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RESEARCH WATCH

For your eyes only: Harnessing human embryonic stem cell-derived retinal pigment epithelial cells to improve impaired vision

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Abstract Vision loss or impairment resulting from the degeneration of the retinal pigment epithelium and photoreceptor death affects millions worldwide. Recent exciting results from clinical studies of small numbers of patients treated with human embryonic stem cell-derived retinal pigment epithelial cells may provide hope for affected individuals.

Vision loss or impairment as a result of the degeneration of the retinal pigment epithelium and the subsequent photoreceptor death affects millions of people worldwide. Two major causes of this condition include dry age-related macular generation and Stargardt's macular dystrophy.[1,2]

There is currently no effective treatment for either of these conditions. Recently, two groups of investigators reported exciting results from clinical studies of a small number of patients treated with human embryonic stem cell-derived retinal pigment epithelial cells.[3,4] Schwartz et al reported their results from a study of nine patients with atrophic age-related macular generation and nine with Stargardt's macular dystrophy in *The Lancet*.[3] Although the trial was performed to examine the safety of the cell-based therapy, assessments of its efficacy were also performed. The patients had been followed up for a median of 22 months. The visual acuity improved in 10 eyes, remained the same in seven eyes and decreased in one eye. There

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were no adverse effects related to the cell therapy identified, suggesting that it is safe.

In another study published in *Stem Cell Reports*, Song et al reported their treatment of two patients with dry age-related macular degeneration and two patients with Stargardt's macular dystrophy. They also used embryonic stem cell-derived retinal pigment epithelial cells.[4] The patients in that study had a different ethnic background (Asian rather than Caucasian). Their findings were consistent with the results obtained by Schwartz et al. The patients showed improvement in their visual acuity, and there were no side effects associated with the treatment.

These studies demonstrated the possibility that human embryonic stem cell-derived cells may provide a new source of therapeutics for retinal degeneration, although the mechanism(s) underlying the visual improvement is still unclear. Since Stargardt's disease affects photoreceptor cells as well as retinal pigment epithelial cells, it is possible that the transplantation of both photoreceptor cells and retinal pigment epithelial cells would have even better efficacy. Since the cells used were not autologous, immunosuppressive agents were used for the first 12—14 weeks after the transplant. However, since the retinal space is considered to be an immune-privileged environment,[5] it is unclear whether immunosuppression is necessary. On the other hand, if the cells being transplanted are immunogenic, immunosuppression for 12—14 weeks may not be sufficient to allow the cells to survive for 22 months. Animal studies would be useful to resolve whether the retinal space tolerates heterologous cells. Since the embryonic stem cells can provide an unlimited supply of cells, these studies can shed new light on using human embryonic stem cells to develop cell-based therapies for retinal diseases, and perhaps also for other diseases.

Conflict of interest disclosure

The authors declare no conflict of interest.

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