



Assessment of Corneal Endothelial Changes in Patients of Pseudo Exfoliation Using Non-contact Specular Microscopy

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ABSTRACT

Background: An altered composition and increased flare intensity of the aqueous humor caused by a breakdown of the blood aqueous barrier in eyes having PEX syndrome which cause corneal endothelial changes.

Aims: To evaluate changes in the corneal endothelial morphology in patients with pseudo exfoliation (PEX) syndrome.

Setting and Design: Tertiary care center of ophthalmology, Ahmedabad, India. **Materials and Methods:** Study included 220 eyes in a tertiary referral care center. In this group of patients there were 110 eyes with PEX syndrome and 110 eyes normal without PEX syndrome. Endothelial cell density, Corneal thickness and Hexagonality of cells were measured in each eye by specular microscopy and were compared between two groups.

Results: The endothelial cell density in eyes with pseudo exfoliation was 2212.60 ± 312.34 cells/mm² & in controls 2588.06 ± 286.54 cells/mm². The average cell size of cases was 492.40 ± 72.12 mm² and of controls was 426.44 ± 73.40 mm² ($p < 0.05$). Hexagonality of corneal cells in the cases varied from 11 % to 90 % with a mean of 48.35 %. The controls had a mean of 62.02 % ($p < 0.05$). There was a statistical difference in the cell density, cell size and hexagonality of the two groups.

Conclusion: Our study showed that in Pseudo exfoliation syndrome, endothelial cell density and the percentage of hexagonal cells are reduced. However, average cell size was increased. Therefore, ophthalmologists must be careful in conducting cataract surgery, use of high viscosity viscoelastics.

Key words: Corneal endothelial morphology–Pseudoexfoliation syndrome–Specular microscopy.

1 INTRODUCTION:

The pseudo exfoliation (PEX) syndrome is characterized by the production and accumulation of extracellular white amorphous-like material in many tissues and organs [1, 2]. Deposits of the pseudoexfoliative material can be found on the pupillary border, on the anterior lens capsule, the inner layer of the ciliary epithelium, on the zonules, on the iris

epithelium, in the anterior chamber angle structures, and in the anterior part of the vitreous [3, 4]. Deposits of the PEX material can also take the form of irregular clumps on the corneal endothelium.

The corneal endothelium is a single layer of hexagonal cells that do not have the ability to regenerate. The normal density of corneal endothelial cells in adults is approximately 2500 cells/mm² and it is reduced by about 0.6% a year. The endothelium performs an essential function of maintaining the hydration of the cornea. When the endothelial cells density is reduced to approximately 800

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cells/mm², it may lead to corneal decompensation causing corneal edema and loss of corneal transparency, which disrupts vision [5].

There are some studies of corneal endothelial changes in eyes having PEX syndrome reporting lower endothelial cell density and a lower percentage of hexagonal cells [6, 7]. However, there are few studies reporting no significant changes in endothelial cell density or the percentage of hexagonal cells in eyes having PEX syndrome [8, 9]. Thus, the changes in corneal endothelial morphology in eyes having PEX syndrome have been controversial.

The aim of this study is to compare the corneal endothelial morphology and central corneal thickness between eyes having PEX syndrome and control group by using non-contact specular microscopy.

2 MATERIALS AND METHODS:

This is a prospective observational study carried out from July 2018 to March 2019 in a tertiary referral care center of India in 220 eyes of 200 patients. All ethical aspects have been taken due care of.

Patients diagnosed to have pseudo exfoliation syndrome, intraocular pressure between 12 to 21 mmHg and for bilateral involvement, both eyes of same patients were included.

Patients having acute corneal disease, contact lens wearers, past history of any intraocular surgery or laser treatment, corneal dystrophies, Diabetes mellitus and Glaucoma were excluded.

Methodology:

The patients were divided into 2 groups i.e. 110 eyes with PEX syndrome as Cases and 110 eyes normal (without PEX syndrome) as Controls. History and Examination comprised of demographic factors like age, sex and occupation, Snellen's best-corrected visual acuity, intraocular pressure (IOP) measurement using applanation tonometry, slit lamp examination and fundus examination by indirect ophthalmoscopy.

Diagnosis of pseudo exfoliation syndrome was made by the appearance of a white, dandruff like material on pupillary margin of iris, classical pattern of 3 zones or "Bulls Eye" pattern due to deposition of pseudoexfoliative material on the anterior capsule of lens, gonioscopy, fundus examination, and specular Microscopy.

Specular Microscopy:

Specular microscopy was performed using a non-contact specular microscope. Following parameters were used for analysis:

- (1) Central corneal thickness (CCT),
- (2) Endothelial cell size,
- (3) Endothelial cell density (ECD),
- (4) Hexagonality of cells.

Statistical analysis:

For comparison of parameters describing morphology between the eyes with pseudo exfoliation and control group Z test applied. Values of $P < 0.05$ to be statistically significant.

3 RESULTS:

In this group of patients there are 110 eyes with PEX syndrome were taken as cases and 110 eyes normal without PEX syndrome and with immature senile cataract were taken as controls for comparative analysis.

Their age varied from 50 to 89 years (mean- 66.2 years for cases and mean- 67.1 for controls). Table 1

Table 1. ge wise distribution of Cases and Controls

Age (years)	Cases No of patients	Controls No of patients
50-59	8 (8.9%)	9 (8.2%)
60-69	38 (42.2%)	48 (43.6%)
70-79	35 (38.9%)	45 (40.9%)
80-89	9 (10%)	8 (7.3%)
Total	90	110

There were 49 men (54.4%) and 41 women (45.6%) in case

group and 47 men (42.7%) and 63 women (57.3%) in control group.

A total of 90 cases were included in the study out of which 20 patients with pseudo exfoliation showed bilateral involvement.

The mean central corneal thickness was observed to be 0.490 mm in both cases and control group. The p value was greater than 0.05, hence there was no statistical difference in the two groups. Table 2

Table 2. Comparison of central corneal thickness

Group	No of eyes	Central corneal thickness (mm) Mean SD	P value
Cases	110	0.490 0.030	>0.05
Control	110	0.490 0.040	>0.05

The average cell size of cases was 492.40 ± 72.12 mm² and that of controls was 426.44 ± 73.40 mm². The p value was less than 0.05; hence there was a significant difference in the average cell size in the cases & control groups. Table 3

Table 3. Comparison of average cell size

Group	No of eyes	Average cell size (mm ²) Mean SD	P value
Cases	110	492.40 72.12	<0.05
Control	110	426.44 73.40	<0.05

The endothelial cell density (ECD) ranged from 1589 to 2898 cells/mm² (Mean – 2212.60 cells/mm²) in the cases and the ECD varied from 2010 to 3189 cells/mm² (Mean – 2588.06 cells/mm²) in the control group. There was a significant difference in the two groups. Table 4

Hexagonality of corneal cells in the cases varied from 11 % to 90 % with a mean of 48.35 %. The controls had a mean of 62.02% ($p < 0.05$). There was a statistical difference in the hexagonality of the two groups. Table 5

Table 4. Comparison of endothelial cell density

Group	No of eyes	Endothelial cell density (cells/mm ²)		P value
		Mean	SD	
Cases	110	2212.60	312.34	<0.05
Control	110	2588.06	286.54	<0.05

Table 5. Comparison of hexagonality of cells

Group	No of eyes	Hexagonality of cells (%)		P value
		Mean	SD	
Cases	110	48.35	15.32	<0.05
Control	110	62.02	8.43	<0.05

4 DISCUSSION:

An altered composition and increased flare intensity of the aqueous humor caused by a breakdown of the blood aqueous barrier in eyes having PEX syndrome which cause corneal endothelial changes [10].

By electron microscopy, large clumps of typical pseudo exfoliation material can be found adhering to the corneal endothelium, and masses of pseudo exfoliation material are incorporated into the posterior Descemet membrane. These may lead to early corneal endothelial decompensation [10].

In the current study, the composition of the corneal endothelium and its thickness in the eyes having PEX syndrome were evaluated at the same time. We have found only one report that evaluated the corneal endothelial composition and thickness in the eyes having PEX syndrome at the same time [10]. However, these authors compared these factors between the eye having PEX syndrome and the fellow eye and did not recruit normal eyes as controls. There are a few reports on the corneal endothelium in Japanese patients having PEX syndrome, which were published in 1989 and 1990 [6, 7]. The corneal endothelium was measured using contact specular microscopy [6, 7].

Recently, noncontact specular microscopy has often been used [9, 11] and we evaluated the corneal endothelium using the noncontact method.

The mean corneal endothelial cell density in eyes having PEX syndrome has been reported as 2052 ± 264 cells/mm² [12], 2234 ± 270 cells/mm² [7] and 2394 ± 271 cells/mm² [11]. In the current study, the mean corneal endothelial cell density was 2212.60 ± 312.34 cells/mm², which was similar to these previous reports.

The mean percentage of hexagonal cells in eyes having PEX syndrome was reported as 54.9 ± 10.9 % [7] and 59.5 ± 6.7 %. In the current study, the mean percentages of hexagonal cells (48.35 ± 15.32 %) were lower to these previous reports.

We also compared the mean corneal thickness (CCT). The mean central corneal thickness was observed to be 0.490 mm in both cases and control group. The p value was greater than 0.05, hence there was no statistical difference in the two groups. De jaun-Marcos L et al evaluated the corneal endothelial morphology and central corneal thickness in pseudoexfoliative eyes with and without glaucoma

and compared with normal eyes and eyes with primary open angle glaucoma. They also found that changes in endothelial cells increased with age & there was no significant difference in mean central corneal thickness between four groups [13]. These findings correlated well with findings in our study.

Many previous reports [6, 7, 9, 11, 12] and the current study showed that corneal endothelial cell density in eyes having PEX syndrome was decreased. Caution and careful techniques are required during cataract surgery in eyes having PEX syndrome.

5 CONCLUSION:

Our study showed that in Pseudo exfoliation syndrome, endothelial cell density and the percentage of hexagonal cells are reduced. However, average cell size was increased. Therefore, we ophthalmologists must be careful in conducting cataract surgery, use of high viscosity viscoelastics and use of soft shell technique should be emphasized.

REFERENCES

- [1] Schumacher S, Schlötzer-Schrehardt U, Martus P. Pseudoexfoliation syndrome and aneurysms of the abdominal aorta. *The Lancet*. 2001;357:359–360.
- [2] Koca MR, Naumann GOH. Pseudoexfoliation syndrome: ocular manifestation of a systemic disorder. *Archives of Ophthalmology*. 1992;110:1752–1756.
- [3] Kurowska A, Kaminska A, Izdebska J. Zespół pseudoeksfoliacji (PEX)-schorzenie ogólnoustrojowe. *Klinika Oczna*. 2009;111:160–164.
- [4] Ludwisiak-Kocerba L, Hevelke A, Kęcik D. Zespół pseudoeksfoliacji-etiopatogeneza i objawy kliniczne. *Klinika Oczna*. 2006;108:82–86.
- [5] Bourne WM, McLaren JW. Clinical responses of the corneal endothelium. *Experimental Eye Research*. 2004;78(3):561–572.
- [6] Miyake K, Matsuda M, Inaba M. Corneal endothelial changes in pseudoexfoliation syndrome. *Am J Ophthalmol*. 1989;108:49–52.
- [7] Corneal endothelial examination of pseudoexfoliation syndrome. *Nippon Ganka Gakkai Zasshi*. 1990;94:957–963. *Acta Soc Ophthalmol Jpn*.
- [8] Puska P, Vasara K, LaKS. Corneal thickness and corneal endothelium in normotensive subjects with unilateral exfoliation syndrome. *Graefes Arch Clin Exp Ophthalmol*. 2000;238:659–663.
- [9] Wang L, Yamashita R, Hommura S. Corneal endothelial changes and aqueous flare intensity in pseudoexfoliation syndrome. *Ophthalmologica*. 1999;213:387–391.
- [10] M. Pseudoexfoliation syndrome for the comprehensive ophthalmologist. Intraocular and systemic manifestations. *Ophthalmology*. 1998;105:951–968.
- [11] Wirbelauer C, Pham AN, DT. Corneal endothelial cell changes in pseudoexfoliation syndrome after cataract surgery. *Arch Ophthalmol*. 1998;116:145–149.
- [12] Seitz B, Iler EEM, Langenbucher A, Naumann GO. Endothelial keratopathy in pseudoexfoliation syndrome: quantitative and qualitative morphometry using automated video image analysis. *Klin Monatsbl Augenheilkd*. 1995;207:167–175.

- [13] Juan-Marcos LD. Morphometric changes of corneal endothelial cells in pseudoexfoliation syndrome and pseudoexfoliation glaucoma. Arch SocEspOftalmol. 2013;88(11):439–483.