Commentary: Endotheial cell damage during cataract surgery: Choosing the best technique

With continuing advancements in techniques and technology, cataract surgery has emerged as one of the most demanding procedures, though perfection seems an elusive goal. According to National Programme for Control of Blindness and Visual Impairment (NPCB&VI) data, the average cataract surgery rate in the last five years is approximately 6.4 million per year, making it pertinent to evaluate the safest, most cost-effective technology that provides the best visual rehabilitation.[1] The most common undesirable side effect of cataract surgery is corneal endothelial cell loss, which may affect postoperative visual outcomes. Various studies have shown an average of 13.6–17.0% corneal endothelial cell loss following conventional extracapsular surgery.[2]

Corneal endothelial cells are both a barrier and a pump, essential for maintaining corneal clarity. Fuchs' endothelial corneal dystrophy (FECD) is the most common primary etiology of corneal endothelial dysfunction. Aphakic or pseudophakic bullous keratopathy (ABK/PBK) is the most common secondary etiology of corneal endothelial dysfunction. Due to amitotic properties, endothelial cells experience a decrease in qualitative and quantitative characteristics with age, trauma, and with various intraocular surgeries. Corneal endothelial decompensation leads to discomfort and blurred vision. In advanced cases causes bullous keratopathy, corneal vascularization, infection, and even severe pain.[3]

Manual small-incision cataract surgery (MSICS) is significantly expeditious, inexpensive, and less technology-dependent than phacoemulsification. In small-incision cataract surgery (SICS), most of the surgical maneuvering is done manually in the anterior chamber compared to phacoemulsification, done mechanically in the capsular bag. In SICS, the nucleus prolapses in the anterior chamber, and nucleus delivery methods affect endothelial cells as opposed to ultrasonic energy in phacoemulsification. In both surgeries, surgical trauma can lead to endothelial damage. The damaged endothelium continues to lose cells and endothelial dysfunction may develop slowly years after the surgery.[2]

Phacoemulsification is a closed chamber procedure and thus causes mechanical and thermal damage to the endothelium during surgery. Endothelial damage during phacoemulsification has been associated with mechanical injury, which correlates with ultrasonic power and total time.[4] Short axial length, shallow anterior chamber depth (ACD), dense cataract, incision size, irrigating solutions, ocular viscoelastic devices (OVD), and type of intraocular lens (IOL) are other factors known to affect corneal endothelial cell density. Comparative studies on harder nuclear grades have shown lesser endothelial cell loss in SICS.[5] Jain *et al*.[6] concluded that the Blumenthal technique of SICS is safe and highly effective in hard cataracts. However, one randomized controlled trial reported that both phacoemulsification and SICS resulted in comparable endothelial cell loss six weeks after the procedure (15.5% in the phaco group versus 15.3% in the SICS group), as well as similar final visual outcomes in both groups.[7]

With the help of a specular microscope, the effect of post-surgical stress on endothelial cells can be documented. Preoperative and postoperative assessments of the number of corneal endothelial cells can help assess the degree of corneal damage during the surgery.

In the present study, the authors have concluded that phacoemulsification with advanced age, hard nuclear cataract,shallow anterior chamber depth and longer effective phacoemulsification time is associated with more significant postoperative corneal endothelial cell loss.[8] As mentioned in the current study, other studies have also reported that harder nuclear grades cause more significant endothelial cell loss.[9] We opine that corneal endothelium should preferably be evaluated preoperatively to utilize the most suitable surgical technique in such cases for better visual outcomes. ACD plays an essential role in affecting the final endothelial cell damage owing to less surgical space and proximity to corneal tissue. It is hence important to assess this parameter preoperatively, to adopt the appropriate surgical technique.

It is recommended that bigger capsulorhexis (6–6.5) should be preferred in hard cataracts to facilitate adequate maneuvering for nucleus removal in SICS in addition to good hydro dissection. Furthermore, before endocapsular phaco, mechanical cleavage of the nucleus should be done to reduce the requirement of ultrasound energy. Torsional phacoemulsification is a better choice to reduce endothelial damage. Phaco in the iris plane should be avoided as it can cause endothelial cell damage up to 10% to 35%.

The visco-adaptive and soft-shell techniques provide better endothelial protection. Lower ultrasound energy levels and lesser phacoemulsification time are important to mitigate endothelial cell loss and faster vision recovery. Further endothelial cell damage can be caused by intracameral drugs, preservatives, detergent residues, toxins, or a flawed sterilization procedure, mandating a careful consideration of these factors. Other factors associated with endothelial cell loss include capsule rupture, vitreous loss, and increased injection volume during surgery. We believe that both SICS and phaco are excellent procedures with individual pros and cons, hence the surgeon should utilize the pros of each technique to further identify the most suitable procedure for a particular patient to accord the best visual outcome and patient satisfaction.

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