



Original Research Article

Comparison of endothelial cell loss by specular microscopy between phacoemulsification versus small incision cataract surgery

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ARTICLE INFO

Article history:

Received 14-03-2020

Accepted 15-05-2020

Available online 16-06-2020

Keywords:

Cataract surgery

Endothelial cell loss

Phacoemulsification

Specular microscopy

Small incision cataract surgery

ABSTRACT

Aim: To compare endothelial cell density, central corneal thickness changes and evaluate best corrected visual acuity after small incision and phacoemulsification cataract surgery.

Materials and Methods: In this prospective study, patient were presented with significant cataract. Cataract were graded using lens opacities classification system grading. Forty three patients underwent phacoemulsification and forty-one underwent SICS. Patient with any other ocular pathology were excluded. Phacoemulsification was performed, the chop-stop technique and SICS by the viscoexpression technique. The endothelial cell count and central corneal thickness were measured by non-contact specular microscope and best corrected visual acuity evaluated by snellen chart preoperatively and postoperatively on day 1st, 3rd and 6th week respectively.

Result: The mean endothelial cell loss (cells/mm²) in phacoemulsification was 194.28 (7.16%), 311.46 (11.48%) and 412.16 (15.20%) and in SICS was 155.41 (6.17%), 230.19 (9.14%) and 296.54 (11.89%) and was statistically significant (P<0.05). There is an increase in mean base line central corneal thickness from 530.44±12.34 micron increased by 62.62 micron (11.80%), 17.88 micron (3.37%) and 6.04 micron (1.13%) in phacoemulsification and 523.24±6.63 micron increase by 38.05 micron (7.26%), 21.24 micron (4.05%) and 2.63 micron (0.50%) in SICS at day 1st, 3rd week and 6th week respectively. There was statistically significant (P<0.001). BCVA of better than 6/18 was achieved in 95.34% of the eyes after phacoemulsification and 92.68% after SICS. There was statistically significant.

Conclusion: No significant differences in endothelial less loss, central corneal thickness and best corrected visual acuity in between phacoemulsification and SICS.

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1. Introduction

The corneal endothelial cell is single layer of polygonal, hexagonal cells.¹ The mean endothelial cell count is about 2000-2500 cells/mm² in a normal adult life. The normal endothelial cell count at birth is 3000 cells/mm² and decreases with increasing age. The rate of declination of endothelial cell is 0.3-0.6% per year.^{2,3}

Loss of endothelial cells occurs in both phacoemulsification and in SICS. If endothelial cell count is below 400-500 cells/mm², the cornea is compromised postoperatively and corneal decompensation develops and

is clinically evaluated as corneal edema and bullous keratopathy. Phacoemulsification has given better results but SICS is more popular in developing countries than phacoemulsification because of cost effectiveness and less expertise.^{4,5} The loss of corneal endothelial cells in phacoemulsification is more than in SICS because in phacoemulsification, manipulation occurs in anterior chamber and more energy is dissipated, while in SICS, manipulation occurs in the capsular bag. Loss of endothelial cells is compensated by increase in size of cells i.e. polymegathism.^{6,7}

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2. Materials and Methods

The prospective observational study was conducted in 84 patients with of cataract between age 40 to 70 year, presenting in outpatient department at the M.D. eye Hospital, Regional Institute of Ophthalmology Prayagraj over a period of one year (from Dec 2018 to Nov. 2019). The ethical clearance was obtained from institutional ethical committee of M.L.N. Medical College, Prayagraj and informed written consent was taken from all patients. Patient underwent for phacoemulsification surgery for cataract. All patients had minimum follow up at 6 weeks.

2.1. Inclusion and exclusion criteria

Patients with senile cataract irrespective of age and sex, patients medically fit for cataract surgery under local anesthesia, patients with normal corneal endothelium were included in the study. Patient with excluded criteria complicated cataract, traumatic cataract, corneal pathology such as corneal scarring, corneal opacity, corneal endothelial dystrophy, cataract associated with glaucoma, primary and secondary glaucoma, diabetes mellitus, uveitis, critical or less than critical endothelial cell count ($<2000\text{cells}/\text{mm}^2$).

2.2. Specular microscopy (Topcon SP-1P, 50 - 60 Hz frequency, Version 1.41)

Specular Microscopy is a non-contact and non-invasive photographic technique that can visualize and analyze endothelial cells density.

2.3. Phacoemulsification

After the peribulbar block, the patient was asked to lay down and the surgical area was painted with 5% betadine lotion and draped. Lids were separated by a speculum. A clear corneal incision was made at 12o'clock limbus by 2.8 mm keratome. Then a corneal tunnel was made by a keratome. Air and trypan blue dye was injected into the anterior chamber and then washed. After doing this, the anterior chamber was maintained by visco elastic substance. Two side ports were made both sides of the main incision by MVR. Anterior chamber was again maintained by visco elastic substance. A continuous curvilinear capsulorrhexis and then hydrodissection or hydrodelineation was performed by using ringer lactate and the anterior chamber was maintained with visco elastic substance. The nucleus was stabilized with the help of a chopper. Sculpting of the nucleus was done with phacotip. The nucleus was fragmented and removed by divide and conquer technique and rest of the cortical matter was removed by using bimanual I/A canula. Again anterior chamber was maintained and a foldable hydrophilic posterior chamber intra ocular lens was placed with help of an injector. At last, anterior chamber was washed with ringer

lactate. Dexamethasone and gentamycin was instilled and patching was done.

2.4. Small incision cataract surgery

Patient was prepare as in previous surgery.

A bridle suture was passed through the superior rectus. A fornix basedconjunctival flap was made at the superior limbus by conjunctival scissors and cauterize the bare area to stop bleeding. A frown shape incision was made on the sclera 1.25mm away from the limbus at 12o' clock. A tunnel was created by using a crescent knife and side port was also made at 3 o'clock or 9 o'clock of the main incision. Air and trypan blue dye was injected into the anterior chamber and washed with ringer lactate and anterior chamber was maintained with visco elastic substance. The 6.00 mm capsulotomy was done by 26 gauge bent needle. The hydrodissection was performed. The anterior chamber was maintained and nucleus prolapsed into the anterior chamber. The nucleus was removed by viscoexpression. I/A was done to remove the remaining cortical matter. A non foldable PMMA posterior capsular intraocular lens was implanted in the capsular bag and washed to remove the viscoelastic substance. Dexamethasone and gentamycin was instilled and patched.

3. Observation and Results

In phacoemulsification, the percentage endothelial cell loss 194.28 (7.16%), 311.46 (11.48%) and 412.16 (15.20%) and in SICS 155.4 (6.17%), 230.19 (9.14%) and 295.56 (11.89%)at first day, 3rd week and 6th week postoperatively.

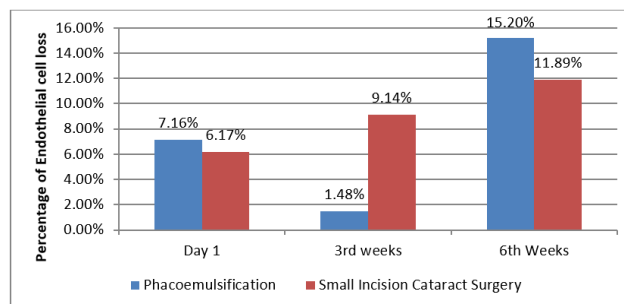


Fig. 1: Percentage endothelial Cell Loss (cells/mm²)

In phacoemulsification the percentage loss of CCT 62.62 (11.80%) micron, 17.88 (3.37%) and 6.04 (1.13%) micron and in SICS was 38.05 (7.27%) micron, 13.00 (2.4%) and 2.63 (0.05%) micron at day 1st, 3rd and 6th week postoperatively.

In phacoemulsification 41 (95.34%) patients were $>6/18$, 1 (2.32%) patient were 6/24-6/60 and 1 (2.32%) patient were $<6/60$ and in SICS, 38 (92.68%) BCVA were $>6/18$, 7 (17.07%) patients were 6/24-6/60 and 2 (4.87%) patients were $<6/60$ on Snellen chart in postoperative.

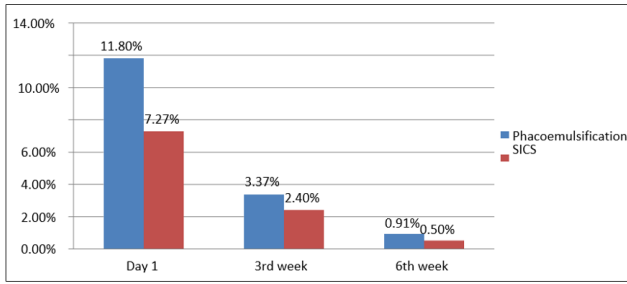


Fig. 2: Percentage change in central corneal thickness

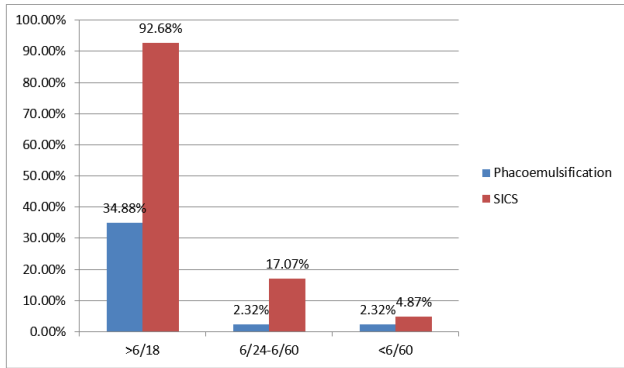


Fig. 3: Phacoemulsification and SICS: BCVA on Snellen Chart

4. Discussion

In our study the measurement of endothelial cell count in phacoemulsification preoperative mean endothelial cell count was 2711.04 ± 197.59 cells/mm² and in small incision cataract surgery preoperative mean endothelial cell count was 2517.36 ± 135.18 cells/mm². The difference in mean endothelial cell preoperatively was statistically significant in phacoemulsification and in SICS ($P < 0.001$).

In our study comparing endothelial cell loss after phacoemulsification, was 194.28 (7.16%), 311.46 (11.48%) and 412.16 (15.20%) cells/mm² and that after SICS mean endothelial cell loss 155.41 (6.17%), 230.19 (9.14%) and 296.56 (11.89%) cells/mm² was day 1st, 3rd week and 6th week postoperative period respectively. The differential endothelial cell loss was significant between the two groups ($P = 0.001$). In our study endothelial cell loss after SICS was significantly less. In another study by Somil N. et al.,⁸ mean endothelial cell loss in phacoemulsification was 307.80 (12.33%), 397.79 (15.93%), and 421.69 (16.89%) cells/mm² and SICS it was 270.86 (10.63%), 385.22 (15.12%), and 413.68 (16.24%) cells/mm² on 1st day 3rd week, 6th week, and 3 month postoperative period respectively. There was no clinical and statistically significant difference between the two groups.

The above result was comparable to our study which showed decrease in cell density of 7.16% in phacoemulsification and 6.17% in SICS at day 1st with

statistically significant difference ($P = 0.001$) and 11.48% in phacoemulsification and 9.14% in SICS at 3rd week with statistically significant difference ($P = 0.005$). At 6th week, the decrease in cell density was 15.20% and 11.89%, with statistically significant difference ($P = 0.034$), with between the phacoemulsification and SICS.

In our study showed that, in phacoemulsification preoperative mean CCT was 530.44 ± 12.34 micron and in SICS preoperative mean CCT was 523.24 ± 6.63 micron. There was statistically significant ($P = 0.001$).

In our study, in phacoemulsification postoperative mean CCT was 593.06 ± 26.46 , 548.32 ± 13.48 and 536.48 ± 12.24 micron and in SICS postoperative mean CCT was 561.29 ± 9.09 , 536.24 ± 6.43 and 525.87 ± 6.81 micron at Day 1 ($P < 0.001$), 3rd week ($P < 0.001$) and 6th week ($P = 0.033$) respectively. This was statistically significant. Sachin M. Salvi et al.⁹ studied central corneal thickness was $550.34 \mu\text{m}$ preoperatively, $626.39 \mu\text{m}$ at 1 hour, $585.80 \mu\text{m}$ at 1 day, and $553.80 \mu\text{m}$ at 1 week. In the control group, CCT remained stable, within $\pm 2 \mu\text{m}$ of preoperative readings.

This study showed that the difference in corneal thickness between pre and postoperative values in the operated eye was statistically significant. This is in agreement with Sachin M. Salvi et al.⁹ studied where increased follow by gradual decreased at baseline preoperative after surgery. These differences were found to be statistically significant ($P < 0.05$).

The post-operative visual outcome was analyzed in phacoemulsification and SICS. In our study, overall 76.76% of the patients achieved in phacoemulsification and 63.73% in SICS, an unaided visual acuity of better than 6/18 and rest 23.25% in phacoemulsification and 46.35% in SICS visual acuity was 6/24-6/60. On analyzing the phacoemulsification and SICS separately, visual outcome in phacoemulsification was better than SICS at 6 weeks. 51.16% of patients achieved best corrected visual acuity of 6/18 or better after phacoemulsification as compared to 43.90% in the SICS. Best corrected visual acuity of better than 6/18 was attained in 95.34% after phacoemulsification and 92.68% after SICS. There was statistically significant difference in best corrected visual acuity in phacoemulsification and in SICS. Sanduk Ruit et al.⁵ out of 108 patients, 85% of patients with Uncorrected Visual Acuity of 20/60 or better and 98% of patients with best-corrected visual acuity of 20/60 or better in phacoemulsification versus 89% of the small incision cataract surgery patients had uncorrected visual acuity of 20/60 or better and 98% had a best-corrected visual acuity (BCVA) of 20/60 or better at six months.

In our study, 79 (94.04%) of 84 patients evaluated at six weeks BCVA better than 6/18 and postoperative visual acuity similar between the phacoemulsification and small incision cataract surgery there was statistically significant ($P = < 0.001$).

5. Conclusion

Despite of many recent advances in the field of cataract extraction, the backlog of visual impairment due to cataract is increasing in developing countries. In our study, postoperatively at 6 weeks the difference in endothelial cell loss and best corrected visual acuity between phacoemulsification and small incision cataract surgery was not statistically significant. Both of these surgeries are equally safe for the corneal endothelium. As the small incision cataract surgery does not depend upon advanced technology and is more economical, it may be a favourable surgical procedure in those areas where high cost advanced phacoemulsification techniques are still not available.

6. Source of Funding

None.

7. Conflict of Interest

None.

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Cite this article: Bhan C, Chaudhary A, Kumar S, Rana J. Comparison of endothelial cell loss by specular microscopy between phacoemulsification versus small incision cataract surgery. *Indian J Clin Exp Ophthalmol* 2020;6(2):176-179.