

## Self-limiting benign paroxysmal positional vertigo following use of whole-body vibration training plate

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### Abstract

**Objective:** We describe a case of benign paroxysmal positional vertigo which occurred after use of a whole-body vibration training plate.

**Method:** Case report and literature review concerning the secondary causes of benign paroxysmal positional vertigo and the physiological effects of whole-body vibration training plates.

**Results:** A 44-year-old woman was referred with classic symptoms of benign paroxysmal positional vertigo following use of a whole-body vibration training plate, a popular form of fitness equipment widely used in sports, rehabilitation and beauty treatments. The condition resolved spontaneously after several days. There have been reports of negative side effects in users of this equipment, such as dizziness, headache and a sensation of imbalance; however, there have been no reported cases involving vertigo. Based on a literature review, this equipment may cause side effects, including vertigo, by generating forces that can increase the original amplitude of internal organs, which may potentially cause labyrinthine trauma or dislocation of otoconia, leading to benign paroxysmal positional vertigo.

**Conclusions:** We suggest that whole-body vibration training plates may potentially induce benign paroxysmal positional vertigo. Manufacturers may need to make users of this equipment aware of this risk, and remind them to use it with caution.

**Key words:** Vertigo; Positional Vertigo; Vibration; Inner Ear

### Introduction

Benign paroxysmal positional vertigo (BPPV) is the most common type of peripheral vertigo.<sup>1</sup> It is a self-limiting condition characterised by the onset of vertigo and nystagmus triggered by certain head positions, with no associated hearing loss or central nervous system disorder. The average age at presentation is in the fifth decade, and the condition occurs equally in males and females. Benign paroxysmal positional vertigo may occur spontaneously, or following a head injury or viral labyrinthitis.<sup>2</sup>

Whole-body vibration training plates have become increasingly popular items of fitness equipment, and are widely available in fitness centres and private homes. Several articles have reported an association between whole-body vibration training and acute, self-limiting dizziness.<sup>3,4</sup>

We report a case of a patient with self-limiting BPPV as a result of using such equipment; to our knowledge, this has not previously been described.

### Case report

A 44-year-old woman was referred to our ENT out-patient department two months after acute onset of rotational vertigo. The vertigo attack had occurred immediately after using a whole-body vibration training plate at the patient's fitness centre, and had lasted for several days. The vertigo had been associated with nausea and vomiting. It had occurred mainly in the supine position, and had been elicited by rotational movement of the head to the right and relieved by repositioning of the head to a neutral

position. A few days after onset, the symptoms gradually improved to only one or two mild episodes a day, lasting a few seconds. The patient had no pre-existing ear conditions or history of vertigo, and there was no hearing loss or tinnitus. There was no recent history of viral illness or head injury. She had been taking no medication prior to this episode.

On examination, both tympanic membranes were normal and healthy. Tuning fork tests were also normal. Pure tone audiography showed normal hearing thresholds. Both the Romberg and Unterberger tests were negative. Cranial nerve examination was unremarkable, with no evidence of nystagmus. Dix–Hallpike manoeuvres were also negative.

Despite the unremarkable examination findings, the clinical history and progression of vertiginous symptoms were very suggestive of self-limiting BPPV resulting from the use of a whole-body vibration training plate.

### Discussion

Benign paroxysmal positional vertigo is defined as rotational vertigo and nystagmus triggered by certain head positions. The signs and symptoms occur after a brief latent period of 1–5 seconds, following adopting the provocative position. Symptoms persist for 5 seconds to 1 minute and then diminish gradually. Reversal of nystagmus occurs upon returning to the original position, and response fatigability is seen.<sup>5</sup>

There are two main theories explaining the pathogenesis of BPPV.

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Accepted for publication: 18 September 2009. First published online 11 December 2009.

Epley theorised that canalithiasis was the cause of BPPV. He believed that the symptoms of BPPV were consistent with the presence of free-moving densities (otoconia) within the lumen of the affected semicircular canals.<sup>6</sup> These densities caused vertigo by displacing the cupula and hair cells.

In 1962, Schuknecht proposed the cupulolithiasis theory of BPPV.<sup>7</sup> He postulated that the semicircular canal was rendered sensitive to gravity by abnormally dense particles attached to or impinging upon the cupula, thereby stimulating the hair cells.

About 50–70 per cent of BPPV cases are found to be idiopathic. Secondary causes of BPPV include head trauma (7–17 per cent), vestibular neuritis (15 per cent) and Ménière's disease. In cases of head trauma, it is thought that the blow to the head may cause the release of otoconia into the endolymph.<sup>8</sup> This could explain why many of these patients suffer from bilateral BPPV. Benign paroxysmal positional vertigo has also been reported to occur after dental procedures and surgery of the ear and nose such as in nasal osteotomy.<sup>9,10</sup> In all these cases, it is thought that the force from the surgical procedure causes either labyrinthine concussion or displacement of otoconia. Anecdotally, BPPV may also occur after exposure of the body to prolonged vibration, such as that produced by industrial pneumatic drills.

In whole-body vibration plate training, the entire body is subjected to vibration. The mechanical stimulation of the muscles causes rapid contractions and relaxations at 20–50 times per second, contributing to muscle toning and muscle mass increase. The transmission of vibrations also causes enough stress to increase bone mineral density.<sup>11</sup> The application of whole-body vibration was first used on astronauts to decrease the rate of muscle and bone mass losses caused by lack of gravity in space. Its principles are also used in athletics training to increase resilience and muscle mass. Nowadays, whole-body vibration training systems are widely used in sports, fitness, rehabilitation and beauty treatments. The equipment consists of a vibrating platform that users can stand, sit or lie on. The amplitude, frequency and direction of vibrations differ between manufacturers. Such platforms can deliver vibrations of 3–50 Hz with varying amplitudes of oscillation. Research has shown that a 30 Hz protocol of vibration training exercise elicits the most significant result.<sup>12</sup> Most vibration training platforms vibrate at 30–50 Hz.<sup>13</sup>

- **Benign paroxysmal positional vertigo (BPPV) is common following head trauma and viral labyrinthitis**
- **It is also known to occur following surgical procedures that generate force or vibration in the head and neck region, e.g. dental procedures and nasal osteotomy**
- **This case report describes a patient with BPPV symptoms occurring after use of a whole-body vibration training plate at a fitness centre**
- **Usage of whole-body vibration training plates at certain frequencies can potentially cause BPPV; therefore, such equipment should be used with caution**

The use of whole-body vibration has been reported to be associated with dizziness and a sensation of imbalance.<sup>14</sup> However, the effect of whole-body vibration on the vestibular system is unknown. In 1989, Suvorov *et al.* tested the effect of low frequency whole-body vibration on the

vestibular system, using electronystagmography.<sup>15</sup> Vertical nystagmus was observed consistently at a frequency of 0.6 Hz. This test did not elicit vertigo symptoms. As every organ and body part have their own resonant frequency, vibrations at this frequency can cause a maximum amplitude that is greater than the original vibration amplitude. Whole-body vibration of 20–30 Hz has been found to cause the strongest resonance between the head and the shoulders, with amplification of 350 per cent.<sup>16</sup> This could potentially cause displacement of otoconia or permanent damage to the vestibular system. Therefore, usage of a whole-body vibration training plate at 20–30 Hz may feasibly cause the above side effects.

### Conclusion

Whole-body vibration training can potentially generate displacement or dislocation of otoconia through vibration transmitted to the inner ear, or due to labyrinthine trauma. We suggest that whole-body vibration training plates may potentially induce BPPV. Manufacturers may need to make users of such equipment aware of this risk, and remind them to use it with caution.

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Miss I Amir takes responsibility for the integrity  
of the content of the paper.  
Competing interests: None declared

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