

Stem cells for the treatment of vision loss

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Degenerative retinal diseases are among the prime causes of irreversible vision loss. These include diseases, such as Stargardt's disease, age-related macular degeneration and retinitis pigmentosa. Transplant of retinal pigment epithelium (RPE) cells is a common application of stem cell therapy in ophthalmology. Cultured RPE cells obtained from the donor's pluripotent stem cells can be transplanted into the subretinal space which refers to the space between RPE cells and photoreceptors. Early phase clinical trials of this method have shown patches of increasing pigmentation, indicating improvement of vision. To this date, no proper evidence has been presented that stem cell-derived retinal pigment epithelium can improve or restore vision. However, clinical trials on the replacement of retinal pigment epithelium in patients with age-related macular degeneration have resulted in transient vision recovery as well as better results if an autologous source is used. Limbal stem cell transplantation is the only stem cell-based transplantation approved for patient care, other than bone marrow transplantation. The development of limbal stem cell transplantation has been done for treating corneal conditions associated with anatomical or functional loss of corneal epithelial stem cells for the restoration of the damaged corneal surface leading to the subsequent recovery of vision. Autotransplantation of limbal tissue from the healthy eye was first performed to supply limbal stem cells to the affected eye. Another procedure called simple limbal epithelial transplantation was developed for unilateral limbal stem cell deficiency, in which a small limbal biopsy was extracted from the contralateral eye. It was then divided into 8-10 pieces and then placed on top of a fresh human amniotic membrane which was already transplanted in the diseased cornea with fibrin glue. This technique was further modified by using cryopreserved amniotic membranes sandwiching the limbal cells, which was approved by the food and drug administration (FDA) for patient care. However, there are still some concerns regarding the procedure, such as how the biopsy will function, the reproducibility and the long-term efficiency of the procedure. It was observed that autologous cultivated limbal epithelial transplantation was effective in inducing long-term regeneration of a fully-functional corneal epithelium in patients with limbal stem cell deficiency due to thermal or chemical burns. This procedure poses fewer risks for the donor's eye, hence it can be used to treat limbal stem cell deficiency if a small part of the limbus is available with the possibility of regrafting in case of failure.

Keywords: Limbal stem cells, Macular degeneration, Retinal disease, Corneal degeneration, Limbal epithelial transplantation

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