

***The Efficacy of Driver Education for the Visually
Impaired Telescopic Driver:
A Retrospective Study***

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1998

In a recent study in Houston, Woo et al found that the complexity of bioptic prescribing and the paucity of training applied to the driving task highlight the need for innovative programs that complement one another.¹¹ They have designed what they hope will serve as a national model for driver rehabilitation training programs. The program utilizes training by certified driver training specialists experienced in working with the visually impaired. This, in combination with bioptic prescribing and training by the low vision clinician, may offer reassurance to the clinician, patient and public that some visually impaired bioptic drivers may safely operate motor vehicles.

Current literature states that 90% of the information required for driving is visual.¹² Although vision is the predominant source of information to the driver, visual abilities are only one of the factors to be considered when judging the overall driving ability of an applicant. Driving requires mastering of a multitude of skills. A deficiency in any one area may make issuance of a driver's license inadvisable. Colenbrander et al submit that the final determination can only be made through on-the-road evaluation of safe driving performance.¹³

Park, Unitan and Herbert¹⁴ have proposed and implemented a driver rehabilitation training program for the visually impaired based on this premise. They describe a multi-disciplinary team approach to training involving static clinical assessment, dynamic environmental assessment, co-pilot training, and driver education protocol to ensure appropriate telescope proficiency and safe driving skills. The goal of the program is to ensure not only that their visually impaired telescopic drivers meet the legal visual acuity and visual field requirements for the state of Michigan, but also to afford patients the opportunity to improve their competency in using their telescopic system for driving.

The purpose of this study is to evaluate the efficacy of the training program described by Park et al. This will be accomplished by means of a retrospective comparison of the driving records of telescopic drivers who completed the driver training program protocol to those who received no formal driver education. Part of the motivation for this study comes from a desire to show further evidence that bioptic telescopic drivers, with the proper in-office and on-the-road training, can be safe, effective operators of motor vehicles.

Methodology

Information was gathered from four sources: (1) patient files, (2) a brief phone questionnaire, (3) driver education records and (4) Department of Motor Vehicle driving records. One hundred subjects were selected at random from a base of low vision patients prescribed telescopic systems. The subjects must have been active patients in the hospital-based low vision rehabilitation clinic within the past five years. Based on chart review, those patients prescribed telescopes for purposes other than pursuing driver's licensure were excluded from the sample. When the information contained in the

patient's file was unclear as to current driving status, a brief phone interview confirmed that the subject was currently utilizing his/her telescope for the act of operating a motor vehicle. The resultant sample of confirmed telescopic drivers numbered seventy-five. Several patients had to be excluded as they were not on record as being licensed in the state of Michigan. In addition, due to difficulties encountered with the Record Look-up Division of the Department of Motor Vehicles, driving records were not obtainable for our drivers over the age of 50. This left our telescopic driver sample with thirty-five subjects age seventeen to fifty.

The patients were then divided into two groups according to the following criteria:

- (1) Telescopic drivers with formal visually impaired driver education program experience
 - (2) Drivers prescribed a telescopic system without formal driver education
- The same pre-driving telescopic training for activities of daily living protocol was used for both groups.

From the driving records obtained from the Michigan Department of Motor Vehicles, the number of traffic violations and accidents were tabulated for a five-year period. For those drivers with less than five years of driving experience, records were reviewed from the date of licensure to the present .

Results

The group consisting of bioptic telescopic drivers who had received formal driver education numbered twenty-seven. Drivers having undergone no formal driver education with the bioptic accounted for eight subjects. The most frequent ocular disease causing visual impairment included optic nerve disorders, Stargardt's disease, and albinism. Due to the age groups being examined, patients with age related macular degeneration are not well represented in this study. Inherent visual acuity of our visually impaired drivers ranged from 20/60 to 20/400. A variety of telescopic lens systems were used to achieve legal visual acuity levels including the Designs for Vision telescopes, M-lens, Walters, and BITA telescopes to name a few.

In the 16-24 age group, our trained drivers had been charged with six traffic violations. The breakdown of the violations by type is as follows: 1 prohibited turn, 2 failures to yield, 2 speeding violations and 1 count of no proof of insurance. In this age group, only one accident was on record with no injuries or fatalities resulting from the incident. Unfortunately, due to the recent nature of the licensing of these drivers, they all underwent formalized driver education as this is the current protocol at our facility. However, some general comparisons can be made with the normally sighted Michigan drivers in this age group. The Office of Highway Safety Planning, a division of the Michigan Department of State Police, states that the 16-24 age group represented 15.7% of Michigan's active driving population in 1996. Drivers in the age group, however, were involved in 23% of all crashes and 23.8% of all fatal crashes. On a per population basis, drivers under the age of 25 had the highest involvement in fatal crashes of any age

group. In our population of trained drivers, only 10% were involved in a motor vehicle accident with no resultant fatalities or injuries.

Drivers age 25 to 34 in the trained group were cited for three traffic violations: 1 failure to stop within an assured clear distance and 2 speeding citations. One accident involving two vehicles was reported for this group with no resultant injuries or fatalities. The average number of violations for this age group is 0.75 per driver with one in four being involved in a traffic accident. In the group receiving no driver training with the bioptic telescope, the number of convictions tallied twelve with two reported accidents. This corresponds to an average of four violations per driver and one accident per driver. The traffic convictions are detailed as follows: 5 speed, 3 failures to display a valid license, 1 lack of proof of insurance, 1 operating a motor vehicle while impaired by liquor, 1 prohibited turn, 1 disobeying a traffic signal. The two reported accidents resulted in zero injured and zero killed; both were characterized as two-vehicle accidents.

According to the 1996 Traffic Safety Facts, the intoxication rate was highest in drivers 21-24 and 25-34 years old. These rates were 27.0% and 26.2% respectively. In our formally trained group the rate of alcohol use while driving was zero. In the untrained population, only one driver was cited for this offense. Due to the small sample size this corresponds to 33.3% intoxication rate in the untrained group.

The 35 to 50 year old members of the trained sample chronicled three traffic convictions and zero accidents. One drug crime, one no proof of insurance and one disobeying a traffic signal were recorded for this group. The average number of violations was 0.33 per driver. Untrained drivers in this age category had been charged with four traffic convictions; 1 failure to stop within an assured clear distance, one failure to yield and two failures to display a valid license. Two accidents are on record for this group, both involving two vehicles and zero injuries or fatalities. One in two drivers in this group was involved in an accident while the average number of convictions was 0.75 per driver.

In making some intra-sample comparisons, we find that the 35-50 year old trained subjects had the lowest violation and accident rates. Perhaps this is due to the fact that our driver training program has been in full force over the past decade and we are reaping the rewards of its success. Perhaps it is because many of these people have had greater access to and utilization of various hand-held and spectacle mounted telescopes due to their increasing availability and improved technology. In using these devices in the work and home environment, they have been afforded the invaluable experience necessary in developing the visual skills needed for telescopic driving. One last factor leading to the success of these drivers may indeed be their age. They are more mature than the younger drivers in our study and have had valuable time on the road to improve their skills while utilizing the bioptic system for driving. Finally, they are not yet hindered by the age-related changes occurring in our older population, including declines in mental function, reaction time, etc.

Finally, there appears to be no significant difference in accident rate between those drivers with inherent visual acuity equal to or better than 20/100 versus those with 20/125 or worse. One's first thought might be to expect those patients whose condition leaves them with better inherent visual acuity to perform better on our state's roadways. Intuitively drivers with inherent visual acuity of 20/100 or better would require less magnification to meet the legal requirements. Thus, they would maintain a larger field of view while viewing through the telescope. In addition, these drivers, who spend 92-95% of their time looking through the carrier portion of their spectacles, realize the benefits of better visual acuity. However, this is not the case in our sample of telescopic drivers. This leaves me with the question of exactly what level of visual acuity is necessary for one to perform the driving task without endangering others utilizing our roadway system. This question is one being addressed by current research and in fact we are still uncertain what level of acuity is necessary to ensure safe operation of a motor vehicle.

An unpublished study by the Michigan Department of State Office of Policy and Planning shows that 78.9% of drivers with a bioptic telescopic lens system have a clear driving record. In comparison, 82% of all drivers licensed in the state have clear records. In this sample of trained bioptic telescopic drivers 66.7% exhibited a clear driving record for the same period (1994-1995). However, the untrained drivers displayed clean records only 37.5% of the time. Thus, the trained sample was 1.78 times more likely to be violation free.²¹

Discussion

When one considers the impact of non-driving on an individual's life it becomes apparent that as providers of low vision care we must strive to preserve the driving privilege for our visually impaired patients. After all, operation of a motor vehicle is a critical factor in allowing one to secure employment thereby enabling him to maintain his livelihood. Driving impacts a number of other socioeconomic and psychosocial aspects of one's life including: the opportunity for social independence, access to health care and enjoyment of avocational interests. Finally, a driver's license imparts a sense of responsibility and self worth to an individual by allowing him to maintain his autonomy.^{5,13,15}

The use of telescopic systems by visually impaired drivers is on the rise. This increase is due in part to the growing elderly population, many of whom have visual limitations. In fact, the elderly now comprise the fastest growing sector of the driving population. By the year 2020, the number of adults over the age of 65 is expected to reach 17% of the American population, with 50 million persons of this age eligible to drive.^{12,18} Age-related declines in visual function are likely to result in an increasing number of elderly who will fail the prevalent visual standards for licensure. These patients, now termed "low vision" in the strictest sense, will be seeking technology that will allow them to maintain their licensure along with their highly valued independence.

Another factor influencing the tendency of bioptic prescribing is the technological improvements and diversity of telescopic systems available today. Current systems offer

improved cosmesis through miniaturization and rear-mount applications.^{1,5-8,12} These and other improvements in technology increase the likelihood that both patient and eye care provider will pursue utilization of a bioptic telescopic system for driving.

Indeed the controversy surrounding licensing of the bioptic telescopic driver has been well documented.^{1-3, 5-14} Fonda and other opponents of bioptic driving, find it paradoxical that a driver can pass the vision test only by use of a telescope, yet he cannot drive while looking through it. Rather, he must drive with his limited vision (sometimes legal blindness) while looking through the carrier lens. In addition, opponents of the use of bioptic telescopes sight reduced field of view when utilizing the system as a cause for concern. They feel the "ring" scotoma created by the telescope offsets any gain in visual acuity realized by its use and actually renders the bioptic itself a potential driving hazard.^{1,4}

Advocates of telescopic driving dispel this misconception on the part of opponents as to how the telescope is utilized during driving. Studies show that only 5-8% of total driving time is spent viewing through the telescope. In effect, it is used much as the normally sighted driver uses his rear-view mirror, for "spotting" purposes only.¹⁰ The issue now becomes what level of measured visual acuity is adequate for safe operation of a motor vehicle. Truly visual acuity is a useful quantitative measure, but it does not provide a qualitative measure of the multifaceted visual skills that impact driving.² Is it possible that state licensing agencies may be overestimating the visual requirements for safe, accident-free driving? To answer this question, it is necessary to determine which visual characteristics are vital to the driving task. Current research seeks to determine if existing visual standards for licensure can be relaxed without endangering public safety.^{1,12}

In addition, research is ongoing as to what aspects of vision and levels of visual skill are necessary to produce safe driving. Early studies by Burg revealed that dynamic visual acuity measurements had a ten times higher correlation to accident rate than did static visual acuity measures. Dynamic visual acuity is defined as a measure of one's ability to recognize an object when both the object and the observer are in motion relative to one another.^{9,12} This finding is significant as dynamic visual acuity is not routinely measured in the process of determining an individual's eligibility for licensure. At this time only static visual acuity is attained and these measures have been shown to be only weakly predictive of on-the-road safety. Studies suggest the Useful Field of View (UFOV), a test of visual attention, is yet another measure that yields a better prediction of accident rate than static visual acuity measurements.¹²

Perhaps the only true measures of the safety of bioptic drivers on the road are studies that review the driving records of these patients. A few states have made attempts at evaluating the safety of their bioptic telescopic spectacle (BTS) drivers. In Texas, the accident rates of 64 BTS drivers were compared to that of a sex and age-matched control group. The bioptic drivers in this study exhibited an accident rate 1.34 times higher than the control group. A 1983 California study showed BTS drivers experienced a 1.5 times higher accident rate as compared to the normalized control group.¹ A follow-up study in

1993-1994 revealed the accident rate for BTS drivers was 1.9 times higher than the control group.²⁰

Conversely, Massachusetts BTS drivers had a lower accident rate versus the general driving population. In the state of New York, the Department of Motor Vehicles found that although BTS drivers were 1.36 times as likely to be involved in an accident than the control group, they compared favorably to male drivers age 29 and under. In fact, their accident rate was significantly lower than this age group and slightly lower than males age 30 to 39. Thus, the conclusion could be drawn that BTS drivers may function equal to or more safely than millions of male drivers currently using our nation's roadways.¹

With respect to traffic violations, one study in Texas revealed that bioptic telescopic drivers may exhibit more caution and better judgement on our roadways. In this study, the control group received four times more citations for speeding than the group composed of BTS drivers. In addition while only 4.5% of BTS drivers had been cited for drunk driving, 21% of the control group had been apprehended for this same offense.¹ Janke's study of California drivers in 1983 showed visually impaired drivers using bioptic telescopic spectacles for driving exhibited accident rates significantly below that of other handicapped drivers. He also illustrated that those drivers classified "high risk drivers" had considerably higher accident rates in comparison to visually impaired BTS drivers, yet these drivers were not penalized or restricted in any manner by the state licensing system.¹ Finally, in the 1993-94 study that followed Janke's original work, it was found that with respect to total citations, the rate for BTS drivers was only 0.7 the rate of the control group.²⁰

Conclusion

Intuitively a driver training program for visually impaired drivers like that designed by Park et al should produce safer drivers. This study confirms that indeed drivers completing our driver education/training protocol fare better on our state's roadways than those drivers who have not received any formalized driver education. The standardized in-office and on-the-road instruction allows for substantiation of safe driving skill while utilizing the bioptic telescope system. In addition, it provides the opportunity for the behind-the-wheel experience vital to the success of any driver. Much like the graduated licensing programs being adopted by more and more states, it allows more time for a gradual, step-wise progression through the stages of driver training. By increasing on the road experience time with a certified driving instructor, the visually impaired driver has a better opportunity to understand his own limitations with respect to vision related driving skills and learns to use the BTS to compensate for them. The potential for receiving valuable feedback from the driving instructor, occupational therapist and low vision specialist is enhanced in this system. By providing patients these opportunities, we afford them the chance to adapt to their bioptic telescopic system and realize the responsibility that accompanies the independence they gain by utilizing the BTS for driving.

Michigan has already adopted a graduated licensing law for beginning drivers following studies that proved that novices have more accidents than experienced drivers. It only seems prudent that new bioptic drivers be subject to the same or similar requirements. The state of Ohio utilizes a system in addition to driver education that is appealing to me as a clinician as well as a driver sharing the roadways with bioptic drivers. Under Ohio law, successful bioptic telescopic drivers have their licenses restricted to daylight hours for the first year. In order to get the daytime-only restriction lifted, drivers must do the following:

- Have no traffic violations or at-fault accidents on their records;
- Pass a state vision test while using the bioptic telescopic lens (BTL) device;
- Be evaluated and trained in night driving; and
- Pass a nighttime drive test given by at least two highway patrol examiners²⁰

Undoubtedly, there continues to be a need for specific training programs for the visually impaired driver, along with further investigations of the impact of bioptic telescopic driving on public safety. Larger cooperative studies must be conducted once additional programs are in place, but these studies can only occur if bioptic drivers are not denied licensure. The data acquired in this study will be utilized in a statewide study comparing bioptic drivers who received formal driver education to those who did not. This study is to be performed by the Michigan Department of State Office of Policy and Planning. We have observed the successes of many of our trained bioptic drivers. Our hope is that the achievements of these and other BTS drivers in Michigan and the other 28 states that allow their licensure, will serve as undeniable confirmation that safe and effective operation of a motor vehicle can be an attainable privilege for many visually impaired individuals.

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