ECRONICON OPEN ACCESS

EC OPHTHALMOLOGY
Editorial

New Horizons in Corneal Transplantation

C Banu Cosar*

Professor of Ophthalmology, Department of Ophthalmology, Acibadem Mehmet Ali Aydinlar University, Istanbul, Turkey

***Corresponding Author:** C Banu Cosar, Professor of Ophthalmology, Department of Ophthalmology, Acibadem Mehmet Ali Aydinlar University, Istanbul, Turkey.

Received: March 18, 2020; **Published:** April 18, 2020

Currently, keratoplasty is the conventional treatment to replace an abnormal cornea. The transition from penetrating to lamellar keratoplasty has become established amongst corneal surgeons.

However, different therapeutic approaches are being investigated as the cadaveric corneal tissue is scarce and the risk of rejection with allogenic tissue is still a problem.

Novel therapeutic strategies such as cell therapy, regenerative therapy, gene therapy and bioengineered corneal grafts are evolving and they are expected to replace corneal transplantation in future [1].

Cell therapy

Endothelial corneal cell therapy involves transplantation of in vitro cultivated human corneal endothelial cells. In 2018, Kinoshita et al injected cultured human corneal endothelial cells into the anterior chamber in bullous keratopathy patients and reported clear corneas with a postoperative follow-up period of 2 years [2].

There is also ongoing research to cultivate keratocytes to treat stromal scars and derive human corneal epithelial cells from pluripotent human embryonic stem cells. Autologous adipose-derived adult stem cells (ADASC) were injected intrastromally in a phase 1 clinical trial to stabilize disease progression in keratoconus and results were promising [3].

Regenerative therapy

Traditional understanding of the human corneal endothelium is that this cellular monolayer is unable to replicate in the event of cell loss. However, self-regeneration capacity might be better in the pediatric age group and in the corneal periphery. Evolution in endothelial keratoplasty has led to the observation of attempted healing in the presence of an endothelial defect.

Regeneration of endothelial cells in pediatric patients with Peter's anomaly after selective removal of central endothelium with preservation of Descemet's membrane has been shown in a clinical study [4].

Descemetorhexis stripping without endothelial keratoplasty (DWEK) is increasingly referred to as Descemet's stripping only (DSO). Reported clearance of corneal edema rates following DSO range from 63 to 100%. Topical Rho-kinase inhibitor has been reported as successfully salvaging failing cases [5].

In Fuchs' endothelial corneal dystrophy (FECD), descemetorhexis followed by transplantation of acellular cadaveric Descemet's membrane proved efficacious by facilitating the corneal endothelial cell migration postoperatively [6].

Gene therapy

Fuchs' corneal endothelial dystrophy is a genetically heterogenous disease, however, large majority of patients have a CTG trinucleotide repeat expansion sequence within the TCF4 gene in chromosome 18q21. Pinto., *et al.* engineered dCas9 molecules to bind to trinucleotide DNA repeat sequences in DM1 cells. As a result, transcription of pathologically elongated mRNA molecules were inhibited. With intracameral delivery, dCas9 molecules treat the genetic changes responsible for FECD [7].

In epithelial-stromal corneal dystrophies such as lattice, granular and Avellino, mutations in TGFBI (transforming growth factor beta-induced protein) gene are responsible. To edit genes, intrastromal injections of vector plasmids and viral vectors are used to deliver CRISPR (clustered regularly interspaced short palindromic repeats) elements to keratocytes and epithelial cells [8,9].

Bioengineered corneal grafts

Tissue-engineered endothelial keratoplasty (TEEK) graft generally includes a monolayer of cultivated corneal endothelial cells, supported on a basement membrane-like substrate. These substrate materials are various ocular tissues (such as acellular Descemet's membrane/posterior stromal discs and anterior lens capsules), xenotic materials, and synthetic materials [1].

For corneal stroma replacement; laminated, keratocyte-carrying ultra-thin amniotic membranes provided favourable results in an animal study [10].

Conclusion

We are taking our steps beyond penetrating and lamellar keratoplasty into novel therapies such as cell therapy, regenerative medicine, gene therapy and bioengineered corneal grafts.

Bibliography

1. Mehta JS., *et al*. "The future of keratoplasty. Cell-based therapy, regenerative medicine, bioennering keratoplasty, gene therapy". *Current Opinion in Ophthalmology* 30.4 (2019): 286-291.
2. Kinoshita S., *et al*. "Injection of cultured cells with a ROCK inhibitor for bullous keratopathy". *New England Journal of Medicine* 378 (2018): 995-1003.
3. Alio Del Barrio JL., *et al*. "Cellular therapy with human autologous adipose-derived adult stem cells for advanced keratoconus". *Cornea* 36.8 (2017): 952-960.
4. Soh YQ and Mehta JS. "Selective endothelial removal for Peters anomaly". *Cornea* 37.3 (2018): 382-385.
5. Garcerant D., *et al*. "Descemet's stripping without endothelial keratoplasty". *Current Opinion in Ophthalmology* 30.4 (2019): 275-285.
6. Soh YQ and Mehta JS. "Regenerative therapy for Fuchs endothelial corneal dystrophy". *Cornea* 37.4 (2018): 523-527.
7. Pinto BS., *et al*. "Impeding transcription of expanded microsatellite repeats by deactivated Cas9". *Molecular Cell* 68 (2017): 479-490. e5.
8. Christie KA., *et al*. "Towards personalised allele-specific CRISPR gene editing to treat autosomal dominant disorders". *Scientific Reports* 7 (2017): 16174.

9. Basche M., *et al*. "Sustained and widespread gene delivery to the corneal epithelium via in situ transduction of limbal epithelial stem cells, using lentiviral and adeno-associated viral vectors". *Human Gene Therapy* 29.10 (2018): 1140-1152.

10. Che X., *et al*. "A novel tissue-engineered corneal stromal equivalent based on amniotic membrane and keratocytes". *Investigative Ophthalmology and Visual Science* 60.2 (2019): 517-527.

Volume 11 Issue 5 May 2020