

# The Bionic Eye

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**Abstract—** Eye degeneration happens, most commonly due to disease and strain lowering the light-accepting cells capacity to function. As a result of this, and new technology we've achieved, new visual prosthesis have been born, from the glasses-video camera style Argus II, to the implant wireless Alpha IMS. These new devices allow those who become blind to have a chance to see again.

## I. INTRODUCTION

Eye degeneration happens with pretty much everyone. Eventually, sight is lost, either a little bit or large quantities to justify being legally blind. Glasses, when first introduced into our culture, were justified in the same sort as a prosthesis, where it was only used if really needed. Today, glasses are used everywhere and nobody really thinks about it; it's accepted that people have eye problems. As we move into the future of technology, we start to become able to do things that we were not able to do before, such as construct a complete replacement eye. The Alpha IMS

## II. THE ALPHA IMS

The Alpha IMS is very similar to other visual prosthesis', but also very different at the same time. Other devices, like the Argus II, use replacement eyes and "amplify" the visual stimuli into a video feed, to help and assist, and provide partial visual stimuli replacement. The Alpha IMS detects light in the eye through implanted electrodes, and that feed is then sent directly into a microchip in the brain, which allows the input to be processed as organic signals would. The Alpha IMS uses 1,500 electrodes vs the 60 electrodes that the Argus II uses, providing significantly higher resolution. Also, the Alpha IMS hooks into the eye, not replacing the eye. This allows the user to move their eye as they would naturally and the retina will pass that image off into the implanted electrodes. Due to this natural linkage, the only acceptable candidates for this technology are those who are inflicted by diseases that take out light-detecting cells in the eye. If the nervous system responsible for optical function is damaged, then the system will not work, as it uses it as the natural eye would.

## III. THE STUDY

The Alpha IMS is in its very early days of approval and function. The Argus II was the first device approved by the FDA as a visual prosthesis, but due to the nature of the Alpha IMS, it has been much more experimental and as a result of that, much more testing is needed. Currently, the study includes only nine human patients, all whom are blind. Eight of these nine patients had the implant successfully installed,

where the ninth's optic nerve was accidentally touched during surgery, resulting in implementation failure.

Of these eight successful implants, the results are astonishing. The patients were able to see vague black and white shapes, some saying they could detect mouths of people, absence of glasses on another, objects, and even bright reflections or light sources. As a result of this 2010 pilot, the Alpha IMS crew was given the green light for more trials in Hong Kong and the UK, for the purpose of studying long-term effects of the device, and the improvement of stability and function over that period of time.

## IV. THE FUTURE

Currently, the Alpha IMS only supports black and white vision, no color. It is a very basic retrieval of light and conversion to allow the brain to read. Depth perception, motion, and a lot of other triggers we rely on do not exist through the use of this device. All of the subjects involved in the experiment reported that the device improved the quality of life significantly. Going from being blind to having at least some form of black and white comprehension allowed them to live their lives better than they would have. However, due to the lack of support, FDA approval will be very far away. Different light sources change how the implant works, and rooms need to be illuminated significantly in order to see shapes. Reflections also seem to be given higher priority through the device, so cars and rivers with sunlight reflections would be seen over other potentially important objects. Being extremely young in the development process, the Alpha IMS looks extremely promising, despite its lack of function. If development goes in the right direction, and long term support and stability is achieved, this could possibly become the first FDA approved internal visual prosthesis.

## REFERENCES

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