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# Objective Comparison of Commercially Available Virtual Reality Perimetry Devices: a cross-sectional descriptive study

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# Objective Comparison of Commercially Available Virtual Reality Perimetry Devices: a cross-sectional descriptive study

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**Abstract**

**Background:** To identify commercially available virtual reality-based perimetry (VRP) devices in the United States and compare characteristics relevant to clinical use.

**Methods:** We conducted a cross-sectional descriptive study of portable, head-mounted perimeters identified through the US Food and Drug Administration Establishment Registration and Device Listing database using product code HPT. Device eligibility and specifications were assessed using manufacturer websites, promotional materials, PubMed searches, and direct communication with manufacturers. Extracted characteristics included physical specifications, testing capabilities, workflow features, and published comparisons with standard automated perimetry.

**Results:** Sixteen commercially available VRP devices met the inclusion criteria. All 16 devices had at least one peer-reviewed publication describing their use or performance. Reported headset weights ranged from 170 to 690 g. All devices supported 10-2 and 24-2 testing patterns, and 15 supported 30-2 testing. Data export and multilingual audio were available for all devices, whereas eye tracking, refractive adjustment, interpupillary distance adjustment, test duration, and additional diagnostic capabilities varied among devices.

**Conclusion**: Commercially available VRP devices differ in characteristics that may affect clinical workflow, patient comfort, and suitability for specific practice settings. Manufacturer-reported specifications were not independently verified, and evidence concerning longitudinal detection of visual field progression remains limited.

**Keywords**: virtual reality, perimetry, visual field testing, glaucoma, medical devices, ophthalmology.

## Introduction

Visual fields testing is a cornerstone of glaucoma monitoring and detection.[1] Innovations in the field of virtual reality (VR) have led to the development of commercially available head-mounted VR-based perimetry (VRP) devices. The companies producing these devices present them as portable, easy to use, compact, and cost-effective options while showing parity of results when compared with traditional perimeters.[2] These benefits and the rapid proliferation of devices have generated significant interest in VRP devices among eyecare providers, especially those seeking solutions for high volume clinics or remote monitoring.

While the abundance of available devices may improve accessibility and convenience, it complicates comparison and informed purchasing. The lack of standardization and availability of device specifications on websites and promotional materials further obscures the VRP market. Without a resource that provides direct comparison between commercially available VRP devices, purchase decisions are based on price and convenience rather than evidence. Previous reviews have summarized validity evidence for VRP devices, finding that agreement with standard automated perimetry varies across devices and populations, and other studies focused on individual devices have created tables and figures for individual VRP devices.[3,4] However, none have created a list focused on clinically relevant specifications of commercially available devices.

To aid eyecare practices in purchasing devices that suit their patients and practitioner needs, we compiled a source with a list of VRP headsets by reviewing the U.S. Food and Drug Administration (FDA) registration database. We include pertinent technical

specifications that will allow practices to evaluate each device's merit and fit for their use case by highlighting similarities and critical differences.

## Materials and Methods

We defined a VRP device as a portable, head mounted perimeter capable of testing each eye individually. We limited our inclusion of devices to those that were commercially available during the time of the study, as portrayed by language used on the brand's website or promotional material.

To create this list, we used the FDA's 'Establishment Registration and Device Listing' search database to find registered devices that met our inclusion criteria. We used the product code search function with the code 'HPT', which is specific for AC-powered, automatic perimeters. For each company with a registration entry under this product code, we searched for that company's website and evaluated whether the device met our criteria.

After identification, we chose specifications that would facilitate evaluation of technical performance, patient comfort, and ease of use. Because these devices are exempt from FDA premarket notification requirements, we included a column indicating whether published clinical evidence evaluating the VRP's performance in comparison to a standard automated perimeter exists. We searched device websites and PubMed with "[device name]" or "[brand name]" and "virtual reality perimeter" or "virtual reality perimetry" to find relevant studies.

Data collection first involved searching device webpages to extract specification data. Next, where available, any specifications found in promotional material were added to the table. Finally, for any device with missing specification data, we reached out directly to the companies via email and phone call.

## Results

We identified 16 devices that met our inclusion criteria. Of these, all 16 had publications evaluating their performance cross sectionally in comparison with standard automated perimetry, though there is little to no data regarding their ability to detect glaucoma progression. Additional comparative findings have been reported for Virtual Eye devices (Munshi H, et al. IOVS 2022;63:ARVO E-Abstract 1275) and the RVF100 (Al-Ani A, et al. IOVS 2024;65:ARVO E-Abstract 5489; Sarhan A, et al. IOVS 2023;64:ARVO E-Abstract 5001). For each device, we listed physical attributes in Table 1 and testing specifications in Table 2.

The devices evaluated in this study had several specifications in common. Most use a hand controller for response method, although the VF2000 Neo and the Heru VF offer an Eye Click option. Eye tracking in some form is available in most headsets. Data export is universally available. Each device has multilingual audio capability. All devices support 24-2 and 10-2 patterns, with 15 devices also offering 30-2.

Other specifications showed greater variability between devices. For example, the Radius XR weighed significantly less than all others at 170 g, likely due to its custom headset design. Because manufacturers do not uniformly specify testing time for each protocol, the duration range was generally reported and was pattern, strategy, and condition dependent, making comparison difficult. Most devices report rapid testing capability (<3 minutes per eye), with more comprehensive strategies extending to 10 minutes or longer for bilateral, full-threshold testing. Refractive adjustment capabilities were uncommon, but most devices allow for corrective lenses to be worn. Specifically, the VF3 Pro allows for trial lenses, while the Radius XR has refractive adjustment from 0.00 to +8.0 and the

VF2000 Focus allows for correction from –1.00 to +5.00. Interpupillary distance adjustment (IPD) is available in the VF2000 series, VisuALL series, Heru VF, and Vivid Vision devices. Additional diagnostic features, such as color vision testing, visual acuity, and extraocular motility, differ between devices. Finally, the lower range of threshold sensitivity capacity was zero dB in most devices, however, the Radius XR has a range of 15 to 40 dB.

**Discussion**

While there are some specifications in which all the devices are similar, there are significant differences between devices with clinical implications. Inability to change refractive adjustment, IPD adjustment capabilities, or availability of pediatric mode, for example, could be make-or-break features for certain practices. Additionally, differences in advertised test durations vary by device, which may be particularly useful information in settings where efficient testing is a priority.

The FDA status of perimetry devices may be of interest to readers. Currently, perimeters are a class I device with exemption (similar to tongue depressors or oxygen masks) requiring no premarket notification 510(k), a process that demonstrates substantial equivalence to another United States marketed device.[5-6] Businesses marketing these devices must register with the FDA, but neither FDA approval nor clinical studies are required.[7] Because VRP headsets do not have to prove their equivalence to traditional perimeters, consumers (clinicians) must determine clinical viability/accuracy based on their own review. Thus, careful comparison of VRP headsets is necessary. In a recent systematic review of 19 studies comparing VRP devices to the Humphrey Field Analyzer (HFA), Vera et al. found considerable variability in agreement across devices, populations and disease

severity. Of note, several of the devices demonstrated clinically acceptable agreement, particularly in the moderate-to-advanced glaucoma group. However, study heterogeneity didn't allow for meta-analysis, and no formal risk-of-bias assessment was able to be performed.[3] As such, the existence of comparative publications for specific devices, as listed in Table 2, does not necessarily validate the device nor should it imply interchangeability with standard automated perimetry. The review also notes the relevant absence of longitudinal studies demonstrating progression detection capability as the current primary evidence gap.[3]

Our study has limitations. First, when reviewing the FDA's registration list for the product code for perimeters, the list experienced some change over the course of the project. This is likely due to the novelty of the field, with rapid rise and fall of start-up companies. Device registration requires a yearly fee that may be difficult for small or struggling businesses to pay, leading to their removal from the list. Similarly, new businesses may register at any time, resulting in a fluid, constantly evolving list. Second, although the table is as complete as possible based on available information, some specifications were unavailable for specific devices. Often, company representatives were unable or unwilling to provide certain information, while others did not respond at all. Third, some specifications may be subject to change, particularly those that may change with software updates. Finally, data in the tables was provided by device vendors and not independently verified due to financial and technical restraints involved with doing so.

**Conclusion**

Ophthalmic practices searching for VF solutions will find that many specifications are not readily available to the public, despite being pertinent information. The table we

have prepared provides available specifications in a manner that facilitates device comparison and informed decision making. Much of the data was not publicly available and required us to contact device vendors directly. By providing device data in this objective comparison, we aim to increase its availability to providers. Future work with VRPs should focus on comparing detection and diagnosis capability as well as prospective studies that monitor longitudinal visual field loss.

## Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki. No human participants, human material, or human data were involved. All information was obtained from publicly available sources, including the U.S. Food and Drug Administration Establishment Registration database and manufacturer-published specifications. Ethics approval and consent to participate were therefore not required.

## Consent for Publication

Not applicable.

## Availability of data and materials

The data supporting the findings of this study are contained within the article and its tables. Source materials were obtained from the US Food and Drug Administration database, manufacturer materials and communications, and the cited literature.

## Competing Interests

The authors report no competing interests in this work.

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**Author Contributions**

All authors meet the ICMJE criteria for authorship, including contributing substantially to project conception or design as well as acquisition, analysis, and interpretation of data, manuscript drafting and critical revision, final version approval, and journal agreement.

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304 Table 1. Physical specifications of virtual reality perimetry devices.

| Device Name | Company Name | Headset Weight (g) | Refractive Adjustment (diopters) | IPD Adjustment (mm) | Response Method |
|---|---|---|---|---|---|
| VF2000 Focus* | Micro Medical Devices | 447 | -1.00 - 5.00 | No adjustment: 54 | Hand controller |
| VF2000 G2 | Micro Medical Devices | 604 | None - fitted with magnetic port and trial lens holder to add correction. | Adjustable: 3 positions (58, 63.5, 69) | Hand controller |
| VF2000 NEO | Micro Medical Devices | 690 | None - fitted with magnetic port and trial lens holder to add correction. | Software based auto-adjusting[55-71] | Hand controller +/or Eye Click option when Eye Tracking feature is active |
| Easyfield VR | Oculus | ~ 600 | None - Room to wear most current Rx. | None | Hand controller |
| VisuALL S | Olleyes | 276 | None - Room to wear most current Rx. | Adjustable Lenses | Hand controller |
| VisuALL ETS | Olleyes | 276 | None - Room to wear most current Rx. | None | Hand controller |
| Heru Prime | Heru | Not reported | None | Digitally accounts for patient IPD | Hand controller +/or Eye Click option |
| RadiusXR | Radius XR | 170 | 0.0 - 8.00 | None | Hand controller |
| Smart System VR Headset | M&S, Hilco Vision | 607 | None - Room to wear most current Rx. | None | Hand controller |
| VF3 | Carrot | 490 | Room to wear most current Rx + magnetic trial lens adapters. | Not reported | Hand controller |
| VF3 Pro | Carrot | 673 | Room to wear most current Rx + magnetic trial lens adapters. | Not reported | Hand controller |
| Virtual Eye Elite | Virtual Vision | <500 | None - Room to wear most current Rx. | Adjustable: 3 positions (58,63.5, 69) | Hand controller |

| Device Name | Company Name | Headset Weight (g) | Refractive Adjustment (diopters) | IPD Adjustment (mm) | Response Method |
|---|---|---|---|---|---|
| Virtual Eye Pro | Virtual Vision | 635 | None - Room to wear most current Rx. | Adjustable: 3 positions (58,63.5, 69) | Hand controller |
| Vivid Vision Perimeter | Vivid Vision | Not reported | None - Room to wear most current Rx. | Adjustable: 3 positions (58, 63.5, 69) | Hand controller +/or Head movement option. |
| RVF100 | RetinaLogik | 673 | None - Room to wear most current Rx. | Adjustable: 58 - 69 | Hand controller |
| VisionOne | PeriVision | 673 | None - fitted with magnetic port and trial lens holder to add correction. | None | Hand controller |

Footnotes:

VF – Visual field.

* – Legacy device and only available for certain institutional contracts

Date of Data Collection – All data was gathered between June-August, 2025.

All devices are commercially available unless otherwise noted as of July 2026.

314 Table 2. Testing specifications of virtual reality perimetry devices.

| Device Name | Supported VF Patterns | Eye Tracking/ Fixation Monitoring Method | Threshold Sensitivity Capacity (dB) | 24-2 Duration (Min), and Duration Range | Additional Diagnostic Capabilities | Publications* |
|---|---|---|---|---|---|---|
| VF2000 Focus† | 10-2, 24-2, 30-2 | Self-guided blind spot monitoring | 0-34 | <5 min/eye. (0.5 - 7) | Esterman, FDT, Neuro, Ptosis, kinetic patterns also supported - over 20 VF patterns available between all VF test types | Yes[8-10] |
| VF2000 G2 | 10-2, 24-2, 30-2 | Self-guided blind spot monitoring | 0-34 | Not reported. (0.5 - 7) | Stereopsis, Contrast Sensitivity, Color Testing, Complex color testing (neuro), Visual acuity | Yes[8-10] |
| VF2000 NEO | 10-2, 24-2, 30-2 | 2 modes:<br>1) Self-guided blind spot monitoring<br>2) Active eye tracking pauses issuance of stimuli if fixation loss is detected | 0-34 | Not reported. (0.5 - 7) | Stereopsis, Contrast Sensitivity, Color Testing, Complex color testing (neuro), Visual acuity, Pupillometry | Yes[8-10] |
| Easyfield VR | 10-2, 24-2, 24-2C, 30-2 | Eye tracking | 0-40 | <3 min/eye. (<1 – 8) | Ptosis, Esterman, Vision Screening/Threshold, Color Vision, Stereo, Contrast Sensitivity, Progression analysis | Yes[11] |
| VisuALL S | 10-2, 24-2, 24-2C, 30-2 | Heijl Krakau blind spot monitoring | Not reported | ~ 3 min/eye. (0.75 - 10) | Visual Acuity, Color Vision, Contrast Sensitivity | Yes[2,12-15] |
| VisuALL ETS | 10-2, 24-2, 24-2C, 30-2 | Eye tracking | Not reported | Not reported. (0.75 - 10) | Visual Acuity, Color Vision, Contrast Sensitivity, Pupillometry, Extraocular Motility, Pediatric mode | Yes[2,12-15] |
| Heru Prime | 10-2, 24-2 | Eye tracking | Not reported | Neither 24-2 nor range reported. | Cover test, Extraocular Motility, Pupillometry | Yes[16] |

| Device Name | Supported VF Patterns | Eye Tracking/ Fixation Monitoring Method | Threshold Sensitivity Capacity (dB) | 24-2 Duration (Min), and Duration Range | Additional Diagnostic Capabilities | Publications* |
|---|---|---|---|---|---|---|
| Radius XR | 10-2,24-2,30-2 | Blind spot monitoring | 15-40 | Not reported. (0.5 - 8) | 2 Suprathreshold Test Patterns: Rapid 50 (50 test locations identical to the 24-2 except the 2 nasal locations and 2 blind spots) and UltraRapid 16 (4 test locations in each quadrant). | Yes[17,18] |
| Smart System VR Headset | 10-2, 24-2, 30-2 | SMARTracker2 eye tracking | 0-30 | <3 min/eye. (<3 - 10) | Ptosis, Esterman, Color Testing, Stereo Testing, Contrast Sensitivity | Yes[19] |
| VF3 | 10-2, 24-2, 30-2 | Heijl Krakau blind spot monitoring | 0-36 | Not reported. 1-11 | Ishihara Color vision, Progression Analysis, Esterman, Full Field 120, Superior 36, N-30 and C-40 screening, G1-GV stimulus sizes | Yes[20] |
| VF3 Pro | 10-2, 24-2C, 30-2 | Eye tracking | 0-36 | Not reported. 1-11 | C-40 Screening, N-30 Screening, Superior 36, Esterman, FF-120, FF-70. BOLT strategy, SFT, Quantify Defects, Two Zone, Color Vision, Foveal Threshold, Pupillometry, EOM, Ptosis Protocol | Yes[20] |
| Virtual Eye Elite | 5-2, 10-2, 24-2, 24-2C, 30-2 | Heijl Krakau blind spot monitoring | 0-44 | <3 min/eye. (<1 - 8) | Screening, Full field 120, Superior 64/36, Esterman, Color Sensitivity (Ishihara, Waggoner), Ptosis | Yes[21-23] |
| Virtual Eye Pro | 5-2, 10-2, 24-2, 24-2C, 30-2 | 2 modes: 1) Heijl Krakau, 2) Eye Tracking | 0-44 | <3 min/eye. (<1 – 8) | Screening, Full field 120, Superior 64/36, Esterman, Color Sensitivity (Ishihara, Waggoner), Ptosis, Pupillography, Extraocular Motility, Cover, Live Eye Camera | Yes[21-23] |
| Vivid Vision Perimeter | 10-2, 24-2, 30-2-M | Not reported | 0-32 | Not reported. 1-20 | Ladybug protocols | Yes[24,25] |
| RVF100 | 10-2, 24-2, 30-2 | Eye tracking | 0-35 | Not reported. (<1 – 20) | Esterman, Quick Screener, Various Threshold Strategies, AI progression monitor, Visual Acuity, Color Vision, Contrast Sensitivity | Yes[26] |
| VisionOne | 10-2, 24-2, 30-2 | 2 modes: 1) Heijl Krakau, 2) Eye Tracking | Upper limit of 30 dB | Not reported. (Average 1.5 with AI feature) | G, Esterman (120 degree), Screening 28, C-40, SORS, SORS Screening, Normal Strategy, Dynamic Strategy, Supra-threshold | Yes[27‡] |

Footnotes:

VF – Visual field.

* – Citations are limited to comparisons of virtual reality perimeters to standard automated perimetry and are not a comprehensive list of all publications related to each headset

† – Legacy device and only available for certain institutional contracts

‡ – Study performed on different hardware; more current data is available in the form of posters that can be found on PeriVision's website.

Testing Duration - For comparability, we prioritized 24-2 thresholds when reported. When unavailable, we reported duration range, which was most commonly available.

Date of Data Collection – All data was gathered between June-August, 2025.

All devices are commercially available unless otherwise noted as of July 2026.