LETTERS TO THE EDITOR: NEW TOPICS

Acute Effects of Whole-Body Vibration at 3, 6, and 9 Hz on Balance and Gait in Patients with Parkinson’s Disease

Vibration as a stimulus to treat Parkinson’s disease (PD) patients was first recommended by Charcot in 1892, and although this approach was subsequently abandoned, recently, whole-body vibration (WBV) protocols have been suggested as a modern substitute. A small number of studies have assessed the effects of WBV on motor symptoms in PD, with apparently positive results, obtained in open-trial designs. In each case, however, only a fixed frequency of stimulation was used, and no placebo group was included. It is therefore of fundamental interest to examine a range of “doses” (in this case, frequencies) in order to optimize potential therapeutic effects. Using an appropriate placebo-controlled experimental design, we have explored the use of different vibration frequencies, some of which had already been reported to have an effect after 1 session.

Forty-eight patients with PD diagnosed as idiopathic participated in this study. Possible participants were excluded if any other disease or impairment potentially affected the validity of the results, and selected PD were naive to WBV protocols. Patients were randomly allocated to each of 4 groups: placebo, vibration at 3 Hz, vibration at 6 Hz, and vibration at 9 Hz (n = 12 each).

The protocol followed previous work reporting excellent results of single-session WBV by means of a vibrating platform comprising 5 vibration sets of 1’ each (interset rest period, 1’). The stepped platform (amplitude of 13 mm) thrusts the right and left legs upward alternately. During stimulation, patients stood on the platform with their feet separated at 10°C stable and comfortable position and with the knees slightly flexed. In the placebo group, patients adopted the same posture without vibration. Instead, they were required to stay still, trying to minimize hip oscillation; this controlled for a placebo effect.

The effect of vibration on gait and balance was evaluated by the timed-up-and-go (TUG) and functional reach (FR) tests. Patients were evaluated just before (PRE), after (POST), and 48 hours after (POST-2) stimulation. Examiners were blind to protocol and group assignment.

—FR: Subjects had to displace, as far as they could, the movable stick of a Harpenden Anthropometer, pushing with their fists, without flexing the knees or lifting the heels. The FR distance was obtained from the difference between the starting and end positions of the stick. Each subject did so 3 times with each arm, with 30-second rests between trials. The variable analyzed was FR distance.

—TUG: Patients had to stand up from a chair, walk 3 m using their preferred pattern, turn, come back, and sit down again. The time taken was recorded, and this was the analyzed variable. Patients performed this task 3 times.

Differences between groups at PRE were assessed by a 1-way-ANOVA. A possible WBV effect was evaluated by a repeated measures ANOVA with within-subjects factor evaluation (PRE, POST, POST-2) and between-subjects factor group (3 Hz, 6 Hz, 9 Hz, placebo). Normality was checked by the 1-sample Kolmogorov–Smirnov test. Significance was set at P < .05.

Before stimulation, groups were comparable for FR distance (F3,44 = 0.685, P = .566) and TUG (F3,44 = 1.052, P = .379). Stimulation led FR to increase (F1,590,69.968 = 4.255, P = .026) and to reduce the time at TUG (F2,88 = 14.128, P ≤ .001). However, the lack of significant interaction in evaluation × group showed that none of the vibration frequencies had an effect different from the placebo: F4,771,69.968 = 0.717, P = .606 for FR; F6,88 = 1.332, P = .251 for TUG (Table 1).

In summary, previous work has shown that a single session of WBV can appear to induce significant short-term improvement on postural stability in PD, an effect subsequently confirmed by others using different protocols. However, the role of placebo was either not investigated or unsatisfactorily controlled. We have shown here that a single session of WBV with 3 frequencies does not have acute effects on gait and balance of PD patients that are different than the effects of a placebo. However, the lack of significant improvements should not mean complete rejection of the use of WBV in the

Table 1. Differences between groups in the pretest (shaded) and effect of the protocol (unshaded)

<table>
<thead>
<tr>
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<th>Placebo group</th>
<th>3 Hz group</th>
<th>6 Hz group</th>
<th>9 Hz group</th>
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<tbody>
<tr>
<td>Functional reach (mm)</td>
<td>237.90 (±6.48)</td>
<td>260.99 (±5.78)</td>
<td>237.51 (±7.05)</td>
<td>264.79 (±48.20)</td>
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<tr>
<td>Timed up and go (s)</td>
<td>16.39 (±7.28)</td>
<td>14.62 (±2.60)</td>
<td>13.38 (±3.29)</td>
<td>15.61 (±2.57)</td>
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</table>

The shaded part of the table shows the values of each group in the pretest. No significant differences were seen between groups in FR or TUG (see Results section). The unshaded part of the table shows the effect of the protocol on the analyzed variables. Results were pooled for the 4 groups, given the lack of significant interaction of evaluation × group. This demonstrates that the effect of the protocol equally affected all 4 groups, therefore suggesting no vibration frequency was superior to the placebo stimulation.

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search for parkinsonian therapies: some reports suggest further analysis of the potential roles of the different vibrations protocols. Future designs involving WBV should be devised in order to explore other parameters, such as application duration, number of sets, frequency, and the nature of vibration; however, in all cases, it is essential that the effect of the placebo be properly controlled for.

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References

Treatment of a Dystonic Storm With Pallidal Stimulation in a Patient With PANK2 Mutation

Pantothenate kinase–associated neurodegeneration (PKAN) is a progressive autosomal recessive neurological disorder linked to PANK2 gene mutations. PKAN accounts for approximately 50% of cases of neurodegeneration with brain iron accumulation and is associated with changes in the basal ganglia on magnetic resonance imaging (MRI), particularly the eye-of-the-tiger sign—a globus pallidus central hyperintensity with surrounding hypointensity on T2-weighted images—regarded as highly specific of PANK2 mutations. Although there is wide phenotypic heterogeneity in PKAN cases, severe generalized dystonia is frequently a prominent clinical sign, which can be very disabling, impair gait, and sometimes lead to life-threatening dystonic storms.

At present, there is no effective pharmacological treatment for this disorder. Several case reports2–5 and 2 small series6,7 of PKAN patients with dystonia treated with deep brain stimulation (DBS) of the internal globus pallidus (GPI) have been published. Clinical outcome was mostly favorable, with results ranging from marked sustained improvement6 to modest improvement lasting only a few months.7 Although many of the reported PKAN patients experienced severe dystonia, data on the effect of DBS of the GPI in PKAN dystonic storms are lacking.

We report on the effectiveness of DBS of the GPI in treating dystonic storm in a patient with PKAN who initially did not show the eye-of-the-tiger sign on MRI.

A 19-year-old man, the son of consanguineous parents and the third of 5 children, had normal neurological development until the age of 13 years, when he began to notice tremor in both hands. Four years later, left foot dystonia appeared, followed by dystonic movements of the fingers of the left hand. Dystonia became generalized within 6 months with prominent extensor trunk spasms. The left foot adopted a permanent varus position, and the patient was unable to walk and became wheelchair-ridden.

Examination revealed generalized dystonia involving the face, neck, trunk, and left extremities, as well as postural tremor of both upper limbs. The remainder of the neurological and general examination was unremarkable. An ophthalmologic evaluation was normal, and neuropsychological tests showed only mild executive dysfunction. A bilateral hypointense globus pallidus signal with no central hyperintensity was observed on T2-weighted MRI images (Fig. 1A), suggesting brain iron accumulation. Plasma concentrations of ceruloplasmin, ferritin, and lipoproteins were normal. No acanthocytes were found in a peripheral blood smear, and no axonal spheroids were observed in a sural nerve biopsy. A homozygous 1021C→T mutation (p.T237M) was found in exon 6 of the PANK2 gene.

Treatment with clonazepam, baclofen, levodopa, anticholinergics, tetrabenazine, and botulinum toxin was ineffective. Dystonia worsened, leading, with no apparent precipitating factors, to status dystonicus with continuous repetitive violent opisthotonic axial spasms (Burke-Fahn-Marsden Dystonia Rating Scale scores of 96/120 and 29/30 for movement and disability, respectively) that did not improve with intravenous infusions of midazolam and propofol and required induction of barbiturate coma. Three days later, the patient underwent a bilateral implant of DBS electrodes into the GPI under general anesthesia with intraoperative microrecording using bispectral analysis monitoring, as described elsewhere. An impulse generator (Kineta, Medtronic, Minneapolis, MN) was inserted. A subtle central pallidal hyperintensity surrounded by hypointensity was observed only on proton...