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Artificial Eye's Parts

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Introduction

There are more than 30 million blind individuals in the world blindness is one of the most demoralizing and debilitating disorders as quality of life is seriously deteriorated. Artificial eye may refer to: visual prosthesis, which is electronic implantable device designed to restore the vision in many cases primarily retinal degenerative problems or , ocular prosthesis, which is non-functioning eyes models used just for replacement of the lost eyes. A visual prosthesis, often referred to as a bionic eye, is an experimental visual device intended to restore functional vision in those suffering from partial or total blindness. There are many designs by this time. In our report we will talk about three new artificial eye's parts designs ,their advantages and the problems related to each type[1,2].

Abstract

It is very hard and very complicated to take about all types of visual prosthetic models but in this report we talked about new metalens which help in replacement of human eye's lens and the ability to control the lens by artificial muscles , the researchers did not try the lens yet until they fix the problem of voltage that are needed to elastomer's activation. The second research was about the ability to create an eye and grew a ring of conjunctival cells — tissue that covers the white part of the eye — around a circle of corneal cells on a contact lens–shaped platform. This artificial eye surface could help researchers study dry eye disease, a condition that affects an estimated 16 million adults in the United States. While these two reports working for future the third report here is the intraocular lens, which is safe and they use it know, the model of intraocular lens very complicated and hard to explain what exactly these lenses are and this report mentioned the most important characteristics of intraocular lens.

Discussion

The first type of artificial eyes is a new metalens which can change its focus and can be used as replacement lens for humans. The researchers at SEAS at Harvard have develop and adaptive metalenses — flat surfaces that use nanostructures to focus light — electronically controlled artificial eyes. The adaptive metalens simultaneously controls for three of the major contributors to blurry images: focus, astigmatism, and image shift. The metalens (made of silicon) are mounted on a transparent, stretchy polymer film, without any electrodes. The iridescence is produced by the large number of nanostructures within the metalens. This metalens shows capability of dynamically correcting for aberrations such as astigmatism and image shift, which the human eye cannot naturally do. This demonstrates the feasibility of embedded optical zoom and autofocus for a wide range of applications. In the human eye, the lens is surrounded by ciliary muscle, which stretches or compresses the lens, changing its shape to adjust its focal length, and to applied this on human eye they need to adhere the large metalens to an artificial muscle without compromising its ability to focus light , and the researchers make a dielectric elastomer actuators, also known as artificial muscles.

The researchers chose a thin, transparent dielectric elastomer with low loss — meaning light travels through the material with little scattering — to attach to the lens. To do so, they needed to develop a platform to transfer and adhere the lens to the soft surface. The elastomer is controlled by applying voltage. As it stretches, the position of nanopillars on the surface of the lens shift. The metalens can be tuned by controlling both the position of the pillars in relation to their neighbors and the total displacement of the structures. The researchers also demonstrated that the lens can simultaneously focus, control aberrations caused by astigmatisms, and perform image shift. Together, the lens and muscle are only 30 microns thick[3].

The second research made the bases of this artificial eye is human cells. For the first time using human cells to build a blinking model of the surface of the eye. To achieve that blinking, the system contains a fake eyelid. Researchers hope to use such an artificial organ to study eye tissues and test medical treatments. Conjunctival cells form a thin tissue that covers the white part of the eye. A team of bioengineers at the University of Pennsylvania in Philadelphia grew a ring of such cells around a circle of cells that ordinarily make up the human cornea. That's the clear tissue in the front of the eye. The researchers grew the cells together on a contact lens–shaped platform. Because these cells need plenty of moisture, the system delivers fake tears. A synthetic "eyelid" spreads that liquid over the cells. The team fashioned that eyelid out of a thin water-based film. It's known as a hydrogel. A mechanical system pulls the eyelid open and closed to move the fluid over the living cells. That motion keeps those thirsty cells properly hydrated. This artificial eye is not anatomically correct. It has no retina, for instance, to capture light and images. It also has no nerve cells to relay such sensory information to the brain. But it does give scientists a more realistic surface to study such conditions as dry-eye disease. This disorder affects some 16 million adults in the United States alone. Affected people cannot produce enough tears to slake their eye cells' thirst. By making the eyelid blink less, The team could give their test bed the symptoms of dry eye. The device also could be used to test the safety and effectiveness of new eye drops to treat this or other conditions. The team said this type of artificial organ should even be able to help study eye injuries. These might include open sores on the eye surface known as corneal ulcers[4].

The third report about the intraocular lens, the report concerned about the focusing capabilities of intraocular lens, which is safe for long-term use in an eye. There are many types of intraocular lens according to their special lens configurations, e.g. multipart lenses; having particular optical properties, e.g. pseudo-accommodative lenses, lenses having aberration corrections, diffractive lenses, lenses for variably absorbing electromagnetic radiation, lenses having variable focus having adjustable focus; power activated variable focus means, e.g. mechanically or electrically by the ciliary muscle or from the outside. Special features of prostheses classified in other groups. Or subgroups that having an inflatable pocket filled with fluid, e.g. liquid or gas.
The characteristic of intraocular lens are similar but with deferens in the companied structures. In more details the lens body having features to facilitate aqueous fluid flow across the intraocular lens, e.g. for pressure equalization or nutrient delivery. Intraocular lenses having supporting structure for lens, e.g. haptics having mechanical force transfer mechanism to the lens, e.g. for accommodating lenses. And surrounding optic which is perform the supporting structure conforms to shape of capsular bag.
In more detail, the lens of the invention comprises an optic coupled to an optic positioning element. The optic positioning element is preferably balloon-shaped or preferably com prises an outwardly extending disc (optionally with thicker, radially extending "winged' portions separated by thin mem branes) The optic is resilient and can be formed of a solid material (e.g., silicone) or can be gas-filled. As result of the size and shape of the inventive lens and the material of which the optic is formed, the focusing action of the natural lens is simulated. That is, the ciliary body of the eye continues to exert a muscular force radially outward from the center of the capsule through the Zonular fibers so as to alter the thickness of the optic, resulting in a decrease in light convergence as is necessary for viewing objects distant from the viewer. When viewing an object close to the viewer, the ciliary body contracts, thus releasing the outward pull on the Zonular fibers. This alters the thickness of the optic to result in an increase in light convergence as is necessary for viewing nearby objects. The optic can be one of many shapes. Furthermore, the optic can be formed of a solid, liquid, or gel refractive material, or the optic can be gas-filled (e.g., air) so long as the chosen materials are safe for use in the eye. The shape of the optic and the material of which the optic is formed are dependent upon one another. That is, the shape is chosen based upon the refractive index of the material used to form the optic, and this choice is made to result in an optic which will highly converge light upon contraction of the ciliary body. Thus, if the refractive index of the optic material is greater than about 1.33 (the refractive index of the fluids within the eye), then optic shapes such as meniscus, planoconvex, and biconvex

would converge light. On the other hand, if the refractive index of the optic material is less than about 1.33, then optic shapes such as biconcave and planoconcave would converge light[5].

Conclusion

By the comparing between the three researches, leads to put the third one at the top because the material of lenses and the ability to be controlled by optics and the capability of lens to work in even the low light and be highly focused and it also safe for eyes. The first report the researcher's team referred that the voltage that are needed to elastomer's activation it may be very dangers to be applied in human eye, and the aim of this researcher to modify that parts. Also the challenge is that the lens in human eye under the ciliary muscle control and the elastomers are so different in almost every way than the normal muscle. The second research in my opinion was very genius idea to create an artificial part from the human cells even that they fail in making a complete artificial eye which was the main aim of this research but they reach to useful point which is using the result or the part that they could make for treat a disease.

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