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Case Study

Effects of vibration on disease activity scores in a patient with rheumatoid arthritis: a case study

Raj Kumari[1], Matt Wyon[2], Adam Hawkey[2], and George Metsios[2, 3]

[1]Department of Sport and Physical Activity, University of Wolverhampton, UK. [2] Research Centre for Sport, Exercise, and Performance, University of Wolverhampton, UK. [3]The Dudley Group of Hospitals NHS Trust, UK.

KEY WORDS

Rheumatoid Arthritis
Disease Activity Score
Whole Body Vibration
Exercise
Flexibility

ABSTRACT

Rheumatoid arthritis (RA) is a disabling disease characterised by chronic inflammation. Moderate to high intensity exercise is recommended for the management of RA, although this is not always achievable due to pain caused by local inflammation. Identifying the current status of the swollen, tender joints and the patient's perception of pain can be assessed using the 'disease activity score' (DAS28). Recently, vibration training has been shown to improve performance within healthy individuals, but has yet to be used in the treatment of RA. One female patient (age: 43yrs; height: 1.53m; mass: 48kg) with active RA was recruited for the current study. A sit and reach test was performed pre- and post- vibration. The DAS28 was recorded pre-, immediately post-, and 24hrs post- vibration. During vibration exposure, the patient performed three exercises (squat, lunge and calf raise), each for 30s with 60s recovery, at a frequency of 30Hz, and amplitude of 2mm. Results of the DAS28 showed no change in swollen joints 15 minutes post- vibration, but a reduction 24 hours post- vibration. There was no change in the number of tender joints 15 minutes post- training, but an increase 24 hours post- training. There was a 10% increase in the patient's perception of health 15 minutes post-training, with no change 24 hours post- training. There was also an increase (0.02m) in sit and reach test scores post- training. The current study suggests that a single bout of vibration training can have positive affects on patients' perceived health, flexibility measures, and potentially reduce factors contributing to inflammation. However, the increased joint tenderness post-vibration warrants further investigation, in a randomised controlled trial, to verify the effectiveness of vibration on inflammation and joint tenderness.

Rheumatoid arthritis (RA) is a chronic, disabling disease characterised by chronic inflammation, often resulting in progressive joint destruction and varying degrees of incapacitation (Rasker and Cosh, 1989). As a consequence of the disease and its treatment, RA sufferers are, compared with their healthy counter-parts, at increased risk of osteoporosis, significant muscle mass loss with subsequent increased fat deposition, and for cardiovascular morbidity and mortality (Metsios et al., 2008; Summers et al., 2010). Evidence is accumulating that intensive weight-bearing exercise improves the aerobic fitness and muscle strength of RA patients without any increase in disease activity (Häkkinen et al., 2001; Van den Ende et al, 1998: Westby, 2001; Munneke and Jong, 2000; Stenstrom and Minor, 2003; de Jong et al., 2003). One mode of exercise that has shown benefits in a range of populations, but has yet to be investigated with regards to RA, is whole body vibration (WBV). WBV is a mechanical stimulus characterised by a recurring motion back and forth over the same pattern. WBV presents a strong stimulus to musculoskeletal structures as a result of changes in muscle stiffness in response to the vibration; this in turn is believed to produce physiological adaptations, known as the tonic vibration reflex (TVR), to accommodate these vibratory waves (Hawkey, 2007). Since vibration training has been found to improve BMD and increase muscle mass in a diverse range of populations (Hawkey, 2007), it may be an effective intervention to combat these highly prevalent manifestations in RA. Therefore, the aim of this case study was to evaluate the effects of a single bout of WBV on symptoms of joint swelling, joint tenderness, perception of health, and flexibility in one RA patient.

Methodology

Following institutional ethics approval, one female participant (age = 43yrs; height = 1.53m; mass = 48kg) suffering from RA was recruited for the current study and completed an informed consent form and a physical activity readiness questionnaire (PAR-Q). For the assessment of disease activity the DAS28 (Van de Heijde et al, 1993) was used. The DAS28 consisted of a 28-joint count for the presence or absence of swelling, 28-joint count for tenderness, and patient assessment of general health (Pincus et al, 2003). The instrument

Corresponding author: Dr George Metsios, Research Centre for Sport, Exercise, and Performance, University of Wolverhampton, UK.

produces a score from 100% (totally inactive disease) to 0% (very active disease). This assessment was conducted by a trained health allied professional with significant experience in these assessments. Following completion of the DAS28, the patient completed a three minute warm up on a Monark Ergomedic Bike at a steady pace in accordance with the American College of Sports Medicine (ACSM) guidelines (ACSM, 2000). Following this, the patient performed a range of motion (ROM) test following the exact validated ACSM guidelines (ACSM, 2000). After the familiarisation session and a demonstration of correct positioning, the participant performed three exercises on a NEMES Bosco vibration platform. Each exercise was performed for 30s, with a 60s recovery after each exercise. Where appropriate the patient used the handles on the platform for support. For each exercise the frequency was pre-set to 30 Hz, and the amplitude controlled at 2mm in accordance with Broekmans et al. (2010), as these frequencies and amplitudes respectively have been shown to illicit improvements in a variety of performance measures (Cochrane and Stannard, 2005; Hawkey, 2009a; 2009b; 2011; Wyon et al., 2010). The three exercises performed on the platform were the squat, lunge, and calf raise in accordance with Cochrane and Stannard (2005) and Shelton and Hynes (2005) respectively. After a recovery period of 5 minutes, the complete circuit was repeated once more. The participant was given a rest period of 15 minutes post- vibration training, where the DAS28 was re-assessed. The ROM (sit and reach test) was then reassessed. The DAS28 was also assessed again 24 hours post- vibration training.

Statistical analysis

There was no statistical analysis performed on the data collected for this study. Instead, evaluation of the descriptive statistics was undertaken. The three scores for swollen joints, tender joints and the patient's perception of health were calculated separately and given a total score to determine the

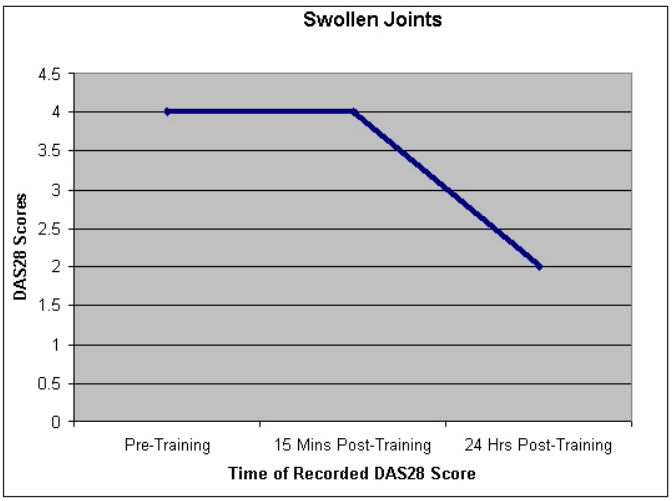

Figure 1. Swollen joints (DAS28 scores)

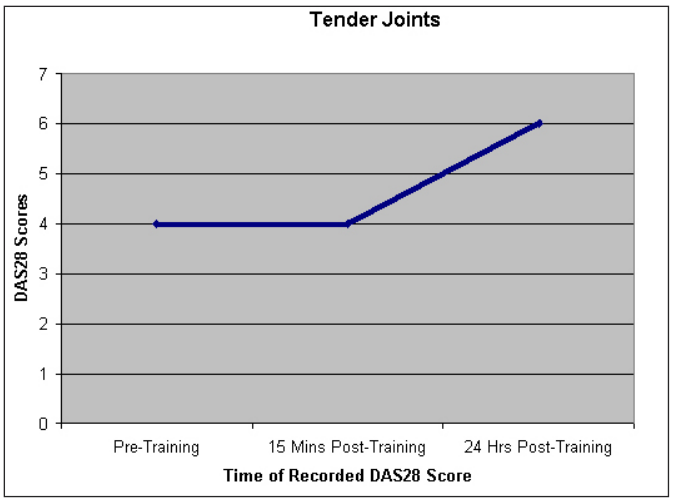

Figure 2. Tender joints (DAS28 scores)

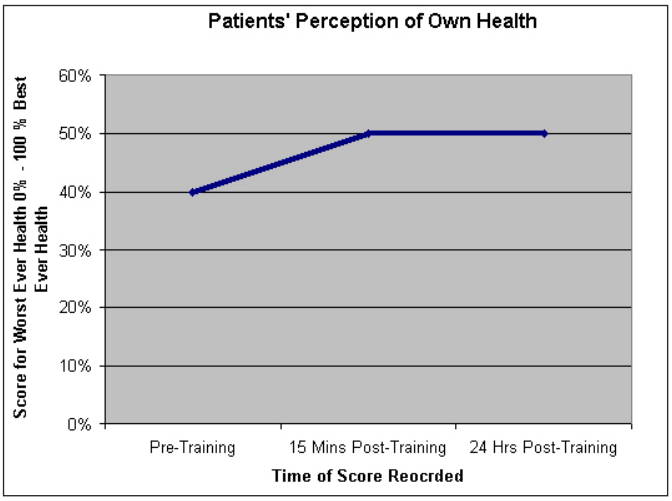

Figure 3. Patient perception of health (DAS28 scores)

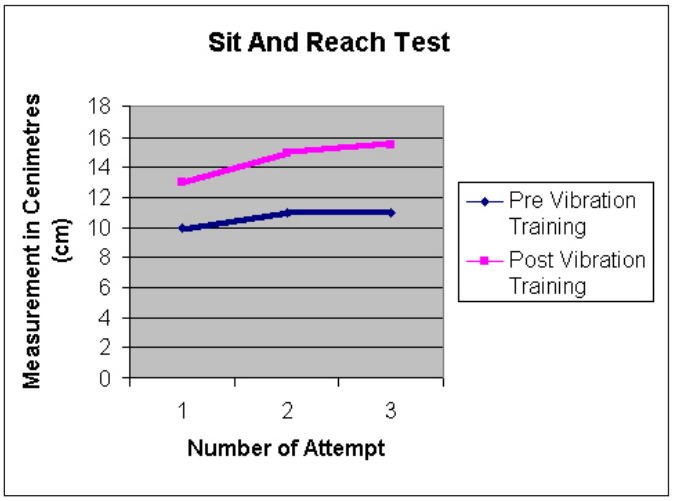

Figure 4. Range of Motion (sit-and-reach-test)

extent of disease activity. The sit and reach scores were analysed using Microsoft Excel.

Results

The results indicated no change in the number of swollen joints (DAS28 scores) 15 minutes post- training; however there was a decrease in the number of swollen joints 24 hours post- vibration training (Figure 1). The results also indicated no change in the number of tender joints (DAS28 scores) 15 minutes post- training; although there was an increase in the number of tender joints 24 hours post- training (Figure 2). The results indicated an increase in the percentage of the patients' perception of own health (from 40% to 50%), 15 minutes post- training, with no change in that percentage 24 hours post- training (Figure 3). The results also showed an improvement in ROM from pre- (0.11m) to post- vibration training (0.13m) (Figure 4).

Conclusions and Recommendations

Currently there are no studies investigating the effects of whole body vibration training in individuals with RA. Findings of the current study suggest that vibration training could be an effective exercise intervention in the management of the disease; including positive affects on patients' perceived health and flexibility measures. However, the increased joint tenderness post- vibration warrants further investigation. There is evidence demonstrating that vibration training may be an effective stimulus to improve both bone mineral density and fat free mass in different populations (Hawkey, 2007), two symptoms that are highly prevalent in RA (Metsios et al., 2008; Summers et al., 2010). Despite that our study demonstrates some benefits, the short-term effects of vibration on inflammatory load and functional ability has to be appropriately investigated using reliable equipment and appropriately designed trials, before this method of exercise could be formally introduced to this population.

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