

Original Research Article

Musculoskeletal disorders, Asthenopia and associated risk factors in computer workers of Hingna Taluka of Nagpur: A cross sectional study

Dr Rakhee A. Ambade¹, Dr Ajay K. Ambade², Dr Mohan M. Sagdeo³, Dr Pradyna A. Tirpude⁴

¹Associate professor, Department of physiology, NKP Salve Institute of Medical Science, Digdoh Hills, Hingna road, Nagpur, 440009, Maharashtra, India

²Consultant, Ambade Eye Hospital, Indora Square, Kamptee road, 440017, Nagpur, Maharashtra, India

³Professor, Department of physiology, NKP Salve Institute of Medical Science, Digdoh Hills, Hingna road, Nagpur, 440009, Maharashtra, India

⁴Assistant lecturer, Department of physiology, NKP Salve Institute of Medical Science, Digdoh Hills Hingna road, Nagpur, 440009, Maharashtra, India

(Presently working at Jagdalpur Medical College)

***Corresponding author**

Dr. Rakhee Ambade

Email: rakhee_t@rediffmail.com

Abstract: It's cross sectional study to examine various work station factors of computer operators with musculoskeletal and visual discomfort for better understanding the impact of computer on general population with taluka background. Associations between variables were tested for their significance using Chi square test with each leading complaints independently at 5% significance with R programming language. Significant association found between neck symptoms, age and distance of screen, similarly asthenopic symptoms was found to be associated with eye distance and glare of screen. Thus in conclusion we found almost similar prevalence of asthenopia and musculoskeletal disorders in studied population, which makes it essential for concerned authorities to take a note and develop recommendations in office ergonomic designing to enhance work performance by minimizing musculoskeletal and visual discomfort.

Keywords: Computer operators, Computer vision Syndrome, WMSD, Asthenopia, Tehsil, Musculoskeletal disorder, and Painful eyes.

INTRODUCTION

In recent years computer usage has exponentially risen in India. To keep pace with time and technology in all the work sectors, Computer has brought mutiny everywhere and computer related health hazards, which is equally affecting urban as well as rural population. Working on computers cause work related musculoskeletal disorders (WMSD) [1, 2] and Asthenopia [3, 4] which is also as a common computer work related problem in operators. As it demands frequent saccadic eye movements and continuous eye focusing hence requires repetitious activity of ciliary and extra ocular muscle and constant adjustment of body posture that produces eye fatigue and musculo skeletal strain. In many forms these musculoskeletal disorders arise from visually demanding task [5, 6] and commonly ascribe as computer vision syndrome (CVS) [7, 8].

Many studies documented risk factors for visual and musculoskeletal discomfort as age [10-12] gender [12-14] workstation factors, [15-18] duration of computer usage, [10,18,19] spells of computer usage, [20] psychosocial problems [12, 13,20,21] and many

more but there is a limited evidence for causal association of workstation habits and physiological factors between computer work and visual and musculoskeletal discomfort at tensile level and therefore, it is required to find out the predominance of factors inducing it; to promote good work practice. Hence this study was undertaken to find out the prevalence of WMSD and Asthenopic complaints in computer workers also we hypothesized that these complaints must be less contemplating their Psychosocial and ethnic background.

STUDY DESIGN

It is cross sectional study carried in age group of 17- 50 yrs. The subjects were selected from common population from Hingna, Taluka of Nagpur district working in cooperative banks and computer institute for more than six months duration. 95 enrolled subjects were interviewed; after taking verbal consent. The pre-designed questioner was filled for asthenopic complaints, work related musculoskeletal disorder, & working habits. Subjects working places were also inspected to find outwork station accessories and factors. The risk factors studied were age of person,

duration of computer usage, number of breaks, refractive status of the person, usage of antiglare screen, level of computer screen from eyes. Subjects working more than four hours [13, 15] on computer per day for minimum five days i.e. 20 hours per week [22] and corrected vision 6/6 were included in study. Subjects working less than the criteria, person having other musculoskeletal abnormalities, thyroid disorder, corneal disorders, conjunctivitis, subjects taking any type of medication were excluded from studies [23]. Person reporting any of the visual or skeleto motor complaints during or after working on computer labeled as WMSD and asthenopic cases. Presence or absence of these symptoms was tested for their significance of association with demographic parameters as well as different habits of computer usage. Chi-square test was used to determine the significance of association of these factors with each symptom type independently, at 5% level of significance. For associations involving more than two levels of factor and with cell frequencies less than 5, simulated p-value was obtained as a reliable estimate of p-value. The analysis was performed using R-programming language.

RESULTS

Out of 95 subjects, 71 people fulfill the criterion, which includes 39 males and 32 females. The mean age

of the subjects was 33.74 + 8.6 with mean age of beginning of computer usage 24.75 +7.89. The average computer usage was 6.3+ 2.1hourperday for 8.65+4.7 years. Data revealed three WMSD symptoms, Pain in back(69.01%), Pain in neck (64.78%)and Pain in leg joints(32.29%) were leading complaints followed by painful wrist joint, while asthenopic symptoms viz. Painful sensitive eye(40.84%), Itching in eyes(33.8%), and Redness (28.16%)were predominantly present followed by headache(26.76%) and blurring of vision(21.12%)(Fig1, Fig2). Association of age and computer working habits with leading asthenopic and WMSD complaints were evaluated. Painful sensitive eye symptom was significantly associated with the distance of eyes from screen (p=0.0075, table4) while itching in eyes were found associated with need of antiglare screen (p=0.03971, table 5). These foremost asthenopic complaints were not found associated with age of subject(table1), hours of usage of computer(table2),number of breaks (table3) and errors of refraction(table 6). We also observed pain in neck was significantly associated with age of subject (p=0.05647, table 7) and eye distance (p=0.01949, table 8) from screen. The principal observed WMSD complaints was not found associated with hours of computers usage and level of computer screen. (Table 9 and 10)

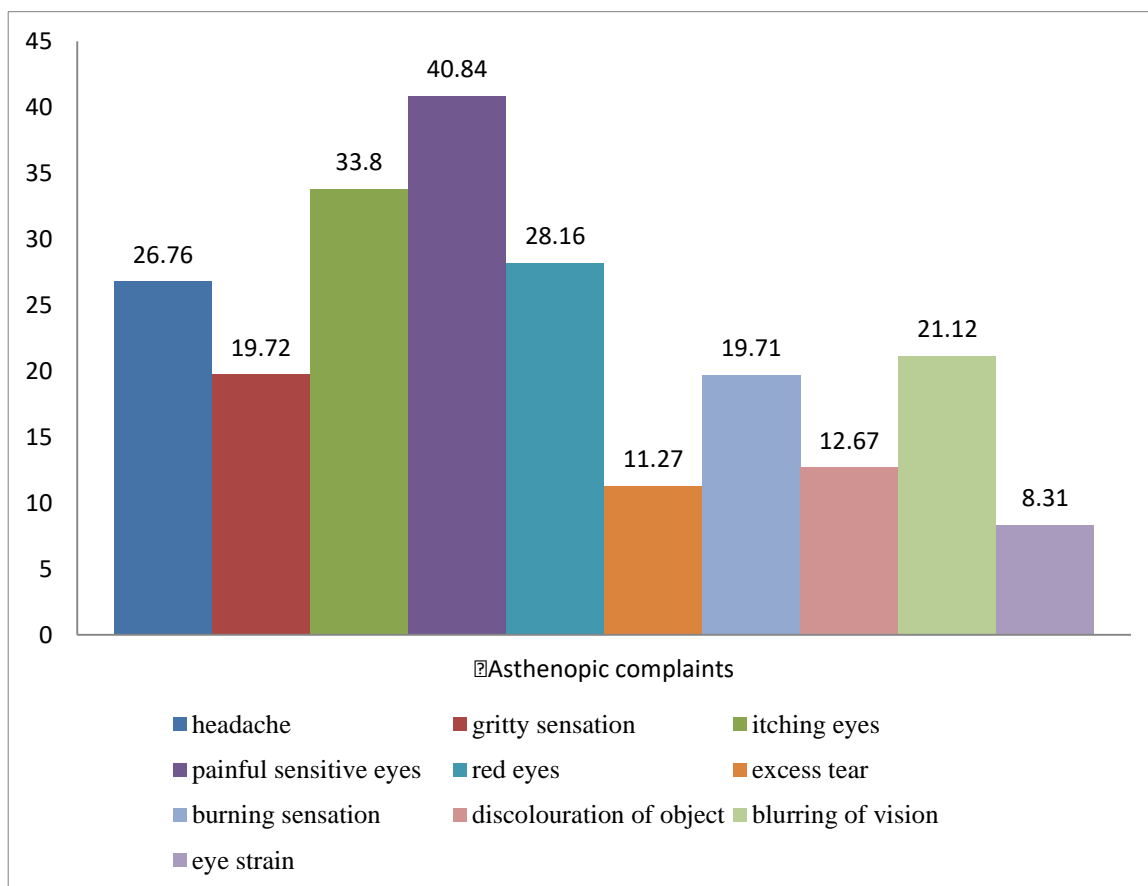


Fig 1 : Prevalence of asthenopia in computer workers

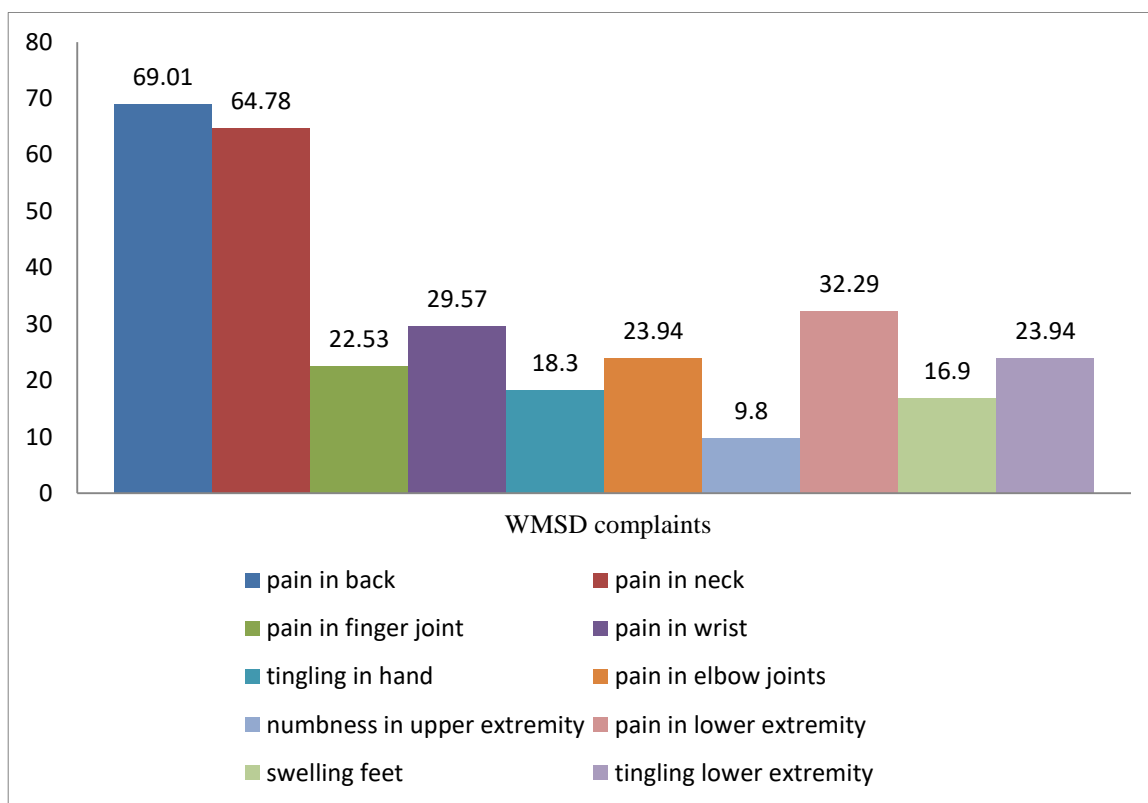


Fig 2: Prevalence of WMSD in computer workers

Table 1: Association of Age of subjects and asthenopic symptoms

Age (years)	Itching in eyes		Painful & sensitive eye		Redness	
	Yes	No	Yes	No	Yes	No
10-20	0	2	1	1	0	2
20-30	11	16	8	19	8	19
30-40	6	19	11	14	6	19
> 40	6	5	7	4	3	8
p-value	0.2174		0.2664		0.9055	

Table 2: Association of Computer usage (hrs.) and Asthenopic symptoms

Usage in hrs	Itching in eyes		Painful & sensitive eye		Redness	
	Yes	No	Yes	No	Yes	No
4-6	12	24	22	14	12	24
7-9	13	20	7	26	9	24
10-13	1	1	1	1	0	2
p-values	0.6807		0.4284		0.7944	

Table 3: Association of number of breaks and Asthenopic symptoms

Number of breaks	Itching in eyes		Painful & sensitive eye		Redness	
	Yes	No	Yes	No	Yes	No
1-3	17	31	23	25	13	35
4-6	3	8	3	8	3	8
> 6	1	2	0	3	0	3
No breaks	2	1	1	2	1	2
p-value	0.7926		0.2814		0.8501	

Table 4: Association of Eye distance and Asthenopic symptoms

Eye distance (in inches)	Itching in eyes		Painful & sensitive eye		Redness	
	Yes	No	Yes	No	Yes	No
<12	7	11	2	16	3	15
13 - 24	8	20	14	14	7	21
25 - 36	8	11	11	8	7	12
p-value	0.5944		0.0075*		0.3712	

****Indicates p value < 0.05**

Table 5: Association of antiglare screen need and Asthenopic symptoms

Use of antiglare screen	Itching in eyes		Painful & sensitive eye		Redness	
	Yes	No	Yes	No	Yes	No
Yes	10	7	5	12	4	13
No	13	35	22	26	13	35
p-value	0.03971*		0.3711		0.9991	

****Indicates p value < 0.05**

Table 6: Association of errors of refraction and Asthenopic Symptoms

Refractive status	Itching in eyes		Painful & sensitive eye		Redness	
	Yes	No	Yes	No	Yes	No
Myopia	4	3	4	3	3	4
Presbiopia	4	2	4	2	1	5
Hypermetropia	1	2	2	1	0	3
Emetropic	14	35	17	32	13	36
p-value	0.1705		0.2628		0.5017	

Table 7: Association of age of subjects and WMSD complaints

Age	Pain in Back		Pain in neck		Pain in lower extremity joints	
	Yes	No	Yes	No	Yes	No
10-20	0	2	0	2	1	1
20-30	18	9	15	12	6	21
30-40	19	6	18	7	9	16
> 40	9	2	9	2	5	6
p-value	0.1039		0.05647*		0.4588	

****Indicates p value < 0.05**

Table 8: Association of Eye distance from screen and WMSD complaints

Eye distance	Pain in Back		Pain in neck		Pain in lower extremity joints	
	Yes	No	Yes	No	Yes	No
<12	15	3	13	5	5	13
13 - 24	16	12	13	15	9	19
25 - 36	15	4	16	3	7	12
p-value	0.1249		0.01949*		0.8876	

****Indicates p value < 0.05**

Table 9: Association of Computer screen level and WMSD complaints

Level of computer screen	Pain in Back		Pain in neck		Pain in lower extremity joints	
	Yes	No	Yes	No	Yes	No
Above	4	0	3	1	2	2
Same	36	15	32	19	16	35
Below	3	3	3	3	0	6
p-value	0.2624		0.7571		0.1964	

Table 10: Association of Hours of computer usage and WMSD complaints

No of hrs of computer usage	Pain in Back		Pain in neck		Pain in lower extremity joints	
	Yes	No	Yes	No	Yes	No
4-6	28	8	26	10	18	18
7-9	22	11	19	14	7	26
10-13	2	0	2	0	0	2
p-value	0.3941		0.5636		0.3302	

DISCUSSION:

Various Studies in India reported computer related WMSD in the ranges 45.2%-86.6% [10, 13, 15, 18, 24-28] and while the asthenopia found to be 33.36%-83.3% [10, 13-15, 18, 24-26]. Most of these studies are carried out in IT professional working at metropolitan cities where work demand, competition drive, ethnical, socioeconomic background and induced Psychosocial stress experience by these subjects is more as compared to the subject working in suburban and tensile areas. Only studies by Bhanderi D *et al.*; [3, 27] showing 75% and 46.3% of WMSD and Asthenopic complaints respectively, had similar Taluka background.

For selection of samples we use criteria based approach for usage on computers, fixing minimum of 4 hours per day, for 5 days per week which was supported by previous studies and also to keep uniformity with previous studies [13, 15, 22]. Our study shows conflicting result our hypothesis that it exhibits almost similar prevalence of WMSD and asthenopic complaints inspite their tensile background. Our findings are accordance with the studies of Bhanderi D *et al.*; reporting WMSD (pain in back-69.01%) and asthenopic(painful and sensitive eyes- 40.84%) as prevalent complaint, but marginally less (Fig 1,2).These leading WMSD complaints were followed by neck pain and pain in lower extremity. Subbarayalu AV [13] and Hameed PS [28] also had similar findings that pain in back as prevalent complaint followed by neck pain. Contrary to our findings previous studies, [10, 16, 18, 21, 24]. illustrate prevalent symptoms as pain in neck followed by pain in back, while Sen A and Richardson SA [20] finds neck and wrist discomfort as predominant symptoms and only few reports lower extremity pain [15, 21,26,28] and tingling [19] ranges from 2%-40%. Our study reports no gender difference for both WMSD and Asthenopia.

Our study findings, significant association of age with pain in back, similar to the Shrivastava SR, Bobhate P [10] which shows association of age for both WMSD and visual complaints; but our study do not find association for asthenopic complaints, which is similar to Banderi D *et al.*; while previous studies [21, 27] found similar association with psychosocial factors and J Sillanpaa *et al.*; [7] found association of age with shoulder pain.

Our study confirms Painful sensitive eye as leading complaint followed by itching and redness. Contrary to our findings previous studies [10, 18] noted redness and eyestrain as prevalent eye complaints. Our study distinguished significant association of eye distance from screen with Asthenopic symptoms(painful sensitive eye) and WMSD complaint (Pain in neck), also itching in eyes was significantly associated with usage of antiglare screen for contrast and brightness adjustment. Distance from screen may be the cause for vergence disparity probably due to ocular muscle fatigue in studied population as uncompensated vergence is associated with increase risk of neck symptoms and most influential factor for these are ocular symptoms [29]. Itching of eyes may be the most presentable symptoms of dry eyes in our study, though found second leading complaint in our study and usage of antiglare screen prevents dryness by minimizing brightness. Logaraj M *et al.*; [25] also had similar findings of association of computer vision syndrome with distance and usage of antiglare screen and frequency of breaks. Studies by Bhanderi D *et al.*; had showed association of asthenopia with eye distance from screen, usage of antiglare screen, level of screen and refractive errors and no association with duration of usage, number of breaks and; WMSD association with psychosocial factors. Our study presented only one similar finding with that of Bhanderi D *et al.*; [3] that no association of Asthenopia with duration of usage of computer; also similar to J Sillanpaa *et al* study; while most of the studies shows strong association with duration of computer usages. Unlike Bhanderi D *et al.*; our studies do not show association with level of computers screen and refractive errors.

Few studies documented association of asthenopia with number of breaks and refractive error, with both visual and musculoskeletal symptoms; but our study failed to show this; perhaps ascribed to more number of emmetropics in the studied population. Other less prevalent complaints found were headache, eyestrain, double vision, gritty sensation and Finger-wrist pain and knee-leg pain similar to the complaints reported in previous reviews [22, 30].

In terms of productivity losses, disability, causation, work comfort and prevention, both Asthenopia and WMSD are continued to be problem for Organizations, Researchers, and Individuals. Notwithstanding the current debate our study appraise

the causation factors of WMSD and Asthenopia are the extra ocular muscle fatigue and dry eyes and recommends to modify worksite equipment that are essential to decrease eye fatigue, awkward body posture and alignment to increase comfort, quality of life and productivity and also advice regular health checkups for computer overuse syndrome who use computer on regular basis.

CONCLUSION:

The early recognition of the computer related symptoms would improve work output and job satisfaction hence prevention strategies have to be undertaken by concerned authorities to minimize the symptoms and also to promote good working technique recommended by occupational safety and health administration like working distance from monitor and usage of antiglare screen for improper lightening conditions at tehsil places. Further longitudinal study may help to understand better association between workstation factors and Computer related syndrome.

REFERENCE

1. Nur turhan, Cecil Akat, MufitAkyuz, Aytul Cakci; Ergonomic risk factor for cumulative trauma disorder in VDU operators International journal of occupational Safety and Ergonomics (JOSE) 2008; 14(4): 417-422.
2. Shrilata,Maiya AG, Bhat V, Sathiakumar N; Prevalence of work-related Wrist and hand Musculoskeletal disorders among computer users, Karnataka states, India, Journal of clinical and Diagnostic research, 2011; 5(3):605-607.
3. Bhanderi DJ, Choudhary SK, Doshi VG; A community-based study of Asthenopia in computer operators. Indian J Ophthalmol, 2008; 56(1): 51–55.
4. Cheng CH, Rong L, Ru-RuL, Zong HZ, Rong BY, Le M; Prevalence of Asthenopia and risk factors in Chinese collage students. Int. J Ophthalmol, 2013, 6(5):718-722.
5. Zetterberg C, Forsman M, Richter HO; Effects of visually demanding near work on trapezius muscle activity. Journal of Electromyography and Kinesiology, 2013; 23: 1190–1198.
6. Ritche HO; Eye neck - scapular area interaction during strenuous near work: Biological plausible pathways with relevance for work musculoskeletal disorders of the neck and upper extremity. Z. Arb. Wiss, 2008; 62: S.3:190-199.
7. Bhagat PR, Pawar GT; Computers, the dryness of technology. Journal of Clinical Research Letters, 2013; 4(1): 65-69.
8. Wimalasundera S; Computer vision syndrome. Galle Medical Journal, 2006; 11(1): 25-29.
9. Loh KY, Reddy SC; Understanding and preventing computer vision syndrome. Malaysian Family Physician, 2008; 3(3):128- 130.
10. Shrivastava SR, Bobhate P; Computer related health problem among software professionals in Mumbai. International journal of health and allied science, 2012; 1(2):74-78.
11. Wu HC, Clin Y ,Chen HC, Wang CH; Key risk factors associated with musculoskeletal disorders in computer workers,http://ir.lib.cyut.edu.tw:8080/bitstream/310901800/7370/1/B32.pdf
12. Mocchi F, Serra A, Corrias GA; Psychological factors and visual fatigue in working with video display terminals. Occupational Environment Med, 2001; 58:267-276.
13. Subbarayalu AV; Occupational health problems of call center workers in India: A cross sectional study focusing on gender differences. Journal of management science and practice. 2013; 1(2): 63-70.
14. Rahman ZA, Sanip S; Computer User: Demographic and Computer related factors that predispose user to get Computer Vision Syndrome. International Journal of Business, Humanities and Technology, September 2011; 1(2):84-91.
15. Singh S, Wadhwa; Impact of Computer Workstation Design on Health of the Users. J. Hum. Ecol., 2006; 20(3): 165-170.
16. Yu ITS, Wong TW; Musculoskeletal problems among VDU workers in a Hong Kong bank. Occup. Med, 1996; 46(4): 275-280.
17. Sillanpää J, Huikko S, Nyberg M, Kivi P, Laippala P, Uitti J; Effect of work with visual display units on musculo-skeletal disorders in the office environment. Occupational Medicine, 2003; 53:443–45.
18. Talwar R, Kapoor R, Puri K, Bansal K, Singh S; A Study of Visual and Musculoskeletal Health Disorders among Computer Professionals in NCR Delhi. Indian Journal of Community Medicine, 2009; 34(4):326-328.
19. SubrattyAH, Korumtollee F; Occupational overuse syndrome among keyboard users in Mauritius. Indian Journal of Occupational and Environmental Medicine, 2005; 9:271-75.
20. Sen A, Richardson SA; A Study of Computer-Related Upper Limb Discomfort and Computer Vision Syndrome. J. Human Ergol, 2007; 36: 45-50.
21. Woods V; Musculoskeletal Disorders and Visual Strain in Intensive Data Processing Workers. Occupational Medicine, 2005; 55:121–127.
22. Veiersted KB, Waersted M; Distal upper limb disorders and ergonomics of VDU work: A review of epidemiological evidence. Norsk Epidemiology, 1999; 9(1): 13-20.
23. Rosen field M; Computer vision syndrome: A Review of Ocular Causes and Potential Treatment. Ophthalmic Or Physiological Optics, 2011; 31:502-515.
24. Sharma AK, Khera S, Khandekar J; Computer related health problems among information technology professionals in Delhi. Indian journal of community medicine, 2006; 31(1):36-38.

25. Logaraj M, Madhu Priya V, Seetharaman N, Hedge SK; Practice of ergonomic principals and computer vision syndrome among undergraduates students in Chennai. *National Journal of Medical Research*, 2013; 13 (2):111-116.
26. Pinto B, Ulman S, Assi H; Prevalence of Occupational Diseases in Information Technology Industries in Goa. *Indian Journal of Occupational and Environmental Medicine*, 2004; 8(1):30-33.
27. Bhanderi D, Choudhary SK, Parmar L, Doshi V; A Study of Occurrence of Musculoskeletal Discomfort in Computer Operators. *Indian J Community Med*, 2008; 33(1): 65–66.
28. Shahul Hameed P; Prevalance of Work Related Low Back Pain among the Information Technology Professionals in India – A Cross Sectional Study. *International Journal of Scientific & Technology Research*, 2013; 2(7):80-85.
29. Richter HO, Zetterlund C, Lundqvist LO; Eye-neck interactions triggered by visually deficient computer work. *Work*, 2011; 39: 67–78.
30. Akinbinu TR, Mashalla YJ; Impact of computer technology on health: Computer Vision Syndrome (CVS). *Med. Pract. Rev*, 2014; 5(3): 20-30.