International Journal of Occupational Safety and Ergonomics (*JOSE*) 2011, Vol. 17, No. 2, 195–205

Neck–Upper Extremity Musculoskeletal Disorders Among Workers in the Telecommunications Company at Mansoura City

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Objectives. *This study was to determine the prevalence and work-related risk factors of neck–upper extremity musculoskeletal disorders (MSDs) among video display terminal (VDT) users.* ***Methods.*** *A comparative cross-sectional study was conducted; there were 60 VDT users and 35 controls. The participants filled in a structured questionnaire, had electrophysiological tests and an X-ray of the neck.* ***Results.*** *The prevalence of MSDs was higher (28.3%) among VDTs users compared to controls (14.3%) with no statistically significant difference. The prevalence of cervical disorders with or without radiculopathy (18.3%) was the most common disorder followed by carpal tunnel syndrome (6.6%). The mean (*SD*) age of MSD cases (51 ± 7.2 years) was statistically significantly higher than of the controls (42.8 ± 9). Physical exposure to prolonged static posture (OR: 6.9; 95% CI: 0.83–57.9), awkward posture (OR: 5.5; 95% CI: 0.6–46.4) and repetitive movements (OR: 5.5; 95% CI: 0.65–46.4) increased risk of MSDs with a statistically significant difference for static posture only (*$p < .05$*). VDT users experienced more job dissatisfaction, work-overload and limited social support from supervisors and colleagues.* ***Conclusion.*** *VDT use did not increase the risk of neck–upper extremity MSDs. The risk increased with older age and static posture.*

work-related musculoskeletal disorders carpal tunnel syndrome video display terminal telecommunication workers

1. INTRODUCTION

In the past 30 years work-related musculoskeletal disorders (MSDs) have become a growing concern in industrialized countries [1]. Most studies on those disorders have been based on populations in Europe and North America and cannot be generalized to other populations due to differences in the economic, social and healthcare systems [2].

Carpal tunnel syndrome (CTS) is a frequent outcome of work-related MSDs; it is associated with significant cost and disability [3]. The relation between computer use and CTS is still controversial and to date there have been few studies on the subject. In Massachusetts, USA, workers who frequently used video display terminals (VDTs), such as insurance adjusters, data entry operators, general office clerks, computer operators and secretaries, had high incidence of CTS [4]. In 1994, Hales, Sauter, Peterson, et al. reported increased prevalence of upper extremity work-related MSDs among telecommunication workers who used VDTs. Among these work-related MSDs, tendon-related

We want to express our deep thanks and appreciation to all the workers in Mansoura Telecommunications Company for their generous co-operation.

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disorders were most common, followed by muscle-related disorders, nerve entrapment, joint-related problems and ganglion cysts. Hand–wrist was the area most affected, followed by the neck, the elbow and the shoulder areas [5].

A cross-sectional study conducted in the telecommunications industry in Malaysia revealed that the overall prevalence of MSDs among different occupations like VDT operators, switchboard operators, clerks, data entry processors and supervisors was 31.2% and it was different among the various occupations. It was highest in switchboard operators and data processors and lowest in supervisors [6]. Toomingas, Nilsson, Hagberg, et al. studied symptoms and clinical findings related to the musculoskeletal system among call center (CC) operators in Sweden and found that they were more symptom-loaded than other professional computer users in spite of their younger age and shorter exposure. Their symptoms were long-lasting and recurrent. Muscle tenderness and nerve symptoms in the neck–shoulder region were the most common specific findings [7]. Moreover, Rocha, Glina, Marinho, et al. found that the prevalence of neck–shoulder symptoms was 43% and of wrist–hand was 39% in CC operators in Brazil [8]. Also, Norman confirmed that CC operators had a higher prevalence of neck–upper extremity disorders than other professional computer users [9].

CC operators' jobs require spending most of their working time responding to telephone calls and using a VDT at the same time, hence, they are exposed to the same ergonomics hazards and, consecutively, musculoskeletal symptoms and disorders as VDT users who work in telecommunication companies [9].

Employees at a medical facility who were identified as frequent VDT users were surveyed; the frequency of clinically defined CTS was 10.5% and the frequency of electrodiagnostically confirmed CTS was 3.5%. The authors concluded that the frequency of CTS in VDT users was similar to that in the general population [10]. A cross-sectional study was also conducted in a communication technology company. It found that the prevalence of CTS symptoms among VDT users was 3.8% in 340 subjects, while prolonged median motor distal latency (>4.2 ms) was disclosed in 3.7% of a subgroup [11].

The main purpose of this work was to study the prevalence and work-related risk factors of neck–upper extremity MSDs among VDT users.

2. SUBJECT AND METHODS

2.1. Study Design and Population

A comparative cross-sectional study was conducted on 95 employees in the Egyptian Telecommunications Company at Mansoura city from February 2006 to August 2007. They were divided into two groups: the at-risk group of 60 telephone operators who used VDTs and the control group of 35 non-VDT users. The at-risk group consisted of telephone operators employed as directory assistance operators (n = 40), telegraph operators (n = 6), cabin operators (n = 4) and data entry operators (n = 10). The control group had clerical jobs without VDT use in the same company; they were matched in age, gender and duration of work.

2.2. Job Description

The at-risk group spent much time sitting at keyboards and VDTs, worked in constrained awkward sitting postures with repetitive hand–arm movements. Leaning forward on the elbows was a common feature of telephone operators. Directory assistance operators used keyboards only to receive incoming and outgoing calls, whereas telegraph operators and data entry operators used keyboards and mouse.

The control group prepared work schedules and assigned switchboard positions, maintained records of incoming and outgoing long-distance and tie-line calls noting duration and time of each call. The posture adopted by the control group was prolonged static sitting position. It caused localized contact stress on the forearm and sometimes the elbow against the sharp edges of the work surface.

3. METHODS

The study had multiple stages. The first sitting included filling in the questionnaire and direct observation of the design of the computer workstations and the work environment at the Telecommunications Company. The second sitting was in the Mansoura University hospital (the neurology and radiology departments) for workers who had symptoms suggesting MSDs to perform the necessary clinical examination and investigation under the supervision of a neurologist. At the end of this sitting, the cases were diagnosed and given the necessary medical recommendations.

3.1. Questionnaire

A structured questionnaire was administered; it fulfilled the requirements of the study and included sociodemographic data (age, gender, smoking and general health status data), occupational history (duration of employment, weekly work hours and job description) and musculoskeletal symptoms (site, onset, course, duration, precipitating workload factors, such as repetitive arm movements, prolonged standing, prolonged sitting period and awkward posture). Items about MSDs and their possible physical risk factors were quoted from the Dutch musculoskeletal questionnaire [12] with responses on a scale from 1—*I never do this* to 4—*much trouble*. Questions on the history of sensory and motor symptoms of the median nerve in both hands, such as tingling and/or numbness in a hand or fingers, pain and weakness were also included in the questionnaire.

3.2. Ergonomics Checklist

A structured observation, in accordance with Dickerson and Baker's ergonomics checklist was used to assess computer workstation design [13]. The checklist included different exposure categories, such as duration of VDT use during current job (in years); duration of VDT use (per working day); position of neck during VDT use; and ergonomics of the keyboard, mouse, screen, desk and chair. The items were categorized as optimal or non-optimal. Work posture was evaluated on the most common posture during the observation. The posture of the neck was evaluated when the operator was looking at the screen or at the keyboard. The work postures of the shoulder, wrist and lower back were evaluated when the operator was using input devices. The checklist also contained questions about the work environment, such as lighting, indoor air quality and background noise [9].

3.3. Work Stress

Psychosocial risk factors were evaluated with questions quoted and formulated by the researcher from a subscale of the questionnaire on the experience and assessment of work [14] and our direct observation of the work environment at different times of the work-shift. For example, "Are your colleagues supportive?" (support from colleagues); "Can you count on your supervisor when you encounter obstacles in your work?" (support from the supervisor); "Do you think your company gives a good salary in comparison to your effort?" or "Are you satisfied with your job in the company?" (financial benefits).

3.4. Anthropometric Measurements

Anthropometric measurements (weight, height and body mass index [BMI][1]) were obtained for all subjects. The subjects were classified according to BMI as underweight (BMI < 18.5), normal weight (BMI = 18.5–24.9), overweight (BMI = 25–29.9) or obese (BMI ≥ 30).

Workers with potential work-related musculoskeletal symptoms of the neck–upper extremity region (pain, stiffness, numbness and tingling or muscle weakness) that had lasted over a year, started with current work and had not been preceded by an accident; or with symptoms that had lasted longer than a week or had occurred at least once a month within the past

[1] BMI = body weight (kg)/height^2 (m^2)

year were referred for clinical examination and investigations (an X-ray of the neck). A subgroup of workers with at least three episodes of numbness, tingling, burning or pain in the fingers, hands or wrists (n = 12) or one episode of over one week during the previous 12 months took part in electrophysiological studies for both median and ulnar nerves in both hands [15].

3.5. Electrophysiological Studies

Nerve conduction velocity (NCV) was studied for both median and ulnar nerves as was electromyography for abductor pollicis brevis and abductor digiti minimi in both hands (Neuropack 2, Nihon Kohden, model MEB/MEM. 7102 A/K.02; Japan). NCV was studied in the electrophysiology unit, Neurology Department, Mansoura University Hospital.

Compound motor action potential was recorded over the abductor pollicis brevis for the median nerve and the abductor digiti quinti for the ulnar nerve. For motor conduction velocity studies distal stimulation was 8 cm away from the recording site and proximal stimulation was at the antecubital fossa. Conduction velocity can be calculated with a single stimulation because there is no transmission along the neuromuscular junction or muscle fibers. Therefore, only one stimulation site was used at the wrist, which is identical to the distal stimulation site in the motor nerve conduction study (13 cm proximal to the active recording electrode). The following parameters were assessed for both motor and sensory NCV: distal motor latency at the wrist and proximal motor latency at the elbow, distal sensory latency, the amplitude of compound motor action potential and sensory nerve action potential, and conduction distance and conduction velocity [16].

3.6. Diagnostic Criteria

3.6.1. Cervical spondylosis and cervical disc space narrowing

The diagnosis was based on the clinical history of neck pain accompanied by stiffness, with radiation into the shoulders or occiput with arm, forearm and/or hand pain. It could be chronic or episodic, with long periods of remission. Radiography confirmed the diagnosis by the presence of cervical spondylotic changes with narrowed disc space.

3.6.2. Cervical radiculopathy

The diagnosis was based on the clinical history and examination findings, such as complaints of neck and arm pain in conjunction with diminished upper limb sensation, reflexes or motor power and positive Spurling's test (radicular pain reproduced with cervical lateral flexion, rotation and axial compression). Radiography confirmed the diagnosis by the presence of cervical spondylotic changes with narrowed disc space.

The diagnosis of the neurogenic thoracic outlet syndrome was based on the clinical history of pain, numbness, tingling and heaviness of the upper extremity with radiography showing cervical rib articulating with first rib.

3.6.3. CTS

CTS was diagnosed on the basis of the clinical history of numbness, tingling, burning or pain on the palmer aspect of the thumb, index, middle and radial half of the ring finger in addition to abnormal electrophysiological findings, i.e., distal motor latency of the median nerve of over 4.2 ms and distal sensory latency of median nerve of over 3.7 ms.

4. STATISTICAL METHODS

Data were analyzed with SPSS version 13 for Windows. The normality data was first tested with one-sample Kolmogorov-Smirnov test. Descriptive statistics, M (SD), were calculated to describe central tendencies in each group. The groups were compared with Student t test for continuous variables and χ^2 for discrete variables. Fisher exact test was used when 50% of cells or more were less than 5; $p < .05$ was considered significant, $p < .001$ was considered highly significant.

5. RESULTS

5.1. Sociodemographic Characteristics

There were no statistically significant differences ($p > .05$) between the at-risk VDT users and the controls in any sociodemographic characteristics (Table 1).

5.2. Musculoskeletal Disorders

There were no statistically significant differences ($p > .05$) between the at-risk VDT users and the controls in the prevalence of neck–upper extremity musculoskeletal disorders. Cervical disorders were the most common disorders among both groups (Table 2).

TABLE 1. Sociodemographic Characteristics of the Study Population

Characteristics	At-Risk VDT Users (%) (*n* = 60)	Controls (%) (*n* = 35)	*p*
Age (years)			
<30	6 (10)	3 (8.6)	
30–45	27 (45)	12 (34.3)	.51
>45–60	27 (45)	20 (57.1)	
M ± *SD*	44.8 ± 9.3	45.6 ± 8.6	.66
Gender			
male	16 (26.7)	10 (28.6)	
female	44 (73.3)	25 (71.4)	.84
Residence			
urban	43 (71.7)	29 (82.9)	.21
rural	17 (28.3)	6 (17.1)	
Marital status			
married	53 (95)	30 (85.7)	
unmarried	3 (5)	5 (14.3)	.14
Education			
secondary general or technical school or lower	13 (21.7)	10 (28.6)	
technical institute	40 (66.7)	18 (51.4)	
university	7 (11.6)	7 (20)	.31
Body mass index (kg/m^2)			
normal (18.5–24.9)	8 (13.3)	5 (14.3)	
overweight (25–29.9)	10 (16.7)	10 (28.6)	
obese (≥30)	42 (70)	20 (57.1)	.18
M ± *SD*	32.38 ± 6.3	30 ± 4.6	.07
Smoking status			
smoker (cigarettes)	8 (13.3)	3 (8.6)	
non-smoker	52 (78.7)	32 (91.4)	.48
Employment (years)			
5–10	14 (23.3)	5 (14.3)	
>10–15	11 (18.3)	5 (14.3)	.42
>15	35 (58.4)	25 (71.4)	
M ± *SD*	19 ± 10.3	20.5 ± 8.6	.46

Notes. VDT—video display terminal.

TABLE 2. Prevalence of Neck–Upper Extremity Musculoskeletal Disorders (MSDs) Among Workers in the Egyptian Telecommunications Company at Mansoura

MSD	At-Risk VDT Users (%) (*n* = 60)	Controls (%) (*n* = 35)	*p*	OR (95% CI)
Overall cases	17 (28.3)	5 (14.3)	.1	2.30 (0.71–8.30)
Cervical spondylosis	11 (18.3)	4 (11.4)	.5	1.70 (0.45–7.18)
Cervical disc space narrowing	11 (18.3)	4 (11.4)	.5	1.70 (0.45–7.18)
Cervical radiculopathy	6 (10)	1 (2.8)	.3	3.78 (0.42–86.93)
Thoracic outlet syndrome	2 (3.3)	1 (2.8)	1	1.20 (0.08–34.01)
Carpal tunnel syndrome	4 (6.6)	0 (0.0)	.2	—

Notes. The total number is not exclusive as some cases had multiple disorders; VDT—video display terminal, OR—odds ratio, CI—confidence interval.

TABLE 3. Risk Factors for Neck–Upper Extremity Musculoskeletal Disorders (MSDs) Among Video Display Terminal (VDT) Users

Risk Factor	MSDs: Cases (%) (*n* = 17)	MSDs: Non-Cases (%) (*n* = 43)	*p*	OR (95% CI)
Personal				
Age (years), *M* ± *SD*	51.5 ± 7.2	42.8 ± 9.05	.003*	—
Gender				
male	5 (29.4)	11 (25.5)	.7	1.21 (0.29–4.93)
female	12 (70.6)	32 (74.5)		
Body mass index (kg/m^2), *M* ± *SD*	32.06 ± 6.70	32.3 ± 6.4	.9	—
Employment (years), median ± *SD*	27.7 ± 7.6	16.8 ± 9.8	.001*	—
Physical				
Static posture				
no trouble ©	1 (5.9)	13 (30.2)	.04*	6.90 (0.83–57.90)
little or much trouble	16 (94.1)	30 (69.8)		
Awkward posture				
no trouble ©	1 (5.9)	11 (25.5)	.08	5.50 (0.60–46.40)
little or much trouble	16 (94.1)	32 (74.5)		
Repetitive hand/wrist motions				
no trouble ©	1 (5.9)	11 (25.5)	.08	5.50 (0.65–46.40)
little or much trouble	16 (94.1)	32 (74.5)		
Forceful hand motions				
no trouble ©	2 (11.7)	9 (21)	.6	0.50 (0.07–3.02)
little or much trouble	15 (88.3)	34 (79)		
Psychosocial				
Job satisfaction				
yes ©	11 (64.7)	30 (69.7)	.7	1.20 (0.38–4.13)
never	6 (35.3)	13 (30.3)		
Perceived long work hours				
yes	4 (23.5)	9 (21)	.8	0.86 (0.22–3.28)
never ©	13 (76.5)	34 (79)		
Work overload				
yes	7(41.2)	12 (27.9)	.9	0.5 (0.17–1.70)
never ©	10(58.8)	31 (72.1)		
Limited social support from supervisors				
yes	4 (23.6)	6 (13.96)	.8	0.5 (0.13–2.10)
never ©	13 (76.4)	37 (86.04)		
Limited social support from colleagues				
yes	3 (17.6)	4 (9.3)	.8	0.4 (0.09–2.40)
never ©	14 (82.4)	39 (90.7)		

Notes. *p < .05, **p < .001; ©—control group, OR—odds ratio, CI—confidence interval.

5.3. Risk Factors of Neck–Upper Extremity MSDs Among VDT Users

The mean age of cases of MSDs was significantly higher compared to non-cases ($p < .003$). However, there was no statistically significant difference between the two groups regarding gender or mean BMI ($p > .05$). Concerning the duration of employment, there was statistically significant longer duration of work among cases of VDT users compared to controls ($p < .01$). Also, cases of MSDs had higher rate of physical exposure in the form of static posture, awkward posture, repetitive arm/hand/wrist movements and forceful hand motions compared to non-cases for static posture only ($p < .05$). Work overload, limited social support from supervisors and colleagues were more frequently reported by cases of MSDs compared to non-cases with no statistically significant difference ($p > .05$). Perceived long work hours were similar among both groups with no statistically significant difference ($p > .05$). Finally, overall job satisfaction was less common among cases compared to non-cases without any statistically significant difference ($p > .05$) (Table 3).

5.4. Nerve Conduction Velocity Studies

The cases of CTS had significantly prolonged sensory and motor latencies ($p < .05$) compared to the non-cases. Also, motor and sensory conduction velocities were slower in CTS cases compared to non-cases, the difference being statistically significant ($p < .05$) in the sensory conduction velocity only (data not tabulated).

6. DISCUSSION

There is considerable growing concern in both the lay and scientific communities that computers place users at increased risk of upper extremity musculoskeletal symptoms and disorders [17, 18]. Numerous studies linked musculoskeletal problems among VDT users with workplace demands [5, 9].

Hales et al. reported that the overall prevalence of potential upper extremity work-related MSDs defined with a questionnaire and physical examination only at 22% among VDT users in a large telecommunications company [5]. The overall prevalence of neck–upper extremity MSDs in our population at the Telecommunications Company was higher among VDT users (28.3%) compared to the control group (14.3%). However, the difference was not statistically significant. Cervical spondylosis, cervical disc space narrowing and cervical radiculopathy were the most common disorders with higher prevalence among VDT users (18.3, 18.3 and 10%, respectively) compared to the control group (11.4, 11.4 and 2.8%, respectively) but this difference was not statistically significant, either ($p > .05$).

These results are in agreement with Toomingas et al. [7] and Rocha et al. [8], who reported that the neck–shoulder region was the most common specific finding among CC operators. Hassan and Abou El-Soaud reported that 66.7% of data entry operators had occupational cervical disorders with radiculopathy, while 33.3% of them had cervical disorders without radiculopathy [19].

In office work, static loading of the neck coupled with dynamic repetitive movements of the wrists and hands are common triggering factors for neck–shoulder complaints particularly among VDT users due to prolonged muscular isometric contraction [20]. Psychosocial exposure at work, such as fear of being replaced with computers [5] and low social support [9], may preferentially affect muscles of the neck–shoulder region.

Moreover, the present study results revealed that 12 out of 95 subjects (12.6%) had symptoms suggestive of median neuropathy so they had electrophysiological tests. CTS was confirmed in 4 out of the 12 subjects (33.3%). The NCV studies of the subjects with symptoms showed significant prolongation of both sensory and motor latencies and significant slowing of sensory conduction velocity among CTS cases compared to non-cases.

The prevalence of CTS among telephone operator VDT users was 3.3% after exclusion of two cases due to the presence of non-occupational risk factors in the form of diabetes

mellitus. These results were consistent with the results of Stevens, Witt, Smith, et al. who reported that 10.5% of a group of computer users at a medical facility met the clinical criteria of CTS and 3.5% were confirmed with nerve conduction studies [10]. According to Hou, Hsu, Lin, et al. the prevalence of CTS among male VDT users in a large communication and information company was 3.8%; they also reported that the percentage was similar to that in the general population [11]. However, Atroshi, Gummesson, Johnsson, et al. reported that the prevalence of CTS which was clinically and electrophysiologically confirmed in the general population was estimated at 2.7% [21]. In a one-year follow-up study of computer users in Denmark, the prevalence of interview-confirmed median nerve symptoms was 4.8% and the one-year incidence of new or worsened CTS symptoms was 1.4% [22].

In our study, the mean age of MSD cases (51.5 ± 7.2 years) was statistically significantly higher than that of non-cases (42.8 ± 9 years) of VDT users. These results were consistent with Premalatha and Noor Hassim's findings who found that older workers had higher prevalence of work-related upper extremity limb disorders in telecommunication workers [6]. El-Hawary, El-Naggar, Soliman, et al. reported that the prevalence of CTS typically increased with age, particularly beyond the age of 35 [23]. Hou et al. reported that prolonged median motor distal latency was associated with older age (over 35 years old) among a group of the male VDT workers in an information and communication technology company in Taiwan [11].

The higher mean age of cases in this study can probably be attributed to the fact that occupational exposure to VDT was relatively short (11 ± 1.4 years) since the use of VDTs at the workplace was quite recent. Moreover, middle and old age is associated with the development of age-related degenerative changes and loss of tissue strength [24]. However, Toomingas et al. reported that young computer operators in the CC group with a short working career had a higher prevalence of neck–upper extremity symptoms than older computer workers in other labor market sectors [7].

Ferreira and Saldiva reported that organizational risk factors for developing upper extremity MSDs among CC operators were longer duration of employment, low job satisfaction and poor workstation design [25]. Meanwhile, the mean duration of employment was statistically significantly higher in neck–upper extremity MSD cases compared to non-cases among VDT users ($p < .01$).

Eleven switchboard operators, 4 telegraph operators and 2 data entry operators had neck–upper extremity MSDs in the current study. Premalatha and Hassim reported that the prevalence of upper extremity MSDs in the telecommunications industry at Malaysia was the highest in switchboard operators and data processors and the lowest in the supervisors [6].

Many studies have described telephone operators' and CC working environment in relation to physical work load due to improper workstation design, high repetition rate during keyboard use, awkward and fixed posture for neck/arm/hand/wrist for long work hours of VDT use, few breaks and poor physical environmental conditions [5, 7, 8, 9].

These study results showed that cases of MSDs had a higher frequency of exposure to physical risk factors than non-cases. Physical exposure included static posture as a consequence of prolonged sitting concentrating on the computer screen, awkward posture of the neck/shoulder/wrist due to combined use of VDT and headsets, repetitive arm/hand/wrist movements during keyboard use and, to a lesser extent forceful, hand motions. This difference was statistically significant for static posture only ($p < .05$).

Repetitive movements during typing are common for most VDT workers, but the risk of CTS does not profoundly increase without concurrent exposure to forceful movements or vibration. Static posture of the neck and upper extremities is common for VDT users but the wrist posture is not so extreme as to lead to the development of CTS as was observed in other occupations, such as meat packer and dental hygienist [26].

Work overload and limited social support from supervisors and colleagues were more frequently reported for cases of MSDs compared to non-cases with no statistically significant difference ($p > .05$). Perceived long work hours were nearly the same in cases and non-cases ($p > .05$). Finally, overall job satisfaction was less common among cases (64.7%) than non-cases (69.7%) without any statistically significant difference between the two groups ($p > .05$).

A positive aspect of the psychosocial working conditions in the Telecommunication Company was a high level of social support from colleagues (88.3%) and a good level of job satisfaction (68.3%), which can be explained by major organizational changes that occurred during the time of study and a reduction in the workload achieved by transferring main services to principal centers in Cairo and Alexandria.

Devereux, Vlachonikolis and Buckle reported that physical and psychosocial risk factors could potentially interact at work to further increase the risk of symptoms of MSDs of the hand–wrist and upper limbs [27].

Finally, psychosocial factors can interfere with the recovery of cases, it may be necessary to discuss them with supervisors or someone from the company's management to attempt to resolve these problems in co-ordination with the company's occupational physician. It is difficult to attempt to change workstation design in such large companies at once but it is feasible to educate operators about the proper use of VDTs or about taking multiple minibreaks for posture changes and rest exercises.

7. CONCLUSION

This study showed that there was no statistically significant difference in the prevalence of neck–upper extremity MSDs among VDT users compared to controls. The results revealed that the mean age of VDT users with MSDs was statistically significantly higher than of those without. Physical risk factors (repetitive hand/wrist motions, awkward wrist posture and forceful hand motions during keyboard use) were more common among CTS cases compared to non-cases with a statistically significant difference for prolonged static posture only. Moreover, psychosocial factors (job dissatisfaction, work overload and limited social support from supervisors and colleagues) were more frequently reported among cases than non-cases, but the difference was not statistically significant.

Limitations of the study

- The relatively short time VDTs had been used in the Egyptian Telecommunications Company at Mansoura (they were introduced in 1994).
- A main service provided by the switchboard department in the company was transferred to principal centers in Cairo and Alexandria, which resulted in a marked downsizing of the number of switchboard operators and a smaller number of studied VDT users.

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