“ASSESSMENT OF RETINAL NERVE FIBER LAYER THICKNESS IN DIABETICS WITH AND WITHOUT DIABETIC RETINOPATHY USING OPTICAL COHERENCE TOMOGRAPHY IN A TERTIARY CARE CENTRE

CHEIF AUTHOR

DR.B.BINDU SWETHA

POST GRADUATE ,DEPT OF OPHTHAMOLOGY,GREH

VISAKHAPATNAM

CO AUTHOR

DR.G.PREMALATHA

ASSISTANT PROFESSOR,DEPT OF OPHTHALMOLOGY,GREH

VISAKHAPATNAM

CODE :2355719

- FINANCIAL DISCLOSURE

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INTRODUCTION

Diabetes mellitus (DM) is a chronic disease the prevalence of which has been steadily increasing everywhere, most markedly in the world's middle income countries.

In developed countries diabetic retinopathy (DR) is the most frequent microvascular complication of diabetes mellitus and the most common cause of blindness in the adult population. Main reasons for loss of vision in patients with diabetes mellitus are diabetic macular edema and proliferative diabetic retinopathy[3]

DR has been described as a type of optic neuropathy which affects the retinal nerve fiber layer (RNFL) like glaucoma.

The OCT (Ocular Coherence Tomography) employs low coherence interferometry to assess peripapillary RFNL thickness and allows an in vivo visualization of the retina and the RNFL.[5]This novel imaging technique generates cross sectional images by mapping the depth wise reflections of low coherence laser light from various tissues. Imaging of multilayer tissues such as the retina, results in different modulation periodicities representing the depth of each layer. [6]

A recent development in this technology, spectral domain OCT (SD-OCT) with eye tracking technology, provides faster, higher-resolution scans than the prior time domain methods.

It specifically measures the retinal nerve fiber layer (RNFL), using a standard circular scan 12 degrees in diameter centered on the optic nerve, thus increasing image capture speed and resolution (down to 4 μm). [10]

The objective assessment of the GCC (ganglion cell complex) which consists of inner plexiform layer, ganglion cell layer and RFNL is crucial in early detection of inner retinal loss associated with DM as it could help in developing neuroprotective therapeutic regimens in future. Thus a preventive rather than an interventional approach can be used in its management.

AIM

To study the assessment of retinal nerve fiber layer thickness in diabetics with and with out diabetic retinopathy using optical coherence tomography in a tertiary care center.

OBJECTIVES

1. To compare effect of diabetes on retinal nerve fiber layer thickness in diabetics with and without Diabetic Retinopathy.

2. To study the quadrant - wise changes in RNFL thickness in both the study groups using SD-OCT (Spectral Domain OCT)

INCLUSION CRITERIA:· Consenting patients

· Patients diagnosed as diabetics atleast 1 year prior to the study and started on antidiabetic drugs

· IOP< 21 mm Hg

· Cup to disc ratio ≤ 0.4

EXCLUSION CRITERIA:

Patients with conditions known to affect ONH and RNFL such as pre existing glaucoma, multiple sclerosis, Parkinsons disease, Alzheimers disease, previous retinal laser treatments and retinal surgeries, DR with tractional retinal detachment, Retinal degenerative conditions like retinitis pigmentosa.

2. People with media opacities such as dense cataracts , dense asteroid hyalosis, corneal opacities.

3. Proliferative DR with media opacities where OCT would be difficult to perform

MATERIALS AND METHODS:

This is a hospital based cross sectional study conducted on 100 patients of diabetics attending Government regional eye hospital, Visakhapatnam.· Group 1- Diabetic patients with diabetic retinopathy. · Group 2- Age and gender matched diabetic patients without diabetic retinopathy

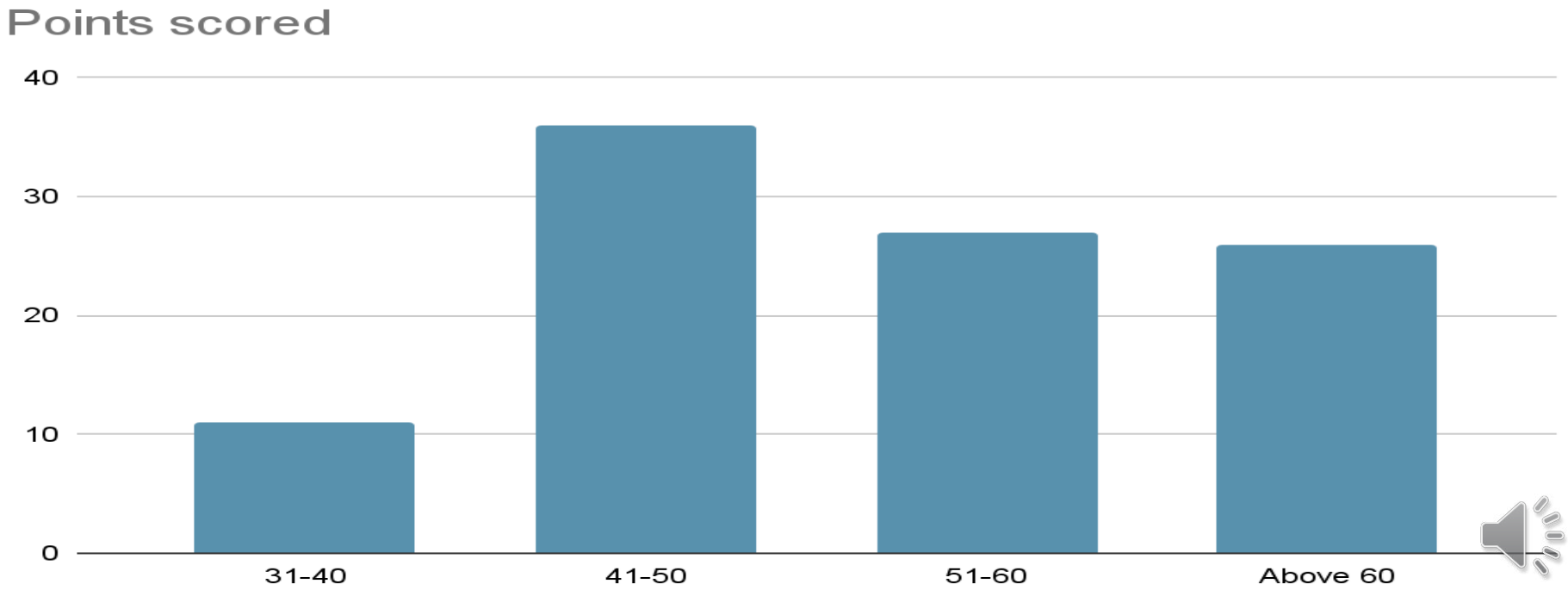
METHODOLOGY

All the diabetic patients attending GREH detailed history of patient was taken Visual acuity was recorded using Snellen's chart.

Examination of anterior segment was done in detail with the help of a slit lamp. Blood sugar levels (FBS, PPBS, HbA1c) were measured . Fundus examination was done using direct ophthalmoscope, indirect ophthalmoscope,slit lamp biomicroscopy using 90D OR 78D lens Applanation Tonometry was done to measure Intraocular pressure in both eyes SD-OCT (Zeiss Primus 200) : Average and quadrant wise RNFL thickness was measured and compared between the 2 groups using spectral domain OCT.

RESULTS :Distribution of subjects based on Age group:

Majority of the study participants were between 41-50 years of age and the mean age was 52.36



Distribution of subjects based on gender :The above figure shows shows that the proportion of

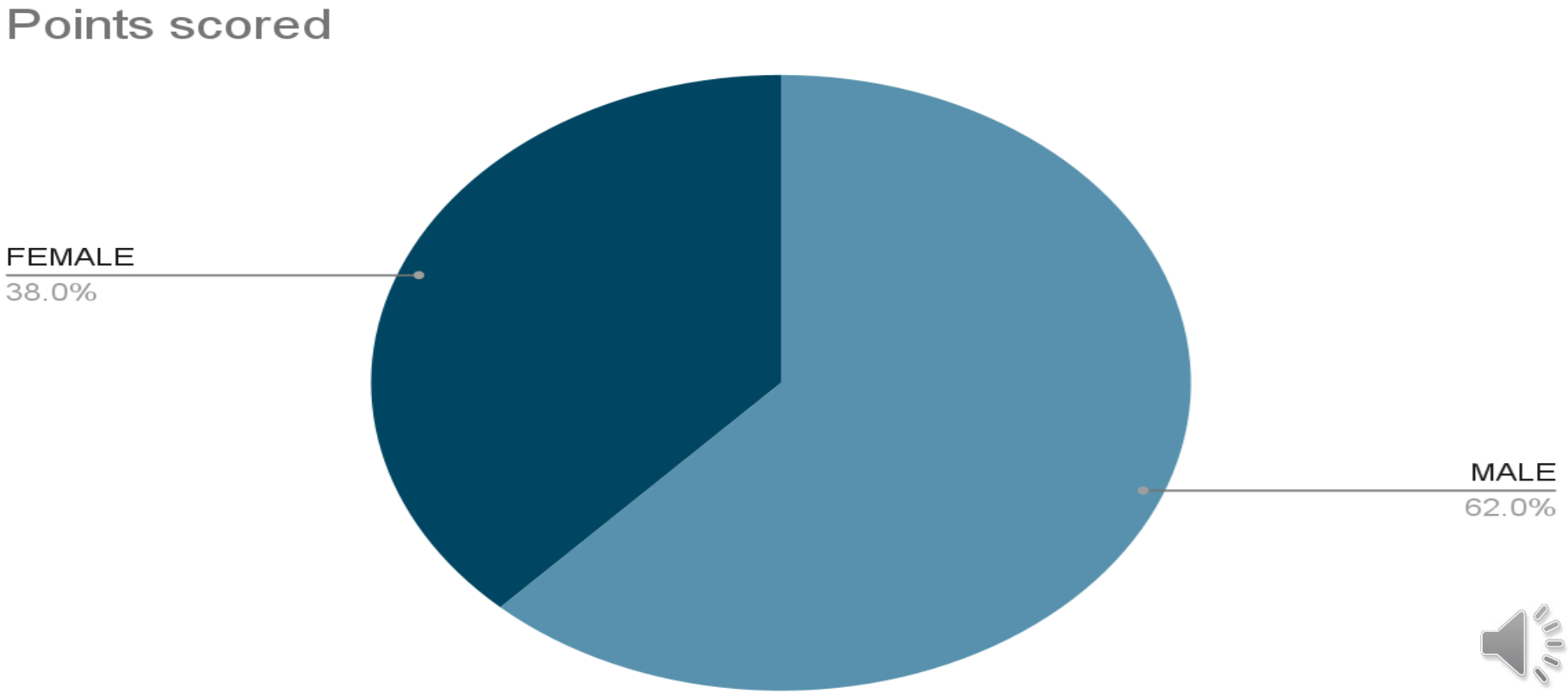
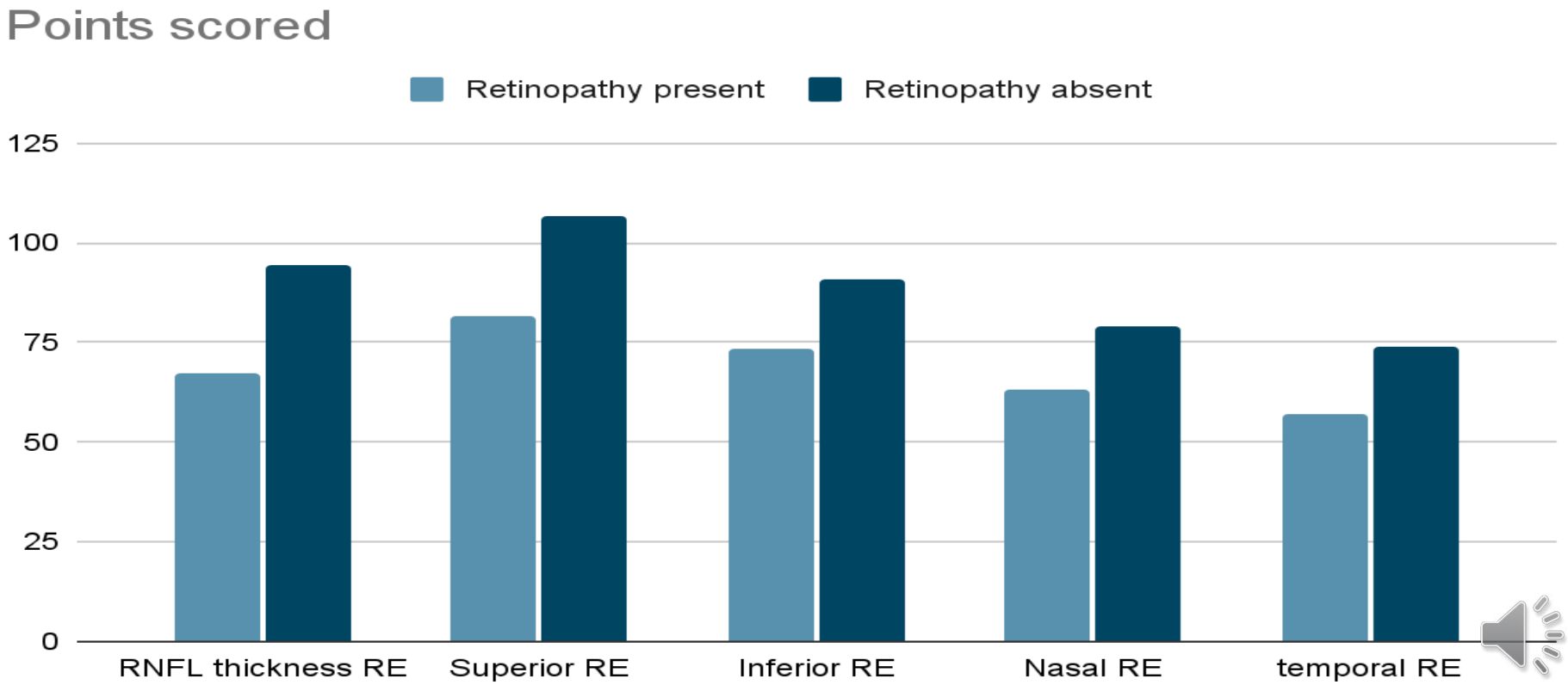


Table 1: Distrubution of study participants into 2 groups based on presence or absence

	frequency	percent
Present	50	50
Absent	50	50
Total	50	50

Study participants were divided into 2 groups based on the presence or

Average and quadrant wise thickness of RNFL in Right eye of participants

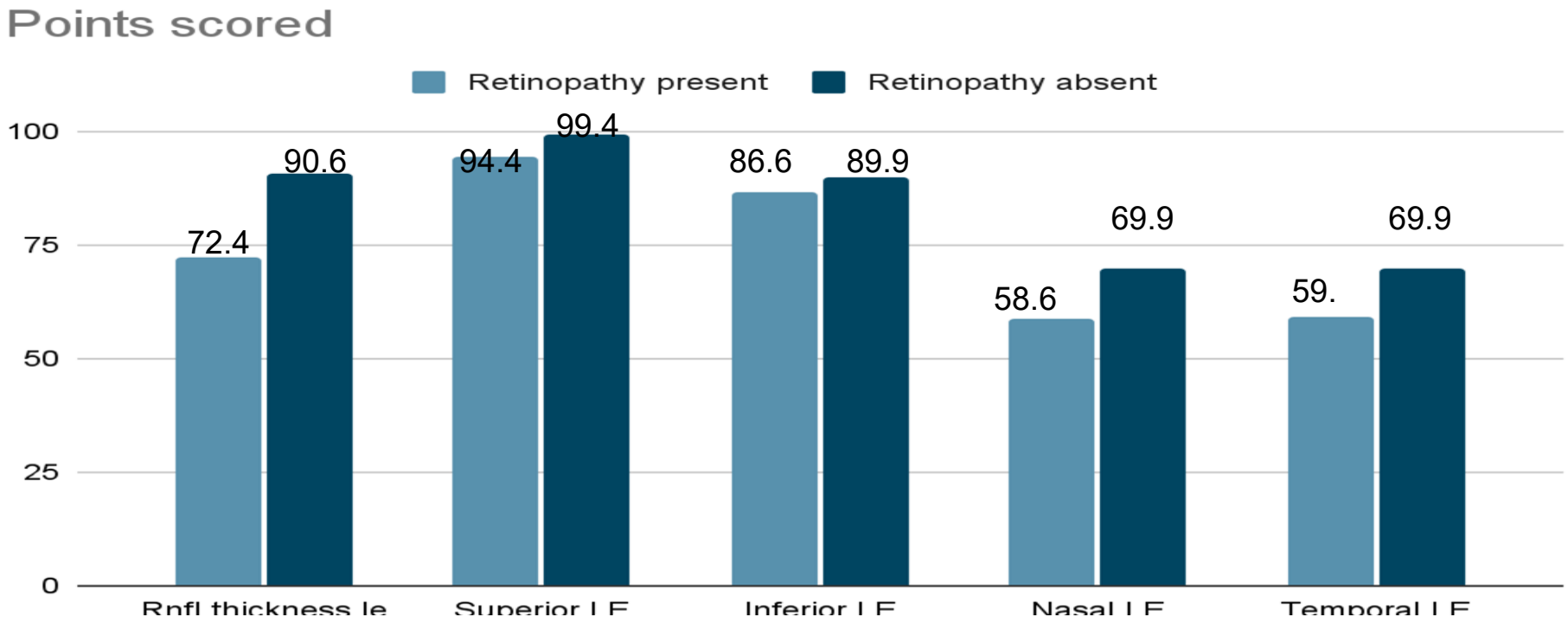


Average RNFL thickness in the group with diabetic retinopathy was 67.47 µm compared to 94.41µm in the group without diabetic retinopathy. ($p<0.05$) The above figure shows that RNFL thickness was thinner in patients with retinopathy as compared to patients without. In both groups thinning was most in temporal quadrant. ($p<0.05$)

Average and quadrant wise RNFL thickness in both groups of right eye:

	Retinopathy present	Retinopathy absent
RNFL THICKNESS	67.47µm	94.41µm
SUPERIOR	81.39µm	106.92µm
INFERIOR	73.51µm	90.84µm
NASAL	63.43µm	78.90µm
TEMPORAL	57.12µm	73.94µm

Average and quadrant wise thickness of RNFL in the left eye of subjects with and without diabetic



The average RNFL thickness in the group with diabetic retinopathy changes showed more thinning (72.40 µm) than the group without (90.63µm) ($p<0.05$) The above figure shows that in the left eye the average RNFL thickness and the quadrant wise thickness was lower in the group with diabetic retinopathy than without. The nasal quadrant was significantly thinner than the other quadrants in both the study groups. ($p<0.05$)

Average and quadrant wise RNFL thickness in both groups of left eye:

	RETINOPATHY PRESENT	RETINOPATHY ABSENT
RNFL THICKNESS LE	72.40µm	90.63µm
SUPERIOR - LE	94.48µm	99.44µm
INFERIOR - LE	86.67µm	89.90µm
NASAL - LE	58.60µm	69.90µm
TEMPORAL - LE	59.08µm	69.92µm

This cross sectional study was conducted to evaluate the effects of neurodegenerative effects of diabetes in the retina by measuring the retinal nerve fiber layer thickness in diabetics with and without diabetic retinopathy changes using the SD-OCT.

According to previous studies these neurodegenerative changes include neural apoptosis, loss of ganglion cell bodies, glial reactivity, and reduction in thickness of the inner retinal layers [91] Altered glutamate excitation, reduced trophic factor signaling, oxidative stress, and neuro-inflammation are among the many potential causes of the increase in apoptosis

Mean RNFL thickness

In our study we have found that the RNFL thickness was significantly lower in groups with diabetic retinopathy as compared to the diabetics without retinopathy changes in right eye (67.47 um, 97.41 respectively $p<0.05$) and left eye (72.40 um, 90.63 um respectively $p<0.05$)

A study conducted in Soeul, Korea comparing nerve fiber layer thickness in diabetics with and without diabetic retinopathy and non diabetic controls showed that NFL thickness was decreased in patients with DR than the other 2 groups. The thinning of peripapillary NFL increased with worsening disease severity, which was consistent with the findings of our study. It was suggested that the nerve fiber loss is a consequence of ischemia which is caused by retinal vasculopathy therefore explaining the thinner RNFL in diabetic with diabetic retinopathy

In another study done by Dhamsana et al, RNFL thickness and ganglion cell complex thickness was measured and compared among normal subjects, diabetic patients with and without DR using fournier domain OCT . RNFL was found to be thinner in diabetic patients in both groups when compared to normal healthy subjects in the superotemporal (p-value = 0.001) and nasal upper (p-value = 0.031) sector. GCC which consists of inner plexiform layer, ganglion cell layer and RNFL, was significantly thinner in both diabetic groups when compared to age matched controls. Inner retinal loss has been attributed to lower perfusion and higher metabolic demands of the inner retina which make it more vulnerable to the metabolic stress induced by diabetes.

Mehboob et al, compared RNFL thickness of controls with DM patients without retinopathy. However in this study diabetics with diabetic retinopathy changes were not included because it was assumed that the microsvascular changes affects different measurements of retinal areas by SD OCT, and results may get altered due to change in thickness due to edema, hemorrhages and cotton wool spots. Mean RNFL thickness, as well as RNFL thickness of all four quadrants was thinner in diabetics without retinopathy than the age matched controls($p<0.001$).

CONCLUSION

Diabetic retinopathy is associated with neurodegenerative changes such as thinning of retinal nerve fiber layer which was found to be statistically significant in this study, particularly in the nasal and temporal quadrants. Duration of diabetes showed a significant negative correlation with RNFL thinning, thus showing that microvascular changes and neurodegeneration are closely linked processes and progress with time.

Also, since there was selective thinning even in the diabetic patients without diabetic retinopathy changes, it can be concluded that this inner retinal loss may precede the vascular events and can be accurately diagnosed by the SD-OCT.

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