DigiVis: validation of self-testing visual acuity web-based app to aid ophthalmic telephone consultations during Covid19 lockdown and subsequent social distancing crisis.

Clinical Study Protocol

Protocol Number:	DigiVis v0.1
NCT:	**IRAS ID 196573**
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Study Title:	DigiVis: validation of self-testing visual acuity web-based app to aid ophthalmic telephone consultations during Covid19 lockdown and subsequent social distancing crisis.
Investigational Product:	Web-based Visual Acuity software
Protocol Version:	Version 0.1

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Study Sponsor:	Cambridge University Hospitals NHS Foundation Trust

1 Study Synopsis

Title of clinical trial	**DigiVis: self-testing vision app for telephone consultations**
Sponsor name	Cambridge University Hospitals NHS Trust
Medical condition under investigation	Visual Acuity (VA) assessment
Purpose of clinical trial	To validate VA self-assessment using DigiVis software by comparison to current chart-based tests
Primary objective	Comparison of VA assessment with DigiVis software to clinic-based VA assessment.
Secondary objective (s)	Calculation of test-retest variability. Assessment of usability and preference.
Study Design	Prospective quantifiable comparison study
Study Endpoints	Completed testing on a sufficient number of individuals to give good statistical power.
Sample Size	Approximately 250 patients in total
Summary of eligibility criteria	Patients aged between 5 and 85 due to attend scheduled clinic appointment with vision +0.8logMAR (6/38) or better in their left eye. Patients with access to two appropriate digital devices. Ability to understand English and log on to the website.
Active comparator product(s)	Clinic VA charts: LogMAR visual acuity chart, SLT childrens' vision chart.
Route(s) of administration	Visual test
Maximum duration of treatment	2 clinical interventions of 5 minutes each at home
Procedures: Screening & enrolment	Eligible patients will be identified from electronic patient record prior to a scheduled clinical appointment. Telephone enrolment will be undertaken.
Comparators	VA test at the scheduled clinic appointment. Two DigiVis self-test VA measurements. Patient preference.
Intervention period	Two 10 minute phone calls explaining study and the test Two 5 minute self-tests of VA on the website 10 minutes conversation to sign the consent form in clinic and get usability feedback
End of Study	End of scheduled clinic appointment
Procedures for safety monitoring during trial	n/a
Criteria for withdrawal of patients on safety grounds	n/a
Regulatory submissions on safety grounds	Software marked as CE Class I Medical Device

2 Introduction

2.1 Background

Eye problems like macular degeneration and amblyopia (lazy eye) require regular monitoring to prevent permanent visual impairment. Over 2000 patients a month are seen in CUH eye clinics; concern about Covid-19 infection has led to over 80% of consultations being conducted by telephone with few clinical clues to inform decision making. Patients will face long delays even when routine clinics restart: there is no doubt that some will suffer preventable visual loss.
DigiVis is a web-based vision testing app enabling self-testing of vision at home. Early testing and patient feedback is positive: 80% of children prefer DigiVis to regular testing. We wish to test how accurately the app works for home use, by asking older children and adults to self-test their vision prior to their planned face to face clinic appointment. Once tested, DigiVis will be available free of charge to patients, not only during the Covid-19 crisis, but also to support telephonic consultations in the future.

Visual acuity (VA) is a fundamental measure of vision required for all ophthalmic assessments. It is measured by health professionals using vision charts. DigiVis is a new app which enables self-testing of VA using two wirelessly connected digital devices. By matching letters on a handheld device to those displayed on the second device a distance away, threshold VA can be measured using a staircase algorithm. The distance and scaling of the test is vital to its accuracy and a concept (patent filed by Cambridge Enterprise) in DigiVis enables this without the need for manual distance measurement or an observer.
Early validation using two tablet computers in 150 clinic patients has given positive results, both in testing accuracy and patient feedback. With the current Covid-19 crisis limiting face to face appointments, there is an urgent need for accurate home VA assessment. The DigiVis app has been re-coded for free website delivery for this purpose.
We wish to formally validate DigiVis home testing following CE (class I) marking so that it can be recommended for clinical use. 250 patients will be invited to self-test their VA twice using DigiVis prior to a planned face to face clinic appointment. The test-retest variability and comparison of DigiVis VA to chart based assessment will be compared.

The DigiVis test can be undertaken at www.digivis.org with a code name of louiseallen.

2.2 Data from other studies

The DigiVis software app has already undergone initial validation and usability studies in clinic patients, which have resulted in software improvement including a reduction of test time.

A similar study design has been used to assess Peek vision, a smartphone based VA testing app. (1) The difference between DigiVis and Peek app is the automated distance measurement, no requirement for an observer and use of standardised optotype design in the former.

2.3 Safety data

The software is CE marked Class1 medical devices and is delivered on a web-site accessed from the patients' own digital devices, no safety issues are foreseen.

3 Rationale for Study

Validation of the accuracy of the software package will enable recommendation of its use in conjunction with telephone consultation to inform clinical decision making during and after the lockdown period as social distancing increases the need for virtual consultations.

4 Trial objective and purpose

Primary objective: to compare VA assessment of self-testing on the DigiVis website to formal VA measurement using chart-based tests in clinic.
Secondary objective: to assess the repeatability and usability of the software.

4.1 Statement of design

This is a prospective quantifiable comparison study.

4.2 Study duration

Study duration will be 6 months, aiming to start testing by the 3rd June 2020 and complete testing by 3rd February 2021.

4.3 Study objectives

4.3.1 Primary research question

Is the visual acuity score measured by home self-testing with DigiVis comparable to current chart-based clinic methods?

4.3.2 Secondary research question

What is the test-retest variation (repeatability) of the DigiVis system?
What is the ease of use of the app and what features could be modified to improve usability? Study endpoints

4.3.3 Primary endpoint

Clinical testing will cease once at least 250 individuals have been recruited to enable adequate statistical power using Bland-Altman calculations.

4.4 Criteria for Discontinuation

4.4.1 Individual subject

Request of the child or parent to withdraw from study or cease testing.

5 Selection and withdrawal of subjects

5.1 Inclusion Criteria

- Age between 5 and 85 years scheduled to have face to face appointment within two weeks
- Previous recorded visual acuity of +0.8logMAR (6/38) or better in the left eye

5.2 Exclusion Criteria

- Individuals with poor conversant English
- Patients with cognitive impairment
- Patients without suitable digital devices or inability to access the internet

5.3 Assignment and Randomisation Number

The data regarding VA assessment of the left eye only of individuals will be analysed.

5.4 Method of Blinding

The health care assistant or orthoptist undertaking the standard chart-based test will not have knowledge of the DigiVis VA results.

5.5 Emergency Unblinding

Not applicable

5.6 Subject withdrawal criteria

The individual will be withdrawn from the study if it he/she is unable to access the DigiVis website or undertake the test twice.

6 Study procedure and assessments

6.1 Informed consent

Subjects who fulfil the inclusion criteria will undergo the following consent process:

First telephone call:
The researcher will telephone patients prior to their scheduled face to face clinic appointment for an introductory phone call to explain the study and to determine if any exclusion criteria apply.

If interested in the study at this first contact, the individual will be directed to the website and shown how to access the study information and consent form. The researcher will go over both forms with the potential participant. A convenient time for a follow up call at least 30 minutes after the first will be arranged to allow the patients

to consider participation and discuss with friends and family. They will be informed that non-participation will not affect patient care. Access to the website is possible via a password and no personal information is stored in the web-server.

Second telephone call:
If the patient wishes to participate in the study they will be asked to read and electronically consent to undertaking the DigiVis test on the website itself. The researcher will then help them undertake the first VA test and will note down the VA values. The participant will be asked to undertake the test themselves a second time before their scheduled clinic appointment and note down, or take a photo of, their VA score.

Clinic assessment:
At this appointment, as standard practice, chart-based VA will be assessed by a health care professional (who is masked to the result of the DigiVis scores). A researcher will approach the subject during their visits and the formal study consent form will be signed and the usability feed-back documented.

6.2 Personal data

The personal data recorded for the study will be hospital number and date of birth. Study data will include: DigiVis VA score x 2, chart based VA score, usability score and patient comments.

7 Evaluation of Results

Bland Altman statistical methods and calculation of test-retest variability will be calculated after 100 adults and 150 children have been tested.

8 Assessment of Safety

No safety issues are expected during this study because the patients is using their own devices and the clinic element of the study is standard clinical practice.

9 Statistics

9.1 Statistical methods to be employed

Bland-Altman statistics similar to those illustrated in the initial validation studies will be used. In addition test-retest variability and quantative comparison of preference and usability will be analysed. Sample size requirements have been calculated using MedCalc based on the results from the initial validation studies (graph 1&2)

9.2 Number of Subjects to be enrolled

100 adults
150 children aged 5-16years

9.3 Criteria for the termination of the trial

Website issues, although this is unlikely since the website is already running and tested.

9.4 Procedure to account for missing or spurious data

The first DigiVis score will be take down over the telephone at the time of the second call. It is possible that the participant may forget to take the DigiVis a second time or forget to bring the VA score. Where this occurs, the DigiVis test will be repeated in clinic.

9.5 Definition of the end of the trial

Interim data analysis will be undertaken once 100 adults and 150 children have been tested to ensure sufficient statistical power. If insufficient further recruitment may be necessary.

10 Direct access to source data / documents

The investigators will permit trial related monitoring, audits, REC review, regulatory inspections.

11 Ethical considerations – none forseen

11.1 Consent

All patients will freely give their informed consent to participate in the study. A patient may decide to withdraw from the study at any time without prejudice to their future care.
Initial electronic consent will be given by parents at the time of their DigiVis testing. Formal written consent will be collected at the time of their clinic attendance.

11.2 Ethical committee review

The study protocol will be submitted to the appropriate ethical review committee with a letters of approval filed in the study file

11.3 Declaration of Helsinki and ICH Good Clinical Practise

The study will be carried out in conformation with the spirit and the letter of the declaration of Helsinki, and in accord with the ICH Good Clinical Practice Guidelines

12 Data handling and record keeping

Data with personal information will be kept for analysis 6-12 months following study and subsequently pseudonymised and kept as a file on an NHS hospital computer for a period of 15 years by Miss Allen.

13 Financial and Insurance

This trial has been funded by a combination of Addenbrooke's Charitable Trust and Fight Against Blindness charitable funding. The original coding of DigiVis was enabled by an MRC: Confidence in concepts grant in 2016. The investigators will be working within Cambridge University Hospitals NHS Trust and will be indemnified by the NHS.
The VA app will be available free of charge to patients for the foreseeable future.

14 Publications policy

Publications arising from the trial will be authored by Miss Allen. If acceptable accuracy and reliability of DigiVis self-assessment is demonstrated, it is likely that the app will be recommended for the use by the Royal College of Ophthalmologists.

References

1) Bastawrous A, Rono H, Livingstone IA, ey al. The development of a smartphone visual acuity test (Peek acuity) for clinical practice and community based field work. JAMA Ophthalmol. 2015 August;133(8) 930-937