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PHYSICAL THERAPY RESEARCH

CASE REPORT

Hydrotherapy after Prolonged Inactivity in A Patient with Rheumatoid Arthritis Was Associated with Recovery of Physical Activity and Return to Work: A Case Report

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ABSTRACT. Background: Long-term physical inactivity may lead to impaired physical function and limited social participation in patients with rheumatoid arthritis (RA). However, there are few reports on the process of recovery of physical function and physical activity following long-term physical inactivity, or on the efficacy of low-frequency aquatic therapy. Case Report: We report the case of a patient with RA who had a marked decline in physical function and activity levels during prolonged pandemic-related isolation, followed by recovery after hydrotherapy. A 57-year-old woman working as a street vendor underwent baseline assessments at her initial visit, and hydrotherapy was initiated. However, the coronavirus disease 2019 (COVID-19) pandemic caused a prolonged interruption of therapy and a reduction in daily activity. Two years later, she returned with self-reported functional decline. Reassessment showed decreased knee extensor strength, reduced 6-min walk distance, and impaired 30-second chair stand performance compared with baseline. An 8-week hydrotherapy program was implemented, consisting of aquatic walking, squatting, and thigh lift exercises performed once weekly for 90 min. Following the intervention, improvements were observed in exercise endurance, lower limb function, and physical activity levels compared with 2 years prior. Furthermore, no worsening of RA disease activity was observed. Conclusions: Once-weekly hydrotherapy in patients with RA may promote the recovery of exercise tolerance and objectively assessed physical activity following prolonged inactivity. In our patient, these improvements led to a return to work without any worsening of disease activity, suggesting that hydrotherapy may contribute to the restoration of physical function and the promotion of social participation.

Key words: Rheumatoid arthritis, COVID-19, Exercise endurance, Physical activity, Hydrotherapy

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Introduction

Decreased physical activity may increase cardiovascular morbidity and mortality in patients with rheumatoid arthritis (RA)[1,2]. During the coronavirus disease 2019 (COVID-19) pandemic, stay-at-home policies were widely mandated to prevent the spread of infection. An unfortunate effect of this was that prolonged periods of staying indoors resulted in reduced physical activity levels in many individuals[3,4].

Hydrotherapy is a form of exercise therapy that utilizes the physical properties of water, including buoyancy, viscosity, hydrostatic pressure, and temperature[5,6]. It is especially beneficial for patients with RA because it allows prolonged exercise while minimizing joint stress. Its effectiveness

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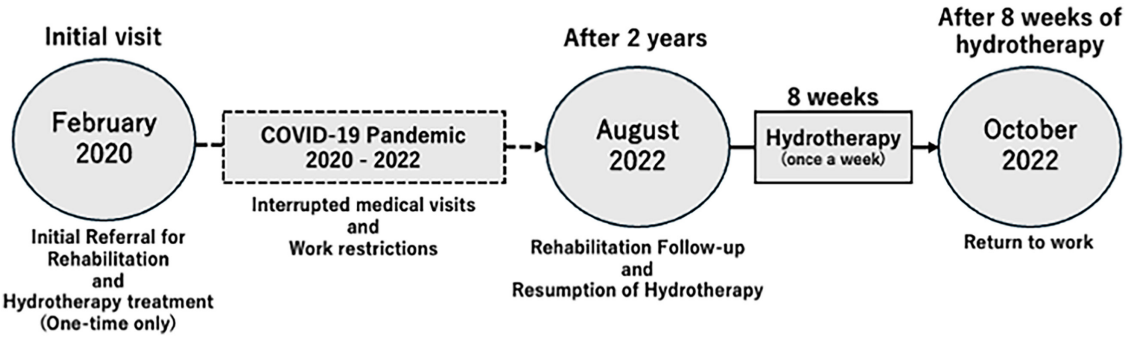


Fig. 1. Medical history and clinical course of treatment.

when performed 2 to 3 times per week has been widely demonstrated[7,8].

Here, we describe the case of a patient with RA who worked as a street vendor. Due to a 2-year interruption of work and prolonged isolation during the COVID-19 pandemic, there was a decline in physical activity and functional capacity, which ultimately hindered her return to work. We describe how these functions improved through weekly prolonged hydrotherapy sessions.

Written informed consent for publication of this case report was obtained from the patient. This report was prepared in accordance with established case report guidelines and includes all relevant information.

Case Presentation

The patient was a 57-year-old woman with a body mass index (BMI) of 25.6 kg/m². She was diagnosed with RA by a local rheumatologist in 2016 and had been treated with oral methotrexate (4 mg). The medical history and clinical course of this case are shown in Figure 1.

In February 2020, she was referred by her primary care physician to the Department of Rehabilitation at our hospital for initiation of hydrotherapy. Her chief complaint was decreased physical endurance, which manifested as frequent fatigue during work. The patient reported a pain intensity of 20/100 on the visual analog scale, with pain mainly affecting the joints of both hands and wrists. According to the Steinbrocker classification, the disease was categorized as stage III. Disease activity was low, with a Disease Activity Score 28–C-reactive protein (DAS28-CRP) of 2.8.

The patient had no notable past medical history and reported no impairments in activities of daily living or instrumental activities of daily living. Exercise endurance was assessed using the 6-min walk test (6MWT)[9] and the 30-second chair stand test (CS-30)[10]. We evaluated upper and lower limb muscle strength. Grip strength was measured using a Smedley digital dynamometer (TKK 5401 Grip-D; Takei Scientific Instruments, Niigata, Japan). Knee extensor muscle strength was measured during maximal isometric knee extension using a handheld dynamometer (μTas F1; ANIMA, Tokyo, Japan). All muscle strength measurements were performed 3 times alternately on each side, and the average value was recorded. Physical activity was measured using a triaxial accelerometer (HJA-750C Active Style Pro; Omron Healthcare, Kyoto, Japan). The patient was instructed to wear the accelerometer on the waist for 7 consecutive days from waking until bedtime, except during bathing and aquatic activities, while simultaneously completing an activity log. For classification of physical activity, activity <1.5 METs was defined as sedentary behavior, 1.6–2.9 METs as light physical activity, and ≥3.0 METs as moderate-to-vigorous physical activity[11,12]. The average daily duration of each activity intensity was calculated, and the mean value of each parameter across valid days was used as the representative value.

After the initial visit, the patient received only 1 hydrotherapy session. Subsequent visits were discontinued for approximately 2 years due to the spread of COVID-19. Then, in August 2022, the patient returned to our hospital wishing to resume hydrotherapy, as the COVID-19 pandemic had subsided. During this interval, her medication remained unchanged, and no disease progression or new complications were observed. Although the patient did not contract COVID-19, she reported a subjective decline in physical function due to prolonged home confinement over the 2-year period. Consistent with the patient's report, both the 6MWT (−18.7 m) and CS-30 (−3 repetitions) scores had decreased compared with the values recorded 2 years earlier. Physical activity levels also showed marked changes, including an increase in sedentary behavior (+108.3 min/day) and decreases in both light physical activity (32.4 min/day) and moderate-to-vigorous physical activity (−3.0 min/day) (Table 1).

Hydrotherapy

The patient resumed hydrotherapy the week following the follow-up visit. Hydrotherapy sessions were conducted once every week for 8 weeks (total of 8 sessions), each lasting 90 min and under the supervision of a physical therapist. The training program consisted of 60 min of aquatic walking (forward, backward, and lateral) and 30 min of resistance exercises, including aquatic half-squats (50 repetitions × 6 sets) and thigh lifts (50 repetitions × 6 sets), resulting in

Table 1. Changes in physical function, physical activity, disease activity, and pain

		Initial visit	After 2 years	After 8 weeks of hydrotherapy
Exercise tolerance	6MWT (m)	410.0	391.3	434.9
	CS-30 (counts)	15	12	15
Muscle strength	Hand grip (kg)	23.3	25.5	24.0
	Knee extension (kgf)	22.3	17.6	17.4
Physical activity	SB (min/day)	327.3	435.6	364.6
	LPA (min/day)	184.6	152.2	255.4
	MVPA (min/day)	16.6	13.6	28.0
Disease activity	DAS28-CRP	2.8	1.8	1.4
Pain	Patient VAS	20	20	5

6MWT, 6-min walk test; CS-30, 30-second chair stand test; SB, sedentary behavior; LPA, light-intensity physical activity; MVPA, moderate-to-vigorous physical activity; DAS28, disease activity score 28; CRP, C-reactive protein; VAS, visual analog scale

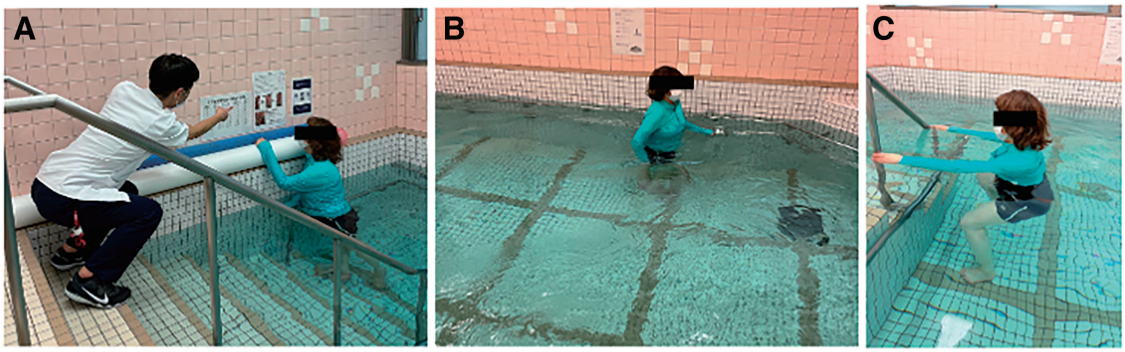


Fig. 2. Hydrotherapy instruction and practice. (**A**) The physical therapist instructs the patient during exercise. (**B**) Walking in the water. (**C**) Half-squat exercise.

a total of 300 repetitions for each exercise (Fig. 2). Exercise intensity was maintained within the moderate (3) to moderately vigorous (4) range on the Category Rating Scale (CR-10)[13], as recommended by the American College of Sports Medicine[14]. The pool had a flat floor and was heated to 33°C, which corresponds to the thermoneutral temperature recommended for aquatic exercise[15]. The pool dimensions were 4.7 m in length, 2.9 m in width, and 1.0 m in depth, reaching approximately the patient's navel level.

The effects of hydrotherapy were re-evaluated 8 weeks after its initiation. Disease activity, which was assessed using DAS28-CRP and the visual analog scale, did not increase during the hydrotherapy intervention period despite there being no changes in medication. The patient attended all sessions, and no adverse events were observed. At 8 weeks after the initiation of hydrotherapy, improvements were observed in exercise endurance. The 6-min walk distance increased by 43.6 m, and the CS-30 score increased by 2 repetitions. However, no improvements were observed in upper or lower limb muscle strength. Regarding physical activity, light physical activity increased by 103.2 min/day and moderate-to-vigorous physical activity increased by 14.4 min/day, while sedentary behavior decreased by 71.0 min/day after the 8-week hydrotherapy program.

Discussion

In this case report, we focus upon the recovery process in a patient with RA following a prolonged period of inactivity. This case suggests that weekly hydrotherapy may be associated with improvements in exercise tolerance, objectively measured physical activity, and the ability to return to work. Although the activity restrictions arose during the COVID-19 pandemic, the clinical significance of this case lies not in the pandemic itself, but in the demonstration of the recovery process following rehabilitation after a prolonged period of inactivity.

The patient wished to return to work as soon as possible, and it was determined that exercise therapy was necessary. The patient was classified as stage III on the Steinbrocker scale, and caution was required regarding high-intensity land-based exercise, so hydrotherapy was selected.

Hydrotherapy is considered beneficial for patients with RA because buoyancy reduces the load during exercise, allowing patients to exercise while minimizing stress on the joints[16]. Previous studies have often involved interventions at least twice a week[17], but in this case, the intervention was limited to just once per week due to restrictions on the use of our hospital's facilities. Nevertheless, the 6-min

walk distance increased by 43.6 m, exceeding the reported minimal clinically important difference (MCID) of approximately 30 m[18]. Furthermore, improvements in the CS-30 also exceeded the MCID of 2 or more points[19], so this intervention may have led to clinically meaningful improvements in physical function.

Another clinical significance of this case lies in the feasibility of the intervention and the high compliance rate. In previous studies involving patients with RA, hydrotherapy is typically administered 2–3 times per week[20]. In contrast, this program consisted of a single 90-min session per week, reflecting practical clinical constraints regarding facility availability and the frequency of hospital visits.

The 90-min intervention duration was set to ensure sufficient exercise volume even under a low-frequency intervention. Furthermore, exercises with a high number of repetitions were designed not to improve muscle strength, but rather to ensure total exercise volume and increase the aerobic exercise load. This case suggests that hydrotherapy may contribute to the promotion of physical activity and functional recovery as a feasible low-frequency rehabilitation model, even in environments with limited access to facilities.

A distinctive feature of this case report is the use of an accelerometer to objectively assess physical activity. Previous studies on hydrotherapy for patients with RA have reported improvements in physical function[20], but few reports have objectively demonstrated that these improvements lead to enhanced physical activity and social participation in daily life. In this case, a reduction in sedentary behavior and an increase in both light- and moderate-to-vigorous-intensity physical activity were observed following the intervention. The improvement in physical function achieved through hydrotherapy may therefore have been reflected in changes in activity patterns in real-life settings.

Furthermore, following the 8-week intervention, exercise tolerance and physical activity levels recovered to levels equal to or higher than those recorded 2 years prior, without any worsening of disease activity. In addition, the patient was ultimately able to return to work. The patient's occupation involves prolonged standing, walking, and carrying equipment, so it requires sufficient exercise tolerance and daily physical activity. The simultaneous recovery of physical activity levels and return to work is therefore considered to be a key patient-centered outcome in this case.

Previous studies have reported that patients with RA engage in less moderate- to high-intensity physical activity and spend more time sitting compared to healthy adults[21]. Therefore, the increase in light-intensity physical activity and the decrease in sedentary behavior observed in this case suggest a shift toward a more active behavioral pattern. Since maintaining daily physical activity is closely associated with functional independence, quality of life, and long-term health outcomes in patients with RA, these changes are clinically significant.

Several factors may explain why there was no observable improvement in knee extension strength in this case. First, this may be explained by the principle of training specificity[22]. The hydrotherapy program for this case was primarily designed to improve exercise tolerance and physical activity levels, and consisted mainly of aquatic walking and repetitive functional exercises. The specific load required to improve knee extension strength was possibly insufficient. Second, the exercise intensity may have been insufficient. Although exercise intensity was managed based on the CR-10 scale in this case, exercise speed was not specified. In aquatic exercise, resistance is known to increase as exercise speed increases due to the effects of water viscosity and hydrodynamic drag[23]. Prioritizing program safety and compliance might therefore have resulted in exercise speeds that were not sufficiently high, and the resistance load on the knee extensor muscles did not reach a level sufficient to induce muscle strength improvement. Third, the characteristics of the aquatic environment itself may have played a role. Water buoyancy reduces body weight load and mechanical stress on the joints, offering the advantage of allowing patients with RA to exercise while minimizing pain and joint strain[8]. On the other hand, this unloading effect may reduce the mechanical load necessary for muscle strength improvement. Although effective for improving exercise tolerance and physical activity, it may not have been sufficient to enhance maximum muscle strength. Furthermore, we cannot rule out the influence of the intervention duration. Relatively long-term exercise interventions are reportedly necessary to improve muscle strength in patients with RA[24]. Therefore, in this case, exercise tolerance and physical activity levels improved, but it is possible that these factors acted in combination and did not lead to an improvement in knee extension strength.

This study has several limitations. First, it is a single case report, and therefore the findings cannot be generalized. Further clinical studies are required to clarify the effectiveness of once-weekly hydrotherapy performed over extended periods. Second, the MCID values used for the 6MWT and CS-30 were derived from studies involving patients with chronic diseases rather than RA-specific populations. We cannot therefore definitively conclude that these thresholds represent clinically meaningful improvements in patients with RA. Third, the improvement in physical activity observed in this case may be attributable not only to the direct effects of the rehabilitation intervention but also to the increased opportunities to go out associated with hospital visits, as well as to social and environmental changes resulting from the easing of COVID-19-related restrictions. It is therefore difficult to clearly distinguish between the specific contributions of the intervention and these situational influences.

Conclusions

Once-weekly hydrotherapy in patients with RA may be associated with the recovery of exercise tolerance and

physical activity following a prolonged period of inactivity. In this case, these improvements led to a return to work without any worsening of disease activity, suggesting that hydrotherapy may not only support the recovery of physical function but also facilitate the resumption of social participation.

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