DIPLOPIA (DOUBLE VISION) AND DRIVER SAFETY

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INTRODUCTION

A driver with diplopia (double vision) is presented with confusing imagery and is at risk of unsafe driving practice. Australia[1] and Canada require drivers to have no diplopia or double vision inside the central 40° (20° to the left, right, above and below fixation). Other countries such as Belgium and Switzerland require no diplopia within the 120° field of vision.[2].

In medical practice, to determine the position and extent of the diplopia, the areas of single and double vision are measured. The methods used require the affected person to follow a slowly moving target. When driving, eye movements include slow/pursuit patterns to follow oncoming vehicles and also include rapid fixation/saccadic eye patterns to look between vehicles, road signs, road markings and to identify hazards. The conventional clinical tests do not include assessment of saccadic patterns, thus their impact on the ability to maintain single vision is unknown. Additionally the link between diplopia and driver safety is not known.

This case series examines diplopia using slow and fast eye movements and the impact of the diplopia on driving skills.

METHODS

Five licensed drivers, 4 males and 1 female, aged 23 to 63 years (mean 44 years) were tested. All participants had acquired diplopia due to either an orbital injury (facial injury involving the eye) or nerve palsy of an eye muscle and met all other vision standards. All participants signed a consent form for inclusion in the study.

The area of single vision was tested on the Goldmann perimeter using two strategies. First was tested the ability to follow a slowly moving target from a position of single vision to where diplopia was seen. Then the ability to move the eyes quickly between two targets which were progressively positioned further apart from each other was tested. For both methods the point at which diplopia was first appreciated was marked.

All drivers were assessed for one hour in a real world on road environment by a Driver

Rehabilitation team and their driving response observed. One driver had his eye movements plotted whilst negotiating a driving route using a vehicle simulator.

RESULTS AND DISCUSSION

All participants had single vision in the central area and therefore believed they could drive. Three of the participants (number 3-5 in table 1) appreciated diplopia inside the central 40° but only when tested with saccadic eye movements. Two participants (number I &2 in table 1) saw diplopia outside 40° and also appreciated diplopia earlier when tested with saccades.

The initial assessment of driving skills for the 5 participants demonstrated that participant 1 and 5 showed similar on road responses to drivers who had single vision and were therefore deemed to be safe. Participant 5 who experienced diplopia inside the central 40° demonstrated compensatory head movement strategies whilst on the simulator and similarly when driving was extremely proficient at moving the head to avoid diplopia.

Three participants were considered unsafe drivers. showing confusion about the content of signs and road markings, difficulty in positioning the vehicle, poor scanning techniques, failing to see hazards such as cars on roundabouts and pedestrians, problems judging distances, shutting one eye when making judgments, reporting blurred vision when refixing on objects and slow driving speed.

CONCLUSION

The results of this case series suggest that diplopia can affect driver skills and decrease safety when driving, whether the diplopia is within the central 40° or outside this area. Saccadic testing is an important method to reveal diplopia which may impact on driving ability, and is a more sensitive test for diplopia than pursuits.

Presence of diplopia, however, is not a reliable predictor of the safety of driving behaviour and needs to be linked to other driver tests such as use of a simulator or on road assessment.

REFERENCES

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Table 1: area of single vision tested with pursuits Slow movements) and saccades (fast eye movements

Patient	Age	Drive outcome	Diplopia 0 -40˚ **Not eligible to drive**		Diplopia 40-60˚ **Eligible to drive**		Diplopia 60-100˚ **Eligible to drive**	
			pursuit	saccades	pursuit	saccades	pursuit	saccades
1 orbital injury	45	PASS				√	√	√
2 orbital injury	53	FAIL		√	√	√	√	√
3 Nerve palsy	23	FAIL		√		√	√	√
4. Nerve palsy	63	FAIL		√	√	√	√	√
5 Orbital injury	33	PASS		√	√	√	√	√