The Effect of Preoperative Quadriceps Exercise on Functional Outcome after Total Knee Arthroplasty

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Objective: *To compare the level of pain scores, range of motion, quadriceps strength and quality of life after TKA patients between preoperative quadriceps exercise group and usual care group.*
Study design: *A randomized controlled trial study.*
Material and Method: *From January 2011-January 2012, 60 patients undergoing primary TKA were included. The patients were randomized into two groups with the use of blocking letter in 30 patients for each. The patients assigned to the preoperative quadriceps exercise group were asked to participate in three weeks home quadriceps strengthening exercise program until their TKA. The patients assigned to the usual care group were asked to continue their normal activities until their TKA. Preoperative data were collected within three weeks prior to the TKA. Should be 4 data collection included visual analog scale (VAS), quadriceps strength, knee range of motion and Modified WOMAC score. Both groups were evaluated four times: three weeks before surgery, 1 month, 3 months and 6 months after surgery.*
Results: *60 patients was divided into 2 groups, the preoperative quadriceps exercise group and the usual care group. Most patients were female, older than 60 years, primary school educated, housekeeper occupation. Body mass index, duration of knee pain, Paracetamal and NSAIDs use were not statistically significant different. The quadriceps exercise group had statistically significant decreased pain in the postoperative 3 months ($p = 0.003$). The quadriceps exercise group had statistically significant decreased mean Modified WOMAC score in the postoperative 1, 3 months ($p \leq 0.001, 0.001$) and quadriceps strength better than the usual care group during the follow-up in the postoperative 3 months.*
Conclusion: *Preoperative quadriceps exercise at least three weeks prior total knee replacement result in short term benefit such as decreased pain, improved quadriceps strength and improved quality of life after elective TKA*

Keywords*: Total knee arthroplasty (TKA), Quadriceps strength, WOMAC score, Visual analog scale*

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Knee osteoarthritis is common cause of severe pain and functional limitation affecting approximately 6% of the adult population. This percentage increases in people who are more than fiffy-five years old[1,2]. Characteristics of knee osteoarthritis includes decrease in strength and functional ability and increase joint pain[3]. Knee osteoarthritis is initially treated pharmacologically in an attempt to control the joint pain and preserve functional ability. Despite these treatment attempts progression of knee osteoarthritis and functional decrease require many patients to undergo TKA[4]. TKA is a safe and cost effective treatment for alleviating pain and restoring physical function in patients who do not respond to nonsurgical therapies. TKA is now the accepted optimal management for patients with severe arthritis of the knee[5-8]. The numbers of thai patients with knee osteoarthritis increased by 6 million in 2007 and has been operating for Total knee arthroplasty from 2,000 to 2,500 patients per year[9]. The numbers of Thai patients with knee osteoarthritis in Phrae Hospital increase from 2,306 patients in 2008 to 2,704 patients in 2010 and was operated with Total Knee arthroplasty from 107 knees in 2008 to 127 knees in 2010.

Quadriceps weakness is often present in osteoarthritis limb and worsens after TKA. Although some quadriceps strength is regained, it may take more than 2 years to achieve preoperative levels. If quadriceps weakness could be addressed prior to TKA, then perhaps patients might experience a better overall functional level. Three of the most common modifiable impairments included in a clinical exam that represent alterable factors with postoperative treatment are pain,

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knee rang of motion and quadriceps strength. Preoperative measures of strength, functional ability,and knee pain have been shown to be significant predictors of outcomes after TKA. Pre operative quadriceps strength is a strong predictor of functional performance 1 year after surgery.

Exercise is considered by many surgeons to be a cornerstone of rehabilitation following TKA. Little attention has been paid to the role of exercise in preparation prior to TKA surgery. The concept of preparing the body prior to a stressful event such as TKA surgery has been termed "prehabilitation[10]". The theory that prehabilitation can improve TKA outcomes is supported by empirical studies that indicate that preoperative knee strength is a consistent predictor of postoperative knee strength[11] and functional ability among TKA patients[12]. Rook et al[13] reported that 6 weeks presurgical exercise program can safely improve preoperative functional status and muscle strength levels in person undergoing TKA. Studies that have attempted to examine the effect of pre-surgical exercise on post surgical recovery among TKA patients have been inconclusive. Well-designed, controlled studies are necessary to determine efficacy. Because knee osteoarthritis and total knee arthroplasty are highly prevalent, improving quadriceps weakness is an important goal for orthopaedic surgeons and rehabilitation specialists.

The objective was to compare the level of pain scores, rang of motion, quadriceps strength and quality of life after TKA patients between preoperative quadriceps exercise group and usual care group.

Material and Method

Design

A randomized controlled trial design was used, comparing preoperative quadriceps exercise with usual care treatment to patients undergoing TKA. The trial was a single-blind randomized controlled trial with the observer undertaking the outcome assessment, blind to the intervention.

Subjects

From January 2011-January 2012, all patients undergoing primary TKA for the treatment of osteoarthritis were included. Eligible patients were 50 years of age or older with idiopathic or secondary osteoarthritis of the knee with grade 2, 3, 4 radiographic severity, as defined by the modified Kellgren & Lawrence classification[14]. Exclusion criteria were history of old cerebrovascular accident, history of knee joint infection, postoperative wound infection post-operative wound dehiscen and post-operative knee trauma. All patients gave written inform consent. The ethics committee of Phrae hospital approved the present study.

Sample size

From previous study[5], the average knee pain score after TKA = 4 + 1.63 points expected to be reduced average knee pain score after intervention to = 2.5 points, with 95% confidence interval. It was estimated that a sample size of 25 in each group would have 90% power to detect a different of knee pain between the quadriceps exercise group and control group at 6 month.

Sample size estimation was performed with Stata Statistical version 11 software.

Study treatment

The patients were randomized into two groups with the use of blocking letter, 30 patients in the preoperative quadriceps exercise group and 30 patients in the usual care group. The randomization was performed in permuted blocks of ten with random variation of the blocking number. After undergoing the randomization. The patients assigned to the usual care group were asked to continue their normal activities until their TKA. The patients assigned to the preoperative quadriceps exercise group were asked to participate in three weeks Home Program (General Quadriceps strengthening exercise) until their TKA.

All patients were instructed on the quadriceps exercise method, starting with sitting on a chair and bending knee and hip joints for 90 degree. Next, stretch the leg up to the maximum extension and hold it for at least 6 seconds then put the knee back to the initial 90 degree flexion position. All these were counted as one time. After finishing, pause for 20 seconds. Repeat the same exercise 10 times to strengthen up the muscle. All these were counted as one session. The patient should done this exercise for three sessions daily by spreading program into morning, afternoon, evening session. All patients were instructed by telephone for home quadriceps exercise program every weeks before TKA.

All patients were scheduled for unilateral TKA with the same PCL-substitute prosthesis. The 5 orthopaedic surgeon used a standard medial parapatella approach to the affected knee with separate prosthesis affixed to both the femur and tibia while preserving the collateral ligaments.

After the TKA, all patients participated in the same post-operative rehabilitation protocol. This

protocol emphasized and assessed the following functional tasks including ambulation, negotiating stairs and transferring from a bed to sitting and from sitting to standing positions. The protocol included straight leg raises, knee extensions with and without weight, continuous progressive movement and flexibility exercises.

Data collection

Preoperative data were collected within three weeks prior to the Total Knee arthroplasty. The pre-operative questionnaire included questions regarding demographic details, socioeconomic data (education, working status and living arrangement), height, weight, history of previous acetaminophen and NSAIDS use.

Participants completed 4 data collection appointment at baseline upon entry into the trial at three weeks prior to the TKA, one month, three month and six month after the TKA. Three to six month after a TKA is a standard assessment point to determine the effectiveness of the surgery. The same data were collected at each of these data collection appointments consisting of the participant knee pain, range of motion, quadriceps strength and the Modified WOMAC score (Thai version).

Knee pain was assessed in the knee undergoing surgical intervention by use of a 10 cm visual analog scale (VAS). The VAS was anchored at the terminal points of scale by term "no pain" and "extreme pain".

Quadriceps strength was measured by the use of dynamometer.

Knee Range of motion was measured by the use of goniometer.

Modified WOMAC score (thai version)[15], includes 24 items evaluating knee pain, stiffness and physical functioning. The pain domain consists of 5 items asking about intensity of pain associated with activities. The stiffness domain consists of 2 items. The physical function domain consists of 17 items. total score can range from 0 to 240; higher scores indicate increased pain, increased stiffness and decreased physical function. The Westem Ontario and Mc Master Universities Index (WOMAC), invented by Bellamy N[16-19] is a validated, self-administered instrument specifically designed to evaluate knee and hip osteoarthritis.

At each visit, visual analog scale (VAS) and Modified WOMAC score were evaluated by a nurse who was unaware of the treatment assignment. Quadriceps strength and knee range of motion were evaluated by a physical therapist who was unaware of the treatment assignment.

Statistical analysis

Baseline characteristics were analyzed by descriptive analysis

For the primary analysis, the total Modified WOMAC score at 6 months was compared between the two groups with Wilcoxan rank sum test. A two-sided p-value of 0.05 was considered to indicate statistic signiificance. Wilcoxan rank sum test analyses of the total Modified WOMAC score were performed at 3 and 6 months after surgery. Paired t-test and Wilcoxan rank sum test were used to analyze the scores on the WOMAC subscale, Visual analog scale (VAS), knee range of motion and quadriceps strength. Statistic analyzes was performed with use of Stata statistical version 11 software.

Results

Between January 2011 and January 2012, 68 patients were assessed for eligibility. 8 patients were not eligible because of 1 surgical wound infections, 1 post-operative knee trauma, 2 post-operative wound dehiscen and 4 loss follow-up. The research population of 60 patients was divided into 2 groups, the pre-operative quadriceps exercisel group and the usual care group with 30 patients for each. The number of male and female patients for preoperative quadriceps exercise group were 26 female patients (86.7%) and 4 male patients (13.4%). The number of male and female patients for usual care group were 24 female patients (80%) and 6 male patients (20%). The average age of patients in the quadriceps exercise group was 63 and 65.9 in the usual care group. Most education level of both group were primary school educated (86.7%). Most occupation of both group were housekeeper (36.7%, 46%). Radiographic severity (grade 4 according to Kellgren & Lawrence) was found 80.0% in the quadriceps exercise group and 66.7% in the usual care group. Most operating side of both group were right side (63.3%, 60%) (Table 1).

No statistical significantly difference were observed between two groups for clinical characteristic such as duration of knee pain, history of paracetamol and NSAIDs (Table 2).

The average visual analog scale pain scores in the quadriceps exercise group had improved to greater extent than those in the usual care group according to Table 3, VAS before surgery is the same. The level of pain score improvement was statistical

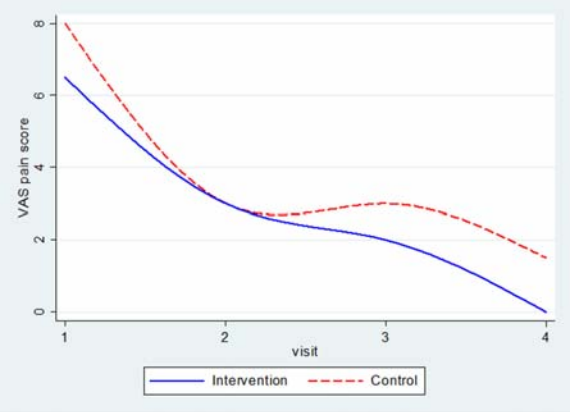

Fig. 1 Compare VAS pain score between the quadriceps exercise group and the usual care group

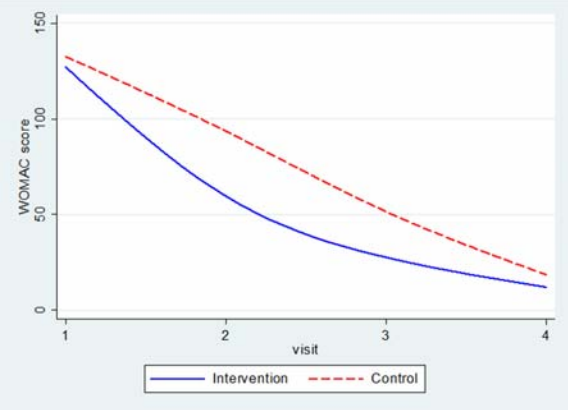

Fig. 2 Compare mean total WOMAC score between the quadriceps exercise group and the usual care group

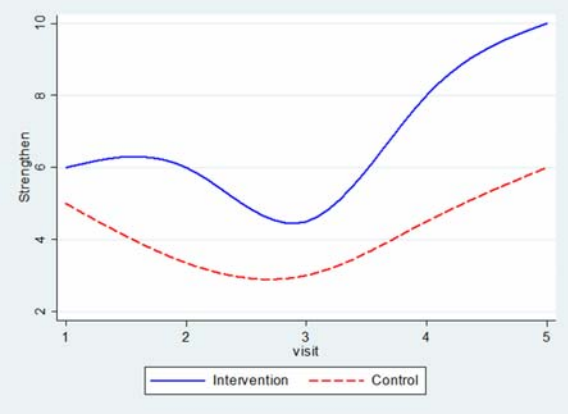

Fig. 3 Compare mean quadriceps strength between the quadriceps exercise group and the usual care group

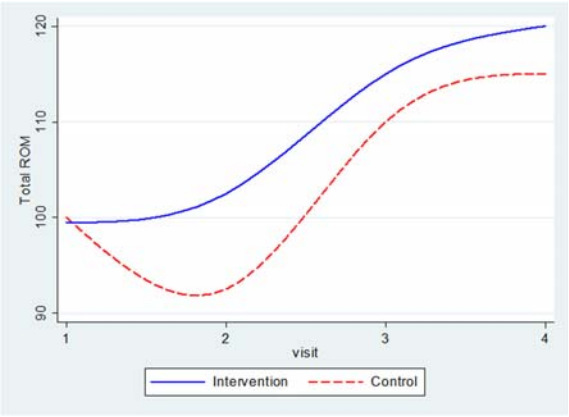

Fig. 4 Compare mean total knee range of motion between the quadriceps exercise group and the usual care group

significantly difference at 3-month period ($p = 0.003$) but the average visual analog scale pain scores was not statistical significantly difference at 6-month period ($p = 0.137$) (Fig. 1).

The average quadriceps strength decreased from the pre-operative value at the 1-month post-operative test (Table 3). The average quadriceps strength in the quadriceps exercise group increased from the preoperative value at 3-month post-operative test (Fig. 2) but the average quadriceps strength was not statistical significantly difference. At 3-month and 6-month period ($p = 0.006, 0.067$).

The mean Modified WOMAC score of both groups decreased from the preoperative value at 1-month, 3-month post-operative test. The mean Modified WOMAC score in the quadriceps exercise group had improved to greater extent than those in the usual care group at 1-month, 3-month and 6-month post-operative (Table 3) test. The mean Modified WOMAC score was statistical significantly difference at 1-month and 3-month post-operative test ($p < 0.001$, $p = 0.003$) (Fig. 3).

Knee range of motion of both groups was not statistical significantly difference at preoperative, 1-month, 3-month and 6-month postoperative test (Fig. 4).

The average knee flexion after TKA rang from 112.6 in the usual group to 117.9 in the quadriceps exercise group at 6-month postoperative test (Table 3). Patients who underwent Total Knee arthroplasty had an expected worsening of ROM, quadriceps strength, and function 1 months after surgery. All measures recovered significant over the first half of the

Table 1. Demographic and Socioeconomic characteristics of the patient

Characteristics	Exercise group		Usual care group	
	Number	%	Number	%
Sex				
Male	4	13.3	6	20.0
Female	26	86.7	24	80.0
Age				
< 55	5	16.7	1	3.3
55-65	14	46.7	14	43.3
> 65	11	36.6	15	53.3
Average (SD)	63	(7.6)	65.9	(7.2)
Education level				
literate	1	3.3	1	3.3
Primary school	26	86.7	26	86.7
Secondary school/graduate orhigher	3	10.0	3	10.0
Occupation				
Not working	9	30.0	5	16.7
Agriculture	6	20.0	8	26.7
Employee	1	3.3	4	13.3
Merchant	3	10.0	0	0
Housekeeper	11	36.7	13	43.3

Table 2. Clinical characteristics of the patient

Characteristics	Exercise group		Usual care group		p-value
	Number	%	Number	%	
Body mass index (kg/m2)					0.110*
Low (12-18.49)	0	0	2	6.7	
Normal (18.50-24.99)	18	60.0	12	40.0	
High (25-40)	12	40.0	16	53.3	
Average (SD)	24.3	(2.4)	25.3	(3.8)	
Duration of knee pain					
< 24 months	9	30.0	11	36.7	
25-48 months	6	20.0	7	23.3	
> 48 months	15	50.0	12	40.0	
Median (Min,Max)	54	(6,144)	42	(5,240)	0.352**
Pre operative analgesic use					
Paracetamal	25	83.3	25	83.3	1.000***
NSAIDs	28	93.3	30	100.0	0.492***
X –ray grading					0.233***
Kellgren- Lawrence 2	1	3.3	0	0	
Kellgren- Lawrence 3	5	16.7	10	33.3	
Kellgren- Lawrence 4	24	80.0	20	66.7	
Operating Site					1.000***
Right	19	63.3	18	60.0	
Left	11	36.7	12	40.0	

* Paired t-test analysis, ** Wilcoxan rank sum test, *** Exact probability test

Table 3. Functional Outcome characteristics of the patient

Characteristics	Exercise group		Usual care group		p-value
	Mean	(SD)	Mean	(SD)	
Pain scores					
Pre-op	6.8	(2.1)	7.2	(2.1)	0.424*
1-month	2.9	(1.5)	3.8	(1.4)	0.032**
3-month	1.6	(1.3)	2.6	(1.4)	0.003**
6-month	0.9	(1.4)	1.4	(1.3)	0.137**
Total Modified WOMAC Score					
Pre-op	128.5	(30.5)	129.0	(32.6)	0.945*
1-month	62.6	(25.3)	89.3	(30.1)	< 0.001*
3-month	31.2	(22.2)	48.9	(26.1)	0.003**
6-month	18.7	(17.9)	22.0	(14.1)	0.160**
Modified WOMAC pain Score					
Pre-op	30.3	(6.3)	27.9	(8.1)	0.210*
1-month	12.7	(5.7)	19.0	(6.4)	< 0.001*
3-month	5.4	(4.4)	10.6	(6.4)	0.001**
6-month	2.5	(3.1)	4.8	(4.2)	0.029**
Modified WOMAC stiffness Score					
Pre-op	5.4	(6.0)	7.1	(5.6)	0.173**
1-month	1.2	(2.4)	3.7	(3.7)	0.001**
3-month	0.2	(0.7)	2.2	(3.3)	< 0.001**
6-month	0.1	(0.4)	0.2	(0.6)	0.959**
Modified WOMAC function Score					
Pre-op	93.3	(22.7)	93.8	(24.9)	0.936*
1-month	48.7	(20.7)	66.4	(24.9)	0.004*
3-month	25.7	(19.1)	36.0	(19.7)	0.024**
6-month	15.8	(15.0)	17.1	(11.8)	0.297**
Quadriceps strength					
Pre-op	6.5	(3.8)	5.8	(3.9)	0.439**
1-month	5.5	(2.9)	4.0	(2.7)	0.012**
3-month	7.5	(2.9)	5.3	(3.4)	0.006**
6-month	8.4	(3.4)	7.2	(4.0)	0.067**
Knee Flexion					
Pre-op	100.2	(27.0)	101.9	(23.8)	0.876*
1-month	104.1	(17.2)	97.8	(17.8)	0.147*
3-month	113.7	(13.8)	109.1	(17.3)	0.292*
6-month	117.9	(13.8)	113.6	(17.0)	0.294*
Knee extension					
Pre-op	5.7	(9.6)	3.5	(7.9)	0.143**
1-month	2.1	(5.3)	1.8	(4.3)	1.000**
3-month	0.3	(1.8)	0.2	(0.9)	0.981**
6-month	0	(0)	1	(4.0)	0.154**
Total knee ROM					
Pre-op	99.1	(30.3)	97.7	(28.3)	0.636*
1-month	102.0	(19.5)	95.6	(18.4)	0.196*
3-month	113.4	(13.6)	109.3	(17.3)	0.308*
6-month	117.9	(13.8)	112.6	(18.6)	0.221*

* Paired t-test analysis, ** Wilcoxan rank sum test

postoperative year.

Discussion

From the present study, the average quadriceps strength decreased from the preoperative value at the 1-month post-operative test. This observation is consistent with the previous studies. Surgical procedures used in TKA involve trauma to the extensor mechanism and preoperative quadriceps weakness is dramatically compounded in early post-operative assessments[20]. 63% of the quadriceps exercise group increased quadriceps strength before TKA compared with the usual group. The average quadriceps strength in the quadriceps exercise group increased from the preoperative value at 3-month postoperative test these finding indicate the efficacy of preoperative quadriceps exercise gains in increased quadriceps strength before TKA and up to 3 months following TKA.

From the present study, the average knee flexion after TKA rang from 109.1 in usual group to 113.7 in quadriceps exercise group. this observation is consistent with the previous studies report that average knee flexion ROM after TKA ranges from 105 to 113[21,22]. This ROM sholud provide adequate mobility to perform the majority of task of daily living.

The present study showed that the quadriceps exercise group had significantly improved visual analog scale pain scores better than the usual care group at 3-months post-operative test. Mean visual analog scale pain score that different equal or less than 1, although statistically significant, seem to have no clinical significant.

The present study showed that the quadriceps exercise group had significantly improved. The Mean Modified WOMAC score better than the usual care group at 1, 3 months postoperative test. Difference in the WOMAC score 9 to 12 points on a 100 point scale have been shown to be perceptible to patients and are clinically meaningful[23,24].

These finding indicate the efficacy of preoperative quadriceps exercise improved Modified WOMAC score up to 3 months following TKA.

Literature review revealed that no significant differences in ROM, quadriceps strength, function and the Health-Related Quality of life (HRQOL) score in patients who underwent preoperative quadriceps exercise training compared to patients who do not[25-27]. These previous studies were likely limited by inadequate exposure to exercise training and a lack of specificity of the training to impact the outcome measures. From the present study, the quadriceps exercise group had significantly improved quadriceps strength, pain scores, Modified WOMAC Score better than the usual care group at 3 months postoperative test. Because of three weeks home program (General Quadriceps strengthening exercise) in the present study had adequate exposure to exercise training. All patients participated in the quadriceps exercise group was instructed by telephone for home quadriceps exercise program every weeks.

A limitation of the present study is that the authors recruited patient from five orthopaedics surgeons in Phrae Hospital rather than using a single orthopedics surgeon. The present study strengths included the use of trained research assistants (one nurse, one physical therapist) to evaluate patients and follow them at each assessment and the fact that the authors obtained detailed preoperative data and high rate follow-up at six months for a large cohort of patients.

Conclusion

Preoperative quadriceps exercise at least three weeks prior total knee replacement result in short term benefit such as decreased pain, improved quadriceps strength and improved quality of life after elective TKA.

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Potential conflicts of interest

None.

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ผลของการออกกำลังกายกล้ามเนื้อ quadriceps ที่มีผลต่อประสิทธิภาพการใช้งานหลังผ่าตัดเปลี่ยนข้อเข่าเทียม

ยอดปิติ ตั้งตรงจิตร , ภัททิรา เวียงคำ, ปิยะรัตน์ สวนกูล

วัตถุประสงค์: *เพื่อเปรียบเทียบระดับความเจ็บปวด, พิสัยการเคลื่อนไหวของข้อเข่า, ความแข็งแรงของกล้ามเนื้อ quadriceps, แบบประเมินคุณภาพชีวิต Modified WOMAC score หลังผ่าตัดเปลี่ยนข้อเข่าเทียมระหว่างผู้ป่วยที่ได้รับการฝึกออกกำลังกล้ามเนื้อ quadriceps ก่อนผ่าตัดและผู้ป่วยที่ได้รับการดูแลแบบปกติ*

วัสดุและวิธีการ: *การทดลองทางคลินิกชนิดสุ่มผู้ป่วยเข้ากลุ่ม ตั้งแต่มกราคม พ.ศ. 2554 ถึง มกราคม พ.ศ. 2555, ผู้ป่วยที่เตรียมตัวเข้ารับการผ่าตัดเปลี่ยนข้อเข่าเทียมจำนวน 60 คน เข้าร่วมในงานวิจัย ผู้ป่วยที่ได้รับการสุ่มออกเป็นสองกลุ่มโดยการใช้ซองจดหมายที่ใช้ปิดผนึก กลุ่มละ 30 คน ผู้ป่วยที่ได้รับการสุ่มให้เป็นกลุ่มออกกำลังกายกล้ามเนื้อ quadriceps ก่อนผ่าตัด ได้รับการแนะนำโปรแกรมการออกกำลังกล้ามเนื้อ quadriceps 3 สัปดาห์ก่อนผ่าตัดจนถึงวันผ่าตัดเปลี่ยนข้อเข่าเทียม ผู้ป่วยที่ได้รับการสุ่มให้เป็นกลุ่มดูแลตามปกติได้รับการแนะนำให้ดำเนินชีวิตตามปกติจนถึงวันผ่าตัดเปลี่ยนข้อเข่าเทียม ข้อมูลที่เก็บก่อนผ่าตัดจะถูกเก็บเมื่อ 3 สัปดาห์ก่อนผ่าตัดเปลี่ยนข้อเข่าเทียม ข้อมูล 4 ชนิด ถูกเก็บรวบรวมข้อมูลได้แก่ ระดับความเจ็บปวด (VAS), ความแข็งแรงของกล้ามเนื้อ quadriceps, พิสัยการเคลื่อนไหวของข้อเข่า, แบบประเมินคุณภาพชีวิต Modified WOMAC score ผู้ป่วยทั้งสองกลุ่มได้รับการประเมินทั้งหมด 4 ครั้ง: คือ สามสัปดาห์ก่อนการผ่าตัด, 1 เดือน, 3 เดือนและ 6 เดือนหลังการผ่าตัด*

ผลการศึกษา: *กลุ่มตัวอย่างผู้ป่วยที่ศึกษาทั้งหมด 60 คน แบ่งเป็น 2 กลุ่ม กลุ่มออกกำลังกายกล้ามเนื้อ quadriceps ก่อนผ่าตัด 30 คน และกลุ่มดูแลตามปกติ 30 คน ผู้ป่วยส่วนใหญ่เป็นเพศหญิงอายุมากกว่า 60 ปี การศึกษาระดับประถมศึกษา อาชีพเกษตรกรรม ดัชนีมวลกาย ระยะเวลาปวดเข่า การใช้ยาแก้ปวด paracetamal NSAIDs ไม่แตกต่างกันอย่างมีนัยสำคัญทางสถิติ จากการติดตามผู้ป่วยทั้ง 2 กลุ่ม ตลอดการวิจัยพบว่ากลุ่มออกกำลังกายกล้ามเนื้อ quadriceps ก่อนผ่าตัดมีระดับความเจ็บปวดลดลงมากกว่าอย่างมีนัยสำคัญทางสถิติเมื่อเปรียบเทียบกลุ่มดูแลตามปกติหลังผ่าตัด 3 เดือน ($p = 0.003$) และมีความแข็งแรงของกล้ามเนื้อ quadriceps เพิ่มขึ้นมากกว่าในการวัดทุกครั้งหลังผ่าตัด กลุ่มออกกำลังกายกล้ามเนื้อ quadriceps ก่อนผ่าตัดมีค่าเฉลี่ย Modified WOMAC score ลดลงมากกว่าอย่างมีนัยสำคัญทางสถิติ เมื่อเปรียบเทียบกลุ่มดูแลตามปกติหลังผ่าตัด 1, 3 เดือน*

สรุป: *ผู้ป่วยที่รักษาโดยผ่าตัดเปลี่ยนข้อเข่าเทียมควรได้รับการฝึกทักษะบริหารกล้ามเนื้อ quadriceps อย่างน้อย 3 สัปดาห์ก่อนผ่าตัดเพื่อเพิ่มประสิทธิผลในการรักษาในระยะสั้นหลังผ่าตัดเปลี่ยนข้อเข่าเทียม*