The Impact of Hydrotherapy on Motor Functions in a Patient with Huntington's Disease

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ABSTRACT
Hydrotherapy is a complementary method in neurological rehabilitation, as it allows safe and flexible exercise. Huntington's disease (HD) causes a gradual loss of motor and functional abilities. The purpose of this article was to evaluate the impact of hydrotherapy on balance, gait and functional independence in a patient with HD. The research consists of a theoretical and empirical part. In the theoretical part, we analyzed the literature on hydrotherapy and HD. In the empirical part, we conducted a case study where a patient with HD performed an individually tailored hydrotherapy program for three months. The effects were measured using the Berg Balance Scale, Functional Independence Measure and 10-Meter Walk Test. After completing the hydrotherapy program, the patient showed improvements in balance, walking gait cycle and partial functional independence. The BBS score increased, indicating better stability in daily tasks. The 10MWT showed a shorter performance time, indicating greater movement efficiency. On the FIM scale, the progress was detected in only one of the seven categories. Hydrotherapy is a specialized form of physiotherapy treatment that serves as an additional method in the rehabilitation of patients with HD. It allows safe movement, improves functional motor patterns, and adapts to the individual's abilities. **Keywords:** physiotherapy, hydrotherapy, Huntington's disease, neuromuscular disease

Vpliv hidroterapije na motorične funkcije pacienta s Huntingtonovo boleznijo

POVZETEK
Hidroterapija je dopolnilna metoda v nevrološki rehabilitaciji, saj omogoča varno in prilagodljivo vadbo. Huntingtonova bolezen (HD) povzroča postopno izgubo motoričnih in funkcionalnih sposobnosti. Namen strokovnega članka je bil oceniti vpliv hidroterapije na ravnotežje, hojo in funkcionalno neodvisnost pri pacientu s HD. Raziskava je sestavljena iz teoretičnega in empiričnega dela. V teoretičnem delu smo analizirali literaturo o hidroterapiji in HD. V empiričnem delu smo izvedli študijo primera, kjer je pacient s HD tri mesece izvajal individualno prilagojen program hidroterapije. Učinke smo merili s testi Bergova ravnotežna lestvica, Merilo funkcionalne neodvisnosti in Test hoje na 10 metrov. Po zaključenem programu hidroterapije smo pri pacientu zabeležili izboljšave v ravnotežju, ciklu hoje in delni funkcionalni neodvisnosti. Rezultat na BBS lestvici se je zvišal, kar kaže na boljšo stabilnost pri vsakodnevnih nalogah. Vrednosti pri 10MWT so pokazale krajši čas izvedbe, kar pomeni večjo učinkovitost gibanja. Pri FIM lestvici smo napredek zaznali le pri eni od sedmih kategorij. Hidroterapija je specializirana oblika fizioterapevtske obravnave, ki služi kot dopolnilna metoda pri rehabilitaciji pacientov s HD. Omogoča varno gibanje, izboljšanje funkcionalnih motoričnih vzorcev in prilagoditev posameznikovim sposobnostim. **Ključne besede**: fizioterapija, hidroterapija, Huntingtonova bolezen, nevromišična obolenja.

INTRODUCTION

Huntington's disease (HD) is one of the disorders that profoundly affects the daily lives of patients and their families. Individuals face uncontrolled movements, progressive loss of cognitive abilities, and increasing psychological difficulties, with no possibility of fully managing these symptoms. This is the reality for people living with this incurable neurodegenerative disorder. The disease affects not only the body but gradually exhausts the mind as well, leading to a loss of independence and growing reliance on others (22). HD is a progressive condition caused by a mutation in the huntingtin (HTT) gene. This mutation results in the production of an abnormal huntingtin protein that progressively destroys neuronal cells. Extensive neuronal degeneration occurs primarily in the basal ganglia, which play a crucial role in motor control and coordination (22). Damage to these brain regions gives rise to characteristic motor disturbances, including involuntary, rapid body movements, abnormal muscle contractions, and slowed motion. Over time, these symptoms lead to severe disability and a marked reduction in quality of life (19). Huntington's disease is an autosomal dominant disorder, meaning that each child of an affected parent has a 50% chance of inheriting the condition. The mutation occurs in the HTT gene on chromosome 4, where the number of CAG (cytosine–adenine–guanine) trinucleotide repeats serves as a key risk factor. In healthy individuals, the number of CAG repeats ranges between 10 and 35, whereas patients with HD have more than 40 repeats, leading to the formation of a toxic protein (12). Epidemiological data estimate the global prevalence of HD between 2.7 and 5.7 individuals per 100,000 population. Chorea is among the most prominent motor symptoms, characterized by involuntary movements that patients cannot control. Other common symptoms include dystonia, which causes abnormal muscle contractions and spasms, and bradykinesia, which slows movement and makes daily activities increasingly demanding (19). At present, no cure exists for HD, and treatment focuses on symptoms management and improving patients' quality of life (23). In recent decades, hydrotherapy has emerged as a promising complementary intervention for managing neurodegenerative disorders, including HD. Hydrotherapy involves performing active and passive exercises in warm water, offering multiple advantages for patients. Due to its buoyancy, water reduces excessive stress on joints and muscles, enabling patients to move and exercise more easily and safely (7). The viscosity of water provides natural resistance that helps strengthen muscles, while hydrostatic pressure contributes to reducing swelling and promoting circulation (3). Warm water also promotes tissue relaxation, which is particularly beneficial for patients experiencing stiffness and muscle spasms (2). Although hydrotherapy has shown positive effects in the management of other neurodegenerative diseases such as Parkinson's disease and multiple sclerosis, empirical evidence on its impact in HD remains limited. Motor symptoms in HD are distinct and differ substantially from those in other disorders, highlighting the need for larger and more comprehensive studies to confirm these findings and establish standardized hydrotherapy protocols for HD patients (8). Physiotherapy has already proven to be a key component of care, but hydrotherapy offers an additional avenue for improving outcomes. Further research is required to confirm the effectiveness of hydrotherapy in managing HD symptoms. The objective of this was to investigate the effects of hydrotherapy on an individual with HD. Specifically, the study aimed to assess the impact of hydrotherapy on motor functions, including balance, functional independence, and gait cycle, through a case study approach. Based on a comprehensive review of the literature, recommendations were formulated for the implementation of a hydrotherapy protocol in patients with HD.

METHODOLOGY

The research comprised both a theoretical and an empirical component. In the theoretical part, a comprehensive review of national and international literature on HD and hydrotherapy was conducted. Relevant scientific and professional literature was identified using the databases Google Scholar, ScienceDirect, PubMed, Medline, PEDro, and the Cobiss+ library information system. The search was performed using keywords and their combinations in both Slovenian and English, including »hydrotherapy«, »physiotherapy«, »Huntington's disease«, and »neuromuscular disorders«. Inclusion criteria encompassed articles published between 1990 and 2025 in Slovenian or English, within peer-reviewed scientific journals. Literature that was not thematically relevant or published in other foreign

languages was excluded. Subsequently, the findings from the literature review were compared with the results obtained from the present case study, allowing for a multidimensional analysis of the core issues and facilitating a critical evaluation of the findings within the context of the research framework. Participant selection for the study was guided by specific inclusion and exclusion criteria. Inclusion criteria required that the participant has a confirmed diagnosis of HD, be able to participate in a hydrotherapy program, and have no contraindications to water-based exercise (e.g., open wounds or respiratory issues). Exclusion criteria included severe cognitive or psychological impairments that could interfere with participation, as well as additional motor disorders unrelated to HD, which could confound study outcomes.
In empirical part a case report is introduced examining the effects of hydrotherapy on motor function in a patient with HD. The physiotherapy sessions were conducted in a shallow pool (chest-deep water) at 28 °C and involved one physiotherapist, one assistant, and the participant. The patient followed a structured hydrotherapy program, and motor functions were assessed using standardized clinical tests. The study was conducted over three months, with the patient receiving therapy twice weekly. The duration of each session and the intensity of exercises were adapted to the participant's abilities. Each session concluded with a cool-down and relaxation phase, during which the participant floated in the water with support from flotation rings and a neck pillow. Measurements were taken before and after the prescribed hydrotherapy program.

RESULTS

The results presented in the research are organized into two thematic sections. The first section comprises a systematic review of the scientific literature and the second part presents the results of the experimental research.
Using selected keywords and phrases, a total of 493 studies were identified in the databases Google Scholar, ScienceDirect, PubMed, Medline, and PEDro. After removing duplicate records, 349 studies remained for further analysis. Based on a review of titles and abstracts, 310 articles were excluded for not meeting the predefined inclusion criteria. A detailed review was conducted on the remaining 16 studies, which were analyzed thoroughly. Following additional content evaluation and the application of exclusion criteria, 7 studies were included in the final analysis. The entire study selection process and search strategy are presented in detail in a PRISMA flow diagram.

Tabel 1: Characteristics of included studies.

Title Authors and year of publication	Study objective	Results
Participants', caregivers', and professionals' experiences with a group-based rehabilitation program for Huntington's disease: a qualitative study. Frich et al., 2014 (6)	The aim of the study was to explore the experiences of people with HD, caregivers and professionals in a rehabilitation program that included hydrotherapy	Participants, caregivers, and professionals described group rehabilitation for HD as beneficial and meaningful. Patients reported improved balance and gait, better swallowing, fluent speech, more accurate memory, increased self-esteem, and lower levels of depression. The importance of interdisciplinary collaboration was emphasized.

Title Authors and year of publication	Study objective	Results
Aquatherapy for people with huntington's disease. Fossmo et al., 2016 (5)	The purpose of the study was to assess the feasibility, safety, and experience of a hydrotherapy program for individuals with early to mid-stage HD.	Hydrotherapy was well-received by patients with HD. Water enabled them to perform exercises that were often not feasible on land. It contributed to improving body functions, resulting in a reduction in chorea.
Hydrotherapy in Huntington's disease. Sheaff, 1990 (20)	The purpose of the intervention study was to investigate the potential benefits of hydrotherapy for patients with late-stage HD. The investigators focused on improving physical function, muscle strength, and overall quality of life. The subjects' progress was monitored and assessed in muscle strength, balance, and mobility.	The study showed that hydrotherapy in warm water was associated with a reduction in muscle tone and greater relaxation in HD patients. The final results showed a reduction in chorea.
Feasibility and Safety of an Aquatherapy Program in Mid- to Late-Stage Huntington Disease. Coleman and Leavitt, 2015 (16)	The purpose of the intervention study was to assess the feasibility and safety of a hydrotherapy program for patients in the mid- to late-stage HD.	The study confirmed the feasibility and safety of a hydrotherapy program in patients with HD. The involvement of experienced therapists and the adaptation of exercises to the advanced stages of the disease proved to be key factors for the successful implementation of the therapy. Patients reported improvement in well-being, sleep, and a higher quality of life.
Effects of a Two-Year Intensive Multidisciplinary Rehabilitation Program for Patients with Huntington's Disease: a Prospective Intervention Study. Piira et al., 2014 (13)	The aim of the study was to evaluate the effects of a two-year intensive multidisciplinary rehabilitation program, which included hydrotherapy, in patients with early to moderate HD. Rehabilitation cycles of the prospective study focused on physical exercise, social activities, and group and educational sessions. The program included monitoring of cognitive function, balance, gait, activities of daily living, quality of life, anxiety, depression, and body mass index.	A two-year rehabilitation program in 6 HD patients tested showed a slight deterioration in walking, no significant change in any motor component, balance remained unchanged. Cognitive processes improved minimally, anxiety and depression decreased. The level of quality of life improved but not significantly. BMI was slightly increased at the final testing.

Title Authors and year of publication	Study objective	Results
Effects of a One Year Intensive Multidisciplinary Rehabilitation Program for Patients with Huntington's Disease: a Prospective Intervention Study. Piira et al., 2013 (14)	The aim of the study was to evaluate the effects of a one-year intensive multidisciplinary rehabilitation program, which included hydrotherapy, on patients with early to mid-stage HD. The prospective study included assessment of motor function, cognitive abilities, anxiety and depression, activities of daily living, quality of life, and BMI.	A one-year rehabilitation program in 31 HD patients tested showed a significant improvement in the gait cycle, here we can talk about a clinically important change. Improvement was also visible in balance. The Bartel scale for daily tasks remained the same. There was almost no improvement in cognitive processes. The level of anxiety and depression decreased significantly. BMI increased.
Cognitive Performance After a One-Year Multidisciplinary Intensive Rehabilitation Program for Huntington's Disease: An Observational Study. van Walsem et al., 2018 (21)	The aim of the study was to assess changes in cognitive functioning in patients with early to moderate HD after a one-year intensive multidisciplinary rehabilitation program that included non-specific cognitive stimulation in addition to physical exercises. As part of the observational study, a comprehensive neuropsychological assessment was performed before and after the program.	After a one-year rehabilitation program, HD patients showed a general decline in cognitive processes. A minimal improvement in phonetic fluency was observed. Of all cognitive tasks, only the SDMT showed statistical improvement. Psychomotor speed and long-term verbal memory showed a decline.

The following section presents the results of a three-month study investigating the effects of hydrotherapy as a physiotherapeutic intervention in a patient with HD, who received an individual hydrotherapy program with a physiotherapist. The subject was male and 62 years old. The diagnosis was confirmed in 2005. Since then, the subject has been regularly involved in the implementation of various methods of physiotherapy treatment. The collected data includes the analysis of balance (BBS), functional independence (FIM), and gait cycle (10MWT).

Tabel 2: Comparison of results obtained by BBS

Testing Time	**BBS result**
Before therapy	26
After therapy	36
Difference	10

Analysis of the results obtained using the BBS indicates improvement in the participant's static and dynamic balance following the completion of physiotherapeutic treatment. In the initial assessment, the participant scored 26 points, while in the second assessment the score increased to 36 points, representing an absolute improvement of 10 points (17.9%).

Table 3: Comparison of the results obtained by FIM

Testing Time	FIM results
Before therapy	61
After therapy	60
Difference	1

Analysis of the results obtained using the FIM indicates an overall decrease in the participant's total score. In the initial assessment, the total score was 61 points, while in the second assessment, the participant scored 60 points, representing a decrease of 1 point (1.64%).

Table 4: Comparison of the results obtained by 10MWT

Testing Time	Mean time for comfortable walking	Mean time for fast walking
Before therapy	25,23 s	22,82 s
After therapy	21,96 s	20,28 s
Difference	3,27 s	2,54 s

Analysis of the results obtained from the 10MWT revealed an improvement in walking speed following the completion of therapy. Before the physiotherapeutic intervention, the participant required an average of 25.23 seconds for comfortable walking and 22.82 seconds for fast walking. After the intervention, the time for comfortable walking decreased to 21.96 seconds, an improvement of 3.27 seconds, while the time for fast walking was reduced to 20.28 seconds, representing an improvement of 2.54 seconds compared to the initial assessment.

DISCUSSION

Although the neurodegenerative nature of HD prevents complete symptom cessation and leads to continuous progression, various physiotherapeutic techniques can stimulate neuroplastic responses, preserve remaining motor abilities, and slow further deterioration. Hydrotherapy represents a unique intervention that combines physical support, reduced joint loading, and enhanced sensory feedback. These characteristics make it particularly suitable for patients with neurological disorders. By reducing the effects of gravity, movement in water allows patients to perform exercises more freely and safely. This enables the repetition of key motor patterns that are often difficult to execute on land, potentially contributing to the preservation or partial restoration of motor pathways affected by the disease. In addition to physical improvements, hydrotherapy also offers important psychological benefits. Enhanced mood, reduced anxiety, and an overall sense of well-being can alleviate caregiver burden and promote greater autonomy in daily life. These findings align with the broader body of literature on neurorehabilitation, which supports multisensory and task-specific physiotherapeutic approaches in managing progressive neurological disorders. Review of scientific literature (3) on the therapeutic effects of water highlights that aquatic exercise leads to pain reduction, improved joint mobility, and increased muscle activation, all of which directly contribute to greater independence and quality of life among patients with various chronic conditions. It was confirmed (18) that aquatic therapy enables safe enhancement of muscle strength and functional capacity in patients recovering from orthopedic surgery. The findings, however, are also transferable to neurological populations, as they are based on the mechanisms of unloading, proprioceptive stimulation, and repetition of motor patterns. It has been further emphasized (7) that the aquatic environment is particularly suitable for neurological rehabilitation due to its ability to promote rich sensory feedback, which is essential for re-establishing motor control following central nervous system damage. The psychological effects of hydrotherapy are likewise well documented. Exercising in water can reduce fear of falling, increase confidence in movement, and allow patients to move with greater freedom and less pain—factors that enhance motivation and engagement in the rehabilitation process (9). Studies have also reported improvements in mood, reduced anxiety, and enhanced self-image following regular aquatic exercise.

These effects are especially important for patients with progressive diseases, where the psychosocial dimension of therapy plays a crucial role in sustaining long-term participation in rehabilitation. Although most of these studies were conducted with patients suffering from other neurological or orthopedic conditions, such as Parkinson's disease, multiple sclerosis, or hip osteoarthritis, their methodological structure and physiological rationale are comparable and therefore indirectly applicable to HD. Given the similar challenges faced by these individuals, including impaired balance, reduced coordination, and decreased independence, the use of hydrotherapy represents a logical and evidence-based therapeutic approach for patients with HD. In the present case study, the participant demonstrated measurable improvements in balance, functional mobility, and walking speed. These findings suggest that hydrotherapy offers not only short-term benefits but may also serve as a component of a comprehensive long-term rehabilitation strategy aimed at slowing the decline in physical function characteristic of HD. To assess baseline status, we used the BBS, a validated and widely used tool for quantitatively measuring balance ability during functional tasks. At the initial assessment, the participant scored 26 points, representing 46.4% of the maximum possible score of 56 points. The average score per task was 1.86 points, consistent with documented levels of balance deficits in individuals with moderately expressed HD symptoms. The highest scores (4 points) were achieved on tasks involving sitting without back support and sitting without back support using hands, indicating relatively preserved static balance in the seated position and the ability to maintain trunk stability without external support. In contrast, the lowest scores (0 points) were recorded for tasks requiring a higher level of dynamic stability, including 360° turns, alternately placing a foot on a step or stool, tandem stance, and single-leg stance. These tasks represent significant challenges for individuals with impaired sensorimotor control and reduced proprioceptive awareness, which are commonly observed in patients with neurodegenerative disorders. Following the three-month aquatic physiotherapy intervention, BBS assessment was repeated. The participant achieved 36 points, representing 64.3% of the total possible score, with an average of 2.57 points per task. This corresponds to an absolute improvement of 10 points and a relative increase of 38.5% compared to baseline. Notable improvements were observed in tasks such as rising from a chair, standing without support, sitting without support, transfers, and picking up an object from the floor, where the participant achieved maximum scores (4 points). These results confirm improved trunk stability, greater capacity for postural transitions, and enhanced functional mobility in daily life activities. The only task without improvement was tandem stance, where the participant remained at 0 points even after therapy. This task, which demands a high level of center-of-gravity control on a reduced base of support, remains a critical challenge, reflecting the limits of adaptation in advanced neurological pathology. These empirical findings are supported by contemporary scientific literature that demonstrates the effectiveness of hydrotherapy in improving balance in individuals with neurological impairments. The clinical guidelines for physiotherapeutic management of HD (17) emphasize the importance of structured exercise programs including balance, strength, and coordination training. Although hydrotherapy was not analyzed in isolation, the authors underline the need for a safe and supportive environment that allows repetitive practice of complex motor tasks with minimal risk of falling, an inherent advantage of aquatic therapy. This approach aligns with disease progression, where loss of postural control is often one of the earliest indicators of functional decline. In the systematic review (11) they had analyzed the effects of hydrotherapy on mobility in adults with neurodegenerative disorders and found moderate evidence supporting the use of aquatic exercise to improve dynamic balance and gait speed. Although included studies were limited in scope and quality, the findings suggest potential benefits of hydrotherapy for enhancing functional independence in this population. Further support is provided by researchers (15), who studied the effects of hydrotherapy in individuals with neurodegenerative disorders. They reported that exercise in warm water reduces muscle spasticity and chorea while positively affecting balance control. The reduced mechanical load on joints and muscles allows more controlled movement and more effective activation of muscle groups, which are often too weak to perform full functional tasks. Consequently, patients show improved body position awareness and muscle synergy, directly contributing to greater stability. The Aquatic Therapy Section of the American Physical Therapy Association (1) also confirms the positive

impact of hydrotherapy on static and dynamic balance in neurological patients. Key advantages include slower movements, longer sensory processing time, and the ability to execute complex motor tasks more accurately. These features are particularly valuable in neurodegenerative conditions, where the capacity for rapid adaptation gradually declines and compensatory mechanisms are limited. The literature supports the notion that hydrotherapy, due to its unique physical properties, has a positive effect on balance in individuals with HD. The supportive nature of water facilitates tasks that would be too challenging on land, enables the development of more reliable motor patterns through increased repetitions in a safe environment, and stimulates the vestibular system. Increased activation of trunk and lower-limb muscles, together with sensory feedback from the aquatic environment, contributes to the reorganization of sensorimotor pathways in the central nervous system. These findings confirm that a structured hydrotherapy program functions not only as a supportive exercise modality but also provides rehabilitative effects, enhancing functional balance in patients with progressive neurological disorders such as HD. The premise of the idea that the values obtained after the hydrotherapy program would show greater functional independence and autonomy in the participant is based on the fact that the aquatic environment serves as a necessary tool for enabling the learning or practice of functional motor patterns. This allows for improved execution of functional tasks, enhanced muscular endurance, and promotes greater independence in daily activities. To assess overall functional capacity and the level of independence, we used the FIM, which allows for quantitative evaluation across seven key categories. These included self-care, sphincter control, mobility, communication, psychosocial functioning, and cognitive abilities. Higher scores on this scale indicated a higher level of independence, while lower scores reflected a need for greater external assistance. In analyzing the collected FIM results, we found a general decrease in the participant's total score, although a closer examination of individual segments revealed improvements. In the first measurement, the total score was 61 points (48.41%), while in the second measurement, the participant scored 60 points (47.62%), representing a relative decrease of 1 point (1.64%). Analysis of the self-care results revealed a complex picture of partial functional progress, which was not consistent across all FIM subcategories. While some segments remained unchanged, others showed either improvement or deterioration. The participant maintained stable independence in feeding and personal hygiene, as reflected by unchanged scores. In contrast, bathing and upper body dressing showed an increase from 3 to 4 points (33.33%). These activities clearly demonstrated improved motor coordination and greater efficiency in performing similar tasks. Particularly in bathing, an increased ability to perform movements independently was observed, which may be attributed to enhanced bodily control and greater confidence in performing daily activities. However, progress was uneven. Lower body dressing, where the score dropped from 4 to 2 points, and toilet use, where the score also fell from 2 to 1 point, were tasks that showed a clear deterioration (50%). These results may be linked to specific coordination limitations, reduced mobility, or increased dependence on assistance. Despite individual improvements, the overall self-care score did not change. This outcome indicates that the impact of therapy on self-care tasks was present but limited and uneven among different activities. In the sphincter control domain, no progress was observed. The participant received the same score (1 point) in both measurements for both urinary and bowel control. The unchanged score confirms that incontinence problems remained despite the therapeutic program. Improvement in functional mobility was therefore not achieved, as the patient continued to require assistance or adaptive devices to perform basic physiological needs. Such regression in functional ability emphasizes the limitations of hydrotherapy, particularly in areas resulting from complex neurological impairments, which require targeted interventions. In the mobility domain, the participant demonstrated the most pronounced and consistent progress among all evaluated FIM categories. In transfers between bed, chair, and wheelchair, the participant's score increased from 4 to 6 points (50%), representing an increase in the ability to move independently between different surfaces without constant assistance. Similar progress was noted in toilet transfers, which increased from 4 to 5 points (25%). Improvements were also observed in bathroom transfers, such as using a shower or bathtub, which increased from 4 to 6 points (50%). These data can be associated with reduced dependence on others and greater ability for safe, controlled movement in a private

environment. Functional progress was also noted in overall mobility. The participant's walking score increased from 4 to 6 points (50%), confirming greater endurance and stability during independent movement. Even more pronounced improvement was observed in stair navigation, where the score doubled from 3 to 6 points (100%). Such a leap indicates increased capacity for vertical mobility, requiring high levels of coordination, strength, and balance. Accordingly, it can be concluded that hydrotherapy contributed to improving the patient's locomotor independence. Regarding communication, post-therapy results revealed a decline in functional capacity. In expressive communication, the participant experienced a decrease, dropping from 5 points to 2 points (60%), indicating an reduced ability for effective verbal or nonverbal communication. Similarly, comprehension decreased from 6 to 3 points (50%), reflecting a diminished ability to understand messages, follow verbal instructions, and respond appropriately in communicative contexts. This functional decline likely reflects progression of the underlying neurological pathology, which often affects language function, information processing, and social interaction. Deterioration in communication skills strongly impacts overall daily functioning, limiting the ability to express needs, participate in therapy, and maintain social interactions. Despite positive effects of hydrotherapy on physical function, these results indicate that the program did not prevent decline in tasks where cognitive and neuropsychological factors are critical for maintaining independence. In the psychosocial domain, a negative change was observed, with social interaction scores decreasing from 5 to 3 points (40%). This may reflect reduced social engagement, decreased motivation for interpersonal communication, or increased symptoms of emotional disorders, such as anxiety and depression. These factors often accompany chronic neurological diseases and can substantially influence overall functional independence. Psychosocial regression may indirectly reduce the effectiveness of rehabilitation procedures by affecting patient participation, engagement, and coping ability with daily life demands. Moderate regression was also observed in cognitive functions, indicating reduced adaptability and impaired ability to manage everyday cognitive challenges. In problem-solving, the score decreased from 3 to 2 points (33.33%), indicating a reduced ability for logical reasoning, strategic planning, and effective response in novel or unexpected situations. Memory scores declined from 4 to 3 points (25%), reflecting difficulties in recalling information, temporal and spatial orientation, and sustaining attention. These cognitive deficits have significant consequences for daily autonomy and the individual's functional integration into their environment. Despite the individually structured hydrotherapy program, the study results indicate that in certain aspects of functional independence, deterioration occurred. While progress was observed in mobility, other domains, such as self-care and cognitive abilities, demonstrated reduced ability to perform tasks independently, reflected in lower FIM scores. These patterns of regression confirm the progressive nature of the neurological disease and secondary complications that limit the effectiveness of the rehabilitation program. Similar findings were reported (4) for some participants, initial improvements in mobility were followed by stagnation or even decline. The authors emphasize that while aquatic exercise produces temporary improvements due to buoyancy support and reduced joint load, long-term functional progress is often hindered by the progressive course of the disease, highlighting the need for a multidisciplinary approach, incorporating cognitive, social, and psychological rehabilitation. The premise of the idea that the values obtained after the hydrotherapy program would show increased walking speed and stride length in the participant is based on the assumption that hydrotherapy has specific effects on improving the biomechanical components of gait. Its physical properties, such as buoyancy, resistance, and specific temperature, create ideal conditions for exercise. Buoyancy reduces mechanical joint load and facilitates movement. Water resistance allows for controlled movement patterns and more repetitions with less fatigue. Heat contributes to muscle relaxation and greater activation. These properties provide a unique environment in which the strengthening of muscle synergy, essential for motor coordination and efficient walking, is promoted. In our study, we focused on gait assessment using objective measurement parameters, particularly walking speed and stride length. To verify the hypothesis, we measured the participant's walking speed using the standardized 10MWT, which allows for quantitative evaluation of changes in locomotor performance. The test aimed to determine whether a structured hydrotherapy program contributed to improvements in

basic gait parameters, such as walking speed and stride length, which directly reflect the level of motor control and coordination. Before starting therapy, the participant required an average of 25.23 seconds for comfortable walking and 22.82 seconds for fast walking. After completing the therapy, the time for comfortable walking decreased to 21.96 seconds, representing an absolute improvement of 3.27 seconds or 12.96%. The fast walking time also improved to 20.28 seconds, representing a gain of 2.54 seconds or 11.13%. Analysis of the 10MWT results showed an improvement in walking speed after hydrotherapy, confirming the effectiveness of the treatment within the context of a rehabilitation program for a participant with HD. Such progress can be understood as a result of greater trunk stability, improved lower limb coordination, and reduced energy expenditure per step. Our findings are also supported by existing research highlighting the positive effect of hydrotherapy on gait in individuals with neurodegenerative diseases. Hydrotherapy has been emphasized (10) as an effective therapeutic approach for nervous system disorders. The author specifically states that hydrotherapy can improve spatiotemporal gait parameters, reduce muscle stiffness, and promote safe movement, which aligns with our findings in a patient with progressive motor impairment. This study confirms that hydrotherapy functions not only as supportive rehabilitation but also as an active factor in restoring functional mobility in patients with neurodegenerative conditions. It has been similarly highlighted (15) that the aquatic environment, due to its physical properties such as buoyancy, resistance, and thermal stability, enables safe and effective execution of gait cycle exercises. Specifically for HD, they note that hydrotherapy can reduce chorea, improve coordination and balance, positively affecting gait patterns. Warm water contributes to muscle relaxation, while water resistance allows for controlled movement, together enhancing stability and gait efficiency. After completing the hydrotherapy program, the participant showed a clear improvement in walking speed, directly reflecting progress in motor control and movement coordination. Increased stability during walking, shorter task completion times, and a safer movement pattern all point to effective rehabilitation of the locomotor system.

CONCLUSION

This study represents the first documented case of an individually structured hydrotherapy protocol applied to a patient with HD in the Slovenian professional context. While international studies have examined aquatic therapy for neurodegenerative diseases, most focus on Parkinson's disease or multiple sclerosis. Research specifically targeting HD, particularly on balance, gait, functional mobility, and psychological well-being, remains scarce. Our findings demonstrate that a structured hydrotherapy program can lead to measurable improvements in balance and gait, particularly in movement coordination, transitions from standing to walking, and reduced instability. Although overall functional independence did not show any change, specific mobility tasks improved, and the patient reported increased satisfaction, relaxation, and confidence during sessions. Hydrotherapy also promoted focus, reduced compensatory movements, and improved postural stability in the aquatic environment. The study highlights the therapeutic potential of water-based interventions, emphasizing that hydrotherapy is more than exercises in water, it requires specialized knowledge of biomechanics, buoyancy, and resistance, and careful adaptation to patient needs. While limitations include the case study design and short observation period, the results provide a valuable starting point for developing tailored protocols for HD patients. In conclusion, hydrotherapy can positively impact motor function, mobility, and psychological well-being in patients with HD when integrated into a structured rehabilitation program. This work underscores the importance of recognizing hydrotherapy as a key component of modern neurorehabilitation, offering potential improvements in independence and quality of life for individuals with progressive neurological disorders.

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