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RESTORATION OF VISION IN BLIND INDIVIDUALS USING BIONIC EYE

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Abstract: One of the terrible diseases that people fear in life is blindness. There were none 200 years ago. The development of a treatment for blindness. If a person is born blind, he must live his entire life in that capacity. A novel gadget, the Bionic Eye, was created as a result of the integration of biomedical and electronics, which has had a significant impact on research. The bionic eye, an artificial eye, helps certain people who are blind. A CCD camera attached to the lenses of the spectacles and a chip inserted into the retina make up a bionic eye. The photos that the camera records are Images from the camera are wirelessly transmitted to the chip, where they are transformed into electrical impulses that the brain may process. The main benefit of the bionic eye is that it offers those who struggle with age-related blindness a remedy. Cataract, diabetic retinopathy, glaucoma, retinitis pigmentosa, macular degeneration, myopia, hypermetropia, presbyopia, macular edoema, keratonosus, trachoma, leucoma, cystoids macular edoema, and drusen are the main disorders that damage the eyes. Retinitis pigmentosa and macular degeneration are two of these disorders that the bionic eye completely eliminates.

Key words **- Bionic eye, retina, vision, visual prostheses**

I.INTRODUCTION

The eye is a necessary organ that allows humans to see the beauty of the world. The human eye is a kind of natural camera. Being blind is a serious disease. A shortened version of Bioelectronics eye is Bionic eye. The bioelectronic connection is the cause of the bionic eye. It is an electrical component that takes the role of the eye's functions in whole or in part. It is employed to enhance or replace functions in the eye. Eye diseases may have an impact on our entire way of life because the eye constitutes the most sensitive portion of our body. The external world is visible through the eyes. We are unable to even think of a single flaw in it. In the present world, bionic eyes are mostly used to treat eye illnesses including retinitis pigmentosa and macular degeneration. This Bionic Eye's function is to offer crystal-clear vision. We wear glasses with a CCD camera attached to them, and a chip is inserted into the retina. Many cells are activated when light strikes it, aiding the brain's ability to perceive an image. The world of blindness is bleak. Everyone in our world hopes to see even a single ray of light. There was no remedy for this problem 200 years ago. Several treatments followed, including cornea and eye transplants, but these are primarily for glaucoma and cataracts. The power consumption for this cutting-edge technology, called "THE BIONIC EYE," is only one-fourth of a milliwatt. In this method, there is no implanted battery in the body. The size of the chip inserted into the eye is similarly incredibly small, measuring between (250 and) 50 micrometres. The benefit of this approach is that blindness may be partially avoided. There are two types of implantations Experimental implant and Sub Retinal implant.Based on whether the implant is positioned in front of or behind the retina, this classification is made.

Australia is the centre that is pioneering Bionic Vision Australia. An enhanced bionic eye is being developed by researchers. With the use of bionic eyes, we can restore sight lost to retinal illnesses. The majority of those who report being blind are from India. India has 15 million blind people. Most of these illnesses can be treated. A bionic eye is made up of cameras, computers, receivers, transmitters, retinal chips, and other components. Within two years, patients will have access to a bionic implant that will cure the world's half-billion blind people. The bionic eye is still in the early stages of development; therefore it travels a lot. The bulky spectacles may one day be replaced with bionic lenses

II. LITERATURE SURVEY

The 2019 Journal of Neural Engineering article, "Bionic eyes: The bridge between biology and electronics," was written by M. C. Walters. The author gives an overview of the evolution of prosthetic eyes, including the many devices and the technology that underlie them, as well as the clinical uses and difficulties of these devices.

2014 saw the release of P. Dorn and M. Humayun's article "Bionic vision: A review of the bionic eye" in Clinical Neurophysiology. The authors examine the current status of bionic technology, including several methods for recovering vision, clinical trials and results, as well as potential applications and difficulties in the future.

In 2019, G. A. Ng, K. F. K. Wong, and M. P. Y. Desai published "Bionic vision: A overview of the engineering hurdles" in IEEE Engineering in Health and Biology Magazine. The construction of electrode and interfaces, data processing and picture reconstruction, as well as power and communication systems, are some of the engineering difficulties associated with creating bionic eyes, which are covered by the writers.

R. J. Greenberg's article "Bionic vision: The clinical reality" was released by Clinical Ophthalmology in 2014. The benefits and restrictions for patients with various types of visual loss, the risks and consequences of installation, and the need for additional research and development are all covered in the author's assessment of the health outcomes and difficulties of bionic eye technology.

The role of technology on restoring visual perception was discussed in the 2010 article "Bionic vision with retinal implants" by D. B. Shire, J. S. Kelly, and M. J. Doyle. The authors discuss the many retinal implants and the technology that support them, as well as the difficulties in enhancing vision, such as the demand for more complex image processing techniques and a deeper comprehension of the neurological systems underpinning vision

III.WORKING

A bionic eye, often referred to as a retinal implant, is intended to restore eyesight to patients who have lost it owing to age-related macular degeneration and retinitis pigmentosa, two degenerative eye illnesses. The remaining healthy retinal cells are electrically stimulated by the bionic eye, which causes them to deliver visual messages to the brain. The following describes the way a bionic eye operates:

- A tiny camera is attached on a set of spectacles, which records visual data and transmits it to a tiny computing device that is likewise worn by the wearer.
- A tiny electrode array is placed just on retina of the eye, and the processor transforms the visual input into electrical impulses that are delivered wirelessly to it.
- The sensor array then activates the retina's remaining healthy cells, which use the optic nerve to transmit vision signals to the brain.
- The person can "see" images as a result of the brain's interpretation of these signals.

Although though prosthetic eyes remain a relatively young technology, clinical trials have yielded encouraging results, and many users have indeed been able to partially recover their vision. Nevertheless, bionic eyes currently only have a limited field of view and resolution.

IV.FEATURES AND TECHNOLOGY USED

Bionic eyes contain a number of features and technological advancements that make it possible for them to restore eyesight people who have lost it because of degenerative eye diseases. Some of these elements and innovations include:

4.1 CAMERA

A set of glasses is equipped with a miniature camera that records visual data and transmits it to a computing device. The retina of the eye turns light into electrical signals, and the camera is made to emulate this process.

4.2 Computer processor

The user wears a small portable processor that receives video data from camera and transforms it into electrical impulses that can be transferred to the electrode array that is implanted.

4.3 ELECTRODE ARRAY

The retina of the eye has an electrode array implanted, which receives electrical impulses from computing device and stimulates the retina's remaining healthy cells. The retina receives electrical stimulation from the electrode array, which is made up of small electrodes

4.4 Wireless transmission

A tiny transmitter that is likewise implanted in the eye wirelessly transmits the electrical impulses from computer processor to the electrode array.

4.5 Stimulator

The electrode array is powered by a small device called a stimulator that is placed under the skin close to the eye.

4.6 Artificial intelligence (AI)

Some bionic eyes employ artificial intelligence (AI) algorithms to analyse visual data and improve the picture quality that is sent to the retina. AI can also assist the device in adjusting the electrode array's stimulation intensity and adjusting to shifts in lighting conditions.

In general, bionic eyes are a sophisticated technology that combines a number of characteristics and technologies to give the blind their sight back. Although the technique is still in progress, clinical trials have yielded encouraging results, and their use has allowed several patients to partially recover their vision.

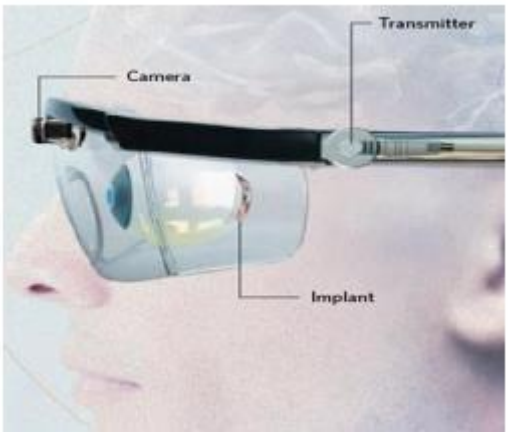

figure 1: components of bionic eye

figure 2: image seen using Bionic eye top) real image. bottom) image interpreted.

V.APPLICATIONS

5.1 Restoring vision

Bionic eyes are primarily used to help the blind or visual impairment regain some degree of vision. By inserting a microelectronic chip into the retina of the eye, these devices stimulate the retina's remaining healthy retinal cells, which then produce visual signals that may be transmitted to the brain.

5.2 Improving mobility

Individuals with visual impairments can move around more freely with the use of bionic eyes since they are better able to navigate their surroundings and recognize obstacles.

5.3 Enhancing quality of life

Regaining vision can significantly improve a person's quality of life by allowing people to read, watch tv, identify people, and participate in other things that they might have previously been unable to do.

5.4 Advancing research

In order to better understand how the human visual system functions, artificial eyes are also being employed in study. This could result in new advancements in sight restoration technologies.

5.3 Military applications

Soldiers who have lost their eyesight in battle might be able to regain some vision and freedom with the use of bionic eyes.

5.4 Industrial applications

Workers in areas like manufacturing or construction who must execute jobs requiring precise vision could use bionic eyes. In general, the creation and application of prosthetic eye technology is expected to greatly enhance the quality of life of people that are blind or vision handicapped.

VI.ADVANTAGES

- Perhaps, this new technology will help those who have AMD and those who have RP.
- The goal is to vastly enhance blind patients' quality of life.
- there is no intricate surgical procedure.
- There are no batteries inside the body.
- incredibly early on in the visual pathway

VII. LIMITATIONS

The expense of the Prosthetic eye, which is roughly $30,000 and is out of reach for many people, is crucial if the technology is to benefit the greatest number of people. The biggest drawback of the bionic eye is its high price; hopefully, this will change in the coming years, and more people will be able to afford them. The bionic eye is primarily for persons who suffer retinal loss as a result of RP, etc.; it is not appropriate for any and all blind people (for example, those with glaucoma). The amount of vision that has returned is indeed not high enough. Unfortunately, because bionic eyes produce clumpy pictures and are too sluggish to detect quick movements, the vision they provide is not precise enough for users to depend on to traverse the environment. Overall, the eyesight is still inferior to what a human eye would see. Although there are inherent difficulties, researchers expect that future bionic eye implants will produce higher resolution vision. Receivers are able to distinguish among form, motion, and light using the Argus system. The technology does not, however, enable humans to see with the same manner that healthy eyes do because it only has 60 electrodes. In contrast, to mimic natural eyesight, we would require about a million electrodes. The Argus business does intend to include more electrodes in upcoming models.

Because to the retina's many different types of neurons and the electrodes' inability to specifically target individual types, the bionic eye cannot imitate human vision due to its inability to perceive colour. This protracted treatment is undoubtedly expensive, and it's possible that health insurance won't pay for it. In addition, recipients must understand how the device functions and how to interpret flashes. It is tedious for the patient to have to move their head around to scan the region. The stability over time and the long-term effects of the device's electronic parts just on retina are still unknown.

VIII. THE FUTURE OF BIONIC EYE

Although the bionic eye's vision falls well short of what a natural eye can see, there are countless ways to enhance this technology. Although many doctors are already getting aware of the advantages of a bionic eye over the conventional glass eye, there is still a long way to go before they are preferred above surgical and medical procedures. Luo YH, da Cruz L. The Argus(®) II Retinal Prosthesis System. Prog Retin Eye Res 2016;50:89-107The main objectives are to reduce host immune response, interface blood clotting, and hardware failure and to boost the amount of sensors in the implants. Future implants might make it possible for patients to see in colour, and they might also be expanded to treat a wider range of blinding illnesses. In order to provide clear, vibrant, and more useful vision, we must use more electrodes. The Argus II retinal stimulator's next iteration is being developed, and it will include 60 programmable electrodes that can project high beam beams and create high-resolution images. With innovations such as this, it is conceivable that loss of vision will be treatable and no longer be a permanent condition inside the near future as technology continues to advance.

IX. CONCLUSION

For those with eye issues, the bionic eye is an excellent option. As the bionic eye is a relatively new invention, it still has a long way to go. This will undoubtedly spark a revolution in the medical industry. We can hope for a number of bionic eye developments, such as nanochips integrated bionic eyes, which eliminate the disadvantage of microchips. We can anticipate a bionic eye in the future that will eliminate blindness from birth.For science, nothing is insurmountable. Even blind people can quickly get vision. I salute technology.

REFERENCES

[1] N. Barnes, P. Lieby, H. Dennet, J. G. Walker, C. McCarthy, N. Liu, and Y. Li. "Investigating the role of singleviewpoint depth data in visually- guided mobility." In Vision Sciences Society (VSS), 2011.

[2] Xuming He, Chunhua Shen, and Nick Barnes. Face detection and tracking in video to facilitate face recognition in a visual prothesis. In ARVO, May 2011.

[3] Mills J, Jalil A, Stanga P. Electronic retinal implants and artificial vision: Journey and present. Eye 2017;31:1383-98

[4] Stronks HC, Dagnelie G. The functional performance of the Argus II retinal prosthesis. Expert Rev Med Devices 2014;11:23-30.

[5] Rizzo JF 3rd. Update on retinal prosthetic research: The Boston Retinal Implant Project. J Neuroophthalmol 2011;31:1608

[6] A. Stacey, Y. Li, and N. Barnes. "A salient information processing system for bionic eye." In Proceedings of IEEE EMBC 2011. IEEE, 2011

[7] Erik Reinhard and Kate Devlin. "Dynamic range reduction inspired by photoreceptor physiology." IEEE Transactions on Vis. and Comp. Graphics, 11:13–24, January 2005

[8] Acland GM, Aguirre GD, Ray J, Zhang Q, Aleman TS, Cideciyan AV, Pearce-Kelling SE, Anand V, Zeng Y, Maguire AM, Jacobson SG, Hauswirth WW, Bennett J. Gene therapy restores vision in a canine model of childhood blindness. *Nat Genet.* 2001;28:92–95.

[9] Gerding H, Benner FP, Taneri S. Experimental implantation of epiretinal retina implants (EPI-RET) with an IOL-type receiver unit. *J Neural Eng.* 2007;4:S38–49.

[10] Luo YH, da Cruz L. The Argus(®) II Retinal Prosthesis System. Prog Retin Eye Res 2016;50:89-107