The impact of distance education on the neck pain among teachers in times of COVID-19

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Abstract. – **OBJECTIVE:** In the course of the COVID-19 pandemic the format of education was forced to change from formal to distance in a considerably short time. The study aimed to analyze the changes in the prevalence and the severity of neck pain among teachers during the pandemic.

SUBJECTS AND METHODS: The study analyzed the Neck Disability Index (NDI), a self-report questionnaire designed to assess the individual's neck pain experience in daily life and rate a disability score due to neck pain, and numerical rating scale (NRS) report pairs completed by teachers.

RESULTS: The mean age of the participants was 41.67 ± 9.57. The majority were female (67.9 %) and were employed for less than 20 years in teaching (68.9%). The survey results collected at the beginning and at the end of the first year of the pandemic showed that: the mean session hours per week were 21.19 ± 9.21 and 21.61 ± 9.45, the mean NDI scores were 11.61 ± 6.17 and 12.65 ± 7.76, and the mean NRS scores were 3.05 ± 2.96 and 4.75 ± 3.13. The female participants scored significantly higher disability scores ($p<0.001$). The NRS scores were increased in both genders ($p<0.001$). The NDI scores, the disability grouping, and NRS were significantly associated with weekly session hours ($p=0.011$, $p<0.001$ and $p<0.001$, respectively). The NRS scores were increased in all age groups ($p<0.001$). The increase in weekly session hours was related to the NRS scores ($p<0.001$).

CONCLUSIONS: In one year during the pandemic, despite unchanged telework hours, a significant increase in neck pain incidence and pain severity was noted among teachers. Unexperienced employees in the line of distance working should receive adequate training to avoid not only musculoskeletal disorders but other physical and psychological unwanted effects.

Key Words:
   Neck pain, Disability evaluation, Education, Distance.

Introduction

Neck pain, with 7.6% mean point prevalence and 48.5% mean lifetime prevalence rates for the adult population has been a public health problem1. The disability caused by neck pain already attracted the attention of researchers and reports show that in addition to the deterioration in personal health, a significant financial burden and major collateral effects are observed[2]. Currently, the world has been recovering from a the Coronavirus (COVID-19) pandemic which forced many changes in daily life. Lockdowns were one of the major mass measures the pandemic has enforced. One of the areas most affected by this pandemic was the education system. Face-to-face education was suspended for a long time around the world and millions of people had to experience remote education, via the internet through their screens. In Turkey, formal education in schools ceased in March 2020, and distance education was initiated within weeks. The transition including the disabled students was fully completed by May 2020. All teachers had to spend long hours on computers, tablets, or smartphones. Epidemiological studies[3] have shown that musculoskeletal complaints are common in employees spending long hours using computers. Personal, physical, psychosocial, and organizational factors were also cofactors in the formation of musculoskeletal complaints due to computer use[4].

Currently, the literature lacks research focusing on the indirect impacts of the pandemic, the unexpected changes in working conditions, pushing employees unaccustomed to working long hours with computers into an almost digital working environment. The study aimed to analyze the changes in the prevalence and the severity of neck pain among teachers during the pandemic.

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Subjects and Methods

The study included teachers working in public and private schools in Adana, Turkey. Individuals with no history of medically diagnosed conditions associated with neck pain including arthritis osteoarthritis, rheumatoid arthritis in the cervical vertebrae, scapulae or shoulders, cervical disk degeneration or hernia, congenital abnormalities or tumors of the neck region, torticollis, injury to the muscles, tendons, or ligaments of the neck in the past three months were asked to complete the electronic surveys shared on the Google online survey platform. The semi-structured survey consisted of two sections. The first section included the demographics, and the latter included the Neck Disability Index (NDI) and the numerical rating scale (NRS). The first online survey was shared on the Google online survey platform on May 1st, 2020, and the second one on May 1st, 2021, for four weeks. A link to the electronic survey was distributed by the school administrations a week before the sharing date in both surveys.

Neck Disability Index (NDI)

NDI, a self-report questionnaire, was designed by Vernon and Mior, as a modified version of the Oswestry Disability Questionnaire to assess the individual's neck pain experience in daily life and rate a disability score due to neck pain. The scale had 10 items including pain intensity, personal care (washing, dressing, etc.), lifting, reading, headaches, concentration, work, driving, sleeping, and recreation. Each item had six questions and scores range from zero; meaning no disability, to five; meaning total disability. The scoring interpretation for the NDI is as follows: 0-4=none; 5-14=mild; 15-24=moderate; 25-34=severe; over 34=complete[5]. The reliability and validity study of the Turkish version of the NDI was made by Aslan et al[6] with test-retest reliability of ICC=0.979.

Numerical Rating Scale (NRS)

The numerical rating scale (NRS) is an 11-point scale ranging from 0 to 10 in increments of 1, where 0 defines 'no pain' and 10 defines 'worst imaginable' pain. The participants are asked to choose the most appropriate number that describes their current pain on an 11-point horizontal scale. As the numbers increase the severity of the pain increases. It is a pain measurement tool that is simple to complete, faster to score, and less susceptible to measurement error[7].

Statistical Analysis

Continuous variables were expressed as mean ± standard deviation and median (min-max), and categorical data were expressed as numbers and percentages. Normality analyzes of continuous variables were performed using the Kolmogorov-Smirnov Goodness of fit test. The Mann-Whitney U test was used in the analysis of continuous variables that did not fit the normal distribution between the two groups in the independent groups, and the Kruskal Wallis Test (Post hoc: Mann Whitney U test with Bonferroni correction) was used in the analyzes between the three groups. The Wilcoxon test was used for the analysis of continuous variables that did not fit the normal distribution between the two groups of dependent groups. The comparison of the presence of pain before and after was made with the McNemar test. The linear relationship (correlation) between NRS and disability scores was tested with the Spearman Correlation test. Analyzes were performed with IBM SPSS version 26.0 (IBM Corp., Armonk, NY, USA) and the statistical significance level was accepted as $p<0.05$.

Results

The first survey was completed by 1032 teachers. However, one year after the first one, 713 participants out of 1,032 joined the second survey. After removing incomplete forms there were 679 form pairs available for analysis. The majority of the participants were female (67.9%). The mean age was 41.67±9.57. The mean employment duration of the participants was 17.04±7.68 years. The demographics and basic employment characteristics of the study population was presented in Table I.

The survey results collected at the beginning and at the end of the first year of the pandemic showed that: the mean session hours per week were 21.19±9.21 and 21.61±9.45, the mean NDI scores were 11.61±6.17 and 12.65±7.76, and the mean NRS scores were 3.05±2.96 and 4.75±3.13.

The first survey results showed that females had statistically higher NDI scores compared to men ($p<0.001$). Age, employment duration, smoking, and weekly session duration were not statistically associated with NDI scores ($p>0.05$). The NRS scores in the first survey revealed slightly similar results to the NDI scores. Employment duration and weekly session duration were not related, but age and smoking had a weak association with the

Table I. The demographic and basic employment characteristics.

		n	%
Gender	Female	461	67.9
	Male	218	32.1
Age (years)	22-30	76	11.2
	31-40	225	33.1
	41-50	288	42.4
	>50	90	13.3
Branch	Sports	10	1.5
	Computer	19	2.8
	Other branches	140	20.6
	Religions	26	3.8
	Science	61	9.0
	Math	109	16.1
	Music	10	1.5
	Painting	10	1.5
	Core teaching	138	20.3
	Social Sciences	24	3.5
	Technical sciences	22	3.2
	Turkish	50	7.4
	Foreign languages	60	8.8
Employment duration (years)	0-5	62	9.1
	6-10	70	10.3
	11-15	140	20.6
	16-20	139	20.5
	21-25	218	32.1
	>25	50	7.4

NRS scores ($p=0.032$, and $p=0.037$, respectively). The link between gender and NRS was statistically significant, females had higher NRS scores ($p<0.001$).

The survey conducted a year after showed that although the number of participants in the no disability group increased and the number of participants in the mild disability group decreased, both overall disability and pain scores increased. The female participants scored significantly higher disability scores ($p<0.001$) compared to the scores of the men reporting slight changes lacking statistical significance ($p=0.932$). The NRS scores were increased in both genders ($p<0.001$). The NDI scores, the disability grouping, and NRS were significantly associated with weekly session hours ($p=0.011$, $p<0.001$, and $p<0.001$, respectively). The NRS scores were increased in all age groups ($p<0.001$). The increase in weekly session hours was related to the NRS scores ($p<0.001$). In parallel, the disability grouping analysis showed that teachers working for more than 11 and less than 30 hours weekly had a higher disability ($p<0.001$). The link between the disability grou-

ping with age and employment duration was weak ($p=0.018$ and $p=0.033$, respectively).

The comparative analysis of the disability grouping was presented in Table II.

The correlation between the scores collected at the beginning and at the end of the first year of the pandemic for NDI and NRS was strong and positive (r=0821; $p<0.001$ and r=0691; $p<0.001$) (Table III). There was a strong and positive correlation between the NDI and NRS scores of both surveys (r=0.421; $p<0.001$ for the first survey data and r=0.715; $p<0.001$ for the second survey data). The correlation was presented in Table IV.

Discussion

The sudden transition of occupation conditions of teachers from working at school to duties completed by a computer, a tablet, or a smartphone at the home environment at the beginning of the COVID-19 pandemic was prone to adverse physical outcomes based on the limited physical activity and increased sedentary behavior[8]. The increase in neck symptoms in individuals extending daily screen use hours was already indicated in various reports[9]. Similar to the literature, the increase in NDI and NRS scores was observed with distance education performed during the pandemic[10]. In the second survey conducted a year after the first one, both overall disability and pain scores were increased[11]. The lack of statistically significant difference among male teachers was reported in other studies[12,13] and might be due to many reasons including women having a higher degree of experiencing emotional exhaustion, a lower pain threshold compared with men, and performing more and heavier household tasks in daily life. A study analyzing[14] the psychological impact of COVID-19 pandemic on individuals affected by temporomandibular disorders, a condition closely related to neck pain, recorded during the lockdown period and compared to the ones before the outbreak reported that there were no significant differences about the presence of a gnathological treatment between the groups, improved/stationary and worsened in temporomandibular symptomatology and headache were identified. On the contrary, cases received gnathological therapy and also declared a worsening of neck pain were significantly frequent, in contrast to the ones with neck pain who did not receive the therapy, highlighting the increased psychological impact of the pandemic.

Table II. The comparative analysis of the disability grouping.

		At the beginning of the pandemic											At the end of the 1st year of the pandemic											
		None (n=49)	%	Mild (n=457)	%	Moderate (n=145)	%	Severe (n=24)	%	Complete (n=4)	%	p	None (n=102)	%	Mild (n=338)	%	Moderate (n=186)	%	Severe (n=44)	%	Complete (n=9)	%	p
Gender	Female	27	55.1	290	63.5	117	80.7	23	95.8	3	75	<0.001	60	58.8	201	58.8	149	59.5	39	80.1	7	77.8	<0.001
	Male	22	44.9	167	36.5	28	19.3	1	4.2	1	25		42	41.2	137	41.2	37	40.5	5	19.9	2	22.2	
Age (years)	22-30	7	14.3	51	11.2	14	9.7	4	16.7	0	0	0.934	16	15.7	41	12.1	11	5.9	7	15.9	1	11.1	0.018
	31-40	17	34.7	155	33.9	47	32.4	5	20.8	1	25		42	41.2	115	34	58	31.2	8	18.1	2	22.2	
	41-50	19	38.8	194	42.5	62	42.8	11	45.8	3	75		34	33.3	137	40.5	88	47.3	26	59.1	3	33.3	
	>50	6	12.2	57	12.5	22	15.2	4	16.7	0	0		10	9.8	45	13.3	29	15.6	3	6.8	3	33.3	
Employment duration (years)	0-5	4	8.2	42	9.2	12	8.3	4	16.7	0	0	0.540	12	11.8	34	10.1	8	4.3	8	18.1	0	0	0.033
	6-10	10	20.4	48	10.5	11	7.6	1	4.2	0	0		10	9.8	45	13.3	11	5.9	4	9.1	0	0	
	11-15	8	16.3	94	20.6	32	22.1	6	25	1	25		24	23.5	64	18.9	44	23.7	7	15.9	1	11.1	
	16-20	11	22.4	90	19.7	34	23.4	4	16.7	1	25		26	25.5	61	18	40	21.5	10	22.7	2	22.2	
	21-25	12	24.5	153	33.5	44	30.3	6	25	1	25		28	27.5	105	31.1	68	36.6	12	27.2	5	55.6	
	>25	4	8.2	30	6.6	12	8.3	3	12.5	1	25		2	2	29	8.6	15	8.1	3	6.8	1	11.1	
Smoking	No	38	77.6	358	78.3	112	77.2	18	76	3	75	0.973	82	80.4	260	76.9	150	80.6	31	70.4	6	66.7	0.336
	Yes	11	22.4	99	21.7	33	22.8	6	24	1	25		20	19.6	78	23.1	36	19.4	13	29.5	3	33.3	
Weekly session duration (hours)	0-10	7	14.3	78	17.1	15	10.3	5	20.8	1	25	0.369	30	29.4	52	15.4	16	8.6	8	18.1	0	0	<0.001
	11-20	8	16.3	74	16.2	31	21.4	6	25	1	25		20	19.6	47	13.9	37	19.9	13	29.6	3	33.3	
	21-30	33	67.3	273	59.7	91	62.8	12	50	2	50		50	49	211	62.4	123	66.1	22	50	5	55.6	
	>30	1	2	32	7	8	5.5	1	4.2	0	0		2	2	28	8.3	10	5.4	1	2.2	1	11.1	

Table III. The comparison of NDI and NRS scores collected at the beginning and at the first year of the pandemic.

		At the beginning of the pandemic				At the end of the 1st year of the pandemic			
		NDI scores [median (min-max)]		NRS scores [median (min-max)]	*p*	NDI scores [median (min-max)]	*p*	NRS scores [median (min-max)]	*p*
Gender	Female	11 (1-38)	<0.001	3 (0-10)	<0.001	13 (1-38)	<0.001	5 (0-10)	<0.001
	Male	9 (1-27)		1 (0-10)		9 (1-29)		4 (0-10)	
Age	22-30	10 (1-29)	0.311	2 (0-10)	0.032	12 (1-31)	0.168	5 (0-9)	0.028
	31-40	10 (3-28)		2 (0-10)[a]		11 (1-32)		5 (0-10)[a]	
	41-50	11 (1-35)		3 (0-10)[a]		12 (1-38)		6 (0-10)[a]	
	> 50	10 (2-38)		3 (0-10)[a]		12 (2-37)		5 (0-10)	
Work years	0-5	10 (1-29)	0.106	2 (0-10)	0.149	12 (1-31)	0.099	3 (0-9)	0.535
	6-10	9 (3-27)		3 (0-10)		8 (2-29)		5 (0-10)	
	11-15	11 (3-28)		3 (0-9)		13 (1-32)		5 (0-10)	
	16-20	11 (1-35)		2 (0-9)		12 (1-36)		5 (0-10)	
	21-25	10 (1-38)		2 (0-10)		10 (1-38)		6 (0-10)	
	> 25	11 (2-28)		4 (0-10)		14 (4-36)		5 (0-10)	
Smoking	No	10 (1-35)	0.612	2 (0-10)	0.037	12 (1-38)	0.812	5 (0-10)	0.808
	Yes	10 (1-38)		3 (0-10)		11 (1-37)		5 (0-10)	
Weekly class hours	0-10	9 (1-29)	0.067	3 (0-10)	0.228	10 (1-30)a	0.011	4 (0-9)[a]	<0.001
	11-20	10 (2-28)		3 (0-10)		12 (1-36)a		6 (0-10)[a]	
	21-30	11 (1-38)		2 (0-10)		12 (1-38)		5 (0-10)[a]	
	> 30	11 (4-25)		2 (0-6)		12 (4-26)		4 (0-9)	

The first survey results of age data did not reveal an association with neither disability grouping nor the NDI scores but showed a weak link with NRS scores. The same finding in the latter survey reoccurred in addition to a weak relation to disability grouping. As the age progressed participants were more likely to develop pain and disability. The analysis results of age data were contradicting the results in many studies[15]. On the other hand, Abdulmonem et al[16] presented similar findings and indicated that there were no relations between musculoskeletal pain with age data including the number of employment years, teaching hours and teaching sessions in their study conducted on 486 female teachers investigating the prevalence of musculoskeletal pain and its associated factors. The analysis of the employment duration data resulted in similar findings to the age analysis, suggesting that as the number of employment years increased, the risk of disability was slightly increased. Although there was a weak link with disability risk, the reports indicate a positive association of employment years with neck pain[17,18]. The weekly session hours at the beginning of the pandemic were in a relatively acceptable range and revealed no correlations, and while remaining the same, the second survey results showed a significant association with the disability grouping and NRS scores. The weekly session hours were positively correlated with the risk of disability and pain scores. Reports are indicating that working hours were significantly associated with neck pain but the number of studies investigating the effect of the change of the work conditions of the teachers on neck pain during the pandemic is scarce[19].

Limitations

The most significant limitation of the study was the sample size. Besides, the data was collected via an electronic platform, thus the absence of face-to-face interviews disallowed ideal data

Table IV. The correlation between NDI and NRS scores.

		NRS scores at the beginning of the pandemic	NRS scores at the end of the 1st year of the pandemic	NDI scores at the beginning of the pandemic
NRS scores at the end of the 1st year of the pandemic	r	0.691		
	p	<0.001*		
	n	679		
NDI scores at the beginning of the pandemic	r	0.421	0.544	
	p	<0.001*	<0.001*	
	n	679	679	
NDI scores at the end of the 1st year of the pandemic	r	0.521	0.715	0.821
	p	<0.001*	<0.001*	<0.001*
	n	679	679	679

*Spearman Correlation test.

collection. Furthermore, other possible conditions accompanying or coexisting with neck pain, including pain evaluation of different musculoskeletal regions of the body, and psychological and social aspects were not studied to reach higher reply to rates and minimize the limitation of the generalization of the results due to the methodology. Finally, the results refer to Turkish teachers from the Adana region and might not be extrapolated to other populations.

Conclusions

In our study, there was a strong and positive correlation between both surveys in terms of NDI scores and NRS scores, meaning that the transition of the work conditions of the teachers developed a significant amount of neck pain and disability. The findings suggest that the unexpected and fast transition of the work models forced by the pandemic has caused unwanted musculoskeletal effects. Such deterioration detected in teachers in this study might be a sample for employees working in different lines of work. The sudden shift forced by the pandemic might have avoided the employers from properly training their employees for ergonomics in working in the remote model. Yet, the focus of the current study, neck pain, is only one of the disorders which seem to be caused by the changing work conditions. Unexperienced employees in the line of distance working should receive adequate training to avoid not only musculoskeletal disorders but other physical and psychological unwanted effects.

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