ORIGINAL RESEARCH PAPER
Volume - 11 | Issue - 08 | August - 2022 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

COMPARISON OF CENTRAL CORNEAL THICKNESS IN PSEUDO EXFOLIATION GLAUCOMA (PXG) AND PRIMARY OPEN ANGLE GLAUCOMA (PROSPECTIVE OBSERVATIONAL STUDY).

Ophthalomology

Farah Deeba Senior Resident, Department of Ophthalmology ASCOMS & Hospital, Jammu.

Aditi Khajuria* Postgraduate Student, Department of Ophthalmology ASCOMS & Hospital, Jammu. *Corresponding Author

Renu Hashia Professor, Department of Ophthalmology ASCOMS & Hospital, Jammu.

ABSTRACT

Purpose- This study was designed to compare central corneal thickness in pseudoexfoliation glaucoma (PXG) and primary open angle glaucoma as corneal thickness has been reported to influence IOP measurements which in turn affects the management of these conditions. **Method-**A hospital based cross sectional study was carried out at eye OPD of ASCOMS and hospital (Jammu) between july2021to december2021 in all adult patients more than 50 years of age who present with symptom suggestive of glaucoma such as diminution of vision, headache, eye ache, color halos , pain , redness in eye , family history of glaucoma and patient who come for routine examination or other complaint shows sign of glaucoma. These patients will be further evaluated for IOP value(by AT), gonioscopy , optic disc finding(90D bimicroscopy) and visual field status(humphry perimeter and CCT(central corneal thickness by Topcon 3D OCT). **Result-** CCT in POAG and PEXG was found to be less than control group but not statistically significant. The mean CCT in PEXG is less than POAG but it is not statistically significant (P=0.38). The mean central corneal thickness in normal subjects (control) is 532 (SD 20) and in pts with POAG the mean central thickness is 523 (SD-30) and in pts with PEXG the mean central corneal thickness is 512 (SD-20). **Conclusion-** This study did not found any statistical difference of CCT in patients with POAG and PEXG, but it is noted that CCT is a clinically important variable, and therefore, pachymetry should be included in the assessment of glaucoma patients.

KEYWORDS

central corneal thickness(CCT), primary open angle glaucoma(POAG) and pseudo exfoliation glaucoma(PEXG)

INTRODUCTION-

In routine clinical practice, intraocular pressure(IOP) represents one of several important parameters (including an assessment of the condition of the optic nerve and nerve fibre layer, gonioscopic findings, and the compass of the visual field) used not only in the diagnosis of glaucoma but also for gauging the progression of this condition and its response to treatment. Clearly, though, its value as a diagnostic tool hinges upon the reliability of measurements taken. The technique most commonly employed for this purpose is application (Goldmann) tonometry, the accuracy of which is influenced by several factors, including sclera **[I]** and corneal rigidity[**2–4**]. Corneal thickness has been reported to influence IOP measurements. Indeed, Goldmann and Schmidt discussed the association between these two parameters in their publication in 1957, Kruse Hansen and Ehlers demonstrated the existence of a positive linear correlation between central corneal thickness and IOP[**5].** And an accurate corneal thickness reading is essential prior to IOP readings[**6]** The mean CCT based on metaanalysis in white adults was 535µm±11.6%. doughty et al. found that any 10µm deviation from the mean normal corneal thickness reading results in 0.5mmHg difference in measurement when using a Goldmann tonometer.[**7]**

Since the first description of optical pachymetry in the 1950s, measurements of central corneal thickness (CCT) have become part of the clinical evaluation of patients. Over the years, the field of pachymetry has developed further with the introduction of new and more sophisticated pachymeters. noninvasive techniques that can be used to determine the global corneal thickness were introduced, including optical coherence tomography (OCT). Optical low coherence reflectometry represents the most accurate and objective pachymetric.

Technique currently available. The precision of central corneal thickness measurements lies in order of 1 µm, and the intraobserver, as well as interobserver, variability is very low.[**,8,9,10,11]** This technique possesses an additional advantage in its non-contact feature mode of measurement.

There are different types of OAG, of which the most common type is primary open-angle glaucoma (POAG [**12].** Pseudoexfoliation glaucoma (PXFG) is most common secondary form of OAG with faster progression and worse prognosis than POAG.[**13,14**]. Quantitatively reduced and morphologically altered corneal endothelium in PXF eyes may lead to distinct type of keratopathy which diffusely involves the entire cornea and affects corneal thickness which in turns influences the IOP.[**15].**

The aim of this study was to evaluate central corneal thickness in patients with PXFG and POAG using noninvasive spectral- domain OCT.

Study Design

Prospective observational study.

MATERIAL AND METHOD

A hospital based cross sectional study was carried out in all adult patients more than 50 years of age who attended the eye OPD of ASCOMS and hospital (Jammu)

Data will be collected using Proforma's with standardised questionnaire consist of complaint related to eye, ocular trauma in past, family history of glaucoma and relevant clinical examination and imaging modalities.

Inclusion Criteria-

The sample under study included patients who present with symptom suggestive of glaucoma such as diminution of vision, headache, eye ache, color halos , pain , redness in eye , family history of glaucoma and patient who come for routine examination or other complaint shows sign of glaucoma. These patients will be further evaluated for IOP value(by AT), gonioscopy , optic disc finding(90D bimicroscopy) and visual field status(humphry perimeter and CCT(central corneal thickness by Topcon 3D OCT)

Sample will also include all the patients of open angle glaucoma initially worked up at other eye hospital and clinics, and who will attend our hospital eye OPD.

Exclusion Criteria-

1.The patients with symptom and sign suggestive of secondary glaucoma(other than pseudoexfoliation) such as history of ocular trauma and surgery in past, sign of past ocular inflammation and uveitis like old KP'S and pigment on lens surface, ectropion uveae and neo vessels in iris and retina , distorted angle structure on goneoscopy. 2. Patients with raised IOP without any optic disc and visual field changes (ocular hypertension). 3.Patients on long term steroid (both topically and orally) for other diseases. 4.Ophthalmic or systemic conditions which could influence corneal thickness measurements, such as corneal pathology (dystrophies and degenerations, scars, and status post corneal refractive surgery), previous ocular surgeries or ocular trauma.

All sample patients were subjected to a set protocol of examination which include

- Visual acuity using snellen's distant test type and refraction was done.
- Slit-lamp biomicroscopy
- IOP recording with Goldman applanation tonometer. The upper limit was taken as 21 mmHg.
- CCT(central corneal thickness.
- Optic disc evaluated by dilated stereoscopic optic disc examination using Volk 90D lens along with Slit-lamp. The normal cup-disc ratio was taken as0.3:1 or less. The significant glaucomatous changes were recorded as- i) vertical cup-disc ratio > 0.5:1 in either eye. ii) asymmetry of cup-disc ratio of >0.2 between two eyes. iii) pallor and thinning of the neuro-retinal rim. iv)other disc changes such as notching of neuro-retinal rim, splinter peripapillary haemorrhages ,wedge defect of nerve fiber layer and paripapillary atrophy in association with other finding.
- Anterior chamber angle are assessed with an indirect four mirror goniolens. And the depth of anterior chamber was graded according to SHAFFER'S SYSTEM of angle grading.
- Visual field assessment was done by static perimetry using Humphrey field analyser. Perimetry was performed using SITA standered 30-2 program. And for glaucomatous field defect Anderson criteria was used which include a cluster of 3 or more non-edge points in location typical of glaucoma, all of which are depressed on pattern deviation plot at p<5% level and one of which is depressed at p< 1% level on consecutive field. If an advanced field defect precludes a successful 30-2examination, the macular program or a 10-2 program was used.

For the purpose of this study, the Primary Open Angle Glaucoma (POAG), also referred to as chronic simple glaucoma defined as bilateral disease of adult onset characterized by an IOP >21mmHg at some stage, an open anterior chamber angle, and glaucomatous optic nerve damage with characteristic visual field loss as damage process and absence of sign of secondary glaucoma**(16).**Pseudoexfoliative glaucoma(PXG) is defined as cases with Pseudoexfoliation syndrome (PEX) which is characterized by the production and accumulation of extracellular granular fibrillar material in many ocular and other tissues.(the material deposited on ocular structure includes the lens capsule, zonular fibres, iris, trabeculum and conjunctiva and associated with raised IOP(>21), glaucomatous disc and field changes.**(17).**

Statistical Methods: Statistical evaluation was performed using a computer software SPSS (V. 12,Chicago, Ill). The independent samples test (*t* test) was used for comparisons of means between the subgroups of PEX patients. A *p* value of < 0.05 was considered significant.

OBSERVATION AND RESULTS-

Table 1 Total Number Of Individuals And Gender Distribution In Normal Subjects(controls), Primary Open Angle Glaucoma (POAG) And Pseudo Exfoliation Glaucoma(PEXG)

	control	POAG	PEXG
Total number	42	40	38
male	24	25	17
female	18	15	21

Table 2 Age Wise Distribution Of Patients In Normal Subjects(controls), Primary Open Angle Glaucoma(POAG) And Pseudo Exfoliation Glaucoma(PEXG)

Age in years	total		control		POAG		PEXG	
	male	female	male	female	male	female	male	female
50-60	13	11	6	4	5	4	2	3
61-70	17	19	7	8	6	3	4	8
>70	36	24	11	6	14	8	11	10

Table3 Average Central Corneal Thickness, IOP And Age Of Individuals In Normal Subjects(controls),primary Open Angle Glaucoma(POAG) And Pseudo Exfoliation Glaucoma(PEXG)

	Control(SD)	POAG (SD)	PEXG (SD)
Corneal thickness(µm) range	532 (20) 490-568	523 (30) 483-570	512 (20) 454-581
IOP(mmHg)	15.5 (2.9)	20.3 (6.5)	23.2 (6.7)
Age	70 (10.5)	71.7 (12.5)	76 (5.2)

A total number of 120 individuals were enrolled between july2021to december2021 after following the inclusion and exclusion criteria. 40 pts with POAG, 38 pts with PEXG and 42 controlled subjects were included in this study. Individuals were examined at ASCOMS Jammu after given consent. In all individuals conditions was bilateral and one eye per individual was being selected randomly for study.

The mean central corneal thickness in normal subjects (control) is 532 (SD 20) and in pts with POAG the mean central thickness is 523 (SD-30) and in pts with PEXG the mean central corneal thickness is 512 (SD-20).

CCT in POAG and PEXG was found to be less than control group but not statistically significant. The mean CCT in PEXG is less than POAG but it is not statistically significant (P=0.38). There is no significant difference in IOP recorded after correction for CCT in POAG and PEXG; that is 20.3mmHg (SD-6.5) in POAG and 23.2mmHg (SD-6.7) in PEXG respectively.

DISCUSSION

The importance of CCT in the diagnosis of glaucoma has recently been highlighted in the OHTS. [18,19] . And If we are to use CCT as part of this decision-making process, we must be sure that our readings are consistent before committing a patient to a diagnosis and treatment.

OCT has the advantages of being a noninvasive, noncontact technique, and therefore, no topical anesthesia is needed to perform the measurement. It is also less affected by the examiner's knowledge and experience, and has high degree of repeatability and reproducibility. [20].

The reports in literature is controversial regarding mean CCT in patients with POAG and PEXG and normal individual without glaucoma. We also found a lower mean CCT in patients with pseudoexfoliative glaucoma when compared to primary open angle glaucoma patients. The difference is however not statistically significant(P=0.38). This results are in concordance with other Studies done by Tolesa and Gessesse,[21] Ventura et al,[22] Shah et al[23] and Ozkok et al[24] did not find any significant difference in corneal thickness between XFG and POAG.

Ehlers et al. found higher CCT values for pseudo-exfoliation glaucoma. It should be noted that this difference was not statistical significant [25]. In another study, Herndon and coworkers reported almost identical values of CCT for pseudo exfoliation glaucoma and POAG, with the PXG patients being a subset of the POAG group [26]. Some studies have shown PXG eyes to have thinner CCT compared to POAG and normal eyes[27,28,29], while others found thicker CCT in PXG compared to POAG eyes.

CONCLUSION

This study did not found any statistical difference of CCT in patients with POAG and PEXG, but it is noted that CCT is a clinically important variable, and therefore, pachymetry should be included in the assessment of glaucoma patients, and also Glaucoma screening should include CCT apart from IOP measurement.

A further study with a better design and a larger sample size that includes all sub-types of glaucoma is recommended.

REFERENCES

1 Goldmann H, Schmidt T. Über Applanationstonometrie. *Ophthalmologica* 1957;**134**:221–42.
2 Cennamo G, Rosa N, La Rana A, *et al*. Non-contact tonometryin patients that underwent photorefractive keratectomy.*Ophthalmologica* 1997;**211**:341–3.
3 Chatterjee A, Shah S, Bessant DA, *et al*. Reduction inintraocular pressure after excimer laser photorefractive keratectomy. *Ophthalmology* 1997;**104**:355–9.
4 Simon G, Small RH, Ren Q, *et al.* Effect of corneal hydration on Goldmann applanation tonometry andcorneal topography. *Refract Corneal Surg* 1993;**9**:110–17.
5 Kruse Hansen F, Ehlers N. Elevated tonometer readingscaused by a thick cornea. *Acta Ophthalmol Copenh* 1971;**49**:
6 A. Konstantopoulos, P. Hossain, and D. F. Anderson, "Recentadvances in ophthalmic anterior segment imaging: a new erafor ophthalmic diagnosis?," British Journal of Ophthalmology, vol. 91, pp. 551–557, 2007.
7 M. J. Doughty and M. L. Zaman, "Human corneal thicknessand its impact on intraocular pressure measures: a review and meta-analysis approach," Survey Ophthalmology Journal, vol. 44, no. 5, pp. 367–408, 2000.
8 Böhnke M, Masters BR, Wälti R, *et al*. Precision and reproducibility of measurements of human corneal thickness with rapid optical low-coherence reflectometry (OLCR). *J Biomed Optics* 1999;**4**:152–6.
9 Böhnke M, Chavanne P, Gianotti R, *et al.* High precision, high speed measurement of eximer laser keratectomies with a new optical pachymeter. *Ger J Ophthalmol* 1997;**5**:338–42. 775–8.
10 Wälti R, Gianotti R, Bonvin P, *et al*. Rapid and precise in vivo measurement of human corneal thickness with optical low-coherence reflectometry in normal human eyes. *J Biomed Optics* 1998;**3**:253–8.

11 Masters BR. Early development of optical low-coherence reflectometry and some recent biomedical applications. *J Biomed Optics* 1999;**4**:236–47.
12 Weinreb RN, Khaw PT. Primary open-angle glaucoma. *Lancet*. 2004;363(9422):1711 –1720.
13 Hyman L, Heijl A, Leske MC, Bengtsson B, Yang Z; Early Manifest Glaucoma Trial Group. Natural history of intraocular pressure in the early manifest glaucoma trial: a 6-year follow-up. *Arch Ophthalmol*. 2010;128(5):601–607.
14 Ritch R, Schlötzer-Schrehardt U. Exfoliation syndrome. *Surv Ophthalmol*. 2001;45(4):265–315.
15 G. O. H. Naumann and U. Schlötzer-Schrehardt, "Keratopathy in pseudoexfoliation syndrome as a cause of corneal endothelial decompensation," Ophthalmology, vol. 107, pp. 1111–1124, 2000.
16 Kanski's Clinical ophthalmology 7th edition. Primary Open Closure Glaucoma(definition): 340.
17 Kanski's Clinical ophthalmology 7th edition. Pseudoexfoliation Glaucoma(definition): 355.
18 Gordon A, Boggess EA, Molinari JF. Variability of ultrasonic pachymetry. Optom Vis Sci 1990;67:162–5.
19 Brandt JD, Beiser JA, Kass MA,Gordon MO.Ocular Hypertension Treatment Study (OHTS) Group. Central corneal thickness in the Ocular Hypertension Treatment Study (OHTS). Ophthalmology2001;108:1779– 88.
20 Muscat S, McKay N, Parks S, Kemp E, Keating D. Repeatability and reproducibility of corneal thickness measurements by optical coherence tomography. *Invest Ophthalmol Vis Sci*. 2002;43(6):1791–1795.
21 Tolesa K, Gessesse GW. Central corneal thickness in newly diagnosed glaucoma patients in South West Ethiopia: a cross-sectional study. *BMC Ophthalmol*. 2016;16(1):152.
22 Ventura AC, Böhnke M, Mojon DS. 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):792–795.
23 Shah S, Chatterjee A, Mathai M, et al. Relationship between corneal thickness and measured intraocular pressure in a general ophthalmology clinic. *Ophthalmology*. 1999;106(11):2154–2160.
24 Ozkok A, Tamcelik N, Ozdamar A, Sarici AM, Cicik E. Corneal viscoelastic differences between pseudoexfoliative glaucoma and primary open-angle glaucoma. *J Glaucoma*. 2013;22(9):740–745.
25 Ehlers N, Bramsen T, Sperling S. Applanation tonometry and central corneal thickness. Acta Ophthalmol (Copenh.) 1975;53:34-43.
26 Herndon LW, Choudhri SA, Cox T, et al. Central corneal thickness in normal, glaucomatous, and ocular hypertensive eyes. Arch. Ophthalmol 1997; 115:1137–1141.
27 Kniestedt C, Lin S, Choe J, et al. Correlation between IOP, CCT, stage of glaucoma, and demographic patient data: prospective analysis of biophysical parameters in tertiary glaucoma practice populations. J Glaucoma. 2006;15(2):91–7.
28 Kitsos G, Gartzios C, Asproudis I, Bagli E. Central corneal thickness in subjects with glaucoma and in normal individuals (with or without pseudoexfoliation syndrome). Clin Ophthalmol. 2009;3:537–42.
29 Yazgan S, Celik U, Alagoz N, Tas M. Corneal biomechanical comparison of pseudoexfoliation syndrome, pseudoexfoliative glaucoma and healthy subjects. Curr Eye Res. 2015;40(5):470–5.