ASSESSMENT OF VISUAL FUNCTIONS IN MOTORWAY DRIVERS

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ABSTRACT

OBJECTIVE: *To assess the visual functions of motorway drivers who drive regularly on the motorway in Lahore in order to avoid road accidents.*

METHOD: *A cross-sectional study has been done to assess the visual functions of motorway drivers using a proforma study design. Data of 70 drivers were taken using different charts and proforma. Visual acuity was recorded on the Snellen chart, colour vision by Ishihara chart, contrast sensitivity by Pelli Robson Chart, and visual field by Confrontation method. Glare sensitivity was excluded.*

RESULTS: *70 drivers were enrolled in this study. 30 to 60 years aged drivers were included. All the participants were males. Data was collected by using proforma and performing practical tests. The mean age was 44 years and the mean driving experience was 9 years. 20 (28.6%) drivers had defected visual acuity, 16 (22.8%) drivers had abnormal contrast sensitivity, 22 (31.4%) drivers had defected colour vision, 7 (10%) drivers had defected visual field. 5 (7.1%) drivers had positive hypertension history and 5 (7.1%) drivers were diabetic. History of diabetes and hypertension were recorded as these have significant effects on human eyes.*

CONCLUSION: *Visual functions are more defected in older drivers than in younger drivers. Impairment of visual acuity and visual field are the major cause of problem with minor effect of other components of visual functions.*

KEYWORDS: *Motorway drivers, Visual functions, Diabetes mellitus, Hypertension, Accidents, Awareness, Medical attention.*

INTRODUCTION

Visual function describes how well the eyes and basic visual system can detect a target stimulus. A comprehensive assessment of vision-related skills should look at the visual performance (performance of parts of the visual system) and operational perspective (work-related skill).[1] There are five basic components of visual functions.

- Visual Acuity (VA).
- Contrast Sensitivity (CS).
- Colour Vision (CV).
- Visual Field (VF).
- Glare Sensitivity (GS).

VA measures the level of quality information that we can be obtained or identify and remains the most significant step in visual observation in all studies and clinical trials. An old method of measuring VA in subjects that can describe what they see with VA charts (such as the log-Mar acuity chart) made up of very different black targets (i.e. optotypes-like characters) presented in a white background.[2,3] VA measures the least sized target that we can recognize. The testing procedure is generally done on a high white contrast background containing black targets. Nevertheless, our natural environment consists of targets at numerous intensities, sizes, and shapes.

Contrast (usually the difference between the brightest and darkest features in a picture divided by the mean intensity) counts variations in image intensity, whereas spatial frequency counts changes in size. The reciprocal of the lowest luminance difference necessary for target recognition is contrast sensitivity, which is significantly dependent on spatial frequency. The Contrast

Sensitivity Function (CSF) describes the relationship between contrast sensitivity and spatial frequency and. It's worth noting that CS has been demonstrated to be a stronger predictor of performances on activities of daily living and the identification of real things than VA.[4]

Colour, on the other hand, is a significant signal in the nature and helps in the identification of any object.[5] The term "trichromatic" refers to the fact that human colour vision is based on three types of cone photoreceptors in the retina. These colour sensitive cones have overlapping spectrum sensitivities peaking at short (S), medium (M), and long (L), wavelengths, corresponding to blue, green, and red cones, respectively, based on the colour appearance of light at each wavelength.[6]

When the eyes focus on a central point, the visual field refers to the whole area in which targets can be viewed including peripheral vision. Visual field assessment is also the most important function in drivers. Peripheral vision plays a major role in environmental analysis, especially in driving. In this field, the amount and quality of visual information that depends on the size of the viewing area is important for safety. This field can be defined as the area around the site where information can be seen and presented during visual interpretation.[7]

Glare can be defined as the sensation that results when a bright light shines before a person's eyes, deteriorating his vision for a few seconds. This is normal which occurs during night driving due to the use of high beam lamps Time taken to recover from glare varies from person to person depending on their age as well conditions of view. Glare increases the response time for drivers, thus affecting their safety negatively.[8]

Driving is a major way for transportation in the whole world. It helps the performances of daily aspects and enhances the quality of life. Vision is undoubtedly an important part of driving. Drivers with certain eye conditions reduce their exposure to driving and limit their driving to safer times, however, there is early evidence that some eye conditions increase the risk of a crash. VA is only slightly related to road traffic crashes, while the visual field seems to play a more important role. Defected colour-vision and contrast deficiency are not serious threats to safe driving.[9]

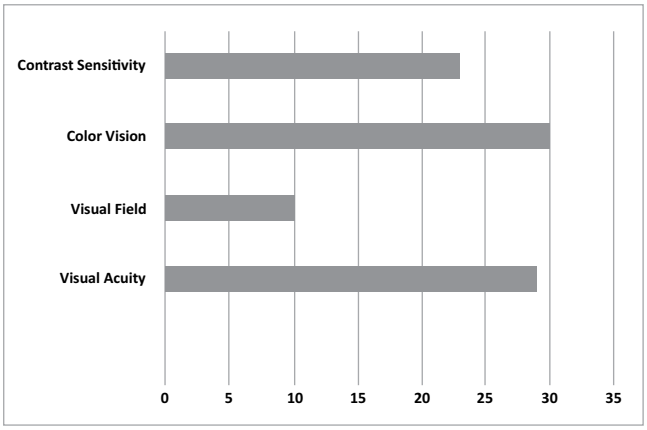
MATERIAL AND METHODS

A cross-sectional study was done to assess the visual functions of motorway drivers using a self designed, pre-tested proforma. Data of 70 drivers were taken using different charts and proforma. Visual acuity was recorded on the Snellen chart, colour vision by Ishihara chart, contrast sensitivity by Pelli Robson Chart, and visual field by Confrontation method. Glare sensitivity was excluded.

RESULTS

Totally 70 drivers were examined. The age limit was 30 to 60 years and the mean age was 44 years. The maximum driving experience was 20 years and the minimum driving experience was 2 years. The mean driving experience of drivers was 9 years. Twenty (28.6%) drivers had defected visual acuity, Sixteen (22.8%) drivers had abnormal contrast sensitivity, 22 (31.4%) drivers had defected colour vision, 7 (10%) drivers had defected visual field.(Fig 1).5 (7.1%) drivers had positive hypertension history and 5 (7.1%) drivers were diabetic. History of diabetes and hypertension were recorded as these have significant effects on human eyes. Out of 70 drivers, 17 (24.3%) were using distant corrective glasses.

Figure-1: Percentage of the defected component of visual function.



DISCUSSION

All the participants were males and this finding is expected because road driving is a special and careful responsibility in Pakistan. The average age of 44 years is in line with the active response team as driving for commercial purposes is a demanding task. The importance of young age compared to safe driving cannot be overemphasized. With age there is a decrease in sensory functions. According to reports, older drivers had more accidents per kilometer than

younger drivers.[10] There is a gradual decrease in sensory vision after the age of fifty years resulting in reduction of VA, CS, CV and VF.

Young drivers tend to drive at high speeds, while older ones are more likely to be easily distracted or unable to recognize and respond to potentially critical conditions. All of these features are not discernible. The state of the human body, sensitivity and slowing response with aging, play a major role in safe driving.[11] Road safety can be improved by understanding how age-related changes affect driving and functional capabilities of drivers.[12]

We examined 70 drivers in this study. Mean age was 44 years and mean driving experience was 9 years. Visual acuity has significant role in safe driving than other components of visual functions. 20 (28.6%) drivers had defected visual acuity.

Visual acuity is a very simple visual parameter and, therefore, measured widely. It is often regarded as gross measurement of vision. Its limit is that it only explores the area of central macula. For eye problems such as poor eyesight or focusing problems, it is considered enough. In retinal diseases that are more common in adults, VA is only partial measurement as perifoveal function cannot be predicted only by central foveal function.[13]

In our study 16 (22.8%) drivers had abnormal contrast sensitivity. Contrast sensitivity may be defected due to visual problems such as cataract. Defected contrast sensitivity may also result from retinal diseases (glaucoma, age-related macular degeneration, retinitis pigmentosa etc.) that are common significantly in the old age people. If defected contrast sensitivity is caused by visual problems such as scatter, defocus both VA and CS will be affected.

Twenty two (31.4%) drivers in our study had defected colour vision which is examined during the survey. Defected colour vision can be a risk to safe driving only as drivers with colour vision problems may have problems seeing traffic signals and seeing traffic lights. A direct relation between the increased risk of a road accidents and the problem of colour vision has not yet been established. However, colour blindness is not a serious barrier to commercial and private driving in many countries.[14]

Visual field should be checked in all meridians properly before issuing driver's license. In our study, out of 70 drivers 7 (10%) had defected visual field. Both the peripheral and central visual fields should fall in normal and standard range for driving. In most of countries 20˚-30˚ of fixation above or below horizontal meridian is labelled as normal for obtaining a driver's license.

Whereas diabetes mellitus (DM) among motorway drivers may not be a great risk factor for road traffic accidents, it can cause severe visual impairment due to diabetic retinopathy. Hypoglycemia is also a main feature of DM. Hypoglycemia can cause sudden mental fogging and thus affect driving performance. In our study 5 (7.1%) drivers were found to be diabetic and 5 (7.1%) drivers had positive hypertension history.

In a previous retrospective study in India in 2019 about 21% bus drivers were diabetic. In 14-67% drivers sudden episodes of hypoglycemia, while driving, was reported.[15] In our study we recorded only DM and Hypertension, all other systemic diseases were excluded.

Adding recent trends suggests that road traffic injuries-related deaths are likely to be the 5th leading cause of death by 2030. Aiming to reduce the rising tide of road accidents, the United Nations (UN) has declared 2011-20 as the “decade of action on road safety”.[16-17]

CONCLUSION

Vision is the main source of information during driving and visual problems can cause many driving related injuries. All the components of visual functions are important for safe driving and to avoid road accidents. visual acuity, contrast sensitivity, colour vision, visual field and glare sensitivity of every driver should be assessed properly. Drivers should not be allowed to drive on motorways if they are unable to fulfill the standard requirements according to the country. Regular checkups of older drivers are necessary as the visual abnormalities are more prominent in older drivers than in the young-aged group. Drivers should be aware of systemic diseases that can affect their driving skills and be encouraged to seek medical attention immediately.

RECOMMENDATION

Driving is a very careful activity which needs focus and attention. Any minor mistake of driver can cause huge

loss of lives, therefore both the physical and ocular health of drivers should be examined regularly. In Pakistan, ocular testing should be made a part of the necessary screening process for obtaining a driver's license. It is necessary to make eye services available to motorway drivers so that they can easily obtain eye services, recommended spectacles whenever the need arises. Drivers should be aware that good vision is important for safe driving. Other factors such as contrast sensitivity, colour vision and visual field screening have to be considered seriously when assessing visual performance of drivers. Especially the older drivers are more prone to defected visual functions due to age related changes like cataract which grossly affects all the components of visual functions, therefore they should be aware of surgical interventions as well.

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