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Optimizing Osteoarthritis Management: A Systematic Review of Hydrotherapy's Impact on Symptoms and Quality of Life

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Abstract

Introduction: Osteoarthritis (OA) is a prevalent type of arthritis, particularly among the elderly, and is a leading cause of disability in older adults. Reduced physical activity in OA patients often results in psychological disturbances when visiting healthcare facilities, contributing to a significant burden on healthcare services and diminishing individual quality of life. Objective: This study aims to analyze the literature on the effectiveness of hydrotherapy and land-based physical exercise in addressing osteoarthritis (OA) symptoms. Methods: A systematic literature search was conducted using the PubMed, Semantic Scholar, and OpenAlexa databases up to December 2024. Keywords included "Osteoarthritis OR OA," "Hydrotherapy OR Aquatic Therapy OR Foot Soak," and "Exercise OR Physical Therapy". Results: A total of eight studies met the inclusion criteria, comprising six randomized controlled trials and two quasi-experimental studies. The findings indicate that hydrotherapy significantly reduces pain, improves joint mobility, and enhances quality of life, particularly for patients with difficulty performing land-based activities. Moreover, land-based physical exercises are effective in improving joint function and overall physical performance. The combination of these approaches may provide an optimal solution for OA management, addressing both physical and psychological challenges faced by patients. Conclusion: These findings highlight the importance of incorporating hydrotherapy into OA treatment protocols to improve patient outcomes and quality of care.

Keywords: *Aquatic Therapy, Hydrotherapy, Osteoarthritis, Quality of Life.*

INTRODUCTION

Osteoarthritis (OA) is one of the most common types of arthritis (Xuan et al., 2023). This condition has a relatively high prevalence, especially among the elderly, and is one of the main causes of disability in older adults (Amelia et al., 2021). About 6% to 12% of the adult population and more than one-third of the population over 60 years old are reported to experience this disorder (Garbi et al., 2021). Knee osteoarthritis is characterized by three main symptoms: persistent knee discomfort, mild morning stiffness, and decreased function (Zhang et al., 2024). Risk factors include age, gender (women are more susceptible), obesity, knee injuries, muscle weakness, and repetitive joint movements (Azra Sadat Etesami et al., 2022). Patients experience stiffness and limitations associated with pain in daily activities (Lei et al., 2024). Due to reduced physical activity, some people with osteoarthritis experience psychological disturbances

when visiting healthcare facilities. This can place a significant burden on healthcare services as well as an individual's quality of life. (Rezasoltani et al., 2020).

WHO data from 2019 shows that around 528 million people worldwide live with osteoarthritis, an increase of 113% since 1990 (Ayán-Pérez et al., 2025). About 73% of osteoarthritis sufferers are over 55 years old, and 60% of them are women. With a prevalence of 365 million, the knee is the most affected joint, followed by the hip and hand. As many as 344 million osteoarthritis patients experience a severity level (moderate or severe) that requires rehabilitation. With an aging population and rising rates of obesity and injuries, the prevalence of osteoarthritis is expected to continue increasing globally (WHO, 2023).

Osteoarthritis is a degenerative joint disease that causes swelling, pain, and stiffness in the knee (Srikandi et al., 2020). This disease develops slowly and worsens over time (Ma et al., 2022). Due to various factors such as heavy work, strenuous exercise, obesity, and excessive pressure on the knee, the knee joint cartilage experiences erosion and damage due to abrasion (Khataee, 2024). The management of osteoarthritis can be done with two main approaches, namely pharmacological and non-pharmacological methods. The pharmacological method involves the use of pain relievers, while non-pharmacological treatment includes various techniques such as massage to hydrotherapy (Malem et al., 2023). Hydrotherapy or water therapy was initially performed by immersing the injured body parts in cold or hot water pools (Khataee, 2024). Buoyancy in water is a very important element because it helps decompress the joints, allowing patients to move more freely without feeling burdened (HANDI, 2020). Additionally, warm water can relax the muscles, which helps reduce pain and the perception of stiffness in the joints (Rachmat, 2022).

Various types of hydrotherapy have been applied to osteoarthritis patients, but there has yet to be a comprehensive review article explaining the effectiveness of hydrotherapy in improving patients' quality of life. Therefore, the authors conducted a literature review to determine the effectiveness of hydrotherapy in helping to reduce symptoms, such as pain and joint stiffness, as well as its impact on patients' quality of life.

METHODS

The search strategy was developed based on PRISMA guidelines to ensure the quality and clarity of the process. Journal searches were conducted through several databases, namely PubMed, Semantic Scholar, and Science Direct. The search was limited to journals published in the last five years, specifically between 2021 and 2024, and in English. Only articles with full access in PDF format were considered for inclusion. The keywords used in the search consist of the combination of the words "Osteoarthritis OR OA," AND "Hydrotherapy OR Aquatic Therapy OR Foot Soak." The same keywords were used to search for journals in each relevant database.

The inclusion criteria in this literature review are: 1) Individuals diagnosed with osteoarthritis, whether in the knee joints, hips, or other joints, who undergo treatment or therapy for the condition; 2) Experimental studies examining the effects of an intervention or therapy on osteoarthritis symptoms, such as pain reduction, improved joint function, or enhanced quality of life; 3) Measured outcomes are the direct effects of the therapy or intervention on osteoarthritis symptoms, focusing on pain reduction, increased mobility, and decreased joint stiffness. Search restrictions were only applied to studies published in English and available in PDF format with full access.

All references found during the journal search were exported into Zotero software to facilitate management and organization. The references were then filtered to remove duplicates, ensuring that each included article was unique and not listed more than once.

After that, the remaining references are filtered based on titles and abstracts to exclude articles that are literature reviews or do not meet the inclusion criteria. This process ensures that only articles meeting the research criteria are considered further. After passing the first screening, articles are read in their entirety to assess the quality and applicability of the research. This literature evaluation uses articles that have been judged to be pertinent, excellent, and in line with the goals of the study on the efficacy of osteoarthritis treatment.

RESULT

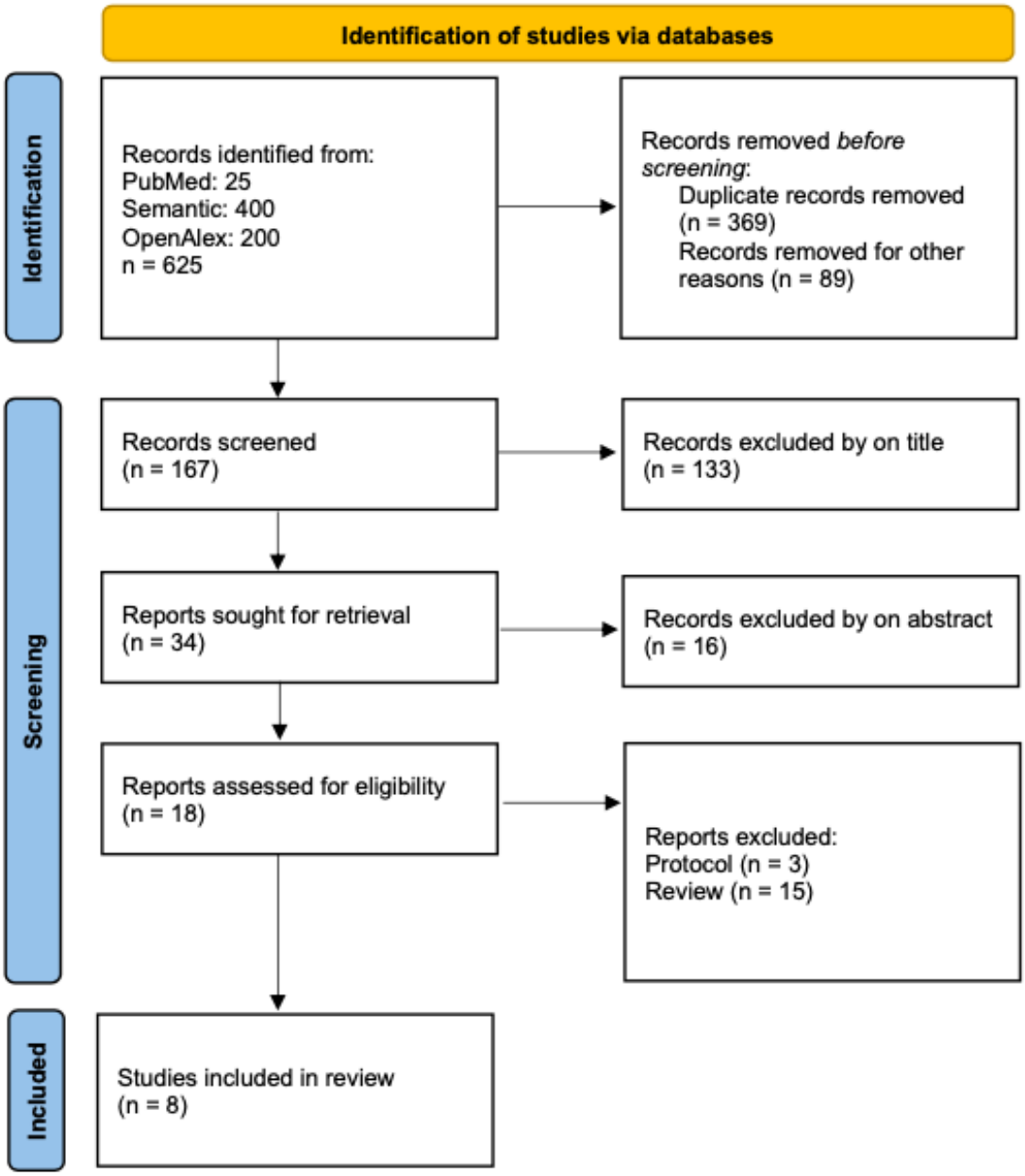

Figure 1. PRISMA Flow Chart

The systematic review process begins with the identification stage, where 625 articles were found through databases, 25 articles from PubMed, 400 articles from Semantic Scholar, and 200 articles from OpenAlex. After the initial screening process to remove duplicate articles, articles were reduced to 167. The next stage is screening based

on title relevance, which eliminates 133 articles, leaving 34 articles for further analysis. At the feasibility stage, the articles were thoroughly examined through their abstracts and full texts. Out of the 34 articles, 16 were eliminated because they did not meet the inclusion criteria. In the final stage, 18 articles were deemed to meet the inclusion criteria and possessed the desired quality, thus being included in the systematic review. This process reflects a systematic selection aimed at choosing high-quality literature relevant to the research topic.

Characteristic of Included Studies

Based on the literature review that has been conducted, we can see that various studies on hydrotherapy and exercise therapy for osteoarthritis (OA) have similar approaches but with slight differences in terms of implementation and outcome measurement. Most studies use the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) as the primary measurement tool to assess OA symptoms, which include pain, stiffness, and physical function in the knee joint. WOMAC is a valid and commonly used instrument to evaluate the impact of OA on patients' quality of life (Rachmat, 2022). This is evident in almost all the studies conducted, such as in the research (Amelia et al., 2021), (Garbi et al., 2021), dan (Khataee, 2024), which relies on WOMAC to measure changes in OA symptoms after intervention.

In addition to WOMAC, there is also the use of the Numerical Pain Rating Scale (NPRS), which is used in several studies to measure pain intensity in patients. For example, (Amelia et al., 2021) dan (Malem et al., 2023), to measure changes in pain before and after the intervention using the NPRS scale. The use of this scale provides direct information about the level of pain experienced by the patient during therapy.

Another measurement tool used is the Visual Analogue Scale (VAS), which is used in the study. (Fokmare & Phansopkar, 2023) and (Naeem et al., 2022), to measure pain intensity. This is also useful in providing a subjective picture of the patient's level of comfort or discomfort during treatment. In addition, to measure physical function and ability, various studies use the Timed Up and Go Test (TUG) and the Six-Minute Walk Test. (6MWT). These measurement tools are used to assess the mobility and functionality of patients in performing daily activities after the intervention. This is evident in the study (Garbi et al., 2021) and (Khruakhorn & Chiwarakranon, 2021), that use TUG and 6MWT to measure improvements in physical function.

There are two dominant types of interventions, namely hydrotherapy and land-based exercise. Most studies involve hydrotherapy or water therapy as part of the main intervention. For example, (Amelia et al., 2021) and (Khataee, 2024), using hydrotherapy conducted through water exercises to improve mobility and reduce pain in patients with OA. Other studies, such as (Garbi et al., 2021) and (Rezasoltani et al., 2020), using various types of water physical exercises, such as water cycling and hydrotherapy exercises to improve patients' physical functions. Some studies also explore combined therapies, as done by (Fokmare & Phansopkar, 2023), who use contrast bath therapy and aromatherapy as an addition to their treatment program. Although these interventions do not focus on physical exercise, they still have a positive effect on pain reduction and improvement in joint function. In addition to hydrotherapy, land-based exercises are also widely applied as part of the OA treatment protocol. In the study (Khruakhorn & Chiwarakranon, 2021), comparing land-based exercises with hydrotherapy and finding that although both are effective, hydrotherapy has additional advantages in improving several aspects such as balance and mental quality of life after 6 months (Tedeschi et al., 2024).

Overall, the results from various studies show significant improvements in pain intensity reduction, physical function, and quality of life after the intervention (Amelia et al., 2021), found a significant reduction in pain intensity and an improvement in functional ability in OA patients after 4 weeks of hydrotherapy (Fokmare & Phansopkar, 2023), also showed significant improvement in VAS, knee range of motion, and WOMAC scores in the group receiving contrast therapy compared to the control. Similar results were also found in the study (Khataee, 2024), where the group undergoing hydrotherapy reported a greater reduction in pain and an increased ability to perform daily activities without assistance.

In addition, (Khruakhorn & Chiwarakranon, 2021), report that although there is no significant difference in WOMAC scores between the land-based exercise group and the hydrotherapy group, the hydrotherapy group shows a more significant improvement in TUG and mental quality of life. However, it is important to note that although interventions such as hydrotherapy and land-based exercises show improvements in pain and physical function, particularly in terms of mobility and muscle strength, there is variation in the types of exercises used, the duration of the interventions, and the frequency of the sessions conducted. For example, the study (Naeem et al., 2022), involving land-based exercises and hydrotherapy with a longer training duration (8 weeks), while (Garbi et al., 2021), using hydrotherapy for 2 months with 16 sessions.

Table 1. Summary of included studies

Author (year)	Country	Study Design	Sample	Intervention	Measure	Outcome
(Amelia et al., 2021)	Indonesia	Quasi-experimental study with a one-group pretest-posttest	• N = 31 respondents (one-group pre-test and post-test) • Patients diagnosed with knee osteoarthritis (OA) at the Medical Rehabilitation Installation dr. Mohammad Hoesin Palembang who will undergo hydrotherapy exercises, aged over 30 years, and willing to participate in the study.	Hydrotherapy once a week for 4 weeks	• NPRS score (Numerical Pain Rating Scale) • WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) questionnaire.	In 31 research subjects, the results showed a significant effect before and after hydrotherapy exercises in reducing pain intensity (p = 0.000) and improving functional ability (p = 0.000) in knee OA patients over 4 weeks.
(Fokmare & Phansopkar, 2023)	India	Randomized controlled trial	• N = 60 respondents (30 patients recived contrast bath therapy aromatherapy group; 30 patients recived knee pad device) • Male and female patients aged between 40 to 60	• Contrast bath therapy • Knee pad device	• Visual Analogue Scale (VAS), • Knee flexion range • Western Ontario and McMaster Universities Arthritis	Both groups showed significant improvement after treatment (p < 0.05). Group B showed more significant improvement compared to

Author (year)	Country	Study Design	Sample	Intervention	Measure	Outcome
			years, with unilateral knee OA grade 1 or 2, and experiencing stiffness for less than 30 minutes, were included in this study. Patients with OA grade 3 or 4, superficial or deep sensory disturbances, systemic diseases, or severe disabilities were excluded.		Index (WOMAC) scale	Group A. Increases in VAS (2.39, $p < 0.020$), range of motion (2.11, $p < 0.039$), WOMAC (2.09, $p < 0.04$), and the two-minute walk test (2.03, $p < 0.046$) indicate improvements in functional ability.
(Garbi et al., 2021)	Brazil	Randomized controlled trial	• N = 29 respondent (17 patients intervention group; 30 control group) • Both genders, with clinic and radiologic diagnosis of knee OA, were referred to the physiotherapy they were required to have age equal or above 60 years	• Hydrotherapy exercise for 2 months with 16 sessions, each session lasting 60 minutes.	• Western Ontario and Macmaster Universities Osteoarthritis Index (WOMAC) • Six-minute walk test (6MWT) • Timed Up and Go Test (TUG) measured the mobility	There are significant differences in physical and functional parameters between the intervention group (IG) and the control group (CG), including pain levels ($p < 0.001$), stiffness ($p < 0.001$), physical activity ($p < 0.001$), distance covered in six minutes ($p = 0.001$), and mobility ($p < 0.001$).
(Khataee, 2024)	Iran	Randomized controlled trial	• N = 46 respondent (23 patients intervention group; 23 control group) • Female patients who have been diagnosed with knee osteoarthritis by doctors using various methods, including photos and MRI. The participants' ages ranged from 61 to 77 years, with weights between 70 to 89 kilograms. Based on the doctor's	• Aquatic activities and hydrotherapy	• Western Ontario and Macmaster Universities Osteoarthritis Index (WOMAC) • Quebec pain intensity questionnaire (QPIQ).	The intensity of muscle pain and spasms decreased in both groups, but in the hydrotherapy group, in addition to a significant reduction in pain, participants reported that they were able to perform daily activities without

Author (year)	Country	Study Design	Sample	Intervention	Measure	Outcome
			examination, none of the participants had respiratory, infectious, skin, or cardiovascular diseases.			assistance from others. In addition, the results also showed that the patients' mental condition significantly improved.
(Khruakhorn & Chiwarakranon, 2021)	Thailand	Randomized controlled trial	• N = 34 respondent (17 patients into land-based exercise group and 17 patients into hydrotherapy group) • Individuals with knee osteoarthritis aged between 45 to 75 years (both men and women) diagnosed by an orthopedic doctor with grades 2–3 based on the Kellgren-Lawrence grading system.	• Land-based exercise • Hydrotherapy • Both exercise groups attended 45−60 minutes classes, three times a week for 6 weeks.	• WHOQOL-BREF-THAI is a self-quality assessment • The time-up and go test (TUG) evaluated functional mobility while walking and balancing. • The five times sit-to-stand (5STS) test was used to evaluate the leg muscle strength. • The WOMAC included pain level, stiffness of the joints, and symptoms during daily life movements. • The stair climb test (SCT) is an assessment method of walking up and down the stairs	There was no significant difference in outcomes between the groups after 6 weeks and 6 months of follow-up. After 6 weeks, the Thai WOMAC scores improved in both groups. Only the 5STS improved in the land exercise group, while the hydrotherapy group showed significant improvements in TUG, 5STS, and SCT. Additionally, only the hydrotherapy group showed significant improvements in the WHOQOL-BREF-THAI scores in the mental, social, health quality, and total domains after six months.
(Malem et al., 2023)	Indonesia	Quasi-experimental study with a one-group	• N = 37 respondents (one-group pre-test and post-test) • Elderly individuals who are willing to	• Feet soak in warm salt water by dipping them 10-15 cm above	• Numeric Pain Scale (NPS).	The research results show that educational interventions are effective

Author (year)	Country	Study Design	Sample	Intervention	Measure	Outcome
		pretest-posttest	be respondents and can follow the research procedures, elderly individuals diagnosed with rheumatoid arthritis, osteoarthritis, and gouty arthritis, as well as elderly individuals experiencing moderate pain.	the ankle for 15 minutes. The water temperature used is 32°C-35°C.		in treating joint pain through complementary therapy in the elderly based on a video of foot soaking in warm salt water (P=0.000). Foot soaking in salt water can be an alternative therapy for the elderly with joint pain.
(Rezasoltani et al., 2020)	Iran	Randomized controlled trial	• N = 32 patients (16 patients intervention group; 16 control group) • Patients are eligible if they suffer from knee osteoarthritis, are 60 years old or older, and have experienced knee pain for at least 3 months. They can participate in the study if they wish to engage in an aquatic exercise program and have sufficient language proficiency.	• Aquatic cycling exercises, 3 sessions per week for 4 weeks with a total of 12 sessions.	• Knee injury • Osteoarthritis Outcome Score	The research results show a statistically significant improvement in pain reduction, physical function, and muscle strength beneficial for aquatic cycling exercises. Within-group analysis indicates that participants in the aquatic cycling group experienced a significant reduction in pain (P < .001), an increase in physical function (P < .001), as well as quadriceps (P < .001) and hamstring (P < .001) muscle strength compared to baseline measurements. Within-group comparisons in the control group did not

Author (year)	Country	Study Design	Sample	Intervention	Measure	Outcome
						show significant differences (all comparisons P > 0.05).
(Naeem et al., 2022)	Pakistan	Randomized controlled trial	• N = 80 respondents (40 patients land based exercise group; 40 hydrotherapy exercise) • Patients are based on the criteria of the American College of Rheumatology (ACR), which includes hand pain, stiffness, or discomfort with 3 or 4 of the following features: swelling of the tissue in two or more of the ten selected joints, tissue hypertrophy in two or more Distal Interphalangeal joints, less than 3 swollen Metacarpophalangeal joints, and deformity in at least 1 of the 10 selected joints.	• Land based exercise take 3 sessions per week, with 10 repetitions of each exercise for 1-2 weeks, 12 repetitions in 3-4 weeks and 15 repetitions in 5-8 weeks. • Hydrotherapy exercise take 3 sessions per week, with 10 repetitions of each exercise for 1-2 weeks, 12 repetitions in 3-4 weeks and 15 repetitions in 5-8 weeks.	• Numeric pain rating scale (NPRS) • Functional Index for Hand Osteoarthritis (FIHOA)	The results of the multivariate analysis of variance indicate a significant interaction between group and time (p=.00). Pain intensity decreased significantly in both groups, while grip strength and functional outcomes showed significant improvement in patients in group B (hydrotherapy-based exercise) compared to group A (land-based exercise) (P=.02 and .00).

DISCUSSION

Further research is needed to fill the gap regarding the sustainability of benefits and the integration of land exercises after aquatic therapy. Compared to regular land-based physical therapy and independent exercises, hydrokinetic therapy shows better results in several aspects, such as pain reduction, improved joint mobility, quality of life, and physical function (Karimi et al., 2024).

This is in line with the growing evidence of the benefits of exercising in water, especially for those with musculoskeletal disorders (Tedeschi et al., 2024). The presence of water that makes the body float reduces the load on the joints, decreases pressure, and helps alleviate pain (Makowska et al., 2024). Additionally, the warmth of the water can improve blood circulation and relax the muscles, which helps relieve pain (HANDI, 2020). Although land exercises are also effective in reducing pain, additional benefits may be obtained with water therapy, especially for patients who experience pain when moving on land (Tong & Liu, 2024). The improvement in quality of life that occurs may be due to a combination of reduced pain, increased mobility, and improved physical function (Azra Sadat Etesami et al., 2022).

The holistic approach of hydrokinetic therapy that addresses various aspects of health simultaneously is likely to play a role in positive outcomes. However, it should be noted that despite physical improvements, many studies rarely measure the psychological and social impact on quality of life. Since osteoarthritis can affect mental health and social abilities, future research needs to take these aspects into account in measuring quality of life.

CONCLUSION

Based on the results of the literature analysis, hydrotherapy and land-based exercises have been proven effective in reducing pain, improving physical function, and enhancing the quality of life for osteoarthritis patients. (OA). The use of measurement tools such as WOMAC, NPRS, VAS, TUG, and 6MWT provides a clear picture of the changes occurring in patients. Although both therapies showed good results, hydrotherapy has advantages in terms of balance and mental quality of life. However, there are variations in the duration and frequency of therapy that need to be further investigated. Subsequent research is recommended to explore the optimal duration and frequency of therapy, as well as to conduct direct comparisons between hydrotherapy and land-based exercises with stricter controls. Additionally, research on long-term effects, combination therapy, and measurements of mental quality of life will provide deeper insights into the long-term benefits and potential of a multidisciplinary approach in OA treatment.

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