Artificial vision by Direct Optic Nerve Electrode (AV-DONE)

There are many blind people in the world. Major causes of blindness are cataract and refractive error according to WHO's report. But those disease have solutions like surgeries, glasses and contact lens. In spite of recent medical development, there are still severe eye diseases which have no effective treatment. Such diseases include retinitis pigmentosa (RP), which is characterized by gradual loss of photoreceptors that could develop into night blindness and visual field deficits, leading to blindness when progressed severely. About 100,000 people in the U.S. are thought to have RP.

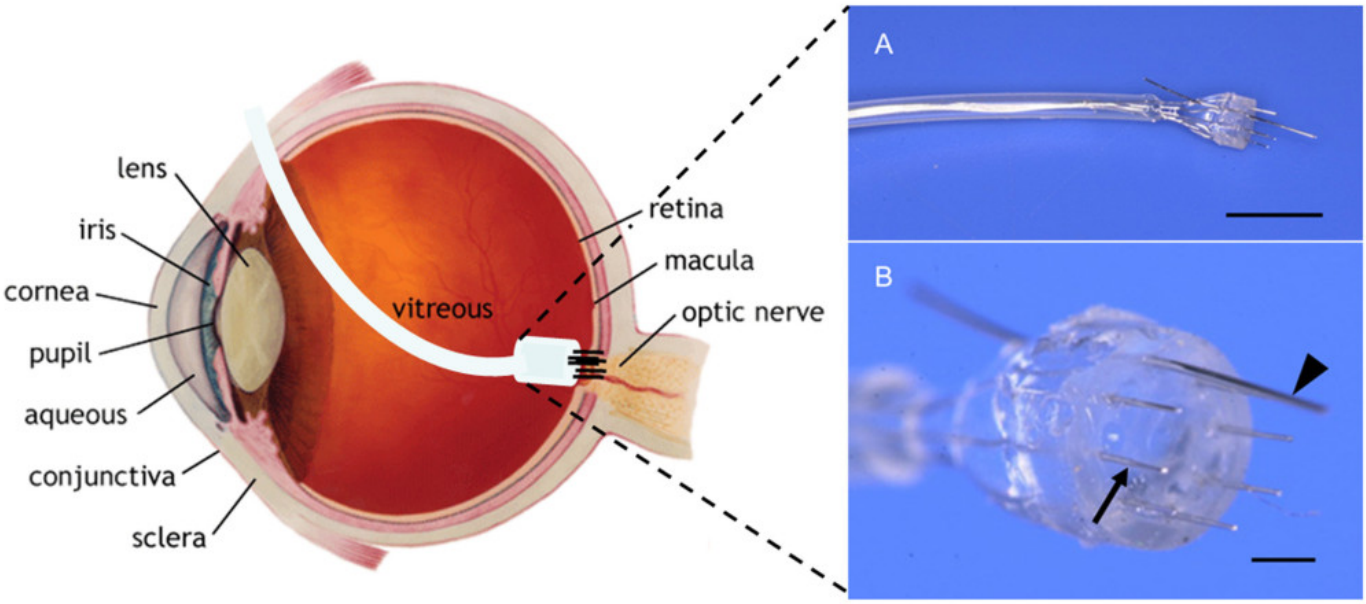

Fig. 1. AV-DONE System and new electrode (eyeball diagram from http://ollanti.host.sk/7.html). (A) This device is comprised of seven stimulation electrodes, one return electrode, one rod, and a cylindrical silicone board. Scale bar=3 mm. (B) The arrow indicates a stimulation electrode and the arrowhead indicates the manipulation rod. Scale bar=1 mm.

An artificial vision is an attempt to restore the vision of blind people by electricity and is considered as one of the treatment options for RP. Clinical trials have been conducted in many countries. The basic idea of an artificial vision system is to reconstruct the transmission of visual information that has been disrupted due to the damage to the neural tissue on the visual pathway by delivering electrical stimulation from electrodes, and thus bypassing the damaged tissue and making use of neural network that is remained still functional and intact.

There are three targets for artificial vision: retina, optic nerve, and visual cortex. I believe that the

optic nerve, especially the optic nerve disc is the best target in order to input visual information into the brain. Because all visual information are transmitted to the brain via optic nerve in normal condition, it can be the best target to input electrical stimulation for visual information into the brain efficiently and the location of optic nerve disc is easy to access..

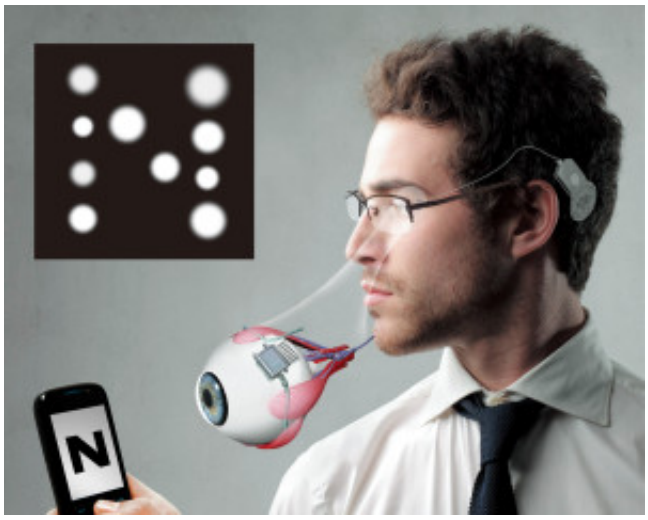

Fig. 2. AV-DONE total system (http://www.nidek.co.jp/visual_prosthesis/?

In previous study Belgian group implanted 4 electrodes around optic nerve and the patient could recognize “T” shape. In our report we implanted the newly developed electrode device which contains 7 stimulating electrodes to the patients for 25 months and obtained electrically induced visual sensation in wide field without adverse event. We confirmed the safety and efficacy of Artificial Vision by Direct Optic Nerve Electrode (AV-DONE). Now we will have completed the total system for our artificial vision soon, and we will be able to evaluate the efficacy of AV-DONE precisely.

The ultimate goal of the treatment of the blindness is to regenerate all parts of the visual pathway and make them work properly, but it is not easy and it takes lot of time. Artificial vision cannot regenerate the visual pathway but it will be great help for blind people until regenerative medicine achieve the ultimate goal and moreover it could overcome its limitations by a combination of other therapies including regenerative medicine.

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Publication

Visual Sensation by Electrical Stimulation Using a New Direct Optic Nerve Electrode Device.
Nishida K, Sakaguchi H, Kamei M, Cecilia-Gonzalez C, Terasawa Y, Velez-Montoya R, Fujikado T, Sanchez-Fontan R, Ozawa M, Quiroz-Mercado H, Nishida K.
Brain Stimul. 2015 May-Jun