

An Artificial Technique to Regain Vision Caused due to Retinal Impairment

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Abstract

Light is what that drives life. Without light it is difficult to imagine a life and allowed humans to evolve to such a level. The proposed analyses the cause for retinal disease that even leads to impairment of vision. The proposed discusses about the device that can smartly provide the solution by mimicking the functions of photoreceptors and provides a means for no longer in loss of vision.

Keywords: Retinal Disease, Photoreceptors, Vision.

Introduction

Vision Working

The eye is the most amazing organ in the body. The role performed when light from an object enters into the eye is:

- Scattered light from the object enters through the cornea.
- The light is projected onto the retina.
- The retina sends messages to the brain through the optic nerve.
- The brain interprets what the object is.

Retina

The retina is a thin layer of neural tissue that lies back wall inside the eye. Some of these cells act to receive light, while others interpret the information and sends messages to the brain through the optic nerve.

This complete process enables a person to see. In case of damaged or dysfunctional retinas, the photoreceptors stop working causing blindness.

Perceiving Light

The retina is complex in itself. This thin membrane at the back of the eye is a vital part of a person's ability to see. Its main function is to receive and transmit images to the brain. There are three main types of cells in the eye that helps to perform are

- Rods.
- Cones.
- Ganglion Cells.

There are about 125 millions rods and cones within the retina that acts as the eye's photoreceptors. Rods are the most numerous of the two photoreceptors, outnumbering cones 18 to 1.

Rods

They are able to function in low light and can create black and white images without much light.

Cones

When enough light is available, cones give us the ability to see color and details of the object. Cones are responsible for allowing us to perceive the objects because they allow us to see at a high resolution.

Ganglion Cells

The information received by the rods and cones are then transmitted to the nearly million ganglion cells in the retina.

The ganglion cells interpret the message from the rods and cones and send the information on to the brain by the way of optic nerve.

Problem Statement

There are number of retinal diseases that attack these cells, which can lead to blindness. The most notable of these diseases are retinitis pigmentosa and age related macular degeneration. Both of these diseases attack the retina, rendering the rods and cones inoperative, causing their loss of peripheral vision or total blindness. However it is found that neither of these retinal diseases affects the ganglion cells or the optic nerve.

This means that artificial rods and cones can be developed so the information could still be sent to the brain for interpretation.

Literature Survey

R.K. Humayun demonstrated that a blind person could be made to see light by stimulating the nerve ganglia behind the retina with electric current. It proved that the nerves behind the retina still functioned even when the retina has degenerated.

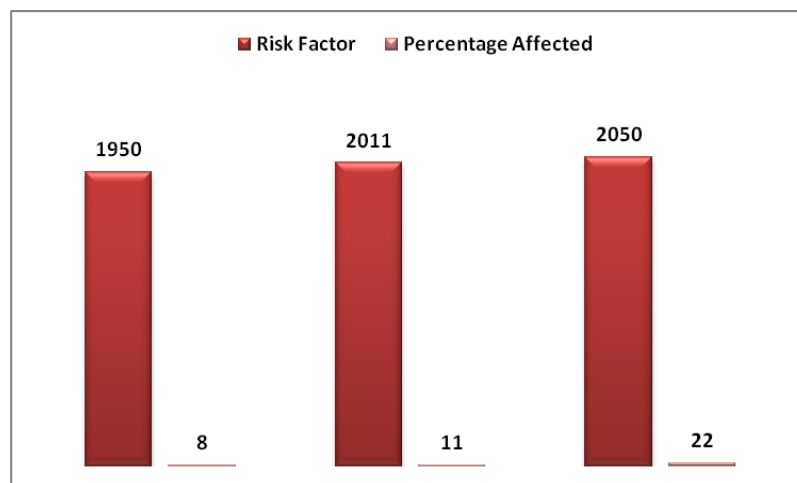
The proposed is to create a device that could translate images and electric pulses that could restore vision.

Collected Facts

In 1950, the global propagation of population over was 8% today is 11% and by 2050 it is expected to have risen to 22%. The cost of health care for the persons is estimated at between 2.8 and 3.5 times that of other health disorders.

Table 4.1: Depicts the potential risk factors.

Risk Factor	Percentage Affected
1950	8
2011	11
2050	22



Graph 4.1: Shows the potential risk factors.

Solution for the Problem

Artificial Silicon Retina

Is an extremely tiny device, smaller than the surface of a pencil eraser. It has a diameter of just 2mm and is thinner than the human hair. In order for an artificial retina to work it is designed to be small enough so that it can be transplanted into the eye without damaging the outer surface of the eye.



Figure 5.1: The dot above the date on this penny is the full size of the artificial silicon retina.

Transplantation Process

It contains about 3,500 microscopic solar cells that are able to convert light into electrical pulses, mimicking the functions of rods and cones. To implant the device the following steps are performed:

- i. Three tiny incisions no larger than the diameter of a needle in the white part of the eye.
- ii. Through the incisions, introduce a miniature cutting and vacuuming the device that removes gel from the middle part of the eye and replace it with saline.
- iii. Next, a pinpoint opening is made into the retina through which they inject the fluid to lift up a portion of the retina from the back of the eye, which creates a small pocket in the sub-retinal space for the device to fit in.

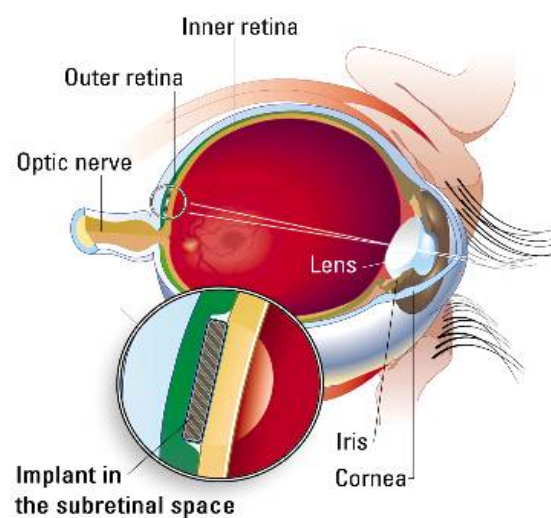


Figure 5.2: The device placed between the inner and outer retinal layers.

Working

For any microchip to work it needs power, and the amazing about the device is that it receives all of its needed power from the light entering into the eye.

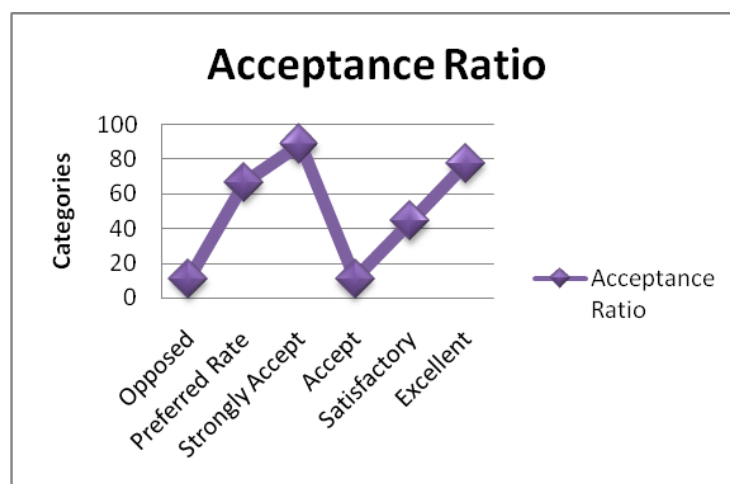
The device is placed behind the retina, it receives all of the light entering the eye. This solar energy eliminates the need for any wires, batteries or other secondary devices to supply the power.

Results and Discussions

We placed the concept in a forum at our college among the students and gathered the data and plotted the statistics using MS-Excel and it is shown as:

Table 6: Collected Statistics for proposal.

Categories	Acceptance Ratio
Opposed	11.1
Preferred Rate	66.7
Strongly Accept	88.8
Accept	11.1
Satisfactory	44.4
Excellent	77.7



Graph 6: showing the tabulated collected facts.

Conclusion

As the technology advances we are in need of depending them since to make our self comfortable and device assists the people who have lost their vision due to retinal

diseases which provides a mechanism to regenerate their vision. However there will arise some drawbacks which should be overcome in the future.

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