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The Role Of Physical Therapists In Promoting Balance And Fall Prevention In Older Adults

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Abstract

Choosing between water or land-based physical therapy activities to enhance balance, gait, quality of life, and minimize fall-related consequences in older individuals living in the community remains a debatable therapeutic choice for physiotherapists. Evaluate the efficacy of randomized or quasi-randomized controlled studies that used aquatic physical therapy exercises to enhance balance, gait, quality of life, and mitigate fall-related consequences in individuals with chronic degenerative osteoarthritis (CDOAs). The articles were examined in the databases MEDLINE/PubMed, EMBASE, SCOPUS, LILACS, Web of Science, CENTRAL (Cochrane Central Register of Controlled Trials), PEDro, CINAHL, SciELO, and Google Scholar. The studies exhibited low-quality findings for balance, gait, quality of life, and fear of falling. The results evaluated showed that both land-based and aquatic physical therapy exercises had a positive impact. However, aquatic physical therapy activities were shown to be more helpful in improving balance, gait, quality of life, and lowering fear of falling in individuals with chronic degenerative osteoarthritis (CDOAs). The meta-analysis revealed that participating in aquatic physical therapy exercises enhances functional reach by causing a 6.36cm anterior displacement of the center of pressure of CDOAs. Aquatic physical therapy activities are superior to land-based exercises in improving balance, gait, quality of life, and lowering the fear of falling in individuals with chronic degenerative osteoarthritis (CDOAs). Nevertheless, the clinical conclusion remains unclear owing to the methodological limitations of the research. It is recommended that future studies be done with increased methodological rigor to get high-quality information about the effectiveness of water physical therapy activities in improving the outcomes assessed in CDOAs.

Keywords: *Physical therapy, physical therapists, chronic degenerative osteoarthritis (CDOAs), geriatric people.*

1. Introduction

Balance disorders have a prevalence rate of 68% among those aged 65 and above. These diseases are characterized by symptoms such as imbalance, gait issues, instability, nausea, dizziness, vertigo, and frequent falls [1]. Falls are a leading cause of illness and death in older persons who live in the community, and each year, one-third of these individuals have falls [2]. Furthermore, it is worth noting that around 50% of individuals aged 80 years and beyond have had falls, with roughly 20% to 30% of them sustaining moderate or severe

injuries, such as fractures [2]. These fractures are responsible for almost 70% of unintentional fatalities in those aged 75 years and above [3].

The primary risk factors for falls in older adults with cognitive decline and other age-related conditions are connected with the deterioration of many bodily systems, including musculoskeletal, sensory, cardiovascular, and cognitive functions. Any alterations in these systems have been shown to increase the likelihood of falling in this population [4]. The incidence of falls in older adults has risen as a result of the global aging population, posing a substantial issue for healthcare professionals, especially physiotherapists [5].

Therapeutic exercise has a crucial role in reducing falls in older adults with cognitive and physical impairments, as stated in the fall prevention recommendations of the American and British Geriatrics Societies [6]. An effective therapeutic exercise program should include strength training, balance exercises, gait and motor coordination exercises. Studies have shown that exercise programs lasting more than 12 weeks, with 1-3 weekly sessions, have the most favorable outcomes [6]. Therapeutic exercise regimens that focus on repairing balance and gait with high frequency, length, and intensity may help reduce the risk of falling in CDOAs [7].

Physiotherapists often use land and water-based activities as primary therapeutic exercise regimens to enhance the balance and gait of individuals with chronic degenerative osteoarthritis (CDOAs). Nevertheless, many individuals with Chronic Degenerative Osteoarthritis (CDOA) have challenges while doing land-based workouts that require balance, gait, and motor coordination. These difficulties arise from a fear of falling or from postural instability induced by the intricate nature of the motor tasks involved in the exercise, which ultimately restricts their capacity to move on land [8,9]. Aquatic physical therapy serves as a substitute for land-based therapy for individuals who face difficulties. The warm water, buoyancy, and reduced fear of falling in the therapeutic swimming pool allow older adults to move more comfortably. This promotes increased confidence, motor skills, range of motion, and displacement of the center of mass.

Therefore, like land-based physical therapy, aquatic physical therapy involves using the physical characteristics of water, such as hydrostatic pressure, buoyancy, viscosity, and turbulence, to promote the tonic-postural responses and balance of older individuals with chronic degenerative orthopedic ailments (CDOAs) [8]. Subjects in the water maintain a stable upright stance over the base of support. Water movement and turbulence overload the postural control systems during standing, reaching movement (with feet fixed on the pool floor), and change of support movement (such as stepping). This relative motion of water causes displacement of the body's center of mass or the base of support, challenging the postural control system. This continuous stimulation leads to a reorganization of body balance stability, making aquatic physical therapy exercises effective for rehabilitating balance and gait in individuals with CDOAs.

Considering the evidence showing the effectiveness of both interventions in enhancing balance, gait, quality of life, and reducing fall-related outcomes in individuals with chronic degenerative osteoarthritis (CDOAs) [11–16], the choice between aquatic or land-based physical therapy exercises to improve these outcomes has become a debatable clinical decision for physiotherapists. The absence of systematic reviews evaluating the quality of evidence from these trials, as well as the lack of meta-analyses comparing the effectiveness of different therapies in improving outcomes in CDOAs, has prompted the need for the current research. The objective of this systematic review was to evaluate the quality of evidence from randomized or quasi-randomized controlled studies that used aquatic physical therapy exercises to enhance balance, gait, quality of life, and decrease fall-related outcomes in individuals with chronic degenerative osteoarthritis (CDOAs) [17-20].

The analysis included eleven studies, which showed improvements in balance, gait, quality of life, and a decrease in fear of falling among individuals with CDOAs following the therapies. However, it is important to note that the quality of this evidence is considered poor due to the methodological constraints and biases included in the trials.

The primary methodological constraints and biases identified were associated with three categories: biases in the selection of the sample, methodological biases, and characteristics of the older persons. Therefore, we made the decision to evaluate and analyze each individually, in the following manner.

2. Sampling biases in the selection process

Bruni et al [21] and Douris et al [22] did not provide information on randomization in their study. Allocation concealment, a methodological approach aimed at preventing researchers from knowing the group allocation of each volunteer beforehand, was not present in several experiments [21–24,25-27,28,29]. Additionally, four studies [23,24,30,31] did not provide details on how the randomization process was carried out. It is crucial to emphasize this step in clinical studies since it ensures that both the intervention and control groups are similar, thereby effectively reducing selection bias.

The analyzed studies lacked scientific rigor in the two stages, particularly in allocation concealment. This indicates that sample selection biases should be more effectively managed in future trials on the subject. Trials without allocation concealment resulted in an overestimation of the effect size of interventions by as much as 30% [32].

3. Blinding of outcome assessors

Another significant bias detected in six out of the eleven studies assessed was the lack of control over the blinding of outcome assessors. Blinding of outcome assessors ensures the reliability of the results by avoiding any influence of previous knowledge of sample allocation on their reaction to treatment (conduction bias) or evaluation of outcomes (detection bias). The absence of blinding of outcome assessors diminished the quality of evidence from the trials, casting doubt on the reliability of their findings. Non-double-blind studies tend to overstate the impact of interventions by 17% [32], highlighting the need for stricter control over the blinding of outcome assessors in future trials.

Another kind of bias identified in the evaluated trials was the loss of samples. Out of the eleven investigations, nine [21,23–29,31] reported sample losses and none of them completed an intention-to-treat analysis. Intention-to-treat analysis ensures that all participants are observed until the completion of the trial, regardless of any events that may happen to any of them, thereby mitigating the potential bias caused by sample loss. Excluding individuals who did not complete the trial from statistical analysis may lead to an overestimation of the effectiveness of the therapies. Intention-to-treat analysis is used to address this bias.

Another significant constraint observed in the studies was the ability to compare therapies. Two trials [22,31] conducted a comparison between a group that underwent aquatic physical therapy exercises and a group that did not perform any exercises. In trials that aim to analyze the effectiveness of a treatment, similar interventions are implemented in terms of exercise characteristics, session duration, number of days per week, and total duration. This ensures that the interventions can be compared effectively. At the conclusion of the study, writers may determine if the therapies are similar or whether any of them is better in improving the researched outcomes. This helps in making therapeutic decisions.

In cases when the control group does not get any intervention and the trial just compares the average results of the intervention and control groups, it is anticipated that the intervention group would achieve superior post-treatment outcomes, as shown by the

two studies [22,31]. The lack of treatment in the control group poses a challenge in reaching clinical decisions on the effectiveness of water physical therapy exercises in these studies, therefore indicating a limitation in this aspect.

Another study [25] did not directly evaluate the effects of doing physical therapy activities in water vs on land at the same time. A crossover experiment was undertaken, where the intervention group engaged in aquatic physical therapy activities while the control group did not participate in any exercises. Following a duration of twelve weeks, the control group started an intervention including aquatic physical therapy activities, whereas the intervention group abstained from exercising for the subsequent twelve weeks.

Therefore, out of the eleven studies reviewed, eight of them (namely trials 21, 23, 24, and 26-30) examined and compared the efficacy of aquatic and land-based physical therapy activities. The retention of this comparative model in future studies is crucial as it effectively directs decision-making and informs the clinical practice of physiotherapists.

It is important to mention that out of the eleven trials reviewed in this systematic review, only two trials [25 and 28] really calculated the sample size for their study. As a result, there was a limited pool of volunteers, consisting of only 395 older adults across the eleven trials. This small sample size poses a significant challenge in generalizing the findings of these studies. It is an additional methodological issue identified in the analyzed trials that needs to be addressed in future research on the topic.

4. Prejudices associated with the characteristics of elderly individuals

A significant bias observed in the trials was the imbalanced age distribution of the CDOAs in both the intervention and control groups. Out of the studies conducted, only two of them did not find any variation in the average age of the CDOAs. However, five trials showed a difference, with average age differences ranging from 1 to 8 years between different groups. In all of these trials, the intervention group, which underwent aquatic physical therapy exercises, consistently had the youngest age groups.

The disparity in average ages between the intervention and control groups introduces confounding bias in the studies. This raises doubts about whether the observed improvements in the intervention group's outcomes were due to the aquatic physical therapy exercises or simply because the participants were younger. This topic is significant since several studies have shown that as people age, their balance and gait deteriorate, increasing the likelihood of falls [33-35].

One further potential bias in the studied trials was the occurrence of sensory abnormalities in the older persons, such as hearing loss and vestibular dysfunctions, which have been extensively linked to the process of aging [36-38]. The studies did not include information on whether the samples had these abnormalities, which were not used as grounds for excluding participants in any of the trials. This knowledge is significant due to several studies indicating that sensorineural hearing loss is a common occurrence in older individuals [39-41]. Furthermore, older persons with hearing loss exhibit worse balance, restricted mobility, and an increased susceptibility to falls [42-44].

The presence of balance and gait issues in individuals with hearing loss, including children, adolescents, and adults, indicates that hearing loss may adversely impact balance and gait across all age groups. However, the utilization of hearing aids and cochlear implants enhances the ability to hear and has resulted in improved balance and walking ability, as well as a decreased likelihood of falls in older individuals with hearing loss [45,46]. This may be attributed to the enhanced auditory capabilities provided by these devices, indicating that hearing input plays a role in maintaining balance and motor skills [47].

The use of hearing aids or cochlear implants in older adults can enhance their balance by providing fixed environmental reference points. This allows sound signals to serve as spatial maps of the environment, leading to improved space-time orientation and balance. This raises the issue of whether it is appropriate to challenge existing paradigms and acknowledge hearing as an additional sensory system that has a role in controlling the balance of the human body [48].

Another factor of uncertainty in the trial samples, which is likewise associated with hearing loss and the process of aging [49,50], is the inclusion of older individuals with vestibular dysfunction. This information is significant because, in certain instances, one of the requirements for including older adults in a study was that they had experienced falls within the past six months. Vestibular dysfunction, which is a common occurrence in this population, is the primary cause of these falls [51]. Older individuals with vestibular dysfunctions have changes in their balance and gait, which increases their vulnerability to falls [52,53]. Therefore, the inclusion of older individuals with hearing loss and/or vestibular dysfunctions in the analyzed trial samples would introduce additional bias and potentially result in underestimating the impact of interventions. This is because these individuals experience greater difficulty with balance and walking.

5. Summary

Aquatic physical therapy activities shown superior efficacy compared to land-based workouts in enhancing balance, gait, quality of life, and mitigating fear of falling in individuals with chronic degenerative orthopedic ailments (CDOAs). Nevertheless, given the limited quality of data, it is advisable to use care when interpreting the findings of the assessed studies.

The examination of the benefits and detrimental effects of the therapies was complicated due to the low quality of evidence and the lack of information in the trials about the existence or absence of adverse effects. As a result, this clinical decision remains unclear. The research does not provide a reliable, definitive assessment on the effectiveness of water physical therapy exercises in improving balance, gait, quality of life, and reducing fear of falling in individuals with chronic degenerative orthopedic ailments (CDOAs).

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