EC OPHTHALMOLOGY
Editorial

Retina Prostheses: A Short Review

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Retinal prostheses are devices to deliver electrical stimulation to retina and induce artificial vision for people with severe hereditary or degenerative retinal diseases.

As early as 1755, French physician Charles Le Roy conducted wires across the head and leg of a blind man who reported to perceive flashes of light (phosphenes) [1]. However, only with rapid development in both biotechnology and vitreo-retinal surgery over the past 3 decades, advances in retinal prostheses have been prominent. To date, 4 retinal prostheses have received marketing approval for use in the United States and Europe, with over five hundred patients having been implanted worldwide over the past decade [2,3].

Retinal prostheses function by delivering direct electrical stimulation to the inner residual retinal neurons either via small pulses of electricity from an array of electrodes implanted in or near the retina, which is triggered by an internal processing unit connected to a video camera [4], or via electronic stimulation transduced from incident light signals toward photodiodes (photovoltaic pixels) implanted in or near the retina [5].

Based on the surgical location of the retinal prostheses, there are 4 categories: 1) Epiretinal (such as The Argus II System by Second Sight Medical Products which utilizes a 60-microelectrode array marketing approved by CE mark and FDA in 2011 and 2013 respectively; The Intelligent Retinal Implant System - IRIS II by Pixium Vision S.A. which uses a 150-microelectrode array marketing approved by CE mark in 2016); 2) Subretinal (such as The Artificial Silicon Retina by Optobionics which consists of 5000 micro-photodiodes using ambient light; The Alpha IMS and AMS by Retina Implant AG which contain 1500 - 1600 photodiodes marketing approved by CE mark in 2013 and 2016 respectively); 3) Suprachoridal (such as GEN 1 and GEN 2 by Bionic Vision Australia which feature 33 and 44 electrodes respectively); and 4) Intrascleral prostheses (such as STS device by Osaka University Japan which has 49 electrodes).

There have been multiple clinical trials conducted to investigate the retinal prostheses. Visual function testing results and patient self-reported outcomes have demonstrated significant difference with patient using the devices. However, the rate of SAEs although all treatable was also notable [6,7].

Ophthalmologists, vision rehabilitation therapists, engineers and industry are facing numerous challenges to develop safer retinal prostheses with improved visual outcomes. They have to keep working closely together in order to win this battle against blindness hopefully in the near future.

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