Posture related musculoskeletal discomfort and its association with computer use among university students

Muhammad Osama,[1] Shaukat Ali,[2] Reem Javed Malik[3]

Abstract

The objective of this study was to assess the association of postural musculoskeletal discomfort with computer use and to determine its contributing factors among undergraduate university students. A comparative cross sectional study with a sample of 136 students was conducted at Shifa Tameer-e-Millat University. Musculoskeletal discomfort was calculated using ssCMDQ. A positive association of musculoskeletal discomfort was found with duration of computer use (P<0.05). Significant differences were observed in musculoskeletal discomfort scores based on the type of posture adopted (P<0.05), however no significant differences were observed in terms of discomfort based on gender, ergonomic awareness and type of computer used (P>0.05). The findings of this study reveal that risk factors for postural discomfort include posture, duration and type of computer used however ergonomic awareness and gender is not associated with the buildup of musculoskeletal discomfort. Ideal posture to be adopted during computer use is supported sitting on chair with computer on desk.

Keywords: Biomechanics, Human-computer interaction, Musculoskeletal discomfort, Posture, Ergonomics.

Introduction

The increase in the use of computers among students has exposed them to greater risks for developing musculoskeletal discomfort and disorders.[1] Computers have become a necessity, however knowledge regarding impact of amplified computer use on student education, health and wellbeing is still in the dark and little attention has been paid to postural education, biomechanical correction and ergonomic design.[2] It is reported that more than half of all students experience musculoskeletal symptoms associated with computer use.[3] The risk factors identified for developing musculoskeletal discomfort include academic concentration, female gender, type of computer use, non-neutral body posture, looking up at a visual display unit (VDU), age and computer use >3 hours/day.[1] Neck, back and upper extremity are found to be the most common site of symptoms.[1,3] The purpose of this study was to assess the association of postural musculoskeletal discomfort with computer use, and factors that may contribute to the buildup of this discomfort.

Methods and Results

The current study was conducted at Shifa Tameer-e-Millat University, Allied Health Sciences campus from January to June 2016. Number of students at the time of study was 366 and the sample was calculated to be 162, using "Raosoft sample size calculator"[4] keeping 5% margin of error, 95% confidence-interval and 75% response distribution, because of skewed distribution of data to one end, and based on the pilot study. Inclusion criteria consisted of under graduate full time students, aged 17-25 years. Exclusion criteria consisted of congenital anomalies such as leg length discrepancy, anomalies of foot and the angles of hip and knee etc., amputations and recent history of physical trauma or burns. Participants were selected using multistage random sampling, firstly stratified random sampling, followed by simple random sampling. Response rate was 82%, after excluding incomplete responses and a total of 136 students were included in the study. Musculoskeletal discomfort was calculated using 'Student Specific Cornell Musculoskeletal Discomfort Questionnaire (ssCMDQ)', which is both valid and reliable with Cronbach's Alpha greater than 0.95 for each sub scale and range of Kappa coefficient was between 0.690 to 0.949 for frequency, 0.801 to 0.979 for severity and 0.778 to 0.944 for frequency with p value less than 0.001.[5] The different types of postures adopted analyzed in the study were identified via piloting and included in the study questionnaire. SPSS 21.0 was used for data analysis. P-value of less than 0.05 via Kolmogrovsmirnov and Shapiro Wilk test shows abnormal distribution of data thus non-parametric tests of significance were used. Ethical approval was obtained from all participants prior to data collection.

The mean age of the participants was 20.3±1.3 years. A

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[1]Foundation University, Institute of Rehabilitation Sciences, [2,3]Shifa Tameer-e-Millat University, Islamabad.
Correspondence: Muhammad Osama. Email: osamadpt@gmail.com

Table-1: Comparison of ssCMDQ scores for categories of Ergonomic awareness & Gender).

	Frequency	Percentage	CMDQ scores (Median±IQ)	Mean Rank	Z-value	P-value
Ergonomic awareness*						
Yes	109	80.1%	42.0±112.38	67.04	-0.569	0.569
No	27	19.9%	34.5±133.0	71.83		
Gender*						
Male	26	19.1%	59.50±118.0	74.58	-0.954	0.340
Female	110	80.9%	38.00±111.75	66.43		

Mann-Whitney U (P>0.05 = No significant difference)*

Table-2: Comparison of ssCMDQ scores for the categories of posture adopted, type of computer use and year of study.

	Frequency	Percentage	CMDQ scores (Median±IQ)	Mean Rank	P-value
Posture adopted*					
Sitting on chair/sofa (knees flexed) with lap top/tablet on lap	10	7.4%	63.25±175.25	83.85	0.025
Long sitting with knees extended and lap top/tablet on lap	57	41.9%	44.00±112.50	69.08	
Supported sitting on chair with computer/laptop/tablet on desk	11	8.1%	12.00±13.50	34.59	
Using computer/laptop/tablet lying straight supine and head flexed	13	9.6%	131.50±143.50	85.42	
Using computer/laptop/tablet while lying prone and head extended	7	5.1%	59.00±60.50	75.86	
Crossed sitting with computer/lap top/tablet in front	38	27.9%	64.50±82.63	64.50	
Type of Computer used					
Laptop	103	75.7%	42.75±103.75	66.58	0.095
Tablet	30	22.1%	37±110.50	68.00	
Desktop	3	2.2%	245†	116.33	
Year of study*					
1st	27	19.9%	45.50±104.50	75.56	0.002
2nd	48	35.4%	27.50±47.00	52.05	
3rd	46	33.8%	65.50±115.00	81.51	
4th	15	11.0%	50.00±106.00	62.93	

Kruskal Wallis (P<0.05 = significant difference)*, IQ=N/A because n < 4†

positive non-significant correlation was found between age and ssCMDQ scores (Pearson Correlation= 0.132 and P-value= 0.127). The most common sites of discomfort were neck (75.7%), lower back (62.5%), upper back (58.8%), right shoulder (52.9%), left shoulder (44.1%) and buttocks/hips (36%). The mean and median values of computer use was 2.75±1.79 and 3.00±1.00 hours per day respectively and mean value for frequency of computer use was 5.51±1.95 days per week. No significant difference was observed among the categories of ergonomic awareness, gender and type of computer used (Table-1), however a significant difference in discomfort was observed based on type of posture adopted (Table-2). A significant positive correlation (pearson correlation= 0.208) was found between frequency of computer use in terms of days/week and ssCMDQ scores with a p-value of 0.015. Similarly a significant positive correlation (Pearson correlation= 0.293) was found between duration of computer use per day and ssCMDQ scores with a p-value of 0.001.

Discussion

According to the current study the posture associated with maximum discomfort was 'using computer/laptop/tablet lying supine and head flexed' which conforms to the findings of Ariens et al stating flexion of the neck during computer use to be associated with neck pain.[6] The current study's results reinforce the fact that poor body posture can contribute towards the development of postural discomfort as indicated by existing evidence.[1] A similar study conducted in the University of Hong Kong showed the postures adopted during computer/VDU use by students included supported sitting (19.2%), forward sitting (31.5%), slumped sitting (18.1%), supine (10.1%), side lying (10.1%) and lying (10.7%). However the study did not conclude which posture was associated with maximum discomfort.[7]

No gender related difference was observed unlike the existing evidence showing female gender to be a risk

factor.[8] Previous studies conducted by Peer & Gibney,[9] Mendez et al[10] and Calik BB et al[8] reported duration of computer use to be 2.9, 3.2 and 3.1 hours/day respectively, similar to that of the current study. The duration of computer use was found to have a positive correlation with musculoskeletal discomfort which is consistent with the existing literature.[1]

Even though a greater amount of neck flexion is associated with the use of portable computers, they tend to provide a greater task variety and postural variation as compared to desktops. Perhaps that is the reason; portable computers are found to have lesser amount of associated postural discomfort as compared to desktop computers. Laptop was the most commonly used computer similar to a previous study showing 77.3% students used a laptop, 71% used a desktop and 48.3% used a tablet.[7]

No significant difference in discomfort levels was observed based on ergonomic awareness, reinforcing the fact that ergonomic interventions are not effective in eliminating the buildup of musculoskeletal discomfort.[11] A study conducted by Peper & Gibney[9] show that 81% of the students adopted different techniques such as change in posture, rest breaks and stretching maneuvers to lessen discomfort buildup. Thus the practice of supplementary rest breaks and exercise breaks need to be promoted among the students, as it changes the loading pattern of different musculoskeletal structures and prevents buildup of discomfort.[12]

Conclusion

Risk factors for postural discomfort include posture and duration and type of computer used. Ergonomic awareness and gender are not associated with the buildup of musculoskeletal discomfort. Ideal posture to be adopted during computer use is supported sitting on a chair with computer on desk.

Limitations and Recommendations

The population parameter and thus the sample size were very small and only subjective measurement of discomfort was carried out.

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