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Relationship between Muscle Strength and Elbow Push Test in Shoulder Evaluation

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Abstract

Background

We examined what muscles were related to the Elbow Push Test (EPT). **The results of the EPT may have reflected the strength of the serratus anterior muscle. Validation of the timing of the contraction of these muscles may be important diagnostic factors for individuals with shoulder disorders.**

Methods

For 21 healthy individuals, the muscular force required to perform the EPT, as well as the strength of the trunk rotators, serratus anterior muscle, and external and internal rotators were measured using a hand-held dynamometer. We e**valuated** the relationship between the results of the EPT and the strength of each muscle.

Results

The results of the EPT may have reflected the strength of the serratus anterior muscle.

Conclusions

Validation of the timing of the contraction of these muscles may be important diagnostic factors for individuals with shoulder disorders.

Background

Shoulder disorders are largely caused by shoulder joint debilitations, rotator cuff dysfunction, or deficits in the kinetic chain of the shoulder with the lower extremities and trunk. Reportedly, postural control works [1] against gravitational central sway during the movement of the upper extremities [1], therefore, it is important to evaluate patients with shoulder disorders for not only shoulder joint function but also, scapula mobility and stability, as well as trunk muscle stability (Kiefer, Shirazi-Adl and Parnianpour, 1998). In Japan, the Elbow Push Test (EPT) and elbow extension test are often used for shoulder evaluation [2]. These tests have shown to accurately reflect the kinetic chain of the shoulder with the scapula and trunk; however, the empiric reliability of the measured parameters that compose these tests is insufficient. Therefore, in the present study, the relationship between muscle strength and the results of the EPT was examined.

Methods

We evaluated 21 healthy individuals (men, 13; women, 8; age, 16.2 ± 1.0 years; height, 165.6 ± 7.7 cm; weight, 59.2 ± 9.9 kg). All subjects were informed regarding the purpose and procedure of the study, and the subjects provided written informed consent before participation.

Using a hand-held dynamometer (μ-tas F-1, ANIMA), the muscular force used while performing the EPT, and the strength of the trunk rotators, serratus anterior muscle, and external and internal rotators were measured. The EPT was performed with subjects in the sitting position with both arms extended and elbows folded in front of the chest (shoulder, 90° **flexion and 90° internal rotation; elbow,** 90° **flexion; and forearms, neutral**). The subjects pushed with their elbows against resistance provided by the examiner at the cubital region, where the maximal isometric force was measured (Figure 1). We checked ICC (1,1) of this measurement prior to this study, and confirmed it was 0.908 which was sufficient. The manual muscle testing method described by Daniels [3] was used to measure the strength of the serratus anterior muscle, and external and internal rotators. The strength of the trunk rotators was measured with subjects in the sitting position (Figure 2). The trunk was rotated against the resistance provided by the examiner at the acromion, where maximal isometric force was measured. We checked ICC (1,1) of this measurement prior to this study, and confirmed it was 0.943 which was sufficient [4]. In all conditions, maximal isometric force was measured thrice and the average values and differences between left and right sides were extracted for statistical analysis [5,6].

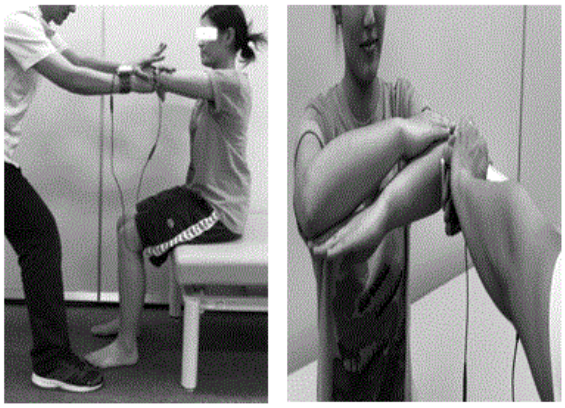

Figure 1: Elbow push test (Lt: saggital plane, Rt: frontal plane)

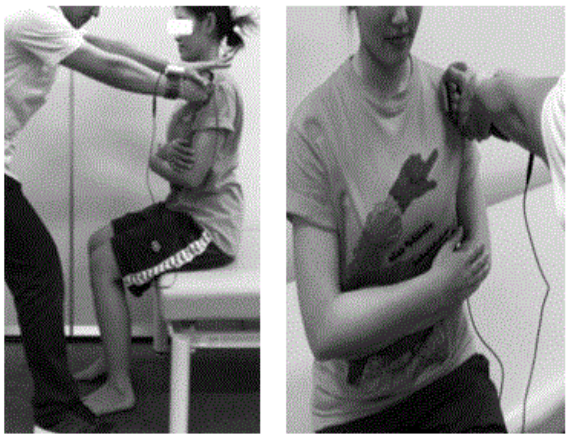

Figure 2: Measurement of the trunk rotators strength (Lt: saggital plane, Rt: frontal plane).

The Pearson's correlation coefficient was used in the statistical analysis to e**valuate** the relationship between the EPT results and strength of the trunk rotators, serratus anterior muscle, and shoulder external and internal rotators. The average values and differences between both sides were determined. All statistical analyses were performed using IBM SPSS 18.0J statistical software for Windows. A probability (p) value of >0.05 was considered statistically significant.

Results

As shown in Table 1, positive correlations were found between the average values of the EPT and strength for each muscle and group of muscles. In the analysis of differences, positive correlations were observed between the EPT results and strength of the serratus anterior muscle.

		TR	SA	EE	E/R	I/R
EPT	average value	.671**	.739**		.619**	.520*
	different value	.005	.470*		-.002	-.068

EPT: elbow push test, TR: trunk rotatiors, SA: serratus anterior muscle, E/R: external rotators, I/R: internal rotators, *: p<0.05, **: p<0.01

Table 1: Results of the correlation analysis of the relationship between EPT and muscle strength

Discussion

From the results of the average value, every muscle was relevant to the EPT. It was easy to image that subjects who had stronger muscles could apply their muscle forces to EPT because they had no problems in their shoulders. It was thought to be the reason of this significant correlation. And then, from the results of the different value, only serratus anterior muscle was relevant to the EPT. **The result of the EPT may have reflected the strength of the serratus anterior muscle**. This measurement was possible to assess the function of scapula because it should be needed to keep the scapula stable during the movement of the upper extremity.

As a limitation of this study, the study subjects were normal, healthy individuals without shoulder disorders or problems associated with the trunk muscles or other stabilizing muscles were reported to work before moving upper extremities (Belen'kll, Gurfinkel VS and Pal'tsev, 1967; Hodges and Richardson, 1997**). And validation of not only the muscle forces but also the timing of the contraction of these muscles may be important diagnostic factors for individuals with shoulder disorders.**

Conclusions

The results of the EPT may have reflected the strength of the serratus anterior muscle. Validation of the timing of the contraction of these muscles may be important diagnostic factors for individuals with shoulder disorders.

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