



Survey on Ocular Symptoms Among Microscope Users in Electronic Industry, India

Gaurav Kumar Bhardwaj*, Phani Krishna Athreya and Nice Ghosh

Department of Optometry and Vision Science, Amity University, India

*Corresponding Author: Gaurav Kumar Bhardwaj, Department of Optometry and Vision Science, Amity University, India.

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Abstract

Purpose: The purpose of this survey is to evaluate ocular symptoms and to understand relation between dry eye disease, years of experience at work among microscope users associated to electronic industry in India.

Methods: This is a cross-sectional, questionnaire based prospective study. Subjects aged between 18 to 30 years working in electronic industry with microscopes were included who did not have any history of ocular disease and surgery. Data related to their demographics, ocular symptoms, DEQ-5 questionnaire and CISS questionnaire were obtained from all the subjects. Data was entered in to excel and a statistical analysis including Spearman's rank correlation coefficient were applied using SPSS software.

Results: Studying a sample of 246 participants, it was revealed that tiredness of eye, loss of concentration were the most common, and floating of objects was the least common symptom among all asthenopia related symptoms. 37.40% of the total participants are suffering from symptoms of dry eye disease. A positive correlation (0.308) between the DEQ-5 score and experience at work has been found in this study.

Conclusion: Symptoms of dry eye and eye tiredness are commonly seen among microscope users of electronic industry. Yearly ocular evaluation and dry eye assessment are recommended for electronic industry workers working with microscopes. Taking a brief, frequent break during work can provide relief from tired eyes symptom.

Keywords: Microscope; Asthenopia; Dry Eye; Electronic Industry; Eye Tiredness

Abbreviations

DEQ-5: 5-Item Dry Eye Questionnaire; DED: Dry Eye Disease; CISS: Convergence Insufficiency Symptoms Survey

Introduction

Globally, the digital revolution is growing day by day and the electronic industry is the backbone for digital infrastructure development. Government encourages local production of electronic components for supporting digital revolution industry. Bangalore is the hub of major public sector corporations, Defense and Telecommunication electronics in India [1].

In the electronic industry, manufacturing, assembling, inspection play a major role in performance. Vision using microscopes play an important role in PCB (printed circuit board) inspection, rework, electronics failure analysis, and quality control [2]. Most of the work like micro components attachment, touch-up, sealing, soldering, and substrate to package attachment is also done by using a microscopes [2].

While working with microscopes, worker continuously needs high visual concentration for a long duration on each working day. Microscope workers of the electronic industry may experience some

ocular symptoms due to higher demand of visual concentration in their work. This study investigates common ocular symptoms faced by an average microscope user working in the electronic industry. Studies on biological laboratory microscope users has shown eye fatigue, ocular discomfort and headache are common [3]. Recent study conducted among cleanroom microscope workers from an electronic manufacturing industry in Northern Taiwan, revealed that ocular symptoms like eye fatigue, blurring of vision, eye itching and other dry eye related symptoms are the mostly reported [4].

As in the recent past, no potential study has been carried out to evaluate the occupational health status based on internal asthenopia and dry eye symptoms among microscope users of the electronic industry in India. This study will help to bridge the gap.

Therefore, the present study is aimed to evaluate internal asthenopia symptoms and dry eye scores among microscope users working in the electronics industry to improve their health status and occupational problems.

Materials and Methods

A cross-sectional, online survey was conducted using a questionnaire in google form from 1st of July 2021 to 31st of July 2021 to carry out this study. Questionnaire link was circulated among microscope users working in the electronic industry with an age limit of 18-30 years were recruited for this study. Participants with survey responses related to squint, low vision, active eye infection, chronic ocular disease, histories of vision therapy, or ocular surgery were excluded from the study. Fischer’s formula was used for the sample size calculation [5]. Institutional Ethics Committee for Human Research of Amity University Haryana granted ethical clearance for this study with Ref No: IEC-AIB/AUH/2021-16. Before proceeding with the questionnaire, all participants gave informed consent by checking a tick box. In the consent note, all participants were prior informed regarding the survey and explained the confidentiality measures.

Following the inclusion criteria, 84 participants among 330 were excluded from this study. A total of 246 participants’ responses were included in our study. The demographic data and experience at work were also considered as important parameters for data analysis.

Symptoms related to dry eyes questionnaires (discomfort, dryness, watery) were adopted from the clinically validated 5-Item Dry Eye Questionnaire (DEQ-5) [6]. In DEQ-5, the maximum value of the total score is 22. A total score >6 were classified as having Dry Eye [6].

Symptoms related to internal asthenopia were adopted from Convergence Insufficiency Symptom Survey (CISS) questionnaire [7]. The frequency of each question was rated on a 5-point scale (0=Never, 1=Not very often, 2=Sometimes, 3=Fairly Often, 4=Always) [7].

Complete data processing steps were carried out using SPSS and MS Excel software. The Cross-tabulation approach was used for statistically prevalence analysis of dry eye among females and males. Spearman’s Rho Correlation has identified the relationships between DEQ-5 scores with Experience at work.

Results and Discussion

Results

In this study, among 246 participants 44.31% were male participants and 55.69% were female. The age distribution of all the participants is shown in table 1. with range, mean, and standard deviation of the age distribution were as 20-30 years, 25.12 years, and 2.785 years respectively.

Maximum	Minimum	Mean	Standard Deviation
30	20	25.12	2.785

Table 1: Age distribution of the participants of this study.

A pie chart was derived to represent the distribution of the participant’s work experience into 3 categories a. 1-4 years category, b. 5-8 years category and c. more than 9-years category (Figure 1).

Response to CISS questionnaire is shown in table 2. Among internal asthenopia related symptoms tiredness (78.0%), loss of concentration (74.0%), pulling feeling around eyes (64.6%), uncomfortable (61.8%), headache (61.0%), are common. The participants felt that their eyes hurt during prolonged closer work

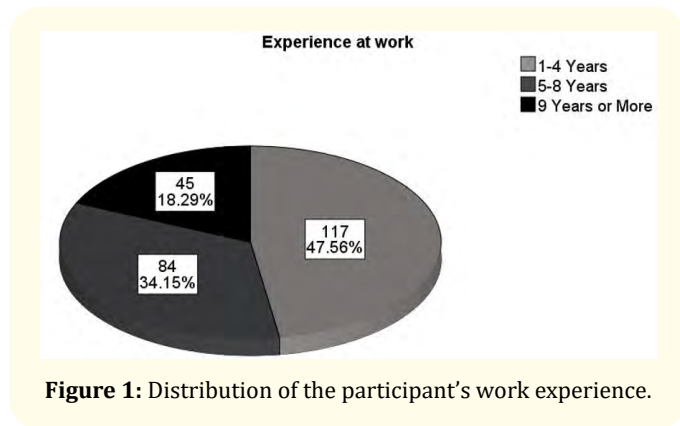


Figure 1: Distribution of the participant’s work experience.

(59.3%), sleepiness (59.3%), loss of place during near activity (57.3%), Sore feeling (48.0%), trouble remembering (43.1%), blurring (42.7%), and they re-read same line (39.4%), they felt slow reading (37.0%). The least common symptoms are double vision (29.7%) and floating of objects (25.2%). After analyzing all the symptoms among all participants, a bar plot was prepared to show the frequency of each ocular symptom in Figure 2.

Symptoms	Frequency (%)				
	Never	(not very often) Infrequently	Sometimes	Fairly Often	Always
Tiredness	54 (22.0%)	50 (20.3%)	89 (36.2%)	36 (14.6%)	17 (6.9%)
Uncomfortable during near work	94 (38.2%)	41 (16.7%)	76 (30.9%)	26 (10.6%)	9 (3.7%)
Headache	96 (39.0%)	41 (16.7%)	82 (33.3%)	17 (6.9%)	10 (4.1%)
Sleepy	100 (40.7%)	50 (20.3%)	67 (27.2%)	21 (8.5%)	8 (3.3%)
Loss of Concentration	64 (26.0%)	42 (17.1%)	95 (38.6%)	32 (13.0%)	13 (5.3%)
Trouble remembering reading content	140 (56.9%)	34 (13.8%)	49 (19.9%)	17 (6.9%)	6 (2.4%)
Double Vision	173 (70.3%)	30 (12.2%)	30 (12.2%)	9 (3.7%)	4(1.6%)
Floating of Objects	184 (74.8%)	21 (8.5%)	31 (12.6%)	7 (2.8%)	3(1.2%)
Slow Reading	155 (63.0%)	40 (16.3%)	33(13.4%)	12(4.9%)	6(2.4%)
Eyes Hurt	100 (40.7%)	43 (17.5%)	82 (33.3%)	12 (4.9%)	9 (3.7%)
Sore Feeling	128 (52.0%)	49 (19.9%)	42 (17.1%)	21 (8.5%)	6 (2.4%)
Pulling feeling around eyes	87 (35.4%)	47 (19.1%)	71 (28.9%)	26 (10.6%)	15 (6.1%)
Blurring	141 (57.3%)	37 (15.0%)	52 (21.1%)	11 (4.5%)	5 (2.0%)
Lose place during activity	105 (42.7%)	50 (20.3%)	62 (25.2%)	21 (8.5%)	8 (3.3%)
Re-read same line	149 (60.6%)	37 (15.0%)	31 (12.6%)	23 (9.3%)	6 (2.4%)

Table 2: Frequency of internal asthenopic symptoms.

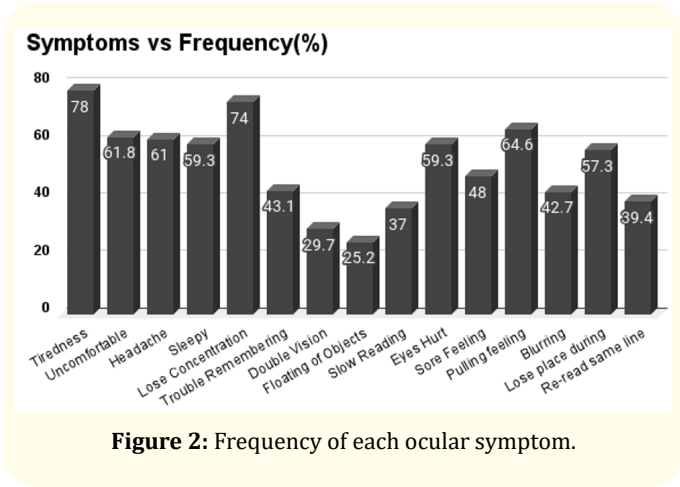


Figure 2: Frequency of each ocular symptom.

The percentage of dry eye disease 37.40% (DED) and the normal eye is shown in Figure 3. Cross-tabulation of dry eye with gender showed a statistically higher prevalence among females than males. Among them 25.20% are female and 12.20% are male (Figure 4). In table 3 it has been shown that there was a positive correlation between the DEQ-5 score and experience at work. In this case, Spearman’s Rho Correlation coefficient value is 0.308.

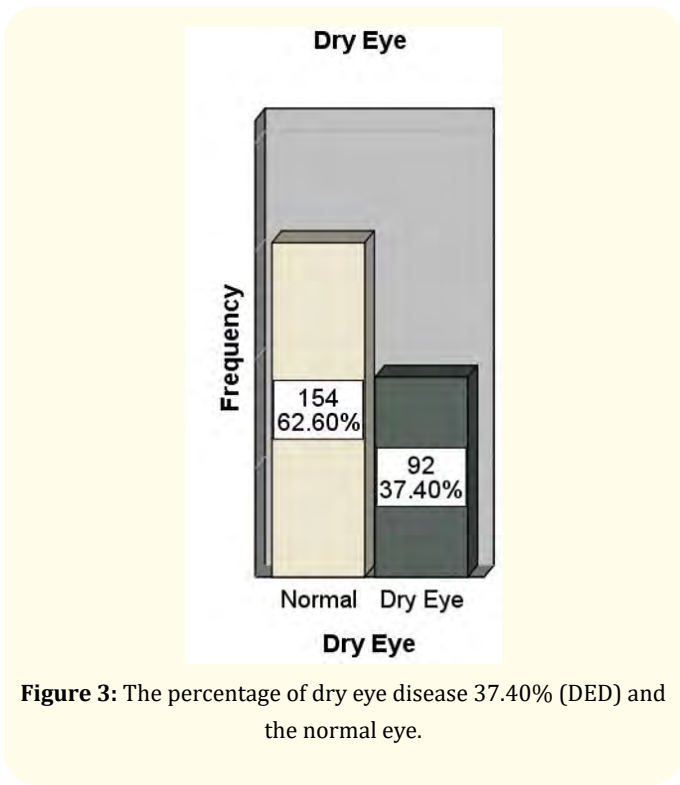


Figure 3: The percentage of dry eye disease 37.40% (DED) and the normal eye.

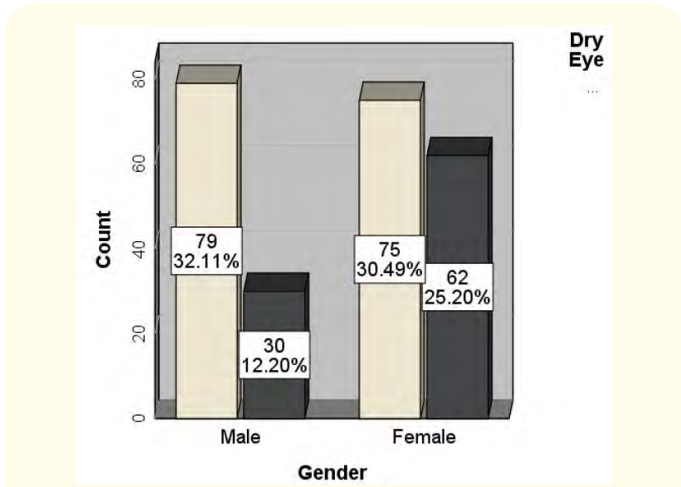


Figure 4: Cross-tabulation of dry eye with gender.

		Experience at work	Dry Eye	
Spearman's rho	Experience at work	Correlation Coefficient	1.000	.308**
		Sig. (2-tailed)	.	.000
		N	246	246
	Dry Eye	Correlation Coefficient	.308**	1.000
		Sig. (2-tailed)	.000	.
		N	246	246

** . Correlation is significant at the 0.01 level (2-tailed).

Table 3: Correlation between experience at work and dry eye disease.

One bar plot was also derived to represent the changes in the population of dry eye symptoms with the year of experience of work in Figure 5.

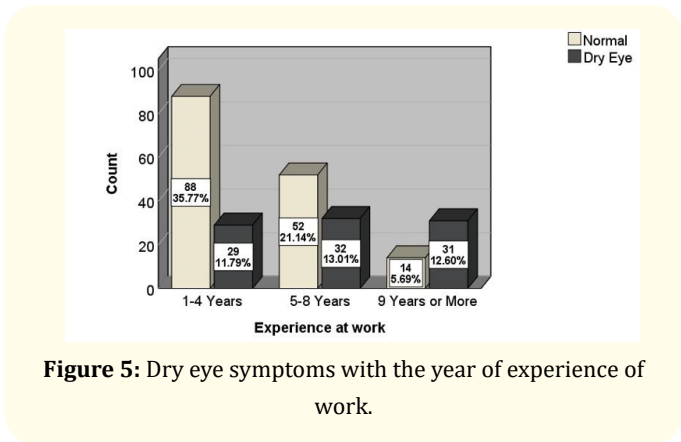


Figure 5: Dry eye symptoms with the year of experience of work.

Discussion

The task of microscope workers in the electronic industry needed high visual inspection demand, which required high cognitive demand. This type of high cognitive demand-related work resulted in a reduced blink rate [8]. Insufficient tear distribution occurs with reduced blinking and it may cause dry eye [9]. Also this type of activity may result in internal asthenopia symptoms. This study analyzed ocular symptoms among microscope workers in the electronics industry.

In a previous study, it has been found that microscope user often reports dry eye, burning sensation, heaviness of the eyelid, and tearing of the eye [10]. In this study, it is founded that 37.40% of workers had DEQ-5 scores greater than the threshold (>6) [6]. Some studies found that there was a proper association between dry eye-related symptoms and work-related factors [11,12]. The results from this study suggest that there is a mild to moderate correlation ($r=0.308$) between the work experience of microscope workers and the dry eye score. So, experience at the work without any precautions and safety rules can be considered as one of the risk factors. Also in one previous study, it was found that among full-time microscope operators in electronic plants 80% resulted in visual strain and the levels of symptoms increase with more time spent with a microscope [5].

In the recent past, a study of cleanroom microscope workers in the electronic manufacturing industry in Northern Taiwan, has revealed that ocular symptoms like eye fatigue 63.7%, dry eye symptoms 41.8%, blurring of vision 13.2% and eye itching 22.0% are most prevalent symptoms [4]. This study has also added that among internal asthenopia related symptoms, the most common symptom is tiredness (78.0%) and loss of concentration (74.0%), pulling feeling around the eyes (64.6%), uncomfortable (61.8%), headache (61.0%), are also very common.

Conclusion

Working with a microscope without any safety protocol is a risk factor for ocular symptoms among electronic industry workers. Dry eye symptoms are very common among microscope users whereas eye tiredness is most common among internal asthenopia-related symptoms. Ocular symptoms may increase with work experience among this group of workers. A regular work break may be helpful to prevent all ocular symptoms.

Conflict of Interest

No financial interest or any conflict of interest exists.

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