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Determining Risk Factors in Cumulative Trauma Disorders of Computer Users and Effects of Risk Factors on Disability

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Abstract

Objective: The aim was to determine the rate of cumulative trauma disorders (CTD) among computer users, to question the risk factors concerning CTD, to assess the disability and depression levels of patients, and to examine the interaction between these factors.
Material and Methods: One hundred fifty computer users were included in the study. They were classified as the "complainant group (Group 1, CTD+)" having symptoms in the neck, back, and upper extremity and "non-complainant group (Group 2, CTD-)" having no symptoms. In the control group, 50 non-computer user hospital staff were included (Group 3). All participants were asked to fill our questionnaire form, including detailed risk factor query and physical examination. Pain was assessed by the visual analog scale. The Jamar hand dynamometer was used for isometric hand grip strength measurement. The Beck Depression Scale (BDS) was used for the assessment of the emotional mood of the participants. To measure the general disability levels of the participants, the Quick DASH Score (QDS) was used, and to measure disability levels during work, the Quick DASH Work Score (QDWS) was used.
Results: QDS, QDWS, and BDS scores were significantly higher in the complainant group than in the non-complainant and control groups ($p<0.01$ - $p<0.05$). Statistically significant correlations were found between QDS, QDWS and increased time spent in the profession, increased daily working time, number of days per week in the complaint, pain duration, increased BDS score, decrease in family and social life satisfaction, and decreased hand grip strength.
Conclusion: We determined that CTD and mood disorders are common among computer users. We believe that recovery in workplace conditions, ergonomic circumstances, depression, and negative aspects in social life have a great importance in the treatment and more importantly in the prevention of this clinic entity that cause serious disability and work force loss.
Keywords: Cumulative trauma disorders, pain, risk factors, disability

Introduction

Cumulative trauma disorder (CTD) is a common clinical condition in which discomfort, disability, or persistent pain occurs in the joints, muscles, tendons, and other soft tissues regardless of the presence of physical symptoms (1). This disorders is also given names such as work-related cervicobrachial illness, occupational overuse syndrome, upper extremity musculoskeletal disorder, upper extremity pain syndrome, and repetitive strain syndrome (2, 3).

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Today, the rapidly increasing use of computers among workers has led to an increase in the frequency of musculoskeletal disorders (4). Among computer users, these disorders are predominantly seen in the neck, shoulders, wrists, hands, and elbows and are less frequently seen in the back and waist (5). In a review of cross-sectional and cohort studies on the risk factors for work-related musculoskeletal disorders (WMSDs) among computer users in several countries, the prevalence was found to be approximately 50%; a correlation between WMSD and work posture, daily computer usage time, data input, "mouse" clicking frequency, and some psychosocial risk factors was observed (6). The introduction of computers to workplaces has led to changes in work organizations and the development of new risk factors and diseases. These emerging problems adversely affect human health and national economies (7).

A large number of non-work factors may also be risk factors for CTD. The aim of this study is to inquire about the risk factors for CTD in computer users among our hospital workers, assess the level of disability and depression among those affected, and examine the interaction between these factors.

Material and Methods

For inclusion in the study, 180 individuals between the ages of 20 and 50 years working in the hospital's data processing center were screened between December 2011 and March 2012. Those with active inflammatory and infectious diseases, active psychiatric diseases, recent major trauma, fractures and/or dislocations, and active rheumatic disease as well as those who were pregnant were not included. Thirty individuals were excluded because they did not match the inclusion criteria. As the control group, 62 hospital employees who were without active locomotor system complaints and who were not computer users were included. Twelve control subjects with the same exclusion criteria were excluded. As a result, 150 computer users and 50 control subjects were finally included. Informed consent was obtained from all included participants, and the study was approved by the Ethics Committee of the Ministry of Health Ankara Training and Research Hospital.

Physical examinations of the participants were performed, and findings were recorded. In the physical examination, cervical range of motion was measured and recorded. In the shoulder examination, speed's test was performed for biceps tendinitis, Neer test for rotator cuff syndrome, and supraspinatus tests for supraspinatus tendonitis (8). The presence of the lateral epicondylitis and medial epicondylitis was investigated with specific tests. Tinel's test was performed to evaluate the presence of cubital tunnel syndrome. Tinel's and Phalen's tests were performed for the diagnosis of carpal tunnel syndrome (CTS), and the participants were queried about symptoms of shaking hands and nocturnal paresthesia (9). Electrophysiological examinations were performed in participants whose test results were positive. Finkelstein's test was performed to detect the presence of de Quervain's tendinitis (10). Computer users were divided into two groups according to whether they had the symptoms of locomotor system disorders mentioned above in their back and upper extremities. Thus, the following three groups were formed: the group of participants with complaints (104 computer users with CTD), the group of participants without complaints (46 computer users without CTD), and the control group (50 asymptomatic hospital employees who were not computer users).

For all participants, a detailed risk factor questionnaire and prepared questionnaire form, including physical examination, were completed. In this form, demographic characteristics of the participant such as age, gender, weight, height, marital status, occupation, and the dominant hand were questioned and recorded. The questionnaire form consisted of questions on the following parameters: personal health history such as history of systemic diseases, history of rheumatic diseases and musculoskeletal disorders, chronic drug use, smoking habit, and menstrual cycle; work-related factors such as time spent in profession, daily working hours, working hours without break, wage adequacy (yes or no), job satisfaction, and workplace satisfaction; detailed assessment associated with pain such as the presence of pain in the neck and upper extremity-if pain was present, localization, duration, propagation, how many days a week it occurred, and diurnal variations; and other factors such as the presence of children and satisfaction of family and social lives.

The pain evaluation of the participants was made with the visual analog scale (VAS). The participants were told what the numbers from 0 to 10 placed on a 10-cm line and were told that no pain meant a value of 0 and the most severe pain meant a value of 10; they were then asked to accordingly grade their pain. Job satisfaction and satisfaction with working conditions and family and social lives were assessed with VAS. After explaining to the participants that dissatisfaction meant a value of 0 and satisfaction meant a value of 10, they were asked to mark a value.

Isometric grip strength was measured with a Jamar hand dynamometer (Preston Co., USA). Measurements were taken when the elbow was in flexion and the forearm was in a neutral position. Measurements were taken in the right and left hands three times one after another, and the average was taken; the result was recorded as the average of isometric right- and left-hand grip strength.

The Beck Depression Inventory (BDI) was used to assess the emotional state of the participants, and the results were recorded. The scale developed by Beck in 1967 consists of 21 questions. On this scale, which is arranged in the form of a questionnaire, the participants were asked to choose the most suitable sentence for themselves. Each item is composed of four sentences. These sentences ranged from a neutral condition (0 points) to the most severe condition (3 points). These sentences consisted of the expression of patients with depression who admitted for treatment. The highest score is 63. Points between 0 and 13 were considered as no depression, those between 14 and 24 were considered as moderate depression, and those over 25 were considered as serious depression (11).

The Turkish version of the Quick Disabilities of the Arm, Shoulder, and Hand (DASH) scoring was used to measure the general level of participant disability (12). In this scoring system, the participants were asked 11 questions regarding the difficulty in daily activities, limitations in social relations, and pain. At least 27 of the 30 items must be completed for a score to be calculated. The assigned values for all completed responses are simply summed and averaged, producing a score out of five. This value is then transformed to a score out of 100 by subtracting one and multiplying by 25. The Quick DASH work score was used to evaluate the disability of the participants during the study. In this scoring, the participants were asked four questions examining restriction and pain in their professional life. The answers were scored, and high scores showed poor results.

Statistical Analysis

Data analysis was performed using the SPSS for Windows 11.5 (SPSS Inc.; SPSS 11.5 Syntax Reference Guide, Chicago, IL, USA). Normality of distribution was investigated with the Shapiro–Wilk test, and the homogeneity of variance was investigated with Levene's test. Descriptive statistics for continuous variables were shown as mean±standard deviation or median and ranges; nominal variables were expressed as the number of cases and percentage (%).

The significance of differences between the groups in terms of averages was evaluated through one-way analysis of variance. The significance of differences between groups in terms of median values was analyzed with the Mann–Whitney U test between two groups and with the Kruskal–Wallis test among three groups. When the result of Kruskal–Wallis test statistics was found significant, Conover's non-parametric multiple comparison test was used to detect situations that caused the differences. Nominal variables were examined using Pearson's Chi-square or Fisher's exact chi-square test. The Spearman correlation test was used to investigate whether there was a statistically significant correlation between the continuous variables.

Multiple variable stepwise linear regression analysis was used to determine the most decisive factors among all factors that are effective or those that were considered to be effective on pain severity, Quick DASH score, and Quick DASH work score. Later, when adjusting according to age gender and risk factors identified as being the most effective in stepwise regression analysis, lineer regression analysis with multipl variables was performed to examine the effects on pain level, Quick DASH score and Quick DASH work score of the groups with and without complaints in comparison with the control group. Regression coefficients and 95% confidence intervals of each variable were calculated. Because data related to pain level, Quick DASH score, and Quick DASH work score were not

Table 1. Demographic, anthropometric, and other clinical features of participants according to the groups

Variables	Existing complaint (n=104)	No complaint (n=46)	Control	p value
Age (years)	31.1±6.2	30.5±6.6	31.9±5.8	0.551
Gender				0.632
Male	32 (30.8%)	18 (39.1%)	18 (36.0%)	
Female	72 (69.2%)	28 (60.9%)	32 (64.0%)	
Menstrual regularity				0.427
None	5 (6.9%)	3 (11.1%)	2 (6.3%)	
Regular	16 (22.2%)	6 (22.2%)	4 (12.5%)	
Irregular	51 (70.8%)	19 (77.8%)	26 (81.3%)	
BMI (kg/m^2)	23.7±3.3	23.8±3.5	23.8±3.8	0.988
Educational status				<0.001
Elementary school	2 (1.9%)	-	-	
High school	64 (61.5%)[c]	31 (67.4%)[b]	6 (12.0%)	
University	38 (36.5%)	15 (32.6%)	44 (88.0%)[b, c]	
Marital status				0.483
Married	68 (65.4%)	27 (58.7%)	28 (56.0%)	
Single/widow	36 (34.6%)	19 (41.3%)	22 (44.0%)	
Having a child	61 (58.7%)[c]	21 (45.6%)	16 (32.0%)[c]	0.007
Right-hand domination	96 (92.3%)	42 (91.3%)	43 (86.0%)	0.473
Systemic disease	20 (19.2%)	4 (8.7%)	5 (10.0%)	0.139
Rheumatic disease	7 (6.7%)	2 (4.3%)	1 (2.0%)	0.396
Musculoskeletal disease	6 (5.8%)	5 (10.9%)	3 (6.0%)	0.535
History of drug use	23 (22.1%)[a]	4 (8.7%)[a]	5 (10.0%)	**0.048**
Smoking history	52 (50.0%)	22 (47.8%)	16 (32.0%)	0.100

[a]: The difference between the groups with and without complaints is statistically significant (p<0.05); [b]: The difference between the group without complaints and control group is statistically significant (p<0.05); [c]: The difference between the group with complaints and the control group is statistically significant (p<0.01); BMI: body mass index

normally distributed, logarithmic transformation was applied in the regression analysis.

Results for p<0.05 were considered statistically significant.

Results

The average age of the 104 participants with complaints included in the study was 31.1±6.2 years, that of the 46 partiticipants without complaints was 30.5±6.6 years, and that of the 50 participants comprising the control group was 31.9±5.8 years. No statistically significant difference was found among the groups in terms of age, gender, and body mass index. However, there was a statistically significant difference among the groups in terms of having children. The proportion of those with children was more in the group with complaints that in the control group (p<0.01). There was a statistically significant difference among the groups in terms of the history of drug use. The history of drug use in the group with complaints was statistically significant than that of the group without complaints (p<0.05). There was no statistically significant difference among the groups in terms of menstrual regularity, body mass index, marital status, right-hand domination, systemic illness history, rheumatic disease history, musculoskeletal disease history, and smoking history (p>0.05). Demographic, anthropometric, and other clinical characteristics of the participants included in the study are shown in Table 1.

Information about the working conditions according to the groups is given in Table 2. There was a significant difference among the groups in terms of years spent in the profession. The average time spent in the profession in the group with complaints (7.5 years) was significantly higher than that in the group without complaints (5.5 years) and the control group (5 years) (p<0.05). There was no statistically significant difference among the groups in terms of daily working hours, job satisfaction, getting adequate wages, workplace satisfaction, and working time without a break.

Distribution of cases in terms of pain characteristics and clinical findings in the participants with complaints of the neck and upper extremity are given in Table 3. Tests for CTS were positive in 14 hands of 11 participants, but electrophysiological CTS was identified in only 3 hands (21.4%) of these participants. The Cubital Tinel test of 2 participants was found positive, and cubital tunnel syndrome was detected in their dominant hands in the electrophysiological examination.

The Quick DASH score, Quick DASH work score, and BDI score are given for the three groups in Table 4. There were significant differences among the groups in terms of the Quick DASH work score (p<0.001). The score was significantly higher in the group with complaints than that of the group with no complaints and the control group. There was also a significant difference among the groups in terms of the Quick DASH score and BDI score (p<0.001). These scores were significantly higher in

Table 2. Features of working conditions according to the groups

Variables	Existing complaint (n=104)	No complaint (n=46)	Control (n=50)	p value
Years spent in profession	7.5 (0–25)[a, b]	5.5 (1–20)[a]	5 (1–25)[b]	0.048
Daily working hours	9 (8–10)	9 (8–10)	8 (8–10)	0.243
Job satisfaction (VAS)	6 (2–10)	7 (0–10)	7 (2–10)	0.799
Wage satisfaction (VAS)	16 (15.4%)	6 (13.0%)	6 (12.0%)	0.832
Workplace satisfaction (VAS)	6 (0–10)	7 (2–10)	5 (1–10)	0.107
Working time without break	3 (2–8)	3 (2–5)	3.5 (2–8)	0.235

VAS: visual analog scale

[a]: The difference between the groups with and without complaints is statistically significant (p=0.046); [b]: The difference between the group with complaints and the control group is statistically significant (p<0.05)

Table 3. Distribution of participants in the group with complaints in terms of pain characteristics and examination findings

Variables	n:104
Pain severity (VAS)	6 (2–9)
Number of days with complaints	5 (1–7)
Duration of pain (year)	2 (0.5–13)
Pain in a single region	51 (49.0%)
Pain in multiple regions	53 (51.0%)
Pain requiring drug	58 (55.8%)
Having more pain during night	18 (17.3%)
Having spreading pain	40 (38.5%)
Speed's test	1 (1.0%)
Neck pain	79 (76%)
Supraspinatus test	2 (1.9%)
Neer's test	1 (1.0%)
Lateral epicondylitis	10 (9.6%)
Medial epicondylitis	1 (1.0%)
Cubital tunnel syndrome	2 (1.9%)
de Quervain's tendinitis	8 (7.7%)
Carpal tunnel syndrome unilateral/bilateral	8 (7.7%)/3 (2.9%)
Non-specific forearm pain	20 (19.2%)

VAS: visual analog scale

Table 4. Quick DASH, Quick DASH work score, and Beck Depression Inventory score of participants according to the groups

Variables	Existing complaints	No complaint	Control	p value
Quick DASH score	15.9 (0.0–45.4)[a, b]	0.0 (0.0–18.2)[a, c]	0.0 (0.0–0.0)[b, c]	<0.001
Quick DASH work score	18.7 (0.0–43.7)[a, b]	0.0 (0.0–6.2)[a]	0.0 (0.0–0.0)[b]	<0.001
BECK depression inventory	11.0 (1.0–33.0)[a, b]	9.0 (0.0–25.0)[a, c]	5.0 (0.0–22.0)[b, c]	<0.001

[a]: The difference between the groups with and without complaints is statistically significant (p<0.05); [b]: The difference between the group with complaints and the control group is statistically significant (p<0.01); [c]: The difference between the group without complaints and the control group is statistically significant (p<0.05)

Table 5. Quick DASH score, Quick DASH work score, and pain severity according to demographic features and accompanying findings

Variables	Pain severity	Quick DASH	Quick DASH work score
Gender			
Female	5 (0–9)	9.1 (0.0–45.4)	12.5 (0.0–43.7)
Male	0 (0–9)	0.0 (0.0–38.6)	0.0 (0.0–37.5)
p value	**0.021**	**<0.001**	**0.011**
Menstrual regularity			
None	2 (0–5)	6.8 (0.0–15.9)	12.5 (0.0–25.0)
Irregular	5 (0–8)	13.6 (0.0–45.4)	12.5 (0.0–37.5)
Regular	5 (0–9)	9.1 (0.0–43.2)	6.2 (0.0–43.7)
p value	0.461	0.368	0.729
Marital status			
Single/widow	0 (0–9)	4.5 (0.0–38.6)	0.0 (0.0–37.5)
Married	5 (0–9)	9.1 (0.0–45.4)	6.2 (0.0–43.7)
p value	**0.196**	**0.199**	**0.294**
Having a child			
No	0 (0–9)	0.0 (0.0–45.4)	0.0 (0.0–37.5)
Yes	5 (0–9)	11.4 (0.0–43.2)	12.5 (0.0–43.7)
p value	0.006	<0.001	0.007
Dominant hand			
Right	4 (0–9)	6.8 (0.0–45.4)	6.2 (0.0–43.7)
Left	0 (0–8)	4.5 (0.0–18.2)	0.0 (0.0–31.2)
p value	0.783	0.218	0.632
Smoking history			
No	0 (0–9)	4.5 (0.0–43.2)	0.0 (0.0–43.7)
Yes	5 (0–9)	6.8 (0.0–45.4)	12.5 (0.0–37.5)
p value	0.150	0.416	0.170
Systemic disease			
No	0 (0–9) 4.5	(0.0–43.2)	0.0 (0.0–43.7)
Yes	5 (0–8)	13.6 (0.0–45.4)	12.5 (0.0–37.5)
p value	**0.038**	**0.004**	**0.028**
Rheumatic disease			
No	2 (0–9)	6.8 (0.0–45.4)	0.0 (0.0–43.7)
Yes	5 (0–8)	10.2 (0.0–22.7)	12.5 (0.0–31.2)
p value	0.353	0.634	0.251
Musculoskeletal system disease			
No	3.5 (0–9)	6.8 (0.0–45.4)	6.2 (0.0–43.7)
Yes	0 (0–9)	6.8 (0.0–43.2)	0.0 (0.0–37.5)
p value	0.444	0.816	0.456
Pain localization			
In a single region	6 (2–9)	13.6 (0.0–38.6)	18.7 (0.0–43.7)
In multiple regions	6 (4–9)	20.4 (2.3–45.5)	18.7 (0.0–37.5)
p value	**0.026**	**<0.001**	**0.101**

the group with complaints than in the group with no complaints and the control group ($p<0.05$). The Quick DASH score and BDI score were significantly higher in the group with no complaints than in the control group ($p<0.05$).

The Quick DASH score, Quick DASH work score, and pain levels according to the demographic characteristics and accompanying symptoms are given in Table 5. Pain severity, the Quick DASH score, and the Quick DASH work score were higher in women than in men ($p<0.05$). Pain severity, the Quick DASH score and Quick DASH work score were significantly higher in the participants having children than in those who did not have children ($p<0.01$). In the presence of concomitant systemic disease, pain severity, the Quick DASH score, and the Quick DASH work score significantly increased ($p<0.05$ to $p<0.001$). When the localization of pain was in many regions, the relative pain severity and Quick DASH score significantly increased ($p<0.05$, $p<0.001$), and no significant change occurred in the Quick DASH work score. Menstrual regularity, marital status, dominant hand, smoking history, rheumatic disease history, and musculoskeletal disease history were found to have no effects on the Quick DASH score, the Quick DASH work score, and pain severity ($p>0.05$).

Table 6. Correlation coefficients of Quick DASH score, Quick DASH work score, and pain severity and other demographic and clinical variables and significance levels

Variables	Quick DASH score		Quick DASH work score		Pain severity	
	r	**p**	**r**	**p**	**r**	**p**
Age	0.002	0.978	-0.010	0.885	0.051	0.471
Weight	-0.130	0.066	-0.056	0.430	-0.033	0.646
Height	-0.186	0.008	-0.115	0.105	-0.140	0.047
BMI	-0.075	0.292	-0.020	0.776	0.033	0.645
Educational status	-0.248	<0.001	-0.232	<0.001	-0.254	<0.001
Years spent in profession	0.152	0.032	0.122	0.086	0.191	0.007
Daily working hours	0.223	<0.001	0.188	0.008	0.243	<0.001
Job satisfaction	-0.008	0.916	-0.017	0.813	-0.041	0.561
Workplace satisfaction	0.117	0.099	0.131	0.064	0.085	0.229
Working time without break	-0,081	0.257	-0.055	0,435	-0,001	0.994
Number of days with complaints per week	0.785	<0.001	0.844	<0.001	0.889	<0.001
Duration of pain	0.785	<0.001	0.817	<0.001	0.867	<0.001
Family satisfaction	-0.145	0.041	-0.149	0.035	-0.156	0.028
Social life satisfaction	-0.132	0.063	-0.090	0.206	-0.141	0.046
Dominant hand grip strength	-0.390	<0.001	-0.327	<0.001	-0.313	<0.001
Beck depression inventory	0.306	<0.001	0.290	<0.001	0.312	<0.001

BMI: body mass index

Table 7. Investigation of the effect on pain severity, Quick DASH score, and Quick DASH work score of the groups with and without complaints through multivariate linear regression analysis according to age, gender, and risk factors

Variables	Regression coefficient	t-value	p value	95% confidence interval Lower limit	Upper limit
Pain severity					
Complaint exists	1.857	42.444	<0.001	1.771	1.943
No complaint	-0.010	-0.237	0.813	-0.091	0.072
Age	0.003	1.401	0.163	-0.001	0.007
Gender factor	0.030	1.078	0.283	-0.025	0.086
Educational status	0.001	0.024	0.981	-0.052	0.054
Quick DASH score					
Complaint exists	2.355	14.858	<0.001	2.043	2.668
No complaint	0.681	4.523	<0.001	0.384	0.978
Age	-0.003	-0.328	0.743	-0.018	0.013
Male factor	0.068	0.507	0.613	-0.197	0.333
Having a child	0.283	2.759	0.006	0.081	0.485
Dominant hand grip	-0.022	-3.736	<0.001	-0.034	-0.010
Educational status	0.035	0.356	0.722	-0.159	0.229
Quick DASH work score					
Complaint exists	2.584	18.232	<0.001	2.305	2.864
No complaint	-0.079	-0.573	0.567	-0.353	0.194
Age	0.002	0.236	0.814	-0.012	0.015
Male factor	0.019	0.199	0.842	-0.171	0.210

Correlation analysis results between the Quick DASH score, the Quick DASH work score, pain severity, and other demographic and clinical variables are given in Table 6. With the Quick DASH score, a significant correlation was found among the increased time spent in the profession, daily working time, number of days per week with complaints, duration of pain, and increase in the BDI score as well as a decrease in satisfaction with family, decrease in social life satisfaction, and decrease in the dominant hand grip strength.

With the Quick DASH work score, a significant correlation was found between the increased time spent in the profession, daily working time, number of days with the complaint, duration of pain, and increased BDI score as well as decrease in family satisfaction and decrease in dominant hand grip strength.

With pain severity, a significant correlation was found between the increased time spent in the profession, daily working time, number of days with complaints, duration of pain, and increased BDI score as well as decrease in family satisfaction, decrease in social life satisfaction, and decrease in the dominant hand grip strength.

When adjustments for age, gender, and risk factors previously found to be decisive were made, their effect on the pain level, Quick DASH score, and Quick DASH work score of the groups with and without complaints, was assessed in multivariate linear regression analysis; the results of this analysis are given in Table 7. The presence of complaints was found as the most decisive risk factor in the regression analysis of the factors that increase pain severity; the presence and absence of complaints, having children, and decrease in the dominant hand grip strength were found to be the most decisive risk factors in the regression analysis of the factors affecting the Quick DASH score; and the presence of complaints in the regression analysis of the factors affecting the Quick DASH work scores was found to be the most decisive risk factor.

Discussion

Currently, the increasing use of computers in the workplace brings about musculoskeletal disorders. These disorders, which primarily occur in the neck, shoulders, wrists, hands, and elbows and less frequently in the back and waist, are common among computer users (5). In our study, we questioned the risk factors for CTDs seen among computer users and investigated their effects on disability. The results of our study showed that many parameters related to these diseases affected disability significantly in participants with CTD.

CTD constitutes an interesting example of physical and psychological factors resulting in pain and disability (13). In our study, the Turkish version of Quick DASH scoring was used to measure the level of overall disability of the participants, and the Quick DASH work score was used to assess the disability of the participants while working (12). In our study, the Quick DASH score, the Quick DASH work score and BDI score were higher in the group with complaints than in the group without complaints and the control group. The Quick DASH score and BDI score were also significantly higher in the group without complaints in the control group. Dissatisfaction in the family and social lives, time spent in the profession, daily working hours, number of days per week with complaints, duration of pain, and an increase in the BDI score were the factors associated with increased disability in our participants.

Patients with CTD often experience a decrease in hand grip strength and drop simple things from their hands in their daily activities (14). Reduction of isometric hand grip strength is a finding that also indicates disability in the upper extremity (15, 16). In our study group, dominant hand grip strength was significantly lower in the group with complaints than in the control group and the group with no complaints. There is no other study on this subject in the literature according to our knowledge.

Having children was a significant risk factor for disability in our study. Regarding this issue, McDermott (17) and Carneiro (18) reported that activities outside the workplace for women may also contribute to an increase in CTD symptoms. Household chores such as cooking and dealing with children prevent the relaxation of muscles; thus, there is very little time for the muscles to heal.

In our study, considering the distribution of pain locations of the participants with complaints, pain in the neck was detected in 79 participants (76%). This was followed by non-specific forearm pain in 20 participants (19.2%), lateral epicondylitis in 10 (9.6%), de Quervain's tendinitis in 8 (7.7%), shoulder pain in 4 (3.9%), CTS in 2 (1.9%), cubital tunnel syndrome, in 2 (1.9%), and medial epicondylitis in 1 (1%). In a prospective study conducted in the US, the prevalence of neck and shoulder musculoskeletal complaints among computer users was found to be 10%–62% (19). In the study by Ozcan et al (20), musculoskeletal complaints were found in 58.5% of 311 computer users at the Istanbul Faculty of Medicine, and stiffness in the neck was identified to be most frequent. The findings we obtained were compatible with those in the literature. However, in case of pain in more than one area, it can naturally be expected that the disability of patients should increase more. According to our study, when pain is in more than one area, pain level and the Quick DASH score significantly increased in comparison to pain localized to one area. Therefore, the treatment of all clinical factors that are pain sources in patients and, more importantly, taking measures to prevent these factors, seem to be important. However, there are no studies conducted on this subject.

In cumulative trauma patients, numbness or tingling sensation in the forearm and hand is felt in a nondermatomal distribution (21). This can cause interference of the clinical picture with CTS from time to time. Aydeniz and Savaş (22) showed that prolongation of the working time among computer users increases the incidence of carpal tunnel symptoms (22). In a study by Jensen (23), a correlation was found between the time spent using computers and hand/wrist symptoms; in addition, in a large British survey, it was determined that using computers for >4 h increases hand/wrist symptoms (24). In our study, tests for CTS were positive in 14 hands of 11 participants, but electrophysiological CTS was identified in only three hands (21.4%) of these participants. This makes us think that paresthesias result from CTD.

The etiology of CTD is multifactorial. Generally, CTD occurs because of work-related reasons such as poor working posture, stress, repetitive and intense activities, poor ergonomics, and long periods of work without a break (25, 26). Demure et al. (27) investigated the relationship between the ergonomics of the workstation and occupational musculoskeletal complaints among 273 computer users working in the video display terminal. A relationship was found between neck and shoulder discomfort and computer use for >7 h, less proficiency in the job, being over 40 years of age, and taking few breaks. In addition, it was indicated in this study that there is a relationship between hand/wrist discomfort and using the computer for >7 h, low job satisfaction, and bad posture and a relationship between back pain and using the computer for >7 h. In our study, there was no significant difference among the groups in terms of work-related factors such as daily working hours, job satisfaction, wage sufficieny, work environment satisfaction, and working time without breaks. Although job satisfaction was lower in the group with complaints, the difference was not significant. Although 88 of the 104 participants in the group with complaints 40 of the 46 participants in the group without complaints and 44 of the 50 participants in the control group thought that the wage they received was inadequate; there was no significant difference among the groups. The work environment satisfaction measured with VAS was 6 of 10 in the group with complaints, it was 7 in the group with no complaints and 5 in the control group. In our study, the reason why no difference was found between these factors may be because the participants worked in the same hospital and have the same working environment; the control group was selected from doctors and nurses having busy working hours and a general dissatisfaction of the work environment because of intensive working conditions.

In our study, there was a significant difference among the three groups in terms of years spent in the profession. The years spent in the profession were higher in the group with complaints (7.5 years) than in the group without complaints (5.5 years) and the control group (5 years). Shuval and Donchin (28) assessed 84 computer users to examine the relationship between the ergonomic risk factors and upper extremity musculoskeletal disorders through a questionnaire form and direct observation method. Consequently, they stated that the use of computers for >2 years in the workplace is a risk factor for work-related musculoskeletal diseases (28). It was shown in the same study that being a woman is also a risk factor for musculoskeletal disorders. In a compilation where 56 studies were reviewed, WMSDs were reported to be more common in women than in men (29). It was determined that women carry a higher risk than men in almost all scientific studies associated with WMSDs, independent from the work performed or profession type. For computer users, similar differences exist between women and men (30, 31). Ekman et al. (32), who aimed to investigate possible differences between men and women reporting musculoskeletal complaints among computer users in the Swedish labor force, found that the probability calculated for gender (male/female) was 11.9. Two explanations related to this risk increase in women are as follows: gender is a cause that changes the factors not associated with work and there might be a difference between men and women in terms of occupational exposure. In a cross-sectional study performed on Swedish computer users, women reported more symptoms than men in all parts of the body and women were more frequently exposed to physical and psychosocial factors that are known to be harmful (33). In our study, pain severity, the Quick DASH score, and the Quick DASH work score were higher in women than in men. Accordingly, the female gender is considered as a risk factor for CTD.

In our study, we used BDI to inquire about the general psychological condition of the participants and found higher BDI scores in CTD participants, being more apparent in the group with complaints. We also found that higher BDI scores had significantly negative effects on pain and disability in participants. CTD induced pain increases in the presence of psychological impairment. These psychosocial factors increase with dissatisfaction with the boss and colleagues at work, stress, anxiety, not having interest in the job, and disliking the job (34). The importance of psychosocial factors that emerge as a potential cause of diseases in employees was emphasized in the report of the National Institute for Occupational Safety and Health. Several psychosocial symptoms suggesting work-related upper extremity musculoskeletal disorders were identified in this report. A person's fear that computers will take over his/her job; professions with variable workloads; increasing job stress; lack of production standards; vocational monotony limiting the initiative to decide, increase, and decrease in workload; uncertainties related to the professional future; insufficient support of colleagues; and absence of supervisor support are among these factors (35). In prospective cohort studies conducted among computer users in Scandinavia, significant relations were shown between upper extremity WMSD symptoms and high job demands, low job control, and high job stress (36, 37). Psychoneurotism and neurotic perfectionism were found to be risk factors for upper extremity musculoskeletal disorders in a case-control study comparing (38).

Conclusion

We determined that CTDs are common among computer users and lead to severe disability and depression. For treatment, more importantly, for the prevention of such a disorder that may result in severe disability and thus loss of labor, we believe that improvement in workplace and ergonomic conditions, management of depression, and amelioration of problems in family and social lives bear great importance. The accuracy of our findings can be confirmed by broader future studies on this subject.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Ankara Training and Research Hospital.

Informed Consent: Informed consent was obtained from participant who participated in this study.

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