The Assessment of Driving Skills in the Presence of Restricted Visual Fields Associated with Retinitis Pigmentosa

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Abstract

The vision standard required by the Roads and Traffic Authority in New South Wales until mid 1997 stated that a driver must have 6/12 visual acuity in the better eye and a peripheral visual field of 130 degrees on the horizontal plane using a standard perimeter with a 3mm target at 1/3 metre.

Three case studies are presented which demonstrate that, in the presence of field loss which fails to meet that standard but matches or exceeds the standard when a larger target is used, the driving skills reflect the standard with the larger target. Assessment of driving performance in the on-road situation is described with reference to the performance of the individual drivers. Remedial strategies are also described.

The outcome for these drivers demonstrates that the visual standard as laid down by the licensing authorities should be used to alert practitioners to the existence of a vision defect and then to refer an affected patient for assessment in the driving situation. The driver's performance can then be evaluated in a realistic setting and where appropriate remediation instigated to achieve a safe driving standard.

Key Words:

Field loss, vision standard, driver performance.

Introduction

Retinitis Pigmentosa is an inherited disease characterised by night blindness and constricted visual fields.[1] Central acuity is often of a good standard. The field loss can be relative, or absolute and when relative, the size of target used demonstrates a range of sensitivity to information in the real world such that large objects are easily seen but small detailed objects are not seen. When driving, the ability to appreciate large objects in the periphery, such as vehicles and people, is important. The identification of detailed information is the role of the fovea and in the presence of adequate central vision this role will continue.

The standard of visual field required by the Roads and Traffic Authority (RTA) of NSW up until mid 1997 was 130 degrees on the horizontal plane using a standard perimeter with a 3mm target at 1/3 metre.[2] This standard on perimeters that have a working distance of 1/3m refers to the Arc perimeter. On the Goldmann perimeter a 3mm size is between the III and IV target size. For both perimeters there are larger targets available and in the presence of a relative field loss the response with the larger targets can be markedly different and approach a normal response. In 1997 the RTA standard was revised and has become 120 degrees using the IV4e (4mm) target on the Goldmann.[3] The target size has slightly increased but the acceptable range decreased which leaves the outcome at a similar level.

It is still not clear what relationship exists between the current standard of the driving authorities and the on-road driving ability. The following case studies demonstrate the inter relationship between the visual standard and driving performance in 3 patients with retinitis pigmentosa and are presented in an attempt to clarify this relationship.

Case Studies

Clinical Information

In summary, each of the 3 patients had a visual acuity level that was within the RTA requirements (6/5 to 6/9), a normal response to contrast sensitivity, bifoveal BSV, appreciation of Lang-Stereotest, and full ocular motility. Each was healthy and alert, and in relation to driving skills had fast reaction time, good insight and excellent planning skills. The response on the visual field assessment by practitioners in the field who used a 3mm target showed an outcome that was less than the medical guideline advises. When a large target such as the V4e Goldmann target (6.4mm) was used the outcome along the horizontal meridian increased to meet or exceed the standard of the guideline. According to the RTA guidelines as the standard had not been met, the licence should be cancelled.

Each of the patients had a strong personal need to continue to hold his/her licence. One was a truck driver who was supporting 3 family members from his earnings, another was an accountant who was required to drive between businesses and the third wished to be able to drive for personal and safety reasons. In the opinion of the referring medical practitioners, all these patients appeared capable of driving safely but their clinical responses supported the cancellation of the licence. For these patients the reality of the RTA standard was called into question. In order to answer this question and with the approval of the RTA medical division the patients were referred for an on-road assessment by the Driver Rehabilitation Team.

The Driver Rehabilitation Process

The team, which consists of the specialist Driver Rehabilitation Occupational Therapist, the Orthoptist and a specialist Disability Trained Driving Instructor conducted an off-road assessment to determine the cognitive, clinical and physical skills of each driver (including an ocular motility and visual field assessment) followed by an on-road assessment with all team members present.

The standard on-road assessment takes up to 50 minutes and follows a specifically planned route that progresses from simple to complex driving situations, namely:

- quiet streets with no lane markings to busy streets with lane markings;
- through quiet shopping centres then busy shopping centres with multiple pedestrian crossings and people crossing.

During this sequence the performance of the driver is evaluated by all team members with the Orthoptist noting the visually related tasks such as:

- the positioning of the car on the correct side of the road, within lanes, when turning corners and on roundabouts;
- the response of the driver to unplanned visual events such as a pedestrian suddenly crossing a road, a car pulling out of a parking spot;
- the use of rear view mirrors and blind spot checking.

Commentary driving, where the driver verbally reports the visual information that is important to that driving situation (road signs, vehicles, traffic lights and pedestrians) is also used. Navigation skills based on visual cues are used to provide good feedback about visual ability and for people with vision problems that change with decreased light conditions. The test includes driving and parking in an underground parking station as well as a driving session at night.

At the completion of the on-road assessment feedback is given to each patient, a report is forwarded to the RTA and, where appropriate, remedial action is taken by the team with the major input from the driving instructor. In the situation where a modification to the vehicle, such as the permanent addition of a convex mirror is required, the patient will have to undertake an additional test with the licensing authority.

Patient Response to the Process

A summary of the main ocular features of each patient and the outcome of the on-road assessment plus follow up information is presented in Table 1.

In each patient there was a marked difference between the field tested with the smaller target size and the largest size available, the 6.4mm size. When tested with the smaller target each patient was well below the required standard and therefore disqualified from driving. When tested with the larger target each patient was able to achieve equal to or better than 130 degrees along the horizontal meridian. One patient gained a full total field and the other two showed a partial loss in the superior and inferior fields. An example from subject 2 of how the effect of a change in the target size can cause a driver to move from licence disqualification (small target) to a normal response (large target) is presented in Figure 1.

In the driving situation each patient drove with an ability that demonstrated visual feedback commensurate with the response for the larger target. There is no routine pattern to these responses but each is typical of driver behaviour in the presence of vision defects. Patient 1 demonstrated a superior field loss yet had problems with road signs in the lower field. This

Table 1. *Summary of Responses for 3 Patients to Driver Rehabilitation Program.*

Procedure	Patient 1 age 43 yrs	Patient 2 age 29 yrs	Patient 3 age 47 yrs
Visual acuity	6/9	6/5	6/6
Field loss	3mm target reported as 30 degrees horizontally, 6.4mm target, 130 degrees horizontally with superior field loss	3mm target reported as 30 degrees horizontally, 6.4mm target; 140 degrees horizontally	automated perimeter 3 degree target 30 degrees horizon, 6.4mm target 140 degrees horizon with inferior quadrant loss on static target
Subjective Opinion about effect of visual standard	driving in reduced light a problem	no effect	safe, he will give up when he is not safe. Avoids car light problems by driving in truck cabin
On-road test performance	**visually:** not using mirrors; position at intersections & roundabouts incorrect; problems with signs in the lower field; satisfactory in dim light **generally:** drives too fast	**visually:** erratic sign identification; using traffic signs to guide actions; no difference in dim light **generally:** bad habits & driving too fast	**visually: daylight** - delayed recognition of internal detail of white background signs. **dusk** - delay for yellow background signs. **night**-internal detail of reflected signs delayed
Remediation	use convex mirrors; increase scanning; commentary driving; lessons to correct bad habits	use convex mirrors; commentary driving; lessons to correct bad habits	during on-road test with conscious scanning delay decreased for detail identification
Outcome	RTA disability test because of mirrors = satisfactory standard gained. On regular review	excellent standard achieved & maintained at 16 month review; personal confidence boost	pending outcome of RTA review.

response is seen in patients who realise that they have a field loss and make an effort to move their eyes to cover the lost vision area.

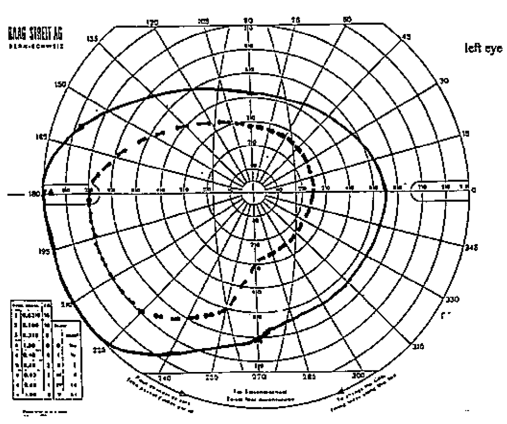

Figure 1. *Goldmann Field of the left eye of subject 2 showing the change in the measurement of the horizontal meridian from 90 degrees with a 2mm target (closet size available to match 3mm) to 140 degrees with the largest 6.4mm target.*

- - - - - - III4e 2mm

——— V4c 6.4mm

Because they are concentrating on the defective area, in this case the superior field, they fail to retrieve the information in the area directly opposite, i.e. the inferior field. Remediation requires a conscious effort to scan in both areas. This process can be reinforced by verbal reporting (commentary) of all relevant driving information.

Patient 2 with the large sized target had a full field but demonstrated a generalised vision deficiency in the on-road situation shown by failure to report signs but not in any particular segment of the field. She also had a gaze pattern that was restricted to rotation across the horizontal field rather than scan up and down as demonstrated by using the traffic pattern to guide her driving decision rather than look up to traffic lights.

There was a lack of confidence to scan widely which was compounded by driving too fast. High speed reduces the amount of visual information that can be taken in over a given distance.

Patient 3 had an inferior field loss when the large target was used in static presentation. This defect was used to advantage for personal comfort, by placing himself in a driving situation at night so that the glare from oncoming cars would shine into the field defect. This patient also demonstrated difficulties reporting detailed information suggesting that although his visual acuity was clinically satisfactory, his actual skill of reading detail was decreased. Remediation was attempted for this patient by requiring him to consciously move his eyes across the visual field and verbally report all relevant information. His subsequent reporting skill became faster but then decreased as he became tired.

Additional convex mirrors were used for patients 1 and 2. These consist of a Brookstone mirror placed over the rear view mirror and fish eye mirrors that are placed on the side mirrors. The convex structure expands the field of vision seen in the mirror and when accurately positioned will cover the blind spot, thereby eliminating the need for the patient to turn to look to the side. Time saved by avoiding this action can then be given to visually scanning the driving environment. Patients using this approach have demonstrated an increase in driving safety.

The impact of bad driving habits on patient performance compounds the end result of a driving assessment. The longer the time lapse between the gaining of a driver's licence and re-evaluation the greater the opportunity for bad habits to develop. These include driving at inappropriate speeds, failing to observe rules of the road, particularly those rules that have been introduced in recent years. When a patient with bad habits also has a physical defect the effect is to make compensation for the defect more difficult e.g. in the presence of a field loss, approaching a corner at a high speed will reduce the available time to scan to compensate for the loss and reduce the visual information that can be retrieved.

Discussion

The responses of these patients demonstrate several issues. The first is that the visual standard is too simplistic. To cancel a licence because a vision standard is not met does not take into account other factors such as the intellectual and general physical ability of a patient. These factors, which include alertness, insight, reaction time and physical strength, when functioning at a high standard, can assist a patient to compensate for an isolated physical defect such as field loss.

Secondly, this group of patients challenges the validity of the test standard. The standard specifies target size and a numeric response. This group of patients showed that if the procedure is varied slightly the response can increase to approach normal and also that this response better parallels actual driving performance. This favours an approach of using the standard as a guide for recommendation of licence disqualification but also raises the need to consider the standard against the total clinical response of the patient. Where the total response suggests an ability for the patient to cope then the patient should be referred for evaluation by an on-road assessment.

Thirdly, this group of patients supports the value of using the clinical response in conjunction with an on-road assessment. The initial performance of these patients showed that their driving ability was better than the specified standard suggested. It did reveal that the vision defects impacted on the driving performance but at a level that was retrievable. The combination of clinical response with actual skill performance provides a total package which is realistic for the individual driver and the driving community at large.

Fourthly, this group of patients also supports the value of adaptations to the vehicle and driving skills as well as remediation of driving performance in enabling patients with some vision loss to continue to drive but at a level of enhanced performance and safety.

Conclusion

It is considered that vision is the most important sense used in driving. It is therefore important that the standard of vision used is at a level that enables a driver to drive safely. This group of patients raises issues that challenge the practitioner to consider the clinical results in a different light. These patients demonstrate that the standards laid down by the licensing authority serve to alert the practitioner that a vision defect is present which can affect driving performance. The practitioner having been alerted to the existence of a vision defect needs to consider the extent of the defect through a range of clinical procedures and also to evaluate its impact on performance in the driving situation.

References

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