Effect of aquomanual therapy on pain and physical function of patients with chronic musculoskeletal disorders: A pilot study using quantitative and qualitative methods

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\textbf{A B S T R A C T}

\textit{Introduction:} Aquomanual therapy, which combines aquatic and manual therapy, aims to treat pain and improve physical function in individuals with chronic musculoskeletal disorders. This study aimed to verify the effectiveness of aquomanual therapy and document the participants’ experiences and opinions.

\textit{Methods:} Aquomanual therapy was applied to individual participants (10 community-dwelling adults with chronic musculoskeletal disorders) in an indoor swimming pool in the aquatic therapy room of the hospital three times per week for 8 weeks. This study used a mixed method prospective descriptive design. And, we used the visual analog scale to assess pain, a goniometer to measure range of motion (ROM), the Fatigue Severity Scale (FSS) to assess fatigue, and the Short Form-36 Health Status Questionnaire (SF-36) to assess quality of life and qualitative symptoms through in-depth individual interviews.

\textit{Results:} On the FSS, there were significant differences in neck, shoulder, and back pain ($p < 0.05$) and ROM of the neck, shoulder, and back ($p < 0.05$) but not in ROM of neck flexion. On the SF-36, there were significant differences in General health, Physical functioning, Role-physical, Bodily pain, and Vitality ($p < 0.05$) but no statistically significant increase in Role-emotional, Social functioning, or Mental health. Qualitative data collected in the in-depth individual interviews included: 1) decreased pain; 2) relaxation and relief of tiredness; 3) ease of use; 4) understanding the correct posture; and 5) novelty and enjoyment.

\textit{Conclusions:} Aquomanual therapy may relieve pain in and increase physical function of patients with chronic musculoskeletal disorders and was received positively.

\section{1. Introduction}

Approximately 25\% of adults suffer from one or more chronic musculoskeletal disorders, which are among the most common diseases in daily life, at some point in their lives [1–4]. Most people with chronic musculoskeletal disorders report experiencing difficulty in moving independently and caring for themselves due to their chronic pain and limited range of motion (ROM), which heavily impacts their quality of life (QOL) [5]. Thus, it is important to identify the optimal method for treating chronic musculoskeletal disorders.

Aquomanual therapy was recently developed using water therapy to treat chronic musculoskeletal disorders [6]. Aquomanual therapy combines the advantages of whole-body movements in the water with land-based manual therapy to maximize the treatment of chronic musculoskeletal disorders. Aquomanual therapy is based on joint and soft tissue mobilization, and myofascial and muscle release methods. This therapy method aims to correct the spinal alignment, mobilize joints and soft tissue, and relax the fascia and muscles to treat chronic musculoskeletal disorders due to musculoskeletal problems, pain, and fatigue that interrupt the patients’ daily life and lead to a disturbed health status [6]. However, the verification of the clinical effect of this newly developed aquomanual therapy on the pain and physical function of patients with chronic musculoskeletal disorders of pain and physical function is required.

Manual therapy can help decrease pain [7,8] and improve ROM in patients with chronic musculoskeletal disorders [9]. Typical manual therapy consists of mobilization and manipulation. Mobilization consists of relaxing the body while focusing on the vertebrae [10,11].

\begin{figure}[h]
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\includegraphics[width=\textwidth]{figure1.png}
\caption{Aquomanual therapy setup.}
\end{figure}
Manipulation consists of correcting alignment as well as loosening knotted muscles after mobilizing the upper and lower extremities, neck, spine, and pelvis [6,11,12]. Aquatic therapy is a simple way to move the entire body because water helps minimize the effect of gravity on the body, reduces the burden on the joints, and has high density [13]. Aquatic therapy also helps improve balance control by increasing postural instability and changing postural control strategies [14] because it is easy to use the metacentric effect for gravity and buoyancy [15]. The metacentric effect, which applies in a water environment only, eases body movements and increases body instability for balance control [14,15]. However, recent aquatic therapy studies mostly focused on improving the gait, balance, and muscular strength of patients with neurological disorders [16–19].

The primary purpose of the current study was to assess the effect of 8 weeks of aquamanual therapy on the pain and physical function of patients with chronic musculoskeletal disorders. The secondary purpose of the study was to investigate factors of the in-depth interview that influence participants to change their lives and verify whether the aquamanual therapy was effective at motivating patients with chronic musculoskeletal disorders. Existing aquatic therapy programs have not revealed patient experiences, and the collection of such information will aid in the determination of patient preferences for aquamanual therapy.

2. Methods

2.1. Design and setting

This study used a mixed-methods study design of a quantitative component followed by a qualitative component. All subjects provided written informed consent prior to participating, and the study was approved by the institutional review board of Korea University (KU-IRB-13-58-A-1).

2.2. Participants

Community-dwelling adults with chronic musculoskeletal disorders for ≥3 months were recruited through a bulletin board at the community public health center of Ilsan, South Korea, over 5 months. Their eligibility for inclusion in the study was assessed in accordance with the following criteria: (1) age of 20–64 years and (2) chronic pain in more than two areas (neck, shoulder, and back) within at least 3 months before recruitment. The exclusion criteria were as follows: (1) any cardiovascular or psychological disease; (2) history of surgery or traumatic injuries within the previous 3 months; (3) other current treatments or medications; (4) history of recent medical treatment; (5) surgery in the past 2 years; (6) history of cardiovascular or psychological disease; (7) history of recent medical treatment; (8) surgery in the past 2 years; (9) history of recent medical treatment; (10) main treatment (40 min), and cool-down (10 min).

The aquamanual therapy program focused on the cervical spine, thoracic spine, shoulder complex, and lumbar spine, and each body part was subjected to four static stretches, manually assisted movements, mobilization, and manipulation (Fig. 2). Specifically, the warm-up involved adaptation to the water including feeling the water environment, flow, and temperature and taking a deep breath. The main treatment was divided into four parts of the body: cervical spine, thoracic spine, shoulder complex, and lumbar spine. This study of the main contents included cervical spine traction, trunk rotation with cervical spine traction, shoulder anterior capsule stretch, shoulder anterior capsule stretch with metacentric effect, and lumbar spine rotation (Fig. 3).

The cervical spine traction consisted of the patient holding his hand to his chest and relaxing with 90° flexion of the hip and knee joints. The physical therapist positioned both thumbs on the base of the patient’s occipital bone and the fingers on the sides of the head. The strength of the traction was controlled by varying the immersion depth.

Trunk rotation with cervical spine traction using isometric force helps improve the mobility of the spinous muscles around the spine. For the shoulder anterior capsule stretch, the patient wore a neck collar while in the relaxed semi-supine position, and the physical therapist externally rotated the affected arm while supporting the hand on the back of the shoulder joint and horizontally abducting the patient’s arm. The shoulder anterior capsule stretch with metacentric effect was induced by slowly raising the patient’s forearm over the surface of the water. At the same time, the physical therapist maintained stability by feeling for changes in shoulder joint tension of the patient by the metacentric effect.

Lumbar spine rotation was performed with the knees bent slightly and fixed with the therapist’s foot while the other leg was held next to the patient’s knee in the direction of the chest in a posture between standing and side-lying. At the same time, the physical therapist held the patient’s iliac crest and released the quadratus lumborum in the caudal direction, which led to pelvic rotation. The cool-down involved walking slowly and taking a deep breath in the water.

2.4. Measurement

Quantitative findings included pain, ROM, fatigue, and QOL. Pain was assessed using the visual analog scale on a 10-cm horizontal line with anchor words placed on both ends (0 mm, no pain; 100 mm, worst possible pain) [20]. ROM was measured using a goniometer by a physical therapist with > 7 years of experience. Fatigue was assessed using the Fatigue Severity Scale [21]. QOL was assessed using the Short Form-36 Health Status Questionnaire (SF–36) [22].

Qualitative findings were collected from the individual in-depth interviews after aquamanual therapy. All interviews were audio-recorded with each participant’s consent. Furthermore, the key words or phrases were selected by reviewing the contents by three researchers. Finally, we decided the theme by combining repeated words and sentences. Afterward; we analyzed an iterative process of coding; reviewed the coding; and creatively conceptualized the themes and their relationships.

2.5. Data analysis

Quantitative data were analyzed using statistical software (SPSS version 23.0; SPSS Inc., Chicago, IL, USA). The patients’ demographic characteristics are expressed as mean ± standard deviation. A paired t-test was used to test the differences pre- versus post-sessions. Significance levels were set at p < 0.05 for the analyses. Qualitative data were analyzed using framework and thematic analyses (Table 1).
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