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Research Article

Quantitative and Qualitative Assessment of Tear Film for Imaging Technology Professional Who Are Daily Exposed To X-Ray

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Abstract

Purpose

To compare the tear secretion and tear breakup time between imaging technology professional and non - imaging technology professionals.

Method

This cross-sectional prospective was conducted among 40 subjects of age group ranging from 18 to 40years. Subjects who have worked minimum 2 years in radiology department was considered as exposed group and who has never been exposed to x-ray was consider as control group. TBUT, Schirmer test-I&II was performed to assed tear film for both groups. Paired t test was used to analysis the data.

Result

In exposed group Schirmer test-I was found 23.2±8.79mm (RE) and 23.3 ±7.07mm (LE) among exposed and in non- exposed group 22.92±4.28mm (RE) & 23.05±5.25mm (LE). The mean value of Schirmer test-II was 15.1±6.81mm (RE) and 14.0±6.98mm (LE) in exposed group and 13.45±4.12mm (RE), 12.9±4.86mm (LE) in non-exposed group. The mean TBUT in exposed group was 8.02±2.84 sec (RE), 7.84±2.75sec (LE) among exposed and 12.25±2.85sec (RE), 9.66±2.49sec (LE) in non-exposed group. There was no significant difference found in Schirmer test I and Schirmer test II ($p>0.05$). But it shows statistically significant difference in TBUT between exposed and non-exposed group($p=0.001$).

Conclusion

No significant difference was found in Schirmer test value but statistically significant difference of was found in quality of tear film between exposed and non-exposed group.

Keywords: TBUT, Schirmer test, Tear film, X-ray exposers & non-exposer, Imaging Technology, Quantitative, Qualitative.

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Introduction

X-Ray are profoundly helpful in different areas, particularly in clinical field for a demonstrative reason. X-Ray test are considered as the easy and non-invasive strategy for diagnosing the illness, to determinate treatment option and supporting clinical careful treatment. The majority of the UV radiation consumed by the tears and cornea. In any case, ionizing radiation, due to its better penetration power, can arrive at all layers of the eye[1]. Research evidence reported that assimilation IR radiation is harming the ocular tissues. Cataract have been analysed in laborers who have been regularly exposed to radiation[2] and in nuclear bomb survivors.[2,3] Patients receiving remedial radiation have develop cataract, radiation retinopathy and optic nerve damage.[4] Beaver Dam Eye Study revealed that Nuclear sclerosis and subcapsular opacity in the posterior surface of lens were essentially connected with CAT scans[1] and regularly presented to radition[8], in spite of the fact that Storrs and Byrd have recommended that rehashed openness to computerized axial tomography (CAT) scans may leads to cataractogenic changes.[5] The most regular IR-initiated ophthalmic impacts incorporate optic neuropathy, glaucoma, cataract, some of the time related with explicit neurocognitive deficiencies, angiopathy [6] and retinopathy [6,7]. Eric D et. al. investigation had inferred that ionizing radiation can make the most huge and durable harm the conjunctiva, lens and cornea.[9] Marcelo Lazzaron et. al. assessed the impacts of X-Ray on the appropriation of filamentous actin (F-actin) in the mouse ex-orbital lacrimal organ wherein mice were divided into groups that got no radiation or one single dose of 36 mGy of X radiation. The creatures were forfeited after 4, 8 or 24 h. The lacrimal organs were stained with Hematoxylin/Eosin or Rhodamine-phalloidin and the filamentous actin course of action was breaking down by confocal microscopy and inferred that a 36mGy symptomatic X-beam portion influenced reversibly the mouse ex-orbital lacrimal organ, recommending that radiation utilized in analysis may prompt changes on cell morphology because of actin remodelling.[10]

Dry eye is characterized as a multifactorial disease of the tears that is described by side effects of uneasiness, visual aggravation and tear-film flimsiness that may make potential harm the visual surface.[11] Oxidative stress of ultraviolet radiation can be engaged with dry eye disorder or kerato-conjuctivitis sicca, a high effect visual pathology that influences twenty percent to thirty percent of the populace overall.[12-14]

This study aimed to compare quantitative and qualitative assessment of tear film for imaging technology professional who are daily exposed to x-ray by assessing the tear secretion and tear breakup time (TBUT) among the imaging technology professional & non imaging professional.

Methodology

This cross-sectional study was conducted among the understudies of A.J College & staffs of Imaging Technology department, Mangalore. Out of total 40 subjects, included 20 subjects between the age group 18-40 years, working in Imaging Technology Department at least two years were taken as considered as exposed group and another 20 subjects working who has never been exposed to x-ray was consider as control group. Subjects who were not willing to participate, newly joined staff and subjects having any systemic or ocular diseases were excluded from this study. Subjects were given a questionaries' along with an informed consent form to fill. In college optometry clinic after taking a details history of subject including history of present illness, past illness, medication history, personal history, family history, all the subject had undergone examination like, visual acuity testing, refraction, cover test, facial asymmetry and ophthalmoscopy. Slit lamp examination was also performed in all the subjects followed by Schirmer test I, Schirmer test II and TBUT measurement. Visual acuity was measured using Snellen's chart at 6m for distance and at 40cm for near.

Retinoscopy was used to find refractive error. A change or presence in spherical equivalent refractive error equal to or greater than +/- 0.50 D was considered significant in people who are not using spectacles. And finally, the correction was given after performing standard subjective refraction. To find out ocular abnormalities in anterior segment slit lamp examination was performed. Ophthalmoscope was used to asses fundus. Subjects who met with inclusion criteria were undergone tear film evaluation by Schirmer's test and TBUT. It measures total tear secretions. It is performed with the help of a 5 × 35 mm strip of Whatman-41 filter paper which is folded 5 mm from one end and kept in the lower fornix at the junction of lateral one-third and medial two-thirds. The patient is asked to look up and not

to blink or close the eyes. After 5 minutes wetting of the filter paper strip from the bent end is measured. Normal values of Schirmer-I test were considered more than 15 mm. Values of 5-10 mm are suggestive of moderate to mild keratoconjunctivitis sicca (KCS) and less than 5 mm of severe KCS. Wetting scale of less than 10mm in 5 minutes was considered abnormal. To conduct Schirmer's test-II test topical anaesthetic drops in both eyes were installed, rest procedure was same as Schirmer's test-I. Below 5mm of wetting after five minutes, was considered as hypo secretion of tears or keratitis sicca. To performed TBUT test fluorescein stripe was touched lightly at the inferior tarsal conjunctiva and subject was asked to blink several times to distribute the dye in the tear film. Then, they have asked to stare without blinking while the cornea was observed through Slit-lamp biomicroscope using specular reflection illumination technique with cobalt blue filter. The time between a complete blink and appearance of a random dark spot in the fluorescein film was measured in seconds. No anaesthetics were used as it can hasten the tear breakup. After completion of this procedure data was obtained and values were compared. Normative value was considered ranged from 15 to 35 seconds. Values less than 10 seconds imply an unstable tear film.

Statistical analysis: T- Test was performed to compare the different parameter values of Schirmer test-I, Schirmer test-II and TBUT in X-ray exposed group and non-exposed group. P value for confidence interval of 95% was considered significant at the $P< 0.05$ level for prevalence estimate.

RESULTS

A total of 40 subjects were enrolled in this study, 20 subjects of them were exposed group and 20 subjects were non-exposed group. Mean age of the subjects was 20.53±1.139 (X-ray exposed 21.8±1.23 and non-exposed 20.25±0.85).

Table 1: Distribution of total subjects in terms of frequency and percentage.

Gender	Exposed group	Non-exposed group
Male	9, 45%	8, 40%
Female	11, 55%	12, 60%

Table 2: Age wise distribution of total subjects in terms of frequency and percentage.

Age	Frequency	Percentage
18-19	3	7.50%

20-21	26	65%
22-23	9	22.50%
24-25	2	5%

Table 3: **Statistical analysis of Schirmer test and TBUT of RE and LE between X-Ray exposed and non-exposed group.**

Parameter	**X-ray exposed**		**X-ray non-exposed**		**T-Test**
	RE	**LE**	**RE**	**LE**	
Schirmer test I (mm)	23.2±8.79	23.3±7.07	22.92±4.28	23.05±5.25	p>0.05
Schirmer test II (mm)	15.1±6.81	14±6.988	13.45±4.12	12.9±4.86	p>0.05
TBUT (Sec)	8.021±2.84	7.84±2.75	12.25±2.85	9.66±2.49	P=0.01

No statistically significant difference found between exposed and non-exposed group in both RE and LE in Schirmer's test-I (p>0.05), Schirmer test-II (p>0.05). But there was statistically significant difference in TBUT (P=0.01).

DISCUSSION

The human eye is exposed to a wide range of radiant energy apart from the visual spectrum, including ultraviolet, infrared, microwave, and ionizing radiation. Of these, ionizing radiation can cause some of the most significant and long-lasting damage to the lens, conjunctiva, and cornea. Ionizing sources include natural levels from cosmic (30mrem/year) and terrestrial sources (60mrem/year) as well as man-made sources (60mrem/year). These latter include x-rays, radioactive isotopes, diagnostic and therapeutic radioactive sources, and release from nuclear power stations. Control of these man-made exposures with shielding of the globe, when possible, can minimize or eliminate the acute and chronic effects of radiation exposure.[9] During the qualitative and quantitative analysis of the tear film, we found a statistically significant difference in TBUT between the exposed and non- exposed group so we believe that ocular discomfort is due to decrease in quality of tear. Previous study also suggest that x-ray exposure can lead to change on cell morphology due to actin remodelling. Thus, X-ray irradiation alters the actin cytoskeleton in murine lacrimal glands. This might be the reason for significant decrease in tear film and the function of the lacrimal gland duct, thereby it may induce dryness of the eye.[10] Although detailed mechanisms working in dry eye have not been completely explained, the collection of proof accessible from fundamental and clinical examination[12,13] demonstrates that immunological changes and inflammation of ocular surface assume a critical part in the inception and advancement of dry eye infection. In

dry eye disorder, the declaration of different cell reinforcement chemicals is altogether lower when contrasted with solid controls[15]. Oxidative pressure of radiation is exceptionally associated with the disturbance in the homeostasis, which causes a problem in the respectability of the ocular surface and harm in extracellular DNA[14, 16]. In this manner, the inflammatory responses are started and turn into the critical component in dry eye disorder and ocular surface injury. In the study by Barba E. K. Klein, cataract and discomfort was diagnosed by slit lamp examination in workers who have been routinely exposed to radiation. But in our study cataract was not diagnosed which may be due to the limitation of working periods as the maximum duration of exposure among the subject were 4 years. No any fundus changes were found during the examination.[1] Study was limited to subjects selected from one particular region only (Mangalore). We didn't consider the same time for performing the Schirmer test for individual subjects of this study. Everyone from the exposed group had limited exposer time period (average 3 years) with x-ray. The variation in TBUT with respect to changes in illumination was not considered. Similar type of study can be conducted with a large sample of population among those individuals who are exposed to x-ray for a longer period of time. New can be designed to protected the eye from the effect of x-ray exposer.

Conclusion This study concluded that there was statistically significant difference in quality (TBUT) of tear film but there was no statistically significant difference in quantity (Schirmer test I &II) of tear film between X-ray exposed and non-exposed group. Present study highlights the importance of developing a new x-ray protective device to minimize such exposure to the different structure of the eye.

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Conflicts of Interest: No conflicts of interest.

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