Ophthalomology

ASSESSMENT OF CHANGES IN RETINAL NERVE FIBER LAYER THICKNESS IN HEAVY SMOKERS USING OCT

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ABSTRACT Tobacco smoke contains oxidizing substances that result in free radicals and can harm or kill cells. Adverse effects of smoking on the eyes are dose-dependent dangers, and a rise in smoking index is correlated with an increase in morbidity. Smoking may predispose to various ocular conditions like thyroid ophthalmopathy, cataract, primary open-angle glaucoma, age-related macular degeneration, retinal venous occlusion, and anterior ischemic optic neuropathy, it is known to impact blood flow, tear film, and RNF thickness in the eye. Few studies showed evidence of decrease in RNFL thickness in smokers when compared to healthy individuals of same age and this is the basis of current study.

INTRODUCTION

Smoking has a number of negative effects on the human body, particularly the eyes, which increase morbidity and hasten death[1]. Smoking is known to cause various ocular pathologies due to its impact on blood flow, tear film. Heavy smoking (>10 cigarettes per day) is known to cause peripapillary RNFL thinning. But the results were inconsistent in various studies. Optical coherence tomography (OCT) is a non invasive method for assessing RNFL thickness and In the current study we compare RNF thickness of heavy smokers with >10 cigarettes per day smoking history for at least 10 years, with age matched healthy individuals who never had history of smoking without any systemic comorbidities by using OCT.

MATERIALS AND METHODS

The cohort study was done at GSL Medical College and General Hospital between study period January 2022 to November 2022. All participants included in the study were explained about the purpose of the study and informed consent was taken from all participants.

Study Design: Retrospective cohort study
Study Location: GSL Medical College and General Hospital, Rajahmundry, Andhra Pradesh
Study Duration: January 2022 to November 2022
Sample size: 40

Out of 40 participants who were included in the study, there are 20 patients who had history of smoking of at least 10 cigarettes per day for at least 10 years. And remaining 20 participants were age matched healthy individuals who never had history of smoking in the past.

Inclusion criteria:
1. Participants between 25 to 45 years of age were included in the study.
2. Patients with best corrected visual acuity of 6/18 or better were included in the study.
3. Patients with clear media were included.

Exclusion criteria:
1. Patients who had history of systemic disorders like diabetes and uncontrolled hypertension.
2. Patient with history of glaucoma and patients with intraocular pressures > 21 mm Hg were excluded.
3. Patients with history of intraocular surgeries or patients with history of trauma were excluded.
4. Patients with history of usage of topical or systemic medications were excluded.

Procedure methodology
Participants included in the study were selected based on inclusion and exclusion criteria

Ocular examination of both eyes including: Best corrected visual acuity, extra ocular muscle movements, Slit lamp biomicroscopy with 90 D lens, IOP calculation by Goldmann applanation tonometry, Fundus examination using direct and indirect ophthalmoscope, Assessment of retinal nerve fiber layer thickness using ZIESS OCT(SD-OCT) were performed in all participants.

RESULTS

Statistical analysis was performed using SPSS software version 20.0 and MS Excel 2007. Descriptive data will be presented as mean ± standard deviation.

The study participants were grouped under two categories for comparison of data and tabulating the results. First group included the participants who had history of heavy smoking at least 10 cigarettes per day and second group was named as non-smokers who were age matched with smokers without history of smoking in the past. 20/ 20 of smokers were males and 15/20 of non-smokers were males and remaining 5/20 of non-smoking group were females. Mean age and SD of smokers group was 37.3±3.009 years and mean age and SD of non smokers was 37.75±3.08 years. (Table I)

Average number of cigarettes smoking in smokers was 21±5 cigarettes/ day. Average duration of smoking was 14±3 years. (Table II)

In smokers group: Mean retinal nerve fiber layer (RNFL) thickness in nasal quadrant was 79.9µm with SD of 9.25m. Mean RNFL in temporal quadrant was 73.95µm with standard deviation of 8.38. mean RNFL in superior quadrant was 114.85 µm with standard deviation of 13.24 and in the inferior quadrant mean RNFL was 128.15 µm with 11.18 standard deviation.

In non-smokers group: Mean RNFL +SD of nasal quadrant was 83.7±8.77µm, temporal quadrant was 76.0±7.77µm, superior quadrant was 131.05 ±11.03 µm and inferior RNFL was 137.45±10.91 µm.

There was statistically significant difference in mean RNFL thickness in superior quadrant and inferior quadrants with p value of 0.0002 and 0.01 respectively between smokers and non-smokers. (Table III)

On comparison of history and OCT findings, there was positive correlation between RNFL and number of cigarettes smoked per day. There was no correlation between number of years of smoking.

Table I: Age distribution of study participants

Age in years	Smokers (n=20)	Non-smokers (n=20)
Mean	37.3	37.75
SD	3.009	3.08

Sex distribution of study participants

	Smokers (n=20)	Non-smokers(n=20)
Males	20	15
Females	0	5

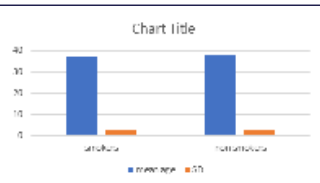**Figure 1 showing age distribution in smokers and non-smokers included in the study**

Table II : Number of cigarettes and years of smoking(n=20)

History of cigarettes / day	21 ± 5
Duration of smoking in years	14 ± 3

Table III : Retinal nerve fiber layer thickness in smokers and non-smokers

Retinal nerve fiber layer thickness in each quadrant (mean +SD)	Smokers (n=20)	Non-smokers (n=20)	P value
Nasal	79.9±9.25	83.7±8.77	0.19
Temporal	73.95±8.38	76.0±7.77	0.42
Superior	114.85±13.24	131.05±11.03	0.0002
Inferior	128.15±11.18	137.45±10.91	0.01

DISCUSSION

Smoking has a number of negative effects on the human body, particularly the eyes, which increase morbidity and hasten death. Tobacco smoke contains oxidizing substances that result in free radicals and can harm or kill cells. Smoking's adverse effects on the eyes are dose-dependent dangers, and a rise in smoking index is correlated with an increase in morbidity.

Free radicals are produced by the oxidizing substances in tobacco smoke, which can harm or kill cells. Smoking has dangers that are dose dependent for the eyes, and the risk of morbidity rises as the smoking index does. In addition to conditions such thyroid ophthalmopathy, cataract, primary open-angle glaucoma, age-related macular degeneration, retinal venous occlusion, and anterior ischemic optic neuropathy, it is known to impact blood flow, tear film, and RNF thickness in the eye.[2]

High-resolution cross-sectional imaging of tissue structure is performed using optical coherence tomography (OCT), a developing technology. By performing high resolution, cross-sectional tomographic imaging of the interior microstructure in biologic systems by measuring backscattered light, this non-invasive, objective, quick, and non-contact approach can identify early structural damage.[3]

In the current study of estimation of RNFL thickness in smokers and comparing with non-smokers group there was a decrease in RNFL thickness in superior and inferior quadrants in smokers when compared to age matched non-smokers group.

According to Solberg et al., nicotine stimulates alpha-adrenergic receptors, which constricts ocular capillaries and raises the carbon monoxide index in smokers, decreasing their ability to carry oxygen. As a result, retinal tissues have been seen to become ischemic, causing the thickness of the RNFL to decrease. These alterations could be the result of smoking-related toxins, which reduce blood flow in the ophthalmic artery and help to create blood clots in the capillaries of the eye, cutting off the nutrients necessary for the RNFL's physiology.[4] This might explain the cause of decrease in RNFL thickness in smokers in the current study.

In support to present study Dervisogulları MS, Totan Y et al conducted a study to know the effects of smoking on retina layers, especially retina nerve fibre layer (RNFL) and ganglion cell-inner plexiform layer complex (GCIPL) and found that smoking might affect RNFL but not Ganglion cell complex.[5]

In contrary Duman R, Sabaner MC et al conducted a study on effect of smoking on the thickness of retinal layers in healthy smokers and concluded that the thickness of retinal layers in healthy smokers was like those of healthy individuals.[6]

According to our study we found correlation of decrease in RNFL thickness in superior and inferior quadrants in smokers which was supported by few studies.

CONCLUSION

The study reported decrease in RNFLckness in heavy smokers with history of >10 cigarettes smoking per day for at least 10 years when compared to age matched nonsmokers.

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