A Comparison of Home-Based Exercise Programs with and without Self-Manual Therapy in Individuals with Knee Osteoarthritis in Community

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Objective: *The present study aimed to compare the effectiveness of the treatment programs of home-based exercise with and without self-manual therapy in individuals with knee osteoarthritis (knee OA) in community.*
Material and Method: *Forty-three participants with knee OA were randomly assigned in groups. All participants received the same home-based exercise program with or without self-manual therapy over 12 weeks. Outcome measures were pain intensity, range of motions, six-minute walk test distance, the knee injury and osteoarthritis outcome score (KOOS), short-form 36 (SF-36) and satisfaction.*
Results: *The results showed that the self-manual therapy program significantly decreased pain at 4 weeks, increased flexion and extension at 4 and 12 weeks, and improved the KOOS in pain item and SF-36 in physical function and mental health items. The home-based exercise group showed significant increase of the six-minute walk distance at 4 and 12 weeks, improvements in the KOOS in pain and symptom items and SF-36 in the physical function and role-emotional items.*
Conclusion: *Overall, the results favored a combination of self-manual therapy and home-based exercise for patients with knee OA, which apparently showed superior benefits in decreasing pain and improving active knee range of motions.*

Keywords: *Knee osteoarthritis, Self-manual therapy, Home-based exercise, Physical therapy, Community*

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Knee osteoarthritis (knee OA) is one of the most prevalent rheumatic disease[1]. Therapeutic exercise and manual therapy are common interventions used by physical therapists with aims to reduce pain, improve physical function and quality of life[2]. The combination of manual therapy applied by physical therapists with home exercise is more effective than only exercise treatment in terms of improved physical function, reduced medications for arthritis and may have delayed or eliminated knee surgery[3]. For patients in the community, treatment accessibility and cost are major issues because of the limited resources of physical therapy services in the hospital setting. The alternative home program for physical therapists teaches patients how to perform simple techniques of manual therapy by themselves. However, the evidence of the usefulness of self-manual therapy in patients with knee OA is lacking. The purpose of the present study was to determine the effectiveness of home-based exercises with and without self-manual therapy for individuals with knee OA in the community.

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Material and Method

Females with a diagnosis of knee OA based on the clinical criteria of the American College of Rheumatology[4] were invited to join the present study. Participants were excluded if they had systemic joint diseases, cerebrovascular conditions, Parkinson's Disease, received corticosteroid injections within the previous 30 days, had lower limb surgery or back and lower limb injury within the previous six weeks. They were instructed to keep taking any current medication and were disallowed to take new medication for OA and physical therapy intervention for their knee while enrolled in the present study. The present study protocol was approved by Mahidol University Institutional Review Board (MU-IRB 2013/038.2703).

The participants were randomized into two groups: home-based exercise only and home-based exercise with self-manual therapy using sealed envelopes (Fig. 1). Then participants underwent clinical

examination. The home-based group received a standardized exercise program. The self-manual therapy group received a combination of the same exercise and self-manual therapy as indicated by the results of examination. Participants were taught and practiced the manual therapy procedures and exercise program until they could perform correctly. The knee OA exercise handout, consisting of the modified exercise program[3] and manual therapy procedures (Table 1) and log book, which estimated the participant's compliance, were provided. The exercise intensity (holding time and repetitions) and the self-manual intensity (mobilization grade and repetitions) were determined according to the participant's tolerance, severity of joint limitation and soft tissue tightness of each participant. They were instructed to walk everyday with gradually increased distances and were contacted by telephone to ask about adverse symptoms at the 2nd, 5th and 8th week of intervention.

The pain level in the previous week was measured using 100 mm visual analog scales (VAS). Active knee range of motion (ROM) was assessed in the supine position using standard goniometer. The greater trochanter of the hip, the lateral epicondyle of the femur and lateral malleolus of the ankle were the landmarks. Decreasing angles indicated better outcomes. Pain and ROM were measured by the same

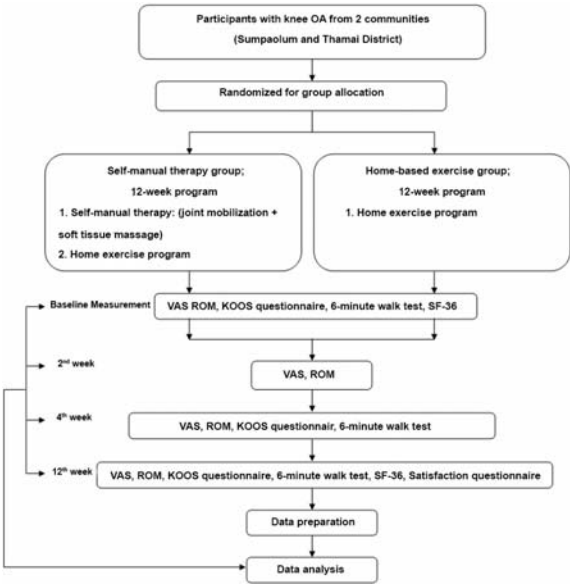

Fig. 1 Flow chart of the study procedure.

Table 1. Standardized exercise program and self-manual therapy procedures

Exercise program (daily)		Self – manual therapy procedures (daily)	
Stretching exercise 1. Standing calf stretch 2. Supine hamstring stretch 3. Prone quadriceps stretch	Hold for 10 sec Repeat 3x5 times	Impairment Loss of patella glides	Self-manual intervention Mobilization (grades III to IV) of the patella in 5°-10° knee flexion (medial/lateral displacement, elevation, depression)
Range of motion exercise 1. Knee in mid-flexion to full-extension in supine position 2. Knee in mid-flexion to full-flexion in supine position	10 times per set (2 sets)	Loss of tibiofibular joint glides	Mobilization (grades III to IV) of the tibiofibular joint in through range of motion (ROM) and end range of knee extension
Strengthening exercise 1. Static quad sets in knee extension 2. Standing terminal knee extension 3. Seated leg presses 4. Partial squats weight-lessened 5. Step-ups	Hold for 10 sec Repeat 3x10 times	Soft tissue tightness	Soft tissue massage (Circular superficial friction and/or deep-fiber friction) - Suprapatellar + peripatellar regions - Medial and lateral joint capsule - Popliteal fossa - Gastrocnemius muscle - Iliopsoas muscle - tensor fascia and the iliotibial band

evaluator at baseline, 2nd, 4th and 12th week. Six-minute walk distance and Thai version of KOOS[5] were reassessed at the 4th and 12th week. The Thai version of the Short Form-36 questionnaire (SF-36) and patient's satisfaction were measured at the 12th week.

Data were analyzed, using SPSS for Windows, version 19. The Mutivariate, normal distribution and homogeneity of variance were assumed. Then the two-way repeated measure of variance was used to evaluate the interaction and main effects. Post hoc multiple comparisons were performed. The mean differences (MD) between and within groups for the simple effects (pair-wise comparisons) were also undertaken using the Bonferonni's correction test. The significance level was set at 0.05.

Results

Fifty-four females with knee OA from two communities were randomly assigned to a home-based exercise group (HB group, n = 27) or self-manual therapy group (SMT group, n = 27) by drawing a sealed envelopes. Forty-three participants completed the present study. Five subjects dropped out of the HB group and six dropped out in the SMT group. No differences were observed between groups in all outcome measures at baseline. The baseline characteristics and results of the simple effects are shown in Table 2 and Fig. 2, respectively.

No interaction was found between group and time for pain intensity, extension, and six-minute walk distance. The main significant effect was significant for time but not for group for VAS [F (2.396, 62.287) = 3.752, $p = 0.022$), ROM [flexion; F (2.578, 105.681) = 6.390, $p = 0.001$/extension; F (2.072, 84.946) = 6.874, $p = 0.002$] and six-minute walk distance [F (1.561, 32.785) = 6.936, $p = 0.006$)].

Table 2. Baseline characteristics of subjects in home-based exercise and self-manual therapy groups

Characteristics	Home-based exercise mean (SD), n = 22	Self-manual therapy mean (SD), n = 21
Age (years)	64.05 (7.86)	66.62 (8.77)
BMI (kg/m^2)	27.13 (3.56)	26.97 (4.56)
Side of pain		
Left side	6 (27.3%)	4 (19%)
Right side	6 (27.3%)	5 (23.8%)
Both sides	10 (45.5%)	12 (57.1%)
Pain intensity (VAS)	5.15±2.37	4.67±2.73
Six-minute walk distance (meters)	347.40 (68.97)	352 (80.39)
Range of motion		
Flexion	141.20 (10.83)	140.07 (13.00)
Extension	7.83 (4.35)	9.57 (6.55)
KOOS		
Pain	63.58 (19.82)	59.57 (21.77)
Symptom	64.95 (18.46)	57.43 (21.39)
Activity of daily living	68.32 (18.83)	64.71 (24.36)
Sport	39.21 (29.60)	41.81 (28.57)
Quality of life (QOL)	45.16 (19.94)	43.45 (17.17)
SF-36		
Physical functioning (PF)	58.50 (29.70)	63.10 (22.83)
Role-physical (RP)	90.63 (21.79)	91.67 (18.47)
Social functioning (SF)	66.25 (20.32)	56.55 (18.38)
Role-emotional (RE)	70.83 (27.37)	76.19 (26.65)
Bodily pain (BP)	46.88 (29.23)	40.60 (28.68)
Mental health (MH)	49.00 (15.99)	45.33 (13.88)
Vitality (VT)	45.50 (16.05)	41.43 (10.26)
General health (GH)	49.25 (14.26)	54.76 (14.36)
Reported health transition (RH)	46.25 (31.70)	36.90 (28.08)

*significant difference between groups at p-value <0.05

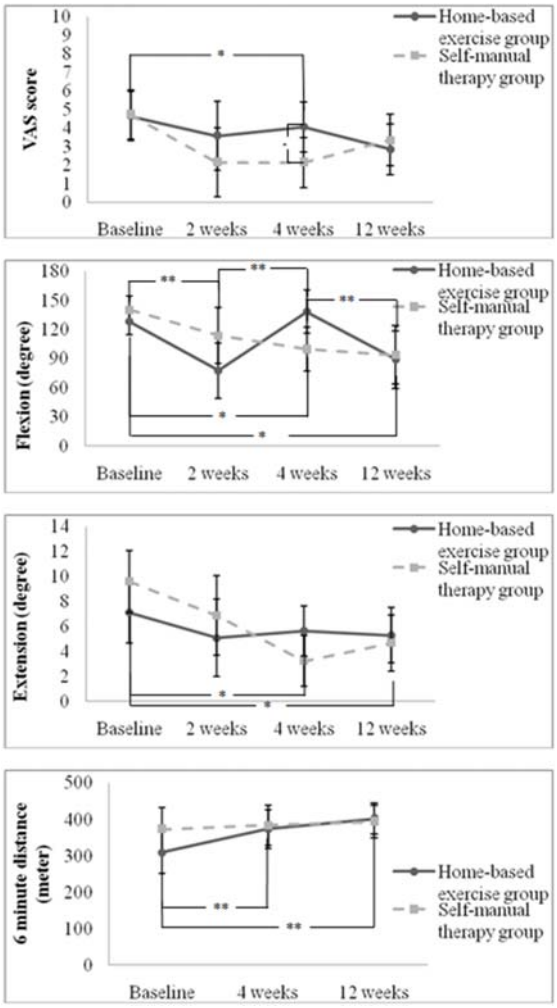

Fig. 2 Mean of VAS, flexion, extension and six-minute walk distanceat baseline, 2, 4 and 12 weeks (* = SMT group, ** = HB group, ▲ = between groups).

The post hoc comparisons of VAS revealed significantly decreased pain at four weeks compared with baseline (p = 0.010). At four weeks, the simple effect between groups was significant (p = 0.048) and the within group effect was significant only in the SMT group (p = 0.002). Compared with baseline, the ROMs were better at two weeks (flexion; p = 0.002/extension; p = 0.041) and 12 weeks (flexion; p = 0.004/extension; p = 0.003). Regarding the simple effect in the SMT group, differences were observed at 4 weeks (flexion; p = 0.026/ extension; p = 0.000) and 12 weeks (flexion; p = 0.049/ extension; p = 0.002) compared with baseline. The six-minute walk distance was increased at 4 (p = 0.042) and 12 weeks (p = 0.003) compared with baseline in the HB group. For SF-36, differences were found in role-emotional (p = 0.001) and physical functioning items (p = 0.001) in the HB group. In the SMT group, a difference was shown in the mental health item (p = 0.002). Most participants reported satisfaction at a good level. The SMT group had an excellent level of signs and symptoms after completing this program.

Discussion

Patients with knee OA, who received self-manual therapy with the home-based exercise program, experienced pain decreasing at 4 weeks and ROM improving at 4 and 12 weeks. However, patients who received only home-based exercise showed improvement of the six-minute walk distance at 4 and 12 weeks. These results implied that the SMT group had superior effects on pain and stiffness. A combination of supervised manual therapy and exercise applied by skilled physical therapists had a greater effect on pain than exercise alone[6] and has been shown to improve physical activity, decrease pain and stiffness and reduce the need for total knee replacement and steroid injection[3,7].

The joint mobilization might complement more widespread hypoalgesic effects[8], restore neurodynamics to their ideal state so that the nervous system could function optimally and adapt the biomechanics forces in both intra-articular and peri-articular tissues[9]. The exercise program could strongly stimulate the degenerative connective tissues and joints and increase their flexibility and strength[10].

Only the participants in the HB group had increased six-minute walk distance at 4 and 12 weeks. The KOOS results also indicated improved self-reported functional activity for symptoms in this group. Receiving combined interventions, the patients might concentrate less on exercise and more on manual therapy since it was rather passive, easier and produces better effects on pain and mobility. Therefore, the authors would suggest that the program might start with home-based exercise to help the patient to recognize and become familiar with an active program to improve their functions. Then self-manual therapy program could be added.

The benefits of treatment in the present study were achieved in 4 weeks. Most previous studies have also demonstrated in 6-8 treatment sessions over 3-4 weeks[7,11,12]. This alternative treatment program cost less and empowered the patients to focus on managing their own impairments on the specific structures that produced pain and limited movement. It was also more applicable for community physical therapists to provide

services to their patients having difficultly commuting to receive treatment at the hospital.

Conclusion

The combination of self-manual therapy consisting of individualized knee mobilization and/or massage with home-based exercise for patients with knee OA showed superior benefits in decreasing pain and improved active knee range of motions.

What is already known on this topic?

Exercise therapy is the first and most recommended treatment for patients with knee OA. Physical therapists also commonly use self-manual therapy to manage this condition. The combination of manual therapy applied by the physical therapists with a home exercise program was more effective than a home exercise program alone in increasing function and decreasing pain and stiffness and may delay or prevent the need for knee surgery.

What does this study add?

This study found evidence of an alternative treatment where physical therapists teach knee OA patients to perform simple techniques of manual therapy by themselves. The self-manual therapy is proper for the patients who have limited accessibility to receive physical therapy treatment at hospital.

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Potential conflicts of interest

None.

References

1. Haq SA, Davatchi F. Osteoarthritis of the knees in the COPCORD world. Int J Rheum Dis 2011; 14: 122-9.
2. Walsh NE, Hurley MV. Evidence based guidelines and current practice for physiotherapy management of knee osteoarthritis. Musculoskeletal Care 2009; 7: 45-56.
3. Deyle GD, Allison SC, Matekel RL, Ryder MG, Stang JM, Gohdes DD, et al. Physical therapy treatment effectiveness for osteoarthritis of the knee: a randomized comparison of supervised clinical exercise and manual therapy procedures versus a home exercise program. Phys Ther 2005; 85: 1301-17.
4. Altman RD. Criteria for the classification of osteoarthritis of the knee and hip. Scand J Rheumatol Suppl 1987; 65: 31-9.
5. Chaipinyo K, Karoonsupcharoen O. No difference between home-based strength training and home-based balance training on pain in patients with knee osteoarthritis: a randomised trial. Aust J Physiother 2009; 55: 25-30.
6. Jansen MJ, Viechtbauer W, Lenssen AF, Hendriks EJ, de Bie RA. Strength training alone, exercise therapy alone, and exercise therapy with passive manual mobilisation each reduce pain and disability in people with knee osteoarthritis: a systematic review. J Physiother 2011; 57: 11-20.
7. Deyle GD, Henderson NE, Matekel RL, Ryder MG, Garber MB, Allison SC. Effectiveness of manual physical therapy and exercise in osteoarthritis of the knee. A randomized, controlled trial. Ann Intern Med 2000; 132: 173-81.
8. Moss P, Sluka K, Wright A. The initial effects of knee joint mobilization on osteoarthritic hyperalgesia. Man Ther 2007; 12: 109-18.
9. Hengeveld E, Banks K. Maitland's peripheral manipulation. 4th ed. Philadelphia, PA: Butterworth-Heinemann; 2005.
10. Twomey LT. A rationale for the treatment of back pain and joint pain by manual therapy. Phys Ther 1992; 72: 885-92.
11. Nor Azlin MN, Su Lyn K. Effects of passive joint mobilization on patients with knee osteoarthritis. Sains Malaysiana 2011; 40: 1461-5.
12. Lamba D, Pant SC. Comparison of manual physical therapy and conventional physical therapy programs in oseteoarthritis of knee. Indian J Physiother Occup Ther 2011; 5: 137-9.
13. Lanza FL. A guideline for the treatment and prevention of NSAID-induced ulcers. Members of the Ad Hoc Committee on Practice Parameters of the American College of Gastroenterology. Am J Gastroenterol 1998; 93: 2037-46.
14. Centers for Disease Control and Prevention (CDC). Arthritis prevalence and activity limitations-United States, 1990. MMWR Morb Mortal Wkly Rep 1994; 43: 433-8.
15. Jan MH, Lin JJ, Liau JJ, Lin YF, Lin DH. Investigation of clinical effects of high- and low-resistance training for patients with knee osteoarthritis: a randomized controlled trial. Phys Ther 2008; 88: 427-36.

ประสิทธิภาพโปรแกรมการออกกำลังกายร่วมกับการรักษาด้วยมือแบบให้ทำเองในผู้ที่มีภาวะข้อเข่าเสื่อมในชุมชน

กรกมล เจียวท่าไม้, มัณฑนา วงศ์ศิรินวรัตน์, วิมลวรรณ เหียงแก้ว, ศศิธร แสงเรืองรอบ

วัตถุประสงค์: *การศึกษานี้มีเป้าหมายเพื่อเปรียบเทียบประสิทธิภาพการรักษาด้วยการออกกำลังกายเองที่บ้าน โดยมีและไม่มีการรักษาด้วยมือแบบให้ทำเองในผู้ที่มีภาวะข้อเข่าเสื่อมในชุมชน*

วัสดุและวิธีการ: *แบ่งผู้ร่วมวิจัยที่มีภาวะข้อเข่าเสื่อม 43 คนแบบสุ่ม ทุกคนได้รับการสอนออกกำลังกายที่บ้านแบบเดียวกันโดยมีและไม่มีการรักษาด้วยมือร่วมด้วยในช่วง 12 สัปดาห์ ผลลัพธ์ได้แก่ ระดับความเจ็บปวด, องศาการเคลื่อนไหว, ระยะทางที่เดินได้ใน 6 นาที, แบบสอบถามความสามารถการใช้งานข้อเข่า (KOOS), แบบสอบถามคุณภาพชีวิต SF-36 และความพึงพอใจ*

ผลการศึกษา: *กลุ่มที่มีการรักษาด้วยมือร่วมด้วยปวดน้อยลงอย่างมีนัยสำคัญใน 4 สัปดาห์, องศาการเคลื่อนไหวเพิ่มขึ้นใน 4 และ 12 สัปดาห์, คะแนนการใช้งานข้อเข่าเรื่องความเจ็บปวดเพิ่มขึ้น และคะแนนคุณภาพชีวิต เรื่องกิจวัตรประจำวันและสุขภาพจิตเพิ่มขึ้น กลุ่มที่ได้รับการออกกำลังกายอย่างเดียว เดิน 6 นาที ได้เพิ่มขึ้นใน 4 และ 12 สัปดาห์, คะแนนการใช้งานข้อเข่าเรื่องความเจ็บปวดและอาการเพิ่มขึ้น และคะแนนคุณภาพชีวิตเรื่องกิจวัตรประจำวัน และบทบาททางอารมณ์เพิ่มขึ้น*

สรุป: *การออกกำลังเองที่บ้านร่วมกับการรักษาด้วยมือแบบให้ทำเองสำหรับผู้ที่มีภาวะข้อเข่าเสื่อมมีผลลดปวด และเพิ่มการเคลื่อนไหวมากกว่าชัดเจน*