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Fibromyalgia and the Relevance of the Whole-Body Vibration Exercises in Vibratory Platforms: A Short Review

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ABSTRACT

Among nonpharmacological strategy to manage fibromyalgia, exercise (aerobic) has shown efficacy. Whole-body vibration (WBV) exercise has been proposed as a potential clinical intervention. WBV would induce increase in growth hormone (GH). An impairment of the hypothalamic–pituitary–GH–Insulin Growth Factor-1(IGF-1) axis has been implicated in the pathophysiology of fibromyalgia. This article aims to review the studies on exploring the relationship between WBV and fibromyalgia. Literature searches were performed in the PubMed database on 04/03/2010 using terms related to "pain", "whole body vibration" and "fibromyalgia". An important number of publications were identified with the term "pain" and in comparison, only a small number of articles were found related to "fibromyalgia". Three publications found with "whole body vibration" and fibromyalgia were analyzed.There are reports describing increase in serum IGF-1 following exposure to WBV in elderly patients. However, one randomized fibromyalgia trial revealed no changes in serum IGF-1 levels in women undergoing WBV. Due to the paucity of available, effective therapies for fibromyalgia, further studies that explore the relationship between the neuroendocrine system, fibromyalgia and WBV are merited.

Key words: Fibromyalgia; Whole body vibration, PubMed

INTRODUCTION

Fibromyalgia is a clinical condition characterized mainly by the chronic widespread musculoskeletal pain and localized tenderness (Gusi et al. 2010). The multiple symptoms related with this condition include fatigue, anxiety, sleep disturbances, and depressive episodes (Goldenberg et al. 2004; Claw 2009). Common medical disorders associated with fibromyalgia are chronic fatigue syndrome, irritable bowel syndrome, irritable bladder syndrome, or interstitial cystitis, temporomandibular disorder (Claw 2009) and impaired balance (Gusi et al. 2010), as well as obesity (Mengshoel and Haugen 2001) and migraine headaches (Thompson et al 2003). While extremely complex, the pathophysiology of fibromyalgia is thought to be related to dis-

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regulation of the hypothalamic-pituitary axis and thus has the potential to affect a myriad of physical and emotional symptoms.

Fibromyalgia patients are prone to the utilization of all types of medical interventions throughout their lifetime. They show more symptoms and co-morbid or associated conditions than the patients with other rheumatic conditions. These symptoms are linked to service utilization and, to a lesser extent, functional disability and global disease severity (Wolfe et al. 1997). Thompson et al. (2003) reported that fibromyalgia questionnaires, along with commonalities of age, gender, menopause status, sleep disturbances, and mood symptoms, may aid in the diagnosis. Mengshoel and Haugen (2001) studied the obesity as a possible comorbid factor. Body mass indexes were recorded in 211 women with fibromyalgia in a rheumatology clinic. Results revealed that over 60% of the women were overweight and over half were classified as obese (Mengshoel and Haugen 2001).

Women are more likely than men to have chronic pain due to clinical disorders, but the sex-based difference is much more apparent in clinical settings compared with the population-based samples (Claw 2009; Thompson et al. 2003). The prevalence of fibromyalgia has been considered for many years to be approximately 2 to 3%. Estimation from the United States suggests that fibromyalgia affects about 5% of all women, and it is the third most common rheumatic disorder after low back pain and osteoarthritis (Lawrence et al. 2008; Spaeth 2009).

The management of fibromyalgia is based on a symptomatic treatment involving various professionals and pharmacological and nonpharmacological strategies. Among all the non-pharmacological treatments, aerobic exercises (walking, strengthening and flexibility) have shown the strongest evidence of efficacy (Goldenberg et al. 2004), although several other procedures (cognitive behavioral therapy, patient education, hypnotherapy and balneotherapy) have been used successfully (Claw 2009). In addition, Panton et al. 2009 have reported that, although research on the effects of resistance training in the women with fibromyalgia is limited, some studies have shown improvements in strength, decreases in total myalgic score, and decreases in the impact of fibromyalgia. A problem with the resistance training studies is the poor adherence rates. In consequence, it would be important to develop strategies to keep the fibromyalgia patients in this exercise program. It is suggested that research is needed to find a way to enhance the adherence to this exercises (Panton et al. 2009).

Whole-body vibration is a modality of exercise in an oscillating platform that has been proposed as clinical intervention in the treatment of several disorders, including fibromyalgia. This kind of exercise improves the strength of the muscle (Bosco et al. 1999; Cardinale and Lim 2003; Cochrane and Stannard 2005; Delecluse et al. 2005; deRuite et al. 2003; Torvinen et al. 2002; Roelants et al. 2004; Verschueren et al. 2004), bone density (Verschueren et al. 2004; Iwamoto et al. 2005), cardiovascular parameters (Mester et al. 2006), body balance (Torvinen et al. 2002; Cardinale and Wakeling 2005). Moreover, the health-related quality of life is increased and the fall risk is decreased (Santos-Filho et al. 2010).

In the therapy involving whole body vibration, normally, the subject stands on an oscillating platform that generates sinusoidal vertical vibrations with frequency and amplitude that are selected and controlled by a trained professional. The time of the subject in the platform working, the time of the subject in the platform resting, the number of sets in a session and the number of sessions are determined following the clinical disorder to be treated, as well as the physical conditions of the subject (Cardinale and Wakeling 2005; Santos-Filho et al. 2010). Marin et al. (2009) have studied the neuromuscular activity during whole-body vibration of different amplitudes in relation to footwear. The effects of the whole body vibration are probably related to direct and indirect actions (Santos-Filho et al. 2010). The indirect effects have been hypothesized to be associated with the neuroendocrine system (Prisby et al. 2008). Whole body mechanical vibration on the muscle performance would be due to the activation of a tonic excitatory effect, the tonic vibration reflex (Torniven et al. 2002). Some authors have described that repeated muscle contractions might exert endocrine and/or metabolic effects (Di Loreto et al. 2004).

The therapeutic effect of exercise has been linked to the growth hormone (GH) regulation (Nindl and Pierce 2010). These findings have lead to the exploration of unique exercise therapies for the fibromyalgia patients based on the hypothesis that hormone regulation is a key factor in symptom control (Abeles et al. 2007; Bennett et al. 1997).

For example, impairment in the hypothalamic–pituitary–GH–IGF-1 axis might manifest as a reduction in serum IGF-1 levels (Bennett et al. 1997; Bagge et al. 1998, Leal-Cerro et al. 1999, Paiva et al. 2002) which in turn has been related to sleep disturbances, poor muscle performance, fatigue, and muscle pain. Moreover, fibromyalgia patients that have underwent GH therapy showed improvements in symptoms and daily functioning in women with fibromyalgia (Bennett et al. 1998). However, it is important to consider that the high cost of this therapy prevents a wide use.

Exercises in oscillating platforms would induce increases in growth hormone (GH) (Cardinale et al. 2006; Bosco et al. 2000; Kvorning et al. 2006; Gosselink et al. 2004). The effects on GH have been attributed to a muscle afferent–pituitary axis (Cardinale et al. 2006; Gosselinnk et al. 2004; McCall et al. 2000). GH is synthesized and secreted in a pulsating manner by the anterior pituitary gland. Serum insulin-like growth factor-1 (IGF-1) is secreted by the liver in response to GH release (Florini et al. 1985). Studies vary regarding the effectives of WBV on the serum hormone levels in non-fibromyalgia-patients following whole body vibration (Di Loreto et al. 2004; Cardinale et al. 2006). However, a study by Cardinale et al. (2006) demonstrated a significant increase in serum IGF-1 following a single exposure to whole body vibration in elderly patients. The vibration produced in oscillating platforms is a low cost physiologic strategy (Winchester et al. 2010) that may be beneficial for the management of the symptoms of fibromyalgia.

PubMed is a databank that comprises more than 19 million citations for biomedical articles from MEDLINE and life science journals. These citations may include links to full-text articles from PubMed Central or publisher web sites. Moreover, these citations have been used as tool to obtain various scientific information (Santos-Filho et al. 2008; Santos-Filho et al. 2010; Winchester et al. 2010).

To our knowledge no previous reviews have been published involving whole body vibration and fibromyalgia. The aim of this work was to present a review on the use of the whole body vibration in patients with fibromyalgia.

MATERIALS AND METHODS

The papers were searched in the PubMed (http://www.ncbi.nlm.nih.gov/PubMed/) on April 3rd 2010. The search was performed using the terms (i) pain, (2) “whole body vibration” and pain, (iii) “whole body vibration exercises” and pain, (iv) fibromyalgia, (v) pain and fibromyalgia, (vi) “whole body vibration”, (vii) “whole body vibration exercises”, (viii) “whole body vibration exercises” and fibromyalgia and (ix) “whole body vibration” and fibromyalgia.

The number of publications (NP) was determined. A percentage between the NP in fibromyalgia and pain was calculated. The NP in fibromyalgia was divided by the NP in pain. The value was multiplied by 100.

The publications involving effects of the whole body vibration in workers were excluded. The selected papers concerning to the use of whole body vibration and fibromyalgia were critically reviewed and were considered to be relevant.

RESULTS

Table 1 lists the number of publications involving pain and fibromyalgia and the whole body vibration. An important number of publications were identified with the term “pain” and, in comparison, only a small number of publications were found with “fibromyalgia”. However, 58.48% of the papers about fibromyalgia are found with the association of the terms pain and fibromyalgia.

A limited number of publications was found with the association between fibromyalgia and whole body vibration. Furthermore, one of them involves workers/employees and was not considered in this study.

The three publications found with "whole body vibration" and fibromyalgia were analyzed in Table 2 and 3. The information in Table 2 describes the device of the oscillating platform, the subjects (number, sex and age), the frequency and the amplitude used in the oscillating platforms.

Table 2 contains information about the conditions of protocols used in the treated, control groups and the clinical findings.

Table 1 – Number of publications found in the PubMed involving pain, fibromyalgia and whole body vibration.

Search	Number of publications
Pain	427786
"whole body vibration" and pain	118
"whole body vibration exercises" and pain	11
Fibromyalgia	5661
pain and fibromyalgia	3311
"whole body vibration"	626
"whole body vibration exercises"	145
"whole body vibration exercises" and fibromyalgia	3
"whole body vibration" and fibromyalgia	4

Table 2 - Information about the device of the oscillating platform, the subjects, the frequency and the amplitude used in the oscillating platforms.

Reference	Device of the platform	Number of subjects/sex/age	Frequency	Amplitude
Alentorn-Geli et al. 2008	Power-Plate, The Netherlands	36/ women/55.97±1.55 years patients with fibromyalgia	30Hz	2mm
Alentorn-Geli et al. 2009	Power-Plate, The Netherlands	24/ women/55.75±3.09 years (vibration group) and 54.17±2.74 years (control group) patients with fibromyalgia	30Hz	2mm
Gusi et al. 2010	Galileo Fitness Platform, Germany	41/women/41 to 65 years patients with fibromyalgia	12.5 Hz	3 mm

Table 3 - Information about the conditions of protocols used in the treated and control groups and the clinical findings.

Reference	Condition of the treated and control groups	Clinical finding
Alentorn-Geli et al. 2008	3 groups, EVG (exercise and vibration), EG (exercise) and CG (control)	Pain and fatique scores (Fibromyalgia Impact Questionaire) were significantly reduced from baseline in the EVG group, but not in the EG or CG
Alentorn-Geli et al. 2009	2 groups, VG (vibration group), EG (exercise) and CG (control)	Results show no change in serum IGF-1 levels in women with fibromyalgia undergoing whole body vibration exercise in comparison with the control group.
Gusi et al. 2010	2 groups, vibration group (n=21) and control group (n=20)	The dynamic balance of the vibration group improved 36%, as compared to baseline, whereas that of the control group was unchanged.

DISCUSSION

The American College of Rheumatology, in 1990 defines fibromyalgia as the presence of chronic widespread pain and allodynia (pain responses to normally non-painful stimuli) to pressure in more than 11 of 18 specified sites or tender points (Wolfe et al. 1990). As expected, the association of pain in the patients with fibromyalgia is strong (see Table 1). Although several others symptoms are associated with the fibromyalgia, 58.47% of the total publications in fibromyalgia involve also pain. This showed the interest in these studies and the relevance of the pain and the pain control in the fibromyalgia, as indicated in Table 1.

Although the use of the oscillating platforms is very inexpensive, there are only a limited number of studies involving fibromyalgia and whole body vibration exercises (Table 1). In consequence, high costs should not be a barrier to future studies.

The clinical findings involving whole body vibration exercises in the management of the fibromyalgia (Gusi et al. 2010), or in the understanding of the mechanism involved in this disease can be seen in the Table 2 and Table 3. The studies revealed the findings with the women

and they were similar to the well documented gender differences in fibromyalgia patients, and confirmed that women were disproportionately affected (Thompson et al. 2003).

Little has been addressed on the clinical effect of the whole body vibration exercises in the management of women with fibromyalgia (Gusi et al. 2010). Although the devices of the platforms, the frequencies and amplitudes used were different in the studies reported, positive effects of the whole body vibration exercises in the treatment of the symptoms of the fibromyalgia have been reported. The findings described by Gusi et al. (2010) were obtained from a randomized controlled trial and it was observed that the dynamic balance of the women of the group that had received whole body vibration therapy was improved by 36%, as compared to the baseline, whereas that of the control group (not received the whole body vibration therapy) was unchanged. Although the design of the procedures and of the controls, the results of (Gusi et al. 2010) were in agreement. Moreover, they support whole body vibration as a promising therapy for fibromyalgia.

Studies have postulated that an impairment of the hypothalamic–pituitary–GH–IGF-1 axis could be one among the several mechanisms implicated in the pathophysiology of fibromyalgia (Abeles et al. 2007; Bennett et al. 1997) and as a consequence of this impairment, a reduction in serum IGF-1 levels would be observed (Bennett et al. 1997; Bagge et al. 1998, Leal-Cerro et al. 1999; Paiva et al. 2002).

Cardinale et al. (2006) have demonstrated a significant increase in the serum IGF-1 following a single exposure to whole body vibration in elderly patients. However, a randomized trial with the women with fibromyalgia, showed no change in serum IGF-1 levels in these women undergoing whole body vibration exercise in comparison with a control group that had performed the same protocol without vibratory stimulus. Although, the parameters used in both the works were similar, the protocol used as well as the individual characteristics of the patients could be responsible for the different findings concerning the plasma concentration of IGF-1.

CONCLUSION

In conclusion, there are a limited number of studies on fibromyalgia and whole body vibration. Only one study presented positive finding which was related to a randomized controlled trial involving whole body vibration and fibromyalgia. One another work showed no change in serum IGF-1 levels in the women with fibromyalgia undergoing whole-body vibration exercise, although whole body vibration exercise increased the serum IGF-1 in healthy individuals.

Due to the negative clinical characteristics of the fibromyalgia and the effectiveness of the whole body vibration exercises in the improvement of the musculoskeletal disorders, it is relevant to pursue additional studies in whole body vibration as a therapeutic option for the fibromyalgia patients. Furthermore, further studies are relevant to try to fully understand and characterize the effect of whole body vibration on fibromyalgia and the chemical changes to the body related to these effects.

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