

ผลของการฝึกออกกำลังกายด้วยไม้พลองต่อความสามารถทางกาย แรงบีบมือ และอาการปวดของผู้ที่มีภาวะข้ออักเสบรูมาตอยด์

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บทคัดย่อ

การศึกษานี้มีวัตถุประสงค์เพื่อประเมินผลของการฝึกออกกำลังกายด้วยไม้พลองต่อความสามารถทางกาย แรงบีบมือ และอาการปวดของผู้ที่มีภาวะข้ออักเสบรูมาตอยด์ เปรียบเทียบระหว่างก่อนและหลังการออกกำลังกาย อาสาสมัครคือผู้ที่มีภาวะข้ออักเสบรูมาตอยด์ที่มีความรุนแรงของอาการในระดับสงบ ต่ำ หรือปานกลาง จำนวน 45 ราย (หญิง 29 ราย ชาย 16 ราย อายุเฉลี่ย 57.3 ± 9.0 ปี) เข้าร่วมโปรแกรมการฝึกออกกำลังกายด้วยไม้พลองวันละ 20 นาทีต่อครั้ง จำนวน 3 วันต่อสัปดาห์ เป็นเวลา 6 สัปดาห์ ตัวแปรของการศึกษา ได้แก่ ความสามารถทางกาย แรงบีบมือ และอาการปวด ซึ่งประเมินด้วยแบบประเมิน Health Assessment Questionnaire ฉบับภาษาไทย (Thai HAQ) เครื่องวัดความดันโลหิตแบบปรอท และ visual analog scale (VAS) ตามลำดับ วิเคราะห์ผลการศึกษาด้วยสถิติ paired t-tests ภายหลังจากได้รับโปรแกรมการออกกำลังกายด้วยไม้พลองเป็นเวลา 6 สัปดาห์ ผลการศึกษาพบว่าความสามารถทางกาย แรงบีบมือ และอาการปวดดีขึ้นอย่างมีนัยสำคัญทางสถิติ ($p < 0.001$) สรุปได้ว่า เมื่อเปรียบเทียบกับช่วงก่อนการฝึกออกกำลังกาย การฝึกออกกำลังกายด้วยไม้พลองสามารถเพิ่มความสามารถทางกาย แรงบีบมือ และลดอาการปวดในผู้ที่มีภาวะข้ออักเสบรูมาตอยด์ได้ และควรทำการศึกษาเพิ่มเติมในอนาคตในลักษณะการวิจัยเชิงทดลองแบบสุ่มที่มีกลุ่มควบคุมและการติดตามผลในระยะยาว เพื่อให้ทราบถึงประโยชน์ของการฝึกออกกำลังกายด้วยไม้พลองต่อผู้ที่มีภาวะข้ออักเสบรูมาตอยด์ที่ชัดเจนยิ่งขึ้น

คำสำคัญ: การฝึกออกกำลังกาย, ข้ออักเสบรูมาตอยด์, กายภาพบำบัด

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The effects of wand exercise training on physical function, grip strength and pain in persons with rheumatoid arthritis

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Abstract

This study aimed to evaluate the effects of a wand exercise training on physical function, grip strength and severity of pain in persons with rheumatoid arthritis (RA), comparing between pre-and post-exercise training. Forty-five persons with RA in remission, low or moderate severity level (29 females and 16 males, mean age 57.3 ± 9.0 years) participated in a wand exercise training program of 20 minutes per session, 3 days a week for 6 weeks. The variables determined were physical function, grip strength and severity of pain which were assessed by the Health Assessment Questionnaire in Thai version (Thai HAQ), sphygmomanometer and visual analog scale (VAS), respectively. Data were analyzed by using paired t-tests. After the 6-week wand exercise training, the results showed significant improvements in physical function, grip strength and severity of pain ($p < 0.001$). In conclusion, when compared with the pre-exercise period, the wand exercise training could improve physical function as well as grip strength and decrease pain in persons with RA. Future studies with a randomized controlled trial and longitudinal design are suggested to clearly reveal further benefits of wand exercise training in persons with RA.

Keywords: Exercise training, Rheumatoid arthritis, Physical therapy

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Introduction

Rheumatoid arthritis (RA) is a chronic, progressive and disabling auto-immune disease which involves synovial joints of the body, resulting in joint pain and inflammation⁽¹⁾. The involvement in these joints frequently results in decreased physical function, leading to disability of persons with RA. Therefore, health promotion and prevention for persons with RA is necessary. Persons with RA should be encouraged to engage in regular dynamic physical activity for maintaining strength and physical function⁽²⁾.

Exercise therapy is essential for persons with RA in the aspects of muscle strength, endurance, aerobic capacity, flexibility and balance^(3,4). It was reported that weight-bearing and upper extremity exercises could decrease the use of medication in persons with RA^(5,6). To date, a form of exercise using a long stick, namely wand exercise, is popular among community-dwellers in Thailand⁽⁷⁾. This exercise is a combination of flexibility, balance, endurance and diaphragmatic breathing exercises and emphasizes movement of all body parts including trunk, and upper and lower extremities^(8,9). Previous studies revealed beneficial effects of wand exercise on various aspects of health of young and older adults such as muscle strength^(8,10,11), flexibility⁽¹⁰⁻¹²⁾, body mass index⁽¹²⁾, body fat^(9,12), vital capacity^(9,11), aerobic capacity⁽¹¹⁾, physical performance as well as mental health⁽¹³⁾ and quality of life^(8,12). The benefits of wand exercise were also reported in persons with diabetes⁽¹⁴⁾ and paraplegia⁽¹⁵⁾ as well as children with autistic spectrum disorder⁽¹⁶⁾. Based on these reports, it could be summarized that wand exercise provided benefits on cardiovascular health, muscle strength, range of motion and flexibility which were recommended aspects of health to be included in exercise programs for persons with RA⁽³⁾. Therefore, it was possible that wand exercise could provide advantage for persons with RA. However, no study determined this issue. The authors

were thus interested in applying wand exercise to improve health status of community-dwellers with RA. This study aimed to evaluate the effects of a wand exercise program on physical function, grip strength and severity of pain in persons with RA, when compared with the pre-exercise period. It was hypothesized that persons with RA who received wand exercise training significantly improved their physical function, severity of pain and grip strength, when compared with before exercise.

Materials and Methods

This quasi-experimental study was conducted from June to November, 2015 at Kosum Phisai District, Maha Sarakham Province. The study was approved by the declaration of Helsinki ethical principles for medical research involving human subjects in Khon Kaen University (HE582072).

Participants

A group of persons with RA were recruited to the study with the following inclusion criteria: male or female community-dwellers aged 18 years or older, having the severity of RA in remission, low or moderate level (Disease Activity Score-28 [DAS28] ≤ 5.1)⁽¹⁷⁾, independent ambulation with or without gait aid, having good standing balance assessed by the standard Romberg Test⁽¹⁸⁾, being able to verbally communicate and willing to participate and cooperate with the study procedures. Volunteers were excluded if they had one or more arthroplasties and surgery within the past 6 months or were determined by a practitioner that they had significant psychiatric or health conditions precluding their understanding of the nature of the intervention or undertaking the exercises. Based on the 2-related group (before-after) design, the sample size was calculated using the following formula⁽¹⁹⁾: $n/\text{group} = [(Z_\alpha + Z_\beta)^2 \sigma^2] / \Delta^2$ (n = sample size, σ^2 = variance, Δ^2 = effect size). The power of 90% was chosen to determine the appropriate sample

size with a 0.05 type I (alpha) error. Referred to a previous study⁽²⁰⁾, a change of 0.21 point in the Health Assessment Questionnaire (HAQ) with standard deviation of 0.33 were used. Moreover, 30% of the participants were added for accommodating drop out. Therefore, the final sample size of this study was $26 / (1 - 0.30) = 37.14$ participants or at least 38 persons with RA.

Wand exercise training program

A home-based wand exercise training program with low to moderate intensity (40-60% HRmax) was designed with the exercise prescription of 20 minutes per session, 3 days a week for 6 weeks. The program

consisted of 5-minute warm up, 10-minute wand exercise and 5-minute cool down. In the warm up and cool down periods, the participants were advised to perform stretching exercises for upper and lower extremity muscles. Ten repetitions with a 15-second hold were suggested for each stretching. Breathing exercise was also recommended during the cool down. After warming up, the participants were instructed to undertake a set of wand exercises in the following patterns: rowing, lateral swing, shoulder abduction, lifting and body shift (**Figure 1**). Each pattern was repeated for 20 rounds.

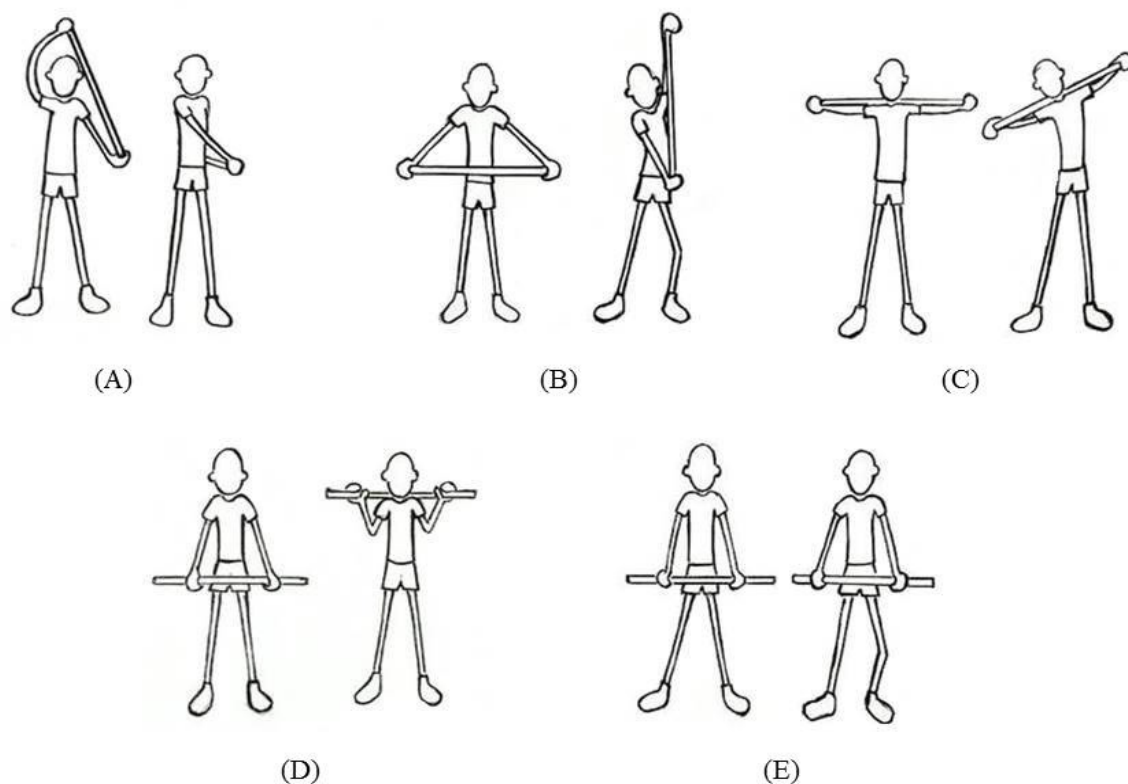


Figure 1 A set of wand exercises: (A) rowing, (B) lateral swing, (C) shoulder abduction, (D) lifting and (E) body shift

Outcome measures

Three outcome measures (physical function, severity of pain and grip strength) were assessed at pre- and post-exercise training periods by a research assistant who was blinded to the study procedure to

control the testing bias. Training of the research assistant to administer the assessments was conducted prior to the main study with 10 persons with RA who were not involved in the current study. Test-retest reliability of the assessments showed an excellent

reliability (Pearson correlation coefficient = 0.96-0.99).

Physical function

The ability to perform daily life activities required to meet basic needs and fulfill usual roles of the participants was assessed by means of the Health Assessment Questionnaire in Thai version (Thai HAQ)⁽²¹⁾. The participants were asked to rate their ability in performing 20 activities over the past week with the scores ranging from 0 (no difficulty in performing that activity) to 3 (unable to perform that activity). Psychometric properties of the Thai HAQ in persons with RA were assessed by a previous study⁽²²⁾.

Grip strength

Grip strength of the participants was measured by using a sphygmomanometer, a pneumatic instrument measuring cylindrical grip pressure in mmHg^(23,24). The sphygmomanometer cuff was rolled up, secured with rubber bands at a circumference of 7 inches and placed inside a non-slippery, non-stretch bag having the same dimensions as the cuff. The bag was inflated up to 260 mmHg and then gradually deflated to 30 mmHg representing the baseline pressure level for measurement. The standardized arm position for the test of grip strength was used during the measurements⁽²⁵⁾. The measurements started in the dominant hand and were done by alternating the hands. Three trials were conducted for each hand with a rest period of 30 seconds between trials. The test result of 3 trials was averaged and used for data analysis. The grip strength test by using sphygmomanometer had a strong relationship with grip strength measured by Jamar dynamometer⁽²⁴⁾ and hydraulic dynamometer⁽²³⁾.

Severity of pain

Pain intensity was measured by the visual analog scale (VAS)⁽²⁶⁾, using a 100-mm horizontal line, anchored from 'no pain' to 'worst pain' imaginable. The participants were requested to place a mark along the line that indicated their pain level over the past 24 hours. The score was determined by measuring (in

mm) from the left to the point on the line marked by the participants. The VAS was found reliable for the test-retest⁽²⁷⁾ and showed correlation with functional status and psychological distress in persons with RA⁽²⁶⁾.

Procedures

Before commencing the wand exercise program, individual participants underwent pre-exercise assessment involving the physical function, grip strength and severity of pain. Then, they began the 6-week intervention program by attending a group meeting comprising health education about rheumatoid arthritis and practical session of the wand exercise. The group meeting was held at the community hall and took about 1.5 hours. It was conducted again in the following week and every 2 weeks after that (i.e. at weeks 1, 3 and 5 of the study period). After each group meeting, the participants were encouraged to practice the wand exercise program at home for 20 minutes per session and 3 days a week. They were asked to record their practices and adverse effects in the diary and present it to the authors during the next group meeting. The participants were reassessed immediately after the completion of the 6-week exercise training program in which the same outcome measures were used.

Data analysis

Descriptive statistics were drawn up to describe the demographic and descriptive data of the participants. Normality of the data set was assessed using the Shapiro-Wilk test. Square roots of the Thai HAQ scores were calculated to provide a normal distribution before the statistical analysis. Paired t-tests were applied to analyze the results of all outcome measures. Statistical significance was inferred at a value of $p < 0.05$. All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 21.0 (Armonk, New York, USA).

Results

Baseline demographic characteristics of the participants are presented in **Table 1**. Of 45 participants, 29 (64.4%) were female. Their age range was 38-73 years with the average age of 57.3 ± 9.0 years. Sixty percent of them had no other health

problems. Their approximate duration of RA diagnosis was 7 years with low to moderate severity level (mean DAS28 3.4 ± 0.8). Most of the participants (71.1%) had no morning stiffness. About one-third of them had deformity of the upper extremity.

Table 1 Demographic characteristics of participants (n=45)

Demographic characteristics	Data
Female [n (%)]	29 (64.4)
Age (year) [mean (SD)]	57.3 (9.0)
Body mass index (kg/m ²) [mean (SD)]	22.4 (3.9)
Other health problems [n (%)] (answer more than one item)	
no	27 (60.0)
hypertension	4 (8.9)
diabetes	3 (6.7)
other (asthma, thyroid problem, etc.)	11 (24.4)
Duration of diagnosis (years) [mean (SD)]	7.3 (5.7)
DAS28 (total score 9.4) [mean (SD)]	3.4 (0.8)
Morning stiffness [n (%)]	
no	32 (71.1)
yes	13 (28.9)
Deformity [n (%)]	
Upper extremity	
no	29 (64.4)
yes	16 (35.6)
Lower extremity	
no	41 (91.1)
yes	4 (8.9)

SD: standard deviation, COPD: chronic obstructive pulmonary disease, DAS28: Disease Activity Score-28

Table 2 exhibits changes in outcome measures during the study period. After receiving the 6-week wand exercise training program, the participants showed significant improvements in physical function, grip strength and severity of pain ($p < 0.001$). Mean

differences of the scores of Thai HAQ, grip strength of dominant and non-dominant hands and VAS were -0.50 points, 14.82 mmHg, 14.23 mmHg and -23.13 mm, respectively.

Table 2 Mean (standard deviation) of outcome measures and comparisons between pre- and post-exercise assessments (n=45)

Outcome measures	Pre-exercise	Post-exercise	Mean differences (95% CI)	p-values
Thai HAQ (0-3 point)				
original values	0.90 (0.55)	0.41 (0.37)		
square root values	0.91 (0.29)	0.53 (0.36)	-0.38 (-0.44 to -0.31)	< 0.001
Grip strength (mmHg)				
dominant hand	174.17 (53.49)	188.99 (53.43)	14.82 (7.36 to 22.28)	< 0.001
non-dominant hand	172.19 (49.26)	186.42 (52.68)	14.23 (8.50 to 19.95)	< 0.001
VAS (0-100 mm)	42.96 (20.39)	19.82 (19.28)	-23.13 (-28.75 to -17.51)	< 0.001

All *p*-values were obtained through paired *t*-tests.

CI: confidence interval, HAQ: Health Assessment Questionnaire, VAS: visual analog scale

Discussion and Conclusion

This 6-week quasi-experimental trial revealed that when compared with before exercise training, the current wand exercise which was a dynamic exercise with low to moderate intensity could improve physical function as well as grip strength and decrease pain in persons with RA. No adverse effects were associated with the wand exercise. This finding added evidence to the beneficial effects of exercise for individuals with RA^(3,28). The improvements in those 3 outcome measures are probably due to the positive effects of wand exercise on cardiovascular health, muscle strength, range of motion and flexibility as reported in previous studies⁽⁸⁻¹²⁾. Grasping a wand with both hands during the upper extremity exercising could lead to the improved grip strength⁽⁶⁾ via the mechanisms of increased neural activity, resulting in improved efficiency of activation of muscle fibers in rapid gains period⁽²⁹⁾. Additionally, it is possible that dynamic movements of the wand exercise helps increase blood circulation to the synovial joints, thereby relieving pain in persons with RA^(30,31). The decreased severity of pain and increased grip strength should lead to the improved physical function in daily life activities of

the participants.

It was noticeable that changes in HAQ and VAS scores in the current study reached the minimally clinically significant improvements, i.e. -0.375 points for the HAQ⁽³²⁾ and -20 mm for the VAS⁽³³⁾. For a minimally important change in the grip strength measured by a sphygmomanometer in persons with RA, it has not yet been reported. However, it was observed that after the 6-week wand exercise training program, average grip strength of both dominant and non-dominant hands of the participants was approaching the grip strength level of healthy persons of 226.88 mmHg⁽²³⁾. To reach such an optimum level of grip strength, further studies should include more vigorous grip exercises, increase exercise intensity and/or use a heavier stick in the wand exercise program. The authors have expected that the increased grip strength will maximize physical function related to the grip, e.g. opening containers, turning on and off a faucet, twisting the cloth after washing.

Based on the findings of the study, it is possible to suggest that the 6-week wand exercise program can provide benefits to community-dwellers with RA. However, owing to time restraints,

performing a randomized controlled trial in the current study was not possible. Therefore, further study for contributing comparison groups is suggested. This will demonstrate whether persons with RA who perform a wand exercise program improve their physical function and/or other variables in comparison with the controls. In addition, a longitudinal study design should be conducted to determine the long term effects of the wand exercise. These future studies should be able to clarify the effects of the wand exercise training in persons with RA.

In conclusion, when compared with the pre-exercise period, the wand exercise training could improve physical function as well as grip strength and decrease pain in persons with RA. It may be applied as an alternative exercise regimen for improving health status of persons with RA in the community.

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