

## **Comparative Evaluation of Oculokinetic Perimetry and Henson CFS 2000 in Detecting Glaucomatous Field Defects.**

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### **SUMMARY**

OculoKinetic perimetry (OKP) is a visual field test developed for use in situations where conventional perimetry is not convenient or readily available. The test is inexpensive fully portable and simple to perform and can therefore supplement conventional perimetry in non-ophthalmic clinics, the community, by the bedsides and in the patients home. OKP uses controlled movements of the patient's eye to position a static test stimulus in the visual field. The test chart consists of a white tangent screen with 26 numbered fixation points located eccentrically at strategic points in relation to a central black spot, which is the test stimulus. As the patient looks at each number in turn, the central stimulus automatically moves through corresponding points in the visual field.

Defects are recorded on a miniature chart by crossing out the numbers that are associated with the disappearance of the test stimulus. In this study we have shown that in 80 eyes of 43 glaucomatous patients, the test is efficient and reliable when compared with Henson CFS2000 field test. The results were comparable in 88.75% of the eyes and the specificity relatively high at 95%. OKP appears to be a useful tool for glaucoma screening in the community.

**KEYWORDS:** *Oculokinetic Perimetry, Glaucoma, Screening, Henson CFS2000, Visual field.*

### **INTRODUCTION**

Visual field examination plays an invaluable role in the diagnosis and management of glaucoma.

Population-based studies have shown that half of the patients with reproducible field loss are unaware they have the disease.<sup>1</sup>

Unfortunately, conventional perimetry is rarely performed as part of primary screening programme for glaucoma outside ophthalmic clinics.<sup>2</sup> This is as a result of the large amount of time, expensive equipment, and expertise required which seem impractical in such situations.<sup>3,4</sup>

The ideal perimeter should be reliable, provide precise detection and assessment of field loss and be available at a reasonable cost.

OKP is a novel method which promises to meet all these requirements.<sup>4</sup> It is a visual field test developed by Damato for use by both medical and untrained personnel in situations where conventional methods are

impractical.<sup>5,6</sup>

It is uniquely suited to screening for glaucoma because it is simple, portable and inexpensive to the extent that patient can examine themselves without assistance using disposable paper chart.

OKP uses controlled movements of the patient's eye to position a static test stimulus in the visual field hence its name because it is the patient's eye moving rather than the stimulus.<sup>7,8</sup>

The chart is a multifixational campimeter since it uses many numbers to alter the direction of gaze and thereby position the stimulus at known locations in the visual field.<sup>6</sup> In the hand held version, a central target is surrounded by 26 fixation numbers such that when the patient views a number the target is located in the visual field within 15° of fixation.<sup>9,10</sup> In contrast to conventional tests which use a light stimulus on a dark background, the stimulus is black on a white background because it reduces the need for standardized lighting conditions.

Henson CFS2000 is a static multiple stimulus suprathreshold gradients adapted instrument that operates in a threshold-related mode. It screens the central 25° of the visual field.<sup>3,11,12</sup> A study by Sponsel et al reported a high sensitivity of 84% and specificity of 100%.<sup>13</sup>

The aims of the present study are:

- (i) To demonstrate the effectiveness of OKP in known glaucomatous field loss and compare the results with those obtained by Henson CFS2000 using the 66 points.
- (ii) To determine the sensitivity and specificity of OKP screening chart.
- (iii) To identify which points are best for screening on the OKP and ways of modifying it.

### PATIENTS, MATERIALS AND METHODS

Forty-three consecutive patients attending the glaucoma clinic of the Bristol Eye Hospital England were selected for this study, and forty control eyes from age matched members of staff, friends and relations accompanying the patients. Informed consent was obtained from the patients.

Exclusion criteria from the study were:

- (i) Best corrected visual acuity less than 6/12.
- (ii) Severely constricted visual field or less than 5 from fixation.
- (iii) Previous history of ocular diseases in control eyes.
- (iv) Frail and weak individuals.

Two groups of patients were studied:

- (a) Patients with reproducible defects consistent with glaucoma on Henson CFS2000 and glaucomatous optic nerve changes with or without raised intracocular pressure.
- (b) Control group with no previous history of eye diseases or family history of glaucoma.

All patients completed the Henson and OKP tests on the same day before formal ophthalmological assessment. The test to be performed was chosen at random and an interval of ten minutes allowed between the tests.

All OKP tests were performed in a consulting room

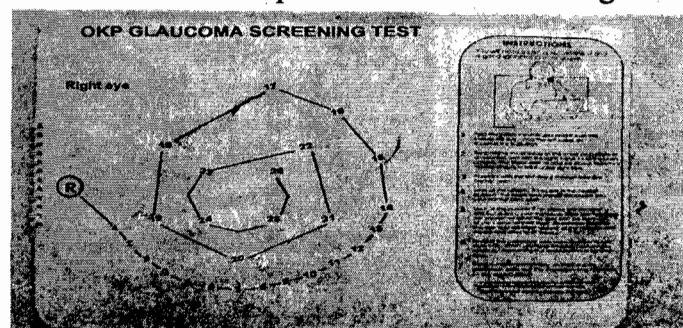


FIGURE 1: Prototype of the OKP glaucoma screener

illuminated by (2) 200 watts fluorescent tubes with the light reflected from the chart measured by lightmeter by lightmeter being 140 lux.<sup>10</sup>

The prototype of the OKP glaucoma screener consisted of a double sided card with a chart on either side for the left and right eye respectively. (Fig1).

Each chart consisted of a white tangent screen with a central black spot of 2mm surrounded by 26 fixation numbers in light blue colour to distinguish them from the test stimulus. These number were located so as to test central field up to 12.5° superiorly, 15° nasally and inferior. Patients had their



FIGURE 2: A patient using the OKP

visual acuities measured using a standard Snellen's chart with distance correction plus or minus pinhole if required. OKP was performed after a brief verbal introduction with patient seated at 40cm from the chart which is held by the patient and supported on the examination table (Fig. II). Each eye was tested at a time with the other eye occluded with a patch attached to the chart. Reading corrections were worn when necessary. Right eye was always tested first. After the inbuilt blind spot check, patients were asked to follow round the spiral of numbers from 1 to 26 and to identify the numbers that made the spot disappear taking about 2 secs. per numbers. Patients with doubtful results at first examination were brought back for retesting. Numbers inducing a miss on 2 spirals were considered as absolute defects and those seen vaguely were labelled as relative defects. The result was considered positive if one or more points were missed<sup>9,10</sup>

For standardization, Henson CFS2000 was performed at the minimum threshold level using patterns of 2,3,4, suprathreshold point within central 25° of visual field (66 points in all with extension to 132 when necessary).

Insensitivity to a stimulus at any points is retested at progressively brighter light intensities 0.5, 0.8, and 1.2 decibels brighter than the initial testing level.

The results of OKP were compared by an independent ophthalmologist. Three grades of correlation were used.<sup>14</sup>

- (i) Grade I Identical results.
- (ii) Grade II Visual field defects similar in location but different in extent and degree
- (iii) Grade III No correlation.

In order to assess the retinal sensitivity at failed points on the OKP test, the Henson CFS2000 interpretation chart with 66 threshold points was enlarged by 1.5 (in order to correct for the disparity in sizes of the two charts) and superimposed on OKP interpretation chart location at 12.5° of eccentricity in the superior field and at 15° inferonasally and nasally.

Data analysis: The sensitivity and specificity were compared using the chi-square test and the P value less than 0.05 (representing 95% confidence interval) was regarded as statistically significant.

**RESULTS**

There were 80 eyes from 43 patients attending the Glaucoma Clinic (18 males/25 females, Mean age 70.7 years; SD9.4) and 40 control eyes from 20 accompanying person and members of staff (8males/12 females; Mean age 58.5 year; SD8.7). Table 1

**TABLE 1:**

**Demographic Characteristics**

Age Group	Glaucoma	Control
40 - 49	2	3
50 - 56	5	8
60 - 69	12	7
70 -79	15	1
80 - 89	9	1
<b>Total</b>	<b>43</b>	<b>20</b>

OKP was accurate in detecting 71 eyes out of 80 eyes with glaucomatous field defects and inaccurate in 2 eyes out of 40 control eyes, giving an overall sensitivity for the screening method of 88.7% and specificity of 95%, and efficiency of 91.6% (Chisquare value 1.29<p< 0.05). Hence there is no significant difference between the two groups in terms of reliability of OKP Table 2. In terms of individuals OKP was accurate in 86% (37 patients) with glaucomatous defects in their worse eye and 90% (18 individuals) of controls.

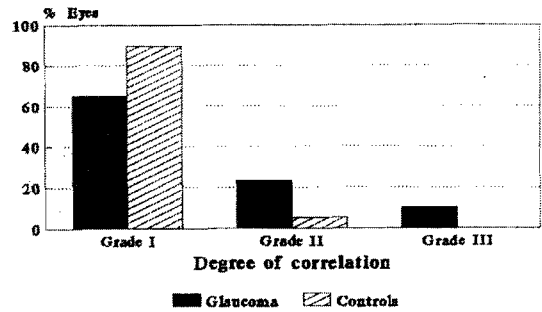
**TABLE 2**

**OKP Screener results in Glaucoma and control**

Outcome	Glaucoma	Control	Total
Accurate fields	71	38	109
Inaccurate fields	9	2	11
<b>Total</b>	<b>80</b>	<b>40</b>	<b>120</b>

The degree of correlation between OKP and CFS2000 in glaucoma patient and controls is shown in Fig III whilst Table 3 and 4 show the degree of correlation in relation to the severity of the field loss in glaucoma patients.

**Results of O.K.P. Screening in Control and Glaucomatous eyes**



**Fig III**

**FIGURE 3: OKP results in controls and glaucomatous eyes**

**TABLE 3**

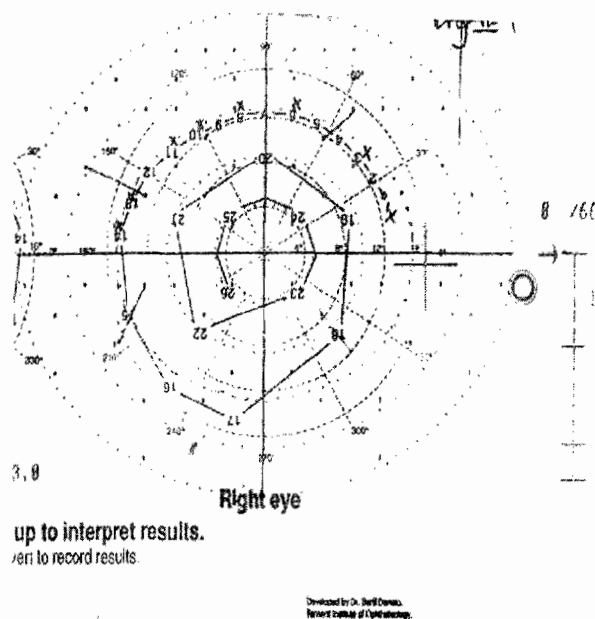
**Degree of correlation between OKP and CFS2000 in 80 eyes of 43 glaucoma patients.**

Degree of Correlation	Extent of field loss			Total No. of eyes
	Mild	Moderate	Severe	
Grade I (fields identical)	40	4	8	52
Grade II (Defects in same area but Different in intensity)	9	7	3	19
Grade III (Not identical)	5	2	2	9
<b>Total</b>	<b>54</b>	<b>13</b>	<b>13</b>	<b>80</b>

**TABLE 4****Degree of correlation of OKP in terms of individuals in glaucoma patients.**

Degree of correlation	Extent of field			
	Mild	Moderate	Severe	Total
Grade I	16	4	5	25
Grade II	3	6	3	12
Grade III	3	2	1	6
Total	22	12	9	43

Out of the seventeen points (i.e. from 1-17) identified between 12.5° and 15, points 1,3,6,8,10,11, and 14 were considered to fall on or within 1° of individual Henson threshold points. The threshold equivalents of point 4, 13, and 15 were taken as the mean of two adjacent points as shown in Fig IV. Of the 43 glaucoma patients, 21 individuals had moderate to severe defects (see Table 4). Eighteen patients (85.7%) with moderate/severe defects in their worse eye had relative absolute scotoma at the ten points identified.

**FIGURE 4: Interpretation of OKP result****DISCUSSION**

The results show that OKP if performed correctly can produce similar results comparable to those obtained with conventional perimetry as already proven by studies done by other workers in the past.<sup>6,9,16,17</sup>

Glaucoma is the second leading cause of blindness worldwide with 6.8 million people suffering from the disease and 6.7 million already blind.<sup>20</sup> Undetected

glaucoma accounts for approximately 50% of cases in population based studies<sup>10,19,20,21</sup>. To detect a maximum number of cases when screening for glaucoma, an assessment of the visual field is desirable. With the cost of standard methods of glaucoma screening including computerized perimetry prohibitive in most developing countries, glaucoma remains undiagnosed till late.<sup>22</sup>

Therefore there is still a need for a simple yet efficient visual field test that could be performed rapidly and conveniently when screening for glaucoma. The OKP screener seems to satisfy all the above conditions, by providing simple, rapid, inexpensive and reproducible method of central field assessment. Its effectiveness depends on its sensitivity and specificity which in our study was found to be 88.7% and 95% respectively. It would appear from our study results that this method of screening has slight chance of missing visual field defect. The relatively high specificity indicate that only about 5% of normal fields will be identified as false positive and will have to be examined unnecessarily by more sophisticated visual field equipment. This result compared favourably with Damato's study with specificity 92% and sensitivity. 81%.<sup>9</sup>

Sponsel and his colleagues also reported sensitivity of 92% in moderate to severe defects and 3.6% false positive rate.<sup>13</sup> Our result compared favourably with the studies done by Greve and Chisholm<sup>23</sup> and Christoffersen.<sup>24</sup>

It is interesting to note that an OKP screening chart testing only 10 points could detect over 80% of eyes with glaucomatous visual field loss. However the sensitivity and specificity of the tests in the community may not equal that calculated in a group of clinic patients who are experienced at field testing and who are being tested under controlled conditions. Test conditions that influence OKP screening include the form of near correction used (small aperture reading glasses, bifocals with small near segments or varifocals are unsuitable, the background lighting (reduced illumination reflections and focal irregularities may cause false positives) and poor adherence to the test protocol.

The methods is not time consuming. On the average OKP required one minute to examine each eye. Because of its low cost and simplicity, OKP could be useful in Ophthalmic clinics in developing countries, in non ophthalmic clinics and community outreaches. The OKP glaucoma screener could be used by Primary Health Care workers in the community as an adjunct to tonometry and ophthalmos-copy,

this may help the health care workers to decide whether or not to refer an individual with suspicious discs or borderline IOP for specialist opinion and enhance the detection of normal tension glaucoma. Its use by Community Eye Health workers in developing countries will help overcome the weakness of glaucoma screening by tonometry.<sup>25</sup> Finally reliable glaucoma suspect under the care of the ophthalmologist could use the chart for self examination at home thereby allowing the frequency of clinic visits to be reduced.

## CONCLUSION

This study has shown that OKP screener is a rapid, efficient and economic way of carrying out clinical research screening of the visual fields in glaucoma, but by no means a convenient substitute for more reliable conventional perimetry.

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