

# Corneal Endothelial Cell Loss after Phacoemulsification with and without Trypan Blue Assisted Staining of Anterior Lens Capsule

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**Purpose:** To study the mean loss of corneal endothelial cell in patients undergoing cataract surgery with phacoemulsification with and without trypan blue.

**Study Design:** Randomized controlled trial.

**Place and Duration of Study:** Institute of Ophthalmology, Mayo Hospital/ King Edward Medical University, Lahore from 1-1-2016 to 30-5-2017.

**Material and Methods:** All patients diagnosed with cataract were selected for surgery. The patients were divided into two groups A and B. Group A patients underwent phacoemulsification with trypan blue aided central curvilinear capsulorhexis while Group B patients underwent phacoemulsification without any aid of trypan blue. Patients with any corneal opacity were excluded from study. Specular microscopy was done on all patients before and three months after surgery. On specular microscopy, corneal endothelial count, hexagonality and coefficient of variation were noted. Specular microscopy and recording of findings was done by researcher.

**Results:** A total of 152 patients presenting to the Institute of Ophthalmology were included in study. Endothelial cell loss was observed in both the groups but it was more in the Group A ( $74.3421 \pm 0.6332$ ) as compared to the Group B ( $37.0658 \pm 2.6891$ ) ( $p 0.000$ ).

**Conclusion:** Phacoemulsification decreases corneal endothelial cell count both with and without trypan blue. The decrease in corneal endothelial cell count was more when phacoemulsification was done with trypan blue but it did not lead to corneal decompensation.

**Key Words:** Phacoemulsification, Trypan Blue, Corneal Endothelial Cell Count.

Cataract surgery is one of the most frequently executed surgeries around the globe. In this surgery the opaque cataractous lens is removed and is replaced by an artificial intraocular lens<sup>1</sup>. The history of cataract surgery goes back two centuries where it started as couching in this part of the world. Later on intracapsular cataract extraction<sup>2</sup> was introduced which was refined to extracapsular

cataract extraction<sup>3</sup> in which the lens capsule was preserved. Phacoemulsification is the surgery of choice now a days as it gives early visual recovery and patient rehabilitation and minimal complications<sup>4,5,6</sup>.

Cornea is an important structure of the eye which imparts about two thirds of the dioptric power to the eye. Due to this the health and status of cornea assumes an important role when deciding for the

prognosis after any ocular surgery<sup>7</sup>. The state of the cornea is mainly assessed by specular microscope<sup>8, 9, 10</sup>. It is well known that anterior segment surgery<sup>11,12</sup> results in a decrease in corneal endothelial cell count and may lead to irreversible corneal compromise if the condition of cornea is not healthy before surgery. Only very few studies are present in literature evaluating the effects of trypan blue during phacoemulsification on corneal endothelium.

Trypan blue is a vital dye which is used in both anterior and posterior segment surgery. In vitreo retinal surgery, trypan blue is used to stain the epiretinal membrane in cases of macular pucker and proliferative diabetic retinopathy. While in the anterior segment surgery trypan blue is mainly used to stain the anterior capsule in mature or white cataracts in which visualization of capsule is difficult. During staining of anterior lens capsule 0.2 ml of 0.18% trypan blue is injected into the anterior chamber<sup>13,14,15</sup>. We undertook this study to evaluate the effect of Trypan Blue on the corneal endothelium during phacoemulsification.

## MATERIALS AND METHODS

A total of 152 patients presenting to the Institute of Ophthalmology were included in study. Patients diagnosed with cataract were selected for surgery. The patients were divided into two groups. Group A patients underwent phacoemulsification with trypan blue 0.18% (RS BLUE BY Alchimia) staining of the anterior capsule for central curvilinear capsulorhexis while Group B patients underwent phacoemulsification without any aid of trypan blue. Patients diagnosed with any coexisting corneal disease or corneal opacity were excluded from the study.

All the patients underwent phacoemulsification with intraocular lens implantation under local anesthesia. HPMC 2% (Ocugel by Farmigea) was used during surgery to maintain anterior chamber. After aseptic measures a corneal incision was made with keratome and 0.2 ml of 0.18% trypan blue was injected

in anterior chamber of group A patients for 30 seconds while no dye was injected in group B patients. Afterwards a central curvilinear capsulorhexis was done and phacoemulsification (Optikon Pulser 2) was done by divide and conquer technique followed by implantation of intraocular lens. The corneal incision was hydrated and antibiotic drops instilled into the eye. Dressing was applied at the end of surgery. All the patients were prescribed a combination of steroid and antibiotic drops post operatively. On the first post-operative day the patients were discharged after slit lamp examination and called for follow up for corneal endothelial cell count measurement.

All patients underwent pre-operative and three month post-operative bilateral specular microscopy for endothelial cell count, percentage of hexagonal cells and coefficient of variation. Specular microscopy (SP-01 by CSO) was done by researcher and findings were recorded. Wilcoxon signed ranks test was applied for statistical analysis.

## RESULTS

Out of 152 patients 83 were male (54.6%) and 69 (45.4%) were female. In group A 42 (55.3%) patients were male and 34 (44.7%) patients were female while in group B 41 (53.9%) patients were male and 35 (46.1%) patients were female.

The mean pre-operative BCVA in the operated eye was  $0.92 \pm 0.97$ . The mean post-operative BCVA in the operated eye was  $0.096 \pm 0.127$ . The mean preoperative corneal endothelial cell count in the operated eye was  $2458.348 \pm 72.382$ . The mean post-operative corneal endothelial cell count in the operated eye was  $2402.644 \pm 77.431$  (**p 0.000**).

In group A, Mean pre-operative BCVA of the operated eye was  $0.91 \pm 0.098$ . The mean post-operative BCVA in the operated eye was  $0.090 \pm 0.127$ . The mean pre-operative corneal endothelial cell count in the operated eye was  $2443.315 \pm 65.89$ . The mean post-operative corneal endothelial cell count in the

**Table 1:** Overall Visual Acuity and Endothelial Count.

Sr. No.	Parameter	Operated Eye	
		Pre-Operative	Post-Operative
1.	Visual Acuity	$0.92 \pm 0.97$	$0.096 \pm 0.127$
2.	Corneal Endothelial Cell Count	$2458.348 \pm 72.382$	$2402.644 \pm 77.431$

**Table 2:** Visual Acuity and Endothelial Count in Group A.

Sr. No.	Parameter	Operated Eye		Difference
		Pre-Operative	Post-Operative	Post-Pre Operative
1.	Visual Acuity	0.91 ± 0.098	0.090 ± 0.127	0.010 ± 0.8616
2.	Corneal Endothelial Cell Count	2443.315 ± 65.89	2368.97 ± 66.52	74.3421 ± 0.6332

P 0.000

**Table 3:** Visual Acuity and Endothelial Count in Group B.

Sr. No.	Parameter	Operated Eye		Difference
		Pre-Operative	Post-Operative	Post-Pre-Operative
1.	Visual Acuity	0.92 ± 0.096	0.10 ± 0.12	0.8263 ± 0.0322
2.	Corneal Endothelial Cell Count	2473.381 ± 75.81	2436.315 ± 73.12	37.0658 ± 2.6891

P 0.000

operated eye was 2368.97 ± 66.52. The difference in visual acuity was 0.010 ± 0.8616 while the difference in endothelial cell count was 74.3421 ± 0.6332 (p 0.000).

In group B, Mean pre-operative visual acuity in the operated eye was 0.92 ± 0.096. The mean post-operative visual acuity in the operated eye was 0.10 ± 0.12. The mean pre-operative corneal endothelial cell count in the operated eye was 2473.381 ± 75.81. The mean post-operative corneal endothelial cell count in the operated eye was 2436.315 ± 73.12. The difference in visual acuity was 0.8263 ± 0.0322 while the difference in endothelial cell count was 37.0658 ± 2.6891 (p 0.000).

## DISCUSSION

It is well known through literature that anterior and posterior segment surgery affects the corneal endothelium but no local data is available is present about the effects of trypan blue on corneal endothelium.

Our study shows that phacoemulsification with intraocular lens implantation decreases corneal endothelial cell count both with and without the use of adjunctive trypan blue. The authors compared the corneal endothelial cell loss with and without trypan blue during phacoemulsification and concluded that the corneal endothelial cell loss was more when phacoemulsification was done with adjunctive trypan blue. Despite the corneal endothelial cell loss no

patient presented with corneal decompensation on follow-up.

Dick HB et al<sup>16</sup> studied corneal endothelial cell loss after phacoemulsification in terms of incision size, per operative phacoemulsification power used and surgery time. They found out that the corneal endothelial cell count decreased more with increasing surgery time and increasing ultrasound power. They concluded that 3.5 mm clear corneal incisions resulted in a meager decreased endothelial cell loss as compared to a 5 mm incision.

Jerome R et al<sup>17</sup> compared loss of corneal endothelial cells after phacoemulsification using ultrasound or fluid based system. They reported a corneal endothelial cell loss of 498±415 in patients undergoing phacoemulsification with an ultrasound system, conversely, the patients undergoing phacoemulsification with fluid based system showed corneal endothelial cell loss of 302±302 cells. Thus, they concluded that phacoemulsification with fluid based system results in a decreased corneal insult.

Price MO et al<sup>18</sup> studied loss of corneal endothelial cell after two different techniques of Descemet's stripping endothelial keratoplasty. In their study, endothelial cell loss was less when the graft was inserted through a clear corneal incision while it was more when the graft was inserted through a scleral tunnel possibly due to more compression during insertion.

Hengerer IC et al<sup>19</sup> compared corneal endothelial cell loss after femtosecond laser assisted phacoemulsification and conventional phacoemulsification. They reported a corneal endothelial cell loss of 7.9% after femtosecond laser assisted phacoemulsification and a loss of 13.7% with conventional phacoemulsification. They concluded that femtosecond laser assisted cataract surgery is a safer and more advantageous method in terms of visual rehabilitation and patient comfort.

Chung CF et al<sup>20</sup> compared trypan blue and indocyanin green assisted anterior capsular staining during phacoemulsification for white cataract. They reported no major differences in phacoemulsification time and corneal endothelial cell loss in both the groups as they were comparable.

Jacob S et al<sup>21</sup> assessed the postoperative outcomes of phacoemulsification assisted with trypan blue anterior capsule staining. They documented an endothelial cell loss of 8.5% in their study. Absence of local data on this topic was the rationale to conduct this study.

## CONCLUSION

Trypan blue assisted phacoemulsification results in more corneal endothelial cell loss as compared to conventional phacoemulsification but it does not result in corneal decompensation. The authors feel the need of a large randomized controlled study to have a bigger picture of the situation.

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