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Effects of Hydrotherapy Programmes on Knee Osteoarthritis

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Abstract

Osteoarthritis (OA) of the knee is a progressive degenerative disorder characterized by the breakdown of articular cartilage, joint margins, and surrounding structures. It is one of the most common musculoskeletal conditions affecting weight-bearing joints, leading to functional limitation, pain, stiffness, and reduced quality of life. Although OA is irreversible, early intervention and appropriate therapeutic strategies can slow its progression and help delay invasive procedures such as total joint replacement. Hydrotherapy has gained recognition as an effective, low-impact therapeutic approach that utilizes the physical properties of water—including buoyancy, viscosity, and thermal effects—to reduce joint load, improve mobility, and enhance muscle strength. These water-based programmes may provide a safer alternative for individuals who struggle with land-based exercises due to pain or mobility restrictions. This study aims to explore the effects of hydrotherapy programmes on individuals with knee osteoarthritis, emphasizing improvements in pain reduction, range of motion, functional mobility, gait patterns, and overall joint health. The intervention leverages warm-water environments to reduce gravitational stress, support movement, and facilitate controlled exercise. By examining patient outcomes, this research highlights hydrotherapy's potential to alleviate symptoms, improve quality of life, and slow disease progression. Understanding its benefits may help clinicians integrate aquatic therapy more effectively into OA management protocols.

Keywords: Hydrotherapy, knee osteoarthritis, aquatic therapy, pain reduction, joint mobility

INTRODUCTION

Osteoarthritis (OA) is a chronic degenerative disorder that affects the articular cartilage, joint surfaces, and surrounding structures. It is irreversible in nature, and without proper management, the condition may progress to the extent that total joint replacement is necessary [1]. As OA commonly affects weight-bearing joints, especially the knee, therapeutic strategies aimed at slowing its progression are essential. Several factors contribute to the development of OA, including age, sex, occupational stress, lifestyle habits, poor diet, sedentary lifestyle, and genetic predispositions. The knee is a synovial hinge joint that is formed by the femur, tibia, and patella [2–4]. It is supported by major cartilaginous structures such as the tibiofemoral and patellofemoral joints, as well as stabilizing ligaments, including the anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), medial collateral ligament (MCL), and lateral collateral ligament (LCL). Tendons, particularly the quadriceps and patellar tendons, facilitate movement by connecting muscle to bone, whereas muscles such as the quadriceps, hamstrings, gastrocnemius, and popliteus contribute to joint stability and function [5–7]. Bursae, the fluid-filled sacs surrounding the joint, help minimize friction during movement until pathological conditions, such as osteoarthritis, disrupt this mechanism (Figure 1).

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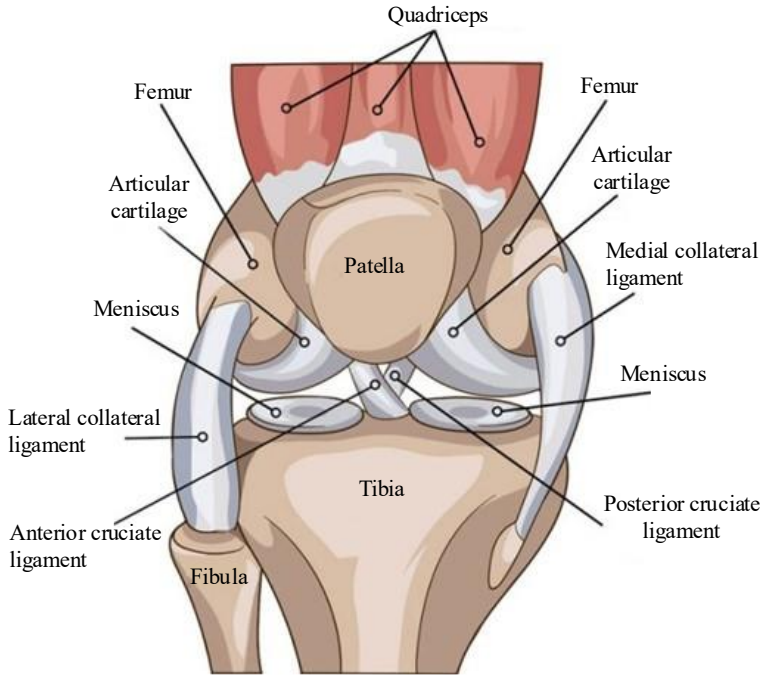

Figure 1. Anatomy of the knee joint.

Grades of the Kellgren-Lawrence (KL) Scale for Osteoarthritis: The Kellgren-Lawrence Scale is a standard method to measure the severity of knee OA based on radiographic findings. It helps grade the extent of joint damage and range of motion (ROM) from mild to severe, and accordingly, a proper treatment plan is made for the patient (Figure 2). The KL Scale has 0-4 grades:

Grade 0: A normal knee with no radiographic features of osteoarthritis
Grade 1: Possible presence of osteophytes, but no narrowing of the joint
Grade 2: Definite presence of osteophytes and mild narrowing of the joint can be observed
Grade 3: Moderate OA, noticeable narrowing of spurs, and early bone hardening
Grade 4: A high number of osteophytes presenting with severe joint narrowing and bone deformity

Kellgren-Lawrence (KL) grading system

KL Grade	Grade 0	Grade 1	Grade 2	Grade 3	Grade 4
Classification	Normal	Doubtful	Mild	Moderate	Severe
Description	No radiographic features of OA	Doubtful joint space narrowing(JSN)	Definite osteophytes possible JSN	Multiple osteophytes definite JSN scierosis	Large osteophytes Marked JSN severe scierosis

Figure 2. Kallgren-Lawrence (KL) grading system.

Hydrotherapy: Hydrotherapy is defined as a pool therapy program specifically designed for an individual to improve neuromuscular skeletal function, conducted and supervised by qualified personnel, ideally in a purpose-built hydrotherapy pool. Hydrotherapy was first employed by Hippocrates (c. 450–375 BC) and is now commonly undertaken by physiotherapists worldwide,

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including both the National Health Service and the private sector in the United Kingdom. Since the 1930s, physiotherapists have employed neuromuscular theory and have continually improved their pool exercise therapy techniques using various methods. Here, we focus on the "Bad Ragaz Ring Method" and "Halliwick method" [8, 9].

Table 1. Indications and contraindications of hydrotherapy.

Indication of hydrotherapy	Contraindication of hydrotherapy
• Pain	• Open wound
• Muscle spasm	• Cardiovascular conditions
• Loss of range of motion	• Aqua phobia
• Abnormal Gait Pattern	• Pyrexia • Contagious disease

Table 1 provides a clear comparison of major indications and contraindications for hydrotherapy. The listed indications, such as pain, muscle spasm, limited ROM, and abnormal gait patterns, highlight the conditions under which hydrotherapy can be beneficial for therapeutic management. In contrast, contraindications, such as open wounds, cardiovascular problems, aquaphobia, pyrexia, and contagious diseases, identify situations where hydrotherapy should be avoided to prevent complications and ensure patient safety.

Table 2. Methods of hydrotherapy with their definitions, treatment procedures, age groups, and treatment duration.

Methods of hydrotherapy	Definition	Treatment	Age group	Duration of treatment
Bad Ragaz's ring therapy	The Bad Ragaz Ring Method is a specific treatment concept of resistive exercise that helps in strengthening and mobilizing using a flotation ring, and it was developed by physiotherapists in Bad Ragaz, Switzerland, and published by Davies (1967). It involves asymmetric, symmetric, bilateral, and unilateral exercise programs	• The patient wear neck ring float, a body ring at the L5-S2 level, and extremity rings • The water level should not exceed axillaries (T8-T10) level of Therapist • Minimal pool area – 15.8 m^2 • Temperature 33.3degree Celsius • Water depth is usually 0.9-1.2 m	Adolescence, early 20s (genetics, trauma) Adults late 30s to 70s (degenerative)	This treatment is done for 8 weeks in alternative days. The duration of the treatment should be in the range of 15 -30 minutes as per requirement, which is 20 times of muscle contraction in one set with one min of break.
Haillwick's aqua therapy	The Halliwick method is a learning process that helps to improve independent movement by gaining motor learning and control, postural control, balance, and muscle movement. It was developed by James and Phyl McMillan in the 1940s and 1950s. It involves mental adjustment, a dynamic and static exercise program.	• Mental adjustment • Sagittal rotational control (RC) • Transverse rotational control (RC) • Longitudinal rotational control (RC) • Combined rotational control (RC) • Upthrust / muscle inhibition (MI) • Balance and stillness • Turbulent gliding	All specified age groups can perform this treatment, depending on their conditions.	This technique requires 2 - 5 weeks or months to get treated.

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Table 2 provides a comparative overview of the two major hydrotherapy techniques: Bad Ragaz Ring Therapy and Halliwick Aqua Therapy. The table outlines the core definition of each method, treatment procedures, recommended age groups, and duration of therapy. This comparison highlights how Bad Ragaz primarily focuses on resistive strengthening with flotation support, whereas the Halliwick approach emphasizes motor control, postural stability, and rotational skills. By organizing this information into a single table, it becomes easier to understand the distinct therapeutic goals and practical applications of each technique.

Need for the Study

Hydrotherapy is part of the rehabilitation program for regaining and correcting certain medical conditions. Therefore, this study focuses on two hydrotherapy methods (Bad Ragaz and Halliwick method) and their effectiveness in patients with knee OA.

Aim /Objective of the Study

To conduct a narrative review of existing articles on the effects of hydrotherapy methods, such as the Bad Ragaz and Halliwick method, for knee osteoarthritis.

METHODOLOGY

The study was conducted by reviewing articles available on various search engines using specific keywords such as osteoarthritis, hydrotherapy exercises, and techniques for knee osteoarthritis. Initially, the titles were screened, followed by a review of the abstracts. Finally, articles published since 1930 were selected, as physiotherapists have developed theories based on model performance and research-based studies using the above-mentioned methods, while excluding irrelevant studies.

Analysis

The establishment of standardized procedures in the methods of hydrotherapy permits the treatment of knee osteoarthritis. We found that the Halliwick method, in comparison with the Bad Ragaz Ring Method, provides broader applicability across all age groups, whereas the Bad Ragaz Ring Method can generally be practiced only among individuals ranging from the early 30s to the late 70s. Since 1946, a review of published articles has shown that the Bad Ragaz Ring Method demonstrates greater accuracy and specificity, supported by objective evidence such as X-ray imaging, ultrasound findings, and ROM measurements using a goniometer. In contrast, the Halliwick method has been supported by only one specific study, which concluded that it did not demonstrate the same level of accuracy as the Bad Ragaz Ring Method.

DISCUSSION

This study confirmed that, after a detailed review of the findings from selected articles using digital databases, meaningful outcomes were identified that provide insight into how and why hydrotherapy methods are used in the treatment of knee osteoarthritis. The methods reviewed included the Bad Ragaz Ring Method, which incorporates proprioceptive neuromuscular facilitation (PNF) techniques. This method stimulates and facilitates the neuromuscular system through active proprioception by utilizing buoyancy-assisted exercises and slow rotational movements with the help of floating devices. Muscle activities performed during this method include isometric contractions [10].

Halliwick uses hydrodynamic, hydrostatic, and body dynamic principles, which have been shown to be effective in improving the quality of life and rehabilitation outcomes of patients with knee pain. The Halliwick method is primarily based on fluid mechanics principles such as buoyancy and gravitational forces. Both forces are equally important and influential. Even a small change in either gravity or buoyancy may cause imbalance, resulting in body rotation as the patient attempts to regain equilibrium.

Grades 1–3 of knee osteoarthritis are generally managed with physiotherapy treatment, whereas Grade 4 typically requires surgical intervention. The certainty and accuracy of both hydrotherapy methods yielded positive therapeutic outcomes.

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CONCLUSION

In conclusion, this study explored and analyzed various aspects and articles that demonstrated the significant impact of hydrotherapy methods for the treatment and rehabilitation of knee osteoarthritis. A total of 14 digitally available articles were reviewed, of which five were selected as they provided more specific and detailed data that met the inclusion criteria. However, it is important to acknowledge that with population growth and increasing adoption of sedentary lifestyles, the prevalence of osteoarthritis is also rising. To address this condition, modern techniques and ongoing research are continuously advancing. This study discussed two hydrotherapy methods to help understand their effects. Despite efforts to confirm evidence and present detailed findings, certain limitations were identified. In particular, there is a lack of sufficient insights and evidence related to the Halliwick method, indicating a need for continued research in this area. In contrast, the Bad Ragaz Ring Method has demonstrated moderate supporting evidence.

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