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Clinical validation of a web-app for remote visual acuity assessment

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Background, Aims, Methods

- The NHS Long Term Plan aims for a third of outpatient consultations to be conducted remotely[a], with urgency increased by COVID. In ophthalmology, this requires accurate visual acuity (VA) assessment.
- DigiVis is a CE marked web-app which enables self-assessment of distance VA at home, using two digital devices (Fig. 1).
- We aimed to evaluate the accuracy, reliability and acceptability of DigiVis assessment, in paediatric and adult patients.

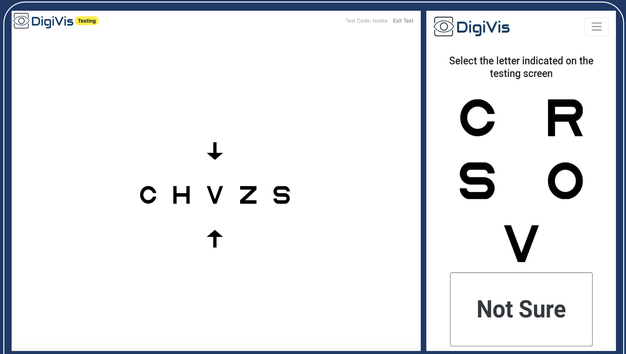


Figure 1 | Screenshots from a tablet (left) and smartphone (right) during the DigiVis test. Prior to testing, the parent follows instructions to calibrate screen resolution and viewing distance. During testing, patients select the letter on the smartphone matching that indicated by arrows on the distant screen.

127 patients (240 eyes) aged 5-87 (median = 27) years completed two DigiVis self-tests, with children <10 (n = 45) undertaking a gamified version of the DigiVis test. Eyes with VA ≥0.8 logMAR were excluded.

Mean DigiVis monocular VA was compared to clinical measurements, and test-retest agreement (TRTA) was determined using Bland-Altman plots and intraclass correlation coefficients (ICC). Feedback was also evaluated.

Results

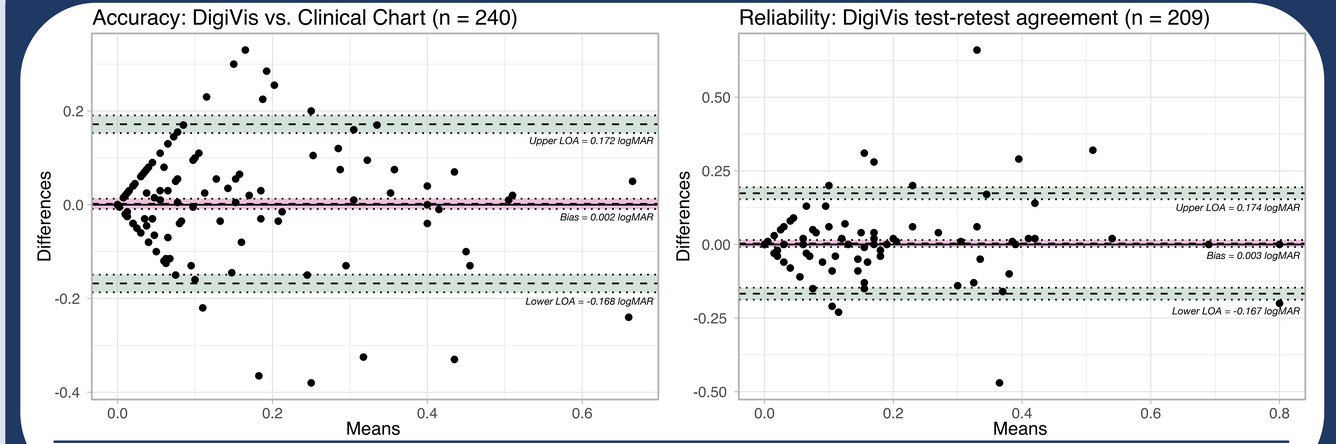


Figure 2 | Bland-Altman plots evaluating DigiVis' accuracy, left, and reliability, right. 95% confidence intervals for the bias and limits of agreement (LOA), themselves indicated by dashed lines, are shaded. There are fewer data-points than counted in the analysis, due to overlap.

Bland-Altman plots (Fig. 2) exhibit mean limits of agreement (LOA) at ±0.17 logMAR for accuracy, and ±0.17 logMAR for TRTA. Minimal bias, with no significant deviation from zero, was observed, indicating no systematic error.

Intraclass correlation coefficients indicated good agreement[b] between DigiVis and clinical chart (ICC = 0.80, $p = 1.1\text{x}10^{-54}$), as well as between repeated DigiVis measurements (ICC = 0.83, $p = 7.5\text{x}10^{-55}$), agreeing with Bland-Altman LOA.

Feedback was overwhelmingly positive: 91% of participants were willing to use DigiVis to track VA in the future; 95% rated the test as 'good' or 'excellent'.

Conclusions

- Bland-Altman LOA of ±0.15 logMAR are quoted for clinic-based VA assessment in adults[c] and children[d]. With similar LOA to clinical assessment, DigiVis represents a remote alternative with comparable accuracy and reliability. These data compare favourably with other apps using trained examiners: ±0.414-444 logMAR reported for Peek acuity[e] and ±0.125-0.208 logMAR for Kay pictures iSight[f]. DigiVis performed similarly well in 5-10 year old children as in older patients, and further investigation is required to establish its accuracy in the sight impaired population. Feedback indicates good patient acceptability, particularly in children.

- DigiVis can be integrated with NHS Attend Anywhere via screen sharing, and could thereby help increase the proportion of consultations undertaken remotely. Remote clinics, triage, and screening could all benefit from this clinically validated remote visual acuity assessment. Successful adoption requires integration into patient pathways, clinician workflows, and patient records.

References

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