

Role of Aquatic Therapy in Knee Rehabilitation: A Narrative review

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How to cite this article: Aboobacker Amras, R. Kamalakannan. Role of Aquatic Therapy in Knee Rehabilitation: A Narrative review. Indian Journal of Physiotherapy and Occupational Therapy 2023;17(4).

Abstract

Background: Knee pain is a prevalent issue affecting adolescents and adults, with various causes ranging from acute injuries to chronic conditions like osteoarthritis. The knee is particularly susceptible to injury, especially among athletes. Aquatic therapy has gained attention as a promising approach to knee rehabilitation because of its unique properties, including buoyancy, hydrostatic pressure, and viscosity, which can aid in reducing pain and enhancing recovery. This narrative review explores the effectiveness of aquatic therapy in knee rehabilitation across different knee conditions and presents findings from several studies conducted between 2006 and 2022.

Methodology: A comprehensive search strategy was implemented using keywords in Google Scholar and PubMed. The search was limited to randomized controlled trials, systematic reviews, and pilot studies conducted between 2006 and 2022, published in English. Inclusion criteria encompassed original research with outcomes related to knee rehabilitation and aquatic therapy, while articles that did not focus on knee rehabilitation and aquatic therapy or were published prior to 2006 were excluded.

Results: Several studies were reviewed to assess the effectiveness of aquatic therapy in knee rehabilitation for different conditions. A total of 7 articles were selected that said the effectiveness of aquatic therapy in knee rehabilitation.

Conclusion: In this review, aquatic therapy is effective in all knee conditions.

Keywords: aquatic therapy, knee rehabilitation, ACL reconstruction, osteoarthritis, meniscal injury.

Introduction

Knee pain is a common adolescent and adult symptom. It is a frequent symptom beginning around the age of 10 and by the age of 15, 1 out of every 3 teenagers will report having some amount of knee discomfort [1]. Both acute and chronic are caused by functional limitation in individuals [2]. With an estimated of 2.5 million injuries associated with sports recorded each year, the knee is the most injured joint that young athlete's injury the most

frequently. The types of major knee injuries, such as ruptures of the ACL or PCL or MCL that occur frequently are explained by the multidirectional loads applied to the complex knee joint during vigorous physical activity [2]. One of the common conditions in the knee is osteoarthritis for over 50 years. Knee problems in teenagers as well as catastrophic events such as ACL and meniscal injury, may raise the chance of developing osteoarthritis (OA) [1]. Obesity is a significant risk factor for knee pain, & both aging and obesity increase the likelihood of developing

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symptomatic knee osteoarthritis [3]. The knee is heavily loaded, and alterations in the biomechanics of the knee can cause pain and damage [1].

In sports, the knee is frequently hurt due to both direct as well as indirect trauma. Example: Meniscal tears, patellofemoral instability, ligament injury, patellar tendinitis, are common causes of knee pain in athletes, and osteochondral injury, arthritis in the elderly group common causes of knee pain. It's also important to keep in mind less prevalent issues including discoid meniscus, apophysitis (osteochondrosis), and plica syndrome, Hoffa's disease is an uncommon cause of anterior knee pain in athletes, medially knee pain causes are semimembranosus tendinitis, pes anserine bursitis, tibial collateral ligament bursitis, saphenous nerve entrapment, and laterally knee pain causes are popliteus tendinitis, iliotibial band syndrome, fabella syndrome, and proximal tibiofibular joint instability [4]. knee pain also due to referred pain from hip or lumbar spine dysfunction [5]. there are many effective treatment for knee pain. Treatment for knee pain is determined by the thorough diagnosis, the patient, and the available resources. The most common treatment choices are conservative treatment, exercise therapy, surgical, acupuncture, manual therapy etc¹. preventing measures best option to from preventing knee pain. Such as controlling Obesity, lack of strength lower limb, stereotyped repetitive usage of the knee joint, severe external loads, awkward working conditions [6]. In recent studies says that aquatic therapy is highly effective in knee conditions. Aquatic therapy involves all therapeutic uses of a water-based setting during the Rehabilitation. Exercise in the water reduces joint loading, and being immersed has been linked to reduced pain symptoms due to improved sensory input and reduced joint compression. Basic hydrodynamic concepts are connected to the biological impacts of submersion in water. Understanding these effects, in addition to the physical characteristics of water, such as its density, specific gravity, hydrostatic pressure, viscosity, and buoyancy, may aid knee rehabilitation [7].

The need for studying aquatic therapy in knee rehabilitation arises from its potential to provide effective and safe rehabilitation for individuals with knee injuries or post-surgery recovery. Aquatic

therapy takes advantage of buoyancy, reducing the impact on the knee joint during exercise. It can be crucial in early stages of rehabilitation and buoyancy allows for easier joint movement, aiding in regaining and enhancing range of motion. Hydrostatic pressure can alleviate pain reduce swelling in the knee, making it more conducive to rehabilitation, aquatic therapy challenges balance and stability which is essential for knee rehabilitation to prevent future injury .it can contribute to cardiovascular fitness and overall well-being [14].

Methodology

Search strategy: The search was conducted using specific keywords in databases such as Google Scholar and PubMed. Articles were selected based on predefined inclusion and exclusion criteria, and only full articles were considered for the literature review.

Database: Google Scholar, PubMed

Duration of the review: 1 month

Inclusion Criteria

1. Randomized control trials, systematic review and pilot studies between the years 2006 to 2022.
2. Original research encompasses a range of outcome measures related to knee rehabilitation and aquatic therapy.
3. Articles that have been published in English.

Exclusion Criteria

1. Articles published prior to 2006.
2. Articles that did not specifically center on knee rehabilitation and aquatic therapy were not considered.
3. Articles in language other than English.

Literature Review

- **Elie Hajouj et al (2021)** Conducted randomized controlled trial on "effects of innovative aquatic proprioception training on knee proprioception in athletes with ACL reconstruction". total 38 male athletes post (hamstring tendon graft) were randomly assigned into two groups. Experimental groups (n=19) received conventional therapy and controlled groups (n=19) received hydrotherapy with same convectional

therapy from after 6 weeks of post-surgery for 3 times per week. Controlled groups got additionally aquatic proprioception training 2 times weekly for 45-60 minutes. The result of the current study revealed that subjects who followed innovative aquatic proprioceptive training plus the conventional rehabilitation accelerated protocol had significantly reduced proprioception magnitude errors, signifying a reduction in proprioceptive deficit after the intervention [10].

- **Sirous Azizi et al (2019)** was guided single blind RCT with 32 men's with knee osteoarthritis aged <60 from university hospital Tehran. The aim of the study is to assess the efficacy of aquatic exercise for the management of knee osteoarthritis. 32 participants in the intervention group (n=16) followed an aquatic exercise program for three sessions for 8 weeks. In control group (n=16) was instructed to use only acetaminophen with lifestyle recommendation for 8 weeks. Results indicated that significantly improve in aquatic exercise for pain and static, dynamic balance. Aquatic exercise regarding static and dynamic balance, step length, stride length, and cadence [11].
- **Richard McAvoy et al (2006)** was conducted pilot randomized controlled trial about "Effectiveness of combining aquatic physical therapy with land-based therapy". 30 participants which had unilateral TKR from Marsh book in Somersworth .15 person randomly assigned to integrated group (aquatic and land) received physical therapy in the water and on land two times a week for 6 weeks. Patients received 30 minutes land and 30 minutes aquatic exercises. Between sessions they got 15 minutes break to change dresses. Other groups received 60 minutes of physical therapy 2 times in 6 weeks. After exercise cessation (6 weeks), a significant improvement of knee functions was observed in the integrated group [12]
- **Qin LI et al (2022)** was aimed study about the "effectiveness of aquatic sports rehabilitation on functional recovery of knee joint injury". Due to epidemic period the recruitment for samples was done through WeChat social media application including 14 boys and 16 girls total 30 participants joined this study. 30 subjects were divided into water sports group, land sports group and control group by pairing method, with 10 people in each group. Study was conducted for 8 weeks. Results indicated that although both water sports rehabilitation and land sports rehabilitation can increase the knee joint function score of patients with knee ligament or meniscus injury [13]
- **Supriya Nikam et al (2022)** conducted double blinded RCT about "Efficacy of Aquatic Therapy and VMO Strengthening in Patellofemoral Arthritis". This Study was conducted with 30 subjects for 5 weeks 3 times a week. All 30 subjects were randomly assigned to 2 groups with 15 participants. Group A received VMO strengthening, and group B received aquatic therapy. Post-intervention results show significant improvement in aquatic therapy exercise [14].
- **Philip.M.Boozer et al (2016)** conducted a systematic review on "effectiveness of traditional land based versus aquatic therapy after ACL reconstruction". Systematic search on googles scholar and sports Discuss. Initial search included six articles. Only two publications concerning comparing aquatic and land-based therapy were discovered after each article's eligibility for inclusion had been evaluated; these two articles were the only ones that met the criterion. All articles were reviewed comparing land therapy and aquatic therapy after ACLR surgery. Only Two articles showed there was no difference in pain, effusion, ROM in land-based rehabilitation. While the aquatic rehabilitation did show improvement in all outcomes [15].
- **Jae-Young Lim et al (2010)** RCT was focused about "Effectiveness of Aquatic Exercise for Obese Patients with Knee OA". 75 participants randomly assigned into Aquatic group (n= 26) and land exercise group (n=25) Other (n=24) participants in the control group. The intervention program for 40 minutes per session three times for 8 weeks. For control group home based provided.. Following an 8-week intervention, both the aquatic group and the land exercise group's BMI indicated some decrease. The improvement in functional performance

was almost equivalent between the two exercise treatments. The degree to which pain interferes with activities is lessened in aquatic groups. Patients with obesity who

struggle to perform traditional workouts because of knee osteoarthritis may find success with aquatic exercise [16].

Table 1: Analysis of literature review

	Author	design	No. of subjects	Outcome measures	Study duration	Frequency of measurement	Results
1	Elie hajouj et al	RCT	n=38	IKDC questionnaire, VAS scale,	6 weeks	Pre and post intervention	Aquatic exercise has significantly improved VAS and IKDC
2	Sirous Azizi et al	RCT	n=32	VAS scale, ROM, balance error scoring system	8weeks	Pre and post intervention	Aquatic exercise significantly improve I pain, and static, dynamic balance
3	Richard McAvoy et al	Pilot RCT	n=30	NPRS, KOOS and WOMAC index	6 weeks	Baseline 6 months	Significant improve in aquatic exercise in pain and ROM AND knee functioning
4	Qin Li et al	RCT	n=30	VAS, KOOS index, ROM	8weeks	2,4,6,8 weeks	Patients with knee joint problems may recover rapidly with aquatic rehabilitation exercises.
5	Supriya Nikam et al	RCT	N=30	VAS, AKPS	5 weeks	Baseline 5 weeks	Aquatic therapy is more efficient than VMO strengthening, which demonstrated greater pain relief and increased functional capacity in PFA
6	Philip Boozer et al	Systematic review	6 articles	NA	Pain recovery, ROM, muscle strength	NA	Evidence supported that aquatic exercise helps to improve in pain, ROM, muscle strength
7	Jae-Young Lim et al	RCT	n=75	WOMAC, BPI	8 weeks	Pre and post intervention	For obese individuals who struggle with traditional exercise due to combination knee osteoarthritis and obesity, aquatic exercise may be a useful technique.

Discussion of Study

The knee joint is prone to damage since it is continually influenced by body weight loading from different angles^[10]. The literature review presents a compelling case for the effectiveness of aquatic therapy in knee rehabilitation across various knee conditions. It consistently demonstrates positive outcomes, including pain reduction, improved range of motion, increased strength, enhanced balance, and better functional abilities. Reduce joint loading with aquatic activities, and water immersion has been linked to reduced pain sensations due to improved sensory input and reduced joint compression^[10]. The biological effects of immersion in water are related to basic hydrodynamic principles. Understanding these impacts, as well as water's physical properties including density and specific gravity, hydrostatic pressure, viscosity, and buoyancy may help knee rehabilitation^[14].

Elie Hajouj et al says that innovative aquatic proprioception training, when added to conventional therapy, significantly improved proprioception in athletes with ACL reconstruction. After the intervention, the proprioception assessments revealed substantial variations in the joint position sensation variables between the two groups. This study revealed that significantly reduced proprioception magnitude errors. Hydrostatic pressure helps by activating muscles to maintain the stability of body by role of external sensory stimuli. Not only improving proprioception this intervention it also improves efficiency of pain and knee function^[10].

Sirous Azizi et al study focused on individuals with knee osteoarthritis. The findings suggest that aquatic exercise can significantly improve pain levels and static and dynamic balance in this group. This is crucial since managing pain and maintaining balance are key aspects of knee osteoarthritis management. Static and dynamic balance and gait parameters such as step length, stride length, cadence is significantly improved here^[11]. Qin Li's study focused on patients with knee ligament injuries and meniscal injuries. It found that water sports rehabilitation led to better improvements in terms of benefits and range compared to land-based rehabilitation. This highlights the potential benefits of aquatic therapy for patients with complex knee injuries, including

ligament and meniscal issues^[13]. Effect of aquatic therapy accelerating rehabilitation in sports injury. Athletes with meniscal or ligament injury only participate in therapy after acute phase. In such case they have designed treatment according to individual condition, time, intensity and frequency. It help accelerate the rehabilitation.

The studies also suggest that aquatic therapy has unique advantages, such as early muscle activation, reduced pain interference during exercises, and the ability to cater to individuals. The literature review presents a compelling case for the effectiveness of aquatic therapy in knee rehabilitation across various knee conditions.

Limitations:

- Cost effectiveness for aquatic therapy is one of the basic limitations in our study. Using the community pool restricted for use all the time. It may only be available at certain times of the day; clinics can optimize their schedules to make the best use of pool hours. This ensures that therapy sessions are maximally productive. And community pools are also not able to maintain temperature as per need for treatment.
- Duration of exercise program was not likely enough to verify effects of treatments. Sessions and duration of exercises must increase to reliable results and validity of outcome measures.
- In post-surgical conditions such ACL reconstruction and meniscal and other ligament surgery will lead to becoming infected because of water based environment exercises.
- In some cases, sample size is not enough to reliable outcome measures and results.

Conclusion

The reviewed studies collectively emphasize the significant benefits of aquatic therapy in knee rehabilitation. These benefits encompass pain reduction, improved range of motion, increased strength, enhanced balance, and better functional abilities across a spectrum of knee conditions. This can accelerate knee rehabilitation in acute and chronic knee conditions.

In summary, aquatic therapy emerges as a promising and valuable tool in the realm of knee rehabilitation. However, ongoing research, protocol standardization, and continuous evaluation are essential steps to fully harness its benefits for individuals recovering from knee-related conditions and injuries.

Conflict of Interest: There is no conflict of interest.

Source of Fund: Provided by Srinivas college of physiotherapy, Mangalore

Ethical Clearance: Ethical clearance taken ethical committee, date: 12th June 2023, Reference number: SCPT/P/3/100666/21/2023

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