Visual and Musculoskeletal Problems among Video Display Terminal (VDT) Operators and their Ergonomic and Working Conditions

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Abstract

Introduction: More people operate computers (visual display terminals/VDTs) on a daily basis in workplaces and are exposed to hazards related to continued usage.

Objective: To determine prevalence of musculoskeletal and visual problems in VDT operators by gender and describe working conditions.

Methodology: This was a comparative cross sectional study of musculoskeletal and visual symptoms in 100 VDT operators in Maradana and Borella and an age and gender matched control group. The latter comprised 100 employees not using computers from the University of Colombo and the same workplaces where the study subjects were located. Data were collected using an interviewer administered questionnaire and a check list to assess posture and working conditions. The total number of checklists filled was 25.

Results: Prevalence of visual fatigue 75.0% (95%CI = 66.5-83.5,SND=7.137,p<0.05);burning / tearing eyes 35.0% (95%CI = 25.7-44.3, SND=3.158,p<0.05); neck pain 51.0% (95%CI = 41.2-60.8, SND=5.860,p<0.05); shoulder pain 48.0% (95%CI=38.2-57.8, SND=5.165, p<0.05), wrist pain 26% (95%CI = 17.4-34.6, SND = 2.784, p<0.05) and lower- back pain 49.0% (95%CI = 39. 2-58.8, SND=3.458, p<0.05) were significantly higher among the VDT operators. Sixty percent of VDT operators were females. Blurred vision (SND = 6.04, p<0.05) and double vision (SND = 2.44, p<0.05) were commoner in males, while visual fatigue (SND = 4.15, p<0.05), neck pain (SND = 2.026, p<0.05), elbow pain (SND = 2.552, p<0.05,), wrist pain (SND = 3.100, p<0.05) and finger pain (SND = 4.125, p<0.05) were commoner in females. All parameters of the workstation were in poor conformity to the expected standard except the monitor. All aspects of posture were unsatisfactory except for straightness of lower- back (76%).

Conclusions: Computer use is associated with occurrence of musculoskeletal problems. Females had a higher prevalence of musculoskeletal symptoms while males had a higher prevalence of visual symptoms. We recommend that more comprehensive studies be carried out.

Introduction

The introduction of the computer (Visual Display Terminal/VDT) has resulted in automation of previously manually performed tasks and thus revolutionized the workplace. In Sri Lanka, computers are now being used in both government and private sectors, including small-scale establishments. Computers are now essential equipment in offices as well as in factories, banks, hospitals and many other workplaces. As a result, more people are working with computers on a daily basis and are exposed to the hazards related to its continued use.

VDTs, as with any other equipment, when used properly do not cause adverse effects for the operator. However, they can contribute to significant health and safety problems if they are used improperly or are poorly matched with the operator. Fitting the workplace and working conditions to the physical and mental needs of the VDT operator is recommended as the solution (1). Symptoms such as eye problems and lower back, neck and shoulder pain are common among computer users. These problems adversely affect the workers' quality of life, efficiency of work and result in decreased productivity (2).

An assessment of visual and musculoskeletal symptoms in VDT operators in Sri Lanka has not been reported in the literature. Currently, the younger generation is increasingly engaged in occupations involving information technology. As a result, more people are working with computers on a daily basis, exposing themselves to hazards related to continued use. We can expect an

increase in these work related problems. Hence research into VDT operators is important and this study was carried out to determine the effects of VDT use and to evaluate the workstations of VDT operators in Colombo.

Methods
This was a comparative cross sectional study of musculoskeletal and visual symptoms in VDT operators and an age and gender matched control group. The study was conducted from August 2006 to December 2006. Sample size was not calculated. The workstations and postures of 25 VDT operators were also assessed. It was initially planned to assess the workstations of all VDT operators who participated in the study, but this was not possible due to limited access to workstations.

Study population
The study sample consisted of 100 VDT operators from two clusters in Borella and Maradana. Data were gathered from 47 VDT operators from Borella and 53 from Maradana. After the interview, participants were given a specially designed leaflet educating them on preventive measures. The exclusion criteria were: age <20 and >59 years; diagnosis of arthritis, osteoporosis or rheumatism; duration of employment <6 months and duration of computer use <4 hours per day.

Control group
This consisted of 100 employees who did not use computers, from the University of Colombo and workplaces where the study group was drawn. Employees who were holding desk jobs (clerks, secretaries and peons) were selected. Those who were doing manual labour were excluded from the study.

Study instruments:
These were specially designed according to the recommended standards (1,3,4,5).

1. An interviewer administered questionnaire for VDT operators and the control group on symptoms. This was developed in English and translated to Sinhalese and Tamil.

2. Check list to assess ergonomic and working conditions of VDT operators. This contained two separate sections to evaluate the workstation and posture of VDT operators. The monitor, worktable, chair and visual environment were each evaluated separately. The participants were assessed while working at the workstations and they were unaware of being assessed.

In order to maintain uniformity in data collection the tasks of filling in the checklist, interviewing the participants and recording information at the interview were divided among the three researchers and maintained throughout data collection. The wording of questions, the degree of prompting and clarification were the same for all participants. Permission to carry out the study was obtained from the relevant heads of the workplaces. Informed verbal consent was obtained from the participants. Statistical analysis was performed using SPSS Windows Version 13.

Results
Of the 42 workplaces visited, 28 gave permission to interview their VDT operators. A total of 193 VDT operators were invited to participate. The sample was selected until 100 VDT operators agreed to be interviewed. Workstations of 25 VDT operators were observed. All 100 employees invited to be in the control group consented.

Socio-demographic characteristics
Mean age of the study population was 29.9 years (SD= 9.094) while the mean age of the control group was 29.6 years (SD=8.069). The majority (73%) of both VDT operators and the control group were in the age group of 21-30 years. Sixty eight percent of VDT operators and 55% of the control group were unmarried. The majority of both VDT operators (60%) and the control group (58%) were females.

Employment
The job profiles of VDT operators included typesetting (39%), computer applications (20%), software engineering (14%) and data entry (4%). Majority of female VDT operators were doing typesetting (35) and computer applications (15) while the most common employment of males was software engineering (12). The control group included clerks (57%), library assistants (16%), secretaries (8%) and peons (3%).

Details on computer usage of VDT operators are given in table 1.

Table 1: Computer usage of VDT operators

Computer usage in current employment	% (n=100)
Duration of use (years)	
<1	33.0
1-5	37.0
6-10	26.0
>10	4.0
Number of hours at the computer per day	
4-6	92.0
>=6	8.0
Typing skill	
Hunt and peck	4.0
Rapid two finger	20.0
Touch	76.0
Usage of keyboard and mouse	
Keyboard predominantly	39.0
Mouse predominantly	14.0
Both equally	46.0
Do not know	1.0
Mean typing speed by gender	words per minute
Male	25.4
Female	27.9
All	26.9

Visual and musculoskeletal symptoms

A significantly higher proportion of VDT operators had the following symptoms compared to the control group: visual fatigue, burning/tearing, neck pain, shoulder pain, wrist pain and lower back pain.

Table 2 summarizes the frequency of symptoms experienced by the study and control groups.

The commonest symptom in VDT operators was visual fatigue, while the control group commonly reported headache.

In assessing musculoskeletal symptoms of the neck and upper limbs, reported symptoms were categorized according to the sidedness: mousing side, non-mousing side, both sides and central. Of those with shoulder pain, 36 (75%, n=48) reported pain to be on the mousing side. Twenty six (51%, n=51) of those with neck pain said the pain was central. Out of 26 VDT operators with wrist pain, 18 said the pain was on the mousing side. Of those who predominantly used the mouse, no one complained of wrist pain, finger pain or numbness in the hand. Those who were key board operators complained of wrist pain.

Table 2: Prevalence and comparison of visual and musculoskeletal symptoms in VDT operators and control group

Symptom	VDT operators % (95%CI)	Control % (95%CI)	SND (p value)
Headache	53.0 (43.2-62.8)	46.0 (36.2-55.8)	1.000 (p>0.05)
Visual fatigue	75.0 (66.5-83.5)	30.0 (21.0-39.0)	**7.137 (p<0.05)**
Blurred vision	22.0 (13.9-30.1)	21.0 (13.0-29.0)	0.172 (p>0.05)
Double vision	7.0 (2.0-12.0)	7.0 (2.0-12.0)	
Burning/Tearing	35.0 (25.7-44.3)	16.0 (8.8-23.2)	**3.158 (p<0.05)**
Dry eyes	14.0 (7.2-20.8)	8.0 (2.7-13.3)	1.362 (p>0.05)
Itchy eyes	13.0 (6.4-19.6)	11.0 (4.9-17.1)	0.435 (p>0.05)
Neck pain	51.0 (41.2-60.8)	15.0 (8.0-22.0)	**5.860 (p<0.05)**
Shoulder pain	48.0 (38.2-57.8)	16.0 (8.8-23.2)	**5.165 (p<0.05)**
Arm pain	11.0 (4.9-17.1)	0.0	
Elbow pain	8.0 (2.7-13.3)	8.0 (2.7-13.3)	
Forearm pain	5.0 (0.8-9.2)	3.0 (0.7-5.3)	(0.723 p>0.05)
Wrist pain	26.0 (17.4-34.6)	11.0 (4.9-17.1)	**(2.784 p<0.05)**
Finger pain	17.0 (9.6-24.4)	11.0 (4.9-17.1)	(1.227 p>0.05)
Numbness in hand	6.0 (1.4-10.6)	0.0	
Tingling in hands/ fingers	10.0 (4.1-15.9)	12.0 (5.6-18.4)	(0.452 p>0.05)
Lower back pain	49.0 (39.2-58.8)	26.0 (17.4-34.6)	**(3.458 p<0.05)**
Tingling in legs/feet	6.0 (1.4-10.6)	8.0 (2.7-13.3)	(0.555 p>0.05)

Gender

A statistically significant difference between males and females was observed in the following symptoms: visual fatigue, blurred vision, double vision, neck pain, elbow pain, wrist pain and finger pain. Blurred vision and double vision were more common in males, while the rest of the symptoms were more common in females. Table 3 shows the symptoms which have a significant difference by gender.

Table 3: Symptoms showing a significant difference by gender (p value<0.05)

Symptom	% of VDT operators (95%CI)		SND
Njn,nm	Male, n_1=40	Female, n_2=60	
Visual fatigue	60 (50.4-69.6)	85 (78.0-92.0)	4.15
Blurred vision	42.5 (32.8-52.2)	8.3 (2.9-13.7)	6.04
Double vision	12.5 (6.0-19.0)	3.3 (0.8-5.8)	2.44
Neck pain	42.5 (32.8-52.2)	56.7 (47.0-66.4)	2.03
Elbow pain	2.5 (0.5-4.5)	11.7 (5.4-18)	2.55
Wrist pain	15 (8.0-22.0)	33.3 (24.1-42.5)	3.10
Finger pain	5 (0.8-9.2)	25 (16.5-33.5)	4.12

Workstation

The total marks allocated for the workstation was 30. The mean of the marks given to the 25 workstations observed was 19.96 (66.5%). Over two thirds (16 out of 25) of the work stations scored <50% for work table while all workstations scored >50% for the monitor (table 4).

Posture

The VDT operators were observed for conformity with the recommended standard (Table 5). This was best seen in straightness of back.

Table 4: Distribution of percentage of marks allocated to workstations

Workstation component	Number of workstations (N=25)	
	<50% marks	>50% marks
Monitor	0	25
Work table	16	9
Chair	6	19
Visual environment	6	19

Table 5: Observations of the posture

Characteristics of the posture	N	%
Back straight	19	76.0
Lower back supported	2	8.0
Head and neck straight and in line	9	36.0
Upper arms and elbows close to the body	13	52.0
Forearms and arms are at right angles	15	60.0
Forearms and wrists are parallel to the floor	7	28.0
Forearms, wrists and hands are straight and in line	17	68.0
No sideways movement of wrists	10	40.0
Thighs are parallel to the floor	0	0.0
Feet are flat on the ground or on a firm footrest	11	44.0

Discussion

Visual fatigue, burning/tearing of eyes, neck pain, shoulder pain, wrist pain and lower back pain was significantly higher in VDT operators compared to the control group.

The prevalence of visual fatigue was 75% (95%CI=66.5-83.5). A previous study found the same prevalence of visual symptoms in Information Technology professionals in India (6). Visual problems and stress were found to be more common in subjects in software development while musculoskeletal problems were more common among data entry/processing operators. In this study, due to the sample size, it was not possible to identify associations between job category and the prevalence of symptoms.

Blurred vision and double vision were commoner in males, while visual fatigue, neck pain, elbow pain, wrist pain and finger pain were commoner in females. This is in accordance with previous studies, where females were found to experience significantly more musculoskeletal symptoms and a twofold increased risk of developing forearm pain (6,7).

A limitation of previous studies (2,6,7,8) was the absence of a control. As non-specific somatic complaints are commonly found in the normal population, it could not be argued that they were more common in VDT operators. In this study, an age and gender matched control group was drawn from the University offices and institutions in the same location as the study subjects. Therefore, it was possible to identify the symptoms where a true difference existed between the 2 groups.

A major difficulty in carrying out this study was collecting the sample of 100 VDT operators. Many workplaces had to be visited and >150 VDT operators were invited. The non-respondents indicated lack of time as the reasons for refusal. The key personnel who refused permission to interview VDT operators of their institutions indicated as reasons for refusal tight schedules as well as apprehension, even after being assured of confidentiality. Due to the inadequate sample size, it was not possible to identify associations between job category and symptoms. It was also not possible to identify other aspects such as psychological problems and stress.

Workstation assessments have been carried out in previous studies by participants, which was not an objective method (6). In this study, all the workstations were observed and evaluated in the same manner by the same observer. However, this also presented a difficulty as only 25 workstations could be assessed due to difficulties in accessing the workstations.

Majority of the work stations scored <50% for work table while all workstations scored >50% for the monitor. The characteristics of the monitor conformed better to the recommended standards compared to the worktable.

The posture was unsatisfactory except for straightness of back and position of forearms and wrists.

As this study was done on a small sample from a few institutions in Colombo, more comprehensive studies should be carried out. VDT operators and administrators of workplaces need to be educated on correct workstation design and posture for operating computers.

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