Effects of elbow angle on finger dexterity

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SUMMARY

Today, various jobs containing manual tasks can have adverse impacts on people's abilities. Therefore, this study aimed to investigate the impact of different elbow angles of manual load handling on hand dexterity. In this cross-sectional study, 34 males manually carried loads in three different positions (i.e., a 90-degree elbow angle, a 180-degree elbow angle, and one hand) for 5 minutes. Then, the O'Connor test was performed after each effort. The results showed that among various methods of manual load handling, load handling with a 90-degree elbow angle caused a significant increase in the number of errors and duration of the O'Connor test (P \leq 0.001). Overall, manually carrying the load with one hand was the best alternative among the three methods. The findings revealed that a 90-degree elbow angle causes the most remarkable drop in people's performance. Therefore, attention should be paid to how to carry loads and choose the correct method of cargo transportation, and danger signs should be taught to the employees in related jobs.

KEYWORDS

Manual handling, Reaction time, Error, O'Connor

Introduction

Nowadays, workers have to do manual work in many occupations after manual handling, such as truck drivers who have to drive after cargo transferring. In addition, the manual load handling by inappropriate elbow angles damages various body parts (Tinubu 2010, Punnett 2004, Borg 1990). Therefore, the study aims to recognize the effects of different elbow angles during manual handling on hand dexterity.

Material and methods

34 people in the age range of 19-35 years participated in this study. Each person had to carry a box (with handle) by using their two hands with an elbow angle of 90 and 180 degrees with straight down fully extended arms (The load was 15% of their body weight) and with their dominant hand (the load was 7.5% of their body weight) for 5 minutes on a treadmill with a slope of 0 degrees over three days (without any order). Load weights were selected according to the MAC (Manual handling assessment charts) standard. The O'Connor test (individuals should put nails in the holes with the highest speed and fewest errors) was performed with the dominant hand after each effort to check the finger dexterity. In this way, the person should insert small nails into the hole with tweezers in the shortest time. Then reaction time and the number of errors were compared for the different elbow angles. It was expected that finger dexterity would decrease after manual handling. Descriptive statistics were used to calculate the mean data, standard deviation, and frequency of variables, and a one-way repeated measure test was employed to test the hypotheses.

Results

Based on the obtained data (Table 1), the maximum number of errors and reaction time were related to handling with an elbow angle of 90 degrees and the minimum number of errors in manual handling with one hand.

Table 1: O'Connor test

	Time (minute)		Errors	
	Mean (SD)	(P)	Mean (SD)	(P)
After manual handling with a 90- degree angle	4.38 (0.29)		3.56 (1.61)	
After manual handling with a 180 degree angle	4.27 (0.25)	_ (P≤0.001)	1.26 (1.18)	_ (P≤0.001)
After manual handling with one hand	4.21 (0.23)	-	0.68 (0.91)	-

Discussion

The time of conducting the test after carrying the load with a 90-degree elbow angle was higher compared to other cases (according to Table 1), and a significant difference was observed between the time of conducting the test and the way of handling the load ($P \le 0.001$). As previously mentioned, the hand becomes tired, and the performance decreases after carrying the load, especially out of the normal state (90-degree elbow angle) (Eddy 2015, Tsao 2017). The number of errors (Table 1) significantly increased after performing the O'Connor test so that this amount was more in manual load handling with a 90-degree elbow angle compared to other methods. In handling the load with one hand, the number of errors was less than that of the other methods, and the amount of error was related to how the load was carried manually ($P \le 0.001$).

Conclusion

In this regard, carrying a load with a 90-degree pressure elbow angle has a more negative effect, while carrying a load with one hand has a less negative impact on hand dexterity. Therefore, the best method should be adopted to reduce the negative effect of manual load handling.

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