

Study of Corneal Endothelial Cell Loss Examined by Specular Microscope in Cataract Patients Operated by Third Year Residents

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Abstract: **Background:** Cataract is an opacification of the crystalline lens or its capsule causing impairment of vision. Every cataract extraction even in experienced hands and modern techniques involves some corneal manipulation and endothelial damage. **Aim:** To determine corneal endothelial cell loss examined by specular microscope in cataract patients operated by third year residents. **Materials and Methods:** A prospective observational study conducted on 500 patients undergoing small incision cataract surgery with posterior chamber Intra-ocular lens by 3rd year residents of Dept. of Ophthalmology, P. D. U. Govt. Medical College, Rajkot was undertaken. Corneal endothelial cell count was examined by clinical specular microscope pre-operatively and at post-operative day 1, 1 week and 1 month. **Result:** The mean endothelial cell loss at post-operative day-1 was 237.2 cells/mm², at 1 week was 259 cells/mm² and at 1 month 305.3 cells/mm². The mean percentage endothelial cell loss with SICS was 8.82% at 1st postoperative day, 9.96% at 1 week post-operatively and 11.35% at 1 month postoperatively. **Conclusion:** There is no significant difference between endothelial cell loss in cataract surgery done by third year residents and experienced ophthalmic surgeons.

Keywords: Cataract, small incision cataract surgery, specular microscope, corneal endothelial cell count

1. Introduction

Cataract is an opacification of the crystalline lens or its capsule causing impairment of vision.¹ Cataract has been documented to be the most significant cause of bilateral blindness in India where vision < 20/200 in the better eye on presentation is defined as blindness.² Every cataract extraction even in experienced hands and modern techniques involves some corneal manipulation and endothelial damage. The damage to the corneal endothelium leads to corneal endothelial cell loss which if severe can eventually lead to the development of corneal oedema. Corneal transparency is regulated by a corneal endothelial pump that can be interfered by surgical trauma. The corneal endothelium is the innermost layer of the cornea made up of hexagonal cell monolayer that does not regenerate when damaged. The corneal endothelial layer possesses the ability to pump water out of the corneal stroma against an osmotic gradient since it contains an active Na⁺/K⁺ pump.³ Its cell count varies from 3500 – 4000 cells/mm² in infancy to about 2400 to 3200 cells/mm² in adults.⁴ For the cornea endothelium to perform the function of maintaining corneal clarity it must consist of healthy cells above a minimum cell density which is reported to range from 400 – 700 cells/mm².

Clinical specular microscopy is a practical tool to examine Corneal endothelium. It can detect endothelial cell density (ECD) (measured as cells/mm²), mean cell area (measured as μm²/cell), coefficient of variation (CV) that is (standard deviation of cell areas/mean cell area), pleomorphism (refers to variation in cell shape), polymegathism (refers to variation in cell size)

Aim

To determine corneal endothelial cell loss examined by specular microscope in cataract patients operated by third year residents.

Objectives

- 1) To determine corneal endothelial cell loss examined by specular microscope in cataract patients operated by third year residents
- 2) To determine pre-operative endothelial cell count among patients undergoing cataract surgery
- 3) To determine corneal endothelial cell loss after SICS with respect to age of the patient
- 4) To determine association between endothelial cell loss in post-operative visual acuity

2. Materials and Methods

Type of Study: Prospective study

Study Design: Observational study design

Source of Data

- 1) A total of 500 patients undergoing Small Incision Cataract Surgery with Posterior chamber intra ocular lens by third year residents are included.
- 2) Patients who have visited outdoor patient department in follow up following cataract surgery. Endothelial count is measured by non-contact specular microscope preoperatively and post-operatively on day 1, day 7 and 1 month

Inclusion Criteria

Patients undergoing SICS by third year residents at Department of Ophthalmology, P. D. U. GOVT. MEDICAL COLLEGE, RAJKOT. Adult patients.

Exclusion Criteria

- Traumatic cataract
- Complicated cataract
- Previous ocular surgery
- Significant corneal opacification
- Corneal dystrophy
- Uveitis
- Glaucoma
- Pre-existing infection
- Vitreous loss during surgery
- ACIOL

Methods

Total 500 cases, who have undergone small incision cataract surgery with posterior chamber intra ocular lens by third year residents were examined and evaluated for post-operative corneal endothelial cell loss, at DEPARTMENT OF OPHTHALMOLOGY, P.D.U. GOVT. MEDICAL COLLEGE, RAJKOY.

Detailed history was taken.

Following investigations were conducted on patients pre-operatively and post operatively)

- 1) visual acuity
- 2) Intra ocular pressure by schiottz tonometer
- 3) Biomicroscopic slit lamp examination
- 4) Fundus examination
- 5) A-scan
- 6) Specular microscopy
- 7) Binocular indirect ophthalmoscopy if required
- 8) B-scan if required
- 9) Routine investigations like blood pressure, urine sugar, HIV, HbsAg, sac syringing at time of admission

3. Results and Analysis

The majority of the patients were in the age group 61-70 years with slight male gender preponderance. Out of 500 cases there were 292 males and 208 females. There is decrease in endothelial cell count with age. Most of the patients presented with immature senile cataract.

Mean endothelial cell count according to Age group

Age group(year)	Mean endothelial cell count (cells / mm ²)
40-50	2751.78
51-60	2707.39
61-70	2669.57
71-80	2633.53
81-90	2008

The preoperative Endothelial Cell Count (ECC) of 500 eyes who underwent SICS had a minimum endothelial cell count of 1509/mm² and a maximum count of 3560/mm². The mean endothelial cell count preoperatively was 2688/mm².

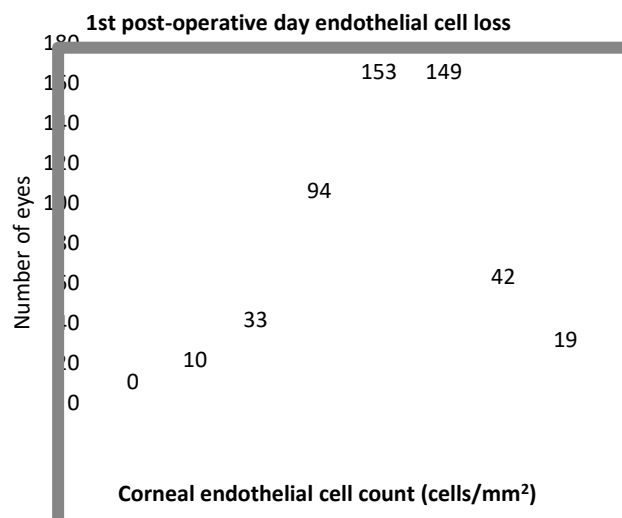
Pre-operative value

Endothelial cell count (cells / mm ²)	Number of eyes
1500-2000	17
2000-2500	108
2500-3000	302
>3000	73

Post-operative Day 1

The mean Endothelial Cell count on the 1st postoperative day was 2448 cells/mm². The endothelial cell density decrease varied from a minimum of 59 cells/mm² to a maximum of 413 cells/mm². The mean decrease in endothelial cell density was 237.2 cells/mm² with a standard deviation of 63.9 cells/mm². On the day of 1 it was reduced to 2448±331.4 mm². The percentage decrease in EC was 8.82%.

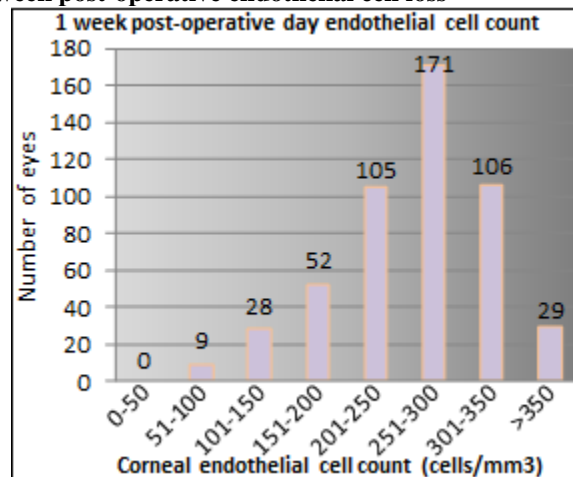
1st post-operative day endothelial cell loss



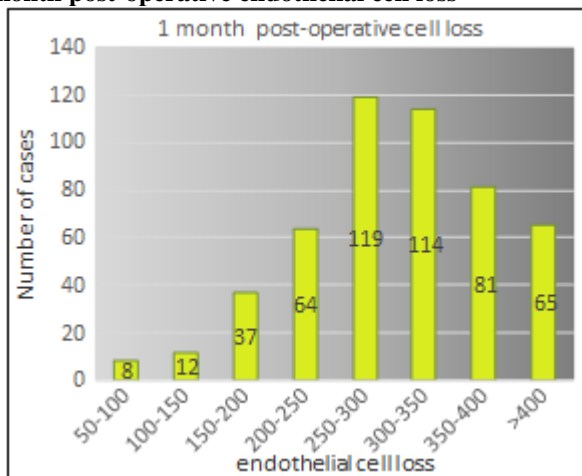
Post-operative 1 week

The mean Endothelial Cell count on 1 week postoperative was 2426 cells/mm². The endothelial cell density decrease varied from a minimum of 65 cells/mm² to a maximum of 459 cells/mm². The mean decrease in endothelial cell density was 259 cells/mm² with a standard deviation of 83.97cells/mm². At 1 week it was reduced to 2426±330.6 mm². The percentage decrease in EC was 9.96%.

1 week post-operative endothelial cell loss



1 month post-operative endothelial cell loss



Post-operative 1 month

The mean Endothelial Cell count on 1 month post-operative was 2380 cells/mm². The endothelial cell density decrease varied from a minimum of 71 cells/mm² to a maximum of 538 cells/mm². The mean decrease in endothelial cell density was 305.3 cells/mm² with a standard deviation of 83.97 cells/mm². At 1 month it was reduced to 2380±327.8 cells/mm². The percentage decrease in EC was 11.35%.

Mean endothelial cell count (cell/mm²)

Time of examination	Endothelial cell count cell/mm ² (+/- SD)
Pre-operative	2688 ± 330.6
Post-operative Day-1	2448 ± 331.4
Post-operative 1 week	2426 ± 330.6
Post-operative 1 month	2380 ± 327.8

Mean endothelial cell loss /mm²

Time of examination	Mean endothelial cell loss/mm ²	% of cells loss
Post-operative Day-1	237.2	8.82
Post-operative 1 week	259	9.96
Post-operative 1 month	305.3	11.35

Mean endothelial cell loss at 1 month according to Age group

Age group (year)	Mean endothelial cell loss at 1 month (cells / mm ²)
40-50	298.73
51-60	302.1
61-70	306.57
71-80	306.75
81-90	307.88

There is a slight increase in endothelial cell loss with increase in age after SICS.

Best corrected pre and post- operative visual acuity

Visual acuity	Pre-op BCVA	Post-op BCVA
6/6 - 6/18	0	181
6/24 - 6/60	347	319
<6/60	153	0

4. Discussion

In the study by SKD Thakur et al (2011)⁵, SICS was done using irrigating Vectis for nucleus delivery. They reported mean endothelial cell loss of 364.03cells/mm² at Day-

1,398.76 cells/mm² at Day-7 and 423.27 cells/mm². They reported a low endothelial cell loss of 13.61% at Day-1, 14.91% at Day 7 and 15.83% at 1 month.

In the study by Tejinder Kaur et al (2016)⁶, SICS was done using visco expression for nucleus delivery. They reported mean endothelial cell loss of 165.81 cells/ mm² with standard deviation 147.52 at Day-1 ,274.03 cells/mm² with standard deviation 189.27 at Day-7 and 359.16 cells/mm² with standard deviation 198.27 at 1 month. They reported a low endothelial cell loss of 6.60% at Day-1 , 10.95% at Day 7 and 14.41% at 1 month.

In the study by Reni Philip et al (2016)⁷, SICS was done using irrigating wire vectis for nucleus delivery. They reported mean endothelial cell loss was 94.36 cells/mm² with standard deviation 65.625 at Day-1, 142.20 cells/mm² with standard deviation 105.054 at Day-7 and 160.34 cells/mm² with standard deviation 99.089 at 1 month. They reported a low endothelial cell loss of 3.9% at Day-1, 6.01% at Day 7 and 6.78% at 1 month.

In the study by Somil N. Jagani et al (2015)⁸, SICS was done via scleral tunnel with PMMA PCIOL implantation. They reported mean endothelial cell loss 270.86 cells/mm² at Day-7 and 385.22 cells/mm² at 6 weeks. They reported a low endothelial cell loss of 10.63% at Day 7 and 15.12% at 6 weeks.

In the study by Reshma Balan et al⁹. They reported mean endothelial cell loss of 298.64 cells/mm² at 2 weeks and 322.48 cells/mm² at 1 month. They reported a low endothelial cell loss of 11.92% at 2 week and 12.86% at 1 month.


The value of endothelial cell loss at day 1, 1 week and 1 month was almost similar to other studies.

5. Conclusion

There is no significant difference between endothelial cell loss in cataract surgery done by third year residents and experienced ophthalmic surgeons .There is decrease in endothelial cell count with age. There is a slight increase in endothelial cell loss with increase in age after SICS. With increasing loss of endothelial cell there is decrease in visual acuity in patients with low endothelial cell count pre-operatively.

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