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Is Manual Small Incision Cataract Surgery the Preferred Technique for Hard Cataract?

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Abstract

Cataract extraction is the most commonly performed surgery in Ophthalmology worldwide. Endothelial cell loss, of variable degree, is an inevitable consequence following cataract surgery. Many preoperative and intraoperative factors decide the outcome; surgical techniques have also been proven to dictate the postoperative endothelial cell loss. It is hence of paramount importance to ascertain the safest procedure. It has been established that no technique leaves the endothelium unscathed and it is indisputable that the amount of energy used in phacoemulsification is directly proportional to the hardness of the cataract. Issues that contribute to final outcome and are poorly addressed by a technique make it the poorer choice. This article reviews the currently available literature analyzing different factors that influence endothelial cell loss.

Keywords: Phacoemulsification; Manual Small Incision Cataract Surgery; Hard Cataract; Endothelial Cell Loss; Central Corneal Thickness

Introduction

Cataract is the most common curable cause of diminished visual acuity worldwide and its extraction is one of the most common surgical procedures performed in Ophthalmology [1]. Recent data from the World Health Organization show that there is a 25% decrease in blindness prevalence in India and this can be attributed to increased number of cataract surgeries over the years [2]. Numerous modifications in cataract surgeries have developed over the last few decades. The main objective in modern cataract surgery is to achieve a better unaided visual acuity with rapid postsurgical recovery and minimal surgery-related complications. In our country, millions of cataract surgeries are performed per year therefore, it is important to determine which technique is the safest, most cost effective and provides the best visual rehabilitation [3].

Corneal endothelial cell loss remains a common, undesirable side-effect of cataract surgery that may negatively impact postoperative visual outcomes. Previous cross-sectional studies have shown the normal attrition rate of corneal endothelial cells is approximately 0.3-0.5% per year [4-6]. Corneal endothelial cells are non-replicative, and the loss of these cells is only compensated for by the migration, enlargement, and increasing heterogeneity of the cells [7,8]. Loss of endothelial function by the damage of endothelial cells can lead to increased corneal thickness and decreased corneal transparency because of increased stromal hydration due to compromised pump function [9]. Therefore, morphological stability and functional integrity of the corneal endothelium are both necessary for achieving good visual outcomes.

Body of Paper

All surgical procedures that involve entry into the anterior chamber damage a proportion of endothelial cells during intraoperative corneal manipulation. The two most commonly performed procedures for cataract extraction that

have been studied are phacoemulsification and manual small incision cataract surgery.

Phacoemulsification surgery is a closed chamber procedure performed in a confined space and thus causes mechanical and thermal damage to the endothelium during surgery because of its proximity to the corneal tissue. Endothelial damage during phacoemulsification has been attributed to mechanical injury caused by anterior chamber instrumentation and/or anterior chamber manipulation of a lens nucleus, heat generation, or prolonged intraocular irrigation [10-14]. Endothelial loss also correlates with ultrasound time and power [15,16], and is greatest near the wound, which is also the area of maximal manipulation [17,18]. However, securing adequate surgical space during an operation can decrease the risk of corneal endothelial cell loss. The choice of a dispersive viscoelastic over a cohesive viscoelastic does not appear to result in any less endothelial cell loss [19-21] even though visco-adaptives and a soft-shell technique may provide more endothelial protection [22].

Manual small incision cataract surgery (SICS) has been proven to be significantly faster, less expensive, and less-technology dependent than phacoemulsification [23-27]. However, many studies concluded that SICS led to higher surgically induced astigmatism [27,28]. Similar results were reported in an elaborate meta-analysis of eleven comparative studies conducted by Gogate P, et al. [29]. There is concern that manual SICS may be more harmful to the endothelium than phacoemulsification because most manipulation is performed manually in the anterior chamber; whereas in phacoemulsification, manoeuvring is mechanical and performed in the capsular bag, relatively far and therefore safer for the endothelium [15-17].

With the advent of specular microscopy, the effect of stress and trauma of cataract surgery on endothelial cell begun to get documented. Pre and postoperative measurement of the number of the corneal endothelial cells can help assess the degree of corneal damage during the surgery. An early publication by Ventura et al found significant reduction in endothelial cell loss following cataract surgery which was although not related to central cornel thickness. The study concluded that moderate decrease in endothelial cell loss does not compromise the pumping activity of the layer as a whole. Similar studies in softer grades of cataract validated insignificant endothelial loss between SICS and phacoemulsification [28-31].

It has been postulated and observed that harder nuclear grade cataracts lead to greater endothelial cell loss. Safety and efficacy of both the techniques have been studied on harder nuclear grade cataract as well Enany H, et al. [32] studied the clinical outcome of phacoemulsification and SICS in harder cataracts and found better early postoperative visual acuity in SICS group [32]. Bourne R, et al. [33] compared phacoemulsification to conventional extra capsular cataract extraction and their impact on corneal endothelial cell loss. Increased cell loss was observed in harder grades of cataract but it was insignificant [33]. In a similar published randomized study by Jain et al, there was no significant difference in postoperative endothelial cell loss and central corneal thickness. The study also concluded that Blumenthal technique of SICS is safe and highly effective in hard cataracts [34]. A recent study in 2019 by Kongsap P, et al. [35] on harder nuclear grade cataract showed lesser endothelial cell loss in SICS group but the results were insignificant. Central corneal thickness was found to be greater following phacoemulsification but it reverted to preoperative levels one month postoperatively [35].

Conclusion

Many preoperative and intraoperative factors have been proven to dictate the postoperative endothelial cell loss following cataract surgery. It has been established that no technique leaves the endothelium unscathed and it is indisputable that the amount of energy used in phacoemulsification is directly proportional to the hardness of the cataract. Central corneal thickness is also found to be insignificantly increased following the surgery [35]. Various studies have established greater endothelial cell loss in harder grades of cataracts following phacoemulsification. However, the loss has been proven to be insignificant in the comparative studies [33-35]. With judicious use of viscoelastic device and proper manouevering, phacoemulsification can also be performed in hard cataracts.

Apart from the effective phacoemulsification time, anterior chamber depth also plays a vital role in affecting the final endothelial cell loss owing to less surgical space and proximity of corneal tissue [36]. Eyes with smaller axial lengths have shallower anterior chamber than normal eyes. Careful preoperative consideration of this parameter helps in deciding the surgical technique. Phacoemulsification puts the corneal endothelium at greater risk of damage in eyes with shallow anterior chamber. Therefore, manual SICS is safer and preferable in small eyes.

Phacoemulsification and manual SICS are both complementary to each other. Phacoemulsification has no detrimental effect on higher grades of cataract as presumed. The effect on the postoperative endothelial cell loss and central corneal thickness is insignificant. Technical issues should be addressed instead of grade of cataract and financial burden to determine the surgical technique.

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