How to Cite:
Charel, S. R., Sheth, H. K. ., Domadia, A., Bavishi, J., & Pandya, N. N. (2022). Study of endothelial cell loss in small incision cataract surgery (SICS). *International Journal of Health Sciences*, *6*(S9), 2129–2137. https://doi.org/10.53730/ijhs.v6nS9.12886

Study of endothelial cell loss in small incision cataract surgery (SICS)

Dr. Sujata R. Charel
Assistant Professor, Department of Ophthalmology, SBKS MI & RC, Dhiraj Hospital, Vadodara, Gujarat, India

Dr. Hetaj K. Sheth
Assistant Professor, Department of Ophthalmology, SBKS MI & RC, Dhiraj Hospital, Vadodara, Gujarat, India

Dr. Astha Domadia
Resident of Department of Ophthalmology, SBKS MI & RC, Dhiraj Hospital, Vadodara, Gujarat, India

Dr. Jash Bavishi*
Resident of Ophthalmology Department, SBKS MI & RC, Dhiraj Hospital, Vadodara, Gujarat, India
*Corresponding author

Dr. Niyant N. Pandya
Head of Department, Department of Ophthalmology, Parul Sevasharam Hospital, Vadodara, Gujarat, India

***Abstract*---**Purpose: To evaluate the density of the central corneal endothelial cell before and after a small incision cataract surgery with posterior chamber intraocular lens implantation and also determine the association between endothelial cell loss and post-operative visual acuity. Methods: A total of 205 eyes of 205 patients undergoing SICS were included in surgery. Patients underwent complete ophthalmic evaluation and endothelial cell density was measured with TOPCON SP1P specular microscope preoperatively and postoperatively day 7 and at 1 month. Results: The majority of the patients were in the age group 61-70 years. The mean endothelial cell count pre operatively was 2689.65 cells/mm^2, post operatively on 7th day 2433.27 cells/mm^2 and at 1 month was 2367.01 cells/ mm^2. At 1 month postoperative mean visual acuity between 20/30-20/70. Conclusion: There is 11.21% endothelial cell count after SICS, which is comparable with other modes of cataract surgery like extracapsular cataract extraction and phacoemulsification.

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.
Manuscript submitted: 9 May 2022, Manuscript revised: 18 July 2022, Accepted for publication: 27 August 2022

Keywords---endothelial cell, small incision cataract surgery (SICS), Specular microscope.

Introduction

Cataract as defined by WHO is clouding of the crystalline lens of the eye which prevent clear vision.[1]According to National Programme for Control of Blindness, considering current population (121crore) of India as per census 2011,1% Blindness (<6/60) constitutes approximately 1Crore 21 lakhs. Out of this approximately 62% i.e.72 lakhs. (7.2 million) are blind due to cataract.[2] Most common cause for cataract development is the natural aging process due to degenerative changes of specific lens protein within the lens which are altered leading to gradual clouding of the lens.

The most effective treatment of cataract is to remove the opaque crystalline lens surgically and replace it with the artificial lens known as intraocular lens which commonly kept in posterior chamber of eye known as posterior chamber intraocular lens, which done by various type of cataract surgery. Endothelial cells which are present in a most posterior layer of cornea maintain this tissue in a dehydrated state by their pumping activity, thereby assuring its transparency. This active process is controlled by Na^+/K^+-ATPase and involves the generation of a bicarbonate ion gradient across the corneal endothelium. The corneal endothelium consists of a monolayer of polygonal cells, the numerical density of which is highest at birth (3000 cells/mm^2) and declines slowly but steadily thereafter. A minimal numerical density of 400–500 cells/ mm^2 is required to sustain the pumping activity of the endothelium. Corneal decompensation occurs when more than 75% of adult age cells are lost (500 cells/mm^2) then vision loss occurs. The fact that the endothelium becomes gradually depleted of cells rather than compensating for its losses reflects the limited capacity of these cells to regenerate. This situation may become exacerbated by losses incurred during the course of certain diseases or after intraocular surgery.

Every cataract extraction even in experienced hands and most modern techniques involves some inadvertent corneal manipulation and endothelial damage. Loss or damage of endothelial cells leads to an increase in corneal thickness, which may ultimately induce corneal decompensation and loss of vision. Moderate or Severe damage of the corneal endothelium during surgery may lead to a transient increase in corneal thickness ultimately induce corneal decompensation and loss of vision. Severe damage leads to late corneal decompensation, which has been reported to occur in 1% of cataract extraction.

Materials and Methods

This is randomized prospective observational follow-up study of 205 patients, assigned to underwent cataract surgery by manual small incision cataract surgery (SICS) with a posterior chamber intraocular lens (PCIOLs) implantation between November 2016 to October 2017 at tertiary eye care in Gujarat. Ethical committee approval was achieved before starting the study.

Eligibility criteria were patients above the age of 40 years of either sex with Grade-I-III nuclear cataract, PS (posterior subcapsular cataract) and cortical were included in the study. Cases of a Patient with corneal pathology,Traumatic cataract, Pseudo exfoliation syndrome, Diabetes mellitus, Uveitis Glaucoma, Prior intra ocular surgery, Active ocular disease, Complicated cataract, Pre-senile cataract, Black cataract, Severe inflammation, Pterygium were excluded from the study. pre-operatively endothelial cell count was performed using TOPCON SP 1P. Detailed ocular examination done using slit lamp and detailed history was elicited and informed consent was obtained.

Surgical technique of manual small incision cataract surgery (SICS)

Preoperatively, adequate pupillary dilatation was achieved one hour prior to surgery with application of tropicamide (0.8%) and 5% phenylephrine for three times. Local peribulbar anesthesia was used for all cases. Ocular hypotony was achieved with digital compression. Under all aseptic precautions the eye to be operated was painted with 10% povidone iodine (for surrounding skin area) and was draped. Wire speculum was used for retraction of eyelids, and one drop of 5% povidone iodine was instilled in the conjunctival cul-de-sac. bridal suture was passed through the superior rectus. fornix based conjunctival flap was made superiorly with corneoscleral scissors and hemostasis was achieved with dry field bipolar cautery then 6 mm straight incision was made on the sclera from 10:30 o'clock to 1:30 o'clock with a 15 number blade posterior to the corneal vascular arcade about 2 mm posterior to limbus. a sclero-corneal tunnel was made using a crescent knife and dissection continued 1 mm into the clear cornea. A side port entry was made 2-3 clock hours away from the primary incision.air was injected. Trypan blue dye used for staining of anterior capsule of lens. Viscoelastic was injected through the side port to form the Anterior chamber. Continuous Curvilinear Capsulorhexis (CCC) Technique with a 26 gauge bent needle was carried out. Entry was made to Anterior chamber from the anterior limit of the sclero-corneal tunnel using a 3.2 mm entry keratome Then inner opening of the tunnel was extended parallel to limbus up to periphery using the 5.2 mm blunt-tip keratome. Hydrodissection and hydrodelineation was performed. Nucleus prolapse into the anterior chamber and delivered using either sandwich technique, visco expression or with the help of wire Vectis. Cortical matter aspirated using a classical simcoe cannula. 6.0 mm Optic Polymethyl methacrylate IOL implanted in the bag. Viscoelastic was washed off from the chamber and the Anterior chamber was formed with ringer lactate solution. Side port openings sealed by stromal hydration. The wound was covered with conjunctiva and tenon's capsule and cauterized. Subconjunctival gentamicin (20 mg) and dexamethasone (2 mg) injection were given. Eye drop moxifloxacin 0.3% and combination ointment (chloramphenicol and polymyxin -B sulphate and dexamethasone) was instilled in the conjunctival sac. Eye patch was applied.

Results

Present Study included 205 eyes of 205 patients who underwent Small incision cataract surgery (MSICS) by the same surgeon. The majority of the patients were in the age group 61-70 years with almost equal distribution among genders. In

the study 123 males and 82 females were included. Most of the patients presented with immature senile cataract.

Pre-operative Distribution of Endothelial Cell Count

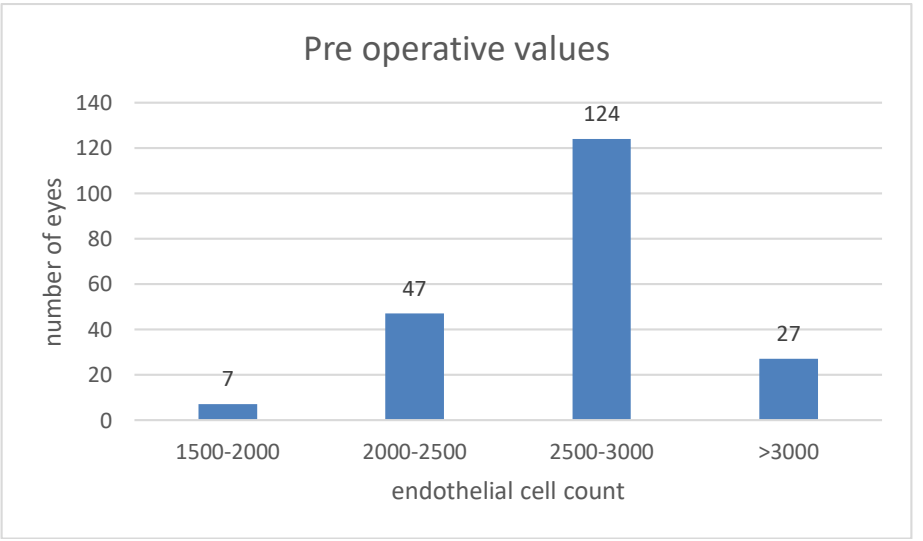
The preoperative Endothelial Cell Count (EC) of 205 eyes who underwent MSICS had a minimum endothelial cell count of 1516/mm^2 and a maximum count of 3453/mm^2. The mean endothelial cell count preoperatively was 2689.654 /mm^2.

Table No. 1 Preoperative value endothelial cell count

Endothelial cell count	Number of eyes
1500-2000	7
2000-2500	47
2500-3000	124
>3000	27

Table No. 2 Pre-operative values

	Endothelial cell (cells/mm^2)
Minimum	1516
Maximum	3453



Graph No. 1 Pre-operative values

Analysis of Post-Operative Endothelial Cell Count on days 7 and 28 was calculated

The difference of post-operative values from preoperative values in endothelial cell count (which occurred as a result of the cataract surgery) was also calculated. Post operatively, the mean endothelial cell count on days 7,28 was calculated by

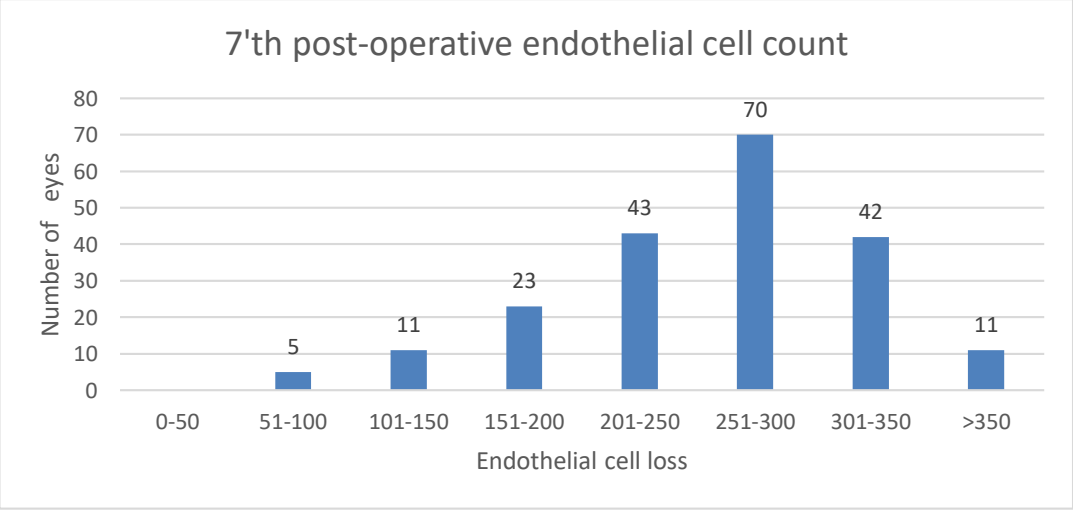
specular microscope SP 1P. Analysis of difference in post-operative endothelial cell count was done by calculating the mean, standard deviation.

Post-operative Day 7

The mean Endothelial Cell loss on the seventh postoperative day was 2433.27 cells/mm^2. The endothelial cell density decrease varied from a minimum of 66 cells/mm^2 to a maximum of 453 cells/mm^2. The mean decrease in endothelial cell density was 256.37 cells/mm^2 with a standard deviation of 74.79 cells/mm^2. On the day of 7 it was reduced to 2433±329.17 mm^2. The percentage decrease in EC was 9.53%.

Table No. 3 7'th post-op day endothelial cell count

Endothelial cell count	Number of eyes
0-50	00
51-100	5
101-150	11
151-200	23
201-250	43
251-300	70
301-350	42
>350	11



Graph No. 2 7'th post-op day endothelial cell count

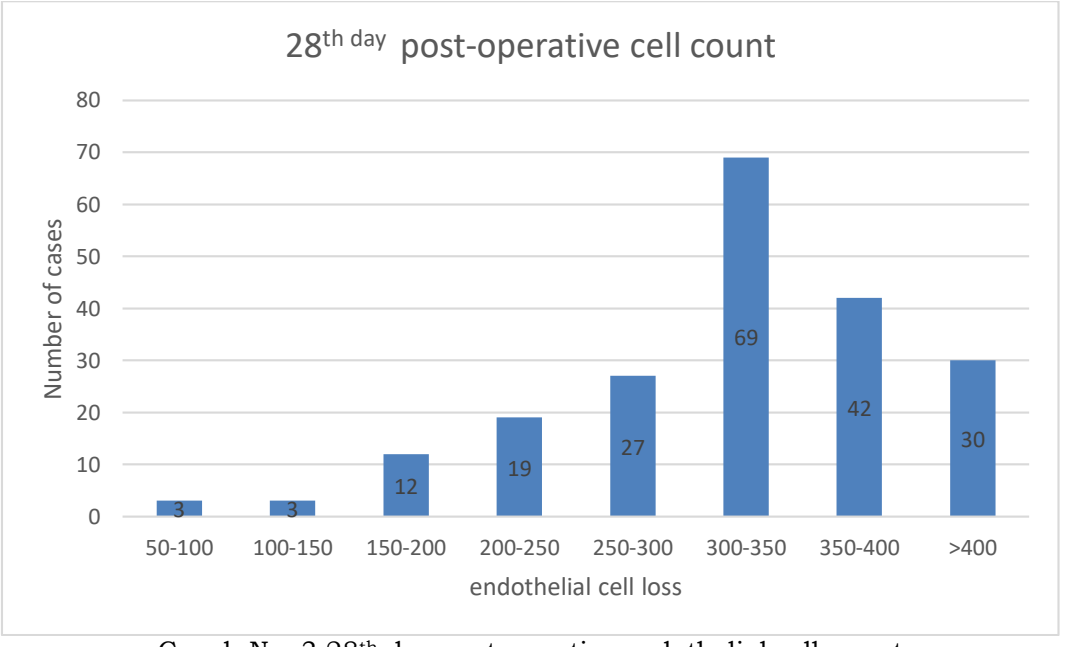
Post-operative Day 28

The mean Endothelial Cell loss on day 28'th postoperative day was 2367.01 cells/mm^2. The endothelial cell density decrease varied from a minimum of 74 cells/mm^2 to a maximum of 529cells/mm^2. The mean decrease in endothelial cell density was 301.67 cells/mm^2 with a standard deviation of 89.56 cells/mm^2.

On the day of the 28th it was reduced to 2367.019±326.176 cells/mm^2. The percentage decrease in EC was 11.21%.

Table No. 4 28th day postoperative endothelial cell count

Endothelial cell loss	Number of cases
50-100	03
100-150	03
150-200	12
200-250	19
250-300	27
300-350	69
350-400	42
>400	30



Graph No. 3 28th day postoperative endothelial cell count

Table No. 5 Best corrected pre and post- operative visual acuity

Visual acuity	Pre-op BCVA	Post-op BCVA
6/6 - 6/18	0	72
6/24 – 6/60	143	133
<6/60	62	0

Table No. 6 Mean endothelial cell count (cell/mm^2)

Time of examination	Endothelial cell count/mm^2(+/- SD)
Pre-operative	2689.65 ± 327.17
Post-operative Day-7	2433.27 ± 329.17
Post-operative Day-28	2367.09 ± 326.04

Table No. 7 Mean endothelial cell loss /mm^2

Time of examination	Mean endothelial cell loss/mm^2	% of cells loss
Post-operative day 7	256.37	9.53
Post-operative day 28	301.67	11.21

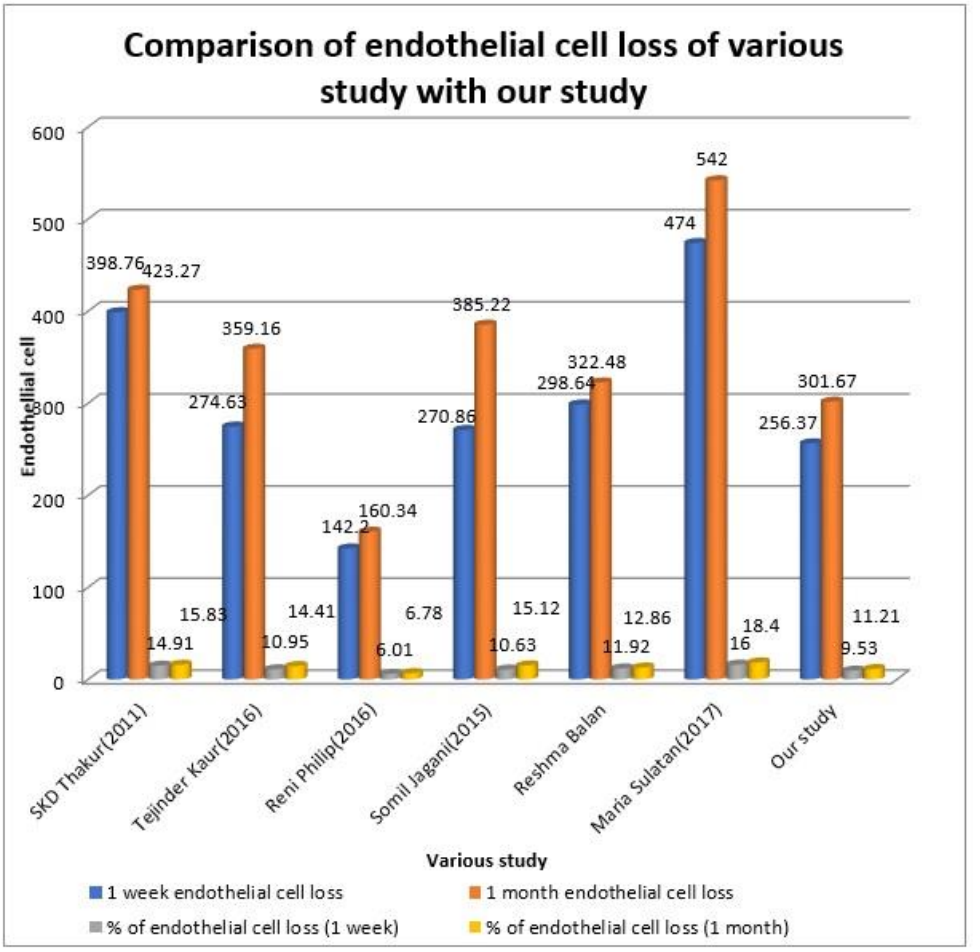
Discussion

Cataract surgery, the most commonly performed surgery, has always been associated with damage to the corneal endothelium, the endothelial layer is so vital for keeping the cornea transparent. There is a lot of concern about endothelial cells because they cannot regenerate. The response and effect of stress and trauma of cataract surgery on endothelial cells could not have been so well documented if it was not for the advent of specular microscopy.

In the developing world, manual small incision technique is gaining popularity as quick, relatively inexpensive techniques for high volume cataract management. Various studies have been undertaken to evaluate the endothelial cell loss after different types of cataract surgery to indirectly assess the safety of the surgical technique. In SICS the nucleus is prolapsed in the anterior chamber before delivery, which leads to the concern of endothelial cell loss.

Table No. 8 Comparison of endothelial cell loss of various study with our study

Study name	1 week endothelial cell loss(cells/mm^2)	1 month endothelial cell loss(cells/mm^2)	% of endothelial cell loss (1 week)	% of endothelial cell loss (1 month)
SKD Thakur et all(2011)	398.76	423.27	14.91	15.83
Tejinder Kaur et all(2016)	274.63	359.16	10.95	14.41
Reni Philip et all(2016)	142.20	160.34	6.01	6.78
Somil Jagani et all(2015)	270.86	385.22 (6 week)	10.63	15.12 (6 week)
Reshma Balan et all	298.64 (2 week)	322.48	11.92 (2 week)	12.86
Maria Sulatan et all(2017)	474 (2 week)	542 (6 week)	16 (2 week)	18.4 (6 week)
Our study	256.37	301.67	9.53	11.21



Graph No. 4: Comparison of endothelial cell loss of various study with our study

Conclusion

In our study post operative at 7th day and 28th day endothelial cell loss 11.2% which is comparable to previously popular ECCE and currently popular phacoemulsification. As per patients concern now a day cataract surgery refractive surgery so increasing expectation from patients. SICS is machine independent and cost effective too. So in developing country manual SICS is appropriate surgical procedure for treatment of cataract

Bibliography

1. World health organization, "global data on visual impairments," who press - who/nmh/pbd/12.01, 2010.
2. From editor's desk, National programme for control of blindness in India , October -December 2011.

3. Thakur S, Dan A, Singh M, et al. Endothelial cell loss after small incision cataract surgery. Nepal J Ophthalmol 2011; 3:177–180.
4. Tejinder Kaur, Karamjit Singh, Prempal Kaur, Dharmvir Chalia; A comparative study of endothelial cell loss in cataract surgery;small incision cataract surgery versus phacoemulsification; indian journal of clinical and experimental ophthalmology October-december,2016;2(4);318-322.
5. Philip R, Kamalakshy J, Narayaniyamma V. Changes in endothelial cell count and central corneal thickness in manual small incision cataract surgery versus phacoemulsification cataract surgery. J. Evolution Med. Dent. Sci. 2016;5 (43):2679-2686, DOI: 10.14260/jemds/2016/627
6. Jagani SN, Lune AA, Magdum RM, Shah AP, Singh M, Datta D. Comparison of endothelial cell loss by specular microscopy between phacoemulsification and manual small incision cataract surgery. Niger J Ophthalmol 2015;23:54-9.
7. Balan R. A comparative study of endothelial cell loss in small incision cataract surgery and phacoemulsification. Kerala Journal of Ophthalmology 2012;24(1):63-5.