

Research Article

Comparison of intraocular pressure and anterior segment parameters between pseudoexfoliation patients and healthy controls



Maria Nazmy Boshra¹, Yehia Mahmoud Khayrat¹,
Hossam El-Deen Mohamed Moharram¹ and Mohamed Tarek Mohamed Mostafa¹.

¹ Department of Ophthalmology, Faculty of Medicine, Minia University, Minia, Egypt

DOI: 10.21608/mjmr.2023.165684.1193

Abstract

Background: pseudoexfoliation (PEX) syndrome is a common age-related disease characterized by the accumulation of grey-white extracellular fibrillary material on anterior segment structures. The aim of the study is to compare intraocular pressure, anterior chamber angle in pseudoexfoliative patients and normal population. **Methods:** The participants were divided into 2 groups: Control group: includes 16 healthy normal eyes. PEX group: includes 25 pseudoexfoliative eyes diagnosed by slit-lamp biomicroscopy. The study was conducted in the ophthalmology department at Minia University Hospital. All participants examined by slitlamp biomicroscopy, intraocular pressure measured by Gold mann applanation tonometry, Gonioscopy grading and Scheimpflug imaging using pentacam (OCULUS, Wetzlar, Germany) analysis under scotopic conditions. **Results:** There are no significant differences of the anterior segment parameters, intraocular pressure or gonioscopy when comparing PEX cases versus controls except in the CCT. **Conclusion:** Assessment of anterior segment parameters is an important as CV measurements and corneal thickness might be indirect indicators of endothelial function in patients with PEX.

Keywords: Pseudoexfoliation; pentacam; pseudoexfoliative materials; anterior segment

Introduction

Pseudoexfoliation (PEX) syndrome is a common age-related disease that affects up to 30% of people older than 60 years -old in worldwide distribution. It is frequently associated with severe chronic secondary open-angle glaucoma and cataract^[1]. Ocular findings of PEX are: the diagnostic key of PEX is the deposition of whitish pseudo exfoliative materials (EXM) on the anterior lens surface. When the pupil is fully dilated the classic pattern of EXM deposition on the anterior lens capsule appears, which consists of three definite zones: A relatively homogeneous central disc-shaped zone corresponding roughly to

the pupil diameter, a granular, peripheral zone, and a clear intermediate zone^[2], EXM also seen at the pupillary margin, transillumination of the iris sphincter region, loss of the pupillary ruff, pigment dispersion in the anterior chamber after pupillary dilation, hyperpigmentation of trabecular meshwork is a characteristic finding^[3]. The accumulation of pigment on the trabecular meshwork and anterior to Schwalbe's line appears as a wavy pigmented line (Sampaolesi line)^[4], scattered flakes of EXM on the endothelial surface of the cornea, accumulation of pigment on the cornea may cause diffuse and specific pigmentation on the central

endothelium, which rarely appears in the pattern of a Krukenberg spindle, most of the time the angle of anterior segment is open but still the incidence of narrow-angle and closed-angle glaucoma is high and should not be underestimated because of some factors such as: increased iris thickness, posterior synechiae, zonular weakness might cause angle closure in, and enlargement of the lens due to cataract [5]. EXM might appear early on the ciliary processes and zonules, which are often frayed and broken, so the incidence of zonular dialysis increases, and spontaneous subluxation or dislocation of the lens may occur in advance [2].

Assessment of anterior segment parameters, such as: central corneal thickness (CCT), anterior chamber depth (ACD), pupillary diameter (PD), anterior chamber angle (ACA) width and corneal volume (CV) is an important part of ophthalmic examination in patients with PEX or pseudoexfoliative glaucoma (PXG). CV measurements and corneal thickness might be indirect indicators of endothelial function, assessment of corneal thickness has become important for intraocular pressure (IOP) evaluation in patients with glaucoma. This parameter can give valuable information to the surgeon to be more careful before both cataract and glaucoma surgery in patients with PEX. For example, narrow ACD significantly increases the risk of complications following phacoemulsification surgery, narrow-angle is more frequently observed in subjects with PEX as compared to age-matched control subjects [6].

Aim of the work

To compare IOP, ACA assessed by Goldmann 3 mirror lens and anterior segment parameters measured by Scheimpflug imaging in pseudoexfoliative patients and normal population.

Patients and Methods

The study participants were divided into 2 groups:

Control group: It includes 16 healthy controls of normal eyes.

PEX group: It includes 25 pseudo-exfoliative eyes diagnosed by slit-lamp biomicroscopy.

This study began in August 2020 to September 2021.

All patients included in this study will be verbally briefed about the details and the nature of the study and will sign a written consent according to the local Ethics Committee of faculty of medicine in Minia University. The study was conducted in the ophthalmology department at Minia University Hospital.

Inclusion criteria

For healthy group

- Age matched with pseudo-exfoliative group.
- Normal IOP (<21mmHg) assessed by GAT in 2 separate visits.
- Normal optic nerve head assessed by ophthalmoscope (volk 90).
- Open angle of anterior chamber assessed by Goldmann 3 mirror lens.
- Brown iris.

For exfoliative group

- Visible EXM on anterior segment structures (anterior lens capsule or at the pupillary border, pupillary ruff defects and transillumination defects of the pupillary ruff and iris sphincter).
- Normal IOP (<21mmHg) assessed by GAT in 2 separate visits.
- Normal optic nerve head appearance by volk 90.
- Open angle of anterior chamber by Goldmann 3 mirror lens.
- Brown iris.

Exclusion criteria for both groups

- Elevated IOP above 21mmHg at any visit.
- Ocular trauma.
- Intraocular inflammation (ocular disease). After slit lamp bio microscopy examination full ophthalmological examination including: IOP using GAT, Gonioscopy grading using Goldmann 3 mirrors and Scheimpflug imaging using pentacam (OCULUS, Wetzlar, Germany) analysis under scotopic conditions, the recorded parameter included:
 - ACD.

- b- ACV.
- c- ACA.
- d- PD.
- e- CCT.
- f- CV.

Results

All participates in our study were 25 pseudoexfoliative patients their ages range from (48 to 91) years old and 16 healthy control eye their ages range from (41 to 81)

years old pseudoexfoliative patients were 16 males and 9 females while the healthy control cases were 6 males and 10 females. by Comparing between intraocular pressure, anterior chamber angle and anterior segment parameters between PEX patients and control cases we found there is significant changes in CCT (P=0.042) only and no significant changes in ACD (P=0.616), ACV (P=0.625), ACA (P=0.521), CV(P=0.635), PD (P=0.548), IOP (P=0.857) and Gonioscopy (P=0.541)

Table 1: Demographic data of participants

	PEX	Control
Age	48-91 66.12±8.7	41-81 55±12
Sex Males/ Females	19/6	6/ 10

Age presented by range (mean±SD)

Table 2: Comparison between IOP, anterior chamber angle and anterior segment parameters between PEX patients and control cases

	Cases (25)	Control (16)	P value
ACD mean±SD	2.7 ±0.58	2.63 ± 0.24	0.616
ACV mean±SD	133.42 ± 28.46	129.04 ± 26.8	0.625
ACA mean±SD	35.2 ± 8.11	33.5 ± 7.94	0.521
CV mean±SD	51.77 ± 12.09	50.08 ± 9.1	0.635
CCT mean±SD	499.24 ± 43.23	525.1 ± 33.6	0.049
PD mean±SD	2.7 ± 0.8	2.85 ± 0.55	0.548
IOP mean±SD	14.13 ± 2.63	14.29 ± 2.86	0.857
Gonio mean±SD	33.67 ± 5.75	32.39 ± 7.4	0.541

Discussion

PEX is a disorder of the extracellular matrix, it is frequently associated with severe chronic secondary open-angle glaucoma and cataract^[1]. One of its criteria is the accumulation of grey-white extracellular fibrillary material on anterior segment structures^[7]; Loss of pigment in the pupillary ruff and iris sphincter regions, which are deposited on the structures of the anterior chamber responsible for the development of glaucoma^[3]

In the present study, we could not find any significant differences of the anterior segment parameters by Scheimpflug

imaging, IOP by Goldmann applanation or gonioscopy when comparing PEX cases versus controls except in the CCT, being significantly higher in the controls (525.1 ± 33.6 um) versus (499.24 ± 43.23 um, p= 0.049) in PEX patients. This comes in agreement with the old study done by Bartholomew et al. in which they found no difference of ACD measured by Goldmann pachymeter in 34 eyes of patients with PEX and in 334 normal controls^[7]. Another prospective study was conducted by Moreno-Montañés et al. in 263 eyes (152 patients) with PEX. No significant differences were found in ACD and ACA when compared to normal controls^[8].

Same results were seen in the clinical study done by Doganay et al. who demonstrated no statistically difference in ACD, ACV, ACA, CCT, PD and central 3, 5, 7 mm corneal volume when comparing patients with PEX (N= 53 eyes) and healthy controls (N=80 eyes)^[4]. The only difference was found in the ACD when comparing healthy controls with patient with PEX glaucoma who were excluded in our study.

Using optical coherence tomography (OCT) for comparing anterior segment parameters in PEX patients versus controls showed same results as the ones seen when using Scheimpflug imaging, many studies showed no difference in ACA, Trabecular-iris space area (TISA), angle-opening distance^[9], As The results of a recent study by Doganay et al. demonstrated that ACA are similar between subjects with PEX and healthy individuals^[5].

In our study, CCT was significantly higher in the control group when compared to the PEX patients. Literature reviewing regarding CCT in eyes with PEX and PXG showed controversial results. Some studies showed values lower than^[10, 11, 12, 13], higher than^[14, 15] or similar to^[16] the CCT of normal controls.

In a study done in 2007, Hapsen et al. showed that CCT was not significantly different in PEX patients versus controls, nevertheless, When PEX eyes were subcategorized, the CCT was significantly thinner in PEX eyes with no glaucoma than both hypertensive PEX eyes and PEXG eyes, they assumed that this difference may be due to endothelial cell count reduction seen in PEXG patients as shown in the^[17].

Still, the higher values of CCT seen in the normal controls compared to PEX patients with no glaucoma need more investigations and logical explanation specially with the same results seen using different corneal thickness measurement techniques like anterior segment OCT, ultrasonic pachymeter (USP) or optical low-coherence reflectometer (OLCR)^[11, 18, 13].

Conclusion

In conclusion, the study informed us that there is there is different in CCT only and no different in ACD, ACV, ACA, CV, PD, IOP and Gonioscopy between PEX cases and normal population.

References

1. Schlötzer-Schrehardt, U. and G.O.H. Naumann, Ocular and Systemic Pseudoexfoliation Syndrome. *American Journal of Ophthalmology*, 2006. 141(5): p. 921-937.e2.
2. Tekin, K., M. Inanc, and U. Elgin, Monitoring and management of the patient with pseudoexfoliation syndrome: current perspectives. *Clin Ophthalmol*, 2019. 13: p. 453-464.
3. Shihadeh, W.A., et al., Delayed intraocular pressure elevation after pupillary dilation in exfoliation syndrome. *Acta Ophthalmologica*, 2011. 89(6): p. 560-562.
4. Sternfeld, A., et al., Diagnosis of Pseudoexfoliation Syndrome in Pseudophakic Patients. *Ophthalmic Res*, 2021. 64(1): p. 28-33.
5. Doganay, S., et al., Evaluation of Pentacam-Scheimpflug imaging of anterior segment parameters in patients with pseudoexfoliation syndrome and pseudoexfoliative glaucoma. *Clinical and Experimental Optometry*, 2012. 95(2): p. 218-222.
6. Mocan, M.C., et al., The effect of pharmacologic pupillary dilatation on anterior segment parameters in patients with exfoliation syndrome. *J Optom*, 2014. 7(1): p. 51-6.
7. Bartholomew, R.S., Anterior chamber depth in eyes with pseudoexfoliation. *Br J Ophthalmol*, 1980. 64(5): p.322-3.
8. Moreno-Montañés, J., et al., [Exfoliation syndrome: clinical study of the irido-corneal angle]. *J Fr Ophthalmol*, 1990. 13(4): p. 183-8.
9. Iwanejko, M., et al., Evaluation of the anterior chamber angle in pseudoexfoliation syndrome. *Adv Clin Exp Med*, 2017. 26(5): p. 795-801.
10. Detorakis, E.T., et al., Central corneal mechanical sensitivity in pseudo-

- exfoliation syndrome. *Cornea*, 2005. 24(6): p. 688-91.
11. Bechmann, M., et al., Central corneal thickness determined with optical coherence tomography in various types of glaucoma. *Br J Ophthalmol*, 2000. 84(11): p. 1233-7.
 12. Shah, S., et al., Relationship between corneal thickness and measured intraocular pressure in a general ophthalmology clinic. *Ophthalmology*, 1999. 106(11): p. 2154-60.
 13. Inoue, K., et al., Morphological study of corneal endothelium and corneal thickness in pseudoexfoliation syndrome. *Jpn J Ophthalmol*, 2003. 47(3): p. 235-9.
 14. Puska, P., et al., Corneal thickness and corneal endothelium in normotensive subjects with unilateral exfoliation syndrome. *Graefes Arch Clin Exp Ophthalmol*, 2000. 238(8): p. 659-63.
 15. Ventura, A.C., M. Böhnke, and D.S. Mojon, Central corneal thickness measurements in patients with normal tension glaucoma, primary open angle glaucoma, pseudoexfoliation glaucoma, or ocular hypertension. *Br J Ophthalmol*, 2001. 85(7): p. 792-5.
 16. Detorakis, E.T., et al., Central corneal mechanical sensitivity in pseudoexfoliation syndrome. *Cornea*, 2005. 24(6): p. 688-91.
 17. Hepsen, I.F., R. Yağci, and U. Keskin, Corneal curvature and central corneal thickness in eyes with pseudoexfoliation syndrome. *Can J Ophthalmol*, 2007. 42(5): p. 677-80.
 18. Aghaian, E., et al., Central corneal thickness of Caucasians, Chinese, Hispanics, Filipinos, African Americans, and Japanese in a glaucoma clinic. *Ophthalmology*, 2004. 111(12): p. 2211-9.