

Group Education and Exercise Program for Overweight Knee Osteoarthritic Patients

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ABSTRACT

Objective: To study the benefits of patient education and an exercise program for the overweight knee osteoarthritis (OA) patients.

Methods: Group education (GE) was arranged for overweight patients for 2 weeks including how to use their joints properly in their daily activities, how to calculate energy of various kinds of food as well as performing controlled group exercise. Each parameter was evaluated at three time points including before joining GE, after 2 weeks of attending GE and 3 months later. The outcomes were determined by the knowledge score about the disease, gait speed calculated from a 50-meter walk, knee pain score after walking, body weight and quadriceps strength.

Results: Eighty-seven subjects were recruited, 11 males (12.6%) and 76 females (87.4%) with a mean age of 59.5 ± 7.6 years, and an average body mass index of 27.5 ± 3.5 kg/m². The duration of disease was 4.6 ± 4.7 years. Most subjects (79.3%) have good compliance on performing exercise with an average 9.15 ± 1.46 days (range 3-10). The knowledge score before and after attending the group education were 35.1 ± 4.2 and 38.1 ± 4.9 , respectively ($p < 0.001$). After two weeks, their body weight and pain score decreased whereas quadriceps strength and gait speed increased. Those outcomes were even better at the 3-month follow up period.

Conclusion: GE, comprised of providing appropriate knowledge, sharing ideas among groups, learning about diet and daily exercise for 2 weeks which can significantly increase knowledge scores, decrease knee pain and body weight, as well as increase quadriceps strength and gait speed.

Keywords: Group education, knee osteoarthritis, obesity, quadriceps strengthening exercise

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Knee osteoarthritis (OA) has been found to be one of the most common musculoskeletal diseases in the elderly. A survey of the elderly who have been living in the community around Siriraj Hospital in year 2001 found that the prevalence of knee OA was 34.5-45.6 percent.¹ As for the progression of the disease, it would proceed gradually and result in the atrophy of the quadriceps muscle. It also affects the use of knee joints in all aspects, i.e. walking, going up and downstairs, sitting and standing, as well as turning. As most activities of daily living required efficient functions of the knee joints, deterioration of the knee joint in the elderly would unavoidably affect the quality of life (QoL).²

There are many strategies for knee OA treatment.³ Educating patients about how to perform or to use their

knees properly in their daily activities is one of the methods that has been proven to have benefits and is effective in reducing pain and increasing coping skills for those living with the disease.⁴ Most of the education program comprised of teaching proper performance in using their knee joints, advice on weight reduction, making recommendations for proper daily exercise as well as for sports. The outcomes for educating knee OA patients was demonstrated to reduce the cost and frequency of visiting doctors,⁵ as well as prevent overuse of their joints.⁶ The pattern of education may be provided by an individual⁷ or by a group.⁸ Improperly using knee joints would accelerate the degeneration process.⁹ In addition, body weight is another factor which affects knee functions.¹⁰ Patients had problems in reducing their weight, especially those overweight OA knee patients. Therefore, educating them about the nature of the disease and the proper performance of activities in their daily living should prevent or delay the development of knee OA in obese patients.

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Objective

To study the pattern and benefits of patient education and an exercise program for overweight knee OA patients.

Design

Comparative study “before and after” design.

MATERIALS AND METHODS

This study was conducted at Siriraj Hospital, a tertiary care medical center in Bangkok, Thailand in accordance with the ethical principles stated in the most recent version of the Declaration of Helsinki even though it was considered by the Ethics Committee as not fulfilling research criteria. It was a part of the behavior modification project for overweight knee osteoarthritis patients. Patients aged more than 50 years old who had any severity of knee OA with body mass index (BMI) of more than 25 kg/m² and could walk were recruited into the study. Subjects who had underlying diseases for example severe coronary heart disease, severe pain of low back or legs that interfered with walking were excluded. All subjects were divided into 4 groups of 15 -20 patients for the 2 weeks course. Each patient would be assessed concerning their knowledge of the disease and about how to use his or her knee joint by evaluating their answers of ‘true or false’ of 50 questions (score range 0 - 50). The gait speed (meter / minute) was assessed by a 50 -meter walk. The pain score after walking was evaluated by a numerical rating scale, range 0 -10. The individual body weights were also recorded. In addition, the strength of leg muscles using an isometric method was evaluated by a dynamometer (in kilograms) twice and reported as the mean average value. In patients with bilateral knee OA, the outcomes were evaluated from the worse side. At the end of study, the global assessment of their overall symptoms was also recorded. We tried to reduce bias by using objective outcomes and using the same evaluator for each measurement. However, the evaluators knew that they were evaluating patients at before or after intervention.

The content of the course comprised of three main activities as follows:-

1. Attending lectures which taught how to use their knee properly in their daily lives activities for one hour, 5 days per week for 2 weeks comprising the following topics:-
 - How important is the knee osteoarthritis?
 - Pharmacological treatment for knee OA
 - Non- pharmacological treatment of knee OA
 - How important is the body weight to knee OA patients?
 - Good health behavior for knee OA patients
 - Cardiovascular exercise to improve fitness in knee OA patients
 - Acupuncture and knee pain
 - When is knee surgery needed?
2. Learning how to calculate the energy received from each kind of food and practicing the energy calculation of each food for one hour, 5 days per week for 2 weeks.
3. Performing controlled group exercise for 45 - 60 minutes per day for 2 weeks. Every group would have an exercise schedule using the same pattern which included:

- Strengthening exercise of the lower limb muscles such as the leg, knee, hip and ankle, emphasizing the knee muscle. The frequency would be 45 minutes/day, three times/week.
- Flexibility exercise of cervical, lumbar, knee and hip joints for 60 minutes once a week.
- Cardiovascular fitness by Thai dancing, known as “Serng” - Thailand North Eastern traditional dance - for 60 minutes, once a week led by a nurse for each group.

The subjects were immediately evaluated for their knowledge score after this 2 weeks course and other outcomes were also followed up at 2 weeks and 3 months after the course including their weight, leg muscle strength, gait speed and pain score after walking. At the end of the 2-week course, we did not control any situation. However, the participants were reevaluated at a 3-month period to assess the long term effect.

Statistical analysis

Descriptive analysis was used to analyze the demographic data. The main outcomes including body weight, pain on level walking, quadriceps strength, and gait speed were analyzed by using repeated measured ANOVA with Bonferroni method in order to classify which pair of parameters was different. For the ordinal data, the number of patients who had pain score changes measured at 2-week and 3-month periods compared to the score before attending the program and the global assessment were analyzed by using Wilcoxon Signed Ranks Test. A p value of <0.05 was considered to be of statistical significance.

RESULTS

Eighty-seven subjects were recruited, 11 males (12.6%) and 76 females (87.4%), with a mean age of 59.5 ± 7.6 years, and an average body mass index of 27.5 ± 3.5 kg/m². Thirty-one participants graduated from elementary school (35.6%), 18 subjects graduated from intermediate school (20.7%) and 38 subjects had college level experience (43.6%). They had experienced knee pain for 4.6 ± 4.7 years. Thirty-five patients (40.2%) used knee supports and 10 (11.5%) used canes. (Table 1)

Most of them (69 subjects or 79.3%) exercised regularly with good compliance for 9 - 10 days. Twelve subjects (13.8%) performed exercise for 7 - 8 days and another 6 subjects (6.9%) complied with the exercise routine for a period less than or equal to 6 days, with the average days of exercise being 9.15 ± 1.46 days (range 3-10). The average knowledge scores about the disease and how to use their joints before and after attending the group were 35.1 ± 4.2 and 38.1 ± 4.9, respectively, which was statistically significant (p < 0.001). When the course ended, their body weight and pain score decreased while quadriceps strength and gait speed increased when compared to those measured before attending the course (Table 2). Those results were still better at the 3-month follow up.

Concerning the pain score, more than 80% of the subjects evaluated their knee pain as having decreased compared to the period before attending the program. When followed up at 3 months, 66% of the subjects still felt that their knee pain was decreasing (p = 0.043) (Table 3). For the global assessment, most subjects

TABLE 1. Demographic data of 87 patients.

Variables	No	(%)
Sex: female	76	87.4
Age (mean, SD)	59.5	7.6
BMI (mean, SD)	27.5	3.5
Educational level		
Elementary school	31	35.6
Intermediate school	18	20.7
College	38	43.6
Duration of knee pain (mean, SD)	4.6	4.7
Using knee support	35	40.2
Using cane	10	11.5

(89%) indicated improvement (Table 4). Eight subjects (9.9%) felt their symptoms underwent no change and only one subject felt a worsening of symptoms. At 3 months after the course, more than 80% of the patients evaluated their symptoms as improved with 2 subjects (3.6%) evaluating them as completely resolved. With regard to behavior modification in their daily lives after the course, participants changed their behaviors concerning proper diet (88.9%), regular exercise (79.4%), and avoidance of knee flexion beyond 90 degree (71.4%) as well as reducing unnecessary going up and down stairs (66.7%) as shown in Table 5. At the end of the course, the patients' satisfaction were evaluated with 76 subjects (93.8%) being very satisfied, 5 subjects being somewhat satisfied and none being unsatisfied.

DISCUSSION

This study proved the positive results of group education in reducing knee pain, strengthening quadriceps' muscles, and as well, improving gait speed, even in a two-week course. Our results were consistent with the study of Mazzuca, et al.⁷ that reported positive consequences after providing group education concerning proper joint use, with a 12-months follow-up. The education group had significantly lower disability scores and resting knee pain throughout the year of post intervention follow up ($p < 0.05$ for both), while the pain score while walking and the global pain score were not different when comparing them to the control group. However, their study was constructed to educate patients individually, not in a group as in our study. In 1996, Kuptniratsaikul V and Nakasuwan V.¹¹ reported on group therapy in 55 knee OA patients. Patients were

TABLE 3. Number of patients who had pain score changes measured at 2-week and 3-month periods compared to the score before attending the program.

Changes of pain score	At 2-week ^B (n=87)	At 3-month ^{BB} (n=63)	p-value#
Decrease	67 (81.7)	37 (66.1)	0.043*
No change	14 (17.1)	18 (32.1)	
Increase	1 (1.2)	1 (1.8)	

Wilcoxon Signed Ranks Test

* Statistical significance

^B score at 2-week compared to score before attending the program

^{BB} score at 3-month compared to score before attending the program

educated for one hour about how to perform movements by themselves in daily living and they were followed up at 1 and 3 months. It was found that the study group had decreasing pain and could walk better, both in level walking and while going up and down stairs, when compared to the control group. Indeed, this study emphasized to obese knee OA subjects through group activities, including education about the disease progression of OA knee, how to calculate energy from diet, and group exercise for 2 weeks. Therefore, these recent studies confirmed the benefits of providing group education to knee OA patients. Participants had multiple chances to share their experiences within groups. This method can stimulate motivation and create group relationships; therefore, health behavior within groups may more easily be modified.

Gaining quadriceps strength and improving gait speed were acquired from carrying out our main activities which included regular muscle exercise along with lectures that stressed the benefits received, as well as various patterns of exercise that are suited for the knee OA patient. Performing strengthening exercise for the quadriceps muscle was one of the effective ways for decreasing pain in the knee OA patient. This method is an alternative that is widely accepted and was evidence-based to prove its effectiveness in pain reduction as well as in the improvement of the functional ability of knee joints.^{4,12-15} Therefore, increasing quadriceps muscle strength should definitely be performed in knee OA patient as seen in our study.

Besides the atrophy of quadriceps' muscle, the other problem that was often found in knee OA patients was being overweight. The more overweight was the patient, the worse were the symptoms of the disease, as

TABLE 2. Body weight, pain on level walking, quadriceps strength and gait speed compared between before, 2 weeks, and 3 months after attending group education.

Variables	Before (n=87)	At 2-week (n=82)	At 3-month (n=63)	p-value#
Body weight (kg)	66.8 ± 10.5 (40 to 94)	65.4 ± 10.3 (40 to 93)	63.8 ± 9.2 (45 to 86)	<0.001 ^{1,2}
Pain on level walking (range = 0-10)	2.32 ± 2.09 (0 to 8)	1.29 ± 1.73 (0 to 8)	1.25 ± 1.38 (0 to 5)	<0.001 ^{1,2}
Quadriceps strength (kg)	15.04 ± 5.44 (1.0 to 31.5)	16.94 ± 5.78 (1.2 to 34.0)	16.67 ± 5.45 (1.5 to 34.0)	<0.001 ^{1,2}
Gait speed (meter / min)	78.13 ± 12.74 (23.8 to 98.6)	86.82 ± 13.60 (27.6 to 119.7)	84.22 ± 12.57 (39.5 to 106.3)	<0.001 ^{1,2}

Repeated Measure ANOVA with multiple comparisons: Bonferroni method p-value <0.001

1. Compared between before and after attending group education

2. Compared between before and 3-month after attending group education

TABLE 4. Global assessment of symptoms.

Global assessment	At 2-week (n=81)	At 3-month (n=56)	p-value#
Completely resolved	-	2 (3.6)	0.22
Much improved	41 (50.6)	24 (42.9)	
Moderately improved	26 (32.1)	17 (30.4)	
Minimal improved	5 (6.2)	4 (7.1)	
No change	8 (9.9)	8 (14.3)	
Getting worse	1 (1.2)	1 (1.8)	

Wilcoxon Signed Ranks Test

the body weight would apply loading directly to the knee joint. The knee joint had to bear the weight of approximately 2-3 times of the body weight in standing or walking and increased to 3-4 times when going up and down stairs. Slemenda et al. reported that there was a strong, highly significant negative correlation between body weight and extensor strength ($r = -0.74$, $p = 0.003$).¹⁰ They concluded that the more obese the subject, the greater was the reduction of quadriceps strength and that the reduced quadriceps strength relative to body weight may be a risk factor for knee OA in women. A systematic review in 2007 revealed that reducing the body weight by more than 5% of the overweight knee OA patients within 20 weeks would significantly decrease the disability.⁹ In addition, there was a report that obesity was shown to be a risk factor for knee osteoarthritis which can be preventable.¹⁶⁻¹⁷ Therefore, reducing body weight was the most important strategy to emphasize. Our studies demonstrated that our participants could reduce their weight around 1.0-1.5 kilogram within 2 weeks. Thus, the benefit for OA patients by reducing weight could mediate through an appropriate education system.

Apart from the study that supported the single factor about providing knowledge, performing exercise or decreasing weight, there also were studies of the results of providing knowledge along with exercising, that would enhance patients' quality of life as well as reducing their pain, disability or lost capability, as in the study of Devos-Comby, et al.¹⁸ and Grainger and Cicuttini¹⁹, respectively. These studies confirmed that medical personnel providing knowledge to the patient would induce better understanding about the progression of their disease, thus improving compliance and encouraging the motivation deriving from group study.

This study combined the benefits of group education, exercising and controlling body weight especially in the obese knee OA patients, who had been ignored for proper education by the medical personnel. Reducing body weight was a difficult issue which requires strong and active cooperation from the patients. However, our participants could reduce their weight around 1.0-1.5 kilogram within 2 weeks, which confirmed the benefits of group education of even a short course for knee OA patients.

When the course was finished, most subjects (82.7%) assessed themselves as "somewhat good" to "very good" and, during the follow up at 3 months, 73.3% still assessed themselves as good, which indicated the continuance of the effectiveness of the course. Our recommendation was that participants should be followed up for at least for 1 year to ensure long-term results, as well as to inquire about the lasting effects of behavior modification.

TABLE 5. Behavioral modification in daily activities at 3-month after attending group education.

Behavioral modification	At 3-month	
	(n=63)	(%)
Proper diet	56	88.9
Regular exercise	50	79.4
Avoiding knee flexion beyond 90 degrees	45	71.4
Avoiding unnecessary going up and down stairs	42	66.7

Our program composed of three hours of activities per day for 2 weeks in order to let patients adapt themselves with new behaviors of exercise and food selection. However, it can be adjusted by reducing some lecture hours of disease or food education, but not the exercise hours that should be performed at least one hour daily.

The limitation of this study is the frequency of conducting group education. We had arranged small groups to enhance the patients' understanding and make it easy to conduct group behavior modification. Therefore, manpower is required. We only had one group of instructors. A video tape with live demonstration of exercise may help us to improve the efficiency of performing group education. Another limitation is the design of the comparative before and after study, which means there is no control group to compare these results. A randomised controlled trial study is required to confirm the effectiveness of this method.

CONCLUSION

The benefits of group education (GE) for providing knowledge for knee OA patients in the form of lectures, sharing ideas among groups and learning about diet, including daily exercise, for 10 days can be statistically measured as a significant increase in knowledge scores, decrease of knee pain and body weight, and improvement of quadriceps strength and gait speed.

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