CULTIVATED STEM CELL TRANSPLANTATION FOR OCULAR SURFACE RECONSTRUCTION

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Background and aim of the project:

Limbal epithelial stem cells are the ultimate source for regeneration of the entire corneal epithelium under normal and injured states. (1,2) Diseases that destroy the limbal epithelial stem cells directly, or disturb their surrounding environment, or a combination of both can lead to a state known as Limbal Stem Cell Deficiency (LSCD), which carries the hallmark of conjunctivalization. There is destruction of the basement membrane with superficial vascularization, and chronic inflammation frequently associated with a compromised corneal epithelium. As a result patients with LSCD suffer from decreased visual acuity, photophobia, and are poor candidates for conventional corneal transplantation. This project aims at investigating cultivated limbal epithelial stem cell transplantation, and providing improvements and eventually standardization of the both, the culture conditions of the stem cells and the surgical technique.

Development of the project:

A new treatment strategy for LSCD is to transplant bioengineered Limbal Epithelial Stem Cell (LESC) grafts that have been expanded ex vivo on a carrier substrate. This strategy is superior to previous ''limbal grafting'' as a very small biopsy is needed from the donor eye, the stem cells from which are expanded on to a carrier, which in this case is a standardized amniotic membrane. This practice of using small biopsies reduces trauma to and prevents possible LSCD in the donor eye. Immunosuppression is not needed in cases of unilateral disease as autologous grafts can be engineered and transplanted from the healthy eye. In cases of bilateral disease biopsies from a close relative or a cadaver eye may be used.

A small pilot study has already been conducted at the Department of Ophthalmology, University Hospital Antwerp. Two patients were transplanted: one with an autologous and one with an allogenic ex vivo cultivated limbal stem cell graft. The results of which have varied.

The autologous graft recipient was a success, resulting in complete epithelization of the cornea with excellent graft integration and no signs of corneal neovascularization. Pre-transplantation, this recipient cornea was heavily calcified; therefore the main objective of this treatment was reducing vascularization of the cornea in preparation for receiving a conventional corneal graft. In this case, therefore, visual rehabilitation was a secondary goal. Interestingly, there was an increase in visual acuity and the patient who could perceive only hand movements at a distance of one meter, now has a visual acuity of 0.2.

On the other hand, the patient receiving an allogenic graft, did not fair too well and the transplant was termed a failure. This patient was under immunosuppression prior to and in anticipation of the transplant. However graft rejection cannot be ruled out and further investigations need to be performed to highlight the reasons for the failure and possible solutions to prevent this in the future.

REFERENCES

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