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Examination of the Relationship Between Muscle Palmaris Longus and Reaction Time

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Abstract: This study was conducted to find people with and without Palmaris Longus muscle on their forearms and to determine whether this muscle has an impact on their reaction time. The study covered 32 female subjects who volunteered to participate. Subjects with Palmaris Longus muscle on their forearms formed Group G_1 while those without this muscle formed Group G_2. The subjects were measured for their length, width and reaction time. An inflexible measuring tape was used for length measurements and a calliper was used for width measurements. For measurement of reaction time, Nelson Reaction Scale was used. Student's t-test for independent samples was used for a comparison of two groups. The difference between Group G_1 and Group G_2 in terms reaction time was found significant ($p<0.05$). As a conclusion, it was found that subjects with Palmaris Longus muscle in their arms had better reaction time compared to those without Palmaris Longus muscle, which tells us that individuals with Palmaris Longus muscle have more advantageous than those without Palmaris Longus muscle and having Palmaris Longus muscle is considered to be an advantage in team sports such as basketball, handball and volleyball and individual sports and particularly racket sports.

Key words: Palmaris longus muscle · Reaction time · Sports anatomy · Muscle variation

INTRODUCTION

People use their hands in both their daily activities and sports. Complex movements of hands are conducted owing to the well-functioning coordination between a balanced muscular system and central nervous system [1]. Muscles that provide motion for hands are located in the forearm and hands and ensure movement of fingers and wrists. One of these muscles is musculus palmaris longustur (mpl) [2]. Mpl is located on the front part of the arm and contributes into clutching function and flexion power of hands. However, it is know that some people do not have this muscle [3]. Mpl is a long, thin, cylindrical muscle on the front part of forearm and enables hands to flex [4,5]. The tendon of mpl is tested at "O" position by bringing the wrist into flexion and combining the thumb with the little finger. Mpl is one of the muscles that display most variations in the body [6,7]. Some studies state that mpl is a tricipital muscle [8-10] while some others suggest that it is a bicephalous muscle [3,11-14].

Hands, as sophisticated parts of human body that can make fine movement, are a motor and functional unit of the body and the most important organs in carrying out physical activities [15]. Many sports activities that we carry out in our daily lives are made by our hands. We owe the importance of our hands to the motion rendered by our hand muscles to our hands.

The hand-skill is the hand-eye coordination skill which is particularly important for works that require fine and rough muscular control. The hand-eye coordination is particularly important for team sports including handball, basketball and volleyball and racket sports as well as individual sports which call for motor hand skills. Measurement of reaction time has a significant place in determining the hand-eye coordination.

There are many definitions available for reaction time. The common point in all these definitions is a stimulus and a response to that stimulus [16-18]. Reaction time is defined as the time that passes from the start of the stimulus until the start of the response [19]. Reaction time is a genetic attribute determining the time between a stimulus and the first muscular response or reaction to that stimulus [20]. In other words, reaction time is the amount of time that passes from reception of a suddenly-emerging signal to the response given to this signal. Reaction time is a decisive motor attribute in sports and it can be developed through training [21,22]. Studies conducted to describe sportive skills have suggested that sportive skills are a mixture of components. Reaction time and hand-eye coordination are part of this mixture [23].

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Athletes should display high performance in terms of physiologic and motor attributes for success in sports. One of the parameters that provide success is reaction time. Fox *et al.* [24] suggested that reaction time of athletes with higher performance is better. Considering that titles are won or lost with one or two-point differences, it becomes more and more important for players to get concentrated. It is stated that reaction time is developed through training. Reaction time is one of the decisive criteria in scouting talents.

This study was conducted to find people with and without Palmaris Longus muscle on their forearms and to determine whether this muscle has an impact on their reaction time.

MATERIAL AND METHOD

Subjects were checked for their mpl tendons on their wrists and those having mpl were distinguished from those who do not. Mpl was checked by bringing the wrist into flexion and combining the thumb with the little finger ("O" Position). 12 subjects were found to have mpl while other 20 did not. Our study covered 32 volunteer female subjects who displayed similarities with one another in terms of their physical attributes. Subjects were measured for their ages, height, body weight, body-mass index (kg/m^2), front arm length and hand length of their dominant, width of elbow and wrist and the reaction time of their dominant hand. An inflexible measuring tape was used for length measurements and a calliper was used for width measurements. The calliper is composed of a fixed part and a dynamic part. There is a scale on its fixed part showing us the measurement unit. After fixing the width to be measured between the extensions of the fixed and dynamic parts of the calliper, the value which was read from the scale was recorded. The Nelson Reaction Scale was used to measure reaction time.

For measurement of reaction time, the subject sat down on a chair with his forearm and hands in a relaxed position on the table. The tips of the thumb and index fingers were prepared at 8-10 cm from the table (picture 2) as the upper parts of the thumb and index fingers in parallel to each other. The administrator of the test held the scale between the thumb and index fingers of the subject (picture3). The subject was asked to look directly at the middle point of the scale (at the concentration area between 0.120 and 0.130 lines). He was then asked to catch the scale with his thumb and index fingers when the scale was released [19].

The scale was released and the line from where the subject caught the scale with his thumb was recorded. Measurements were repeated for four times and the best value was recorded as the reaction time of the subject. The reaction time on the scale is the value calculated through the following formula in milliseconds (msn) [19].

Reaction Time = v 2 x The Distance from which the scale falls down / Speed depending on Gravity)
Reaction Time = v2 x Distance (cm) / 980 msn.

Measurement results were presented in average and standard deviation. Student's t-test for independent samples was used for a comparison of two groups. SPSS (Statistical Package for the Social Sciences) 13,0 package software was used in data analysis and the value 0.05 was considered to be significant.

Findings: Statistical findings which were obtained in the study have been presented in tables.

A comparison between subjects with and without mpl was found significant differences between their reaction time values ($p<0.05$).

DISCUSSION AND CONCLUSION

The frequency of having or not having mpl was defined in athletes and it was found that athletes having this muscle had significantly-different reaction times. Lack of any other previous study on this subject increases the importance of our study. We have found various authors indicating many abnormalities of this muscle [25-30]. Such abnormalities are reported as being tricipital or bicephalous, making insertions into different places, the core of the muscle being in distal, the core of the muscle being in the middle and tendons being on both sides [8-10].

According to our findings, reaction times are different in those with and without mpl in their arms. The value of reaction time which is defined as the time that passes from the start of the stimulus until the start of the response [19] were different between those with/out mpl. It was observed that reaction time was smaller in those with Mpl than those without mpl, which tells us that mpl positively contributes into the reaction time. In this respect, having Mpl can provide an advantage for an athlete over those who do not have it. This conclusion is particularly important for scouting athletes in sports which require using upper extremities.

Table 1: Physical attributes of subjects with/out mpl

Variables	Group	n	Mean	SD	t	p
Age (year)	G_1	20	21.40	1.69	0.745	0.462
	G_2	12	21.00	0.95		
Height (cm)	G_1	20	164.25	4.64	-1.073	0.292
	G_2	12	166.16	5.28		
Body Weight (kg)	G_1	20	55.55	5.47	1.344	0.189
	G_2	12	52.91	5.17		
BMI (kg/m^2)	G_1	20	20.60	1.94	2.195	0.056
	G_2	12	19.14	1.55		

Table 2: Length and width measurement values of subjects with/out mpl

Variables	Group	n	Mean	SD	t	p
Upper Arm Length (cm)	G_1	20	29.15	2.13	0.090	0.929
	G_2	12	29.08	1.83		
Forearm Length(cm)	G_1	20	23.00	1.12	0.623	0.538
	G_2	12	22.75	1.05		
Hand Length (cm)	G_1	20	17.95	0.99	-1.507	0.142
	G_2	12	18.50	1.00		
Elbow width (cm)	G_1	20	57.39	3.76	0.247	0.807
	G_2	12	56.98	5.62		
\Hand wrist width (cm)	G_1	20	50.87	4.35	0.352	0.727
	G_2	12	50.31	4.36		

Table 3: Reaction time measurement values of subjects with/out mpl

Variables	Group	n	Mean	SD	t	p
Reaction Time (msn)	G_1	20	0.18	0.09	-2.085	0.046*
	G_2	12	0.21	0.06		

**p<0,05

Reaction time is defined as the time that passes from the start of the stimulus until the start of the response, or the amount of time that passes from reception of a suddenly-emerging signal to the response given to this signal [9, 17,29,30]. The reaction time is a genetic attribute determining the time between a stimulus and the first muscular response or reaction to that stimulus [19]. In our study, when the Nelson Reaction Scale used to measure the reaction time was released, the subject developed a response to this stimulus and grasped the scale. Our findings support the idea that mpl which increases the clutching skill of hands is effective in grasping the scale. In this sense, eye-hand coordination is an important parameter in determining the reaction time.

The hand-skill is the hand-eye coordination skill which is particularly important for works that require fine and rough muscular control. The hand-eye coordination is particularly important for team sports including handball, basketball and volleyball and racket sports as well as individual sports like archery which calls for motor hand skills. Mpl as a fundamental component for clutching skills also plays an important role in reaction times. In this respect, having mpl can be considered to be a prerequisite in selection of athletes.

As a conclusion, we can rely on our findings to claim that having mpl makes positive contribution into reaction time. It is important that our study is the first study on this area. We find it useful to conduct further studies on more athletes in different age groups, which might yield stronger conclusions.

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