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Lecture

Effects of a 16-week hydrotherapy program on three-dimensional scapular motion and pain of women with fibromyalgia: A single-arm study

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ABSTRACT

Background: Although hydrotherapy is widely used to treat women with fibromyalgia, no studies have investigated the effects of this intervention on scapular kinematics in this population. This study verified the effectiveness of a hydrotherapy program on scapular kinematics, pain and quality of life in women with fibromyalgia.

Methods: Twenty women completed the study and performed three evaluations before treatment (to establish a baseline), and two other evaluations (after 8 and 16 weeks of hydrotherapy) at the end of treatment. Three-dimensional kinematics of the scapula was evaluated during arm elevation in two different planes with the Flock of Birds® system. Patients also answered quality of life and Fibromyalgia Impact Questionnaires and had pain assessed with a digital algometer. Treatment consisted of 2 weekly hydrotherapy sessions, lasting 45 min each, for 16 weeks. Data were analyzed with a two-way ANOVA (for kinematics results) and one-way ANOVA (for the other variables). Effect size was assessed with Cohen's d coefficient for all quantitative variables.

Results: Although an important improvement was achieved in terms of pain and quality of life ($P < 0.05$, effect sizes varied from −1.93 to 1.61 depending on the variable), scapular kinematics did not change after treatment ($P > 0.05$, effect sizes from −0.40 to 0.46 for all kinematic variables).

Interpretation: The proposed program of hydrotherapy was effective to improve quality of life, pain intensity and fibromyalgia impact in women with fibromyalgia. However, scapular kinematics did not change after the period of treatment. Although symptoms improved after the treatment, the lack of changes in scapular kinematics may indicate these women have an adaptive movement pattern due to their chronic painful condition.

1. Introduction

Fibromyalgia (FM) is a chronic non-inflammatory syndrome and the diagnosis is basically clinical as there are no supplementary exams that identify this condition (Wolfe et al., 1990, 2010). The core feature of FM is the widespread musculoskeletal pain (Wolfe et al., 1990, 2010). In 1990, the American College of Rheumatology established the widespread pain for > 3 months, and at least 11 out of 18 active tender points as the first diagnostic criteria for FM (Wolfe et al., 1990). The tender points are sensitive sites in which a digital pressure of 4 kg/cm^2 or less induces pain (Wolfe et al., 1990). Ten of these 18 points are located in the cervical and shoulder girdle regions (Mease, 2005), which could interfere in the shoulder joint performance. Avila et al. (2014) have shown that women with FM presented with greater scapular upward rotation and posterior tilt in the resting position and during elevation and lowering of the arm when compared to a control group. The authors suggested that the alterations in scapular kinematics may be a compensatory mechanism due to the chronic painful conditions of the subjects with FM as an attempt to reduce pain during arm elevation (Avila et al., 2014).

Hence, it is expected that scapular kinematics would change with improvement in the painful condition presented by this population. Muscle strengthening, stretching and aerobic exercises are known to be effective in improving symptoms in people with FM (Ambrose and Golightly, 2015). Among types of exercises for FM, hydrotherapy is widely used to treat this population (Bidonde et al., 2014; Carbonell-Baeza et al., 2012; Latorre et al., 2013; Lauche et al., 2015). Water buoyancy abolishes gravity thus allowing the body to float, reducing the weight over joints, bones, and muscles and leading to early active mobilization (Biscarini and Cerulli, 2007). Also, warm water decreases

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stiffness and improves pain, while water viscosity provides the required resistance for aerobic and strengthening exercises (Mannerkorpi, 2005).

Some studies have shown that hydrotherapy may lead to changes in kinematics parameters. Walking under water for subjects after spinal cord injury was associated with kinematic parameters more similar to those of the controls (Tamburella et al., 2013). Gait training under water lead to important changes in gait kinematics for people with Parkinson's disease (Volpe et al., 2017). No studies have investigated the effects of hydrotherapy on shoulder kinematics, thus, it could be interesting to know if hydrotherapy is effective to change scapular kinematics in women with FM.

Given the lack of studies that identify possible scapular kinematics changes in FM after physical therapy interventions, the present study aimed to check if 16 weeks of hydrotherapy would change scapular kinematics in women with FM. It was hypothesized that hydrotherapy treatment would be effective to improve pain sensitivity, together with quality of life, and pain sensitivity improvement would reflect directly on changes in scapular movement patterns in this population.

2. Method

2.1. Design

All women with FM underwent the initial interview, in which the inclusion and exclusion criteria were evaluated, and those who fit the study were invited to take part in it. A week after this interview, volunteers underwent the first evaluation (BL1). In an attempt to determine a baseline (BL) and lower the error of the mean for statistical purposes, two other evaluations (BL2 and BL3) were performed, with an interval of 2 weeks between each one. After the baseline evaluations, volunteers started the 16-week hydrotherapy program. They were evaluated eight weeks after the start of the hydrotherapy program (H8), and eight weeks after, at the end of the program (H16).

Scapular motion during ascending and descending phases of arm elevation in two different planes (sagittal and scapular), as well as the Fibromyalgia Impact Questionnaire (FIQ), the Medical Outcomes Study 36-item Short Form Health Survey (SF-36), the pressure pain threshold (PPT) over the 18 fibromyalgia tender points, and pain intensity during arm movement were assessed in all evaluation sessions.

2.2. Participants

Participants (n = 172) with a clinical FM diagnosis were recruited from the University clinical setting. From the 40 subjects that agreed to participate, 28 started the hydrotherapy program and 20 completed all stages of the study (Fig. 1). Sample size was calculated based on a previous study (Haik et al., 2014). Sample size was determined using G*Power Software (Düsseldorf, Germany), considering a significance level of 0.05 and a power of 0.80 to obtain an effect size of 0.5. Based on these criteria, at least 16 participants were necessary.

All volunteers had the FM diagnosis given by their physicians and were recruited when responding to an announcement for this research. The FM classification criteria recommended by the American College of Rheumatology (ACR) was also assessed by the first author. The inclusion criteria were: 1) to have a clinical fibromyalgia diagnosis according to the 1990 ACR criteria, including the examination of the 18 tender points (Wolfe et al., 1990); and 2) to be aged from 30 to 60 years old. The exclusion criteria were: 1) Body Mass Index $> 28\ kg/m^2$, as it could influence the scapular and PPT assessments (Alburquerque-Sendín et al., 2013); 2) cognitive deficits that prevented volunteers to understand the evaluation procedures; 3) uncontrolled systemic illnesses (*e.g.* diabetes mellitus and systemic arterial hypertension) based on self-report; 4) neurological and musculoskeletal conditions that could have directly interfered in the evaluations, as paresis, important sensitive alterations, advanced joint diseases (*e.g.* arthroplasties or osteoarthritis); 5) infections; 6) urinary incontinence to avoid possibility of urinary loss during treatment (Resende et al., 2008); and 7) pregnancy.

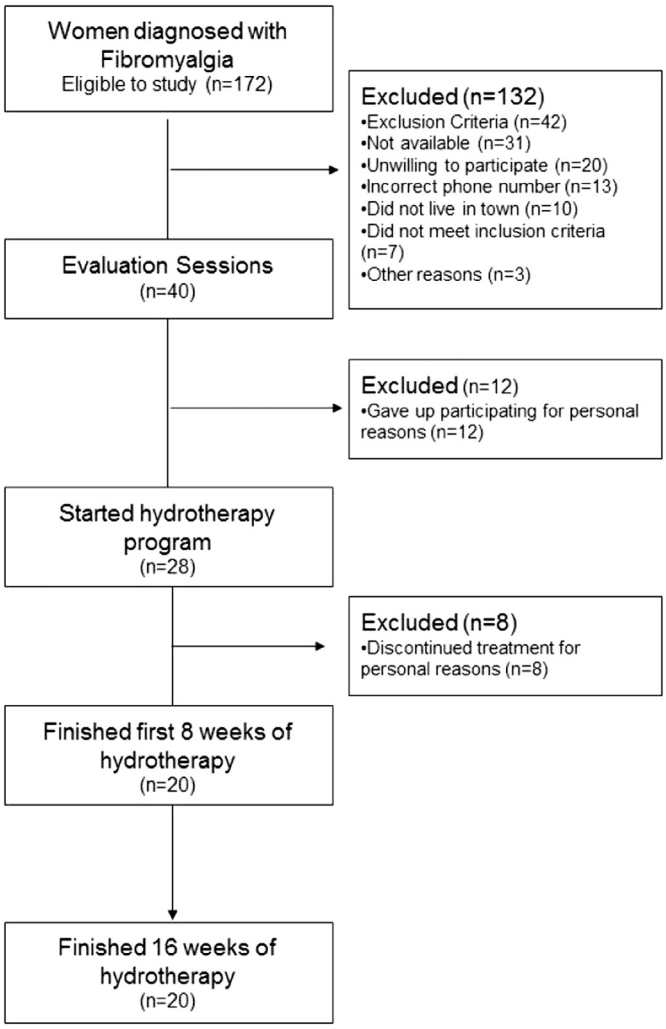

Fig. 1. Flowchart of the study.

This study was approved by the Ethics Committee of the University (protocol number 485/2011), and is registered at the ClinicalTrials.gov, as a part of a bigger study, under the number NTC01839305. Volunteers gave their written and informed consent to participate in this study, which was conducted according to the Helsinki Declaration of 1975/83.

2.3. Interventions: hydrotherapy treatment program

Hydrotherapy consisted of 2 weekly sessions that lasted 45 min, for 16 weeks. Treatment was performed in groups of up to 5 volunteers. All exercises were performed in a warm pool (30 °C ± 2 °C), in a closed room (Ortega et al., 2012) at a gym club. All exercises were performed according to the physical ability of each volunteer, respecting their own rhythm and limits (Mannerkorpi et al., 2009). Previously to each exercise, the physical therapist showed the movement in a compassed slow way, emphasizing that each individual should respect the pain and fatigue limits (Mannerkorpi et al., 2009; Vitorino et al., 2006). Once the movement was learned and performed right, volunteers were stimulated to increase rhythm and number of repetitions. Individual instructions were given whenever necessary aiming the correction of the performed movement (Mannerkorpi et al., 2009). The training protocol is described in the Appendix.