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Computer assisted parent's vision screening in children

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ABSTRACT: A total of 70 children who attended the paediatric ophthalmology clinic were entered into this prospective study. These children were aged between 3 and 10 years with a mean age of 5.86 years. The children were selected based on the parents willing to participate in the study. The children had their visual acuity tested by their parent/s using a computer with a 15″ flat panel display set in a clinic room. The parents used Snellen's E-chart with a testing distance set at 3 meters. The orthoptist also measured their visual acuity in the normal fashion. The orthoptist assessment included visual acuity assessment using linear Snellen's chart except when indicated. Children either had their vision assessed first by the orthoptist then parents (39 children) or first by parents and then orthoptist (31 children). All the children apart from 4 (6 eyes out of 140) carried the test successfully. 81% parents found the testing process easy and 77% of the parents found the child co-operation was excellent to good. A total of 24 (17%) amblyopic eyes were detected by the orthoptist testing at the visual acuity level of 6/12 or worse. However, a total of 76 (54%) eyes had a vision of 6/12 or worse by the parents testing. Thus the false referral rate was 37%. All the 24 amblyopic eyes were detected by the parents' testing. If the parents' referral rate is reduced to those who had a vision of 6/18 or worse, then the over-referral rate is reduced to 18%. However, in this case the parents missed 3 amblyopic eyes. All eyes (apart from 3) had worse or similar vision on the parent testing compared to that of the orthoptist.

1 INTRODUCTION

Vision screening has been controversial in the recent ophthalmic literature. Current controversies include does it work? Is it cost effective? And who is best to do it? All are valid questions, which the profession needs to address.

Recent questions raised on the validity of vision screening (Snowdon SK and Stewart-Brown SL, NHS Centre for Reviews and Dissemination, University of York, 1997). With such controversies many societies, even the affluent ones, find it difficult to justify the cost involved in setting up national screening programs.

The screening process normally requires qualified personnel to conduct the testing process. The orthoptist obtained the best result. This is an expensive option for many societies. Additionally, access to the patient can be less than satisfactory, especially in remote countryside in certain countries.

In a previous study Assaf and Dowaidi used Television for parents to the test the vision of their children, which was compared to that of the orthoptist. Nowadays personal computers are widespread and present in many, if not most, homes. With the advent of liquid crystal display (LCD) screens the display contrast and brightness can easily meet the national standards for vision testing devices. We present in this article a method for visual acuity screening in children using personal computer with LCD monitor. The actual testing process is carried out by the parent/s of the child. The result of the testing by the parent/s will be compared with the orthoptic assessment of the child's visual acuity.

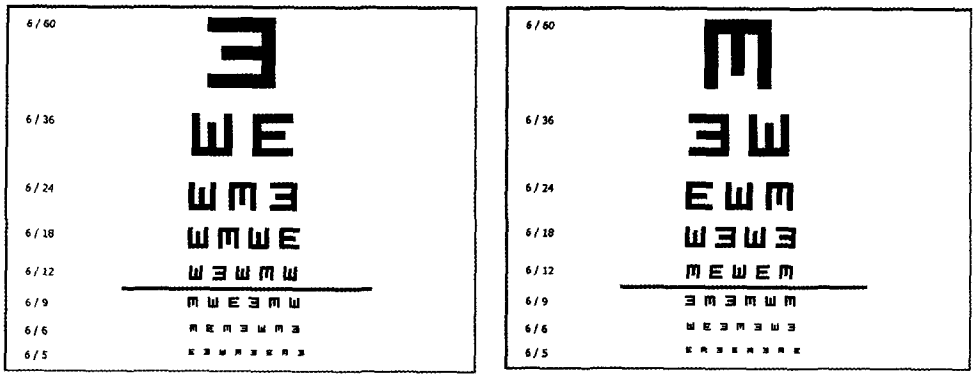

Figure 1. Computerised Snellen E-test set at 3 meters testing distance to run under MS windows environment. The display is refreshed by pressing the "Enter" key with new random letter arrangement. Fresh display was used for testing the second eye. Also there were no similar shapes "E" on the same line if the number of letters =<4.

2 MATERIALS AND METHODS

A Prospective study involving 70 children who attended an orthoptic clinic over a 6 months period (September 03 to February 04) at Milton Keynes Hospital Ophthalmology Department. Before the start of the study a 2 weeks trial period involving 10 children was carried out to find out and correct any possible pitfalls of difficulties in the testing process or instructions given to the parents. These 10 children were not included in the study.

Children were randomly tested first either by parent then orthoptist (31 children) or by the orthoptist then parent (39 children). Both the parent and Doctor conducting the study signed a consent form for the study.

The orthoptist used the appropriate age related vision testing method, which was one of the following: LogMAR Kay pictures, linear Sheridan Gardiner or linear Snellen. Most had linear Snellen testing.

The parent/s on the other hand used linear E-chart Snellen test computer software to work under Microsoft Windows (author AA) and set for a 3 meters testing distance (figure1). The software is installed on the computer placed on a side room in the clinic. The display screen was Flat 15″ monitor.

Instructions explaining the test were given to the parent plus E-shape for the child to point with. The parent and the child were left in the room to conduct test. The parent filled a form after carrying out the test.

3 RESULTS

3.1 *Children*

A total of 70 children were tested. The sex ratio was 39 females to 31 males. The age range of the selected children was 3–10 years. The average age was 5.87 years.

3.2 *Visual acuity*

All the children apart from 4 (6 eyes out of 140) carried out the test successfully. Table 1 shows the visual acuity testing results by both parents and orthoptist.

At visual acuity level of 6/12, the parents detected all the 24 amblyopic eyes as diagnosed by the orthoptist (figure 2). However, the false referral (over-referral) rate is 37% (table 2).

Table 1. Amblyopia rate at 6/12 level for orthoptist and parents.

	Orthoptist		Parent	
	Right eye	Left eye	Right eye	Left eye
6/12 or worse	11 (16%)	13 (19%)	39 (56%)	37 (53%)
6/9 or better	59 (84%)	57 (81%)	29 (41%)	29 (41%)
Total amblyopic eyes	24 eyes (17%)	24 eyes (17%)	76 eyes (54%)	76 eyes (54%)
Not possible/not done	–	–	2 (3%)	4 (6%)

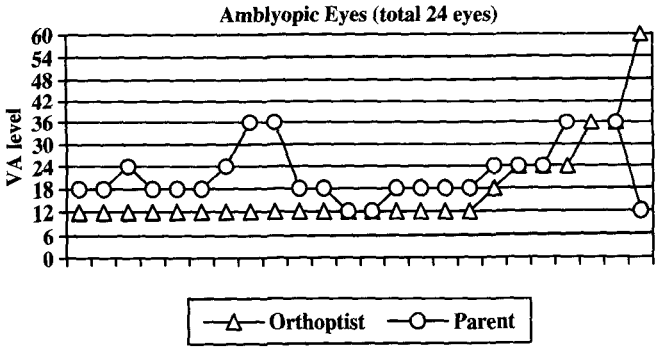

Figure 2. The visual acuity level in 24 amblyopic eye as found by the orthoptist versus parent testing. Notice the parent testing is lower than the orthoptist in all cases except one.

Table 2. Over-referral at acuity levels of 6/12 (and 6/18) with parent testing.

	Right eye	Left eye
Amblyopic	11/70 (16%) (non missed at 6/12) (at 6/18 = 0 missed)	13/70 (19%) (non missed at 6/12) (at 6/18 = 3 missed)
Over-referral	28/70 (40%) (at 6/18 = 11 (16%))	24/70 (34%) (at 6/18 = 16 (20%))
Total	39/70 (56%)	37/70 (53%)

Among the 140 eyes, 3 eyes (2 children) had a better vision with parents testing, but was within one line of that of the orthoptist. All the remaining eyes had worse or similar vision on the parent testing compared to that of the orthoptist.

Child co-operation was excellent to good in 77% of cases. In response to a questionnaire in regard to the ease of the testing process, 81% parents found the testing process easy.

4 DISCUSSION

Visual screening of children is an important topic. On the other hand, controversies exist in regard of the application of such screening program. The main objection to such an application has been the significant cost involved. This cost of universal visual screening is currently prohibiting in many developed countries, is even more so in most developing countries.

Computers are becoming widespread and available increasingly in many home. The current LCD computer monitors offer excellent contrast and brightness can easily meet the national standards

for vision testing devices. Thus computers with LCD monitors have the potential of being an excellent home screening tool for visual acuity testing both eyes in adult and children.

In our method of study we used linear Snellen E-test set at 3 meters. The 3 meters distance is appropriate to testing children as well as the dimension of most homes. The E-test was chosen for its familiarity and universal use both for English and non-English speaking adults and children as well as being available free. The old limitation of having 4 possibilities has been overcome by the ability to refresh the display with new random letter arrangements every time. This is used for testing the second eye and whenever guessing is suspected. We felt Snellen's test format would be less confusing and more familiar to parents than LogMAR since they would have been tested with Snellen charts or seen them in their GP or optometrist practices.

In this around 81% thought the child co-operation with the test was excellent or good and 77% indicated that the testing process was easy. This test is not suitable for children 3 years old or under.

Most of the children completed the test (94%). If the fail level for the orthoptic testing was 6/12 and for the parents testing was 6/12 then the amblyopia detection rate was 100% (24/24). However, the false referral rate was 37%. If the parents fail rate was increased to 6/18 then the amblyopia detection rate increased to 87.5% (21/24). At this visual acuity level the false referral rate was reduced to 18%. However, in this case the parents missed 3 amblyopic eyes detected by the orthoptist testing. Among the 3 eyes missed, 2 had a vision of 6/12 by both parents and orthoptist testing and a 3rd eye had 6/60 vision but found to have 6/12 vision (in both eyes) on the parent testing. This child was examined first by the orthoptist who recorded that he attempted to cheat with on testing his amblyopic eye. Thus he appeared to have cheated with his parent testing since his vision in the amblyopic eye was 6/12, similar to that of the good eye. All the 24 amblyopic eyes had scored similar or worse vision on the parents testing compared to that of orthoptist, apart from this child who appeared to have cheated on testing his amblyopic eye (figure 2).

At both levels the over-referral rate using visual acuity testing at school by community nursing revealed 43% over-referral (Yang and Dole). In another study this was 41% (Ingarm).

In almost all instances (131/134 of the eyes tested) the visual acuity results obtained by the parents were similar or higher (worse vision) when compared to that of the orthoptist. Perhaps repeating the test at home could reduce the over-referral. Moreover, testing in the home environment where the child and parent are in familiar surroundings and not pressed with time might produce more accurate results.

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