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Original Research

Assessment of retinal fibre layer thickness with the help of Spectral Domain Optical Coherence Tomography in a given population: A clinical study

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ABSTRACT

Background: Glaucoma is the leading cause of blindness worldwide1 and reduction of retinal nerve fibre layer (RNFL) thickness imaged with optical coherence tomography (OCT) is an early hallmark of glaucoma. It has been well established by the spectral OCT/ SLO about the reproduction of RNFL thickness (RNFLT) measurements.Hence; the present study was undertaken for evaluating the retinal Nerve Fibre Layer Thickness using Spectral Domain OCT in a known population. **Materials & Methods:** A total of 105 subjects were enrolled in the present study. Only those subjects were enrolled in the present study that had refractive errors. In all the subjects, comprehensive ophthalmic examination was carried out through achromatic automated perimetry. Random selection of any one eye was done following the dilatation of the eyes followed by RNFL scanning of the participants with spectral OCT/SLO. All the data was recorded in Microsoft excel sheet and were analysed by SPSS software. **Results:** Non-significant results were obtained while comparing the RNFL and RNFLT parameters in between males and females. **Conclusion:** A normative database is obtained in Indian eyes for RNFLT using SD-OCT.

Key words: Optical coherence tomography, Retinal nerve fibre layer.

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INTRODUCTION

Glaucoma is the leading cause of blindness worldwide1 and reduction of retinal nerve fibre layer (RNFL) thickness imaged with optical coherence tomography (OCT) is an early hallmark of glaucoma.[1-3] Despite significant improvements with OCT, there remain limitations in relation to its use for glaucoma diagnosis. First, the OCT modality does not adjust for ocular biometry and morphology such as optic disc (size and area) and disc-fovea angle, retinal vessel position, refractive error and axial length, which can reduce the precision of RNFL thickness measurement. Second, retinal vessels reduce with age, systemic comorbidities and also in glaucoma.[4,5]It has been well established by the spectral OCT/ SLO about the reproduction of RNFL thickness (RNFLT) measurements.[6-8] Age or race related inter-individual variation has been shown by RNFLT.[3]Hence; under the light of above mentioned data, the present study was undertaken for evaluating the retinal Nerve Fibre Layer Thickness using Spectral Domain OCT in a known population.

MATERIALS & METHODS

The present study was undertaken for assessing the evaluating the retinal Nerve Fibre Layer Thickness using Spectral Domain OCT in a known population. Ethical approval was obtained from institutional ethical committee and written consent was obtained after explaining in detail the entire research protocol. A total of 105 subjects were enrolled in the present study. Only those subjects were enrolled in the present study that had refractive errors. In all the subjects, comprehensive ophthalmic examination was carried out through achromatic automated perimetry.Random selection of any one eye was done following the dilatation of the eyes followed by RNFL scanning of the participants with spectral OCT/SLO.All the data was recorded in Microsoft excel sheet and were analysed by SPSS software. Chi-

square test was used for the assessment of level of significance.

RESULTS

In the present study, non-significant results were obtained while comparing the RNFL and RNFLT parameters in between males and females. Mean superior quadrant value for males and females was 136.1 and 138.4 respectively. Mean temporal quadrant value for males and females was 71.1 and 68.3 respectively.

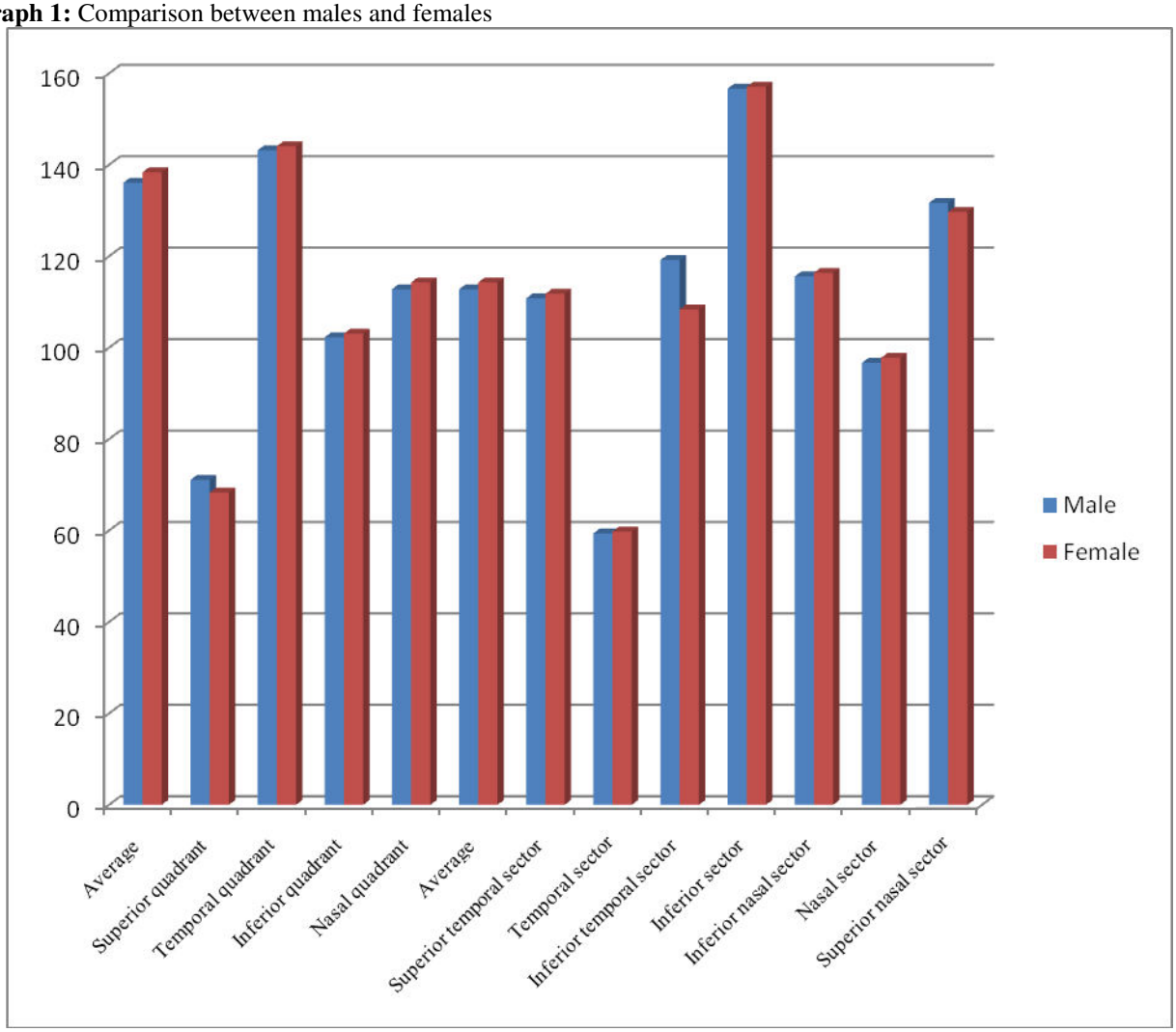
Table 1: Mean value of RNFL for superior and nasal sector

Parameter	Males	Females	p- value
Superior quadrant	136.1	138.4	0.44
Temporal quadrant	71.1	68.3	0.72
Inferior quadrant	143.2	144.1	0.39
Nasal quadrant	102.3	103.1	0.15
Average	112.8	114.3	0.33

Table 2: Mean value of RNFLT for temporal sector

Parameter	Males	Females	p- value
Superior temporal sector	110.8	111.8	0.12
Temporal sector	59.4	59.8	0.52
Inferior temporal sector	119.2	108.4	0.46
Inferior sector	156.7	157.1	0.31
Inferior nasal sector	115.6	116.4	0.15
Nasal sector	96.7	97.8	0.27
Superior nasal sector	131.7	129.7	0.39

Graph 1: Comparison between males and females



DISCUSSION

Spectral-domain OCT (SD-OCT) also automatically outlines the optic nerve head, optic cup, and disc borders similar to mental estimations by clinicians, but then also calculates more objective measurements such as optic disc area and neuroretinal rim area in addition to the classic clinician-subjective average and vertical cup-to-disc ratios. ONH parameters have also been found to have excellent ability to discriminate between normal eyes and eyes with even mild glaucoma. The parameters found to have the greatest diagnostic capability are vertical rim thickness, rim area, and vertical cup to disc ratio. These ONH parameters were found to be as good as RNFL thickness parameters in diagnosing glaucoma. Autosegmentation has been found to be inaccurate in some retinal pathologies such as neovascular age related macular degeneration and central serous retinopathy and in optic nerve head pathologies such as glaucoma.[7,8] Hence; under the light of above mentioned data, the present study was undertaken for evaluating the retinal Nerve Fibre Layer Thickness using Spectral Domain OCT in a known population.

In the present study, non-significant results were obtained while comparing the RNFL and RNFLT parameters in between males and females. Mean superior quadrant value for males and females was 136.1 and 138.4 respectively. Mean temporal quadrant value for males and females was 71.1 and 68.3 respectively. Aojula A et al characterised the extent and location of the Retinal Nerve Fibre Layer (RNFL) Thickness automated segmentation error (SegE) by manual refinement, in a cohort of Idiopathic Intracranial Hypertension (IIH) patients with papilloedema and compared this to controls. Baseline Spectral Domain OCT (SDOCT) scans from patients with IIH, and controls with no retinal or optic nerve pathology, were examined. The internal limiting membrane and RNFL thickness of the most severely affected eye was examined for SegE and re-segmented. Using ImageJ, the total area of the RNFL thickness was calculated pre and post re-segmentation and the percentage change was determined. The distribution of RNFL thickness error was qualitatively assessed. Significantly greater SegE ($p = 0.009$) was present in RNFL thickness total area, assessed using ImageJ, in IIH patients ($n = 46$, $5\% \pm 0$-58%) compared to controls ($n = 14$, $1\% \pm 0$-6%). This was particularly evident in moderate to severe optic disc swelling. RNFL thickness was unable to be quantified using SDOCT in patients with severe papilloedema. SegE remain a concern for clinicians using SDOCT to monitor papilloedema in IIH, particularly in the assessment of eyes with moderate to severe oedema.[10]

Huang-Link YM et al analyzed potential of spectral domain optical coherence tomography (SD-OCT), to measure neuro-retinal rim thickness and area, optic cup-to-disc ratio (C/D) and cup volume of ONH which have not previously been reported in IIH. In parallel, thickness of peripapillary retinal nerve fiber layer (RNFL) and macular ganglion cell layer (GCL) together with inner plexiform layer (IPL) (GCL-IPL) were examined. All 7 enrolled IIH patients had increased neuro-retinal rim thickness ($p<0.01$ for both eyes) and rim area ($p<0.05$), decreased C/D ($p<0.01$) and optic cup volume ($p<0.01$) when compared to findings in 18 sex- and age-matched healthy controls (HC). In a longitudinal study, two IIH patients were followed repetitively by SD-OCT before and after measurement of intracranial pressure (ICP) and removal of cerebrospinal fluid (CSF) by lumbar puncture. Rim thickness and area, C/D and optic cup volume remained altered. RNFL thickness may change with very high ICP, but not immediately after CSF removal. GCL-IPL thickness was unchanged irrespective of ICP change or CSF removal. SD-OCT allows detection of ONH changes even in subtle IIH without papilledema and has potential for routine use in IIH.[11]

CONCLUSION

Under the light of above obtained results, the authors conclude thata normative database is obtained in Indian eyes for RNFLT using SD-OCT. However; further studies are recommended.

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