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ORIGINAL ARTICLE

Is active rowing time associated with lateral epicondylitis symptoms in rowers?

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Purpose: We aimed to investigate the relationship between active rowing time, pain, function, and strength in rowers.
Methods: Forty volunteer rowers from Turkish National Rowing Team participated in the study. Rowers' gross and fine grip strength, muscle strength, and symptoms of lateral epicondylitis was evaluated by the same physiotherapist.
Results: The mean age was 21.4±4.3 year of rowers. The mean results of right gross grip was 91.3±25.2 kgf, left gross grip 89.7±18.0 kgf, right fine grip 24.6±5.2 kgf, left fine grip 23.0±4.6 kgf. The manual muscle testing results were for extensor carpi radialis longus on right 5.0±0.0, on left 4.9±0.3, extensor carpi radialis brevis on right 5.0±0.0, on left 4.9±0.3, extensor pollicis longus on right 5.0±0.0, on left 4.9±0.3, extensor digitorum communis on right 4.6±0.5, on left 4.3±0.7. The Patient-Rated Tennis Elbow Evaluation pain subscale score was 10.5±6.2, function subscale score was 7.9±3.4 and total score was 18.4±8.6 points. There was statistically significant relationship between grip, muscle strength and "Patient-Rated Tennis Elbow Evaluation" scores (p>0.05).
Conclusion: There was no statistically significant relationship between lateral epicondylitis symptoms, grip strength and muscle testing in rowers. The reason for this, we conclude that the number of cases was low and active rowing times of the cases are not uniformly distributed. Reducing symptoms with equipment modifications is recommended as protective rehabilitation.
Keywords: Pain, Tennis elbow, Muscle strength, Upper extremity, Athletes.

Kürekçilerde kürek çekme süresi lateral epikondilit semptomları ile ilişkili midir?

Amaç: Çalışmamızda kürekçilerde kürek çekme süresi ile ağrı, fonksiyon ve kuvvet ile ilişkili semptomları araştırmayı amaçladık.
Yöntem: Türkiye Ulusal Kürek Takımında yer alan 40 gönüllü kürekçi çalışmaya dahil edildi. Kürekçilerin, kaba ve ince kavrama kuvvetleri, kas kuvvetleri ve lateral epikondilit ile ilişkili semptomları aynı fizyoterapist tarafından değerlendirildi.
Bulgular: Kürekçilerin ortalama yaşları 21,4±4,3 yıl idi. Değerlendirme sonuçlarına göre kavrama ve kas testi ortalamaları, sağ kaba kavrama 91,3±25,2 kgf, sol kaba kavrama 89,7±18,0 kgf, sağ ince kavrama 24,6±5,2 kgf, sol ince kavrama 23,02±4,64 kgf idi. Manuel kas testi sonuçlarında, extansor carpi radialis longus için sağ 5,0±0,0, sol 4,9±0,3, extansor carpi radialis brevis için sağ 5,0±0,0, sol 4,9±0,3, extensor pollicis longus için sağ 5,0±0,0, sol 4,9±0,3, extensor digitorum communis için sağ 4,6±0,5, sol 4,3±0,7 idi. "*Patient-Rated Tennis Elbow Evaluation*"in iki alt başlığından ağrı 10,5±6,2, fonksiyon 7,9±3,4 ve total skoru 18,4±8,6 olarak bulundu. Çalışmamızın sonuçlarına göre kürekçilerin, kavrama kuvveti, kas testi ve "*Patient-Rated Tennis Elbow Evaluation*" sonuçları arasında istatistiksel olarak anlamlı ilişki bulunmadı (p>0,05).
Sonuç: Kürekçilerde lateral epikondilit semptomları, kas gücü ve kavrama kuvvetleri arasında ilişki bulunmadı. Bunun nedeninin, olgu sayısının az olması ve olguların kürek çekme sürelerinin homojen dağılmaması olduğu görüşündeyiz. Ekipman modifikasyonlarıyla semptomların azaltılması koruyucu rehabilitasyon olarak önerilir.
Anahtar Kelimeler: Ağrı, Tenisçi dirseği, Kas kuvveti, Üst ekstremite, Sporcular.

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Fine motor control is important for the academic and possibly social realms. Fine motor skills affect the person's quality of life. Grooming tasks such as brushing one's hair and putting on makeup require fine motor coordination. Gross motor ability may impact on physical appearance, as having the resources to engage in physical activity will enhance one's overall physique.[1] Forearm and wrist injuries are relatively common rowers. Most often, forearm and wrist problems can be traced back to poor technique or fatigue.[2,3] Both forearm tendinitis and tenosynovitis are commonly seen in the rower, and excessive wrist motion during the feathering action is usually to blame. Many factors contribute to forearm and wrist problems in rowers. Wrongly sized grips, poor rigging, and wet or rough conditions can cause the rower to use excessive wrist motion.[4]

Lateral epicondylitis is characterized by microtears, collagen degeneration, and angioblastic proliferation of the common extensor tendon. It is also defined by pain at the lateral side of the elbow, which is increased by pressure on the lateral epicondyle and during resisted dorsiflexion of the wrist. Specific manual tests or palpation at the lateral epicondyle can aggravate pain. And they are the most important diagnostic findings for the lateral epicondylitis.[5] This pain is often exacerbated by gripping activities with grip strength often impaired. In addition to the pain, tenderness can locate over the lateral epicondyle of the humerus at its origin of the wrist extensor tendons. Rowers are at risk for overuse injuries defining the utility of screening tests for identifying those at risk for lateral epicondylitis can aid the development of guidelines for injury prevention. Junior rowers have higher injury rate than senior rowers. Training volume was significantly associated with injury.[6]

In rowers have several problems with their sports which is included lateral epicondylitis. In the literature, there is no study relationship between active rowing time and symptoms of lateral epicondylitis in rowers. In this study, we aimed to investigate the relationship between active rowing time, muscle strength, grasping and symptoms of lateral epicondylitis in rowers.

METHODS

Study design

This study was approved on 04/10/2017 and with the number of 377, by Istanbul Medipol University Clinical Research Ethics Committee and conducted according to Helsinki Declaration Rules.

Forty volunteer rowers from Turkish National Rowing Team whose age between 16-33 years participated in the study. All of the participants were given an informed consent and permission of parents whose children under aged 18 years. They were asked to sign this paper, indicating that they were participating voluntarily (Figure 1). Forty subjects were screened using a self-reported, socio-demographic questionnaire, and functional scales.

Exclusion criteria of the study:

- If they had an upper extremity musculoskeletal injury history in the six months before the study during against evaluation.
- Any neurological or specific orthopedic problem in the upper extremity.

Methods

The sociodemografic features of rowers were evaluated by questionnaire. The questionnaire was included; age, body weight, body height, body mass index (BMI), and gender.

Assessment of gross and fine grip strength

For testing with the Jamar® handgrip (Jamar® Hydraulic Hand Dynamometer, Model Number: 63785) the participant attempted to squeeze hand grip dynamometer with dominant hand to generate as much force as possible. The participant was seated on a straight-back armless chair with feet flat on the floor, shoulder with apart. The nondominant arm was resting neutrally. The participant's forearm was in 90 degree of flexion. For standardization, it was set at the second handle position for all subjects. Once the dynamometer had been adjusted to the correct position, the participant was instructed to squeeze the handle as hard as possible. Three trials were administered, allowing at least 30 sec between trials for each hand. The needle was rested at zero after each trial. Each participant's score was recorded to the nearest

kilogram. The middle score of the three trials serves as the criterion score.[7] For fine grip strength evaluations, The American Society of Hand Therapists recommended positioning the forearm in the neutral or midposition and recording the mean of three trials.[8] Once the dynamometer had been adjusted to the correct position, the participant was instructed to squeeze the fingers with lateral type grip as hard as possible. Three trials were administered, allowing at least 30 sec between trials for each hand. The needle was rested at zero after each trial. Each participant's score was recorded to the nearest kilogram. The middle score of the three trials serves as the criterion score.

Assessment of muscle strength

Manual muscle testing (MMT) is a procedure for the evaluation of the function and strength of individual muscles and muscle groups based on effective performance of a movement in relation to the forces of gravity and manual resistance. MMT is a convenient, versatile, quick to apply, and inexpensive means of assessing muscle strength. MMT is applied in MMT grading procedures.[9] Extensor digitorum communis (EDC), extensor pollicis longus (EPL), extensor carpi radialis longus (ECRL) and extensor carpi radialis brevis (ECRB) were tested manually. The MMT was shown to be a clinically useful tool, but its ultimate scientific validation and application requires testing that employs sophisticated research models in the areas of neurophysiology, biomechanics, and statistical analysis.[10] The scoring of the MMT as Oxford Scale which that 0=No visible or palpable contraction, 1=Visible or palpable contraction, 2=Full range of motion gravity eliminated, 3=Full range of motion against gravity, 4=Full range of motion against gravity, moderate resistance, 5=Full range of motion against gravity, maximum resistance.

Patient Rated Tennis Elbow Evaluation

The Patient-Rated Tennis Elbow Evaluation (PRTEE) measurement was used in an unconventional manner, and the power calculation. The scale included pain and functional disability (specific activities and usual activities) subtitles. The scoring of the scale is in the below. In our study we used the Turkish version of PRTEE questionnaire.[11]

Pain subscale - Add up 5 items. Best score=0, worst score=50.

Specific activities - Add up 6 items. Best score=0, worst score=60.

Usual activities - Add up 4 items. Best score=0, worst score=40.

Function subscale- (Specific Activities + Usual Activities)/2. Best score= 0, worst score =50.

Total score = Pain subscale + Function subscale. Best score=0, worst score=100

(pain and disability contribute equally to score).

Statistical analysis

The power analysis of the study was done with 80% (ß=0.20), the confidence interval was 95% and the margin of error was α=0.05.According to the power analysis results, the number of individuals to participate in the study was at least 37. Statistical analysis was performed using the SPSS software package (version 20.0; SPSS, Inc., Chicago, IL, USA) for Windows. Before the statistical analysis, Kolmogorov-Smirnov test was used to test for normal distribution of data. Descriptive statistics were used to determine differences of subjects' demographic and clinical features. Correlations between parameters were computed through the Spearman correlation analysis. The significance value was taken as $p<0.05$ in all statistics.

RESULTS

The demographical and clinical subject's mean value ± standard deviation of age, weight, height, gender, gross and fine grip strength, manual muscle testing, and PRTEE were shown in Table 1. There is no significant difference between active rowing time and muscle testing that measured ECRL, ECRB, EPL, and EDC muscles ($p>0.05$) (Table 2). There is no correlation between grasp strength, muscle testing and PRTEE (Table 3).

DISCUSSION

Tennis elbow is frequently seen in overuse injuries in rowers.[12] At the end of our study, while there was a statistically significant relationship between pain and function subtitle

of PRTEE there was no relationship between active rowing time, lateral epicondylitis-related symptoms, muscle and grip strength.

Bhargava et al. was showed about chronic lateral epicondylitis and grip strength, that all the subjects with history of trauma, fracture, surgery, or other medical and non-medical interventions to elbow, bilateral symptoms, polyarthritis, upper quadrant neuromusculoskeletal disorders that might affect grip strength.[13] In our study exclusion criteria were upper extremity musculoskeletal injury history in the six months before the study and any neurological or specific orthopedic problems in the upper extremity as well.

Masini et al. found that lateral epicondylitis has been recognized as an upper extremity complaint in rowers.[14] In the literature PRTEE is frequently used to evaluate the symptoms of lateral epicondylitis.[15] In our study, we evaluated the symptoms related with lateral epicondylitis with PRTEE, which was validated and validated in Turkish. We chose this test because it is easy to apply; it evaluates both pain and function. There was a relationship between pain and function scores of test. We think that it caused from similar evaluations included by the pain and function subtitles of test. We did not find any relationship between pain and function scores of active rowing time and we think that the symptoms of the cases were not very severe.

In the literature, it is stated that in some studies the grip strength in patients with lateral epicondylitis decreases.[16,17] We also evaluated gross and fine grip strength which we think that the effected with the symptoms of lateral epicondylitis. The most common functional limitation is pain on gripping, and this can be measured as pain-free grip strength, which is a reliable and valid measure that is more sensitive to change than maximal grip strength.[18] In Smidt's study, examining grip strength in patients with lateral epicondylitis, pain-free grip strength and maximum grip strength was measured with the Jamar hand held dynamometer.[5] In our study we also used Jamar Hydraulic Hand Dynamometer. In Smidt's study almost perfect reliability was found for the pain-free grip strength and maximum grip strength (ICC 0.97). Chourasia et al. found significant correlations between grip strength and PRTEE function subscale and pain subscale.[19] The fact that there was no significant relationship between active rowing times and grip strengths was due to the fact that the rowing times of the cases were not uniformly distributed. Manual muscle testing is one of the most commonly used methods for assessing muscular strength. The most commonly used method of assessing muscle strength is the manual muscle test. Hand Held Dynamometer (HHD) is also recommended for objective evaluations. Limitations of HHD include tester strength, lack of stabilization and inconsistency with testing procedures.[20] The most commonly affected muscles are; EDC, EPL, ECRL and ECRB in lateral epicondylitis. In our study, we evaluated muscle strength with manual muscle test because of muscles and ease of application.

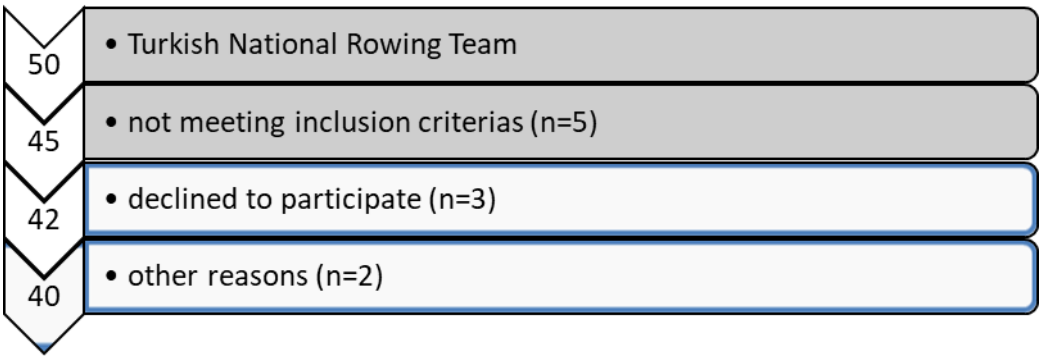

Figure 1. The flow chart of the participants.

Table 1. Sociodemographical and physical characteristics of participants.

	Mean±SD	Min-Max
Age (yrs)	21.37±4.30	16-33
Body weight (kg)	76.88±8.17	69-91
Body height (m)	1.86±0.05	1.78-1.97
Body mass index (kg/m^2)	22.16±1.57	19.39-25.46
Grip strength (affected side) (kgf)		
Gross	91.33±25.15	25.00-100
Fine	24.62±5.24	15.00-35.00
Grip strength (unaffected side) (kgf)		
Gross	89.71±18.02	25.00-100
Fine	23.02±4.64	15.00-35.00
Muscle testing (affected side)		
Extensor carpi radialis longus	4.90±0.30	4.00-5.00
Extensor carpi radialis brevis	4.90±0.30	4.00-5.00
Extensor pollicis longus	4.90±0.30	4.00-5.00
Extensor digitorum communis	4.27±0.71	4.00-5.00
Muscle testing (unaffected side)		
Extensor carpi radialis longus	5.00±0.00	4.00-5.00
Extensor carpi radialis brevis	5.00±0.00	4.00-5.00
Extensor pollicis longus	5.00±0.00	4.00-5.00
Extensor digitorum communis	4.57±0.50	4.00-5.00

Muscle testing measured as Oxford Scale.

Table 2. Comparisons between active rowing time and muscle testing.

	Active rowing time (yrs)				
	1-2	2-3	3-4	More than 5	p
Muscle testing					
Extensor carpi radialis longus	3	2	5	30	0.77
Extensor carpi radialis brevis	3	2	5	30	0.77
Extensor pollicis longus	3	2	5	30	0.77
Extensor digitorum communis	3	2	5	30	0.42

Muscle testing measured as Oxford Scale (0-5) on affected side.

Table 3. Correlations between grip strength, muscle test and, the Patient-Rated Tennis Elbow Evaluation scores.

	Patient-Rated Tennis Elbow Evaluation		
	Pain subscale r	Function subscale r	Total score r
Grip strength (affected side)			
Gross	0.137	0.103	0.007
Fine	-0.155	-0.135	-0.049
Grip strength (unaffected side)			
Gross	0.128	0.118	0.058
Fine	0.038	0.077	0.123
Muscle testing			
Extensor carpi radialis longus	-0.054	-0.084	-0.071
Extensor carpi radialis brevis	-0.054	-0.084	-0.071
Extensor pollicis longus	-0.054	-0.084	-0.071
Extensor digitorum communis	-0.169	0.291	0.010

r: Spearman correlation coefficient (p>0.05).

In our study there is no relationship between active rowing time and muscle strength. We think that it caused from ages and active rowing times have so wide range.

Limitations

The study has not had the control group for comparing the data. Our measurements were subjective, not have the objective outcomes as HHD etc. The demographic characteristics of rowers have wide range and have differences for example; the duration of sports, etc. Also we have no groups which separated by age.

Conclusion

Active rowing time, symptoms related lateral epicondylitis, muscle and grip strength were not correlated in rowers. We believe that early detection of symptoms associated with lateral epicondylitis will be effective in developing appropriate equipment and appropriate training technique. In the future studies including detailed assessments based on age groups and active rowing times will lead to protective rehabilitation against overuse injuries especially in rowers.

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