

To study the effectiveness of hydrotherapy versus isometric exercises in well being of knee osteoarthritis patient: A narrative review

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ABSTRACT

Aim: To make a narrative review on the effectiveness of Hydrotherapy (water based exercise) versus Isometric exercise on knee OA patients.

Background: Osteoarthritis is a common degenerative disease affecting the joints, most prevalent in females and middle aged group. Like any other musculoskeletal diseases, exercise is one of the main treatments. They can be of two types (a) land based exercises (b) water based exercises. It is to be noted that exercises serve two purposes (a) as a preventive measures (b) as a treatment measure. The objective of this narrative review study is to provide more helpful inputs on the management of knee OA.

Search Methods: The materials on the review study were searched from- Pub Med, Medline, Pedro, and Cochrane.

Results and Discussion: 25 articles were read on the topic, and a positive result is observed. However, the degree of effectiveness may differ, for instance both exercises reduce the pain, but it is seen that hydrotherapy is not superior to land based in this regard.

Conclusion: Both land based and water based exercise are effective in the treatment of knee OA. They improve the knee ROM, reduce pain and increase the knee strength.

Keywords: Knee Osteoarthritis, land based exercise, Hydrotherapy, aquatic exercises, Isometric exercises.

INTRODUCTION

Osteoarthritis is a chronic degenerative disease which mainly affects the weight bearing joints like hip and knee joint. The main symptom of the disease is pain along with joint stiffness, instability in the joint, weakness, limited range of motion, progressive deformity causes restrictions in activities of daily living [1]. OA is the most prevalent disease and affects older population worldwide [2]. Osteoarthritis is a noninflammatory disease of a degenerative type affecting the joints and is characterized by progressive deterioration of the articular cartilage and formation of new bone (osteophytes) at the joint surfaces.

It is (a) primary when the cause is natural wear and tear with aging, overuse and (b) secondary when it is due to some known primary cause, e.g., obesity, trauma, infection and rheumatoid arthritis (RA).

In later cases, patient present with knee deformities like genu valgum or genu varum. Genu varum is most commonly present in the patient because joint space decreases mostly on the medial side of knee. A review of physiotherapy treatment for knee osteoarthritis includes the exercise, braces and heel wedges [5]

It is usually observed in weight bearing joints like hip joint and knee joint. While other places include the spine, carp metacarpal joint of the thumb and the distal interphalangeal (DIP) joints of the fingers.

The most prominent symptom of OA is pain, other symptoms can be;

- 1) Reduced balance
- 2) Muscle weakness
- 3) Decreased ROM
- 4) Joint instability
- 5) Crepitus on movement

All these deficits lead to poor performance of daily living

Studies shows that all the deficits can be managed through Exercises

Land based exercises and isometrics both have positive results in the treatment of osteoarthritis [4].

Land -based exercises, as a nonpharmacological intervention can be recommended for the treatment of knee OA, as it will improve strength, endurance, reduces pain and stiffness, and improves physical function. An exercise here includes isometrics, resistance, isokinetic and aerobics exercises. However, there is a down side to this too because excessive exercise dosage may worsen the condition by increasing weight bearing and load.

A possible alternative to land – based exercise is **aquatic exercise**, where buoyancy reduces the loading on the damaged joints, reduces edema and pain.

The other positive point about hydrotherapy is that the effects of gravity on exercise is minimize, hence, less painful and easy, as compared to when done in normal conditions.

Aquatic exercise or water based exercise refers to exercise performed on water. Hydrotherapy is suggested to the patients with knee osteoarthritis because water provides lots of benefits such as reduction of edema, pain reduction and decrease load on weight bearing joints. [3] Hydrotherapy has been widely used in physiotherapy programs, mainly when exercising under normal conditions of gravity is difficult and painful. Water buoyancy helps to reduce weight on joints, bones and muscles. The warmth of water and pressure helps to reduce swelling around the knee joint and increase blood circulation. Exercises underwater do early mobilization and dynamic strengthening. [6]

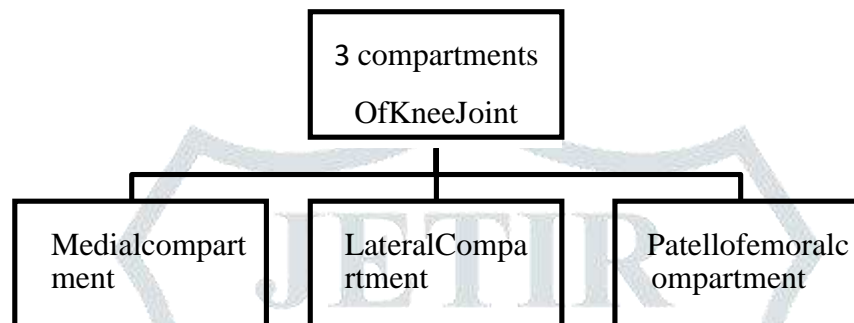
Risk Factors Prevalence

Obesity	middle- aged patient
Hormonal	Women > men
Genetic	>60 years old
Age	
Poor posture	

Pathophysiology

In osteoarthritis, there is loss of ground substances of the cartilage, which results in disturbance of dissipation of the stresses. The collagen fibers are therefore, subjected to excessive stresses and strains leading to their rupture. The cartilage then develops fissures, gets eroded and exposes the underlying subchondral bone. Micro fractures of the trabeculae develop in the subchondral bone.

Resorption of these microfractures results in subchondral cyst formation, a characteristic radiographic feature of osteoarthritis. Inflammatory synovitis may occur; the new bone and cartilage outgrowths developed at the margins of the articular cartilage are seen as osteophytes on radiographs.



SEARCH METHODS

The various sources used for obtaining this information are listed below: - Various search Engines and databases were visited for reviewing the articles. Data have been taken from Pub Med, Cochrane Library, Science Direct, Research gate, Oxford Academy of Physical Therapy.

Table 1- Various search methods and databases

PubMed(2003-2018)	Keywords- osteoarthritis, hydrotherapy, physical function, aqua cycling, and land based exercise, pain, quality of life, and aged meta-analysis.
Science direct(2016-2018)	Keywords- osteoarthritis, exercise, strength training , Rehabilitation, muscle strength, water based exercise, evidence Based medicine.
Research gate(2018-2019)	Keywords- osteoarthritis, aquatic therapy, activities of daily living, function, occupational therapy, pain, gait, balance.
Cochrane Library(2015)	Keywords- aquatic exercise, hip and knee osteoarthritis.

SELECTION CRITERIA

• **Type of studies:-** Randomized control trials, clinical trials compared with control group (Usual care, education, social attention, medication, lifestyle modification)[1][3].

• **Types of participants:-**

• **INCLUSION CRITERIA:-**

1. Patient diagnosed with knee OA according to symptoms and radiologic findings without any invasive intervention.
2. Age over 55 years old.
3. Consented to participate.
4. Patients without hydrophobia.
5. Patients with knee pain ranging from (30 and 90)mm on a visual analog scale (VAS).

• **EXCLUSION CRITERIA:-**

1. People who are exercising regularly and having intra-articular corticosteroid injections.
2. Hydrophobia.
3. Urine incontinence.
4. Acute congestive heart failure.
5. History of periarticular knee fracture and total knee Replacement
6. Myocardial infarction.
7. Unstable angina.
8. Inflammatory joint disease.
9. Neurological disease of lower limbs.
10. Symptomatic lung disease.

INTERVENTION

- Strength training is most common intervention for the management of patients with osteoarthritis which focuses on the muscular strength and joint stability.[7]
- A review study shows that patients with knee osteoarthritis can improve physical health and reduce pain with weight loss and physical exercises. High and low intensity exercises are helpful to maintain gait, posture and reduce physical disability.[8]
- Sometimes land based exercises are too painful for the patients to perform, so hydrotherapy is a best for patients with moderate to severe OA. The warm water eases pain during exercises and progresses to long term improvements. The water supports body weight also which increases the range of movement of joints. [9]
- Stretching, tai chi, water aerobics, aqua running are the types of aquatic therapy exercises which helps to reduce swelling and increase mobility.[10]
- Studies show that supervised cycling is beneficial for the knee osteoarthritis patients. Strengthening exercises also included use of weights, resisted exercises with or without equipment's such as TheraBand's and isometric exercises. [11]
- Balance exercises are control body posture and improve gait. Also decreases the risk of fall in patients with knee and hip OA. [11]
- Warm- up, strengthening /endurance exercises, balance exercises, stretching exercises are the part of both

aquatic and land-based exercises which recommended for the patients [12]

- Before performing aquatic exercises, patient should require 10 – 15 min warm up and cool down period such as submerge exercised part in the water, move body parts slowly and gently, sideways walking, forward and backwards walking [13]

DESIGN OF INTERVENTION

The study consisted of an eight week intervention (Table 3). The participants underwent a thorough assessment before and after the intervention. Additionally the experimental group received an after effect assessment at 13 weeks (8 weeks post completion of intervention). This procedure was done to see if the outcomes of the intervention were short term or long term.

Two groups of study where taken: Group 1: Control group, Group 2: Experimental group.

Control group: these are the participants that did not receive either therapeutic aquatic therapy or strengthening exercises during the period of the study, on the less these participants where offered another kind of intervention.

Participants were assessed (fig.3) before starting of the treatment part and make them eligible for take part in the intervention procedure. [2, 10, 19, 21]

Fig3- Screening of OA patients

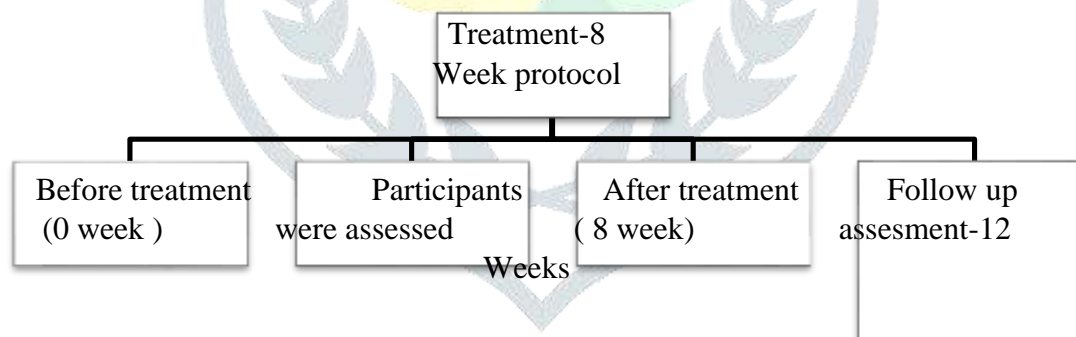


Table 2- Type of intervention planned for control group [11, 13, 16,17]

Type	Duration
Medication/socialattention	This is done along with the experimental group for over 8 weeks.
Nutrition/usualcare	
DiseaseEducation	
Not starting any new exercise intervention for the affectedknee.	

Experimental group: this is the trail group that had to follow procedure for the two exercises being studied. Some participants can withdraw their treatment from control group and switch to experimental group. More

people were taking part in the interventional group after completion of more than 3 months after seeing the positive effects.

Table 3 - Guidelines and treatment protocol for Knee OA patients [12, 13, 16, 17]

Name of Intervention	Name of exercises	Duration	Time	Frequency	Intensity	Water Temp.
Hydrotherapy and isometric exercises	Squats ROM exercises Functional weight bearing exercises Isotonic, isokinetic and isometric exercises Progressive exercises Gait training Balance	8 weeks	45 Minute	4 sessions /week	10 repetition/ Exercise. Progressive intensity.	33*c

Table 4– Aquatic exercise treatment protocol

GUIDELINES OF AQUATIC EXERCISES

Aquatic exercise duration, min	Procedure (duration)	Water temperature	Frequency (times per week)
Seven days, 60 min	Warm up (5min) Isometric and dynamic exercises (15 min) Aerobic exercises (20 min) Step training and proprioceptive exercises (10 min) Massage and relaxation (10 min)	32	2
Two weeks, 60 min	Warm up (15 min) Resistance exercises and Isokinetic exercises (30 min) Cool down (15 min)	30 – 32	3

Three weeks, 50 min	Warm up (5 min) Flexibility training (10 min) Aerobic training (10 min) Lower body training (10 min) Upper body training (10 min) Cool down (5min)	30	3
Four weeks, 65 min	Warm up (10 min) Exercise (double-leg squat, double-leg calf raises stand stretch and bend knee, standing kick leg- to-side, standing kick leg- to-front, sitting stretch knee, sit spin bike and fast walking forward and backward) Cool down (10 min)	Ambient Temperature	3
Five weeks, 40 min	Warm up (5min) Strength training, resistive exercises, aerobic training (30 min) Cool down (5 min)	34	3
Six weeks, 50 min	Stretching exercise(N/A) Isometric strengthening (N/A) Isotonic strengthening (N/A) Gait training (N/A)	32	3
Seven weeks, 50 min	Warm up (10 min) Resistance training (20 min) Balance and stabilize exercises (10 min) Lower limb stretching training (5 min) Cool down (5 min)	33.5	2
Eight weeks, N/A	2 sets of manual resistance knee extension and knee flexion (N/A) 4-way straight leg raises, mini squats (N/A) Walking forward (N/A)	32	3

[14]

OUTCOMES MEASURES

A. PRIMARY OUTCOMES –

- **Pain** – Pain is the most common symptom of OA and is assessed by Visual Analog Scale- (VAS).
- **Range of Motion** – Movements like Hip abduction, Knee flexion/extension, External/Internal Rotation was assessed by goniometry to check the range of motion of affected patients. [1]

B. SECONDARY OUTCOME –

- **Disability-** WOMAC scale = The WOMAC is a self-reported instrument. It includes 24 questions which divided into 3 sections; pain (5 question), stiffness (2 questions), and physical function (17 questions). The pain category is assessed by aggravating of pain during activities of daily living (ADL), stiffness assesses amount of stiffness evoke after certain fixed positions and at what time experienced. The physical function involved certain activities like sit to stand, stair climbing, walking etc. The higher score on WOMAC defined the worst status functional status. [15]
- **KOOS** outcome measure evaluates five elements - Pain, signs & Symptoms, Functional Independence, Sport and restoration function and Knee related quality of life. It is alternative part of WOMAC.
- **Balance** – Static Balance – Romberg test – Evaluated in four situations - (i) Eyes Open/Firm surface [EO] (ii) Eyes closed/Firm surface [EC] (c) Eyes Open / shaky surface [EOSS] (d) Eyes Closed/Shaky surface [ECSS]. To avoid differences. Dynamic Balance – Balance error scoring system and step test.
- **Muscle strength** – Severity of the disease assessed by Kellgren and Lawrence (KL) grading scale. Participants with large osteophytes graded as higher score and with less osteophytes graded as lower score.[16]
- **Gait parameters** – 6-minute walk test / 3D gait analysis. To measure walking pattern without assistance.
- **Quality of life:** - SF-36, SF-36 scale used to assess the capabilities of the client in context of life performancetasks.

RESULTS

The results of the 8 weeks study trail work out that an average trail of confirmation in regards to the use of isometric exercises along with aquatic exercises was effective than control interventions as seeing the outcome measures had improved.

The participants had a reduction in pain during ADL's (VAS), their physical function significantly improved as well as their strength and gait capacity as compared to when they hadn't taken the interventions. The main point of conducting isometric exercises with aquatic is because the water has low impact on the body. Thus causing a reduction in joint stiffness too, there is body conditioning due to its cooling effect and is good for cardiovascular health conditions. The strengthening of both the major knee muscles quadriceps and hamstring significantly increase the joint stability.

- Before performing exercises, a 10-15minutes session of warm up and cool down is needed, such as walking in the pool front ways and backwards, sideways and high stepping the temperature of the water is also checked.
- This intervention is to be given for a maximum of eight weeks reports following these exercises proved to have had an effect on the reduction of pain during movement.
- The main point of doing combination of aquatic exercises and isometric exercises is that because water has low impact on the body. So cooling effect of this helps to maintain good cardiovascular health.
- And strengthening of quadriceps and hamstrings helps to maintain joint stability. Thus it can be effective for overweight patients.
- As OA affecting the medial side of knee so it may more worse because of stress on the medial side, thus strengthening of unaffected muscles is beneficial to reduce the stress on the medial side and vice-versa.
- It also helps in reduction of joint stiffness and improved quality of life.
- As compared to land based exercises, performing them in water is advantageous because there are less chances of injury.

The output of this study demonstrates, participants in each experimental group notably improved, in that; pain and physical dysfunction were decreased, and also increasing the speed of walking, all is observed following intervention. A post treatment check up was done few weeks after intervention and the outcome showed that the functional status of Experimental group was better than their inceptive status.

Although a number of patients could not go all the way through the intervention, due to the unbearable pain that came with exercises, it was seen that, administration of isotonic based exercises gave a considerable amount of outcome on decreasing pain. On the other hand isokinetic exercises proved to have had improved the physical disability as well as enhancing the speed at which the patients walked, with that said, a 60 degrees/ second angular speed peak torques lied in both isokinetic and isotonic exercise groups thereby producing a substantial muscle strength procure. Nonetheless remarkable muscle strength procures in 180 degrees/second angular speed top force was only established in the isokinetic set following intervention. Survey of the tests which counted for self assessment dysfunction revealed a close decline in the disorder

In general this study depicts, that water based exercises do hold, yet temporary medically applicable results on dysfunction, self assessed pain and the well being of patients suffering from osteoarthritis of both knee and hip succeeding a water based treatment. Still there is no clarity in regards to the results being centered on the contemporary proof. The prompt effects of water based exercises demonstrate an exact with sustained results, even after having varying partaking set of patients with either knee or hip osteoarthritis. In contrast to the people who did not partake in the water based exercise interventions, the experimental category that had performed these exercises had statistically significant values in context to the results. Control group have lesser positive results as compared to experimental group.

There was a reduction in pain, improved performance and well being, as a result of the treatment. With a sum of seventy two percent to seventy five percent patients showing reduction in pain and advanced performance in context to seventeen percent of the non experimental group. There was a continued satisfaction ½ months post fulfilling the intervention, meanwhile a large percentage of the survey partakers continued performing the therapeutic aquatic exercises on their own.

DISCUSSION

This review is a study on the effectiveness of aquatic exercises and land based exercises for the treatment of knee OA

Increasing evidence from the studies shows that a treatment for 8 weeks with 4 sessions/week revealed that there is reduction in pain intensity and joint stiffness around the knee along with better and improved ADLs and QoL. The treatment protocol focuses exercises on the posture in which patient performs actively couple

with increase in the resistance progressively with the help of turbulence of water. Strengthening of the hip abductors stabilizes the opposite pelvis during walking, hence decreases the compressive forces around the knee joint.

One notable and striking observation of the review states that Knee OA can be cured and prevented by exercise. An exercise program protocol is designed to have a beneficial result in pain reduction and muscle stiffness around knee joint along with improvement in functional independency in people with knee OA.

Our findings revealed experimental group has better positive results in relation to balance and walking. Balance on different types of surfaces(uneven and smooth) and increase of walking speed are the main components(distance covered per seconds) .Their static and dynamic balance also improve with increase of step and stride length. In Cochrane review, researchers advised that aquatic exercise can have better benefits for the cure of patients/clients with osteoarthritis. They conducted many clinical experiments up to 28 April, 2015 and suggested that Aquatic Exercise have greater impact on muscle strength and compared to control group whereas no significant positive results came. Functional independence, Activity limitation, participation restrictions, pain intensity, QoL are assessed before, during and after the treatment have been completed. The outcome measures used in the study showed clearer results in context to outcome of severity of pain and physical function.

Our narrative review of evidence exposed the effect of strengthening along with Aquatic Exercises in reduction of pain and improvement of physical function. The evidence also revealed that strength training with aquatic therapy for extremities of lower limb reduces pain and improve physical function, that is strengthening of quadriceps and hamstring is beneficial for knee OA.

Clinical Trials assessed different outcomes measures relating to Physical function and mobility. Water provides the surface and platform for doing exercise in comfortable manner. In acute stage OA Isotonic exercises play important role in strengthening of muscles around knee joint complex and to provide mobility and stability isokinetic helps the people with OA. However, there are some clinical guidelines and recommendations to follow strengthening exercises along with aquatic therapy. This can be given to all individuals with OA.

Our review suggested that strengthening along with aquatic therapy exercises is needed in reducing the pain severity and improving independence level in patients with Knee OA.

Although, both exercises reduces pain in the patients, but it is seen that their effectiveness in this regards differ as aquatic exercise is not superior to land based in pain reduction.

CONCLUSION

The conclusion of the narrative review is based on the topic of improvement 'Effectiveness of Hydrotherapy versus Isometric exercises in well being of knee osteoarthritis patients 'and we have efficiently concluded with evidence that hydrotherapy along with an isometric exercises increased in the functional status of osteoarthritis patients and decreased pain and joint stiffness also. The conclusion of the narrative review is based on the topic of 'Effectiveness of Hydrotherapy versus Isometric exercises in well being of knee osteoarthritis patients 'and we have efficiently concluded with evidence that hydrotherapy along with an

isometric exercises increased improvement in the functional status of osteoarthritis patients and decreased pain and joint stiffness also.

The treatment protocol has helped in increased strength of major group muscles like muscles of hip and knee joint that maintains the joint stability. The strengthening exercises consistently helped to enhance muscle mass, density of bone, and joint flexibility. Aquatic exercises have helped for early mobilization of joints due its properties because for some people land-based exercises are too painful to perform. So water based exercises helped in improvement of posture, walking patterns and decreased deformities. Mobility under water increased joint range of motion also. Overall exercise protocol and outcome measures accommodating both the approaches has shown better result and together they have brought a positive health impact on patients suffering from osteoarthritis.

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