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Research Article

Night Vision in Automobile Drivers

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Abstract

Night driving has become. very common even in smaller cities. The rules of driving recommend that the main lights of the car should be dipped if another vehicle is coming from the front. However, many young persons when in hurry hardly follow this rule. The bright light from front dazzles the eye and increases the chance accident. Adaptometer is an instrument by which capability of seeing in dim light can be tested. It also tests the vision when eye is dazzled by bright light. 50 drivers were tested on adaptometer to look for these two functions and the value were compared with accidents that they had committed. A vague correlation was observed. Many drivers were hesitant to disclose the number of accidents they had committed.

Keywords: Automobile Drivers; Night Vision

Introduction

With rapid industrial growth all over world automobile (car, scooter, motor cycle) driving has become very common even in smaller places. With increasing population and with no corresponding increase in number and width of roads, accidents have become quite common. Poor lighting in roads and rash driving by many youngsters adds to the problem. When a bright light falls on eyes vision is suddenly reduced for a short time which is soon regained [1]. This is what happens when a driver forgets to dip the light, the driver coming from opposite side fails to see clearly for a short time but usually recovers quickly. However in some disease this night vision becomes low and a person cannot recover vision after being exposed to light thus causing more chances of accident. The purpose of study was to check the night vision and post-dazzling visual activity of some vehicle drivers to know their liability of making an accident. Although many studies have been made in pigmentary retinal dystrophies [2,3] and in vitamin A deficiency [4], little work has been done on dark adaptation in automobile drivers.

Methods

50 drivers were examined for this study who were between 20 - 40 years. The study was carried out in the eye department of medical college, Gwalior by the author. An instrument called adaptometer was used for the study. It consists of a dark sphere where illumination can be altered in a graded way First nocturnal visual acuity is measured and then eyes are dazzled with bright light and post-dazzling visual acuity is tested. All measurements were automated as provided in the adaptometer. This was matched against the number of accidents a driver had committed during night driving. The illumination can be increased or decreased by a very sensitive way by increasing or decreasing the filters. The following protocol for examination was followed:-

1.	Initial light adaptation	2 min.
2.	Preliminary dark adaptation (P.D.A.)	1 min.
3.	Preliminary light adaptation (P.L.A.)	1 min.
4.	Nocturnal visual acuity (N.V.A.)	1 min.
5.	Dazzling with bright light	½ min.
6.	Post-dazzling visual acuity (P.D.V.A.)	1 min.

The filters and diaphragms have various optical reducing values (D) which have the following relation to the transmission value (E)

D = 2 -- log E (logarithms are to the base 10)

Observations

As mentioned earlier the illumination in the sphere can be altered to great variations depending on introduction of different densities in form of filters. Table 1 gives the values of optical densities introduced in different tests The normal value of P.D.A. is 30 - 60 seconds for N.V.A. it is 0.4 N (up to the 4th line shown in the reading chart and for P.D.V.A. it is 0.3. N (up to 3rd line shown in the chart). After second light adaption of 1minute N.V.A. is tested by showing a reading chart. Thereafter the eyes are dazzled by a dazzling device for ½ minute and P.D.V.A. is tested. Besides them the type of vehicle the number of accidents are also noted.

Test	Diaphragm	1/100 filter	Additional filter	Total density
PDA	1.1	2	0	3.1
NVA	0	0	1.3	1.3
PDVA	0.5	0	1.3	1.8

Table 1: Optical densities in different tests.

PDA: Preliminary dark adaptation; N.V.A.: Nocturnal Visual acuity; PDVA: Post dazzling visual acuity.

Table 2 shows the average values of P.D.A., N.V.A. and P.D.V.A. in 50 automobile drivers which are 42 sec.,0.3 N and 0.2 N respectively. Both N.V.A, and P.D.V.A. values are slightly lower than the normal. Table 3 shows the age incidence of P.D.V.A. in 5 steps from 20 to 40 years. There is a definite fall in P.D.V.A. value with increasing age. It is within normal limits from 20 - 30 years but in the 30 – 40 years age group it is definitely low. Table 4 shows the age incidence in accidents and there seem to be no relationship. Table 5 shows the P.D.V..A. values in accidents. Surprisingly in the no accident group the P.D.V.A. value is fairly low. It is within normal limits in 1 and 2 accidents groups and then there is a fall. The last group includes four or more accidents. Table 6 shows the relation of P.D.V.A. to N.V.A. and P.D.A. There is some correlation with the former. Table 7 shows the incidence of accidents in various types of vehicles (motorcycle, scooter, car).

Test	Average	Range
sec	15-90	
NVA	0.30 N	0.1 - 0.4 N
PDVA	0.20 N	0.0 – 0.4 N

Table 2: Noctovision in automobile drivers.

Age (yrs.)	No. of cases	Average (N)
21 - 25	20	0.30
26 - 30	10	0.20
31 - 35	10	0.16
36 - 40	10	0.08

Table 3: Age incidence in post dazzling visual acuity.

No. of accidents	0	1	2	3	4
No. of cases	12	13	10	7	8
Average age (yrs).	10.1	30.0	28.2	21.8	29.3

Table 4: Age incidence in accidents.

No. of accidents	0	1	2	3	4
No. of cases	12	13	10	7	9
Average PDVA	0.150	0.223	0.270	0.228	0.187

Table 5: Post-dazzling visual acuity in accidents.

No. of cases	18	12	12	8
PDVA (N)	0.1	0.2	0.3	0.4
NVA (N)	0.228	0.300	0.350	0.362
PDA (sec.)	33.61	49.71	42.58	51.50

Table 6: Relation between PDA, NVA and P.D.V.A.

Type of vehicle	Motor cycle	Scooter	Car
No. of drivers	10	24	16
Average. No. of accidents	3	1.66	1.50

Table 7: Incidence of accidents in different vehicles.

Discussion

In this preliminary study with small number of cases no definite conclusions can be drawn. However a few points of interest do emerge. There is a definite fall of post dazzling visual acuity (PDVA) with increasing age which suggests that night driving may be risky beyond a certain age. There is a vague correlation with PDVA and number of accidents particularly if no accident group is excluded. In zero and one accident groups there were many persons between 35 and 40 years whose PDVA value was lower. Many of them were professional drivers and in spite of all assurance given for non-disclosure they were apprehensive of disclosing the number of accidents for fear of job security. Lack of correlation between age and accidents may be due to compensation of PDVA by more driving experience in elderly drivers. There is some correlation between PDVA and NVA. Motorcycles to be more common cause of accidents during night.

Answers to review comments and suggestions

1. The article title has been changed
2. The purpose of the article is restated
3. Most of the points in study method have been clarified
4. It is already mentioned in the beginning that it was a preliminary study on a small number of cases hence no definite conclusions could be drawn.
5. It is not confirmed that all accidents occurring in night were due to night vision problem only. There could be other factors as well. However there could be a possibility of defective night vision or low P.D.V.A. also.
6. With such a low number, no reliable statistical test was possible.
7. Four references have been given. However as no similar article could be traced no reference has been given in the discussion part.

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