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REVIEW ARTICLE

Effects of whole-body vibration training in patients with multiple sclerosis: A systematic review☆

I.C. Bueno[a], **D.J. Ramos-Campo**[b,c], **J.A. Rubio-Arias**[b,c,*]

[a] *Cátedra de Fisiología del Deporte, Universidad Católica de Murcia, Murcia, Spain*
[b] *Centro de Investigación de Alto Rendimiento, Universidad Católica de Murcia, Spain*
[c] *Facultad de Deporte, Universidad Católica de Murcia, Murcia, Spain*

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Abstract
Introduction: Multiple sclerosis (MS) is an autoimmune inflammatory disease of the central nervous system. MS is characterised by nerve demyelination that can alter nerve transmission and lead to such symptoms as fatigue, muscle weakness, and impaired motor function. There are 47 000 people with MS in Spain. Vibration training can be an effective and complementary alternative to traditional exercise to treat patients with MS. The aim of this study was to analyse the effectiveness of vibration training programmes in patients with MS.
Development: We searched 5 electronic databases (PubMed, SPORTDiscus, SciELO, Lilacs, IBECS, and ISI Web of Knowledge) in August 2015. By using a set of keywords, we found studies linking vibration training and MS and included randomised controlled trials that applied vibration training to patients with MS. Our search yielded 71 studies. Only 9 of them were included after removing duplicate studies and those which were not relevant according to our selection criteria. These studies obtained different outcomes.
Conclusions: Some studies found improvements in muscle strength, functional capacity, coordination, resistance, balance, and some areas of 88-Item Multiple Sclerosis Spasticity Scale. However, we identified limitations in some of these studies and there are still few publications on vibration training and MS to ensure training effectiveness.

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* Corresponding author.
E-mail address: jararias@ucam.edu (J.A. Rubio-Arias).

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Efectos del entrenamiento vibratorio de cuerpo completo en pacientes con esclerosis múltiple: una revisión sistemática

Resumen
Introducción: La esclerosis múltiple (EM) es una enfermedad inflamatoria autoinmune del sistema nervioso central. Se caracteriza por la desmielinización del nervio, pudiendo alterar la transmisión nerviosa y conducir a síntomas como fatiga, debilidad muscular y deterioro de la función motora. En España existen 47.000 personas afectadas de EM. El entrenamiento vibratorio puede ser una opción complementaria eficaz al ejercicio tradicional para el tratamiento de la EM. El objetivo fue determinar la efectividad de los programas de entrenamiento vibratorio en los sujetos con EM.
Desarrollo: Cinco bases de datos electrónicas (PubMed, SPORTDiscus, SciELO, Lilacs, IBECS e ISI Web of Knowledge) fueron consultadas para la búsqueda bibliográfica en agosto del 2015. Un conjunto de términos de búsqueda identificaron estudios que relacionaban el entrenamiento vibratorio y la EM. Se incluyeron ensayos clínicos controlados y aleatorizados que aplicaron un programa de entrenamiento vibratorio dirigido a pacientes con EM. Setenta y un artículos fueron obtenidos tras la búsqueda. Finalmente, se incluyeron 9 de ellos tras descartar los estudios duplicados y aquellos que no fueron relevantes sobre base de los criterios de selección. Se encontraron varios resultados entre los estudios.
Conclusiones: Algunos estudios hallaron mejoras en la fuerza muscular, la capacidad funcional, la coordinación, la resistencia, el equilibrio y algunas áreas del MSSS-88. Sin embargo, detectamos algunas limitaciones entre los estudios y son todavía pocas las publicaciones realizadas hasta la fecha sobre entrenamiento vibratorio y EM para certificar la efectividad de dicho entrenamiento en esta patología.

Introduction

Multiple sclerosis (MS) is the most frequent neurological disease among young adults, and one of the main causes of disability in this population.[1] MS is an autoimmune inflammatory disease of the central nervous system, characterised by demyelination due to inflammation and progressive degeneration of the myelin sheaths enveloping nerves of the eye, brain, periventricular grey matter, brainstem, and spinal cord.[2–5] The process can cause the formation of multiple plaques (scleroses) in the white matter of the brain and spinal cord, which can become permanent scars that cause alterations in nerve transmission,[6,7] leading to such symptoms as fatigue, muscle weakness, and motor function alterations.[3,8]

MS prevalence is high in developed countries[9]; 47 000 people are affected in Spain, 600 000 in Europe, and over 2 000 000 in the world.[10] The condition is usually diagnosed in patients aged between 20 and 50 years. Women are affected far more frequently than men, and account for approximately two-thirds of cases.[9,10] The disease is currently the leading cause of neurological disability in young adults in developed countries, and its incidence rate is increasing.[9] The aetiology of MS is unknown, and is usually complex[11] and multifactorial, potentially resulting from an interaction between genetic, infectious, and environmental factors.[3,9,11–21]

The symptoms of MS mean that patients are usually sedentary and generally have lower levels of physical activity than other individuals. This can result in muscle weakness, decreased bone density, poorer cardiovascular health, and higher levels of fatigue.[3]

Although MS is incurable, symptoms may be addressed with physical exercise, which can help maintain and improve balance, mobility, quality of life, and autonomy in the activities of daily living.[3] Physical activity improves impaired bladder and bowel function in patients with MS and can have positive effects on mental health, quality of life,[22,23] muscle strength,[24] symptomatic fatigue, and other symptoms.[25] It may also improve risk factors for cardiovascular or metabolic disorders.[26]

Patients with MS who partake in aerobic exercise have a lower risk of relapse[27] and display improvements in their symptoms.[25] Resistance exercise is essential to improving these patients' functional capacity (mobility, independence, everyday tasks, etc.).[3] Strength training increases isometric[28] and dynamic strength[24] by means of neural adaptation (in the short term) and muscle hypertrophy (in the long term).[29] Patients can also achieve functional improvements including greater walking speed[30] and muscular endurance,[24] decreased symptomatic fatigue,[28] and improved balance[31] and gait kinematics.[32] Finally, flexibility training has been observed to counteract spasticity, reduce or prevent contractures, increase muscle length and range of motion, and to improve posture and balance; all these parameters are affected by MS.[3]

Of the different training systems studied with patients with MS, vibration training may improve physical function