

# Effectiveness of Home Exercise Program in Patients with Knee Osteoarthritis



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## ABSTRACT

To investigate effects of home exercise program including isotonic, isometric and joint range of motion (ROM) exercises on pain, functional capacity and quality of life in knee OA patients. Seventy-five patients with knee OA were included into the study. Patients were exposed to home exercise program including 8-week active ROM, and isometric and isotonic exercises for quadriceps and hamstrings. In patients, severity of pain, functional capacity, severity of disease and quality of life were assessed with Visual Analogue Scale (VAS), The Western Ontario and McMaster Universities Arthritis Index (WOMAC), Lequesne's knee severity index (LSI) and 36-Item Short-Form Health Survey (SF-36) on admission, at the end of and 12th week after the treatment, respectively. At the end of 8th week, of 75 patients, 52 were determined to perform home exercise program regularly. At the end of treatment for 52 patients with knee OA, a significant improvement was seen in physical function, bodily pain and social functioning scores among subscales of SF-36, and VAS, WOMAC and LSI, compared to basal findings. The improvement also continued at 12th week after the treatment. Also, a marked amelioration was observed in role limitation physical, health perception, mental health, role limitation emotional and energy scores among subscales of SF-36, after completing exercise program; however, the amelioration disappeared at 12th week after the treatment. Our findings indicate home exercise program increases functional level, decreases pain severity and improves quality of life. Therefore, physicians following-up patients with knee OA should take home exercise programs into consideration while planning treatment regimes.

**Key words:** knee osteoarthritis - home exercise program - pain - functional status - quality of life

## Diz Osteoartritli Hastalarda Ev Egzersiz Programının Etkinliği

### ÖZET

Diz osteoartritli (OA) hastalarda izotonik, izometrik ve eklem hareket açıklığı (EHA) egzersizlerinden oluşan ev programının ağrı, fonksiyonel kapasite ve yaşam kalitesi üzerine etkisini araştırmak. Diz OA tanısı alan 75 hasta çalışmaya alındı. Hastalara 8 hafta aktif EHA, kuadriseps ve hamstringler için izometrik ve izotonik egzersizlerden oluşan ev programı uygulandı. Hastalarda bazalde, tedavi bitiminde ve tedavi bittikten sonra 12 haftada Vizüel Analog Skala (VAS) ile ağrı şiddeti, The Western Ontario and McMaster Universities Arthritis İndeks (WOMAC) ile fonksiyonel durum, Lequesne diz eklemi şiddet indeksi (LŞİ) ile hastalığın şiddeti, 36-Item Short-Form Health Survey (SF-36) ile yaşam kalitesi belirlendi. 8 haftanın sonunda Diz OA'li 75 hastanın 52'nin ev egzersiz programını düzenli uyguladığı tespit edildi. 52 diz OA'li hastanın tedavi bitiminde VAS, WOMAC, LŞİ ve SF-36 alt skorlarından fiziksel fonksiyon, ağrı ve sosyal fonksiyon skorlarında bazale göre belirgin düzelme mevcuttu ve bu düzelme azalmakla birlikte tedavi bittikten sonra 12 haftada da devam ediyordu. Yine hastalarda egzersiz programı bitiminde SF-36 alt skorlarından mental sağlık, emosyonel rol, fiziksel rol, genel sağlık ve vitalite skorlarında bazale göre belirgin düzelme mevcuttu, ancak bu düzelme tedavi bittikten sonra 12 haftada da devam etmiyordu. Sonuçlarımız diz OA'li hastalarda ev egzersiz programının fonksiyonel düzeyi arttırdığı, ağrı düzeyini azalttığı ve yaşam kalitesini düzelttiğini göstermektedir. Bu nedenle diz OA'li hastaları takip eden sağlık profesyonelleri tedavi planlarken ev egzersiz programlarını mutlaka gözönünde bulundurmalıdır.

**Anahtar kelimeler:** Diz osteoartriti, ev egzersiz programı, ağrı, fonksiyonel durum, yaşam kalitesi.

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## INTRODUCTION

Knee osteoarthritis (OA) is the most commonly encountered type leading to pain of muscle-skeleton and disability in the elderly. Patients generally complain about pain, muscle weakness, joint stiffness, instability and decrease in physical functions. All such complaints give rise to physical disability and restrictions in quality of life with time. In the treatment of knee OA, pharmacologic, non-pharmacologic and surgical therapeutic options are present. The importance of non-pharmacologic approaches and rehabilitation is becoming more and more significant at the moment, because no drugs are of effectiveness to change the course of the condition (1-4). In our study, it was aimed to investigate the effects of home exercise program including isotonic and isometric exercise protocols and joint range of motion (ROM) exercises on pain, functional capacity and quality of life in patients with knee OA.

## MATERIALS AND METHODS

Applying to the Physical Medicine and Rehabilitation Department of Konya Training and Research Hospital with the complaints of knee pain at least over six months, 75 patients diagnosed with bilateral tibiofemoral knee OA under clinical and clinical-radiologic criteria recommended by American College of Rheumatology (ACR) and at the ages of 40-65 were enrolled into the study (5). All participants were investigated as outpatients with two-sided comparative radiographies and exposed to Kellgren-Lawrence radiological scoring (6). Patients with stage I, II and III knee OA were included. An approval was obtained from the Ethical Board of Meram Medical School, Konya University. Those accepting to participate in the study were informed, and written consent forms were obtained.

All participants gave detailed history, and detailed physical examinations were carried out. Knee joints were manually examined, and tenderness with palpation, bursitis, effusion, deformity and existence of popliteal cyst were evaluated. ROM of knee was measured with active and passive flexion and extension. Those physically treated for knee OA within the last six months or given steroid injections to knees, with the history of knee surgery, genu varum, genu valgum and disability of ROM of knee joint, arthritis on any joints, and

any cardiovascular, respiratory, neurologic, orthopedic or metabolic diseases to prevent exercises, and major psychiatric diseases were excluded out of the study. Measuring height, weight and body mass index (BMI) was calculated in all patients.

Participants were asked to perform home exercise program including active ROM, isometric and isotonic exercises for quadriceps and hamstrings everyday over eight weeks. How exercise program would be applied was accounted for to participants by a physician of physical medicine and rehabilitation, and written and visual supplementary materials were provided as a file for each patient. Patients were recommended to take up paracetamol, if necessary, but not to take up during 24 hours before their follow-ups. ROM exercises for knees were asked to be performed with a whole joint motion as 10 repetitions twice a day. Isometric quadriceps exercises were asked to be performed in a way in which patients were at rest, and knees at 30° of flexion were supported from the bottom with a rolled up towel and pushing the towel to floor as contractions of 6 sec and rests of 20 sec, 10 repetitions twice a day. Isometric hamstring exercises were performed as five sets in a way in which knees at whole extension were pressed on a towel placed under ankles by applying maximum pushing of 10 sec and rests of 35 sec. For isotonic exercises, De Lateur's technique, a method with stable low weight, was used, because De Lorme's technique could lead to pain and joint strain. Therefore, for quadriceps, participants in our study were asked to perform knee flexion-extension as 10 repetitions, two sessions a day, in a way where knees were at 30° of flexion and with 1 kilo of weight on ankles. For hamstrings, isotonic exercises were performed at prone position with 1 kilo of weight on ankles (7-9).

In order to evaluate the severity of pain and functional status in patients, 0-10 point Visual Analogue Scale (VAS) and The Western Ontario and McMaster Universities Arthritis Index (WOMAC OA) were used, and Turkish version of WOMAC OA has been indicated to be reliable and valid. WOMAC OA of total 24 questions and 96 scores (0:best, 96:worst) is composed of three parts, including pain of 5 questions, stiffness of 2 and physical function of 17 (10,11). In the evaluation, our study was based on total score.

Lequesne's knee joint severity index (LSI) consisting of scores between 0-24 and including pain, maximal gait

capacity and daily activities of life was used in our study. Scores are defined according to patients' responses, and the rate of severity increases as the score rises (12). Our evaluation was based on total score of the index.

In order to assess general quality of life, the form of 36-Item Short-Form Health Survey (SF-36) was used. SF-36 including 36 items which could also be filled in by patients is a test whose validity and reliability are indicated in patients with diseases of muscle-skeletal system. The test is composed of 8 subscales related to physical function, mental health, energy, bodily pain, health perception, role limitation physical, role limitation emotional, and social function. Scores of each item are coded for each subscale and turned into a scale with scores from 0 (poorest health status) to 100 (best health status) (13).

### Statistical Analysis

For statistical analysis, SPSS 20.0 package software was used. Descriptive statistical values were presented as mean  $\pm$  standard deviation. Findings obtained from patients on admission, at the end of the treatment and at 12th week after the treatment were compared with repeated measures of variance analysis, and significant findings were evaluated with post hoc Bonferroni adjusted paired t test. Statistical significance and confidence interval were accepted as  $p < 0.05$  and 95%, respectively.

## RESULTS

In the study, the data obtained from the patients declaring to perform exercises regularly for eight weeks were taken into account. Of 75 participants, 52 (69.3%) were determined to perform home exercise program regularly, but 23 (30.7%) not to perform regularly. Socio-demographic data of 52 patients with knee OA were presented in Table-1. Under radiologic classification of Kellgren-Lawrence, eight of patients (15.4%) were at stage-I knee OA, 19 (16.0%) stage-II knee OA and 25 (48.1%) stage-III knee OA. When compared to basal results, a significant improvement was present at the end of the treatment as to physical function, bodily pain and social functioning scores among the subscales of SF-36, and VAS, WOMAC and LSI. The improvement also continued at 12th week after the treatment, with a slight decrease. In addition, at the end of exercise program, a significant improvement was observed in patients as to role limitation physical, health perception, mental

health, role limitation emotional and energy scores among the subscales of SF-36; however, the improvement disappeared at 12th week after the treatment (Table 2).

## DISCUSSION

OA, although frequently seen and leading to disabilities, has no cure (14). Interdisciplinary healthcare providers dealing with the treatment of OA came up with recommendations to achieve the best clinical practice in light of evidence-based studies. The most recent procedure was recommended for hands, hip and knee OA by ACR in 2012 (15). Muscle strengthening and aerobic exercises were reported to be important in order to decrease pain and increase physical function in knee OA patients (3,4,15,16). In addition, it was recommended by Osteoarthritis Research Society International (OARSI) in 2008 that hip and knee OA patients should be encouraged to perform regular muscle strengthening and ROM exercises. Level of evidence for this recommendation was stated as IA (17,18).

Quadriceps and hamstring muscles are of vital importance in knee OA. In studies performed, a strong correlation was reported to be between the decrease of quadriceps muscle strength and knee OA (19). While weakening of muscle strength took place after knee OA within previous years, weakening in quadriceps muscles has been demonstrated to be one of the primary risk factors

**Table 1. Demographic and clinical data of participants**

	Patients
Age (years)	54.44 $\pm$ 8.12
BMI (kg/m <sup>2</sup> )	32.42 $\pm$ 5.21
Duration of complaints (months)	41.77 $\pm$ 31.42
Gender	
Women	40 (80.2%)
Men	12 (19.2%)
Marital status	
Married	47 (90.4%)
Single	5 (9.6%)
Profession	
Housewife	41 (78.8%)
Retired	11 (21.2%)
Educational status	
Illiterate	14 (26.9%)
Primary school (8 years)	31 (59.6%)
High school (11 years)	5 (9.6%)
College (12 years and over)	2 (3.9%)

BMI: Body mass index.

**Table 2.** Data related to subscales of VAS, LSI, WOMAC and SF-36 on admission, at the end of and 12th week after treatment

	On admission	At the end of treatment	12th week after treatment	p
VAS	7.90±1.99b.c	5.08±2.55a	6.04±2.54a.	<0.001
LSI	13.19±3.92b.c	10.30±4.41a	11.09±4.99a	<0.001
WOMAC	51.79±18.32b.c	38.02±18.97a.	45.21±19.13a	<0.001
SF-36				
Physical function	32.22±23.42b.c	47.12±29.18a	40.34±26.31a	0.002
Bodily pain	29.33±31.92b.c	48.17±25.36a	46.15±22.50a	<0.001
Social function	31.73±22.88b.c	55.17±22.24a	48.38±24.38a	<0.001
Role limitation physical	27.23±35.02b	43.37±27.86a	38.03±22.53	0.004
Health perception	42.24±20.25b	52.90±24.80a	51.13±23.38	0.013
Mental health	54.00±20.03b	63.00±19.97a	57.31±16.72	0.021
Role limitation emotional	23.07±32.03b	36.62±36.32a	32.23±32.84	0.025
Energy	46.92±21.26b	56.25±24.00a	52.88±20.13	0.026

a According to on admission p<0.05, b According to at the end of treatment p<0.05, c According to 12th week after treatment p<0.05, VAS; Visual Analogue Scale WOMAC; The Western Ontario and McMaster Universities Arthritis Index, LSI; Lequesne's knee joint severity index, SF-36; 36-Item Short-Form Health Survey

in the development and progression of knee OA (20). In literature, quadriceps and hamstring muscles were reported to have strength at the rate of nearly 60/40 for knee stabilization, and it was emphasized that exercises related to quadriceps and hamstring muscles play a role in the treatment of knee OA patients (2, 21). In a study, hamstring and quadriceps muscles around knees were reported to have preventive and shock-absorbing effects on the joint in proportion to their strength (22). Moreover, increased mass of muscles was reported to be strongly associated with the volume of medial tibia cartilage. Hudelmaier et al. also demonstrated that a positive correlation is present between mass of muscles and volume of knee cartilage (23). Therefore, muscle strengthening exercises are of crucial significance in the treatment of knee OA (22).

Although many studies related to exercises given to knee OA patients were encountered in literature, no accepted approach regarding type, frequency and intensity of exercises essential in the treatment of knee OA has been present so far (11, 24-26).

Increasing fiscal burdens on health require that exercises be implemented in the most cost-effective and influential way. So, in the treatment of knee OA, a frequently encountered disorder, easily-applicable home exercise programs with no economic burdens and side effects are becoming increasingly considerable.

In various studies, home exercise programs, when performed regularly, were reported to have positive effects on muscle strength and functional capacity in knee OA

patients (11,16,27,28-32). In a study performed by Tunay et al. on 60 patients with knee OA, 6-week home and hospital-based strengthening and proprioception exercises were determined to be effective in order to decrease pain and correct proprioception and functions (11). In a study performed with 113 knee OA patients, O'Reilly et al. performed home exercise program including 6-week quadriceps strengthening exercises, and determined a significant decrease in pain and improvement in physical functions assessed with WOMAC at the end of treatment (28). In the study where Doi et al. compared the effectiveness of NSAIDs with 8-week home exercise program of quadriceps strengthening in 121 knee OA patients, no difference could be detected at 8th week between groups in terms of physical function, pain and quality of life (31). Shakoor et al. gave home exercise program with 8-week quadriceps strengthening exercises to 38 knee OA patients, and reported a marked decrease in pain and an increase in quadriceps muscle strength assessed with isokinetic system at the end of the treatment (32). Further, quadriceps strengthening exercises were demonstrated to have positive effects on level of pain and disability, need for analgesics and seeking medical help (20). In the meta-analysis of 13 randomized controlled studies, quadriceps strengthening exercises performed at home and regular aerobic walking exercises were found to be effective in knee OA patients, defined as primary recommendations, and level of evidence was reported as IA (33).

As consistent with literature, home exercise program including exercises related to quadriceps, hamstring and

ROM was found to improve functional status and quality of life and to decrease pain severity in knee OA patients in our study. Moreover, three months after discontinuing exercise program, the improvement kept on going in functional status, pain and the scores of physical function, bodily pain and social function among subscales of quality of life determined with SF-36.

The most significant culprit of home exercise program is the lack of patients' compliance with exercises. Therefore, the factor defining the achievement of home exercise treatment in knee OA patients is patients' compliance. In a study performed to determine the effectiveness of aerobic and resistant exercise program in 439 knee OA patients, Ettinger et al. indicated a dose-response association between compliance and the effects of exercises (34). Likewise, Thomas et al. reported in the study they performed with 786 knee OA patients that as the compliance self-reported by patients decreases, the effectiveness of home exercises decreases (27). In another study including home exercise program, most of which was composed of strengthening exercises in knee OA patients, Campbell et al. detected the rate of compliance was higher when patients were guided by a physiotherapist during the first session, but the rate became decreased after the guidance by the physiotherapist was discontinued. The factors motivating the compliance with exercises were reported to be the approach to exercises, awareness of severity of symptoms, thoughts related to causes of OA and perception regarding the effectiveness of treatment, all experienced by patients (35). As consistent with these findings, 30.7% of patients in our study were determined not to perform home exercise program for sure or regularly. In order to maximize the compliance, at first, patients should appropriately be trained as to benefits of exercises by experienced healthcare providers; home exercise program should be designed by trained professionals; exercises performed voluntarily by patients should be determined; accurate and safe exercise techniques should be applied; patients should be motivated to perform such exercises in longer periods; exercise providers should get in touch with patients at regular intervals; and patients, if possible, should be followed up from time to time to find out whether exercises are appropriately performed. On condition that patients and healthcare professionals take these factors into consideration, home exercise programs are considered to be performed more regularly.

Findings in our study indicate that cost-effective and easily-applicable home exercise program with no side effects, including quadriceps and hamstring strengthening and ROM exercises, increase functional level, decrease severity of pain and improve quality of life. Considering adverse drug interactions, cost-effectiveness, and the mortality and morbidity of surgeries, healthcare professionals following-up knee OA patients should take home exercise program including quadriceps, hamstring strengthening and ROM exercises into account, while designing treatment modalities.

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