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The Effect of Laptop Usage on The Angle of Wrist Extension Among Undergraduate Students.

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ABSTRACT

The laptop usage is an essential part of daily activities and jobs for adults as well as children. Most laptop users are unaware of the consequences of long term usage on their wrist joint which is the most important joint that comes in contact with laptop and is thus related to overuse problems. Prolonged usage of the laptop may lead to mild to obvious changes in the angle of wrist extension on both hands. Hence the purpose of this research was to study the effect of laptop usage on the angle of wrist extension among undergraduate medical students. The angle of wrist extension among 321 medical students from Faculty of Medicine of SEGi University, aged 18-25 years old were assessed and measured on both hands by using a goniometer. Other variables such as duration of computer usage in hours per day, number of years have been using computers and total estimated duration for computer usage were recorded. The statistical analysis were conducted using statistical package for the social sciences software (version 22.0). Male participants had higher angle value and more computer usage hours than female participants. Handedness data analysis showed no statistically significant results. Descriptive and comparative data analysis showed that all measurements except number of years spent for computer usage were statistically significant at $p \leq 0.05$ level. Our data also showed there was no statistically significant correlation between angle on right hand, angle on left hand and adjusted angle with number of years have been using computers. However, there was statistically significant correlation ($p \leq 0.05$) between angle on right hand, angle on left hand and adjusted angle with duration of computer usage in hours per day and total estimated duration for computer usage. In conclusion this study may give awareness to the individual to avoid or minimize the overuse of laptop and the complications by breaking bad habits, practicing recommended/approved posture while using the laptop and modulating the design of the keyboards. This may eventually help to prevent changes in the angle of wrist extension on both hands.

Keywords: Effect of Laptop Usage, Angle of Wrist Extension

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INTRODUCTION

The wrist joint is an ellipsoidal type (condyloid) of synovial joint permitting movements at two axes. The anatomical name of the joint is radiocarpal joint [1-5]. It presents sinuous opposing. The concave proximal articular surface is formed by lower end of the radius and the articular disc of the inferior radio-ulnar joint. The reciprocally convex distal articular surface is formed by the scaphoid, lunate and triquetral bones from lateral to medial side. The joint capsule surrounds the wrist joint and is attached to the distal ends of the radius and ulna and proximal rows of carpals excluding the pisiform. Strong ligaments strengthen and stabilize the joint from the sides, and on the ventral and dorsal surfaces [1,6].

The wrist joint permits abduction- adduction and flexion- extension movements [6-8]. All these movements are augmented by movements at the intercarpal and midcarpal joints which are principally responsible for abduction and greatly increase the range of flexion. Flexion describes the movement of bending the palm down towards the wrist and extension describes the movement of raising the back of the hand. At the radiocarpal joint, extension and adduction have the greatest range. The association in movement of the wrist where the movement of extension is combined with radial abduction, and of flexion combined with ulnar adduction. Pure flexion-extension and abduction-adduction, however, are unusual movements [2].

Over time it has been observed and a correlation identified between posture and musculoskeletal function; such as that of long term laptop users and angle of movement of the wrist joint. Patients with wrist pain commonly present with an acute injury or spontaneous onset of pain without a definite traumatic event [9].

It had been reported that injuries that cause acute pain may result in contusions, fractures, ligament sprains or tears, and instability. Sub-acute or chronic pain may result from overuse, have neurologic or systemic causes, or be a sequel from an old injury. Patients with these injuries may have a history of repetitive wrist movement, either occupationally or recreationally. When the same motion is repeated for extended periods of time, the joint responsible for that particular motion and the associated soft structures, may be over stressed. Repeated episodes of mechanical stress can lead to the development of repetitive motion injuries or overuse injuries, which when coupled with poor posture and biomechanics put much strain on the joints. They usually develop slowly over a long period of time. Wrists are one of the most common sites of repetitive motion injury [10].

Therefore this research was designed to study the effect of laptop usage on the angle of wrist extension among undergraduate medical students. This study may give awareness to the individual to avoid or minimize the overuse of laptop and the complications by breaking bad habits, practicing recommended/approved posture while using the laptop and modulating the design of the keyboards. This may eventually help to prevent changes in the angle of wrist extension on both hands.

MATERIALS AND METHODS

Traditional Universal goniometer was used for recording of the extension angles of wrist ankle joint. It is an easy read scale with reciprocals for measuring the range of movement in a joint [11]. Three hundred and twenty one (321) males and females medical students aged 18 to 25 from the Faculty of Medicine, SEGi University were taken as active human subjects in this research. Among 321 participants 58.3% were females and 41.7% were males. The ethical approval to perform our research was obtained by the ethical committee of SEGi University. The test was conducted to identify the absence or presence of abnormalities in the range of motion of wrist angle. The expected or the normal range of motion of wrist joint is an average of 75˚ (the range of 68 to 85˚) [11]. Students with previous history of wrist injury, joint diseases, and ages under 18 and above 30 were excluded.

The subject was seated on a chair with the elbow flexed at 90˚,and their wrist over edge of table with forearm in full pronation and the forearm stabilized. The target site was marked with a soft pen to avoid errors. The proximal arm of goniometer was placed over the triquetrum bone parallel with the ulna bisecting the ulnar styloid, radial head and lateral epicondyle while the distal arm of goniometer was placed parallel to the longitudinal axis of fifth metacarpal bone. The subjects were then asked to fully extend their wrists with their fingers comfortably flexed [11]. The measurements were taken by reading the degree between the

proximal and distal arms of the goniometer. After measurement of degree of extension of both wrists were taken, the respondents were asked questions whether they are right or left handed, the duration of computer usage per day and the number of years that they have been using the computer. The measurements and answers were tabulated. The total estimated duration for computer usage was calculated by multiplying daily usage and years of hours spent. The data collected were analysed and interpreted by using SPSS version 22 and Pearson correlation statistics [12].

RESULTS

Descriptive and Comparative Data Analysis

The table 1 shows the mean and the standard deviation of measurements: angle on right hand, angle on left hand, adjusted angle, duration of computer usage in hours per day, number of years have been using computers and total estimated duration for computer usage. Angle was also adjusted by their nature (right handed or left handed). These measures were compared between male and female participants and analyzed by independent "t" test. All measurements except number of years spent for computer usage were statistically significant at $p \leq 0.05$ level. Male participants had higher angle value and more computer usage hours than female participants.

Table1: Showing data analysis based on descriptive and comparative statistics

	Sex						
		Male		Female		Total	
	p value	Mean	SD	Mean	SD	Mean	SD
Angle on right hand	0.001	66.08	6.95	62.09	9.30	63.75	8.62
Angle on left hand	0.026	68.21	7.96	65.86	10.14	66.84	9.35
Duration of computer usage per day (Hours)	0.001	5.34	2.67	3.92	2.40	4.51	2.61
Number of years have been using computers	0.267	11.84	4.01	12.34	3.94	12.13	3.97
Total estimated duration for computer usage (Hours)	0.001	23,643.28	14,883.80	17,779.60	12,671.65	20,227.37	13,920.91
Adjusted angle	0.025	68.13	8.10	65.75	10.15	66.74	9.41

Handedness Data Analysis

The majority of participants (93.8%) were right handed persons. Table 2 shows the measures that were used to compare participants by their handedness and analyzed by independent "t" test. All measurements were not statistically significant.. There were no differences whether they are right handed or left handed.

Table 2: Showing data analysis based on handedness statistics

	Handed				
	Right handed			Left handed	
	P value	Mean	Standard Deviation	Mean	Standard Deviation
Angle on right hand	0.350	63.64	8.60	65.50	8.87
Angle on left hand	0.936	66.83	9.45	67.00	7.85

Duration of computer usage per day (Hours)	0.139	4.46	2.61	5.35	2.60
Number of years have been using computers	0.714	12.11	3.99	12.45	3.76
Total estimated duration for computer usage (Hours)	0.06	19,845.81	13,618.44	25,969.75	17,277.09
Adjusted angle	0.542	66.83	9.45	65.50	8.87

Correlation between Angle Measurements and Computer Usage

Table 3 shows the statistically significant correlation (p≤0.05) between angle on right hand, angle on left hand and adjusted angle with duration of computer usage in hours per day and total estimated duration for computer usage. However, there was no statistically significant correlation between angle on right hand, angle on left hand and adjusted angle with number of years have been using computers.

Table 3: Showing correlation data between angle on right hand, angle on left hand and adjusted angle with duration of computer usage in hours per day, number of years have been using computers and total estimated duration for computer usage.

		Duration of computer usage per day (Hours)	Number of years have been using computers	Total estimated duration for computer usage (Hours)
Angle on right hand	Pearson Correlation	0.219	-0.063	0.205
	p value	0.001	0.259	0.001
Angle on left hand	Pearson Correlation	0.231	-0.050	0.215
	p value	0.001	0.368	0.001
Adjusted angle	Pearson Correlation	0.252	-0.041	0.238
	p value	0.001	0.459	0.001

DISCUSSION

The descriptive and comparative data analysis were based on the mean and the standard deviation of measurements for angle on right hand, angle on left hand, adjusted angle, duration of computer usage in hours per day, number of years have been using computers and total estimated duration for computer usage. Angle was also adjusted by their nature (right handed or left handed). In our study the male participants had higher angle value and more computer usage hours than female participants. Other study also similarly reported that the duration of computer work was positively associated with hand/wrist symptoms among men is more common than women [13].

In our research, majority of participants (93.8%) were right handed persons. Hence we compared participants by their handedness and analyzed by independent "t" test. The results showed that all measurements were not statistically significant. There were no differences whether they are right handed or left handed. There is no report on previous study of correlation between right handed or left handed.

In our study all measurements except number of years spent for computer usage were statistically significant at p≤0.05 level. Also in our finding there was no statistically significant correlation between angle on right hand, angle on left hand and adjusted angle with number of years have been using computers. However, our data showed that there was statistically significant correlation (p≤0.05) between angle on right hand, angle on left hand and adjusted angle with duration of computer usage in hours per day and total estimated duration for computer usage. Our above findings are supported by other researchers. They found that working with a computer more than 6 hours per day was associated with musculoskeletal functions [14]. They also reported that there was a significant associations between daily or weekly hours of laptop usage and

musculoskeletal functions. They also mentioned that that there was an increase in risk as the duration of use increased [15-16].

CONCLUSION

In conclusion all measurements except number of years spent for computer usage were statistically significant in our study. Also there was no statistically significant correlation between angle on right hand, angle on left hand and adjusted angle with number of years have been using computers. However, there was statistically significant correlation between angle on right hand, angle on left hand and adjusted angle with duration of computer usage in hours per day and total estimated duration for computer usage. Hence this study may give awareness to the individual to avoid or minimize the overuse of laptop and the complications by breaking bad habits, practicing recommended/approved posture while using the laptop and modulating the design of the keyboards. This may eventually help to prevent changes in the angle of wrist extension on both hands.

AUTHOR CONTRIBUTIONS

Conceived and designed the experiments: KTZ NSS HTD SRD. Performed the experiments: AT NFAH EM AFA. Analyzed the data: AT NFAH EM AFA HTD. Wrote the paper: KTZ NSS HTD SRD. Revised the paper: KTZ NSS HTD SRD AT NFAH EM AFA KAJ MAE MES VA SYAK JZ RM WAC AY RSYW NMHM ATK SAY MB KTO SWWL. All authors read and approved the final manuscript to be published.

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