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RESEARCH ARTICLE

"COMPARISION OF RETINAL NERVE FIBRE LAYER THICKNESS BY CIRRUS HD-OPTICAL COHERENCE TOMOGRAPHY IN EMMETROPIC, MYOPIC AND HYPEROPIC EYES"

S. Mounica, B.V. Kranthi and M. Lakshmi Sarvani
Department of ophthalmology, santhiram Medical College, Nandyal.

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Key words:-
Peripapillary Retinal Nerve Fibre Layer Thickness, Emmetropia, Myopia, Hypermetropia, Cirrus HD-OCT

Abstract

Purpose: The purpose of our study is to compare the average peripapillary retinal nerve fibre layer thickness by cirrus HD-Optical coherence tomography in emmetropic, axial myopic and axial hyperopic cases.

Materials And Methods: Total of 120 subjects aged between 10 to 50 years were enrolled in this study, divided into 3 groups with 40 in each, namely group 1 - emmetropia, group 2- myopia >2.5 D and group 3- hypermetropia>2.5 D. In which, 58 (48.3%) were females and 62 (51.7%) were males. This study was done in the Department of Ophthalmology, Santhiram Medical College Hospital Nandyal,from October 2019 to March 2020. The average as well as quadratic assessment of peripapillary RNFL thickness by cirrus-HD optical coherence tomography and comparison among these 3 groups.

Observation And Results: In our study, average peripapillary RNFL thickness between emmetropic, myopic and hyperopic groups was found to be statistically significant. The average peripapillary RNFL thickness was thickest in the hyperopic group (102.95 ± 5.629, n=40), followed by the emmetropic group (102.55 ± 5.505, n=40), and then the myopic group (83.38 ± 3.726, n=40) (all P<0.0001) . And in all four RNFL quadrants, myopic group showed thinning when compared to Emmetropic and hyperopic group (p<0.001).But hyperopic group showed thicker RNFL than emmetropic group only in temporal quadrants in right eye(p<0.001)and nasal and superior quadrants in left eye (p=0.017)

Conclusion: In our study, average as well as in all the four quadrants peripapillary RNFL thickness shows highly significant results between emmetropia, myopia and hyperopia. When compared with emmetropia, RNFL thickness being thinnest in myopic group, and slightly thicker RNFL thickness in hyperopic group.

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Introduction:-

The Retinal nerve fibre layer comprises of neuroglia, astrocytes and ganglion cell axons. These ganglion cells axons converge at the optic disc which forms the optic nerve.(1) Peripapillary RNFL is thicker in the inferior part followed by superior. But the temporal part of RNFL is significantly thinner than the rest of the quadrants.(1) As temporal part receives nerve fibres only from a small part of the retina, because of which the thickness of the nerve fibre layer

Corresponding Author:- S. Mounica
Address:- Department of Ophthalmology, Santhiram Medical College, Nandyal.

is reduced to 10 μ here.(2) Based on the histological studies, the peripapillary RNFL thickness follows pattern of double hump whereby thickness is greatest at the inferior and superior poles of the optic disc and thinnest at the nasal and temporal disc margins and it varies with the axial length of the eye. (1,3) Optical coherence tomography (OCT) is a non-invasive technique that has been used extensively to evaluate pathologies of the optic nerve and retinal structure. This technique was first demonstrated in 1991 by Huang et al. (4) HD OCT provides cross-sectional images with approximately 2-3 mm penetration inside the tissue and micrometre scale of axial and transverse resolution for optic nerve and retina and anterior segment of the eye. This high resolution OCT allows visualization of intra-retinal layers and correct measurement of retinal thickness, mainly the RNFL.(4,5) OCT is a new imaging technology based on the laser interferometry principle. Comparison of OCT and histological images from prototype devices shown good correlation between real measurements of RNFL thickness and OCT estimates.(6) 2 RNFL thickness measurement helps to detect many ocular diseases in early stages such as myopia, glaucoma and conditions like, diabetic retinopathy, central serous chorioretinopathy, macular edema, macular holes and epiretinal membrane.(6) Previous studies carried out with OCT technique revealed that axial length influences RNFL thickness. If axial length related ocular magnification is not taken into account, RNFL thickness thins out as the eye elongates. This value also helps in the diagnosis of glaucoma when eyes with different axial length are compared with the normative database. RNFL is thicker with shorter axial length. (7)

Our study is aimed to assess whether axial length exerts any effect on the peripapillary RNFL thickness measurement performed by cirrus HD-OCT. We have analysed Average peripapillary RNFL thickness in 3 different groups of healthy emmetropic, hyperopic and myopic subjects.

Materials And Methods:-

Patient Selection:

The study was performed at Santhiram Medical College & Hospital ,Nandyal, Andhra Pradesh,from October 2019 to March 2020. In this study,120 individuals in the age group of 10-50 years underwent evaluation of peripapillary retinal nerve fibre layer (RNFL) thickness using Spectral Domain OCT (Cirrus HD OCT). They were split into three different groups with 40 patients in each. Group 1 as emmetropia Group 2 as myopia >2.5 D and Group 3 as hyperopia >2.5 D In group 2 and group 3 subjects with astigmatism of > 1.5 D and with any other pathology or surgery were excluded from the study. 31

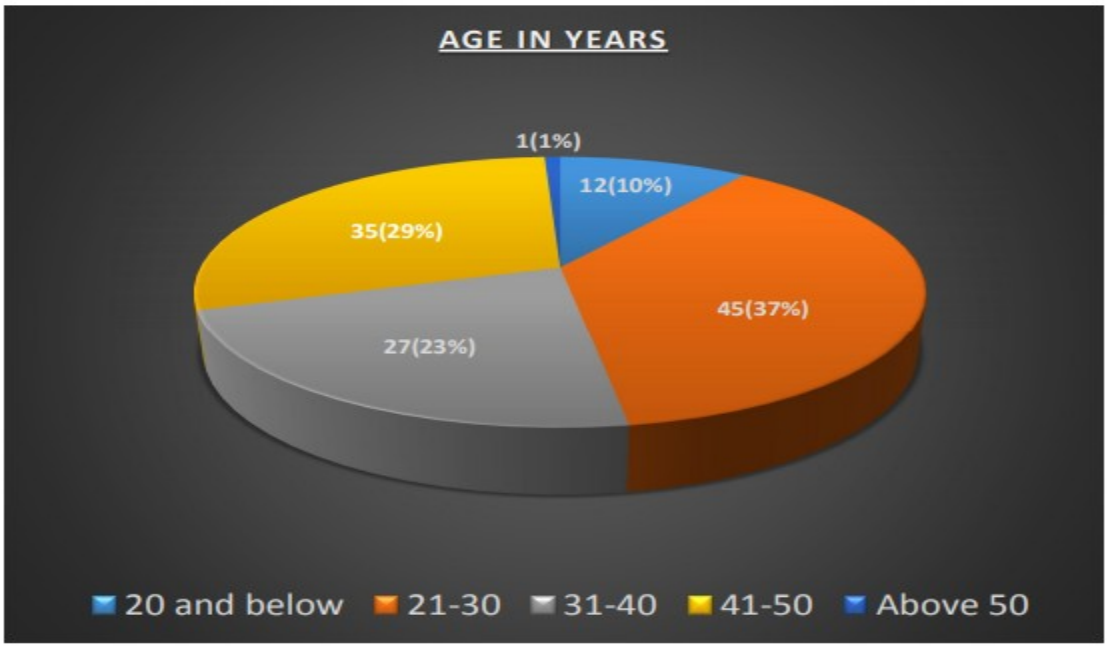
Procedure:

Information and Screening:

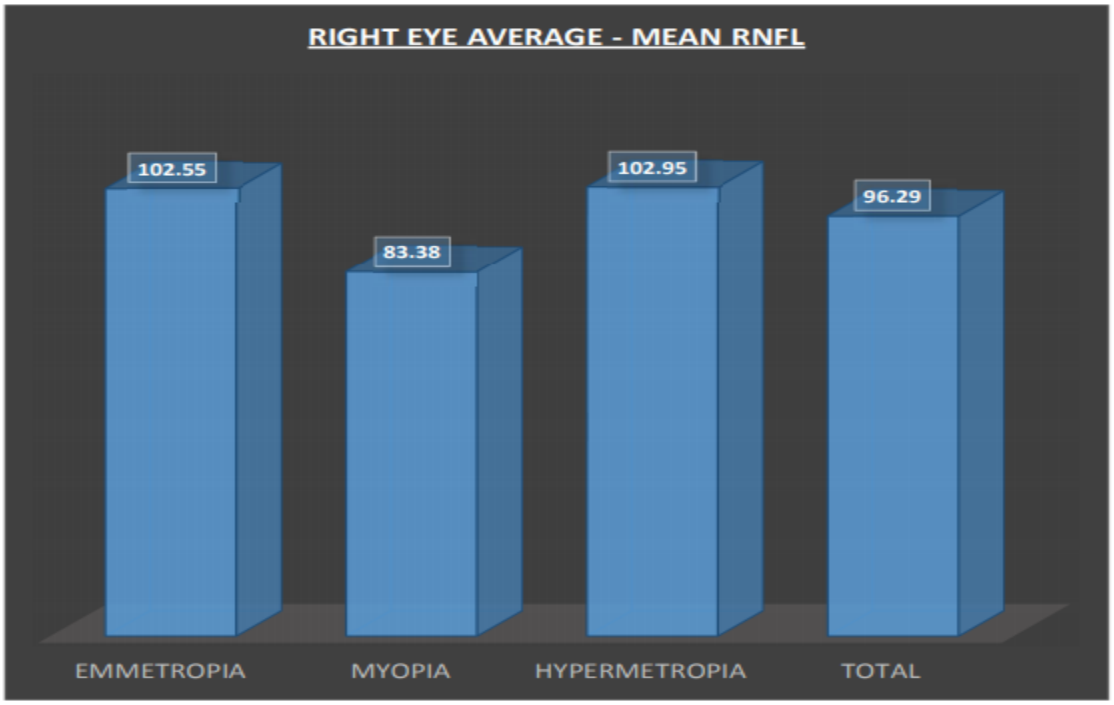
The subjects were informed about the general procedure and the study both verbally and written form. Each subject signed an informed consent form on information of the study, see Annexure. Prior to the RNFL measurements a short history was taken. Dilated refraction was assessed by auto-refractometer based on their current glasses. OCT Measurements: All the subjects who fulfilled the inclusion criteria were subjected to the OCT, and the retinal thickness was measured. Peripapillary RNFL Thickness Measurement: RNFL thickness measurement was performed by Spectral Domain OCT in a mydriatic and cycloplegic state, by a single technician who was masked to subjects' clinical information. Scans were centred on the optic disc and scanning diameter of 3.5 mm obtained. Scans were repeated 3 times and assessed for signal strength and centration. Scans with poor signal strength quality and concentration were excluded. The RNFL thickness of each of the 4 quadrants and the average RNFL thickness were recorded in micrometres (μm).

Results:-

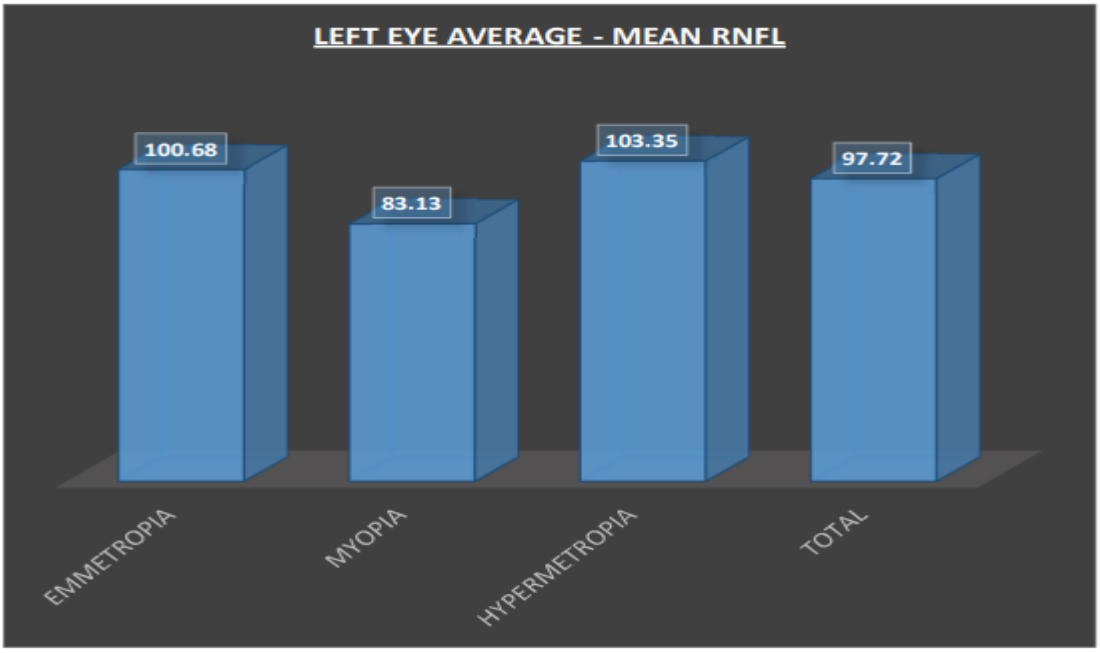
In our study, 240 eyes of 120 subjects underwent evaluation of peripapillary retinal nerve fibre layer thickness in the age group of 10-50 years in which 58 females and 62 males using Spectral Domain OCT. The quadrantic assessment of RNFL thickness in the 3 different groups followed ISNT rule with inferior quadrant showing the greatest thickness followed by the superior, nasal and temporal quadrants and the average RNFL thickness were assessed. Total of 120 patients were enrolled in this study, 40 each in the three arms namely emmetropia, myopia and hypermetropia. In these groups 58 (48.3%) were females and 62 (51.7%) were males. Based on age distribution, there are 12 individuals in 20 and below (10%), 45 in 21-30 years of age group(37.5%), 27 between 31-40 years of age group(22.5%),35 in 41-50 years of age group(29.2%), 1 above 50 years(0.8%).



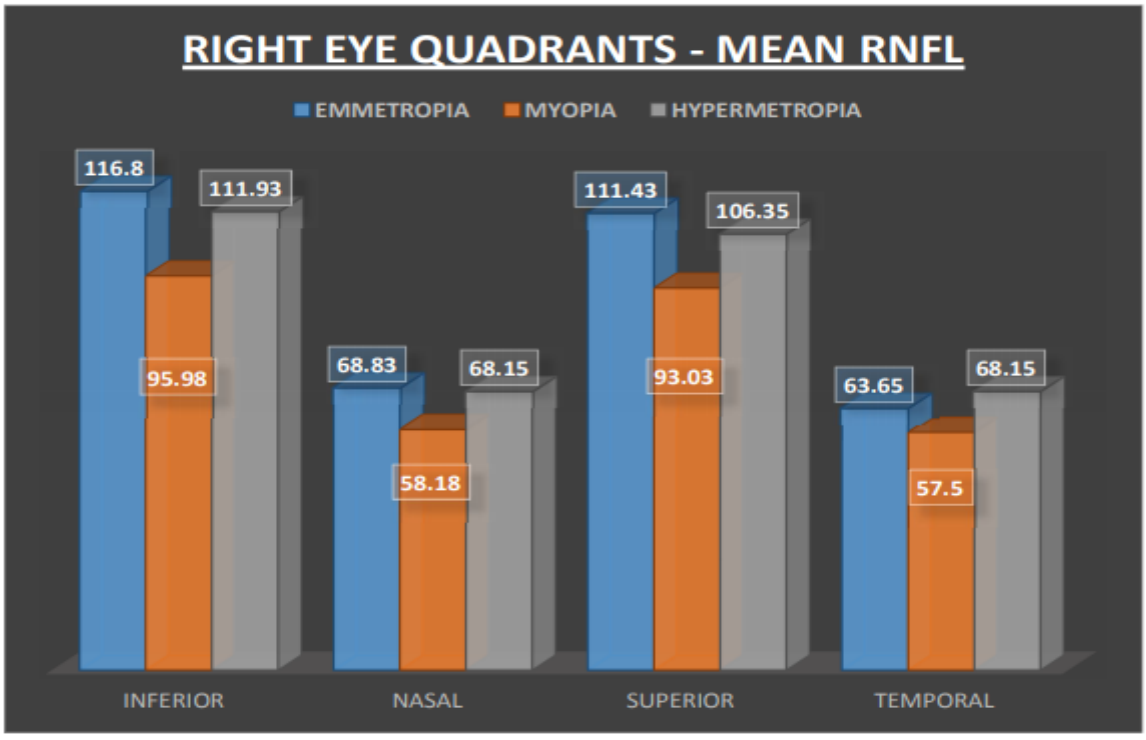
GRAPH 1: AGE DISTRIBUTION AMONG EMMETROPIA, MYOPIA AND HYPEROPIA



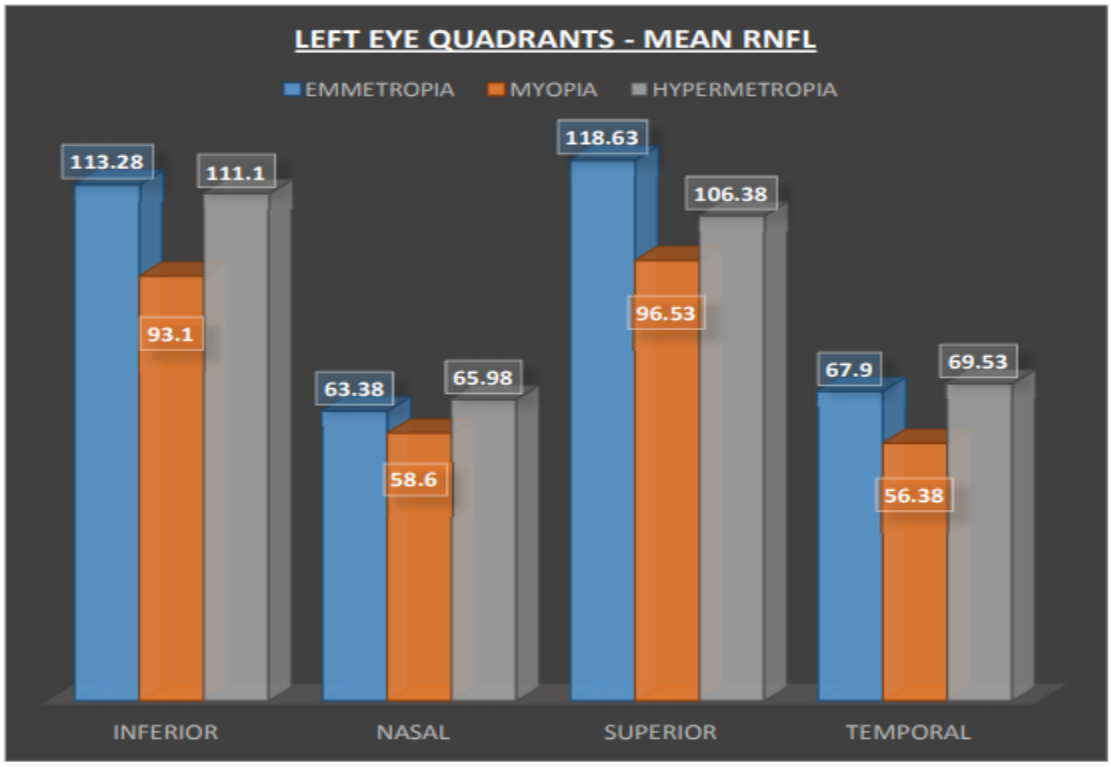
GRAPH 2: RIGHT EYE MEAN AVERAGE RETINAL NERVE FIBRE LAYER THICKNESS AMONG THE THREE GROUPS



GRAPH 3: LEFT EYE MEAN AVERAGE RETINAL NERVE FIBRE LAYER THICKNESS AMONG THE THREE GROUPS



GRAPH 4: RIGHT EYE FOUR QUADRANTS OF EACH MEAN RETINAL NERVE FIBRE LAYER THICKNESS AMONG THE THREE GROUPS



GRAPH 5: LEFT EYE FOUR QUADRANTS OF EACH MEAN RETINAL NERVE FIBRE LAYER THICKNESS AMONG THE THREE GROUPS

By ANOVA analysis, the mean RNFL ± Standard Deviation in all the quadrants of both right and left eye were highly statistically significant (p= 0.000). The average right and left eye RNFL ± Standard Deviation were also highly statistically significant (p= 0.000)

Table 1: Right eye Mean Retinal nerve fibre layer and standard deviation of all the four quadrants and average in Emmetropia, myopia and Hyperopia

RIGHT EYE	MEAN RNFL ± STANDARD DEVIATION				
	INFERIOR	NASAL	SUPERIOR	TEMPORAL	AVERAGE
EMMETROPIA	116. 80 ± 12.968	68.83± 8.578	111.83 ± 13.218	63.65 ± 5.289	102.55 ± 5.505
MYOPIA	95.98 ± 5.6	58.18± 4.483	93.03 ± 6.274	57.50 ± 7.100	83.38 ± 3.726
HYPERMETROPIA	111.93 ± 8.77	68.45 ± 4.685	106.35 ± 7.570	68.15 ± 4.933	102.95 ± 5.629
p VALUE (**HS – Highly Significant)	**HS p= 0.000	**HS p= 0.000	**HS p= 0.000	**HS p= 0.000	**HS p= 0.000

Table 2: left eye Mean Retinal nerve fibre layer and standard deviation of all the four quadrants and average in Emmetropia, myopia and Hyperopia

LEFT EYE	MEAN RNFL ± STANDARD DEVIATION				
	INFERIOR	NASAL	SUPERIOR	TEMPORAL	AVERAGE
EMMETROPIA	113. 28 ± 12.121	63.38 ± 4.465	118.63 ± 11.270	67.90 ± 6.424	100.68 ± 6.044
MYOPIA	93.10 ± 8.673	58.60 ± 3.740	96.53 ± 4.696	56.38 ± 4.436	83.13 ± 4.439
HYPERMETROPIA	111.10 ± 7.752	65.98 ± 4.148	106.38 ± 8.536	69.53 ± 3.693	103.35 ± 5.357
p VALUE (**HS – Highly Significant)	**HS p= 0.000	**HS p= 0.000	**HS p= 0.000	**HS p= 0.000	**HS p= 0.000

Multiple comparisons were done between the groups by Bonferroni test. Emmetropia showed highly statistical significance with myopia in all the quadrants and average values for both right and left eye (p=0.000). Hypermetropia showed highly statistical significance with myopia in all the quadrants and average values for both right and left eye (p=0.000). Whereas, hypermetropia showed statistical significance with emmetropia only in right eye temporal quadrant and left eye nasal and superior quadrants.

Table 3: Right eye Mean Difference of all the 3 groups when compared with Bonferroni Test

RIGHT EYE	MEAN DIFFERENCE		
	EMMETROPIA		MYOPIA
	MYOPIA	HYPERMETROPIA	HYPERMETROPIA
INFERIOR	20.825**	4.875	-15.950**
NASAL	10.650**	0.375	-10.275**
SUPERIOR	18.400**	5.075	-13.325**
TEMPORAL	6.150**	-4.500**	-10.650**
AVERAGE	19.175**	-0.400	-19.575**
**HS (Highly Significant) p= 0.000			

Table 4: Left eye Mean Difference of all the 3 groups when compared with Bonferroni Test

LEFT EYE	MEAN DIFFERENCE		
	EMMETROPIA		MYOPIA
	MYOPIA	HYPERMETROPIA	HYPERMETROPIA
INFERIOR	20.175**	2.175	-18.000**
NASAL	4.775**	-2.600*	-7.375**
SUPERIOR	22.100**	12.250**	-9.850**
TEMPORAL	11.525**	-1.625	-13.150**
AVERAGE	17.550**	-2.675	-20.225**
**HS (Highly Significant) p= 0.000 * Significant p= 0.017			

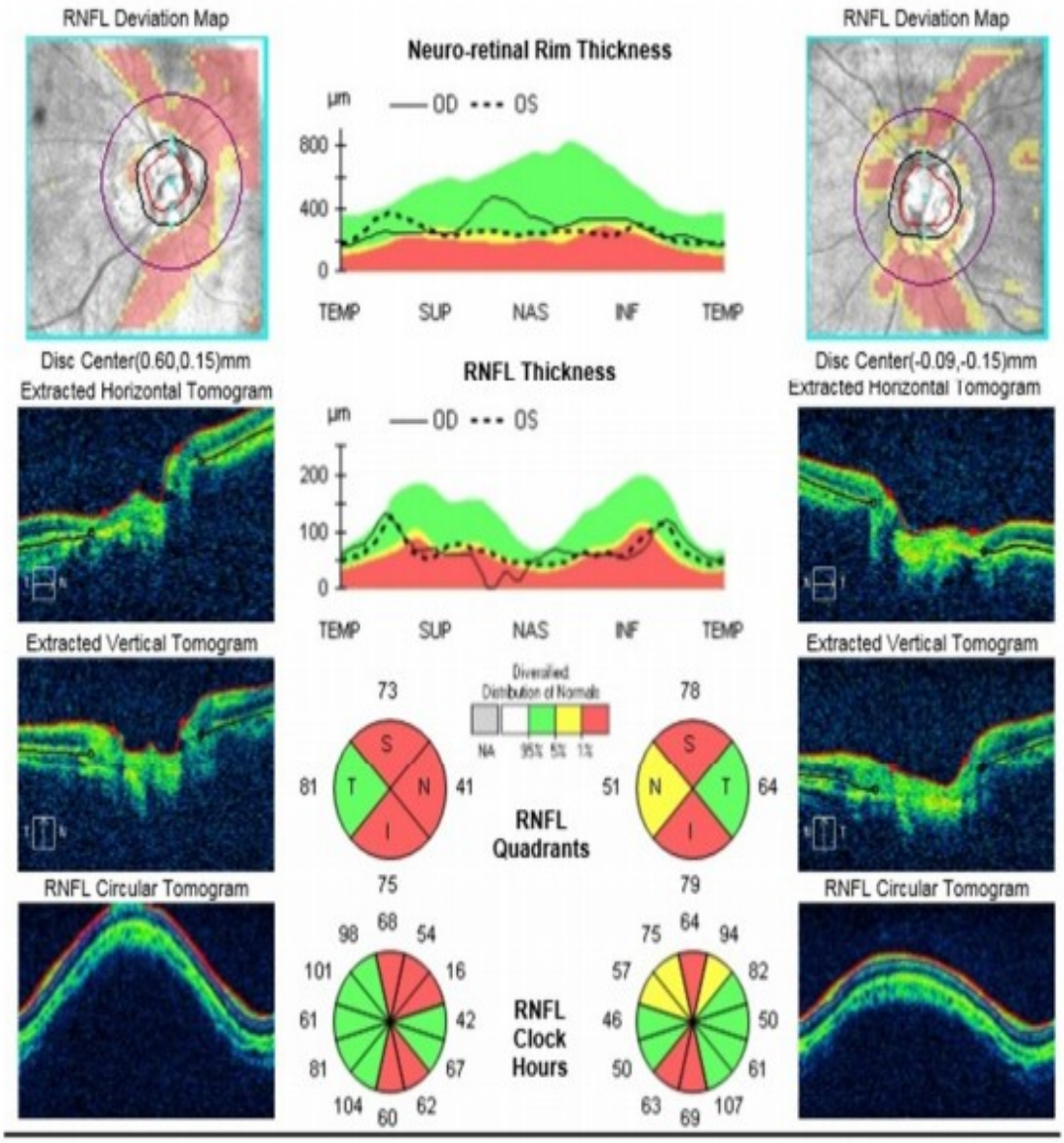


Figure 13: Example of cirrus HD OCT showing RNFL thinning in superior and inferior quadrantsin Myopia

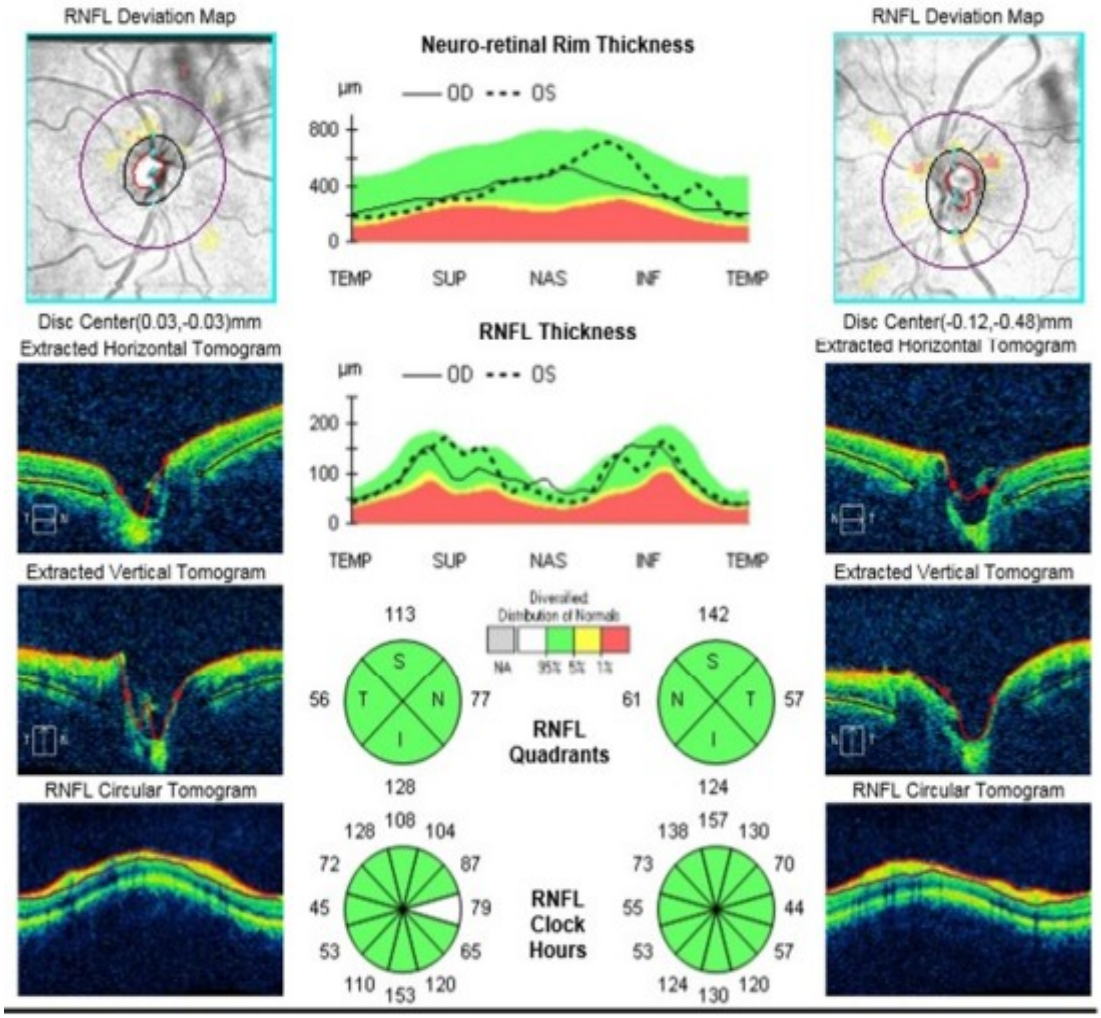


Figure 14: Example depicting the RNFL thickness in Hyperopic eyes similar to Emmetropia

Discusssion:-

Our study demonstrated that Average retinal nerve fibre layer thickness and RNFL thickness in all the 4 quadrants that is inferior, nasal, superior and temporal by cirrus HD OCT in emmetropia, myopia and hyperopia along the 3.4 mm-diameter circle around the optic nerve head. The average RNFL thickness in emmetropic eyes was approximately 102.55±5.505 µm in right eye and 100.68±6.044 µm in the left eye. The average RNFL thickness in myopic eyes was 83.38±3.726 in right eye and 83.13±4.439 in left eye and in hypermetropic eyes average RNFL were 102.95±5.629 in right and 103.35±5.357 in left eyes. Our study results done by ANOVA test shown that average and all the 4 quadrants RNFL thickness has statistically significant difference between all the 3 groups, emmetropia (p=0.000), myopia (p0.05).But hypermetropia showed statistical significance with emmetropia only in right eye temporal quadrant and left eye nasal and superior quadrants. This suggested that the RNFL thinning in the myopic group was due elongation of axial length and hyperopic group had a thicker RNFL in some quadrants as compared to those with emmetropia.

Conclusion:-

Our study concludes that axial length influences the peripapillary RNFL thickness mean average as well as of inferior, nasal, superior and temporal quadrants in emmetropic, myopic and hypermetropic group. When compared with emmetropia and hypermetropia, myopic group has statistically significant thinner RNFL thickness. But no

much statistical significant difference noted in between emmetropic and hyperopic groups, except it showed significant difference only in right eye temporal quadrant and left eye nasal and superior quadrants.

Bibliography:-

1. Varma R, Skaf M, Barron E. Retinal Nerve Fiber Layer Thickness in Normal Human Eyes. Ophthalmology. 1996;103(12):2114-2119.
2. Kaufman PL, Alm A. Adler's Physiology of the Eye, Clinical Application. 10th ed. Mosby; 2003.
3. Dichtl A, Jonas J, Naumann G. Retinal nerve fiber layer thickness in human eyes. Graefe's Archive for Clinical and Experimental Ophthalmology. 1999;237(6):474- 479.
4. Huang D, Swanson E, Lin C, Schuman J, Stinson W, Chang W et al. Optical coherence tomography. Science. 1991;254(5035):1178-1181.
5. Schuman J, Pedut-Kloizman T, Hertzmark E, Hee M, Wilkins J, Coker J et al. Reproducibility of Nerve Fiber Layer Thickness Measurements Using Optical Coherence Tomography. Ophthalmology. 1996;103(11):1889-1898.
6. Parvaresh MM, Imani M, Kashkouli MB, Sanjari MS. Optical Coherence Tomography-Measured Nerve Fiber Layer and Macular Thickness in Emmetropic, High-Myopic and High-Hyperopic Eyes. Iran J Ophthalmol. 2008 Nov 02;20(2):4-9.
7. Savini G, Barboni P, Parisi V, Carbonelli M. The influence of axial length on retinal nerve fibre layer thickness and optic-disc size measurements by spectraldomain OCT. British Journal of Ophthalmology. 2011;96(1):57-61.
8. Khurana AK. Theory and Practice of Optics and Refraction. 2nd ed. U.P: Elsevier; 2008. 52
9. Skuta GL, Cantor LB, Weiss JS. Pediatric ophthalmology and strabismus, American Academy of Ophthalmology.AAO USA. 2012-1013;6:167-169.
10. Curtin, B. J. The myopias: Basic Science and Clinical Management. Harper & Row. 1985.