A comparative study of effect of SICS and phacoemulsification on corneal endothelium

Shrikant Deshpande[1], Neeraj Israni[2,*], Swetha Narayanam[3], Nitesh Bhalla[4]

[1,2,3,4]Dept. of Ophthalmology, MGM Medical College & Hospital, Maharashtra

***Corresponding Author:**
Email: drneerajisrani@gmail.com

Abstract

Introduction: Senile cataract has been documented to be the most significant cause of bilateral blindness in India. The aim of cataract surgery is no longer restricted to just visual restoration, but is now considered to be a refractive surgery i.e. to achieve a state of emmetropia. Preservation of corneal endothelial function is a major goal in cataract surgery.

Objectives: Present study aims to highlight the importance of measurement of central corneal thickness and compares the effect of SICS vs Phacoemulsification on corneal endothelium.

Material and Methods: This was a prospective study consisting of 101 patients who presented to the department of Ophthalmology, who fulfill inclusion criteria and are willing to enroll in the study. Standard uneventful small incision cataract surgery was done on 51 patients and standard uneventful clear corneal phacoemulsification was done on 50 patients. Change in central corneal thickness was observed post-surgery on day 7th and day 30th. This study was conducted over a period of two years.

Results: Both groups showed increase in CCT values on post-operative day 7 indicating some endothelial cell disturbances, but the increase in CCT was comparable between the two groups. At day 30 there was a decrease in CCT value as compared to day 7, the decrease was more in SICS as compared to PHACO, but the difference between the two groups was statistically insignificant.

Keywords: Cataract, Central Corneal Thickness, Corneal Endothelium, SICS, PHACO

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Introduction

Senile cataract has been documented to be the most significant cause of bilateral blindness in India. The most recent estimates from World Health Organization (WHO) reveal that 47.8% of global blindness is due to cataract. In India cataract is the principal cause of blindness accounting for 62.6%. The key to the success of the Global Vision 2020: The right to sight initiative is a special effort to tackle cataract blindness which includes estimation of magnitude of the problem and understanding factors associated with it[1]. The burden of global cataract blindness continues to rise, because the number of surgical ophthalmologists is insufficient, and they are unevenly distributed. Hence there is an urgent need to train surgeons quickly and comprehensively in high-quality, low-cost cataract removal techniques[2].

Management of this age-old impairment of vision requires surgical treatment in the form of manual removal of the lens which is either by intracapsular lens extraction or extracapsular lens extraction (small incision cataract surgery) or by phacoemulsification with intra-ocular lens (IOL) implantation.

The aim of cataract surgery is no longer restricted to just visual restoration, but is now considered to be a refractive surgery i.e. to achieve a state of emmetropia. Because of these changing trends regarding results of cataract surgery, the surgical technique has revolutionized rapidly.

Recent advances in cataract surgery have reduced the incidence of corneal complications; however this new technology has also led to various new complications like mechanical or toxic injury to endothelium[3]. Moderate damage to the endothelium during surgery can lead to a transient increase in corneal thickness. Detrugescene of the corneal stroma is controlled by the pumping action of the endothelial layer and can be monitored by measurement of central corneal thickness. Loss or damage of endothelial cells leads to an increase in corneal thickness, which may ultimately induce corneal decompensation and loss of vision[4]. Careful attention during cataract surgery and in the post-operative period can prevent most corneal complications.

In India from around 1.2 million cataract surgeries per year in the 1980s, the cataract surgical output increased to 3.9 million per year by 2003. Therefore, it is important to determine a safe, quick and cost effective surgical technique which will lead to lesser post-operative complications[5].

Both phacoemulsification and SICS achieve excellent visual outcomes with low complication rates and SICS is significantly faster, less expensive, and less technology dependent than phacoemulsification. Therefore it may be a preferred surgical procedure for the treatment of cataracts in the developing world[6].

Preservation of corneal endothelial function is a major goal in cataract surgery as literature proves that

measurement of corneal edema is an indirect indicator of corneal endothelial function, which plays an important role in maintaining the corneal transparency and thus visual rehabilitation[4,5].

Objectives

This study aims to highlight the importance of measurement of central corneal thickness which is an indirect indicator of corneal endothelial dysfunction post cataract surgery as there is a very limited data available from India on the effect of SICS and phacoemulsification on the corneal endothelium.

Material and Methods

This was a prospective study consisting of 101 patients who presented to the department of Ophthalmology, who fulfill inclusion criteria and are willing to enroll in the study.

Standard uneventful small incision cataract surgery was done on 51 patients and standard uneventful clear corneal phacoemulsification was done on 50 patients. Change in central corneal thickness was observed post-surgery on day 7th and day 30th. This study was conducted over a period of two years.

After taking informed consent, detailed history regarding patients name, age, sex, occupation, address, presenting symptoms, duration, progression, and associated conditions was recorded.

The procedure done was small incision cataract surgery and phacoemulsification surgery with posterior intra ocular lens implantation under local anesthesia. The central corneal thickness was measured using ultrasound pachymetry under topical anesthesia.

All patients were examined and selected for cataract surgery as per standard protocol.

Results

Baseline Characteristics: Total number of patients operated for SICS were 51 and for Phacoemulsification were 50. Total number of males in SICS were 24 and in PHACO were 28. Total number of females in SICS were 27 and in PHACO were 22. The mean age for SICS was 62.66667 and for PHACO was 62.18.

The baseline mean CCT in SICS was 509.098 and in PHACO was 518.46. The baseline IOP in SICS was 18.5451 mmHg and in PHACO was 18.834 mmHg. There was no significant difference between the baseline line parameters between the two groups.

Central Corneal Thickness (CCT) parameters in small incision cataract surgery: The pre-operative value of mean central corneal thickness was 509.098, on day 7th was 528.9608 and on day 30th was 514.1569. The mean value of Central corneal thickness on post-operative day 7th is 528.9608. There was a statistically significant increase ($p<0.05$) in central corneal thickness on day 7th. The mean value of central corneal thickness on post-operative day 30th is 514.1569. There was a statistically significant increase ($p<0.05$) in central corneal thickness on day 30th when compared to pre-operative values (Table 1). Hence it shows that there was some endothelial cell loss leading to change in corneal thickness but not to the extent to cause visual impairment post operatively.

Table 1: Central Corneal Thickness (CCT) parameters in small incision cataract surgery (n=51)

Day of measurement	Mean Central Corneal Thickness	P value
Pre-operative	509.098	
Day 7th of post-surgery	528.9608	0.001
Day 30th of post-surgery	514.1569	0.001

Central Corneal Thickness (CCT) parameters in phacoemulsification surgery: The pre-operative value of mean central corneal thickness was 518.46, on day 7th was 533.78 and on day 30th was 524.9. The mean value of Central corneal thickness on post-operative day 7th was 533.78. There was a statistically significant increase ($p<0.05$) in central corneal thickness on day 7th. The mean value of central corneal thickness on post-operative day 30th was 524.9. There was a statistically significant increase ($p<0.05$) in central corneal thickness on day 30th when compared to pre-operative values. Hence it shows that there was some endothelial cell loss leading to change in corneal thickness but not to the extent to cause visual impairment post operatively.

Table 2: Central Corneal Thickness (CCT) parameters in phacoemulsification surgery (n=50)

Day of measurement	Mean Central Corneal Thickness	P value
Pre-operative	518.46	
Day 7th of post-surgery	533.78	0.001
Day 30th of post-surgery	524.9	0.001

Comparison between SICS Vs Phacoemulsification surgery: The Pre-operative CCT values showed no significant difference between the two groups (Fig. 1). Both groups showed increase in CCT values on post-operative day 7 indicating some endothelial cell disturbances, but the increase in CCT was comparable between the two groups ($P = 0.1353$). At day 30 there was a decrease in CCT value as compared to day 7, the decrease was more in SICS as compared to PHACO, but the difference between the two groups was statistically insignificant ($P=0.4024$) when compared to pre-operative values. This indicates that the endothelial cell loss in both the groups were comparable. The improvement in BCVA was comparable ($P=0.1931$) between the two groups at the end of day 30 (Table 3).

Table 3: Comparison of Mean CCT between SICS Vs Phacoemulsification surgeries

Day of measurement	CCT in SICS	CCT in Phacoemul-sification	P value
Pre-operative	509.098	518.46	0.13
Day 7th of post-surgery	528.9608	533.78	0..41
Day 30th of post-surgery	514.1569	524.9	0.19

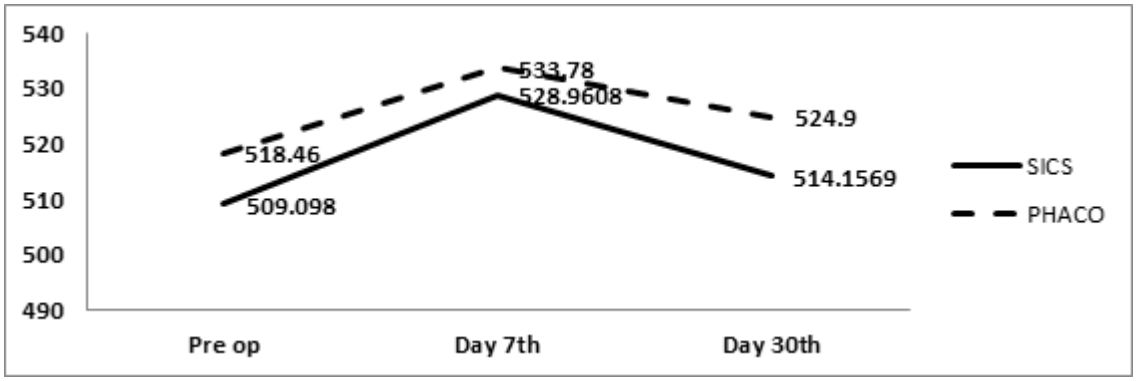

Fig. 1: Comparison of CCT in SICS and PHACO

Discussion

Cataracts constitute a significant volume of visual impairment in developing countries like India. In developing nations, where cataract back log is still a socio economic problem, procedures like phacoemulsification remain an expensive modality of management and majority of the population find it difficult to afford. MSICS promises safety of this procedure.

Corneal edema is an indirect indicator of corneal endothelial function which plays an important role in maintaining the corneal transparency and thus is vital for visual rehabilitation. Endothelial alteration is considered an important parameter of surgical trauma and essential for estimating the safety of the surgical technique. Hence preservation of corneal endothelial function continues to be a major goal as cataract surgery continues to evolve.

In our study we have compared:

- Change in central corneal thickness post SICS and Phacoemulsification on day 7th and day 30th.
- Best corrected visual acuity between the two groups on day 30th.

It showed that in manual small incision cataract surgery the mean CCT on day 7th post-operative increased from 509.098 baseline CCT to 528.9608 and on day 30th was 514.1569. Whereas in phacoemulsification the mean CCT on post-operative day 7th increased from 518.46 baseline CCT to 533.78. And on post-operative day 30th was 524.9.

Though on post-operative day 30th there was a statistically significant increase in the CCT of SICS (p value 0.0000) and of PHACO (p value 0.0001), but the increase in CCT between the two groups at the end of 30th day post-operative was statistically insignificant (p value 0.4024). Hence it shows that there was some endothelial cell loss leading to change in corneal thickness in both the groups but they were comparable.

There was a significant improvement in best corrected visual acuity in both the groups. The improvement in vision was comparable between the two groups. The increase was statically insignificant (p value 0.1931). It thus concludes that there was some endothelial cell loss but not to the extent to cause visual impairment. Hence proven that the visual rehabilitation in form of BCVA was comparable between both the surgical groups.

Various studies have been published comparing the change in corneal thickness and the endothelial cell dysfunction.

Cheng H and associates also found a significant linear correlation between increase in corneal thickness in the immediate postoperative period and percentage of cell loss, one and six months after surgery. The results suggested corneal thickness could be a useful clinical indicator of endothelial cell loss[7].

Bjorn Lundberg and associates through their study concluded that the central corneal swelling at postoperative day 1 is strongly correlated with the central corneal endothelial cell loss at 3 months and that the difference in pachymetry at postoperative day 1 is a useful way to assess the effects on the corneal endothelium exerted by the phacoemulsification procedure[8].

Mencucci R and associates studied corneal endothelial changes after phacoemulsification versus a bimanual microincision cataract surgery (MICS) technique. He concluded that there was no difference in corneal thickness, corneal endothelial

cell loss or endothelial morphology between the groups at the end of 1 and 3 month[9].

Michaeli A and colleagues compared central corneal thickness and endothelial cell loss after phacoemulsification with clear cornea and scleral tunnel incisions. They found that corneal thickness increased significantly in all measurements post-op and returned to baseline by 3 months and there was no difference in the pachymetry change between the two study groups[10].

Ganekal S and Nagarajappa A, compared the morphological and functional endothelial changes after phacoemulsification versus manual small-incision cataract surgery (MSICS) and found that at the end of 6 weeks the endothelial changes were not statistically significant between the 2 groups. They concluded that the function and morphology of endothelial cells was not affected despite an initial reduction in endothelial cell number in MSICS. Hence MSICS remains a safe option in the developing world[11].

The result of our study is consistent with most of the studies done in western countries. Our study also showed that the change in the CCT and BCVA is comparable between SICS and PHACO on day 30th post uneventful surgery. Hence concluding that SICS and phacoemulsification surgery are comparable in respect to visual rehabilitation and there is no difference in safety between MSICS and phacoemulsification.

MSICS is still a safe and cost-effective option in the developing world. Proper case selection, diligent surgery, and adequate postoperative care are essential to maintain a clear cornea.

Conclusion

Study findings concludes that,

1. Both groups of surgery showed significant increase in CCT values on post-operative day 7 indicating some endothelial cell disturbances.
2. On day 30 there was a decrease in CCT values as compared to day 7 but the change in CCT values was comparable between the two surgical groups. This indicates that the endothelial cell loss in both the groups were comparable.
3. The improvement in BCVA was statistically insignificant between the two surgical groups, indicating that the visual rehabilitation was comparable between both the surgical groups.

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