Press Release

ZEISS Makes Car Driving Safer

The new all-day ZEISS DriveSafe eyeglass lenses provide wearers with more safety through better vision in challenging driving conditions

Aalen, October 1, 2015 - - - Most spectacle wearers are also car drivers and experience discomfort or vision impairment when it gets dark, rainy or misty. The disproportionately large number of traffic accidents after nightfall shows their concerns are justified. 83% of spectacle wearers use cars and the vast majority (72%) of them are interested in having a single pair of spectacles to provide an everyday solution that can also cope with the special challenges of driving. Car-driving spectacle wearers feel discomfort, especially in rain (94%), at dusk (88%), at night (76%) and in fog (74%) [1].
ZEISS DriveSafe lenses are designed to maximise safety and comfort for car-driving spectacle wearers and can nevertheless be used all day. A new premium coating and a state-of-the art lens design technology make this possible. The new lenses address the major challenges facing spectacle wearers while driving in difficult light and weather conditions, resulting from dim light, fog or rain.

More safety with modern car headlamps. But also more discomfort glare for oncoming drivers

The discomfort glare is very often attributable to the spread of modern headlights and to the fact that the driver’s sight is changed because their eyes have to adapt to dusk and darkness and they “see differently”. High-intensity discharge (HID/Xenon) and LED headlamps are brighter and provide better road lighting. Drivers appreciate the increased visibility of their surroundings provided by these lamps. But the increasing prevalence of vehicles with these new headlamps has led to complaints about glare from oncoming cars.
The severity of the discomfort glare grows in general as the brightness of these light sources and its influence on the visual system increase. Discomfort glare is a matter of subjective perception and seems to be dependent on the spectral composition of the source of glare.
The ZEISS DuraVision DriveSafe antireflective coating has been designed for a light transmission spectrum that optimises protection against discomfort glare in the presence of Xenon/ HID and LED headlights.

To assess the effectiveness of the ZEISS DuraVision DriveSafe coating versus two other premium ZEISS anti-reflective coatings, a study compared its efficacy for visual comfort while being subjected to glare and for perceived glare under controlled setup conditions. ZEISS DriveSafe Coating was strongly preferred by almost 50% of test subjects over the alternative coatings, and was seen as being “most comfortable in order to see the low-contrast optotype while being glared with the white light LED setup” [2]. The new coating was rated best for “least perceived glare” compared to the other premium AR coatings.
Although the new coating can reduce perceived glare by reducing a portion of the visible spectrum, it still ensures maximum ability to see the surrounding environment for safe night driving. Like the ZEISS DuraVision Platinum coating, the lenses coated with DriveSafe are very robust, dirt-resistant and easy to clean while offering first-rate anti-reflective properties.

The challenge of complex visual tasks while driving
Driving presents a complex and changing set of requirements, may it be varying light or weather conditions. Drivers must contend with a rapidly alternating set of circumstances that require them to constantly redirect their attention.
There are only a few other situations in daily life with similar high demand for dynamic vision like driving a car. So even for single vision lenses, but particularly with progressive lenses, it is important to map the distribution of optical power in a spectacle lens to the spatial and temporal composition of the environment and tasks.
One requirement is the view of the road ahead to anticipate future turns and any required acceleration or stopping. Another is peripheral awareness of spatial location within traffic flow as well as the detection of potential threats posed by other drivers or road hazards. Yet another is the information presented in multiple visual displays on the instrumentation panel both straight-ahead and to the side. These requirements are compounded by the need to check several mirrors in order to remain aware of traffic that is approaching from behind.
The dynamics of the vision process while driving include changes of gaze direction, convergence and accommodation. Both the focus of attention and the visual dynamics are powerful influences on driving safety [3].
To better understand the requirements for dynamic vision while driving a car, ZEISS commissioned a study by the Research Institute of Automotive Engineering and Vehicle Engines Stuttgart (FKFS) using a modified car in a real world course. The setup included head and eye tracking systems to observe drivers’ visual behaviour.

The study found that drivers focus on the road ahead and distant moving objects about 97% of the time, look at the dashboard 2% of the time and alternate viewing dynamically between the several rear-view mirrors 1% of the time [4].
In the visual dynamics of driving, head and eye movements interact and are coordinated. Progressive lens wearers need to move their heads more than single vision wearers do in order to avoid zones that do not provide the correct addition power for the task or that have higher levels of aberration. A further finding of ZEISS's research is that the closest object viewed on the instrument panel is approximately 50-75 cm away from the driver's eye. This implies that while driving, the near zone of a progressive lens, designed for a much closer distance, is virtually unused.
The new ZEISS DriveSafe lens design was established to provide excellent visual dynamics. Therefore the lens design is optimized for adjusted pupil size as well as for uncompromised distance vision. Because quick glances at the instrument panel are essential for accurate information, the entire ZEISS DriveSafe design is tailored to relieve the specific head-eye-movements. For progressive lenses additional optimized vision zones allow for quick transition in the intermediate zone and provide the wearer with appropriate near vision for typical tasks in all day life. Taking all these factors into account, the DriveSafe designs enhance the possibility of comfortable, unstressed driving and are entirely suitable for all-day use for all kinds of activities.

Luminance Design Technology to tackle the illumination challenge
For several decades it has been sufficient to calculate the aberrations of spectacles by following a "chief ray" at any point. In effect, this means that the traditional calculation assumed that the pupil has an infinite small diameter. The ZEISS Luminance Design Technology overcomes limitations of the traditional appraoch which ignore a natural pupil size. The new method of lens computation optimizes dioptric powers using the entire beam of light passing through the pupil. The Luminance Design Technology was recently introduced for ZEISS progressive lens designs and is now also available for ZEISS DriveSafe lenses.
The result is a smoothening of dioptric microstructures for the moving eye that leads to improvement of overall clarity compared to traditional methods. For progressive lenses this optimization ensures a smooth transition from central to peripheral vision zones of the lens.
By studying the daily activities of spectacle lens wearers and using published research to establish pupil size at various levels of illumination, ZEISS has been able to determine the range of pupil sizes for specific activities. Based on

the average proportion of time spent performing each type of activity, a pupil diameter of 5mm and 4.3mm for single vision lenses and progressive lenses respectively, was chosen for optimization of ZEISS DriveSafe lenses.
The Luminance Design Technology represents the latest innovation by ZEISS to advance the precision of spectacle lens design. By considering the vision needs of wearers in varying light conditions, it optimizes ZEISS DriveSafe for continuous wear, ensuring clarity in both bright and low light conditions.

Test wearers confirm high satisfaction with ZEISS DriveSafe
Wearer trials [5] were conducted to compare the effectiveness and acceptance of ZEISS DriveSafe lenses in a driving scenario. The trials reveal very high satisfaction levels for the new lenses. The factors that were assessed included overall satisfaction while driving, driving in the dark and twilight, dynamic vision in near, intermediate and far vision, perception of colours, and dazzle from headlights. 97% of the test subjects were satisfied with the new lenses when driving, 94% doing everyday tasks, e.g. work in the office.

References:
(1) ZEISS data on file. Market research study (August 2013) with ECPs & consumers with 480 participants in USA and Germany
(2) Niedenzu, Laura; Spektrale Einflüsse auf Blendung im Straßenverkehr im Zusammenhang mit Brillenglasbeschichtungen, Cal Zeiss Vision, HTW Aalen, 2014 (ZEISS study with 50 subjects, 2014)
(3) Underwood, G.; Chapman, P.; Brocklhurst, N.; Underwood, J.; Crundall, D., Visual attention while driving: Sequences of eye fixations made by experienced and novice drivers, Ergonomics, 46, 629-646, 2003
(4) Study by ZEISS Vision Science Lab, Tuebingen, and Research Institute of Automotive Engineering and Vehicle Engines Stuttgart (FKFS). Data from 44 subjects was recorded totalling more than 33 hours net driving time.
(5) Internal wearer trial (ZEISS, Germany in 2014) with 50 subjects; and external wearer trials with 72 eye care professionals and consumers (Spain, 2014)

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