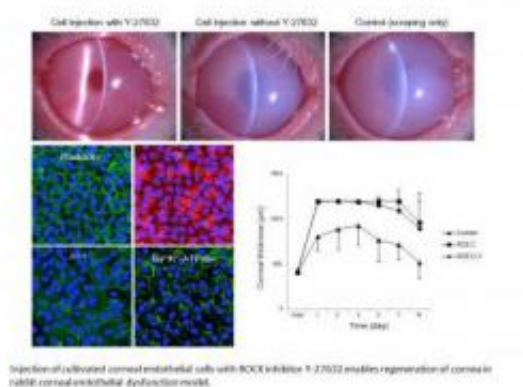


Regenerated cells may restore vision after corneal dysfunction

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Injection of cultivated corneal endothelial cells with ROCK inhibitor Y-27632 enables regeneration of cornea in rabbit corneal endothelial dysfunction model. Credit: N. Okumura et al.

Regenerative medicine, or the use of specially grown tissues and cells to treat injuries and diseases, has been successful in treating disorders of a number of organs, including heart, pancreas, and cartilage. However, efforts to treat disorders of the corneal endothelium, a single cell layer on the inner surface of the cornea, with regenerative techniques have been less effective. Now, a group of scientists has developed a method that enhances the adhesion of injected corneal endothelial cells (CECs), allowing for successful corneal transplantation to repair pathological dysfunctions. Their results are published online today in advance, in the July issue of *The American Journal of Pathology*.

"Corneal [endothelial dysfunction](#) is a major cause of severe visual impairment, since the cells maintain the transparency of the cornea," explains lead investigator Noriko Koizumi, MD, PhD, of the Department of Biomedical Engineering, Faculty of Life and Medical Sciences, Doshisha University, Kyotanabe, Japan. "Injected cultured CECs can be washed off by aqueous humor flow, resulting in poor adhesion of the cells injected onto the corneal tissue. Previous studies demonstrated that Rho-associated [kinase](#) (ROCK) signaling interferes with adhesion. We found that transplanting cultivated CECs in combination with a low-molecular weight compound that inhibits ROCK (ROCK inhibitor Y-27632), successfully achieved the recovery of corneal transparency."

Using rabbit cells, researchers cultivated CECs in the lab and injected them into the anterior chamber of rabbit eyes with damaged corneal endothelia. Based on the recovery of the corneal [endothelial function](#), they found that when the cultivated cells were injected along with Y-27632, the rabbit corneas regained complete transparency 48 hours after injection. In contrast, rabbit CECs injected without Y-27632 resulted in hazy and severely swollen corneas. No complications related to cell injection therapy were observed and reconstructed corneal endothelium with Y-27632 exhibited normal hexagonal cell shape.

Since rabbit CECs are highly prolific in vivo, the scientists performed another round of experiments with monkey CECs, which are more similar to those in humans. The transplantation of CECs in these primates also achieved the recovery of long-term corneal transparency with a monolayer of hexagonal cells, suggesting that cell adhesion modified by ROCK inhibitor may be an effective treatment for human corneal endothelial disorders.

Although surgical techniques to replace the injured corneal endothelium have been developed, these procedures are technically difficult and challenging due to a shortage of donor corneas. "The novel strategy of

using a cell-based therapy combined with a ROCK inhibitor may ultimately provide clinicians with a new therapeutic modality in regenerative medicine, not only for treatment of corneal endothelial dysfunctions, but also for a variety of pathological diseases," Dr. Koizumi concludes.

More information: "A ROCK Inhibitor Converts Corneal Endothelial Cells into a Phenotype Capable of Regenerating In Vivo Endothelial Tissue," by N. Okumura, N. Koizumi, M. Ueno, Y. Sakamoto, H. Takahashi, H. Tsuchiya, J. Hamuro, and S. Kinoshita (DOI: [dx.doi.org/10.1016/j.ajpath.2012.03.033](https://doi.org/10.1016/j.ajpath.2012.03.033)). It will appear in *The American Journal of Pathology*, Volume 181, Issue 1 (July 2012)

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