Original Article / *Orijinal Makale*

DOI: 10.4274/tftr.22230

Turk J Phys Med Rehab 2013;59:292-8
Türk Fiz Tıp Rehab Derg 2013;59:292-8

Muscle Strength, Fatigue, Functional Capacity, and Proprioceptive Acuity in Patients With Fibromyalgia

Fibromiyaljili Hastalarda Kas Gücü, Yorgunluk, Fonksiyonel Kapasite ve Proprioseptif Keskinlik

Yeşim AKYOL, Yasemin ULUS, Berna TANDER, Ayhan BİLGİCİ, Ömer KURU

Ondokuz Mayıs University Faculty of Medicine, Department of Physical Medicine and Rehabilitation, Samsun, Turkey

Summary

Objective: To compare muscle strength (MS), fatigue, functional capacity, and proprioceptive acuity in patients with fibromyalgia (FM) and controls, to evaluate the impact of FM severity on these features.
Materials and Methods: Sixty women with FM and 45 healthy controls were included. FM-related measurements (number of tender points, myalgic score, pain visual analogue scale (VAS), fibromyalgia impact questionnaire (FIQ)) of the patients were recorded. The patients were classified as having moderate and severe FM assessed by the FIQ. All participants underwent following assessments: knee flexor-extensor muscles strength, handgrip strength, proprioceptive acuity, 6-minute walk test (6MWT), and the multidimensional assessment of fatigue scale (MAF).
Results: Knee flexor-extensor muscles strength, and 6MWT were significantly lower, MAF score was significantly higher in FM patients than in controls ($p<0.05$). There were no significant differences between the patients and controls in terms of proprioceptive acuity and handgrip strength ($p>0.05$). Pain VAS and MAF scores were significantly higher in patients with severe FM compared with those with moderate FM ($p<0.05$). In patients, knee flexor-extensor muscles strength and handgrip strength were not associated with pain VAS and MAF scores, 6MWT, and proprioceptive acuity ($p>0.05$). 6MWT was negatively associated with pain VAS score ($p=0.001$). MAF score was positively associated with pain VAS score ($p<0.05$), but it was not associated with 6MWT ($p>0.05$).
Conclusion: The patients had increased fatigue and pain intensity, reduced knee flexor-extensor muscle strength and functional capacity compared to the healthy subjects. Pain intensity and fatigue were found to be more affected by FM severity. According to these results, improving function and MS should be taken into consideration in the management of FM, but releiving pain and improving fatigue should be prioritised.
Key Words: Fibromyalgia, fatigue, muscle strength, proprioception

Özet

Amaç: Fibromiyalji (FM)'li hastalar ve sağlıklı kontrollerde kas gücü (KG), yorgunluk, fonksiyonel kapasite ve proprioseptif keskinliği karşılaştırmak; FM şiddetinin bu özellikler üzerine etkisini değerlendirmek.
Gereç ve Yöntem: Çalışmaya 60 FM'li kadın ve 45 sağlıklı kontrol alındı. Hastaların FM ile ilişkili ölçümleri (hassas nokta sayısı, miyaljik skor, ağrı vizüel analog skalası (VAS), fibromiyalji etki sorgulaması (FES)) kaydedildi. Hastalar FES ile orta ve ciddi FM'li olarak sınıflandırıldı. Tüm katılımcılarda değerlendirilen parametreler: diz fleksör-ekstansör kas gücü ve el kavrama gücü, proprioseptif keskinlik, 6 dakika yürüme testi (6DYT) ve yorgunluk çok boyutlu değerlendirme skalası (YDS) idi.
Bulgular: FM'li hastalarda diz fleksör-ekstansör kas gücü ve 6DYT kontrollerden önemli ölçüde daha düşük, YDS skoru önemli ölçüde daha yüksekti ($p<0,05$). Proprioseptif keskinlik ve el kavrama gücü açısından hasta ve kontrol grupları arasında anlamlı fark yoktu ($p>0,05$). Orta düzeyde FM'li hastalarla karşılaştırıldığında, şiddetli FM'li hastalarda ağrı VAS ve YDS skoru önemli düzeyde daha yüksekti ($p<0,05$). Hastalarda diz fleksör-ekstansör kas gücü ve el kavrama gücü; ağrı VAS skoru, YDS skoru, 6DYT ve proprioseptif keskinlik ile ilişkili değildi ($p>0,05$). 6DYT ağrı VAS skoru ile negatif ilişkiliydi ($p=0,001$). YDS skoru ağrı VAS skoru ile pozitif ilişkiliydi ($p<0,05$), fakat 6DYT ile ilişkili değildi ($p>0,05$).
Sonuç: FM hastaları sağlıklı bireylere kıyasla artmış yorgunluk ve ağrı şiddetine, azalmış diz ekstansör-fleksör kas gücüne ve fonksiyonel kapasitesine sahiptiler. Ağrı şiddeti ve yorgunluk, FM şiddetinden daha çok etkilenmiş olarak bulundu. Bu sonuçlara göre, FM tedavisinde fonksiyonun ve KG'nün artırılması dikkate alınmalıdır, ancak ağrının azaltılması ve yorgunluğun giderilmesi öncelikli olmalıdır.
Anahtar Sözcükler: Fibromiyalji, yorgunluk, kas gücü, propriosepsiyon

Address for Correspondence/Yazışma Adresi: Yeşim Akyol MD, Ondokuz Mayıs University Faculty of Medicine, Department of Physical Medicine and Rehabilitation, Samsun, Turkey, Phone: +90 362 312 19 19 E-mail: yesimakyol@yahoo.com
Received/Geliş Tarihi: March/Mart 2012 Accepted/Kabul Tarihi: July/Temmuz 2012

Introduction

Fibromyalgia (FM) is a condition characterized by chronic, widespread musculoskeletal pain and multiple sites of tenderness (1,2). Estimated prevalence of FM is approximately 2–3%, higher among women than men (3,4). It is associated with a variety of symptoms such as chronic fatigue, sleep disturbance, cognitive dysfunction, and mood disorders (1,2).

The combined effect of FM symptoms often has a significant impact on the physical performance and functional ability in patients with FM (5,6) and it was shown that patients with FM had a considerable reduction in functional performance as compared with healthy individuals (7-9). The combination of pain and reduced physical capacity may lead to inactivity and a vicious circle may be created, leading to progressive deconditioning. One component of deconditioning is reduced muscle strength (MS) (10). Previously, MS has been found to be reduced in FM patients compared with healthy subjects (11-16). Little is known, however, about differences in MS between patients with moderate and severe FM (17,18). Fatigue, which is a major component of FM experience, is a symptom whose causes are protean and whose phenotype includes physical, mood, and behavioral components (19,20). Additionally, it was shown that subjects with worse FM severity reported significantly increased fatigue, previously (21). Proprioception is the sense of joint and limb position partially derived from neural inputs arising from mechanoreceptors in joints, muscles, tendons, and associated tissue (22,23). Previous studies of patients with several musculoskeletal disorders such as osteoarthritis and rheumatoid arthritis have shown decreased proprioceptive abilities, and association of proprioception with MS, pain, and functional ability (24-27). Proprioceptive acuity in patients with FM still remains unclear.

To the best of our knowledge, there is no clinical study assessing MS, functional capacity, severity of fatigue, and proprioceptive acuity together in patients with FM. The aim of the present study was to compare MS (knee flexor and extensor muscles strength, and handgrip strength), functional capacity, severity of fatigue, and proprioceptive acuity in women with FM with those in healthy women as well as to evaluate the impact of FM severity on these features.

Materials and Methods

Sixty female patients (aged 20-53 years) diagnosed with FM according to the American College of Rheumatology (ACR) 1990 criteria (1) and 45 healthy female controls (aged 19-55 years), who had similar age, body mass index (BMI), and geographic location, were enrolled in the study. The women, who did not have any problems that might indicate risk for muscle and functional performance tests, were included. In order to avoid conflicting results, sedentary individuals, who do not have the habit of exercising, were enrolled in the study. Subjects with other rheumatic diseases, cardiovascular, neurologic, metabolic and endocrine problems, inflammation, effusion, or restriction on any joint, ligament and intra-articular pathologies or who had undergone any orthopedic procedures, or who were pregnant were excluded.

All participants were initially examined by the same physician with regard to the selection criteria, and, if found to be appropriate, the participants were included in the study. Socio-demographic data including age, weight, height, BMI (kg/m^2), duration of symptoms (month) were obtained. Group I (n=60) included female patients with FM. Group II (n=45) included healthy female subjects. Additionally, FM patients were classified as having moderate or severe FM by the fibromyalgia impact questionnaire (FIQ) (28). All participants gave their written consent for this study. The study received the approval of the local Ethics Committee.

Clinical Assessments

The following outcome measures were included in this study:

-FMS-Related Measurements

Widespread Pain was assessed by visual analogue scale (VAS) pain score (0-10 cm, with higher scores indicating more pain) (29).

Number of tender points (NTP) defined by the ACR were determined by applying a 4 kg pressure with the thumb on 18 specific body points, and the NTP recorded (1).

Myalgic Score (Ms) is a rating given by the physician to describe the sensitivity of a tender point when pressure is applied. The number of tender points and tender-point sensitivity were assessed by the same physician. The physician determined the number of active tender points and rated the sensitivity of the pain on a scale of 0 (no pain) to 3 (withdrawal of the patient from the examiner) of each tender point to determine a myalgic score. Each of the 18 tender points was evaluated, with the highest possible myalgic score being 54 (7,30).

Fibromyalgia Impact Questionnaire (FIQ); FM severity was evaluated by the Turkish version of the FIQ (31). The FIQ is based on patient self-report and is the most frequently used available instrument for obtaining a standardized measure for patient-reported disease severity. The FIQ consists of 20 questions pertaining to morning stiffness, mood, pain, and the ability to perform daily life activity (7,28). Scores range from 0 to 100 with a higher value indicating a greater impact of the disorder. FM patients were classified as having moderate FM if the FIQ score was <70, and as having severe FM if the FIQ score was ≥70 as previously described (17,28).

-Muscle strength (MS)

Knee Flexor and Extensor Muscle Strength; A computerized isokinetic dynamometer (Cybex Human Norm Testing & Rehabilitation System, CSMI Medical Solutions, Massachusetts, USA) was used for the testing procedures. The same examiner performed isokinetic dynamometric measurements using the same test protocols in all participants. After giving explanations, the subjects were familiarized with the procedure by performing three submaximal repetitions at each speed. The protocol of concentric/concentric knee flexion and extension in the dominant limb at velocity of 60°/sec (10 repetitions) and 180°/sec (10 repetitions) were used (14). The movement range was set in the pain-free 90°of knee flexion around neutral (0°). A two-minute rest was permitted between testings at the different speeds. The subjects were instructed to push the lever up, and pull it down, as hard and as fast as

possible with flexion undertaken first for concentric actions. All subjects were encouraged by using both visual feedback and strong verbal encouragement to give a maximal effort for each action. During testing, no participants complained of pain or discomfort. The highest torque generated in each movement was recorded from strip-chart recording. The effect of gravity was corrected. The maximum peak torque (PT) values in Newton-meters were calculated for each subject.

Handgrip strength (HS); Grip strength was measured at dominant hand using a handheld dynamometer (Jamar) following published procedures (32). For performing the test, the subjects were seated on a high plinth without supporting the forearms. The shoulder was kept in adduction and neutral rotation; elbow flexed at 90° forearm in neutral position. The grip bar was adjusted to fit comfortably in the subjects' hand with the middle phalanges under the grip handle. Subjects were requested to squeeze as hard as they could while exhaling. Each hand was tested, alternating back and forth for three trials. The highest force production (in kilograms) for each hand then was totaled for the dependent variable (7).

-Proprioceptive Acuity Assessment

Joint position sense of knee was measured by a isokinetic dynamometer (Cybex Humac Norm Testing & Rehabilitation System, CSMI Medical Solutions, Massachusetts, USA). Joint position sense measurements in the dominant limb were obtained prior to muscle strength measurements. From the initial position of 0° of knee flexion [neutral position], the resistance arm of the dynamometer passively flexed the subjects' leg at an angular velocity of $10°s^{-1}$, until reaching the target angles (30° and 60° flexion) and then, was maintained for 5 s. The participants were instructed to remain relaxed and to focus on this position. Then, the assessed limb was returned to the starting position and the dynamometer was changed from the passive mode to allow active repositioning. Immediately afterwards, the subjects actively flexed their knees by pushing the dynamometer lever arm and, when they believed to have reached the target angle, they activated the device's lock button. The angle reproduced by the participants was registered by a positional sensor of the dynamometer as the absolute errors (differences between the target and the measured angles). Three repetitions were carried out for each target angle and the mean values at each angle were considered for analyses. The tests were conducted in a quiet room by the same researcher, who always employed standardized verbal commands. During this test, the participants were blindfolded, thus, visual cues were eliminated. Prior to testing, the Cybex dynamometer was calibrated as a part of the regular schedule for maintenance of the equipment used for this testing device (23,33).

-Fatigue Assessment

Multidimensional assessment of fatigue (MAF) scale was used for fatique assessment. MAF scale contains five dimensions of fatigue: degree, severity, distress, impact on activities of daily living, and timing. Each 100-mm VAS was changed to a 10-point numerical rating scale. Scores ranged from 0 (no fatigue) to 50 (severe fatigue) (34).

-Functional Capacity

The 6MWT was used as a test for objective assessment of functional performance (34). The test was always applied by the same properly trained examiner. The subjects completed this test on a 24-m walkway. They were given the same standard verbal instructions before each test and instructed to walk their maximum distance in a 6-min period. The total distance covered in meters during the 6 min of walking was used as the score for each session.

Statistical Analyses

The data were analyzed using SPSS for Windows, version 15. Data were presented as mean±standard deviation (SD), median (minimum; maximum). The Shapiro-Wilk test was used to analyze normal distribution assumption of the quantitative outcomes. All outcomes were not normally distributed. To compare outcomes between groups (patients and controls, moderate and severe FM patients) the Mann-Whitney U test was used. Spearman's correlation coefficients were calculated to assess the univariate relationship between the outcomes (muscle strength and pain, fatigue, functional capacity, proprioceptive acuity) in patients with FM. The socio-demographical characteristics of the groups were evaluated by the Chi-square test. In order to have statistical power of 0.90, and $p<0.05$, using data from a previous study (13), it was calculated that 40 subjects in each group were required to detect the differences in muscle strength measurement (knee extensor muscles peak torque at 60°/sec) between the groups. A p value of less than 0.05 was considered statistically significant.

Results

Demographical properties and clinical characteristics of the patients with FM and healthy controls are presented in table 1. There were no significant differences between the groups in demographical characteristics (age, height, weight, BMI), proprioceptive acuity, and HS ($p>0.05$). Knee flexor and extensor muscle strength (60°/s- 180°/s Extensor PT, 180°/s Flexor PT) and 6MWT were significantly lower; MAF score was significantly higher in FM patients than in controls ($p<0.05$) (Table 1).

Sixty percent of patients (n=36) with FM had moderate FM severity (FIQ<70) and 40% of patients (n=24) had severe FM severity (FIQ ≥ 70). Pain VAS and MAF scale scores were significantly higher in patients with severe FM compared with those with moderate FM ($p<0.05$). There were no significant differences between the subgroups of FM patients in NTP, Ms, 6MWT, HS, knee flexor and extensor muscle strength (except knee extensor PT at 60°/s), and proprioceptive acuity (Table 2).

The correlations of MS measurements with pain, fatigue, functional capacity, and proprioceptive acuity in patients with FM are shown in Table 3. MS measurements were not associated with pain VAS score, 6MWT, MAF score, and proprioceptive acuity ($p<0.05$). There was a negative association between 6MWT and pain VAS score ($p= 0.001$) (Table 3). MAF score was positively associated with pain VAS score ($p<0.05$) (Table 3), but not with 6MWT ($r=0.008$, $p=0.949$) in FM patients.

Discussion

The present study showed that the women with FM had reduced knee flexor-extensor muscle strength and functionality, and increased fatigue and pain intensity compared with healthy subjects, but proprioceptive acuity and HS were similar in both

Table 1. Comparison of demographical -clinical characteristics and outcomes of the FM patients and healthy controls.

Characteristics	Group I The patients with FM group (N=60)	Group II Control group (N=45)	P
	Mean±SD Med (min-max)	Mean±SD Med (min-max)	
Demographic characteristics			
Age (years)	40.18±8.84 42 (20-53)	36.62±9.39 36 (19-55)	0.061
Height (cm)	161.10±4.28 160 (154-170)	162.16±6.49 163 (150-178)	0.372
Weight (kg)	66.57±10.52 65 (50-95)	65.07±12.02 65 (48-92)	0.412
Body mass index (kg/m^2)	25.64±3.89 25 (18-35)	24.85±5.07 24 (18-40)	0.140
Duration of disease (month)	43.28±42.72 24(1-156)	_	_
FM-related measurements			
Pain VAS (0–10)	6.83±2.37 7(2-10)	_	_
The number of TP (0–18)	13.16±2.32 16 (10-18)	_	_
FIQ score (0–100)	63.29±1.66 67 (27-98)	_	_
Myalgic score (0–54)	26.60±11.27 24 (12-54)	_	_
Functional capacity 6 MWT (m)	472.27±109.00 482 (144-654)	562.62±79.49 576 (444-768)	0.001
Fatigue MAF scale (0–50)	39.34±10.54 44 (5-50)	29.87±84.05 17 (1-58)	0.001
Handgrip strength (kg)	25.90±5.69 25 (10-40)	27.24±6.04 27 (12-42)	0.115
İsokinetic knee flexor and extensor muscles' strength (PT, Newton-meters)			
60°/s Flexion	36.22±18.70 33 (8-103)	38.02±14.30 35 (11-85)	0.310
60°/s Extension	33.28±20.33 28 (8-103)	51.07±22.68 47 (11-103)	0.001
180°/s Flexion	19.60±10.07 18 (7-54)	27.18±9.67 26 (12-54)	0.001
180°/s Extension	20.48±10.17 19 (7-53)	27.51±12.34 27 (8-60)	0.002
Proprioceptive acuity			
30° Knee flexion	4.17±2.90 3 (0-12)	4.45±4.134 (0-18)	0.714
60° Knee flexion	6.53±4.226 (0-19)	5.76±3.25 6 (1-16)	0.435

Mean± SD: Mean±Standart Deviation
Med (min-max): Median (Minimum-Maximum)
P value is significant when <0.05
MAF scale: Multidimensional Assessment of Fatigue Scale, 6 MWT: 6 minute walking test, FIQ: Fibromyalgia Impact Questionnaire, FM: Fibromyalgia, TP: Tender Points
VAS: Visual Analouge Scale
30° Knee flexion: Detection error for 30° knee flexion in joint position sense
60° Knee flexion: Detection error for 60° knee flexion in joint position sense

groups. The results of this study also suggested that fatigue and pain were worse in patients with severe FM compared with those with moderate FM.

Muscle strength, which is measured from knee extensors and flexors, and/or from upper body muscle groups, has been examined several times in FM patients. It was shown that patients with FM had a considerable reduction in lower extremity MS as compared with healthy individuals (8,10,13). Similarly, in this study, knee flexor and extensor muscle strength was lower in FM patients than in controls. The reason for this difference may be the disparity in age of groups. However, FM patients were slightly older than controls; this difference was not statistically significant. On the other hand, there are conflicting results about HS in FM. In most investigations, lower levels of HS have been reported (8,14,15,18,36,37), while some authors did not find significant differences between FM patients and healthy controls (7,38). In the current trial, HS was similar in both groups. These results may support the opinion

Table 2. Comparison of demographical -clinical characteristics and outcomes of moderate and severe FM patients.

Characteristics	The moderate FM (FIQ <70, n=36)	The severe FM (FIQ ≥70, n=24)	P
	Mean±SD Med (min-max)	Mean±SD Med (min-max)	
Demographic characteristics			
Age (years)	38.69±9.41 41 (20-52)	42.42±7.55 43 (26-53)	0.081
Body mass index (kg/m^2)	25.72±3.72 25 (19-34)	25.52±4.22 25 (18-35)	0.874
Duration of disease (month)	41.25±43.25 24 (1-156)	46.33±42.64 24 (1-120)	0.373
FM-related measurements			
Pain VAS (0–10)	6.47±2.586 6 (2-10)	7.38±1.95 8 (3-10)	0.023
The number of TP (0–18)	14.08±2.92 14 (10-18)	15.54±2.68 16 (11-18)	0.051
Myalgic score (0–54)	24.94±10.61 24 (12-48)	29.08±12.00 28 (12-54)	0.146
Fatigue MAF scale (0–50)	36.10±9.97 38 (15-50)	44.21±9.62 47 (5-50)	0.001
Functional capacity 6 MWT (m)	483.81±104.67 504 (144-654)	454.96 ±115.26 480 (144-624)	0.315
Handgrip strength (kg)	26.39±5.65 25 (10-40)	25.17±5.79 24.5 (16-38)	0.368
İsokinetic knee flexor and extensor muscles' strength (PT, Newton-meters)			
60°/s Flexion	39.33±19.26 35 (12-103)	31.54±17.17 27 (8-77)	0.095
60°/s Extension	36.11±19.86 32 (8-102)	29.04±20.71 23 (9-103)	0.029
180°/s Flexion	21.17±10.33 20 (7-54)	17.25±9.38 15 (7-43)	0.118
180°/s Extension	21.97±10.51 20 (8-53)	18.25±9.40 16 (7-42)	0.141
Proprioceptive acuity			
30° Knee flexion	4.08±2.82 4 (0-12)	4.32±3.06 3 (1-13)	0.856
60° Knee flexion	6.47±4.09 6 (0-19)	6.60±4.49 7 (0-15)	0.833

p value is significant when <0.05
r: Spearman's correlation coefficient
VAS: Visual Analogue Scale, MAF scale: Multidimensional Assessment of Fatigue Scale, 6 MWT: 6 Minute Walking Test,
Flexor PT: Knee Flexor Muscles Peak Tork, Extensor PT: Knee Extensor Muscles Peak Tork
Proprioception 30°: Detection error for 30° knee flexion in joint position sense
Proprioception 60°: Detection error for 60° knee flexion in joint position sense

reported by Panton et al. (7) that the hands are used for most activities during the day and perhaps HS is preserved in women with FM. Although HS is a quick and easy-to-perform muscular fitness test; in the evaluation of FM patients using HS alone can be misleading because it may not be always influenced in FM. Henriksen et al. (10) also mentioned that there are no standards for measurement of MS in FM. For these reasons, it can be suggested that MS in both lower and upper extremities should be examined together in patients with FM.

The 6MWT is safe, easy to apply, inexpensive, well tolerated and reflects the daily-life activities (35). Reduced functional capacity in the 6MWT in FM patients was shown previously (8). In this study, FM patients had poor functional capacity measured by 6MWT than healthy controls, as expected. Marsh et al. (39) reported that quadriceps and hamstring muscles are important contributors to walking performance. On the contrary, there was no association between upper-lower extremity MS and 6MWT in the present study. Additionally, in this study, it was found that FM patients, who had more pain, had poor walking performance. Bennett et al. (40) have reported that due to a decrease in their sleep, most women with FM had a reduced physical activity level, which leads to progressive lack of fitness. It can be suggested that MS may not be the only factor affecting functional capacity; pain severity, sleep disorders should be considered in the assessment of functional capacity in patients with FM.

Fatigue is a well known feature of FM and it also appears to be more prevalent in FM than in other rheumatological conditions

Table 3. The correlations between muscle strength and pain, fatigue, functional capacity, proprioceptive acuity in patients with FM.

(N=60)		Pain VAS	Handgrip strength	60°/s Flexor PT	60°/s Extensor PT	180°/s Flexor PT	180°/s Extensor PT
Pain VAS	r	1	0.033	-0.079	-0.001	0.025	0.040
	p		0.800	0.546	0.993	0.851	0.764
MAF scale	r	0.386	-0.004	-0.063	-0.151	0.013	-0.077
	p	0.002	0.977	0.630	0.251	0.919	0.559
6 MWT	r	-0.400	-0.043	0.056	-0.042	-0.041	-0.025
	p	0.001	0.744	0.673	0.749	0.753	0.851
Proprioception 30°	r	-0.065	-0.279	-0.197	-0.185	-0.064	-0.048
	p	0.622	0.054	0.131	0.157	0.627	0.716
Proprioception 60°	r	0.142	-0.261	-0.169	-0.238	-0.041	-0.141
	p	0.280	0.064	0.197	0.067	0.756	0.282

p value is significant when <0.05
r: Spearman's correlation coefficient
VAS: Visual Analogue Scale, MAF scale: Multidimensional Assessment of Fatigue Scale, 6 MWT: 6 Minute Walking Test
Flexor PT: Knee Flexor Muscles Peak Tork, Extensor PT: Knee Extensor Muscles Peak Tork
Proprioception 30°: Detection error for 30° knee flexion in joint position sense
Proprioception 60°: Detection error for 60° knee flexion in joint position sense

(41). In a study by Crawford et al. (20), patients with FM reported that fatigue was an important symptom of their illness. In the literature, the relationship of fatigue with psychological status, pain, and sleep has been studied (21,42). In the present study, patients with FM demonstrated greater fatigue scores than controls. Moreover, in FM patients, who had more pain severity, reported more fatigue, however, we did not find any association of fatigue with MS and walking distance. It seems that high levels of fatigue in FM patients may be related to pain severity while fatigue may have no effect on MS and functional performance.

Proprioception is the sense of joint and limb position partially derived from neural inputs arising from mechanoreceptors in joints, muscles, tendons, and associated tissue (23,43). There have been many studies investigating the relationship between MS and proprioception in individuals with knee osteoarthritis and, the results are conflicting (43). Until recently, no published reports have specifically reported the proprioceptive acuity in patients with FM. We have recently reported that proprioceptive acuity was not different between FM patients and healthy controls (23). Similarly, in the current trial, proprioceptive acuity was found to be similar in both FM patients and controls. Additionally, in this study, proprioceptive acuity was not associated with MS in FM patients. Proprioception has been shown to decline with age (43). Since the study population was made up of middle-aged women, proprioceptive acuity in FM patients might not be different from that in healthy subjects and might not be affected by MS. To clarify the proprioceptive acuity in FM and its relationship with MS, future studies including FM patients with a wider age range should be planned.

The FIQ, which is a specific questionnaire measuring all aspects of FM, is the most widely used quality of life instrument in studies on patients with FM (44). In a study by Bennett et al. (27), it was shown that the FIQ has credible construct validity, reliable test-retest characteristics and good sensitivity in demonstrating therapeutic change. In the same study, the author noted that the average score for FM patients is around 50 and that severely affected patients usually score 70 or above. Little is known about the differences of clinical or self-reported measures of FM symptoms between patients with moderate and severe FM. In a recent survey by Schaefer et al. (21), it was reported that FM severity level is very important for the evaluation of FM treatments and priority setting in health care. They found that patients with worse FM severity reported significantly increased pain severity and fatigue. Aparicio et al. (17,18) reported that HS levels were lower in patients with severe FM. In the current trial, patients with severe FM had more pain intensity and increased fatigue than patients with moderate FM. NTP and Ms, MS (upper and lower extremity) and functional capacity were not related to FM severity. It can be suggested that severe FM is more likely to be accompanied by pain and fatigue, rather than TP, MS and functionality.

The major limitation of the current study is the limited number of patients who were all middle-aged women, thus, the results cannot be generalized to general FM population. Future studies with larger populations with wider age range and both sexes are needed. Powerful aspect of our study is exploring the disease burden of FM by disease severity levels. The other strength of this study was the evaluation of parameters such as upper and lower limb MS, fatigue, functional capacity, and proprioceptive acuity in FM patients together.

The findings of this study are consistent with published studies showing that FM patients have reduced knee flexor and extensor muscles strength, higher functional limitations and increased fatigue and pain intensity compared to healthy controls. Additionally, pain intensity and fatigue were found to be more affected by FM severity. Improving function and MS should be taken into consideration in the management of FM, but relieving pain and improving fatigue should be prioritized especially in patients with severe FM.

Conflict of Interest

Authors reported no conflicts of interest.

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