Corneal Wound Healing: Current Cell therapies, challenges and future approach

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Presently 1.8 million people are corneal blind in India and out of that 30% of corneal blind are children. Corneal blindness can be due to multiple factors like physical scar, refractive error, chemical burns, LSCD and genetic etiology. Limbal stem cell deficiency (LSCD) is one of the major causes for corneal disorders. Epithelial transplantation serves as an appropriate redressal for severe ocular surface disorders like burns, chemical injuries and diseases like Steven-Johnson syndrome. The earlier surgical modalities for Limbal stem-cell deficiency (LSCD) include cultured limbal epithelial transplantation (CLET), cultured oral mucosal epithelial transplantation (COMET), etc.

Secondly, the recent discovery of multi-potent stem cells in the corneal stroma has opened up the possibility of developing a cell-based approach to treating corneal scars as an alternative to keratoplasty. In a murine model of corneal opacity, human stromal stem cells were effective in regenerating normal corneal extra-cellular matrix and repairing collagen fibril defects. We foresee the ability of a clinician to isolate limbal stromal cells from a healthy eye, expand the cells, and, after surgically removing the scar tissue from the wounded eye, apply the patient's own limbal stem cells to regenerate healthy, transparent tissue.

The future challenge

This would add an insight to the current standard surgical techniques involving limbus as a source of stem cells assisting in corneal epithelium regeneration. Still we can't cure many of the corneal diseases and its need corneal transplant (clinically known as Penetrating Keratoplasty) but there is huge difference between the demand and supply of healthy donor corneas. Its open up new door for artificial cornea or corneal bioprinting to fill up the future gap. We will mainly discussing on our present approach and ideas regarding the corneal bioprinting and the future collaboration between LVPEI and IITH.

Corneal endothelial transplantation: are we there yet?

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Transparency of the cornea, the first refracting surface of the eye, is crucial for experiencing clear vision. A polygonal mosaic of endothelial cells located on the posterior surface of the cornea maintains corneal transparency by regulating the fluid flow to and from the stroma. An imbalance in the hydration control due to corneal endothelial dysfunction leads to corneal edema and eventually a severe loss of vision. Since these cells are essentially non-mitotic in vivo, their loss is irreversible and the only successful treatment option available is to replace the dysfunctional host cornea with a healthy donor cornea. And of the over 40,000 transplantations done in a year in the US (2014 data), nearly 50% were done to restore corneal endothelial function. The paucity in the number of healthy donor corneas continues to pose a challenge for timely restoration of vision in these patients. Of the million donor corneas required for treatment only 35,000 healthy donor corneas become available every year.With the large gap in the demand and supply of the tissue, the development of alternative solutions for meeting this demand becomes critical.

We will discuss the progress made in the field towards replacing / restoring corneal endothelial function and the possible future direction.