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Effect of Retro Walking on Pain in Patients with Knee Osteoarthritis (Randomized Control Trial)

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Abstract

Background: Osteoarthritis is a common disease in Egypt; with a prevalence of 8.5%. This disease is more common in females than males and predominantly affects the knees. Retro walking is a novel treatment method for knee osteoarthritis.

Aim of Study: The study was conducted to investigate the effect of 4 weeks of retro-walking exercise on pain in patients with knee osteoarthritis.

Patients and Methods: This study was carried out on forty-two patients of both genders with mild to moderate knee osteoarthritis. Their ages ranged from 40 to 55 years, and their body mass index (BMI) didn't exceed 30kg/m^2. All patients were referred by the orthopedic surgeon who diagnosed knee osteoarthritis based on clinical and radiological examination. Patients were divided randomly into two groups: Group A the control group and group B the retro-walking group. The control group received four weeks of conventional exercises three times per week. The walking group received four weeks of retro walking exercise 3 times per week from 10min up to 30 minutes added to conventional exercise, the intensity of Pain measured by the Visual Analogue Scale (VAS).

Results: The results of this study revealed that all patients showed a statistically (p-value <0.001) significant decrease in pain in VAS score in favor of retro-walking group.

Conclusion: Retro-walking is an effective method to relieve pain in patients with mild to moderate knee osteoarthritis.

Key Words: *Knee osteoarthritis – Pain – Retro walking.*

Introduction

KNEE osteoarthritis (KOA) is one of the most common degenerative diseases worldwide **[1]**. Pain is a common symptom associated with knee osteoarthritis with a prevalence of 23% **[2]**. Osteoarthritis is considered a serious problem that causes not only pain, loss of function, disability, and muscular strength deficits but also reduces quality of life **[3]**.

Patients with knee OA have lower isokinetic strength in the hip muscles than healthy subjects. Strengthening the whole muscles surrounding the hip joint not only the quadriceps muscle may help to decrease pain in people with knee OA **[4]**.

Aerobic exercise, such as a walking program, jogging in water, yoga, and T'ai Chi can have statistically significant effects on pain, joint tenderness, functional status, and respiratory capacity for patients with OA **[5]**.

Retro Walking (Backward walking) is considered a type of closed kinetic chain exercise which paid attention recently in the rehabilitation of orthopedic, neural, and sports cases and approved to have positive effects on promoting balance **[6]**.

This exercise can reduce the burden on joints and promote muscle strength in the lower limbs. In addition, retro walking does not cause adverse effects on the body through the stimulation of the major muscles rhythmically and dynamically which makes it effective and safe for reducing health risks **[3]**. Retro walking reverses the motion of the lower limb muscles which significantly decreases the load over the knee joint, since osteoarthritis is linked to increased load over the knee joint then any attempts to decrease the load lead to a decrease in related symptoms, especially pain **[7,8]**.

Hence, Retro-walking may offer positive benefits in this population. The current study aimed to find out the effectiveness of retro-walking treatments on pain in patients with knee osteoarthritis.

Subjects and Methods

The study was conducted in Shirbin Central Hospital outpatient clinics from May 2023 to October 2023. Ethical approval no. P.T.REC/012/004638

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Subjects: This study was carried out on 42 patients of both genders with mild to moderate knee osteoarthritis, their ages ranged from 40 to 55 years and their body mass index (BMI) didn't exceed 30kg/m^2. All patients were divided randomly into two groups equal in number Group (A) and Group (B).

Group (A) consisted of 21 patients. Each patient in this group received conventional isometric exercises (isometric straight leg raising, isometric quadriceps exercise, and isometric hip abduction exercise) based on a previous study of the effects of quadriceps isometric contraction in the treatment of knee osteoarthritis [9]. All exercises were performed in sets of 10 repetitions; 1 set of all exercises was performed twice a day for the 1st week, and this progressed to 2 sets twice a day until the 3rd week and then 3 sets twice a day until the 4th week.

Group (B) received retro walking exercise added to the previous exercise program in group A, supervised retro walking training was conducted over a treadmill with handrails at normal speed without inclination. The participants were instructed to gradually increase their walking time up to 10min by the end of 1st week then gradually increase to 15min by the end of 2nd week and then gradually increase to 30min by the end of 3rd and 4th weeks.

Materials:

Consent form: Each patient was asked to sign the consent form before participating in this study.

Recording data sheet: It was used to record all data of each patient before starting the treatment course. It included: name, age, address, BMI, occupation, and the degree of arthritis.

Weight-height scale: It was used to measure the weight and height of each patient.

Visual Analogue Scale (VAS): Used in the assessment of pain intensity before and after treatment.

Stopwatch: It was used to determine the time of each treatment session.

Treadmill with handrails: Used as a treatment tool for retro walking exercises.

Methods:

(A) *Evaluative procedures:*

1- All data of each patient was recorded in the recording data sheet before starting the treatment course.
2- The weight and height of each patient were measured, and BMI was calculated before starting the treatment course.
3- The intensity of perceived pain was measured using a 10cm Visual Analogue Scale (VAS). The scale had 0 (no pain at all) and 10 (maximum pain felt at this moment) at either end. The patient was asked to mark his/her pain where she/he felt it would take its position on the scale.

(B) *Treatment procedures:*

The subjects were randomly allocated to either of the two treatment groups; blank folders numbered from 1 to 42 with concealed codes for the group assignment by an independent therapist, and kept in a safe locker. When a participant was eligible and agreed to participate, an independent therapist drew the next folder from the file to decide the group assignment. The duration of the session was ranged from 30 to 45min.

In the warm-up and cool-down sessions, the subjects were instructed to perform 5 minutes of gastrocnemius-soleus, hamstring stretches, and heel raise exercises. In heel raise exercises: The patient was in a long sitting position and was asked to raise his heel for 10 repetitions, In gastrocnemius-soleus and hamstring stretches: The patients were in long sitting positions with extended knees and were asked to lean forward as possible to their tip toes with their fingers for 20-30 seconds and repeated 3 times, and In the hamstring stretch: The patient was in a standing position facing a small stool and he was asked to do a self-stretch by placing his extended knee over the stool leaning forward for 20-30 sec and repeating 3 times.

Group (A): Based on a previous study of the effects of quadriceps isometric contraction in the treatment of knee osteoarthritis [9] the patients in the conventional group received the following isometric contraction protocol: Isometric Straight leg raising (SLR) exercise, Isometric quadriceps exercise, and Isometric hip abduction exercise.

All exercises were performed 3 sessions per week in sets of 10 repetitions; 1 set for the 1st week, and this progressed to 2 sets until the 3rd week and then 3 sets until the 4th-week.

Group (B): The retro walking exercise was added to the previous exercise program, and then supervised retro walking training was conducted over a treadmill with handrails at normal speed without inclination. The participants were instructed to gradually increase their walking time up to 10min by the end of 1st week then gradually increase to 15min by the end of 2nd week and then gradually increase to 30min by the end of 3rd and 4th weeks as shown in Fig. (1).

All conventional exercises were performed as a home program in sets of 10 repetitions; 1 set of all exercises was performed twice a day for the 1st week, and this progressed to 2 sets twice a day until the 3rd week and then 3 sets twice a day until the 4th-week for both groups.

Fig. (1): Retro walking ex.

Statistical analysis:

- Data were expressed as mean ± SD.
- Unpaired *t*-test and chi-square were used to compare between subjects' characteristics of each group.
- Shapiro-Wilk and Kolmogorov Smirnov tests were used for testing the normality of data distribution.
- MANOVA was performed to compare within-group effects for measured variables (pain by VAS).
- Statistical package for the social sciences computer program (version 20 for Windows; SPSS Inc., Chicago, Illinois, USA) was used for data analysis. *p* less than or equal to 0.05 was considered significant.

Results

Demographic data of subjects:

A total of 42 patients participated in this study; they were assigned into 2 equal groups; The control group) consisted of 21 patients who received conventional exercises and the experimental group) consisted of 21 patients who received Retro Walking training added to previous conventional training. The mean values of the age of the control and experimental groups were (46.3±4.1) and (45.5±4) years respectively, and the mean values of BMI were (27.3±1.3) and (26.9±1.5) kg/m^2 respectively. There was no significant difference between the mean value of age and BMI of both groups (p>0.05). The number (%) of males in control and experimental groups was 2 (9.5%) and 4 (19%) and the number (%) of females was 19 (90.5%) and 17 (81%) respectively. The number (%) of mild degree arthritis in control and experimental groups was 11 (52.4%) and 14 (66.6%) and the number (%) of moderate degree arthritis was 10 (47.6%) and 7 (33.3%) respectively. There was no significant difference in sex distribution and degree of arthritis between both groups (p>0.05) as shown in Table (1).

Table (1): Demographic data of subjects of both groups .

Demographic data	Group A	Group B	*t*-value	*p*-value
Age (years)	46.3±4.1	45.5±4	0.606	0.548
BMI (kg/m^2)	27.3±1.3	26.9±1.5	0.808	0.424
Sex:	N (%)	N (%)	$\chi2$=0.778	0.661
Males	2 (9.5%)	4 (19%)		
Females	19 (90.5%)	17 (81%)		
Degree of arthritis:	N (%)	N (%)	$\chi2$=0.889	0.530
Mild	11 (52.4%)	14 (66.7%)		
Moderate	10 (47.6%)	7 (33.3%)		

Data was expressed as mean ± standard deviation.
$\chi2$: Chi square. *p*-value: Significance

Within-group comparison:

Control group: The mean ± SD of VAS pre and post-treatment of the control group was 59.8±27.2 and 37.5±19.4mm respectively. There was a statistically significant decrease of 37.3% post-treatment (p=0.001).

Experimental group: The mean ± SD of VAS pre and post-treatment of the experimental group was 64.3±22.6 and 16.7±12.4mm respectively. There was a statistically significant decrease of 74% post-treatment (p=0.001) (Table 2, Fig. 2).

Table (2): Mean ±SD of measured variables pre and post-treatment of both groups.

Measured variables	Control group	Experimental group	*t*-value	*p*-value[1]	n^2
VAS (mm):					
- Pre-treatment	59.8±27.2	64.3±22.6	0.315	0.578	0.008
- Post-treatment	37.5±19.4	16.7±12.4	19.9	0.001*	0.338
- % of change	37.3%	74%			
- *p*-value [2]	0.001*	0.001*			

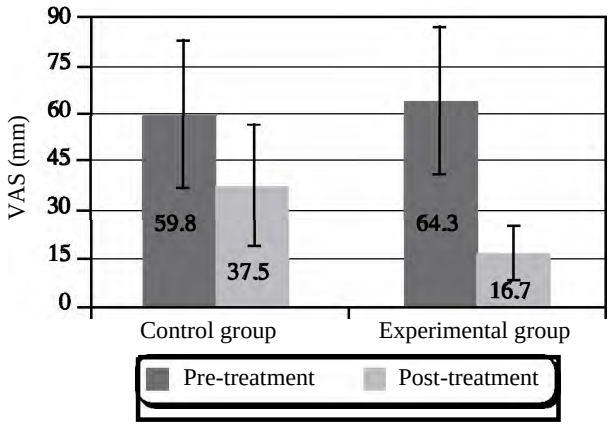

Fig. (2): Mean values of VAS pre and post-treatment within each group.

Between groups comparison:

There was no statistically significant difference in the mean values of VAS pre-treatment between both groups (p=0.578), while there was a statistically significant difference post-treatment (p=0.001) in favor of the experimental group (Table 2, Fig. 3).

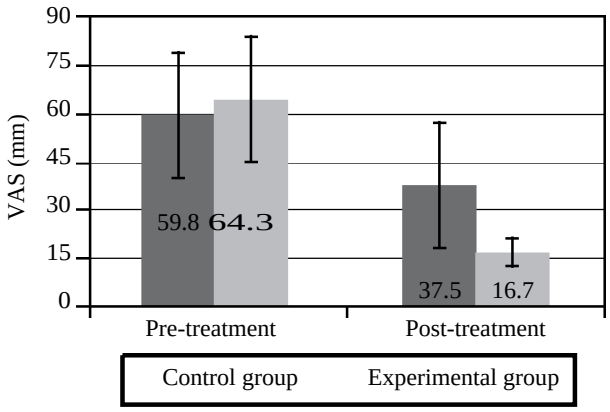

Fig. (3): Mean values of VAS pre and post-treatment between group.

Discussion

The current randomized, controlled trial aimed to compare the effects of a retro walking exercise on pain in patients with mild and moderate degrees of knee osteoarthritis. The results of the present study indicated that the retro walking program was effective in reducing pain after 4 weeks in patients with knee osteoarthritis.

Biomechanically, during retro walking muscles around the ankle and knee reversed their action. In retro-walking, the knee gives the primary power producer with co-contraction of the quadriceps and hamstring muscle that helps to steady the knee and give additional joint protection from shock and stress in conjunction with ankle plantar flexors that work as shock absorbers, reducing pain by retro walking may as a result of reducing excess adductor moment at the knee joint and decreasing the compressive forces on the medial compartment of the knee joint **[8,12].**

The findings of this study were in agreement with a recent RCT conducted over Sixty-eight individuals with knee osteoarthritis divided into three groups the control group received a routine physiotherapy program, the forward walking group completed 10min of supervised forward walking training in addition to a routine physiotherapy program, 3 days/week for 6 weeks and retro walking group completed 10min of supervised retro walking training in addition to a routine physiotherapy program 3 days/week for 6 weeks, the primary outcomes were mean pain and knee function scores measured by the Index numerical rating scale and the Western Ontario and McMaster Universities Osteoarthritis (WOMAC), respectively. The secondary outcomes were the mean score of quadriceps muscle strength and timed up-and-go test scores. All the outcomes were analyzed at baseline and week 6 and have shown that compared to forward walking; backward walking is more effective in reducing pain, and functional disability and improving quadriceps muscle strength and performance in individuals with knee OA **[3].**

The findings of the current study came in agreement with the study done over twenty patients with knee osteoarthritis divided into two groups, Group A received backward walking training with conventional physiotherapy treatment whereas Group B received only conventional treatment for 2 weeks, Pain on Numeric Pain Rating Scale, Quadriceps strength and Reduced WOMAC scale for disability were assessed before the treatment and after 2 weeks and revealed that there was a significant improvement in pain, disability and quadriceps strength in favor to retro walking group **[11].**

The findings of the current study were recommended by a recent systematic review which confirmed that backward walking with conventional physiotherapy treatment is effective and clinically worthwhile in patients with knee osteoarthritis **[10].**

However, the findings of the current study were not supported by a previous study conducted for 3 weeks over thirty chronic knee osteoarthritis patients divided into two groups, group A received conventional treatment and Group B received conventional treatment and retro-walking, all the participants were tested for Pain measured through (VAS), and WOMAC) were the primary outcomes and knee range of motion, hip abductor and extensor strength were secondary outcomes; measured pre-intervention, after 1 week, and after 3 weeks of intervention and reported that there was no significant effect of retro walking adjunct to conventional treatment over pain compared to the control group of conventional treatment as they are equally effective in relieving pain **[8].**

Conclusion:

Retro walking added to conventional is an effective treatment method for relieving pain in patients with mild and moderate degrees of knee osteoarthritis.

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تاثير المشى الخلفى على الالم لمرضى الالتهاب العظمى المفصلى للركبة

يهدف هذا البحث إلى توضيح اثر العلاج بالمشى الخلفى على الألام المصاحبة لمرضى الالتهاب العظمى المفصلى للركبة.

اجريت هذة الدراسة على اثنى واربعون مريضاً بالالتهاب العظمى المفصلى للركبة تتراوح اعمارهن بين ٤٠ إلى ٤٥ ومؤشر كتلة الجسم لايتعدى ٣٠ كجم / م٢ . تم تقسيم المرضى عشوائيا الى مجموعتين مجموعة (ا) والتى تلقت العلاج بالتمارين التقليدية ومجموعة (ب) التى تلقت العلاج بالمشى الخلفى اضافة الى التمارين التقليدية لمدة اربع اسابيع بمعدل ثلاث جلسات اسبوعياً تتراوح مدة الجلسة من ٣٠ إلى ٤٥ دقيقة. وقد تم تقييم التغير فى مستوى الالم عن طريق مؤشر قياس مستوى الألم فاس وتم اخذ القياسات قبل وبعد العلاج واسفرت النتائج عن نقص ذا دلالة احصائية فى الاحساس بشدة الالم مما يثبت فعالية المشى الخلفى فى علاج الالم المصاحب لمرضى الالتهاب العظمى المفصلى للركبة.