The Bright Future of High-Intensity Discharge Headlights

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Neil J. Deledda

Mark Swan, OD, MEd
Advisor

While most advancements in technology serve a purpose and usually help the concerned issue, they often have unforeseen complications. The new ultra-bright high-intensity discharge (HID) headlights are a prime example. There are an ever increasing number of automobiles with HID headlights roaming the streets, and these headlights have caused quite a stir in the court of public opinion. It seems people are either singing their praises or cursing their existence, depending on whether or not they are behind the wheel of a car with them, or being distracted by them from other motorists. Complaints have flooded the National Highway Traffic Safety Administration (NHTSA), mostly about the excessive glare from the blue-white colored HID headlights. More than 1,800 complaints were filed over a five month span, calling the new headlights annoying, distracting, and even blinding.[3] According to the NHSTA, that is a record number of complaints on any single issue. Though HID headlights can be beneficial, there is question as to whether or not their enhanced visibility for drivers outweighs their glare effects on other motorists. Government and private agencies are working hard in studying and implementing ways to make headlight glare less of a problem for motorists. Additionally, optometrists are in a unique position to evaluate and manage these individuals, as well as educate them on ways to diminish their glare problems. Optometrists have a responsibility to contribute to patient welfare by making recommendations that will improve their visual performance and to educate the overall public about the many factors involved in this problem.

HID headlights are currently used in over two million vehicles in the United States alone, and they are becoming increasingly common in new cars as standard features.[4] These headlights originated on European luxury cars and are used on a much larger scale in Europe than in the U.S. HID headlights produce their effect by passing an electric current through xenon gas, with the resulting light produced being projected precisely by reflectors and focused by lenses.[2] Conversely, traditional headlights produce their effect by heating a tungsten filament inside of a halogen capsule.[2]

The technical benefits of HID headlights have been widely reported on since their inception in the mid 90's. When compared to traditional tungsten-halogen headlights, HID headlights are significantly brighter, they have a wider beam, and they are much more efficient.[6] The HID headlight triples the output of the traditional tungsten-halogen headlight while consuming fewer watts. For example, the HID light consumes 33 watts to produce 5200 lumens, compared to 60 watts to produce 1600 lumens for traditional headlights.[8] Since the HID light contains no filament that can break, they are more durable, and shock and vibration resistant. Therefore the HIDs have a much greater longevity compared to tungsten-halogen headlights. In fact, HIDs are said to have "life of vehicle performance" which equates to approximately 3,000 hour average lamp life or 150,000 miles on the car.[8] On the other hand, the one technical aspect of HID headlights that trailed in comparison to tungsten-halogen headlights was glare. Their overwhelming brightness causes their major drawback, glare.

Some people see HID headlights as having intangible benefits as well. According to Dave Hulick, HID global product manager for OSRAM, the Sylvania Corporation's HID manufacturer, "Besides the tangible benefits of safety and efficiency, HID light

sources have subjective benefits as well. For example, many people associate the blue-white light emitted from HID headlights with expensive, high technology, luxury automobiles; others recognize the light as an example of cutting edge technology."[8]

Numerous studies have taken place comparing on road performance of HIDs to the traditional tungsten-halogen headlights with the same general outcome. HID beams are directed more towards the sides of the automobile, making them superior for driving through curves and detecting hazards along the sides of the road.[2] However, tungsten-halogen headlights were found to be better at illuminating the center of the road or straight ahead.[2] It is then debatable which characteristic is more important for driver safety. It would ultimately depend upon which type of roads or area the driver is using most frequently.

When it comes to evaluating the benefits and drawbacks of HID headlights, the issue of glare is the major point of contention. Glare occurs when visual field brightness is greater than the luminance to which the eyes are adapted; it can be caused by direct or indirect sources.[4] There are two different types of glare- discomfort glare and disability glare. Discomfort glare causes discomfort, annoyance, and fatigue. Whereas, disability glare produces a reduction in the visibility of objects being viewed. University of Michigan Transport Research Institute scientist Michael Flannagan has spent at least ten years studying glare problems. He has found that while glare annoys oncoming drivers, it doesn't disable them.[1] "Discomfort glare is not always related to disability glare. Oncoming motorists are bothered by HID glare because of the more harsh blue light. Light from conventional tungsten-halogen headlights is toward the softer red end of the spectrum".[1] Flannagan states, "We think there is some problem with glare, but we think

it is a good trade-off, our overall opinion of HIDs is that they are good things. HID lamps can be and normally are better for seeing."[1] HID headlights, although very bright, do not exceed maximum illumination standards set by the NHTSA; however, the standards have not had any major revisions since 1968. As of now, no accidents or injuries have been blamed on HID headlights.[2]

The glare problem with HID headlights is not as big of an issue in European countries as it is in the United States. This is because bright light rarely causes glare on a bright background, so it is not the brightness of the headlight by itself that causes glare, but the difference between the light and the background. Therefore, headlights in bright urban environments have a reduced glare effect. Most European driving takes place in these urban environments where lighted signs and greater amounts of background lighting are present. So the bright headlights are not as noticeable as they are in the U.S. when you meet a car on a dark vast interstate or in a rural setting.

Recent studies have found certain measures can be taken by highway agencies, automobile manufacturers, and individuals alike to reduce or eliminate glare problems. Some highway agencies have implemented glare screens in certain areas with some success. They are placed on a dividing median to diminish glare from the oncoming traffic. Glare screens are good for topographically flat areas with or without minor curvature.[4] The screens are most appropriate where traffic volumes are high and the driving tasks are demanding, such as freeways and construction work zones.[4]

Headlight height also plays a very large role in glare effects on other motorists. Currently, the maximum height for headlight mounting is 54 inches, but this standard has also been in place since 1968. The Society of Automotive Engineers (SAE) has

suggested lowering the maximum height to 39 inches, which should solve glare issues from newer SUVs, which in conjunction with light trucks and vans comprise 50% of all new vehicle sales.[1,7] It would, however, do nothing for the millions of older vehicles currently on the streets. Also, polarized headlights are a new concept that has shown promise in early studies.[4] They are being touted as possibly the perfect trade-off between visibility and glare; but more studies need to be done, and cost cutting measures taken, before they can be implemented on a large scale.

All things considered, headlight alignment has been found to be paramount when it comes to glare problems for other motorists. Recent studies have shown that misaligned headlights are the most problematic source of headlight glare.[4] Misaligned headlights are a real problem that is difficult to fix, because the driver of the automobile with the problematic headlights is likely to think they are fine. This is because when driving with misaligned headlights, their increased glare production for other motorists correlates with improved visibility for their driver.[4] Also, it is very difficult to police individuals with misaligned headlight because there are no standards or regulations in place. Regulations on headlight alignment are being considered for implementation in the future.

Antiglare mirrors are planned to start appearing in more and more new vehicles, and are available as after-market options. These automatic glare reducers can be very beneficial for driver comfort. In the mean time, drivers are encouraged to use night settings on their prism mirrors. Current studies show that antiglare mirrors in conjunction with height and alignment standards on headlights, will control all mirror glare created from passing or following vehicles.[4]

One theory that is currently being explored is the correlation between increased headlight glare complaints and the aging of the population. The relationship between discomfort glare and age is established, and the fact that older populations are more prone to cataract formation, retinal disease, decreased retinal adaptation, and optic nerve disease reinforces the relationship between the two. Therefore, education of this population is paramount in controlling night driving symptoms. Also, refresher driving courses are available for older drivers from several organizations including AAA, AARP, and the National Safety Council.

As an eye care professional, complaints about glare and difficulty with night driving are all too common. Additionally, these complaints undoubtedly stand to increase as the population ages and the headlights become brighter. Along with elderly patients, and patients with cataracts, individuals who have had LASIK surgery are at an increased risk of having glare problems while driving at night. Glare occurs with these patients when their pupil enlarges in the dark and equals the size of the treatment zone on the cornea. For patients who have had the surgery, up to 30% of them will experience increased glare problems.[9] However, there is one treatment that has been shown to be effective for some post-LASIK patients struggling with glare. The off label use of the glaucoma medication Alphagan, when instilled approximately thirty minutes before driving, has been shown to inhibit pupillary mydriais under scotopic conditions.[5] Therefore, the pupil doesn't infringe upon the treatment zone on the cornea and the glare effects are reduced.

Ultimately, whether it comes from their eye doctor, refresher driving courses, or the media, the best way for people to diminish the effects of glare on driving is education.

Some ways that eye care professionals can educate their symptomatic patients involves proper spectacle applications. There are certain products available that can help with discomfort glare from spectacles, the most notable being anti-reflective coating. Anti-reflective coating decreases the amount of light reflected off the spectacle lenses and increases the amount of light that makes it to the retina. Fitting these patients with contact lenses will also eliminate problematic spectacle glare. Additionally, drivers should never wear colored or tinted glasses when setting out to drive at night. They should always be sure that their glasses are clean and scratch free, and that the temples on their glasses are not too wide. It is also important to have annual eye exams for optimal management of symptoms.

Some other tips and strategies that can be employed by drivers include keeping headlights adjusted and clean, make sure all car windows are clean and free of cracks, position mirrors so that the light from following cars is not directed into their eyes, and avoid looking directly into the headlights of oncoming traffic. If ultimately people are too debilitated from their symptoms, avoidance of driving at night and dusk should be implemented. If driving cannot be avoided, they are recommended to limit their driving time at night and to use only well lit roads.

The advancement of technology is not going to stop, and undoubtedly automotive headlights are going to continue to evolve. Whether or not the perfect headlight will ever be developed is uncertain, but there is definitely promise. Government agencies are very interested in this topic and countermeasures will become more and more evident on the roadways. However, with all of the technological advances around us, it seems that

annual eye exams, education, and common sense are still the best ways for individuals to control glare problems from night driving.

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