Aquatic Exercise for the Treatment of Hip and Knee Osteoarthritis

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<LEAP> highlights the findings and application of Cochrane reviews and other evidence pertinent to the practice of physical therapy. The Cochrane library is a respected source of reliable evidence related to health care. Cochrane systematic reviews explore the evidence for and against the effectiveness and appropriateness of interventions—medications, surgery, education, nutrition, exercise—and the evidence for and against the use of diagnostic tests for specific conditions. Cochrane reviews are designed to facilitate the decisions of clinicians, patients, and others in health care by providing a careful review and interpretation of research studies published in the scientific literature. Each article in this PTJ series summarizes a Cochrane review or other scientific evidence on a single topic and presents clinical scenarios based on real patients or programs to illustrate how the results of the review can be used to directly inform clinical decisions. This article focuses on an older adult with severe knee joint pain. Can aquatic exercise help this patient with knee osteoarthritis?

Find the <LEAP> case archive at http://ptjournal.apta.org/collection/leap-linking-evidence-and-practice.

Osteoarthritis (OA), the most common type of arthritis, is referred to as a degenerative joint disease characterized by localized loss of cartilage, remodeling of adjacent bone, and associated inflammation. Osteoarthritis affects more frequently people's hips, knees, and small hand joints.[1] Hip and knee OA in particular is one of the leading causes of disability worldwide.[2] Furthermore, these patients have an almost twofold increased risk of sick leave and about 40% to 50% increased risk of disability pension compared with the general population.[3] Common complaints in this population include pain and reduced physical function and quality of life. At present, there is no cure for OA, only control of the symptoms and treatment to prevent further development of the disease are available.

International clinical practice guidelines recommend conservative treatment, both pharmacological and nonpharmacological modalities, as first-line care for patients with OA.[1,4,5] Joint replacement surgery should be considered a treatment option only for those patients with more severe OA symptoms who are refractory to conservative treatments.[1] Conservative treatment options endorsed by clinical practice guidelines include medication, education, weight loss, and exercise.[1,5] Therapeutic exercise is considered to be a core treatment for people with OA irrespective of age, comorbidity, pain severity, or disability and should include a combination of strength and aerobic components.[1,4,5] Land-based and water-based exercise programs are recommended options, as both can be designed to increase muscle strength and overall fitness of patients with knee or hip OA.[4,5]

Aquatic exercise is undertaken in water, usually with a temperature between 32°C and 36°C. Aquatic exercise may be more beneficial for people with OA than similar training on land, as the element of hot water is believed to reduce pain and stiffness of the musculoskeletal system and cause muscle relaxation.[6] Bartels et al[7] conducted an update of a published Cochrane review to investigate the effect of aquatic exercise for treating people with knee and hip osteoarthritis. The searches were conducted in 6 relevant databases up to April 2015.

Take-Home Message

This Cochrane review[7] included 13 randomized controlled trials with a total of 1190 participants (Tab. 1). All 13 trials compared aquatic exercise to control interventions. Control interventions varied among the trials, including: no intervention (7 trials), education (2 trials), telephone calls (2 trials), social attention (1 trial), usual care (ie, home-based quadriceps exercises plus behavioral correction of daily activities and lifestyle) (1 trial). Two trials recruited participants with hip OA alone, 3 trials recruited participants with knee OA only, and 8 trials recruited participants with knee or hip OA, or both. The sample size of the included trials varied from 30 to 312 participants. The primary outcomes evaluated were pain, disability, quality of life, and radiographs. Serious adverse events regarding aquatic exercise were also investigated. Authors assessed the risk of bias of included studies and used the 5 GRADE (Grades of Recommendation, Assessment, Development, and Evaluation) criteria (study limitations, consistency of effect, imprecision, indirectness, and publication bias) to assess the overall quality of evidence.

When compared with control interventions, there is moderate evidence that aquatic exercise has small short-term (immediately after treatment) improvement in pain, disability, and quality of life in people with knee and hip OA or both. These effects on pain and disability correspond to a 5-point lower score

Table 1.
Cochrane Review Results[a]

Characteristics of the Included Trials	
Thirteen randomized controlled trials were included, providing data for a total of 1190 participants.	
Most participants were women (75%), with an average age of 68 years and a body mass index of 29.4.	
Details of the intervention and outcomes	
The mean duration of the aquatic exercise was 12 weeks. Control group treatments include usual care, education, social attention, and waiting list for surgery.	
Primary outcomes were pain, disability, quality of life, and radiographs.	
Analyses were performed at 2 time points: immediately after treatment and at follow-up.	
Results in comparison to the control group	
Pain	There was a statistically significant pain reduction immediately after treatment (SMD = –0.31; 95% CI = –0.47 to –0.15), with no sign of heterogeneity.
Disability	A statistically significant reduction in disability was found immediately after treatment (SMD = –0.32; 95% CI = –0.47 to –0.17), and negligible heterogeneity.
Quality of life	There was a statistically significant improvement in quality of life immediately after treatment (SMD = –0.25; 95% CI = –0.49 to –0.01). However, a high heterogeneity was observed (I2 = 65%).
Radiographic evaluation	No included trials investigated any type of radiographic evaluation.
Conclusion	
On moderate-quality evidence, aquatic exercise has a small, short-term clinically relevant effect on self-reported measures of pain, disability, and quality of life in people with knee and hip OA after completion of an aquatic exercise program. It is unclear whether this effect is sustained over the long term based on current evidence.	

[a]SMD = standardized mean difference; CI = confidence interval.

on a scale from 0 to 100, and a 7-point higher score on quality of life on a scale from 0 to 100, and were considered clinically relevant. No included trials performed a radiographic evaluation, and no serious adverse events were reported with relation to aquatic exercise.

This updated Cochrane review has some limitations. Firstly, one included study was considered to be at low risk of bias, 9 were at unclear risk of bias, and 3 trials were at high risk of bias. Authors, therefore, concluded that the evidence presented was based "upon high risk of bias of the included studies." Secondly, the conclusions of this review should be applied to only a mixed group of people, with knee or hip OA, or both, as the meta-analyses performed in the review are based on trials including a mixed group of participants. Nevertheless, as stated in the review, the knee and hip joints are different, and exercise programs applied to a mixed group of people may not be as beneficial as exercise programs specifically designed for a group of people with either knee or hip OA. Given that a small number of the included studies recruited patients with only knee or hip OA, the authors could not reach definite conclusions about the effect of aquatic exercise separately for each joint. Lastly, it is unclear whether the results are sustained over the long term based on the current evidence, as very few trials investigated the long-term effect of aquatic exercise.

Case #30: Applying the Evidence to a Patient with Knee OA

Can aquatic exercise help this patient?

Mrs Lopes is a 68-year-old retired widow who lives by herself. She reported having an 8-year history of bilateral knee pain, left worse than right. Previous treatment included analgesics and anti-inflammatories as well as physical therapy sessions for temporary pain relief. She reported having had one corticosteroid injection directly into the knee during an episode of debilitating pain 3 years ago. Her symptoms have become more frequent and severe in the last 3 months after taking up dance classes. She complained of stiffness in the morning that resolved after about 15 minutes and pain that progressively gets worse throughout the day. Activities such as going up and down stairs, squatting or kneeling, and walking more than 400 meters (ie, 2 blocks) exacerbated her pain, whereas resting and icing the knees alleviated her symptoms. She is upset and frustrated with her condition. Radiographs of both knees show decreased medial knee joint height and presence of osteophytes. Overall, Mrs Lopes' clinical presentation is compatible with moderate to severe knee OA.

At the physical therapist evaluation, Mrs Lopes was assessed with regard to pain, disability, and quality of life. Pain was assessed using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) pain subscale. The WOMAC used was the Likert version with 5 response levels for each item, ranging from 0 (none) to 4 (extreme).[8] The WOMAC pain subscale evaluates the patients' pain experience on 5 different activities: walking on a flat surface, going up or down stairs, at night while in bed, sitting or lying, and standing upright. Total score for the WOMAC pain subscale varies from 0 (no pain) to 20 (extreme pain). Disability was assessed with the WOMAC physical function subscale, which includes a total of 17 items assessing the patient's difficulty in

performing daily activities due to pain. With the same item scoring system as in the pain subscale, the WOMAC physical function total score ranges from 0 (no disability) to 68 (extreme disability). Quality of life was measured using the EuroQoL-Visual Analogue Scale (EQ-VAS), which ranges from 0 (worst) to 100 (best imaginable health state).[9] The score for the WOMAC pain subscale was 11/20; the WOMAC physical function subscale, 34/68; and the EQ-VAS, 55/100. WOMAC values found for Mrs Lopes were higher than the values reported by people aged over 50 years with chronic bilateral knee pain.[10] Functional performance was objectively assessed with the Six-Minute Walk Test (6MWT). Mrs Lopes walked a distance of 390 meters in 6 minutes. Pain was also elicited during palpation of the medial joint line and passive end-range knee flexion, left greater than right knee. Physical examination revealed limited active range of motion (ROM) of bilateral knee flexion (ie, left worse than right knee), as well as tightness of the calf and hamstring and quadriceps weakness bilaterally.

How did the results of this systematic review apply to Mrs Lopes?

Using the PICO (Patient, Intervention, Comparison, Outcome) format, Mrs Lopes' physical therapist asked the following question: In patients with knee OA, will aquatic exercise (compared with control interventions) be beneficial for reducing pain and disability and improve quality of life? The review by Bartels et al[7] was identified by the therapist and provided relevant information that allows her to answer this question.

Patient relevance. The Cochrane review included studies in which most of the participants were women (75%), between the ages of 62 and 74, with a mean OA duration of 6.7 years. Mrs Lopes fits with these criteria.

Intervention. The trials included in Bartels' review focused on interventions that used all types of exercise, such as stretching, strengthening, and aerobics, performed in a therapeutic/heated indoor pool. The treatment plan developed by Mrs Lopes' physical therapist consisted of 1-hour individual sessions twice a week for 3 months. Three months' treatment period was the mean aquatic exercise duration reported in the review. Each session included the following components: warm-up, lower limb ROM, strengthening, and stretching exercises, balance and coordination exercises, and general cardiovascular conditioning. The intervention consisted of an element of progression every 2 or 3 weeks by increasing the number of sets and repetitions and/or making the exercises more challenging—for instance, by using floats to increase resistance. The water temperature was kept at approximately 32°C and Mrs Lopes was instructed to bring a water bottle to hydrate herself throughout the session.

During the first treatment sessions, she exercised with the water level at approximately waist height. Every session started with a 5-minute warm-up walk and stretching exercises for the major muscle group of the lower limb, particularly for calf and hamstring muscles. At the initial stage, she performed strengthening exercises focusing on knee and hip muscles, including squats (first bilateral, then unilateral), side-to-side lunges, and step up/down. She initially performed one set of 10 to 15 repetitions and gradually increased to 3 sets of 15 repetitions. These exercises were progressed from hand support (ie, holding on to an exercise bar or pool wall), then progressed to without hand support. Around week 4, more challenging exercises were incorporated into the treatment program. With water level at the shoulder height and using a pool noodle wrapped behind her back and under her arms, Mrs Lopes started exercises such as water running, scissor kicks, abduction-adduction kicks, and cycling movements. For these exercises, she aimed to perform 3 to 5 cycles of 30 seconds of moderate effort with a 1-minute rest period between cycles. Ankle cuffs or variation in speed, if tolerated, was used to increase difficulty. As treatment progressed, cycling underwater on a static bike for 3 to 10 minutes was gradually incorporated into the treatment session. Mrs Lopes completed 90% of all exercise sessions, which is aligned with attendance rates reported in the Cochrane review (87%). To overcome the misconceptions about the disease process and the misbelief that exercise could be potentially harmful for patients with OA, Mrs Lopes received education about disease progression and the role of strength and aerobic exercises in the management of her condition. The rehabilitation program was restricted to aquatic exercises and patient education.

Comparison. The results of the systematic review suggest a moderate quality of evidence that aquatic exercise is better than control interventions (ie, no intervention, telephone calls, social attention, education, and usual care) for reducing pain and disability and increasing quality of life in the short term. Hence, aquatic exercise supervised by a physical therapist was used to treat Mrs Lopes.

Outcome. Mrs Lopes' posttreatment outcome measures were pain, disability, and quality of life. These 3 patient-reported outcome measures were considered primary outcomes in the Cochrane review. In addition, we investigated Mrs Lopes' functional performance using the 6MWT.

How well do the outcomes of the intervention provided to the patient match those suggested by the systematic review?

After 12 weeks of the aquatic exercise program (Tab. 2), Mrs Lopes experienced reduction of 5 points (6/20) in the WOMAC pain subscale, reduction of 10 (24/68) points in the WOMAC physical function subscale, and improvement of 10 points (65/100) in the quality-of-life scale. The changes in pain and physical function with treatment were greater than the suggested minimal detectable change for each subscale.[11,12] The results for the 6MWT revealed that she walked 55 m more (445 m) in the posttreatment assessment compared with the initial assessment, which is greater than the published minimal detectable change for older adults.[13] The physical examination by the end of the 12-week

Table 2.
Self-Reported Measures Before and After Intervention

Measure	Initial	12 wk
WOMAC Pain (0–20 scale)	11	6
WOMAC Physical Function (0–68 scale)	34	24
Quality of life (0–100 EQ-VAS)	55	65
Six-Minute Walk Test (m)	390	445

program showed that Mrs Lopes improved lower limb strength and flexibility. Although she still reported mild pain at both knees with passive end-range knee flexion, the posttreatment assessment revealed that active knee flexion improved bilaterally and the difference in ROM between left and right knees found at the initial assessment was no longer present. She also reported that she is now more confident of being able to walk long distances without experiencing any symptoms.

Can you apply the results of this systematic review to your own patients?

The findings of the updated Cochrane systematic review conducted by Bartels et al[7] apply well to Mrs Lopes. She is an older woman in her late sixties with a long history of bilateral pain reporting more severe symptoms in one knee than the other. She had experienced a worsening of her symptoms over the last 3 months, which interfered with her daily activities. She adhered to the treatment regime and reached her goals. Mrs Lopes is a typical patient seen by physical therapists in clinical practice. Aquatic exercise will probably help patients with knee and hip OA immediately after the end of the program of treatment. A limitation of the current literature, according to the Cochrane review, was that the included studies did not sufficiently describe the exercises and doses (intensity, frequency, and duration) used, so the optimal intervention could not be established. Hence, we opted to use the aquatic exercise program described in detail by Fransen et al[14] as the basis for the development of Mrs Lopes' rehabilitation program. Given the available evidence from Cochrane reviews[15,16] supporting the use of land-based therapeutic exercise programs for patients with knee and hip OA, aquatic exercise may be seen as an alternative treatment option in the short term for the management of this condition.

What can be advised based on the results of this systematic review?

Based on the results of the systematic review, we can conclude that aquatic exercise can be effective for treating people with knee and hip OA. The proposed intervention can result in pain and disability reduction and improve quality of life.

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