2018

Does Pre-Operative Exercise Improve Quality of Life, Compared to Patient Education Alone, In Patients With Hip Osteoarthritis (OA) While Awaiting Total Hip Arthroplasty (THA)?

Laura Ann McCann
Philadelphia College of Osteopathic Medicine

Does Pre-Operative Exercise Improve Quality of Life, Compared to Patient Education Alone, In Patients With Hip Osteoarthritis (OA) While Awaiting Total Hip Arthroplasty (THA)?

Laura Ann McCann, PA-S

A SELECTIVE EVIDENCE BASED MEDICINE REVIEW

In Partial Fulfillment of the Requirements For

The Degree of Master of Science

In

Health Sciences – Physician Assistant

Department of Physician Assistant Studies
Philadelphia College of Osteopathic Medicine
Philadelphia, Pennsylvania

December 15, 2017

ABSTRACT

Objective: The objective of this selective EBM review is to determine whether or not pre-operative exercise improves quality of life, compared to patient education alone, in patients with hip osteoarthritis (OA) while awaiting total hip arthroplasty (THA).

Study Design: Systematic review of three randomized controlled trials (RCTs) published in peer-reviewed journals between 2015 and 2016, all in the English language.

Data Sources: Three randomized controlled trials were found using PubMed.

Outcomes Measured: The change in ADL (activities of daily living), recreational function, and pain were measured in all trials using self-reported patient questionnaires (WOMAC) and a variety of physical activities before and after the patient completed the required pre-operative exercise program. Which were then presented as a change in mean from baseline and compared to the control group.

Results: Study by Hermann et al. showed in increase in ADL function in the intervention group vs. control group (p-value <0.001) after completing a pre-operative progressive explosive-type resistance training. Study by Svege et al. saw at long term follow up that the patients that performed the pre-operative exercise program prolonged their need for THA (p-value 0.034) and had an increase in ADL function compared to the control group (p-value 0.004). Study by Zeng et al. showed that the patients that performed pre-operative tai chi and strength training had an increase in ADL function compared to the control group (p-value <0.01). However, none of the studies showed a significant change in pain outcomes between the intervention and control groups.

Conclusions: Evidence supporting the use of pre-operative exercise regimens is feasible for increase in activities of daily living and function, but not for pain in patients with hip OA awaiting THA. Pre-operative exercise programs should be considered in patients that can tolerate it while awaiting their surgery, but the THA is what will ultimately improve pain.

Keywords: hip arthroplasty, strength training, exercise, hip osteoarthritis

INTRODUCTION

With the aging baby boomer population and increased life-expectancy, osteoarthritis (OA) is not only more prevalent, but is a significant, potentially debilitating disorder that will require proper management to assure maximum quality of life. OA is a degenerative, non-inflammatory disease of joint failure that involves hyaline cartilage loss and bone remodeling leading to pain, loss of function, and decreased muscle strength. When patients get to the point where they are experiencing pain, loss of function, and decreased muscle strength their quality of life is greatly impaired. They struggle to complete activities of daily living (ADL), such as, cooking, grocery shopping, showering, and laundry. They even begin to lose interest in activities/hobbies they once enjoyed, due to these worsening of symptoms.

Currently, OA affects over 30 million American adults and is a leading cause of disability in the US.[1] Arthritis is the cause for more than 100 million outpatient visits per year and 6.7 million hospitalizations per year.[2] Physician assistants, that practice in primary care, can recognize and treat OA initially; while also knowing when then patient needs to be referred to an orthopedic surgeon for further management. Physician assistants, that practice in orthopedics, work together with the surgeon to treat more severe OA.

Not only do patients rely on their healthcare provider to treat their OA and associated symptoms, but also do it in the most cost effective way. Costs for treating OA varies greatly and depends on the modality being used. For mild-moderate OA, the recommended treatment is anti-inflammatory medications and physical therapy. For severe OA, the recommended treatment is total joint replacement followed by physical therapy. Specifically, for hip OA, the cost of a total hip arthroplasty (THA) varies significantly from state to state and city to city. In 2015, the average price was $30,124.[3] However, in Alabama, it was about $11,327 and in NYC it was

about $59,448.[3] In 2011, there were approximately 512,000 total hip replacements nationwide, and continues to increase.[2] The cost of physical therapy sessions and exercise programs, like the ones that will be discussed in this review, also vary depending on type, location, and frequency.

Hip OA can affect most people, especially with risk factors such as, increased age, sex, race, overuse, certain occupations, trauma, genetics, diet, and obesity. OA can be clinically diagnosed based on signs and symptoms, but imaging can further help with diagnosing. An x-ray of the involved joint will show asymmetric joint space narrowing, marginal osteophytes, subchondral sclerosis, and cysts. However, if these characteristic features are incidentally noted on x-ray and the patient is asymptomatic, the patient should not be treated. Symptomatic management is the mainstay of treatment in OA.

Since the current guidelines focus on symptomatic treatment of hip OA, there is vast opportunity to develop different treatment modalities. Not only is patient education an important factor in successful treatment of hip OA, but so is staying mobile. In several recent studies, a variety of exercise programs, including progressive explosive-type resistance training, tai chi, and strength training, have been utilized to improve the quality of life in patients with hip OA while awaiting THA.[4,5,6] Patients that are candidates for THA usually have significant pain, decreased function, and decreased muscle strength. If they do not stay mobile, they have the potential to have a more difficult recovery from surgery and cannot optimize their time while awaiting surgery. These exercise programs, in addition to patient education, have the potential to improve quality of life and allow patients to do more of what they enjoy while awaiting surgery. This systematic review will discuss three randomized controlled trials and evaluate their effectiveness of the above-mentioned exercise programs, in addition to patient education, for patients with hip OA awaiting THA.

OBJECTIVE

The objective of this selective EBM review is to determine whether or not pre-operative exercise improves quality of life, compared to patient education alone, in patients with hip osteoarthritis (OA) while awaiting total hip arthroplasty (THA).

METHODS

Three randomized controlled trials that included men and women over the age of 40 who were diagnosed with hip osteoarthritis and a candidate for THA were selected for this review. The interventions used in the three studies included a strength training exercise programs that consisted of different exercise regimens. Hermann et al. utilized a progressive explosive type resistance training program, Svege et al. utilized a strength training program, and Zeng et al. utilized a tai chi and strength training program.[4,5,6] These exercise programs were in addition to patient education that is always provided to patients undergoing THA. All intervention groups were compared to control groups that consisted of patient education alone. Baseline assessments were made for all groups and outcomes were measured as a change in the mean from baseline.

The key words utilized in this search were “hip arthroplasty”, “strength training”, “exercise”, and “hip osteoarthritis”. These studies were researched by the author from November 2016 to January 2017, published in the English language, in peer-reviewed journals, and found through using PubMed. The articles selected were based of correlation to the topic being discussed and how it is relevant to patients’ quality of life. Inclusion criteria was RCTs published after 2010, with male and female patients over the age of 40 who were diagnosed with hip OA and candidates for THA. Exclusion criteria for the RCTs were many medical comorbidities that could interfere with the study, such as, cancer, other forms of arthritis, medical conditions where

exercise is contraindicated, pregnancy, and prior THA of affected hip. The statistics reported in the studies used change in mean from baseline and p-values.

Table 1: Demographics and Characteristics of Included Studies

Study	Type	# of pts	Age (yrs)	Inclusion Criteria	Exclusion Criteria	W/D	Interventions
Herm-ann A, et al., 2016 [4]	RCT	80	70.4 +/- 7.6	Pts dx'd with primary hip OA ages 50+, scheduled for THA	Pts dx'd with other types of arthritis, uraemia, cancer, tx with systemic glucocorticoids for >3mo in the last 5yrs, present or previous hip fx, other LE fx within 1yr, body weight >135kg, severe walking deficits, not able to speak Danish	5	Progressive explosive type resistance training vs. "care as usual" which includes pt education
Svege I, et al., 2015 [5]	RCT	109	EG: 58.4 +/- 10 CG: 57.2 +/- 9.8	Age between 40-80, hip pain for at least 3mo, radiographically verified minimum joint space to Danielsson's criteria, harris hip score between 60-95	Previous THA of index joint, knee pain or knee OA, low back pain, RA, osteoporosis, cancer, CV ds unable to tolerate exercise, LE dysfxn due to accident or dz, pregnancy, unable to understand Norwegian	7	Supervised exercise therapy sessions that consisted of strengthening, flexibility, and functional exercises vs patient education alone
Zeng R, et al., 2015 [6]	RCT	81	60-69	Age 60-69, dx'd with end-stage hip OA, unilateral chronic hip pain that hasn't responded to conservative tx, stable health, able to appoint a regular family member as their training partner	Hx of hip infection, congenital hip dysplasia, b/l hip dz, inflammatory arthritis, a medical condition for which moderate exercise is contraindicated, significant neuromuscular dz, walking with supportive devices, exercised regularly	17	45-60min tai chi training and 20-30min hip muscle strengthen training and ROM training vs patient education alone

OUTCOMES MEASURED

The primary outcomes of these randomized controlled trials were change in ADL and recreational function and pain. The outcomes measured in these three RCTs used self-reported patient questionnaires (ie. WOMAC) before and after the patient completed the required pre-operative exercise program or patient education alone. WOMAC is the Western Ontario and McMaster Universities Osteoarthritis Index, which comprises three subscales (pain, stiffness, and physical function) composed of 24 questions with scores ranging from 0-100 (the higher the score the greater the severity).[5] Each measurement was performed with the intervention group and control group. All scores were reported as change in mean from baseline, with attention drawn to the comparison between intervention and control groups.

RESULTS

Hermann et al. conducted a randomized controlled trial utilizing 80 patients diagnosed with hip OA and scheduled for THA, who were separated into an intervention group (n=40) and control group (n=40).[4] The intervention group performed supervised pre-operative progressive explosive-type resistance training twice a week for 10 weeks in addition to patient education and the control group received "care as usual"; which consisted of standardized pre-op information by the surgeon, an educational meeting at the Department of Orthopedic Surgery, and a handout suggesting low-intensity home-based training program without specific resistance training exercises.[4] However, there were no restrictions in engaging exercise programs outside of the study.[4] The endpoints of the study were to determine a change in ADL function and symptoms, including, but not limited to pain.[4] These outcomes were measured using WOMAC self-reported questionaire at baseline and pre-op follow-up after intervention (1-7 days before surgery).[4]

Results of the study showed that progressive explosive-type resistance training was feasible in the included group of hip OA patients scheduled for THA and resulted in significant improvement in self-reported outcomes, including ADL function.[4] There was no significant difference between the intervention group and control group at baseline.[4] Changes in ADL function was 10.0 points (95% CI) higher in the intervention group compared to the control group (p-value <0.001).[4] However, change in pain was only an 8.4 points difference, which is not clinically significant.[4] No serious adverse events or drop-outs were reported.[4]

Table 2: Comparison of Intervention Group vs. Control Group at baseline and follow-up [4]
Outcomes at baseline and follow-up are $\bar{x}$ +/- SD; adjusted between group differences are $\bar{x}$ (95% CI); between-group difference at follow-up is adjusted for baseline, sex, age, and BMI.[4]

	Intervention Group		Control Group		Adjusted between group difference at follow-up
Outcomes	Baseline	Follow-up	Baseline	Follow-up	
ADL function	49.2 (12.5)	59.9 (17.1)	48.1 (13.8)	48.7 (13.9)	10.0 (4.7-15.3)
Pain	48.0 (12.7)	55.4 (16.9)	46.3 (14.4)	45.9 (14.1)	8.4 (2.5-14.3)

Svege et al. conducted a long-term follow-up on a randomized controlled trial that utilized 109 patients diagnosed with hip OA and eventually needing THA, who were separated into an intervention group (n=55) and control group (n=54).[5] All patients were given three group sessions of patient education, then the intervention group completed an exercise program that consisted of strengthening, flexibility, and functional exercises 2-3x/wk for 12 weeks and the control group only received the educational sessions.[5] The long-term follow up looked at the efficacy of the exercise program on length of survival of the native hip, pain, stiffness, and function.[5] The endpoints of the study were to determine if there was any change in pain or an increased amount of time until THA was needed.[5] These outcomes were measured using

WOMAC at baseline, 4 months, 10 months, 16 months, and 29 months and displayed as the mean difference between the intervention group and control group.[5]

Results of the study suggested that the exercise therapy group had better self-reported hip function prior to THA or at the end of study, but there was no significant difference in pain.[5] There was no significant difference between the intervention group and control group at baseline.[5] Over the 29 month WOMAC follow-up period, the exercise therapy group had significantly better physical function scores compared to the control group (p-value 0.004), but the differences in pain did not reach statistical significance (p-value 0.083).[5] Also, the median time to THA was 5.4 years in the intervention group and 3.5 years in the control group.[5] The long term follow-up response rate was 94%.[5] No serious adverse events were registered.[5]

Table 3: Comparison of Intervention and Control Group at baseline, 4mo, 10mo, 16mo, & 29mo[5]
Mean difference (95% CI) between the exercise therapy group and the control group[5]

	Baseline	4 months	10 months	16 months	29 months
Function	-2.5 (-8.7 to 3.7)	-4.6 (-10.7 to 1.6)	-8.4 (-15.2 to -1.6)	-9.2 (-16.5 to -1.9)	-6.4 (-14.1 to -1.3)
Pain	-1.3 (-8.0 to 5.3)	-4.7 (-11.4 to 1.9)	-6.6 (-13.9 to 0.8)	-6.5 (-14.3 to 1.3)	-5.9 (-14.2 to 2.4)

Zeng et al. conducted a single blind, randomized controlled trial utilizing 59 patients diagnosed with end-stage hip OA and scheduled for THA; who were divided into an intervention group (n=32) and control group (n=27).[6] 97 patients were initially recruited, but due to withdrawals the researchers only included 59 patients in the analysis.[6] Patients in the intervention group were required to perform home based exercise sessions with a "training partner" at least 5 times per week for 12 weeks prior to scheduled THA.[6] These exercise sessions included 45-60mins of tai chi training followed by 20-30mins of hip muscle strength training and ROM training.[6] Both the intervention and control group received one-to-one preoperative education programs.[6] The endpoints of the study was to determine the efficacy of the exercise program on

physical function and pain.[6] These outcomes were measured by using WOMAC at baseline and at the end of the 12 week program.[6] Data was displayed as change in mean from baseline.[6]

Results of the study suggested that the tai chi/strength training program can effectively improve balance and physical function in patients with end-stage OA, but not effectively improve pain.[6] There was no significant difference of baseline characteristics between to two groups.[6] The self-reported functional status scores evaluated by WOMAC was improved from 40.97 +/- 5.65 at baseline to 36.28 +/- 5.11 at 12 weeks (p-value <0.01), but no significant change in pain.[6] During the intervention, no serious adverse events occurred.[6]

Table 4: Comparison of Intervention Group vs. Control Group at baseline and follow-up [6]
Values are the $\bar{x}$ +/- SD except otherwise indicated[6]

	Intervention Group		Control Group		
Outcomes	Baseline	Follow-up	Baseline	Follow-up	p-value
ADL function	40.97 +/- 5.65	36.28 +/- 5.11	41.65 +/- 5.87	41.08 +/- 5.16	<0.01
Pain	10.81 +/- 2.44	9.30 +/- 1.97	10.53 +/- 2.26	10.55 +/- 2.02	0.06

DISCUSSION

This three-study systematic review evaluated the effectiveness of different exercise programs on improvement of quality of life in patients with hip OA awaiting THA. After thorough evaluation of each study, it can be concluded that staying mobile and completing an exercise program can improve physical function of the index hip while awaiting hip replacement. If patients have increased physical function of their hip they can do more of what they enjoy and successfully complete activities of daily living without the burden that severe OA can cause. Patients show concern when they are unable to complete daily tasks, and if these exercise programs can improve that, then recommending these programs should be considered as a part of

their treatment plan. However, in each study, there was no clinically significant improvement in self-reported hip pain with the completion of each exercise program; which can question whether the patient will think the program is worth their time and energy.

Each study revealed their own limitations that could have had impacts on the results. Hermann et al. stated that a major limitation to the study is risk of assessor bias; ie., a combined test and training site was used which made sufficient masking impossible.[4] Svege et al. stated the criteria for when THA was indicated was not specified prior to the start of the study and the criteria used for THA at their institute is not necessarily used at all other hospitals.[5] Zeng et al. stated it was possible that the participants in the intervention group were also benefiting from the positive features that are inherent to group-based exercises; ie. Social interactions and attention from instructors.[6] The limitations in all three studies may question the validity of each study, but the results potentially outweigh the limitations and have a positive impact for patients.

In addition to the above limitations, each study included different types of exercise programs. This could be seen as a limitation or an advantage. The limitation with this is that there is a lack of consistency in regards to which exercise program is the best. However, the advantage to this is there are different options in programs for patients. Exercise programs are not always covered by insurance and can be expensive for patients. Having different program options allows for patients, with the assistance of their healthcare provider, to decide which is appropriate for them. Additionally, transportation to and from the program can be difficult for patients without access to an automobile or public transportation. This would be the scenario where a home-based program would be the best for these patients.

CONCLUSION

Based on the information provided by these three randomized controlled trials, it can be concluded that a pre-operative exercise program can improve quality of life in patients with hip OA while awaiting THA, but only when focusing on physical hip function. If the patient cares more about pain than they do the physical function of their hip, then the exercise program does not improve their quality of life. Ultimately, a THA will be what improves patients' pain. Svege et al. concluded that the exercise program prolonged the need to THA.[5] Further research in the area of exercise programs vs the need for THA could be more beneficial than just focusing on physical function of the hip. If the patient can prolong the need for surgery, that could ultimately allow for improvement of quality of life.

References:

1. Osteoarthritis | basics | arthritis | CDC. Centers for Disease Control and Prevention Web site. https://www.cdc.gov/arthritis/basics/osteoarthritis.htm. Updated 2017. Accessed 10/1/2017.

2. Arthritis statistics and facts. Arthritis Foundation Web site. http://www.arthritis.org/about-arthritis/understanding-arthritis/arthritis-statistics-facts.php. Accessed 10/1/2017.

3. Melton C. Knee and hip replacement costs vary greatly by region -- why? *Medscape*. 2015:10/1/2017.

4. Hermann A, Holsgaard-Larsen A, Zerahn B, Mejdahl S, Overgaard S. Preoperative progressive explosive-type resistance training is feasible and effective in patients with hip osteoarthritis scheduled for total hip arthroplasty - a randomized controlled trial. *Osteoarthritis Cartilage*. 2016;24(1):91-98.

5. Svege I, Nordsletten L, Fernandes L, Risberg MA. Exercise therapy may postpone total hip replacement surgery in patients with hip osteoarthritis: A long-term follow-up of a randomised trial. *Ann Rheum Dis*. 2015;74(1):164-169. doi: 10.1136/annrheumdis-2013-203628 [doi].

6. Zeng R, Lin J, Wu S, et al. A randomized controlled trial: Preoperative home-based combined tai chi and strength training (TCST) to improve balance and aerobic capacity in patients with total hip arthroplasty (THA). *Arch Gerontol Geriatr*. 2015;60(2):265-271.