± 16.6
Sex, female (%)	19 (63.3%)
Laterality, right (%)	29 (50%)
BCVA	0.11 ± 0.52

Overall, 58 eyes from 30 patients (11 males and 19 females) with a mean age of 51.6 ± 16.6 years were included for the final analysis. We excluded two eyes: one with PitNET due to a history of retinal detachment surgery, and the right eye of a patient with meningioma because it had been previously enucleated for retinoblastoma. Of the 30 assessed patients with chiasmal lesions, the underlying etiologies were PitNET (n = 20), meningioma (n = 7), craniopharyngioma (n = 1), Rathke's cleft cyst (n = 1), and germinoma (n = 1).

Visual Field Outcomes: handheld switch-type GAP30-2 versus HFA30-2

The visual field outcomes for the handheld switch-type GAP30-2 and HFA30-2 are summarized in Table 2. The mean elapsed time was significantly shorter with the handheld switch-type GAP30-2 than with the HFA30-2 (332.6 ± 86.1 vs 460.6 ± 83.2 s, $p < 0.001$). Univariable GEE regression analysis initially showed that lower MD values were significantly associated with longer elapsed times for both perimeters (β = −5.5 for handheld switch-type GAP30-2 and β = −8.3 for HFA30-2; both $p < 0.05$; **Supplementary Figure S1**). Furthermore, multivariable GEE analysis showed that the visual field severity (MD value) was independently associated with the elapsed time for both perimeters (**Supplementary Table S1).**

Table 2
Comparison of Visual Field Parameters Between handheld switch-type GAP30-2 and HFA30-2

	GAP30-2	**HFA30-2**	**P value (GEE)**	**Repeated-measures correlation**	
				***r* (95% CI)**	**P value**
Elapsed time, seconds	332.6 ± 86.1	460.6 ± 83.2	**< 0.001**	0.43 (0.07 to 0.69)	**0.021**
Mean deviation, dB	-7.5 ± 7.8	− 6.1 ± 7.8	**0.0073**	0.92 (0.84 to 0.96)	**< 0.001**
Pattern Standard Deviatin, dB	5.8 ± 2.8	6.0 ± 4.6	0.73	0.71 (0.46 to 0.85)	**< 0.001**
False positive, %	4.1 ± 7.6	2.3 ± 3.0	**0.047**	0.42 (0.07 to 0.68)	**0.022**
False negative, %	7.5 ± 13.6	4.6 ± 6.0	0.095	-0.096 (-0.47 to 0.30)	**0.64**
Fixation Losses	13.8 ± 17.0	8.8 ± 12.5	0.083	0.32 (-0.08 to 0.63)	**0.11**

For the visual field parameters, the MD value showed a very strong and significant positive correlation across the two devices (handheld switch-type GAP30-2; −7.5 ± 7.8 dB vs HFA30-2; −6.1 ± 7.8 dB,

repeated-measures correlation, $r = 0.92 = 0.92$; 95% confidence interval [CI], 0.84 to 0.96, $p < 0.001$). Figure 3 shows a Bland–Altman plot illustrating the agreement between the MD values obtained from the handheld switch-type GAP30-2 and HFA30-2. The mean difference between the two methods was 1.3 ± 3.1 dB. The 95% limits of agreement ranged from − 4.83 to 7.52 dB, indicating that most differences fell within this range. No significant proportional bias was observed (p = 1.00).

Vertical Step: handheld switch-type GAP30-2 versus HFA30-2

The agreement in the vertical step detection between the handheld switch-type GAP30-2 and HFA30-2 is presented in Table 3. When applying the vertical step criteria, a vertical step was detected in 25 eyes (43.1%) with the handheld switch-type GAP30-2 and 33 eyes (56.9%) with the HFA30-2. The two devices demonstrated overall agreement of 82.8%, with Cohen's kappa indicating a substantial strength of agreement (κ = 0.66; 95% confidence interval [CI], 0.48 to 0.85). The detection rates differed significantly between the two perimeters (McNemar's test, $P = 0.0046$). Contingency tables for HFA30-2 and handheld switch-type GAP30-2 are presented in **Supplementary Table S2**. Box-and-whisker plots with overlaid scatter plots were generated to illustrate the distribution of MD values across the four corresponding groups **(**Fig. 4**).** Cases in which a vertical step was identified on the HFA30-2 but not on the handheld switch-type GAP30-2 were observed in nine eyes, whereas one eye showed a vertical step on the handheld switch-type GAP30-2 but not on the HFA30-2 (**Supplementary Figure S2**).

Table 3
Statistical agreement, Cohen's κ and McNemar's test for vertical step detection between the handheld switch-type GAP30-2 and HFA30-2

vertical step	Percent Agreement (%), (95% CI)	Cohen's κ (95% CI)	P-value (McNemar's test)
	82.8 (0.72 to 0.92)	**0.66 (0.46 to 0.83)**	**0.0046**
2 dB, 4 pairs	69.0 (0.57 to 0.81)	0.40 (0.19 to 0.61)	**0.0017**
3 dB, 3 pairs	79.3 (0.67 to 0.90)	0.59 (0.35 to 0.79)	**0.039**

95% confidence intervals for percent agreement and Cohen's κ were estimated using a patient-level cluster bootstrap. The McNemar test accounted for inter-eye correlation using a clustered approach.

Sensitivity analysis according to visual field reliability

Twenty patients (32 eyes) met the predefined reliability criteria for the sensitivity analysis. These results were generally consistent with those of the primary analysis (**Supplementary Table S3, S4 and S5**).

GAP30-2 remained significantly faster than HFA30-2 (323.4 ± 84.8 vs 435.8 ± 77.0 s, P < 0.001), and the MD value showed strong correlations between the two devices (r = 0.89, P < 0.001). Vertical step

detection showed substantial agreement (81.3% agreement; κ = 0.64), although the detection rates remained significantly different between devices (P = 0.041).

A significant proportional bias was observed for MD values in the sensitivity analysis (P = 0.0033), although the mean difference between devices was similar to that in the primary analysis (1.2 ± 3.0 dB vs 1.3 ± 3.1 dB). The association between visual field severity and test duration remained significant for both devices (**Supplementary Table S6**).

Discussion

The main findings of this study were that the handheld switch-type GAP30-2 showed substantial agreement with the HFA30-2 in vertical step detection, a strong correlation in MD values, and a significantly shorter elapsed time. The strong correlation in MD values was consistent with the previous study[5]. Regarding vertical step detection, a previous study has compared head-mounted perimetry with HFA30-2 in neuro-ophthalmic patients and reported 87.5% correlation for hemianopic field patterns[7]. However, the criteria for classifying hemianopic field defects were not explicitly described. In the present study, the two devices showed substantial agreement in terms of vertical step detection, although some discrepancies were observed.

The scatter and box plots in Fig. 4 suggest that discordant cases were more frequently observed in eyes with mild visual field loss, particularly in those with MD values between 0 and 5 dB. Fujimoto et al. reported that the vertical step detected by HFA may represent an initial manifestation of temporal hemianopia associated with chiasmal lesions[4]. This is consistent with our finding of discordant detection in eyes with mild visual field loss.

Upon reviewing these 10 discordant cases, we found that the location of the vertical step or the region suggestive of a vertical step was generally similar across the two devices. In many cases, the discrepancies appeared to arise from small differences in the measured sensitivities at the corresponding test points (**Supplementary Figure S2**). These findings suggest that the handheld switch-type GAP30-2 can capture vertical step defects in a manner broadly consistent with HFA30-2, although subtle defects near the detection threshold may be identified differently for the two devices.

Fifty-four of the 58 eyes had radiologically evident chiasmal compression, and vertical step defects may have been present in some of them. The fact that the HFA30-2 detected vertical steps in 9 of the 10 discordant eyes raises the possibility that the HFA30-2 may detect vertical steps more frequently than the handheld switch-type GAP30-2. However, this possibility cannot be confirmed because neither device can be considered as a reference standard for determining the true presence of a vertical step. Together with its shorter examination duration and handheld design, these findings suggest that the GAP30-2 may be a practical option for visual field assessment of patients with chiasmal lesions, particularly when conventional automated perimetry is difficult to perform.

The strong correlation between the MD values of the two devices suggests that the handheld switch-type GAP30-2 provides a broadly comparable measure of the overall visual field sensitivity to the HFA30-

2. Previous studies have reported correlation coefficients ranging from 0.81 to 0.83 between HFA and imo[5, 8, 9]. Although these studies focused on patients with glaucoma, the present findings suggest that the relationship between the two devices is similarly strong for patients with chiasmal lesions. However, the strong linear association does not necessarily indicate interchangeability. The systematically lower MD values obtained with the handheld switch-type GAP30-2 and the relatively wide limits of agreement indicated that clinically meaningful differences may occur between the two devices. Notably, no proportional bias was detected, suggesting that the magnitude of the disagreement was not systematically related to the severity of the visual field loss. The underlying cause of this discrepancy remains uncertain and may be related to differences in device configuration, stimulus presentation, or response modality. In addition, potential order effects cannot be excluded, as most examinations were performed on the same day, and handheld switch-type GAP30-2 was generally performed after HFA30-2. Although no significant differences were found in the test reliability, the handheld switch-type GAP30-2 tended to show lower reliability than the HFA30-2. Therefore, test-related fatigue may have contributed to the lower MD values observed for the GAP30-2.

In the present study, the handheld switch-type GAP30-2 demonstrated a significantly shorter testing time than the HFA30-2. Miyake et al. reported no significant difference in the elapsed time between the gaze-analyzing GAP24-2 and HFA24-2[5]. The shorter testing time observed in our study may reflect differences in the testing protocol between the handheld switch-type and gaze-analyzing GAP approaches.

Multivariable analyses showed that MD value was independently associated with elapsed time for both perimeters, despite differences in their algorithms. This suggests that the severity of visual field loss may influence the examination duration. Previous studies have suggested that longer test durations may increase visual fatigue and its effects on VF measurements, particularly in advanced glaucoma[10–12]. Schiefer et al. reported that the examination duration increased with increasing visual field loss for SITA Standard and suggested that the number of questions asked in locations with moderate to advanced visual field loss may contribute to this increase[13]. Similar factors may also contribute to the association between visual field loss and examination time observed with HFA30-2 in the present study. For GAP30-2, this may be partly explained by the increased number of stimulus presentations required to determine the initial sensitivity in eyes with more severe visual field loss.

Sensitivity analysis restricted to examinations meeting the predefined reliability criteria yielded results that were broadly consistent with those of the primary analysis. Although a significant proportional bias in MD value was observed in the sensitivity analysis but not in the primary analysis, the mean differences of the two devices were similar for both analyses. This supports the robustness of the main conclusion and suggests that the results were not driven solely by unreliable visual field examinations.

This study has limitations. First, the sample size was relatively small, comprising 58 eyes of 30 patients. Second, no external reference standard was available to determine the true presence of a vertical step; therefore, this study assessed the agreement between the two devices rather than their diagnostic

accuracy for detecting vertical steps. Of the 58 eyes, 52 were tested on the same day, with 48 undergoing testing using the handheld switch-type GAP30-2 after HFA30-2. HFA30-2 is the standard visual field examination in our clinical workflow, and it was performed before the handheld switch-type GAP30-2 testing. Therefore, the potential order effects, including testing fatigue and learning effects, cannot be completely excluded. Future studies should randomize the examination order to minimize potential order effects. For the six eyes tested on separate days, the interval between examinations was 1 day for one eye, 2 days for two eyes, 9 days for two eyes, and 29 days for one eye. Thus, the testing conditions may have differed from those of the 52 eyes tested on the same day. However, none of the six eyes had pituitary apoplexy or rapidly progressive visual field defects.

Given its strong correlation with the HFA30-2 for MD values and substantial agreement on the vertical step detection, its compact design, shorter examination duration, and lack of a requirement for a dark room, the handheld switch-type GAP30-2 has the potential for use in clinical practice. Performing standard visual field testing in an ophthalmology clinic within a few days of surgery is often challenging. A head-mounted perimeter may reduce the burden on patients and enable early bedside postoperative visual field assessment. At present, we should be cautious about directly substituting HFA30-2 measurements with those obtained using the handheld switch-type GAP30-2 for longitudinal follow-up or relying solely on GAP30-2 to determine the presence of a vertical step.

Conclusions

In the visual field assessment of chiasmal lesions, the handheld switch-type GAP30-2 showed substantial agreement with the HFA30-2 in vertical step detection and a strong correlation in MD values, with a shorter examination time.

Declarations

Acknowledgments

None

Data availability

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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Human Ethics and Consent to Participate: The Institutional Review Board of Kyoto University Graduate School of Medicine approved this study (No. R0134). All the study procedures adhered to the tenets of the Declaration of Helsinki.

At our institution, written consent for the use of clinical information in observational studies of retinal diseases was obtained from patients at their first visit, and they were given the opportunity to decline participation through an institutional opt-out process.

Conflicts of Interest Statement:

Munekatsu Ito, None; **Eri Nakano**, Senju Pharmaceutical; **Kenji Suda**, Alcon Japan, NIPRO, Google, Fitting Cloud, Santen Pharmaceutical, Senju Pharmaceutical, Kowa Pharmaceutical, Otsuka Pharmaceutical, Novartis Pharma, TEIJIN HEALTHCARE LIMITED, Mitsubishi Tanabe Pharma; **Akihiro Tsutsumino**, None; **Miho Tagawa**, None; **Manabu Miyata**, Alcon Japan, Chugai Pharmaceutical, Santen Pharmaceutical, Bayer Yakuhin, Senju Pharmaceutical, Kowa Pharmaceutical; **Akinari Yamamoto**, None; **Yuhei Iga**, None; **Satoshi Kashii**, None; **Hiroshi Tamura**, Findex, Google, Suntory Global Inn, Bayer Yakuhin, Otsuka Pharmaceutical, Santen Pharmaceutical, TOPPAN holdings, Suntory System Technology, TEIJIN PHARMA; **Masahiro Miyake**, Novartis Pharma, Daiichi-Sankyo, KANEKA CORPORATION, ROHTO Pharmaceutical, Bayer Yakuhin, Kowa Company, AMO Japan, Santen Pharmaceutical, Senju Pharmaceutical, Johnson & Johnson K.K., Chugai Pharmaceutical, Japan Ophthalmic Instrument Association, Findex, TOPCON CORPORATION, SYSMEX CORPORATION; **Hiroyuki Ikeda**, None; **Noritaka Sano**, None; **Masahiro Tanji**, None; **Akitaka Tsujikawa**, Canon, Findex, Santen Pharmaceutical, Sumitomo Pharma, Otsuka Pharmaceutical, Senju Pharmaceutical, Alcon Japan, Bayer Yakuhin, Wakamoto Pharmaceutical, Chugai Pharmaceutical, AMO Japan, ROHTO NITTEN, Novartis Pharma, Kowa Company, MSD, Ellex, HOYA, Johnson & Johnson K.K., ROHTO Pharmaceutical, NIKON SOLUTIONS, Boehringer Ingelheim, Janssen Pharmaceutical, Sumitomo Pharma, KYOWA KIRIN.

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Figures



Figure 1

The weight of the head-mounted display is 400 g. The target size, peak luminance of 10,000 apostilbs, and background luminance of 31.5 apostilbs were identical to the HFA testing conditions.

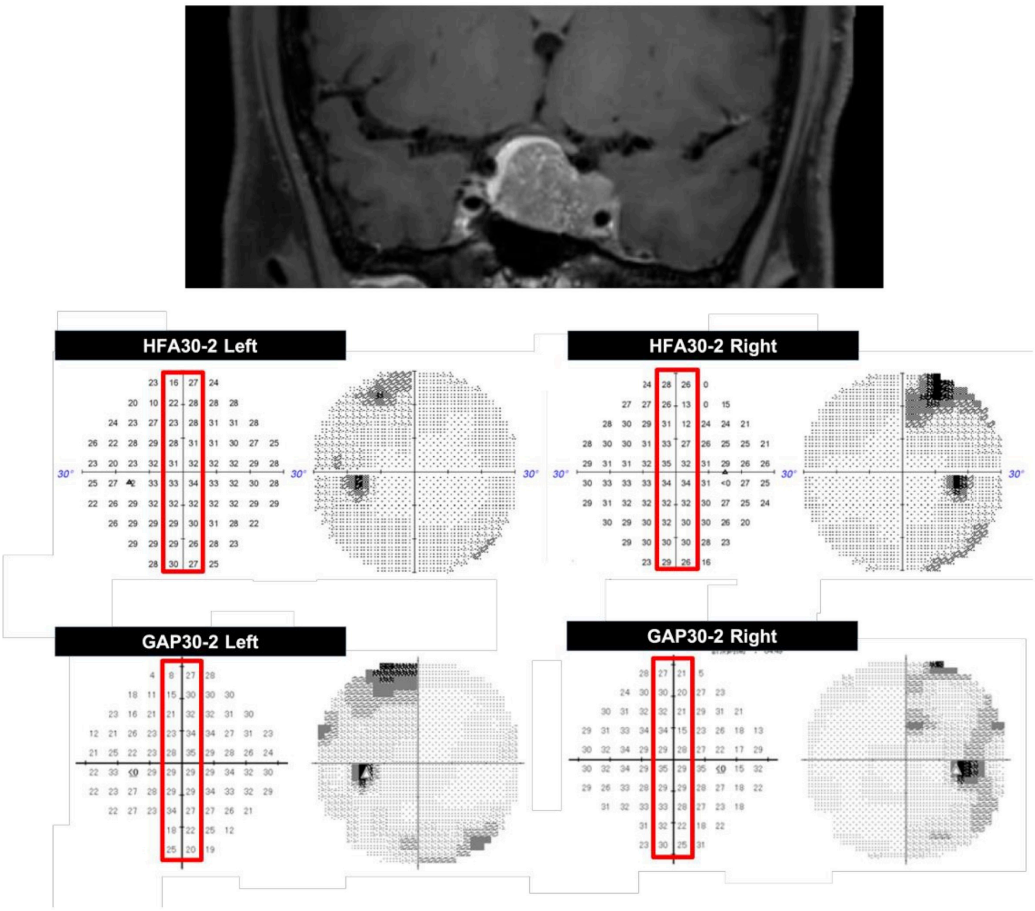


Figure 2

Representative case of PitNET demonstrating concordant vertical step detection between GAP and HFA.

(A) Brain MRI shows distinct compression of the optic chiasm by the tumor. (B) Visual field test results from both GAP and HFA reveal bitemporal hemianopia in the superior visual fields of both eyes. In both perimeters, a vertical step—defined as a reduction in sensitivity on the temporal side along the vertical meridian of ≥2 dB for four or more consecutive pairs of points, or ≥3 dB for three or more consecutive pairs of points—is clearly observed.

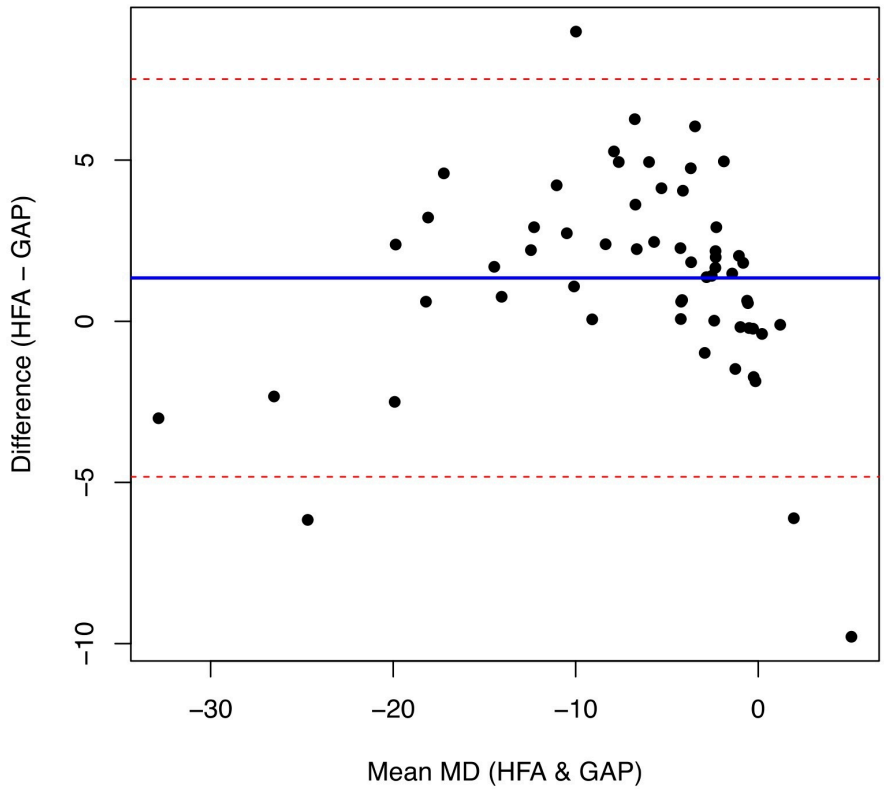


Figure 3

Bland–Altman plot illustrating the agreement between mean deviation (MD) values obtained from GAP and HFA.

The solid line represents the mean difference (1.31 dB), and the dashed lines indicate the 95% limits of agreement (-4.83 to 7.52 dB). There was no significant proportional bias (p = 1.00).

GAP, Gaze Analyzing Perimeter; HFA, Humphrey Field Analyzer; MD, mean deviation

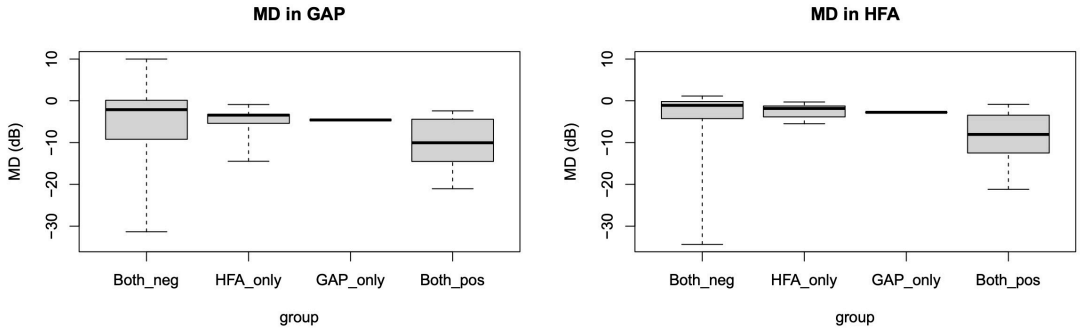


Figure 4

Mean deviation (MD) values and their differences across the four diagnostic groups. Box-and-whisker plots with overlaid scatter plots illustrate the distribution of MD values across four groups based on vertical step detection: both GAP and HFA positive, HFA-only positive, GAP-only positive, and both negative. (Left) Distribution of HFA MD values. (Right) Distribution of GAP MD values.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

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