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Dry eyes among information technology professionals in India

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印度信息技术专业人员干眼症的研究

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摘要

目的:研究信息技术(information technology,IT)专业人员的干眼患病情况及其与日常生活的相关性分析。

方法:收集2013-10/12印度南部金奈地区三个IT公司员工进行地横断面调查。入选标准:从事IT行业至少6mo以上,年龄≥18岁,自愿参与研究并签署知情同意书。通过问卷调查和眼科检查收集相关信息,包括社会人口特征。采用Schirmer's试验进行干眼评估,所有结果应用SPSS 16.0统计软件进行分析。

结果:大约有五分之一的参与者(n=36,18%)疑患有干眼,平均年龄29岁(SD=7),并且大多数是男性,本科生/研究生,单身,住在城市的大家庭中。多风的环境显著地增加了红眼的患病率(P=0.04)及眼睛的灼热感(P=0.000)。看电视同样也能增加了眼睛的异物感(P=0.01),从而导致分泌物过多(P=0.02)。

结论:研究结果显示,许多日常活动比如看电视,使用电脑,读书,吹空调及多风的环境(干燥的环境)等都与干眼的症状相关。而且看电视及多风的环境更能加重干眼的一些症状。这项研究强调IT人群迫切需要多种方法和措施减轻干眼症。

关键词:干眼症;信息技术专业人员;视力模糊;计算机;红眼

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Abstract

• AIM: To perform the determination ofthe burden of dry eye syndrome among information technology (IT) professionals and examine association of dry eye syndrome between various daily activities.

• METHODS: This was a pilot cross-sectional study conducted for a period of 3mo from October-December, 2013 in Chennai, South India. The study population was enrolled from three IT companies in a city in Chennai. The inclusion criteria consisted of individuals working in the IT industry at least for a period of 6mo, aged 18y or above and giving voluntary, written informed consent. Variable information was gathered by using series of questionnaires and ophthalmic assessment. Information about sociodemographic characteristics was also gathered. Schirmer's test was performed for ophthalmic assessment. All of the analysis was performed by using SPSS vs.16.

• RESULTS: About one fifth (n = 36, 18%) of the participants were suspected to have dry eyes, with mean age of 29y (SD=7), and majority of them being males, graduates/ postgraduates, single, living in extended families in urban areas. Windy environment significantly showed to aggravate redness (P = 0.04) and burning sensation of the eyes (P = 0.000). Similarly, watching television significantly showed to aggravate gritty sensation (P=0.01) and led to excess mucous in the eyes (P=0.02).

• CONCLUSION: Based on the results of our study, it can

be concluded that the exposure to various daily activities such as watching television, using computer, reading, and use of air conditioning and windy environments (dry environments) were associated with signs and symptoms of dry eyes. Also, watching television and windy environment were significantly positively correlated with some of the signs of dry eye. This study emphasizes the urgent need of multi-factorial approach including policy measures for addressing the burden of dry eye in population.

• KEYWORDS: dry eye syndrome; information technology professionals; blurred vision; computers; redness of eyes
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INTRODUCTION

Dry eye syndrome (DES) is a growing public health problem and one of the most frequent reasons for seeking eye care[1-3]. Dry eye is defined as a multifactorial disease of tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tears film instability with potential damage to ocular surface. It is accompanied by increased osmolality of tear film and inflammation of ocular surface"[4]. Dry eyes can adversely affect common tasks of daily living such as reading and driving and negatively impact the vision-related quality of life[1-3], psychological health and overall well-being[5,6]. This disease has significant economic implications, including costs associated with increased healthcare utilization, missed school or work days, adverse effect on leisure and quality of life issues[7].

Prevalence rates of DES ranges from 5.5%-37.7% in the general population and more common in women[8]. Factors which predispose to DES include socio-demographic characteristics like age (30-40y), female gender, urban region; systemic and age-related diseases and medications; environmental factors like smoking and air pollution; occupational exposures to computers and use of air-conditioning[7,8]. Windy environments, increased television watching and reading time have also been reported to be associated with clinical signs of DES[2]. An increase is noted in the young to middle aged population with the dramatic increase in the amount of work undertaken using visual display terminals (VDTs) such as computer screens[9]. Visual-related problems to be the most frequently reported health-related problem occurring in over 70% of computer workers. Studies in India estimate that every 7 of 10 information technology (IT) students had eye-related problem, with females facing more burden than male counterparts[10]. Ocular problems in occupational computer users have been observed in 23%-32% from Japan[11] and in more than 65% in various studies from India[12]. In a knowledge economy with growing numbers of workers using computers, visual strain can affect performance and overall workforce productivity[13]. It is likely that the ever increasing demands of modern living that require prolonged visual tasking[1] like extensive use of computers in daily life seems to be an important contributing factor[8,14].

Symptoms following sustained computer use have been found to be significantly worse than those that look at a hard paper copy under similar viewing conditions[15]. Ocular symptoms experienced by visual display terminal users are eyestrain, tiredness, irritation, burning sensation, redness, reduced visual acuity, ocular pain, double vision, and dry eyes[8,16]. The degree of work performance loss is most prominent among self-reported dry eye office workers[11]. Factors affecting increased visual symptoms among VDT users include VDT displays, working practices, environment and workstation design. However, there is little attention and evidence on interventions, especially ergonomics-related, to reduce visual symptoms[13]. Office ergonomic studies have suggested both medical and office ergonomic interventions (*e.g.* improved lighting conditions and optometric corrections, adjustable chair design) coupled with office ergonomic training to improve visual health and potential productivity in computer-related jobs[13].

A better understanding of the physiology underlying to visual syndromes is critical to determine more accurate diagnosis and treatment to ocular disorders, which will allow practitioners to provide solutions for optimal visual comfort and efficiency during computer operation[15]. IT professionals spend the majority of their workday in front of computer screens. However, it is unclear of the frequency of other eye aggravating activities IT professional engage in during their work day and outside of their IT occupation, and how much DES is attributable from visual display terminal use. Dry eyes attributable to daily activities have been studied among dry eye disease patients[4]. However, such evidence from developing countries like India, with the IT service industry growing at a rate of 14%-18% annually[17], is missing. With VDTs becoming quintessential in almost every industry, such evidence may be required urgently to plan tailored occupational health interventions.

Thus, the present cross sectional study was conducted to determinethe burden of DES among IT professionals and examine association of DES between various daily activities.

SUBJECTS AND METHODS

This was a pilot cross-sectional study conducted for a period of 3mo from October to December, 2013 in Chennai, South India. The study population was enrolled from three IT companies in a city in Chennai. The inclusion criteria consisted of individuals working in the IT industry at least for a period of 6mo, aged 18y or above and giving voluntary, written informed consent. Individuals with mental or physical challenges making it difficult to participate in the study, or enrolled in other clinical studies were excluded from the study. The investigator contacted the Human Resource Department (HRD) of each of the IT companies and sought permission by explaining the study objective, the procedures

involved in the study and demonstrating the Schirmer test to the HRD. Three IT companies, employing about 750 individuals, gave permission for the study to be conducted on their employees. Of these, 210 refused to participate. A simple random sampling technique was used to select a convenience sample of 200 individuals. For this, all 540 individuals were assigned numbers and by random selection, 200 individuals were enrolled. The participants were interviewed in a separate place allotted by the HRD of the companies to maintain participant confidentiality. Written Informed consent has been obtained from each and every participant after explaining the about the study and objectives of the study, before the recruitment as "study subjects". Those participants who have given written informed consent and who agreed to undergo "Schimmer´s" test ONLY has been included in the study and those subjects who have either refused to give written informed consent and/or refused to undergo "schimmer´s" test have been excluded from the study.

The study conformed to the Declaration of Helsinki and the study protocol was approved by the Institutional Review Board (IRB) of Foundation of Healthcare Technologies Society, New Delhi, India (IRB#FHTS/008/2013). Ethical approval has been obtained from the IRB of Foundation of Healthcare Technologies Society, New Delhi, India and the IRB number is: IRB#FHTS/008/2013.

Data Collection Tools Variable information was gathered through a series of questionnaires and ophthalmic assessment was performed by Schirmer test. Each questionnaire has been outlined below.

Socio - demographic Characteristics The variables assessed included age, gender, income, total household members, marital status, household location, family type and educational level. Job information was gathered by interviewing about the current designation, duration in the present occupation, duration of working in the field of IT, previous occupations and duration and workdays and rest days in a week and year.

Dry Eye Questionnaire It includes 12 questions that focus on clinical risk factors for DES. The questions employ response options that vary in number and type. For example, question 1 had three response categories consisting of yes (2), no (0), and uncertain (1), whereas question 9 had four response categories, consisting of never (0), sometimes (1), often (2), and constantly (3). For the final two questions (11 and 12), the three response categories were yes (2), no (0), and sometimes (1) (2).

Activity Log Questionnaire The participants were given an activity recording form and told to complete the form as they performed their usual activities like a diary. In blocks of 15min, time spent performing known DES - aggravating activities was recorded in the log. Items assessed included time spent in air - conditioned environment, in windy environment, driving, reading, computer use, watching television, smoking, contact lens use, and watching movies in the theater. Marking more than one column of the chart in any particular unit of time was permissible when more than one item was satisfied concurrently. A "windy environment" included an indoor situation exposed to a revolving fan or outdoor in a windy environment. The log was completed for 1 typical rest day and 1 typical work day. A variable was computed based on the weighted average of the number of rest days and work days each subject reported to have per week (usually 5 work days and 2 weekend days)[4].

Schirmer's Test Schirmer test was performed after the interview at the study premises. For Schirmer's test, a 35mm×5mm size filter paper strip (Contacare Ophthalmics & Diagnostics, Vadodra, India) was used to measure the amount of tears produced over 5min. The strip was placed in the inferior fornix at the junction of outer one third and medial two thirds of the lower eyelid. The patient was instructed to keep their eyes closed during the course of the test. The level of tears on the strip was then read off and recorded in millimetres. The right eye was assessed first followed by the left. The entire procedure took 15min[4].

Statistical Analysis Descriptive analysis was performed using univariate statistics to report means and standard deviations for the continuous variables and frequency distribution for the categorical variables. Spearman correlation coefficient, t - statistic and 1 - way Analysis of Variance (ANOVA) were performed to compare differences in the continuous variables. Chi-square and Fisher Exact analyses were performed to compare the frequency of categorical variables. Results with a P-value of less than 0.05 were considered statistically significant. All analysis was performed using SPSS v.16.

RESULTS

A total of 202 participants were enrolled between months of October to December 2013. All 202 participants completed the activity logs. Mean age of the participants was 29y (SD=7.6). Males formed the majority (n=158, 78%) of the participants. Mean household size was 4 (SD=2) with a mean annual household income of 638 618 (SD=5, 39 691) Indian National Rupees (INR).

About one fifth (n=36, 18%) of the participants were suspected to have dry eyes, with mean age of 29y (SD=7), and majority of them being males, graduates/ postgraduates, single, living in extended families in urban areas. However, none of these variables were found to be statistically significant (Table 1).

Schirmer Test Participants with dry eye had similar mean Schirmer's test scores for both right and left eyes (mean=22; SD=11) which was lower than that for participants without dry eye (right: mean=24; SD=10; left: mean=26; SD=9) and this difference was not statistically significant.

Participants suspected with dry eye had significantly higher total score (mean=38; SD=8; P=0.000), symptoms score (mean=17; SD=5; P=0.000) and sensitivity to conditions (mean=15; SD=7; P=0.000) compared to those without dry eye (Table 2). Participants suspected to have dry eyes self reported to have significantly more eye strain (mean=3;

Table 1 Socio-demographic characteristics of study participants with and without dry eye

Variables	All (n=200)	Dry eye (n=36)	Non-dry eye (n=166)	P
Age	29±7.6	29±7.0	28.87±7.8	>0.05
Sex (F/M)	44/156	11/25	33/133	>0.05
Marital status (M/S)	82/118	14/22	69/97	>0.05
Family type (joint/nuclear/extended)	3/99/98	0/17/19	3/82/79	>0.05
Education [graduate (or) postgraduate/post high school diploma but no college/some college]	167/29/6	33/3/0	134/26/6	>0.05
Household income in INR	638 618±539 691	680 556±449 228	629 524±558 160	>0.05
No. of people in house hold	4±2	5±2	4±2	>0.05
House hold location (urban/rural/other)	184/15/1	34/2/0	150/15/1	>0.05
Duration in present occupation (a)	4±5	3.6±3	4.1±5	>0.05

INR: Indian National Rupees.

Table 2 Mean symptom, condition sensitivity, clinical and medication scores among participants with and without dry eye

Symptoms/conditions	Dry eye	Non-dry eye	P
Redness	3±1	1±2	
Sandy or gritty sensation	3±2	1±2	
Itching	3±1	1±2	
Excess watering	2±2	1±1	
Burning	3±2	1±1	
Blurred vision (corrected by blinking)	3±2	1±2	>0.05
Smoker	2±2	1±2	
Lights	2±1	1±1	
Air pollution	2±1	1±1	
Heater	2±5		
Contact lens	1±1		

SD=2; P=0.000) and excess blinking (mean=1; SD=2; P=0.007) compared to participants without dry eye. None of them reported to have any medical conditions or on any medications except lubricating eye drops (n=4; 2%). None of the participants reported to be post menopausal.

The average time spent on different activities for dry eye and non dry eye participants is shown in Figure 1. On calculating the weighted average of each activity over a mean of 5 working days and 2 rest days, exposure to air conditioning (mean=9; SD=3), windy environment (mean=8; SD=4) and VDTs/computers (mean=7; SD=2) were higher followed by mean time of exposure to activities such as driving (mean=1; SD=1), reading (mean=1; SD=1), smoking (mean=0.4; SD=1) and wearing contact lens (mean=0.01; SD=0.1). Exposure to all activities, except driving and smoking, were reportedly higher among participants with dry eye compared to those with non dry eye. Time spent in watching television was found statistically significant with dry eye (r=0.14; P=0.042) while exposure to driving was negatively correlated with dry eye (r=-0.05) but not significant (P=0.479).

All of the symptoms, except gritty sensation and excess watering, of dry eye were negatively correlated with exposure to driving. However, it was not statistically significant (Table 3).

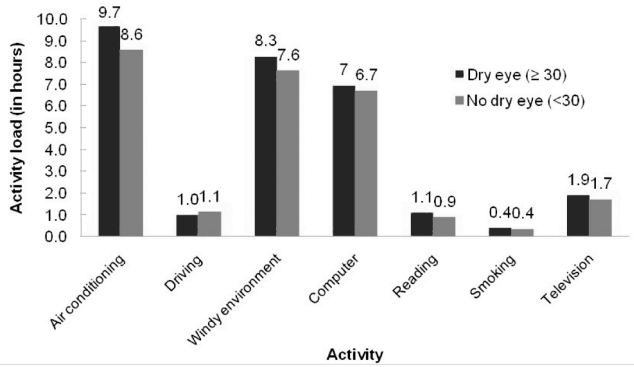

Figure 1 The mean number of hours spent on different activities for dry eye and non dry eye participants.

Windy environment significantly showed to aggravate redness (P=0.04) and burning sensation of the eyes (P=0.000). Similarly, watching television significantly showed to aggravate gritty sensation (P=0.01) and led to excess mucous in the eyes (P=0.02).

DISCUSSION

There are approximately 6 computers/1000 population with 18 million personal computers and increasing in India alone[12]. A prospective dose-response relationship has been seen between computer usage and visual symptoms since research on visual effects and comfort effects of VDT work has been recommended[13]. Visual discomfort results in lost productivity[13], and prevention and early detection of visual symptoms among computer users is considered an important strategy[18]. This pilot study thus attempted to assess some of the factors associated with dry eye among IT professionals in South India.

The McMonnies questionnaire is among the earliest and most widely used screening instruments for DESs with sensitivity reportedly varying between 87% and 98% and specificity between 87% and 97%[19].

An activity log, a continuous monitoring tool, has been said to be useful as a clinical tool to monitor the extent of behavioural adjustment and allow clinicians to recognize the impact of certain activities on the dry eye status of the patients. Lifestyle modifications may be a very useful adjunct in the management of DES[4].

Table 3 Time spent for each item and correlations with dry eye symptoms

Activity	Redness	Sandy/gritty sensation	Itching	Excess watering	Burning	Excess mucous	Blurred vision
Use of air conditioning	$r=0.00$	$r=0.10$	$r=0.07$	$r=-0.02$	$r=0.03$	$r=0.08$	$r=0.03$
	$P=0.97$	$P=0.16$	$P=0.31$	$P=0.082$	$P=0.73$	$P=0.26$	$P=0.68$
Driving	$r=-0.04$	$r=0.02$	$r=-0.05$	$r=0.03$	$r=-0.03$	$r=-0.07$	$r=-0.09$
	$P=0.58$	$P=0.80$	$P=0.49$	$P=0.69$	$P=0.64$	$P=0.30$	$P=0.23$
Windy environment	$r=0.15$	$r=0.09$	$r=-0.08$	$r=0.03$	$r=0.20$	$r=-0.07$	$r=-0.05$
	$P=0.04$	$P=0.20$	$P=0.25$	$P=0.67$	$P=0.000$	$P=0.36$	$P=0.49$
Computer	$r=-0.04$	$r=0.03$	$r=0.01$	$r=0.05$	$r=0.06$	$r=-0.03$	$r=-0.03$
	$P=0.58$	$P=0.67$	$P=0.90$	$P=0.50$	$P=0.37$	$P=0.70$	$P=0.72$
Reading	$r=-0.04$	$r=0.07$	$r=0.01$	$r=0.02$	$r=0.05$	$r=0.10$	$r=-0.03$
	$P=0.56$	$P=0.34$	$P=0.84$	$P=0.80$	$P=0.53$	$P=0.15$	$P=0.65$
Smoking	$r=-0.06$	$r=0.08$	$r=0.04$	$r=0.01$	$r=0.06$	$r=0.01$	$r=0.02$
	$P=0.39$	$P=0.25$	$P=0.62$	$P=0.91$	$P=0.38$	$P=0.93$	$P=0.73$
Watching television	$r=0.07$	$r=0.18$	$r=0.13$	$r=0.03$	$r=0.02$	$r=0.16$	$r=0.06$
	$P=0.34$	$P=0.01$	$P=0.07$	$P=0.68$	$P=0.79$	$P=0.02$	$P=0.40$

The mean age of participants with suggested dry eyes was 29y. This is similar to a study among computer users[12,14] and attributed to the increasing use of computers among younger age groups. One fifth (36%) of the participants had score 30 or more suggestive of dry eyes. This study found that exposure to daily activities such as watching television, using computer, reading, and use of air conditioning and windy environments (dry environments) were associated with signs and symptoms of dry eyes. This observation was similar to a study by Iyer *et al*[4] among dry eye patients. The average time on using computers (7h) was also similar to this study.

Watching television and windy environment were significantly positively correlated with some of the signs of dry eye. Increased episodic blur vision with increased duration of watching television which was linked to possible higher tear evaporation and tear film instability due to reduced blinking was documented in literature[4]. Windy environment was significantly associated with redness and burning of the eyes which was similar to finding by Iyer *et al*[4]. Tear evaporation rate is reported to increase in low humidity environments such as air conditioning and dry windy environment, also demonstrated by significantly increased blurring[4]. In the present study, use of air conditioning was positively associated with blurring of vision, but not significant, and a reduction in excess watering was observed and can be explained as above.

Increased exposure to driving, windy environment and computers was seen to reduce some of the symptoms of dry eye[4]. This has been suggested as an "activity modification" where people with dry eye tend to avoid such environments or drive less due to their condition.

The modification of behaviour for selected activities among participants with dry eye has also been observed[4] and has been suggested that this could be due to the inability to change work-related activities (*e. g.* use of computer) compared to leisure activities, and conclude for a behavioural modification approach.

Medical cost for the treatment of dry eye outweighs the loss of productivity, producing economic benefits. Thus, it is very important to provide treatment for dry eye, because it not only improves quality of life for individual office workers, but also contributes to vitalization of the entire industry[13]. Moreover, cost-effective ergonomic measures such as incorporation of anti-glare screens[12], taking periodic breaks and increasing knowledge and awareness[20] have been found to significantly reduce visual symptoms. An urgent multi-sectoral collaboration to stringently deploy prevention measures has also been suggested. This would also include sensitizing the employers and employees[4].

Limitations of the Study The study population was limited to one geographical setting which could limit its generalization to all IT professionals. Secondly, this was a cross sectional study and thus cannot establish causality of the multiple factors involved in DES. Thus, a longitudinal study with a larger population is warranted to study causality. Though Schirmer test is used to objectively assess dry eye, relying on it solely may lead to an incomplete or inaccurate representation of the disease as the physician only assesses the patients in a very specific time in a confined artificial environment. Daily leisure and work-related activities apart from computer use were associated with clinical signs and symptoms of dry eye among IT professionals. A multi-factorial approach of addressing medical interventions and office ergonomics, behaviour modification and policy measures may be urgently needed to reduce the morbidity, loss of productivity and quality of life due to dry eyes.

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