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Research article

CORRELATION BETWEEN THE RETINAL NERVE FIBRE LAYER (RNFL) PARAMETERS MEASURED USING STRATUS OPTICAL COHERENCE TOMOGRAPHY AND GDx VCC (SCANNING LASER POLARIMETRY) IN ESTABLISHED GLAUCOMA PATIENTS IN SOUTH INDIAN POPULATION

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ABSTRACT

Purpose: Optical Coherence Tomography and Scanning LASER polarimetry (GDx) are investigatory modalities used to evaluate the structural changes in the optic nerve and retina in glaucoma patients.This study aims to evaluate the correlation between the Retinal Nerve Fibre Layer (RNFL) parameters measured using Stratus-OCT (optical coherence tomography) and GDx VCC(scanning laser polarimetry) in established glaucoma patients in South Indian Population. **Materials and methods:** Prospectively planned cross sectional study of 67 eyes of 34 established glaucoma patients on medical management The mean age of patients was 46.911 years (SD±13.531). A complete ophthalmic examination, automated perimetry with octopus interzeag 1-2-3 perimeter, retinal nerve fiber analysis with GDx VCC and Stratus OCT was done. Correlation coefficients between the parameters of OCT and GDx VCC were calculated. **Results:** Statistically significant positive correlations were observed between GDx VCC and OCT parameters in the respective areas. **Conclusion:** The RNFL thicknesses measured by two different investigatory modalities OCT and GDx are well correlated despite the differences in values of RNFL thickness.

Keywords: Retinal nerve fibre layer, OCT, GDx

INTRODUCTION

Glaucoma is defined as a disturbance of the structural and functional integrity of the optic nerve that can usually be arrested or diminished by adequate lowering of the intraocular pressure[1]. Glaucoma is a type of progressive optic neuropathy in which there is a morphological change in the optic nerve head and retinal nerve fibre layer with visual field loss[2]. Visual field analysis by automated static perimetry is both sensitive and specific to detect field loss and is currently the most widely used to evaluate and to monitor disease progression. However it is prone to variability as it is highly subjective [3]. It has been documented that up to 40 percent of the RNFL may be lost before a field defect is detectable[4,5]. Studies have shown

that structural changes of the ONH[6-8]and NFL [5,9-11] may precede field loss.

Stereoscopic photographs of the optic disc and RNFL were the objective methods utilized to diagnose and monitor glaucoma. But the interpretation of photographs remains subjective, and variations in assessment among even experienced observers are well documented[12-14]

Confocal scanning laser ophthalmoscopy (HRT), scanning laser polarimetry with fixed and variable corneal compensator (GDxVCC), optical coherence tomography (OCT) and the retinal thickness analyzer (RTA) have become available that provide quantitative reproducible, and objective measurements of RNFL thickness.

The purpose of this study is to evaluate the relationship between structural changes evaluated by OCT and GDX VCC in established glaucomatous eyes.

MATERIALS AND METHODS

This was a cross sectional study, prospectively planned. 67 eyes of 34 glaucoma patients attending glaucoma clinic were included in this study after getting clearance from the ethical committee. Informed consent was obtained from all the patients.

Inclusion and exclusion criteria: Primary open angle glaucoma patients on medical treatment and routine follow up were chosen for the study. The patients were diagnosed as glaucomatous by the following criteria: at least three or more occasions of elevated intra ocular pressure >21 mm Hg now on medical control and significant optic nerve head changes with or without visual field defects. The patients had a best corrected visual acuity of 6/12 or better. The refraction of these patients were as follows: Hyperopia $\leq$ +2.50D, Myopia ≤-3.00 D , Astigmatism≤+2.00 D.

All patients who had Closed angles /narrow angles, secondary glaucomas, juvenile and congenital glaucomas, media opacities that may prevent good RNFL assessment and coexistent retinal pathology or neurological problems were excluded. Primary open angle glaucoma patients who had undergone surgical or laser therapy for glaucoma were also excluded.

All subjects underwent a complete ophthalmologic examination including Slit lamp biomicroscopy for anterior segment evaluation and fundus examination with +90 D lens, gonioscopy, intra ocular pressure measurement using Goldmann applanation tonometry and also direct ophthalmoscopy. Glaucomatous appearance of the Optic disc was defined as an increased C: D ratio, asymmetry of the C:D ratio of >0.2 between the two eyes, neuro retinal rim thinning , disc haemorrhage , notching and excavation. Visual field analysis was performed with Octopus Interzeag1-2-3 perimeter.

RNFL analysis with Optical coherence tomography: Retinal nerve fibre layer measurements were obtained with Stratus OCT (Zeiss) version 4.0.1. All scans were performed by well trained technicians who were unaware of the patient's diagnosis. The OCT parameters analyzed in this study were Total average nerve fibre layer thickness (OCT T Avg), superior average (OCT S Avg) and inferior average thickness (OCT I Avg).

RNFL analysis with GDX VCC: The GDX VCC (Version 5.2.3) is a scanning laser polarimeter that measures RNFL thickness using polarized light. The disc margin on the image was established by marking with an ellipse by the same experienced technician who was masked to the patient's diagnosis. A series of RNFL parameters were generated by the software for this study. The parameters TSNIT average thickness, Superior Average thickness, Inferior average thickness and Nerve Fibre Indicator (NFI) were considered.

All these investigating modalities were carried out within a period of 3 weeks to obtain the best cross sectional comparison and to nullify the effect of any temporal lag.

Statistical analysis was carried out using SPSS™ software. Correlation analysis was done by

Pearsons' correlation coefficient and the statistical significance ascertained by two tailed significance test.

RESULTS

67 eyes of 34 established Primary open angle glaucoma patients were analysed in this study. The mean age of the patients of this study was 46.911(±13.531) .The ages of these patients ranged from 26 to 70 years. Out of the 34 patients, 10 patients were females accounting for about 29.41%.

Optical coherence tomography RNFL parameters: The Retinal nerve fibre layer thickness was analysed by Optical coherence tomography and the parameters which were obtained were total average nerve fibre layer thickness (OCT T Avg) , superior average(OCT S Avg) and inferior average thickness (OCT I Avg). Analysis of the OCT parameters are shown in table:1

GDX RNFL parameters: The GDX VCC RNFL analysis parameters studied were the TSNIT average (TSNIT Avg), superior (GDXSAvg) and inferior averages (GDXIAvg) and the nerve fibre indicator (GDX NFI).The mean values of the parameters are tabulated in table :2.

Correlational analysis was carried out between RNFL parameters as obtained by OCT and GDXVCC: The OCT parameters correlated were the Total average nerve fibre layer thickness (OCT T Avg) , superior average(OCT S Avg) and inferior average thickness (OCT I Avg) with the GDX VCC parameters TSNIT average (TSNIT Avg), superior (GDXSAvg) and inferior averages (GDXI Avg) respectively. A high positive correlation was obtained with a p value ≤ 0.01-significant at 1% level. (table:3).Scatter plots showing the positive correlation between the parameters are shown in figures 1,2 and 3.

Table.1: RNFL parameters obtained by OCT

OCT parameters (microns):	Primary open angle glaucoma (N=67)		
	Mean±SD	Min	Max
Total average thickness	87.74±22.218	20	129
Superior average	112.80±32.32	0	164
Inferior average	103.50±32.67	34	159

Table: 2, RNFL parameters as obtained with GDXVCC:

GDX parameters: (microns)	Primary open angle glaucoma (N=67)		
	Mean±SD	Min	Max
TSNIT average thickness	48.21±9.02	24.16	64.7
Superior average	58.42±13.28	23.80	79.2
Inferior average	54.47±11.62	26.86	73.3
Nervefibre indicator	32.46±25.36	9	98

Table.3: Correlational analysis between RNFL parameters as obtained by OCT and GDXVCC:

Correlation between	N=67	
OCT T Avg& GDX TSNIT Avg	r	0.7925
	p	0.000**
OCT S Avg & GDXS Avg	r	0.8123
	p	0.000**
OCT I Avg & GDXI Avg	r	0.7341
	p	0.000**

r = Pearsons correlation coefficient; p = p value,
*p≤0.05 (0.01 to 0.05) –significant at 5% level
**p≤ 0.01- significant at 1% level

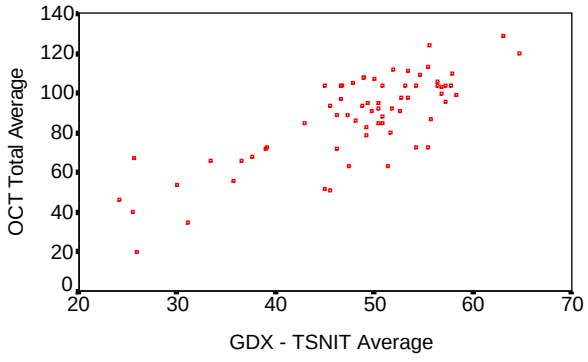

Fig.1: Scatter plot showing the positive correlation between the total average nerve fibre layer thicknesses (in microns) obtained with GDx and OCT.

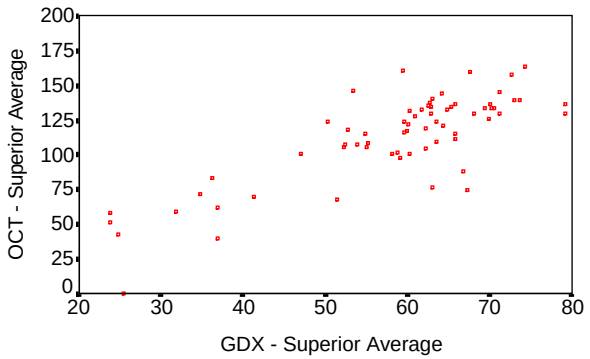

Fig2: Scatter plot showing the positive correlation between the superior average nerve fibre layer thicknesses (in microns) obtained with GDx and OCT.

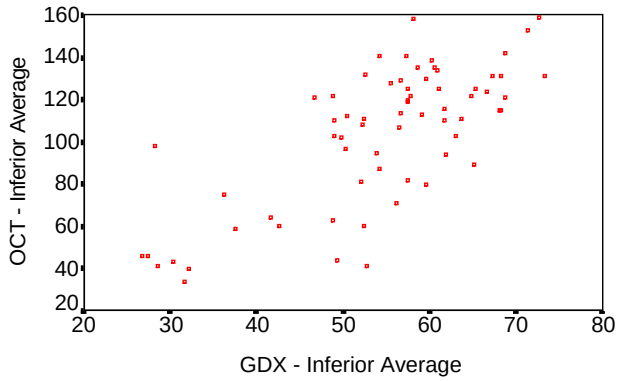

Fig. 3: Scatter plot showing the positive correlation between the inferior average nerve fibre layer thicknesses (in microns) obtained with GDx and OCT

DISCUSSION

The purpose of the study was to compare the results obtained by these two methods (OCT and GDX VCC) for assessing the RNFL in established glaucomatous eyes in south Indian population. We have compared the two methods in a single population . The limiting factor in this study is the smaller sample size.

The diagnostic accuracy with different modalities of imaging in glaucoma has been demonstrated in various studies[15-20].

In this study when the OCT parameters, the Total average nerve fibre layer thickness (OCT T Avg), superior average (OCT S Avg) and inferior average thickness (OCT I Avg) were correlated with the GDX VCC parameters TSNIT average (TSNIT Avg), superior (GDXSAvg) and inferior averages (GDXIAvg) respectively, a high positive correlation was obtained with a p value $\leq$ 0.01- significant at 1% level(table:4,Figures 1,2,3).In a recent study by Chen et al[21], the RNFL thickness measured by both Stratus OCT and GDX VCC were well correlated in early glaucoma and poorly correlated in ocular hypertensive and glaucoma suspect eyes.

We obtained Correlation coefficients (r) 0.7925 for TSNIT average/average thickness, 0.8123 for superior average, and 0.7341 for inferior average(table:3). Similar results were brought out in studies by Leung et al [22] and Chung et al[23] .They demonstrated the significant positive correlations between GDx VCC and StratusOCT RNFL measurements even though there were substantial differences in RNFL thickness.

CONCLUSION

Outcomes of the study: The RNFL thicknesses measured by two different investigatory modalities OCT and GDx are well correlated in established glaucoma patients. The newer instruments are valuable tools that have become available to provide quantitative reproducible and objective measurements of RNFL thickness.

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