



Near vision assessment in the 21st century

Professor David Thomson describes the latest gadget in his portfolio, sure to be popular with those wanting a flexible and portable battery of test targets

The patient had looked genuinely impressed—and why wouldn't he? I had shown him an image of his fundus, tested him on a computerised fields screener and measured his refractive error using a computerised phoropter while he viewed a computerised test chart.

'I am going to test your near vision now,' I said and rather apologetically handed him a plethora of yellowing near test types, old grey boxes and various dog-eared near tests. 'Is that the best that you can do in the 21st century,' he enquired playfully.

Until recently it was. However, the advent of the iPod Touch and iPhone has changed all that.

The potential of computer displays for presenting visual test stimuli was first recognised almost 50 years ago and since then computer-generated stimuli have been used extensively in vision research. However, it was not until the development of LCD displays that computerised test charts became a viable option for clinical vision assessment. These displays are capable of generating bright, flicker-free, high contrast images which are remarkably immune to ambient lighting conditions and the units are light, neat and have become very affordable.

In the mid 90s, we set about developing the software to exploit this emerging technology to provide eye care professionals with a powerful new set of tools for vision assessment in the consulting room. Test Chart 2000 was launched in January 2000 and proved to be an instant success. To date, over 5,000 consulting rooms in the UK have adopted the system.

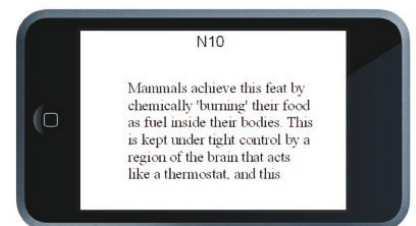
Having seen the benefits for distance vision testing, many clinicians started asking for an equivalent system for near vision assessment to replace the plethora of printed test cards and 'boxes'

TABLE 1 Near vision tests

Test type	Conventional test types with N point size labeling N5-N24	Adult text Children's text
LogMAR reading test	Reading test scaled in a logMAR format	Multiple rows Single row
LogMAR chart	LogMAR test chart scaled for 100cm	British Optotypes Sloan Optotypes Tumbling Es
Task images	Selection of images representing everyday tasks. Each image can be scaled or panned	Maps Newspaper Books Telephone directory
Binocular vision tests	Selection of binocular vision tests. Patient wears red/green visor	Horizontal and vertical fixation disparity Binocularity Random dot stereograms Worth 4 dot test 3D images
Duochrome test	Duochrome for refining near add	Rings Dots Letters
Amsler grids	Wide range of Amsler grids for detecting disturbances of central vision. Patient can 'draw' directly on screen and image can be emailed	Range of sizes and fixation targets Positive and negative contrast
Fixation images	Range of dots, crosses and images for the patient to fixate on while doing the cover test for example. Slideshow mode automatically shows sequence of images	Letters Crosses Cartoon characters
Miscellaneous	Selection of other useful near vision tests	Near point of convergence Astigmatic fan Maddox rod targets Cross cyl add check

conventionally used for the purpose. In early 2002, the development team started work on Near Chart 2000. While it was possible to generate the normal range of near vision tests on a computer screen, the team encountered two practical problems. Firstly, the pixel size on conventional LCD displays limits the minimum text size to approximately N6. Secondly, it is not easy to position a conventional display in the normal reading position. Laptop and tablet PCs were found to be the best solution but neither was ideal.

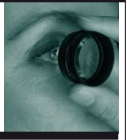
The advent of the iPod Touch and iPhone has largely overcome these limitations. The combination of a high



Conventional test type

resolution screen and versatile interface in an elegant handheld unit opened up exciting new opportunities for near vision testing.

Relishing an excuse to purchase these desirable gadgets 'on the business', we



Test in use

set about developing the software to exploit the new technology and iChart 2000 was born. The software includes a huge range of tests and stimuli which are categorised into four modes:

Near tests: A large selection of tests designed for assessing 'near vision'. The iPod or iPhone is held at a typical reading distance (eg 40cm) for these tests

3m tests: A range of tests and stimuli designed to be viewed from 3m. These may be used within the consulting room or for domiciliary testing

Patient information: A selection of images and a video to help explain various eye conditions to patients

Toolkit: This contains a number of calculators to help with optics and vision-related calculations.

The required mode is selected from the opening menu. A secondary menu is then displayed, showing the groups of tests. The software makes full use of the unique user interface. For example, different tests within each group are selected by 'stroking' the screen horizontally and different configurations are available by simply rotating the unit.

Near tests

The iPod Touch and iPhone can be easily held by the patient at their normal reading distance. The small high resolution screen is ideally suited for displaying a wide range of near vision tests (Figure 2).

iChart2000 contains nine groups of near vision tests described in Table 1.

3m tests

While primarily designed for near vision assessment, the software contains a selection of tests scaled for 3m which may be used in the consulting room, home visits etc.

iChart2000 contains seven groups of 3m tests described in Table 2.

Patient information

The high quality screen of the iPod Touch/iPhone provides an ideal

TABLE 2

3m tests

LogMAR chart	LogMAR test chart scaled for 3m	British Optotypes Sloan Optotypes
Single letter acuity	Crowded single letters -0.2 to 0.6 LogMAR	British Optotypes Tumbling Es
Children's acuity	Crowded Lea symbols -0.2 to 0.6 LogMAR. Ideal for testing young children	Lea symbols
Duochrome test	Duochrome test	Rings Dots Letters
Cross cyl targets	Range of targets to be used during cross-cyl test	Circles Dots
Registration plate	Car registration plates scaled for 3m viewing to assess compliance with legal standard for driving	Front plate Back plate
Fixation images	Range of dots, crosses and images for the patient to fixate on while doing the cover test, for example. Slideshow mode automatically shows sequence of images	Letters Crosses Cartoon characters

medium for showing patients images and videos. Panning around the image, zooming in on significant features and 'drawing' on the image can all be achieved using the touch screen interface. The images are divided into five self explanatory categories: eye diagrams, eye disease, front of eye, retina and videos.

Toolkit

iChart2000 includes five tools/calculators for use by eye care professionals (Table 3).

Summary

At last we have the technology to

consign the drawer full of near vision tests to history.

The reality is that the evidence base supporting the value of many of the tests is wafer thin. With the versatility that comes with a computer-based test, now is probably a good time to re-evaluate and re-design some of the tests that have become part of accepted practice.

Professor David Thomson is former Head of the Optometry Department at City University. iChart 2000 costs £45 and can be downloaded directly from the Apple App Store. See www.thomson-software-solutions.com or call 01707 654689 for further details

TABLE 3

Tools

Visual acuity converter	Tool for converting between LogMAR scores and Snellen and vice versa
LogMAR scorer	Tools to demonstrate how to score a LogMAR chart
Vertex distance calculator	This tool calculates the equivalent power of a spherocylindrical lens on the eye, taking account of the vertex distance. This can be useful when fitting contact lenses for patients with higher prescriptions
Toric contact lens over-refraction calculator	Enter the toric lens Rx and the over-refraction (including cyl) and this tool will work out the Rx of the contact lens which will provide a full correction
Transposition calculator	This calculator transforms a spectacle prescription from a minus cylinder to plus cylinder format or vice versa