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# Okayama University research: Successful implantation and testing of retinal prosthesis in monkey eyes with retinal degeneration

(Okayama, 27 June) **Researchers at Okayama University report in the journal *Artificial Organs* the successful implantation of dye-based prosthetic films in monkey eyes. The study demonstrates the implantation's surgical feasibility, and marks an important step towards the development of a treatment for patients with macular degeneration or retinitis pigmentosa.**

With age, the macula — a pigmented area near the center of the retina in the human eye — often becomes damaged, resulting in deteriorated vision. Nearly 12% of people aged 80 or older suffer from such age-related blurred or lost center-of-field vision, known medically as macular degeneration. At present, there is no treatment for recovering lost vision due to macular degeneration, but a team of researchers led by Dr.Toshihiko Matsuo from Okayama University are making significant progress towards implants that could replace damaged maculas in humans.

Dr.Matsuo and colleagues succeeded in surgically inserting a retinal implant, known as Okayama University-type retinal prosthesis (OUReP$^{TM}$), in the subretinal space of monkey eyes suffering from macular degeneration. OUReP$^{TM}$, developed earlier at Okayama University, is a material based on photoelectric dye molecules, capable of converting light into electric potentials, and as such mimicking phototransduction as it takes place in mammalian eyes.

The researchers worked with cynomolgus monkeys, in which macular degeneration was induced in one eye through injections with cobalt chloride. Initial experiments done with 6 monkeys during one month were followed by tests on 8 monkeys in a 6-month period. In the latter study, 3 monkeys underwent surgery after 5 months for inspection of the OUReP$^{TM}$ implant. Monkeys were not only used because their retinas, like human retinas, have a macular structure, but also because monkey studies are a necessary intermediate step, required by Japan's Pharmaceuticals and Medical Devices Agency, towards the development of implants for human eyes,

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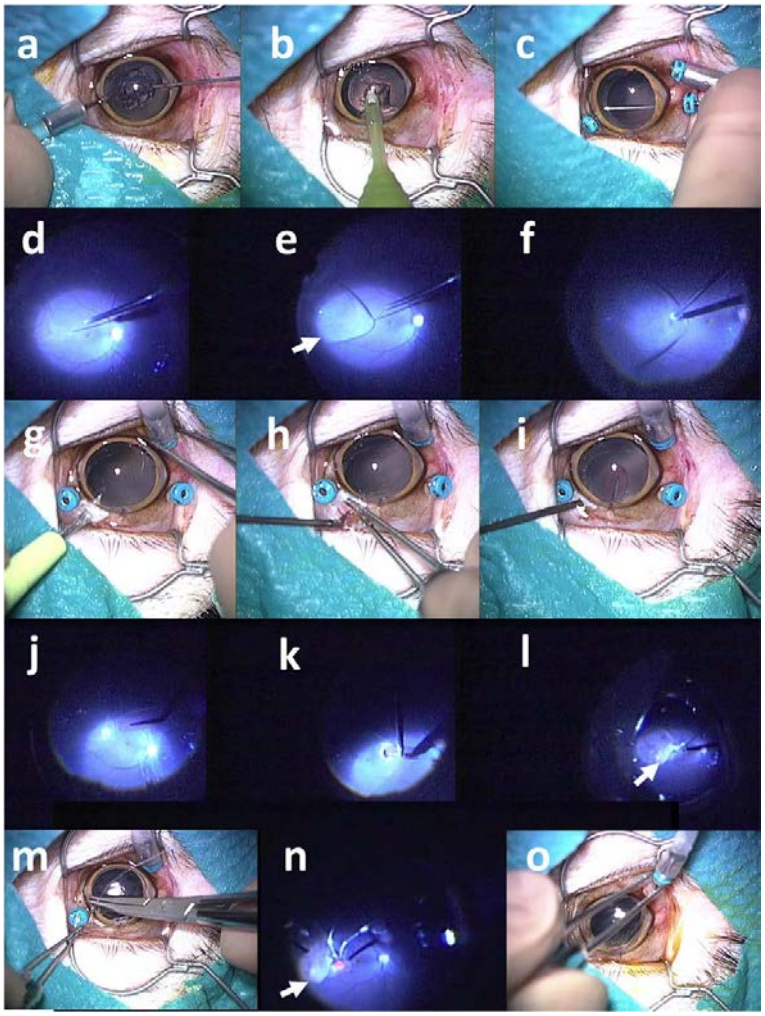
All monkeys involved in the experiments were healthy during the observation period. Dr.Matsuo and colleagues demonstrated the surgical feasibility of implanting OUReP$^{TM}$; the neuroretina (the part containing the retina's neural elements) remained attached to the dye films through the 1- and 6-month periods, and structural integrity of the implantation site was observed as well. Furthermore, the researchers checked that no monkeys developed retinal toxicity or inflammatory cells. The implants' functioning was tested by measurements of the amplitude of visually evoked potentials; normal signal amplitudes were observed one month after implantation and remained stable after.

The scientists point out that OUReP$^{TM}$ implants could also become applicable as a treatment for retinitis pigmentosa, a hereditary retinal disease causing blindness due to dead photoreceptor cells. Quoting Dr.Matsuo and colleagues: "The filing of a first-in-human clinical trial for OUReP$^{TM}$ in patients who have lost vision by retinitis pigmentosa is now negotiated at Pharmaceuticals and Medical Devices Agency (PMDA) in Japan."




**Caption**
Sequence of surgical procedures for implanting Okayama University-type retinal prosthesis in a monkey eye.

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**Reference 1**
Toshihiko Matsuo, Tetsuya Uchida, Jun Sakurai, Koichiro Yamashita, Chie Matsuo, Tomoaki Araki, Yusuke Yamashita, Kunihisa Kamikawa. Visual Evoked Potential Recovery by Subretinal Implantation of Photoelectric Dye‐Coupled Thin Film Retinal Prosthesis in Monkey Eyes With Macular Degeneration. Artificial Organs, 42, 2018.
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https://onlinelibrary.wiley.com/doi/full/10.1111/aor.13120

**Reference 2**
Toshihiko MATSUO, Tetsuya UCHIDA, Makoto NITTA, Koichiro YAMASHITA, Shigiko TAKEI, Daisuke IDO, Mamoru TANAKA, Masao OGUCHI, Toshinori FURUKAWA. Subretinal implantation of Okayama University-type retinal prosthesis (OUReP$^{TM}$) in canine eyes by vitrectomy. *Journal of Veterinary Medical Science*, Volume 79 (2017), Issue 12, Pages 1939-1946.
DOI : https://doi.org/10.1292/jvms.17-0450
https://www.jstage.jst.go.jp/article/jvms/79/12/79_17-0450/_article

**Reference 3**
Toshihiko MATSUO, Tetsuya UCHIDA, Koichiro YAMASHITA, Shigiko TAKEI, Daisuke IDO, Mamoru TANAKA, Masao OGUCHI, Toshinori FURUKAWA. Visual evoked potential in rabbits' eyes with subretinal implantation by vitrectomy of Okayama University-type retinal prosthesis (OUReP$^{TM}$). *Journal of Veterinary Medical Science*, Vol. 80 (2018), No. 2 pp. 247-259.
DOI : https://doi.org/10.1292/jvms.17-0422
https://www.jstage.jst.go.jp/article/jvms/advpub/0/advpub_17-0422/_article

**Reference (Okayama Univ. e-Bulletin): Associate Professor Matsuo's team**
e-Bulletin Vol.8 : Photoelectric dye-coupled thin film as a novel type of retinal prosthesis
OU-MRU Vol.8 : Light-responsive dye stimulates sight in genetically blind patients
OU-MRU Vol.39 : Successful test of retinal prosthesis implanted in rats
OU-MRU Vol.47 : Candidate genes for eye misalignment identified

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About Okayama University (YouTube):
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Okayama University Image Movie (YouTube):
https://www.youtube.com/watch?v=KU3hOIXS5kk

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http://www.okayama-u.ac.jp/eng/access_maps/Shikata_Campus.html

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## ◆About Okayama University

Okayama University is one of the largest comprehensive universities in Japan with roots going back to the Medical Training Place sponsored by the Lord of Okayama and established in 1870. Now with 1,300 faculty and 13,000 students, the University offers courses in specialties ranging from medicine and pharmacy to humanities and physical sciences.

Okayama University is located in the heart of Japan approximately 3 hours west of Tokyo by Shinkansen.

Website: http://www.okayama-u.ac.jp/index_e.html


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