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Commentary

# Innovating Eye Care: Transforming Corneal Epithelium Regeneration through Stem Cell Therapy and Clinical Practices

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## DESCRIPTION

The limbal crypts of the Palisades of Vogt and the full perimeter of the corneoscleral limbal niche are home to corneal epithelial stem cells. With regular cell turnover, they play a part in maintaining a healthy corneal epithelium by replacing worn-out or damaged epithelial cells. The so-called Limbal Stem Cell Deficiency (LSCD) syndrome, which is a challenging and complex illness to manage when it is complete and severe, is caused by a deficit or absence of corneal epithelium renewal due to limbal epithelial stem cell depletion or malfunction. The replacement of the corneal epithelium by conjunctival epithelium is the distinguishing feature of the LSCD phenotypic endpoint. The limbal conjunctival epithelial cells infiltrate the superficial cornea as a result of the loss of the limbal epithelial stem cells. In LSCD, the unstable ocular surface leads to persistent inflammation-related vascularization and recurrent ulceration or disintegration of the corneal epithelium that does not heal. Pain, photophobia, blurred vision, and eventually corneal blindness are brought on by these surface modifications. Because of the lack of epithelial limbal cells in the donor graft (or artificial cornea), this disease increases the chance of corneal transplant failure. Similarly, while amniotic membrane transplantation is effective for treating cases of partial LSCD, it is insufficient for treating whole LSCD and calls for the inclusion of limbal tissue. Obviously, transplanting limbal tissue or limbal epithelial cells is the only effective therapy for medically irreversible complete and/or severe LSCD. This method has consistently been demonstrated to aid in ocular surface regeneration, and as a result, it enhances the chances of a successful corneal graft in the future. There are currently tests being done on more cell types, and some have made it to the human clinic. For instance, recent research has described the utilisation of autologous conjunctival cells grown *ex vivo* on amniotic membrane. There are currently running clinical trials using non-stem cell resources from non-ocular mucosal epithelial cells, such as those from the oral mucosa. The intriguing prospect of employing induced pluripotent stem cells as a source of limbal epithelial stem cells with translational potential has just started. Stem cells produced from nonocular mucosal or nonepithelial sources have not yet entered the human clinic. At this time, it is unclear whether the success rates of autologous and allogeneic (Cultivated Limbal Epithelial Sheet Transplantation) CLET are comparable. Also, there are very few studies that contrast CLET with other techniques for transferring limbal tissues. The one study that compares CLET to whole donor limbal transplantation concludes that CLET is more effective than traditional methods. These statistics are based on separate procedures being carried out on each of the patient's eyes. There are no studies that contrast CLET with straightforward limbal epithelial transplantation as of yet.

## CONCLUSION

It is possible to successfully expand and cultivate limbal cells by employing the methodology under Good Manufacturing Practices (GMP) conditions and in accordance with EU laws. Patients with ocular surface failure owing to LSCD saw a substantial improvement in corneal epithelial quality after receiving both autologous and allogeneic CLET. After three years, it permitted further symptom relief, improving 75% of the patients' quality of life. This study further confirms that, in clinical investigations and trials, corneal epithelium repair in the central cornea, the primary assessment endpoint, may be assessed using the minimally invasive laser IVCM approach. Finally, an objective imaging approach has been in conjunction with a stringent but adequate clinical composite score is the perfect instrument for use in upcoming clinical studies.

Finally, coordination of multicenter clinical studies and trials that help address many of the unresolved questions about this otherwise successful transplantation technique is necessary. This will require agreement on cell preparation protocols and patient-related issues (pre, intra, and postoperative). It goes without saying that in order to better treat these complex and challenging blinding disorders, clinical and scientific efforts must be coordinated.

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