Commentary: A review of long-term corneal preservation techniques: Relevance and renewed interests in the COVID-19 era

Corneal transplant is the most commonly and the most successfully performed human transplant.[1] During the COVID-19 pandemic, worldwide decrease in donor cornea collections have dramatically affected the frequency of corneal transplants.[2] Due to reduced supply and demand, corneal transplant has been notified as an elective procedure and deferred in multiple countries till restoration of normalcy. However, areas where sight-threatening microbial keratitis forms the primary indication for emergency corneal transplantation, it might be reasonable to find logical solutions of overcoming the current donor scarcity.

As the authors rightly mention, during these tough times, commonly employed methods of short and intermediate-term storage of donor corneas is expected to worsen the existing shortage and the eye banks need to adapt to long-term methods of tissue preservation.[3] The authors have done a good work of assimilating the presently existing literature on this topic and each preservation method is well-discussed with their clinical applications and outcomes.[3]

To summarize, cryopreservation, glycerol preservation, lyophilization, and gamma irradiation are presently available techniques of long-standing donor cornea storage. Cryopreservation saves graft tissue form early degradation by reducing intra as well extracellular temperatures to extremely low degrees. Cryoprotectants might reduce the damage endothelial cells suffer due to this lethally low temperature. Glycerol, a useful medium to store donors at room temperature, is a known cryoprotectant, has anti-microbial properties, is inexpensive, simple to prepare, and has a presumed role in reducing allograft rejection post-transplantation. However, it is again not conducive for endothelial survival and to ensure a reasonable graft clarity, an intensive process of vacuum preparation is desirable. Lyophilization is another reasonable alternative of conserving donor cornea but requires special lyophilization machine and dry ice for its execution alongside a rehydration process before surgery for maintaining corneal architecture. Nevertheless, similar to glycerol, it can also be combined with cryopreservation. Gamma irradiation is yet another effective way of prolonging storage ability of donor tissues. Besides, it is also advantageous in eradicating diverse microorganisms. Newer methods such as cell-based therapies and direct endothelial cell culture are currently under extensive research for their safe and economical utilization.

In general, while these are effective means of increasing shelf-life of human donor corneas, they are expensive and detrimental to endothelial cells. Due to corneal opacification and cosmetic disfigurement, these approaches may be more desirable for urgent lamellar keratoplasty procedures, and for peripheral corneal melts where the host endothelium

is well-preserved for gradually combatting graft edema. Although these can be ignored to certain extent, a major cause of concern is the effect of these procedures on COVID-19 virus survival and transmission. As the virus particles have been detected in ocular surface, any non-viricidal method of preservation is fraught with risk of virus communication.[4] Therefore, further studies are validated to ensure safety of these methods in this regard.

Considering the limitations of afore-mentioned preservation techniques, ophthalmologists can consider exploring non-donor dependent approaches such as autologous partial thickness scleral flaps, tenon's patch grafts, conjunctival flaps, and autokeratoplasty for restoring ocular integrity in emergency corneal disorders. Commercially available sterile bioengineered corneas can also be tried for battling the current crisis and unlike all other methods, these can also be utilized for elective corneal transplantation.

To conclude, as rightly suggested by authors, we need to revise our present storage methods for effective and timely utilization of precious human tissues. We also need to devise methods of long-term storage without risking endothelial health and virus transmission in order to minimize the waiting time for elective transplants. The present pandemic has crippled us enormously and learning from current situation is expected to prepare us for future uncertainties. Till then, we have a long way to go.

Rinky Agarwal, Namrata Sharma

Dr. Rajendra Prasad Centre for Ophthalmic Sciences, AIIMS, New Delhi, India

Correspondence to: Prof. Namrata Sharma, Dr Rajendra Prasad Centre for Ophthalmic Sciences, AIIMS, New Delhi - 110 049, India.
E-mail: namrata.sharma@gmail.com

References

1. Duman F, Kosker M, Suri K, Reddy JC, Ma, JF, Hammersmith KM, *et al*. Indications and outcomes of corneal transplantation in geriatric patients. Am J Ophthalmol 2013;156:600-7.e2.
2. World Health Organization. Coronavirus Disease (COVID-2019) Situation Reports. World Health Organization; 2020. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situationreports. 20 [Last accessed on 2020 Jun 07].
3. Chaurasia S, Das S, Roy A. A review of long-term corneal preservation techniques: Relevance and renewed interests in the COVID-19 era. Indian J Ophthalmol 2020;68:1357-63.
4. Xie HT, Jiang SY, Xu KK, Liu X, Xu, B, Wang L, *et al*. SARS-CoV-2 in the ocular surface of COVID-19 patients. Eye Vis (Lond) 2020;**7**:23.

Access this article online

Quick Response Code:

Website: www.ijo.in

DOI: 10.4103/ijo.IJO_1877_20

Cite this article as: Agarwal R, Sharma N. Commentary: A review of long-term corneal preservation techniques: Relevance and renewed interests in the COVID-19 era. Indian J Ophthalmol 2020;68:1365-6.