SEMI-AUTOMATED OPHTHALMIC SCREENING IN THE EMERGENCY DEPARTMENT

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BACKGROUND

While ophthalmic complaints comprise a substantial portion of Emergency Department (ED) visits, accurately screening and triaging these patients in the ED setting can be difficult, and initial ophthalmic assessment by ED providers is often limited and incomplete. Commercially available semi-automated technology, such as virtual reality (VR) headsets, have potential to improve screening. We assess the Olleyes VisuALL ETS VR headset in screening for decreased visual acuity (VA), visual field (VF) defects, and afferent pupillary defects (APD) in ED patients with eye complaints.

METHODS

Adults with eye complaints presenting to Harborview Medical Center in Seattle, WA, were recruited from October 2023 to August 2024. The Olleyes device was used to assess VA, VF by confrontation, and presence of APD. Decreased visual acuity was defined as visual acuity worse than 20/40. Sensitivity specificity, and predictive values were calculated for Olleyes device in its ability to detect decreased VA, presence of VF defect, and presence of APD on the exam by the ophthalmic consultant.

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RESULTS

91 subjects were screened using the Olleyes device, mean age of 48 +/- 18, 46 males and 45 females. The contingency tables below were used to evaluate the screening capability of the Olleyes device for VA >20/40, VF deficits, and APD detection. Below the contingency tables the sensitivities, specificities, positive predictive values (PPV), and negative predictive values (NPV) calculated from the contingency tables are compared.

Visual Acuity, Olleyes vs. Ophthalmologist (127 eyes)		
	Ophtho VA > 40	Ophtho VA ≤ 40
Olleyes VA > 40	30	2
Olleyes VA ≤ 40	44	51
Visual Field Defects, Olleyes vs. Ophthalmologist (99 eyes)		
	Ophtho VF Abnormal	Ophtho VF Normal
Olleyes VF Abnormal	15	5
Olleyes VF Normal	6	73
Afferent Pupillary Defects, Olleyes vs. Ophthalmologist (31 patients*)		
	Ophtho APD	Ophtho No APD
Olleyes APD	1	3
Olleyes No APD	4	23

Screening Type	Population	Number of Eyes	Sensitivity	Specificity	PPV	NPV
VA	73 subjects	127 eyes	0.94	0.54	0.41	0.96
VF	52 subjects	99 eyes	0.71	0.94	0.75	0.92
APD	31 subjects	31 patients*	0.20	0.89	0.25	0.85

*APD (afferent pupillary defect) is a clinical sign that indicates dysfunction of the optic nerve or severe retinal damage in one eye yet is determined via pupillary light response in both eyes.

PLAIN LANGUAGE SUMMARY
The objective of this study was to evaluate the effectiveness of the Olleyes VisuALL ETS VR headset in screening for decreased visual acuity (VA), visual field (VF) defects, and afferent pupillary defects (APD) in Emergency Department (ED) patients. The most significant finding was the device's high sensitivity for detecting decreased VA and moderate sensitivity for VF defects, with high specificity for VF defects and APD. This suggests the device could be a valuable preliminary screening tool in settings without on-call ophthalmologists, despite its limited utility in emergency settings due to variability in screening metrics. Future research should focus on validating these findings with larger studies and improving the device's algorithms.

DISCUSSION

Interpretation of Results:

Visual Acuity Screening:

- Sensitivity (0.94) suggests Olleyes device is effective in identifying subjects with decreased VA. Specificity (0.54) suggests a higher rate of false positives. NPV (0.96) means the device is reliable in confirming normal VA when no issues are detected.

Visual Field Screening:

- Sensitivity (0.71) and specificity (0.94) show the device is good at detecting VF defects and confirming normal VF. PPV (0.75) and NPV (0.92) indicate reliable performance in both detecting and ruling out VF defects.

Afferent Pupillary Defect Screening:

- Sensitivity (0.20) indicates the device is less effective in detecting APD. Specificity (0.89) suggests it is good at confirming the absence of APD. PPV (0.25) and NPV (0.85) show it is more reliable in ruling out APD than detecting it.

Limitations:

- Small sample size, particularly for APD screening. Potential bias in subject selection. Limited generalizability due to the specific population studied.

Future Research:

- Larger studies to validate findings. Explore improvements in device algorithms to enhance specificity and sensitivity. Investigate the device's utility in different clinical settings.

CONCLUSIONS

- The Olleyes VisuALL VR headset is highly sensitive for detecting decreased VA and moderately sensitive for VF defects.
- Its high specificity for VF defects and APD makes it reliable for confirming normal results.
- The variability in screening metrics suggests limited utility in emergency settings but potential value in non-ophthalmic settings with minimal training required.
- Overall, the device offers a promising tool for preliminary ophthalmic screening where comprehensive ophthalmic work-up is not available.