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VISION TESTING OF ADULT DRIVERS WITH A VISION SCREENER

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Abstract:

This study uses an automated vision screener to examine the incidence of a range of ocular dysfunctions in a group of adult drivers. The instrument enables screening of a range of ocular functions including visual acuity, heterophoria, fusion, stereopsis, colour vision and visual field. It was found that 20% of those screened had unacceptable results in one or more area of ocular function.

Key words: *Vision Screener, ocular function, ocular dysfunction.*

INTRODUCTION

In driving, as in many tasks, a range of visual factors occur. The most essential is visual acuity. Other visual functions are assessed in some countries when determining visual standards of drivers.[1-3] These factors include the detection and measurement of heterophoria, binocularity, stereopsis, colour vision, night vision and visual fields.

'Vision Screeners' have been used to assess the visual standards of drivers in many countries. Unger[4] who reviewed the tests available for screening drivers vision found that vision screeners were used by licensing authorities in "The United States of America, in Canada, Sweden and Switzerland and in one area of Germany".

The vision screener is a small, portable instrument designed to screen a range of ocular functions. In a few minutes a variety of monocular and binocular ocular functions can be assessed both with and without glasses. These screening devices enable a non-professional to screen a large population under standard conditions, in a short period of time.

Unger[4] further reported that one of the most widely used vision screeners is the Keystone VS II Vision Screener manufactured by the Keystone View Company in America. This particular model provides for the screening of the following ocular functions:

- visual acuity, right, left and both eyes together
- heterophoria, horizontal and vertical
- fusional ability
- stereopsis
- colour vision

Except for colour vision, each of these functions can be tested at near and far (6 m) distances. It also tests horizontal peripheral visual fields.

Currently in Victoria, the minimal visual standards for drivers of a private vehicle are 6/12 in the better eye and 6/60 in the worse eye. Basic

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recognition of the colours used for traffic lights is another requirement. The assessment of vision is performed by Vic Roads personnel using a Snellen's or modified chart. Colour recognition is tested by asking applicants to identify a variety of coloured materials. It was decided to retest driver applicants at the Vic Roads centres using an automated vision screener.

The results would provide information on:

1. The suitability of using a Vision Screener to test vision of drivers.
2. The visual status of a large population of adult eyes.
3. The incidence of a range of ocular funtions as detected by a Vision Screener.

It should be noted that this study does not attempt to evaluate the reliability or suitability of the automated vision screener as a screening tool, but uses the device as a recognised method of screening a population. Further studies could be undertaken to compare the results found by an automated vision screener and an orthoptist's conventional screening assessment.

METHOD

Subjects

The candidates screened on the Vision Screener were volunteers who had passed the Vic Roads eye sight test as part of their driver licence or learner permit test.

Apparatus

A Keystone View VS II Vision Screener was used to screen the candidates. The instrument measures 25 cm wide, 40 cm long and 16 cm high and houses eight stereoscopic targets which are illuminated internally by a series of miniature lamps. The stereoscopic targets test not only vision but also if the eyes are working together. This is a major advantage of the instrument as the results are indicative of how the eyes are used by the individual in his everyday activities such as driving. A bifocal lens system provides for testing at far (6 m) and near (40 cm) test distances. The candidate's forehead is rested against the headrest which has an optical sensor to ensure that the candidate's head is properly positioned in the instrument. All tests are operated under push button control by the tester.

The screener has its own internal light source ensuring identical operating conditions at all times. The test cards can only be viewed from the correct testing distance as the targets are enclosed within the unit and cannot be viewed prior to testing. Standardised instructions and recording forms further ensure uniformity of testing across large populations.

Procedure

The automated vision screener was operated by a single tester at three of the Vic Roads Driver Licensing Centres. These centres were able to provide a suitable working area for the instrument and operator, as well as large numbers of candidates. The testing was performed between April and July 1991.

Candidates who had passed the Vic Roads eye sight test wearing their corrective lenses performed the tests on the vision screener with their lenses. Conversely those who had elected to do the Vic Roads test without their lenses, performed the tests on the screener without their lenses. Testing took 3-4 minutes and data collected was recorded on a score sheet.

RESULTS AND DISCUSSION

Seven hundred and twenty seven candidates were assessed on the vision screener. Those assessed were aged between 16 and 52 years with 98.3% being under the age of 40.

Vision

The vision of each eye and with both eyes open was assessed on the screener for both 6 m and near (40 cm) distances. It was found that 566 candidates (77.8%) demonstrated 6/6 in the right eye, while 572 candidates (78.7%) demonstrated 6/6 in the left eye. When both eyes were tested together 651 (89.5%) demonstrated 6/6. During the vision test, 14 candidates (2%) exhibited suppression — 6 of the right eye and 8 of the left eye.

When assessing near vision it was found that 635 candidates (87.4%) had 6/6 equivalent in the right eye and 626 candidates (86.1%) in the left eye. With both eyes together, 687 candidates (94.5%) obtained this level.

TABLE 1
Number and types of phorias

	Far		Near	
Horizontal phoria	eso	76	eso	85
	orthophoric	272	orthophoric	222
	exo	367	exo	408
	suppression	12*	suppression	12*
	eso > 6△	2*	eso > 4△	6*
	exo > 4△	6*	exo > 6△	11*
	FAR		NEAR	
Vertical phoria	R/L	8	14	
	orthophoric	354	362	
	L/R	353	339	
	SUPP	12*	12*	
	>1△R/L	0	1*	
	>1△L/R	20*	13*	

* Unsatisfactory

Heterophoria

The normal limits for heterophoria, according to the manufacturer, were not more than 6 prism dioptres esophoria or 4 prism dioptres exophoria for distance, and not more than 4 prism dioptres esophoria or 6 prism dioptres exophoria for near. For hyperphorias, not more than 1 prism dioptre of right or left hyperphoria was acceptable.

The majority of candidates 707 (97.2%) were within normal limits for horizontal heterophoria and 695 candidates (95.6%) for vertical heterophoria at far. For near, 698 candidates (96%) were within normal limits for horizontal heterophoria and 701 candidates (96.4%) for vertical heterophoria. Table 1 shows the numbers and types of heterophorias detected on the vision screener. It was not possible to assess the heterophorias in 12 candidates as they exhibited suppression.

Fusional Ability

Fusional ability was demonstrated by 701 candidates (96.4%) for far and by 703 candidates (96.7%) for near.

Heterophoria and Fusion

As the control of a heterophoria is dependant on good fusional ability it was decided to examine the relationship between these two as assessed on the vision screener.

Of the 30 candidates (4.1% of total) who exhibited unacceptable phorias, 6 of these candidates had an unacceptable level of fusion. The manufacturers of the Keystone Vision Screener recommend a clinical eye examination for these people.

It is conceivable that problems in these two areas of ocular function could intefere with one's visual ability during driving.

TABLE 2
Other test results for candidates with unacceptable levels of stereopsis
FAR 123 candidates (17%) had unacceptable stereopsis
NEAR 85 candidates (12%) had unacceptable stereopsis

	Far	Near
Suppression	15	14
Visual difficulties	73	46
Failed distance vision test	4	—
Problem phorias	4	—
Problem phorias and/or problematic fusion	—	7
No obvious anomaly	27	18
	123	85

Stereopsis

Stereopsis for far was acceptable in 604 candidates (83.1%) and for near in 642 candidates (88.3%).

For those candidates with unacceptable levels of stereopsis, their results to other tests are shown in Table 2. It is possible that their poor stereopsis is a consequence of the other unacceptable results or is a consequence of the sensitivity of the stereopsis test within the screening device.

Colour

The vision screener claims to detect severe (red/green) and mild (blue/violet) deficiencies in colour discrimination. Table 3 shows the candidates colour screening results. Fifty candidates (6.9%) had difficulties with the colour discrimination task.

Horizontal Peripheral Vision

The vision screener assesses horizontal peripheral

TABLE 3
Results of colour discrimination screening

	Red/Green	Blue/Violet
Acceptable	714 (98.2%)	690 (94.9%)
Borderline	5 (0.6%)	28 (3.9%)
Unacceptable	8 (1.2%)	9 (1.2%)

visual fields up to 85° on the temporal side and 45° on the nasal side. All candidates exhibited complete horizontal peripheral visual fields.

Suppression

Suppression was detected during one or more tests in 16 candidates (2.2%). In this group 4 people (25%) had unacceptable levels of fusion. All candidates with suppression had unacceptable levels of stereopsis. There was no detectable stereopsis for far and near in 12 candidates (75%).

Overview of Results

A review of results for all candidates to each test of ocular function reveal that 148 candidates (20.4%) had unacceptable results in one or more areas. Of these, 102 candidates (14%) had unacceptable results in two or more areas. Furthermore, 30 candidates (4.1%) had unacceptable results in three or more areas.

These figures reinforce the desiribility of examining a wider range of ocular functions of drivers, thus ensuring that drivers have compotent visual skills suited to the task of driving.

CONCLUSIONS

The results to testing with an automatic vision screener support the following conclusions:

1. That the Vision Screener was able to provide consistent and reliable testing of a large range of ocular functions in only a few minutes.
2. That the use of the Vision Screener could be justified when screening a large population and could be applied to the vision screening of drivers.
3. That the Vision Screener can provide information about the ocular status of a large population of adult eyes.
4. That the Vision Screener was able to detect a range of visual dysfunctions in those tested. In total 148 (20.4%) of those screened exhibited an unacceptable result to one or more test.

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