

Review Article

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Exploring Eye Tracking Technology in Ophthalmology

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ABSTRACT

The eye is the window to the body and soul as the functional use of the eyes affect what we see and do. It affects how we receive, process and transmit information from the visual world. Eye tracking technology enables the detection, measurement and monitoring of eye position and movement in order to detect normal and/or abnormal human behavior.

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Eye tracking is the modalities of measuring either the point of gaze or the motion of an eye relative to the head of person or object [1]. An eye tracker is a device for measuring eye positions and eye movement. There are three main types of eye tracker and includes the screen-based eye tracking device like the remote or desktop, the eye tracking glasses like the mobile devices and the eye tracking webcams like the video-based headsets [2].

The types of eye tracker usually measure rotations of the eye in one of several ways but principally in these three ways which includes measurement of moving object attached to the eye such as a contact lens or magnetic field sensor, optical tracking without direct contact to the eye using some non-contact methods and for measuring eye motion and the measurement of electrical potential using electrodes placed around the eyes such as electro-oculogram being used in measuring saccadic eye movement associated with gaze shift and detecting blinks.

The most commonly used current designs are video based eye tracking devices which is a modern eye tracker placed on the center of pupil and infrared non-collimated light to create corneal reflections which when calibrated help determine required measurement [3]. The modern eye trackers can be available as small and tiny as a pencil case and are getting more flexible and compact just like pachymeter used for central corneal curvature and intraocular pressure difference. The benefits of eye tracking technology help observe and measure eye movement, pupil dilation, point of gaze and blinking to see where object of focus lies in the visual attention, what they engage with as well as what they ignore. Eye movements are powerful indicators of human behavior, preference and decision making. Pupils dilate when a person is intrigued by something or having an intense emotional response [4].

The result of eye tracking technology will assist in understanding of the human eye and vision and also developing innovative approaches to diagnosing diseases. These have helped in the

development of perimetry, vision testing and screening, direction of eye misalignment or strabismus, oculomotor functions, refractive surgery and diagnosis of age-related macular degenerations [5].

Eye Tracking Technology in Ophthalmology

Technology has played a big role in ophthalmology. It has helped optometrists and ophthalmologists to be able to do their jobs better and has also helped improve patient outcomes [6]. There are many different types of technology that have been beneficial to optometry. Some of the most common ones include: Electronic Health Record have helped optometrists and ophthalmologists to be able to track patients' medical history more easily. This is important because it can help them to make informed decisions about treatment plans and also helps them keep track of progress over time.

Computerized refraction systems have helped to be able to test patients' vision more accurately. This is important because it helps them to prescribe the right glasses or contact lenses for each individual patient.

Eye-tracking devices have helped optometrists to be able to diagnose and treat eye conditions more effectively. This is important because it can help improve patient outcomes and also helps clinicians to save time on diagnosis and treatment. Because of these and many other benefits, technology has played a big role in improving the field of ophthalmology and has helped to improve the industry as a whole. For instance, glasses for visually impaired people can now be made in under an hour. This is because technology has allowed for the development of new methods and materials to be used in optometry [7].

In addition, technology has also allowed for the development of new treatments for eye conditions. For example, there are now treatments available for conditions such as macular degeneration and glaucoma that were not available in the past. All of these advances have helped to improve the ophthalmic industry and have made it possible for more people to achieve better eye health.

Advantages of Eye Tracking Technology

The improvement of eye care necessitates the involvement of technology in patient management as this focuses on understanding the patterns and signs of dysfunctions in neuro-ophthalmic diseases, optimizing present diagnostic evaluations including eye movement behavior as a focal point of complementing other clinical evaluations, vision training and teaching programs [8]. The advantages are enormous but the basic includes:

1. In ophthalmic imaging as instruments such as Optical coherence tomography, angiography, microperimetry, fundus camera is used real time in reducing motion artifacts and also to increase image acquisition for accurate imaging and results.
2. Medical education is made simpler in developing student's proficiency in the interpretation of visual images by reviewing video of eye movements.
3. Functional diagnostics is efficient based on evaluation of eye movements behaviour, pupil dynamics and in perimetry tests.
4. Eye tracking technology is applied in refractive surgery with excimer laser ablation, retinal photocoagulation and in proper evaluation of intraocular lens using keratometer and A/B ultrasound scan during cataract surgery.
5. The use of eye tracking based rehabilitative system in vision training/ therapy and rehabilitation is expedient as it aids in navigation training using real life simulations.
6. Security approach can be enhanced by eye tracking measures in safeguarding smart devices and documents as face checks must be verified satisfactory before access can be granted.

Disadvantages of Eye Tracking Technology

The world of technology is gradually changing and optometrist need to constantly upgrade the level of practice to meet with current visual challenges. While technology is an exciting advancement, it has also created more visual problems [9].

1. The constant complaint of eyestrain related to computer use is at all time high and there is need for optometrist to measure visual performance on digital devices.
2. Apart from preventive and corrective care, suggestions can be proffered to improve dynamic visual acuity over time.
3. Ergonomic evaluations are particularly prevalent among those using these devices especially on a regular basis to prevent onset of visual defects.
4. School children often complain of difficulty reading or doing school work because of vision related issues associated with computerized learning protocol for long period of time. The right assessment, diagnosis and treatment can help students get the vision correction required for school work.
5. The use of specific sport assessment services in eye tracking devices can assist in prevention of sport related injuries. The treatment options from supportive temporary prescriptions to computer- based strengthening exercises and therapy.
6. Optometrist use eye tracking technology to support vision care programs of the aged by identifying and providing treatment services to help preserve and improve ocular health in the elderly.

Conclusion

Eye tracking technology has provided great contribution and immense possibilities in the field of ophthalmology and vision science. There is need for long-term guided research in order to improve on innovative tools for exploring its complete potential thereby expanding its scope in order to revolutionize the eye industry.

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