



ORIGINAL RESEARCH PAPER

Ophthalmology

SPECULAR MICROSCOPIC STUDY FOLLOWING TREBECULECTOMY AND CATARACT EXTRACTION(ONE STAGE VS TWO STAGE SURGERY)

KEY WORDS: cataract, trabeculectomy, one stage, twostage, endothelial count.

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ABSTRACT

Purpose: To do quantitative and qualitative analysis of corneal endothelium after cataract extraction & trabeculectomy with comparison of endothelial cell damage between one stage and two stage surgery.
Method: The study was performed by examination of 30 cases for their corneal endothelial status pre operative and post operative(7th day) following one stage and two stage surgery with specular microscope.
Result: The difference in the corneal endothelial cell loss between the one stage and two stage surgery is found to be statistically insignificant on 7th post operative day.

INTRODUCTION

The endothelial cells form a barrier that prevents the entering of the water molecules from the anterior chamber fluid into the cornea. They also pump water from the cornea into the anterior chamber and nutrients in and out of the cornea. Intact endothelium is therefore imperative for corneal transparency .

AIMS AND OBJECTIVES

- To do the quantitative and qualitative analysis of corneal endothelial after cataract extraction and trabeculectomy.
- Comparison of endothelial cell damage between one stage that is combined surgery(trabeculectomy+ cataract extraction) and two stages that is first trabeculectomy and then cataract extraction .

REVIEW OF LITERATURE

- **ANATOMY OF CORNEA**
***GROSS ANATOMY**

Cornea is transparent resembling watch glass. Its curvature is greater than rest of the globe. cornea is elliptical anteriorly being 12mm in horizontal meridian and 11mm in vertical plane. Posteriorly it appears circular being 11.5mm in diameter. The radius of the anterior surface of the cornea is 7.8mm and posteriorly it is 6.5mm. The thickness at the periphery is 0.67mm and at the centre is 0.5mm. The posterior surface is 147mm²

*** MICROSCOPIC ANATOMY**

1. EPITHELIUM :

It is the continuation of the conjunctival epithelium, approx thickness about 50um. It consists of 5-6 layers of the cells.

2. BOWMAN'S MEMBRANE:

it is thin homogenous sheet of 8-14 um thickness, good resistance to injury and infection.

3. STROMA

It makes up 99% of corneal thickness and composed of lamellar fine collagen fibril

4. DESEMENT'S MEMBRANE:

It is strong homogenous and very resistance membrane. Its thickness is 10-12 mm.

5. ENDOTHELIUM:

Most posterior layer consist of single layer of flatten cells which has hexagonal pattern. Normal cell count in young is 2500-3000 cells/mm².

TRANPARENCY OF CORNEA:

It is regulated by

1. Stromal swelling pressure
2. Epithelial and endothelial barriers
3. Endothelial pump
4. Intraocular pressure

5. Evaporation

SPECULAR MICROSCOPY:

It is reflected light microscope used for study of corneal endothelium.

PRINCIPLE:

Specular reflection is like mirror reflection where in the angle of reflection is equal to angle of incidence.

ANALYTICAL MEASUREMENTS BY SPECULAR MICROSCOPY

1. QUALITATIVE ANALYSIS:

This is being done to see any presence of abnormal endothelial structures and evaluation of endothelium to assess the risk of intraocular surgery.

A complete qualitative analysis include :

- (a) cell confirmation
- (b) cell boundaries and their intersection
- (c) figuration of dark boundary
- (d) presence of cellular structures

A number of inter and intraendothelial cell structures are seen, corneal guttae can be easily make out. Two types of corneal guttae identified by it , one has smooth regular posterior surface, second has irregular surface.

2. QUANTITATIVE CELL ANALYSIS:

This include cell size, cell perimeter, average cell length, cell shape and cell density.

Mean cell area(m²/cell)=10 6/cell density9cells/mm²)

Two different methods:

1. fixed frame analysis
2. variable frame analysis

EFFECTS OF INTRAOCCLULAR SURGERY ON ENDOTHELIUM:

- Most damage area healed by enlargement and migration of remaining cells due to limited proliferative capacity of endothelium. Endothelium cells are in transition form after intraocular surgery with decline cell density and hexagonal pattern. Due to injury or inflammation loss of corneal cells become more faster.
- Critical density has been estimated to be 10-15% of normal cell count i.e. 300-500 cells/mm². therefore 500 cells loss with relatively good qualitative cells help in maintaining normal corneal transparency known as physiological reserve.
- Factors affecting endothelial cell loss related to surgery:

1. Pre existing corneal disease
2. Operative factors
3. Post operative factors

EFFECTS OF CATARCT ON SURGERY OF ENDOTHELIUM:

- Endothelium is greater in superior part of cornea in the area of maximum manipulation adjacent to incision. Inferior portion is least affected and central endothelial cells count are intermediate. Since endothelial wound healing occur primarily by migration rather than cell replication, by loosing their hexagonal shape to cover the defects. Within 3 months they return to normal configuration without any complication. Several viscous and visco elastic substance minimize endothelial cell damage

EFFECTS OF GLAUCOMA AND ANTIGLAUCOMA SURGERY ON ENDOTHELIUM:

In acute angle closure glaucoma and glaucomatocyclitic crisis-decrease central corneal endothelial cell density.

Uncomplicated trabeculectomy and iridectomy has little effect on central corneal endothelial cell density. Flat AC following trabeculectomy can cause decrease cell density which cause mechanical effects on iris or lens or endothelium inflammation ,altered aqueous humor metabolism, hypotony or some combination of these. Average endothelial cell loss after trabeculectomy had been reported from 0.2-14.9%.

MATERIAL AND METHODS

- 30 cases for their corneal endothelial status pre operatively and post operatively(7th day) following combined (trabeculectomy and cataract extraction) and 2 stages with modern ALCON –PRO –CEM-4 contact specular microscope.
- Cases are divided into two groups
- * GROUP 1 : (1-15) 15 cases of combined surgery.
- * GROUP 2: (16-30) 15 cases of 2 stage(1st trabeculectomy and then cataract)

METHODS TO CALCULATE THE NUMBER OF ENDOTHELIAL CELLS:

- All previously recorded film by still and tracking method viewed for endothelial count and morphology pattern by using standard grid .

- Standard grid is 52 x 7.5 cm in size and rectangular shape. It is divided into 4 equal rectangle.

• ENDOTHELIAL CELL COUNTING :

Endothelial cell in = endothelial cell count/
total grid x 50 mm² of corneal area .

In cases in which full frame is not focused we used 2 or 1 rectangle reading.

Endothelial cell count= endothelial cell count/
in 2 rectangles x 100 mm² of corneal area.

Endothelial cell count =endothelil cell count/
In 1 rectangle x 200 mm² of corneal area.

OBSERVATION AND DISCUSSION

TWO STAGE table 1

	CLOSE ANGLE	OPEN ANGLE	PHACOGENIC	TOTAL
RIGHT EYE	2	5	0	7
LEFT EYE	3	5	0	8
TOTAL	5	10	0	15
%	33.3%	66.7%	0	100%

COMBINED table 2

	CLOSE ANGLE	OPEN ANGLE	PHACOGENIC	TOTAL
RIGHT EYE	2	2	2	6
LEFT EYE	3	3	3	9
TOTAL	5	5	5	15
%	33.33%	33.33%	33.33%	100%

Table 2 shows different type of glaucoma in 2 groups.

In group 1 33.3% patients were of close angle, 66.7% patients were of open angle and 0% were of phacogenic type.

In group 2 33.33% were of close angle ,open angle, and phacogenic each.

PRE AND POST OPERATIVE CELLULAR DENSITY

Table 3

CELL/ MM ²	OPERATION					
	TWO STAGE		COMBINED		TOTAL	
	PREOPERATIVE	POST OPERATIVE	PREOPERATIVE	POST OPERATIVE	PREOPERATIVE	POST OPERATIVE
<1000	2	7	1	5	3	12
1000-1200	2	3	2	4	4	7
1200-1400	3	4	3	2	6	6
1400-1600	3	1	4	2	7	3
1600-1800	5	0	2	1	7	1
1800-2000	0	0	2	1	2	1
2000-2200	0	0	1	0	1	0
TOTAL	15	15	15	15	15	30

Table 3 shows maximum pre op cell density was ranging from 1400-1800 cells/mm² in 14 patients, among them 8 patients were for 2 stage,6 patients were for combined.

cells/mm², among them 10 patients were from two stage,9 patients were from combined surgery.

Maximum patients post op cell density was ranging from 0- 1200

PRE AND POSTOPERATIVE CORNEAL THICKNESS

Table 4

CORNEAL THICKNESS	OPERATION					
	TWO STAGE		COMBINED		TOTAL	
	PRE OPERATIVE	POST OPERATIVE	PRE OPERATIVE	POST OPERATIVE	PRE OPERATIVE	POST OPERATIVE
<0.500	0	0	2	0	2	0
0.501-0.520	3	1	1	1	4	2
0.521-0.540	3	2	3	2	6	4
0.541-0.560	2	1	4	1	6	2
0.561-0.580	4	2	3	3	7	5
0.581-0.600	3	3	2	2	5	5
0.601-0.620	0	4	0	2	0	6
TOTAL	15	15	15	15	30	30

Table 4 shows that in both 2 stage and combined surgery corneal thickness upto 0.560mm were 26.7% (4/15) and more than 0.560mm were 73.3% (11/15).

Table 5

CELLULAR LOSS	CELLULAR LOSS IN BOTH GROUP OPERATION		
	TWO STAGE	COMBINED	TOTAL
0-100	1	5	6
100-200	3	5	8
200-300	3	0	3
300-400	5	1	6
400-500	2	1	3
500-600	0	1	1
600-700	1	0	1
700-800	0	0	0
800-900	0	0	0
900-1000	0	2	2

Table 5 shows in two stage cellular loss range was upto 700, where in combined surgery range was upto 1000. But among them maximum patients were in range of 0-200 in combined and 0-400 in two stage.

Clinically it seems to be more cellular loss in two stage, but statistically it is insignificant. (t=0.224 df 28 p>0.05 suggests insignificant. If p< 0.05 then only it is significant.

TYPES OF CATARACT OPERATION

Table 6

OPERATION	TWO STAGE	COBINED	TOTAL
ICCE	10	14	24
ECCE	5	1	6
TOTAL	15	15	30

Table shows in two stage surgery 10 ICCE and 5 ECCE. In combined surgery 24 ICCE and 6 ECCE.

SUMMARY AND CONCLUSION

- Study evaluated corneal endothelial changes in 30 eyes of 30 patients operated for combined surgery and two stage surgery.(trabeculectomy+ cataract extraction)

1. Morphological changes (pleomorphism and increase intracellular space). We have noticed pre operatively in all patients except 1, that suggest that increase intraocular pressure leads to morphological changes.
2. The patients who have corneal guttate pre operatively will have more corneal endothelial cellular loss post operatively.(2 patients with corneal guttate had more than average cell loss.
3. In our study corneal endothelial cellular loss was same with ICCE & ECCE.
4. Corneal endothelial cellular loss is more with perforating injury.(we had 1 patient whose preoperative cell density was 800 cells/mm² and post operative 300 cells/mm² where other eye cell density was 2500 cells/mm².
5. average corneal endothelial cell density pre and post operative are as follows:

	Pre operative(cells/mm ²)	Post operative(cells/mm ²)
Two stage	1493.33	1186.67
Combined	1733.33	1366.67

6. The difference in the corneal endothelial cell loss between the combined surgery and two stage surgery is found to be statistically insignificant on 7th post operative day.

References:

1. Engene wolff: The eye ball cornea. The anatomy of eye and orbit 1968 pg.29-36.
2. The cornea-by Gilbert smolin and Richard A Thoft 1983. Ch.1 pg3-6.
3. Alder: The cornea physiology of eye-clinical application 1981 38-60.
4. Wide field specular microscopy koester et al. American academy of ophthalmology.
5. Long term corneal endothelial cell loss after cataract surgery.Results of randomized control trial.Oxford cataract treatment and evaluation team .Arch ophthal vol.4
6. Central corneal endothelial cell density and central corneal thickness in ocular hypertension and primary open angle glaucoma. Michael korey, M.D. David Gieser, Michael A. kass. M.D. Stephen, R. waltmen., M.D. American journal of ophthalmology.