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Effects of Whole Body Vibration on People with Post-Polio Syndrome

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Introduction

People with post-polio syndrome (PPS) frequently have difficulty finding ways to exercise without worsening symptoms or over-exerting muscles. Whole body vibration (WBV) is a way to exercise that causes muscle contractions through stimulation of reflexes. The purpose of this study was to determine the feasibility of WBV as a means of weight-bearing exercise in people with PPS by assessing its effects on walking speed and endurance (measured by 10-meter walk test and two-minute walk test, respectively), pain severity and interference (measured by the Brief Pain Inventory), sleep quality (measured by the Pittsburg Sleep Quality Index), fatigue (measured by the Fatigue Severity Scale), leg muscle strength (measured by manual muscle testing and hand-held dynamometry), and muscle cramping (through patient reported written logs).

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The Participants

The study was approved by the human subjects Internal Review Boards of Baylor College of Medicine and Texas Woman's University in Houston, Texas. Twenty-one individuals were recruited from the TIRR-Memorial Hermann Rehabilitation and Research outpatient post-polio clinic, Texas Polio Survivors' Association and Post-Polio Health International. Each person provided medical clearance from their personal or TIRR physician.

Fifteen completed the study, with withdrawals due to non-study related reasons. Average age of the participants was 63.53 years, with average age at onset of polio 3.55 years. Nine females and six males completed the study. Eleven walked full-time, three part-time and one did not walk. Three people used one or both AFOs (short braces), two people used one or both KAFOs (long braces). Three people used one straight cane or walking stick, one used two straight canes and one used two Lofstrand crutches. Five people continued to work full-time during the study, two worked part-time and eight had retired prior to the study.

The Activity

Each person participated in eight sessions of WBV over four weeks on two different WBV machines. Each person was asked to stand on the machine's vibrating platform with knees slightly bent and weight as even between the two legs, as possible. They did not wear their braces/orthoses during vibration sessions, to avoid possible loosening of hardware or friction between the device and person's skin. They wore socks only on their feet to best feel the vibration. If the person was unable to stand, then he or she sat in a wheelchair or chair with seat elevated, leaning forward onto knees with feet on the platform. (See the photos for equipment used and sitting and standing positions.)

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Each person started with one minute standing with vibration on, one minute sitting down with no vibration, repeating this sequence 10 times for a total of 10 minutes of vibration time per session. Time was gradually increased to 10 times of two minutes of vibration for total of 20 minutes per session. Each person was able to increase to the goal of 20 minutes without difficulty. Blood pressure and heart rate were measured before and after each vibration session. Rating of perceived exertion was measured after each session.

All participated in eight sessions on the Soloflex unit at its lowest setting of "acceleration-load" 0.3 g and eight sessions on the Power Plate Pro5 at settings of 35 vibrations per second, low amplitude (vibration height). The Power Plate settings were more intense than the ones on the Soloflex. When measured with a separate accelerometer, the total amplitude of the Power Plate was 8.82 millimeters and the Soloflex was 4.53 millimeters. The g forces were 2.76 on the Power Plate and 2.21 on the Soloflex. The people were randomized into which machine/settings were used for the first eight and second eight sessions.

Testing

A physical therapist (PT) who did not know which vibration machine was being used by each person performed all the testing. Testing of outcome measures occurred before and after each four weeks of eight sessions per machine and two weeks following the last testing session. There were two weeks scheduled off in between the two four-week vibration interventions. Each person completed muscle cramping logs two weeks prior to start of any testing and vibration and continued throughout entire study period (approximately three months).

Rationale

I first became interested in WBV when a patient from our post-polio clinic asked me if it was safe for him to do, as he had been advised by a physician to start a vibration program because of his recent diagnosis of osteopenia (bone density loss, prior to osteoporosis). I had to tell him that I did not know, would look some things up, and get back with him. As I studied WBV, I became more and more interested in it to see if it could be an addition to a person's exercise routine or used as an exercise substitute. Frequently, people with PPS have difficulty finding safe ways to exercise without worsening their symptoms of muscle weakness, pain, sleep disturbances, fatigue and/or muscle cramping.

Studies have shown WBV to improve leg strength, balance, flexibility, health-related quality of life and bone mineral density in healthy and elderly populations. There have also been small studies of WBV used with adults with stroke, Parkinson's disease, multiple sclerosis and cerebral palsy that have inconsistently shown improvements in leg strength, balance and walking. One previous study of people with PPS was discontinued after no changes were found in leg strength or walking performance.

Concerns

My first concern in designing the current study was that I did not want to cause any of my patients and other polio survivors to have more problems than they already had. This concern was why we used a low intensity protocol on the Soloflex and a higher intensity one on the Power Plate. No one reported any increasing PPS symptoms, even handling fatigue although some of the people commuted more than one hour each direction to participate. Additionally, one person had her work demands approximately double and another babysat her two very young grandchildren for two weeks full-time during the course of the study, with both situations potentially greatly impacting fatigue levels. A few of the participants reported feeling quite energized after sessions.

Of the people who completed the study, one person who was unable to walk and stand used the sitting protocol. One other person who was able to walk and work full-time chose to sit through most of the higher intensity protocol due to it being "too intense." Most of the people who first participated in the higher intensity protocol asked if the low intensity of the Soloflex could be "turned up," because they felt like they were "not getting enough." Some reported the testing sessions to be more strenuous than the vibration sessions.

Results

There were no study-related adverse events. The people who first started with the higher intensity protocol on the Power Plate significantly improved in their walking speed ($p = 0.017$), However, when combining the people who started with either intensity of intervention, their improvement was not significant ($p = 0.087$). Pain severity significantly improved ($p = 0.049$) and pain interference came close to significant improvement ($p = 0.055$) as measured by the Brief Pain Inventory after the more intense Power Plate vibration intervention, regardless if they had the Power Plate vibration sessions in the first intervention block or not.

No significant changes were found after the gentler Soloflex intervention. There were no significant changes in walking endurance, sleep quality, fatigue, leg strength or muscle cramping. There were also no significant changes in blood pressure and heart rate after each session. The changes seen in walking speed and pain severity and interference were temporary and not maintained during follow-up testing.

The Limitations

The biggest study limitation was of recruitment. Many people expressed interest by email or when approached in the clinic. However, the biggest reason given for choosing not to participate was due to the time, expense and energy involved with commuting into the huge Texas Medical Center in Houston, Texas twice a week for the testing and vibration sessions. The most common reason for a person to be excluded from the study was due to metal implants, particularly joint replacements or internal bone fixations due to scoliosis or previous fractures.

Because of the small number of people who were able to participate and complete this study, the results of improved gait speed and pain must be interpreted cautiously, and I do not have an explanation for why the one group of people walked faster than the other after the Power Plate intervention, as both groups' baseline walking speeds were not statistically different. Obviously, the 15 people who completed this study cannot represent the wide spectrum of types of people who have survived polio, with or without PPS. Also, the improvements that were found did not last until the follow-up testing that occurred two weeks later, indicating that a person may need to continue with WBV to maintain the effects.

The Strengths

Strengths of the study included having two PTs administer all the tests, with significant effort made for each PT to follow the assigned participant throughout the study duration, as much as possible. Each PT worked full- or part-time at TIRR Memorial Hermann and was skilled in the testing protocols. They were "blinded" to which machine each participant was using and to previous testing forms to maximize their objectivity and minimize bias. The primary investigator, who has worked with polio survivors at TIRR since 1998, was present during almost all of the vibration sessions and able to verbally or physically assist with participants accessing the vibration platforms, body positioning and education regarding the protocols.

Conclusions

In conclusion, WBV appears to be a safe, tolerable, and feasible type of weight bearing exercise for people with PPS. Further research needs to be done to study long-term use in people with PPS and other neurological conditions, particularly in reducing barriers to participation to promote the physical aspects of health and wellness.

Dissemination Plans

Preliminary data and results were presented at the Texas Physical Therapy Association meeting in Galveston, Texas in October, 2014. Final study results have been submitted as abstracts for presentations at the American Physical Therapy Association Combined Sections Meeting and American Congress of Rehabilitation Medicine and will be submitted as a manuscript for Archives of Physical Medicine and Rehabilitation. ■

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References

Bautmans I, Hees EV, Lemper J, Mets T. The feasibility of whole body vibration in institutionalized elderly persons and its influence on muscle performance, balance and mobility: a randomized controlled trial. *BMC Geriatrics.* 2005; 5:17.

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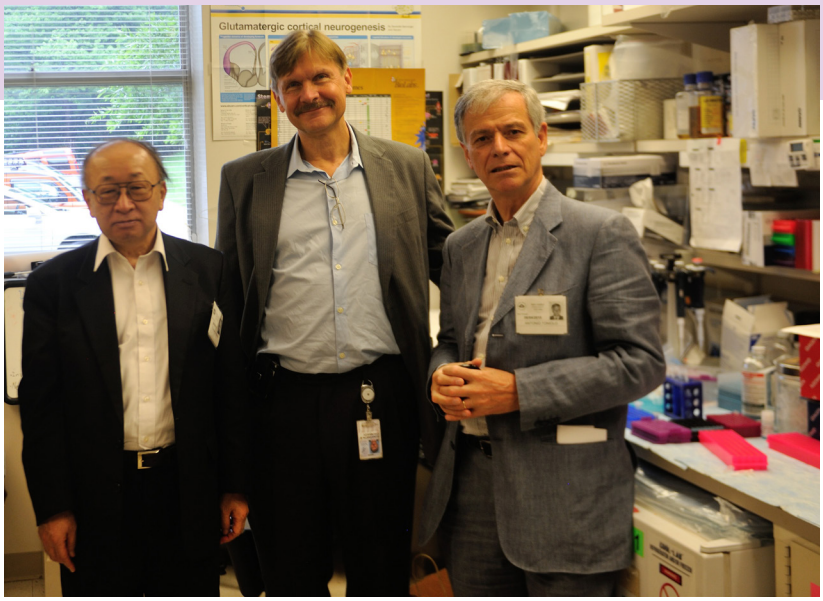

Left to right: Drs. Takashi Onodera, Konstantin Chumakov and Antonio Toniolo at National Institutes of Health discussing how to apply novel sequencing methods for examining poliovirus isolates of PPS cases.

identification of chronic PV carriers might indicate the need of treatment with human IgG or antiviral drugs/ antibodies that are under development (McKinlay et al., 2015). Some treatments (Hu immunoglobulins) are currently under clinical trial in a multicenter international study.

What are the team's next steps?

Select viruses isolated from PPS cases are being examined at the FDA in order to define the peculiarities of genomic sequences of polioviruses present in PPS cases versus those of wild-type polioviruses.

The recruitment of polio survivors with "stable polio" is continuing to extend the observations from the current to at least 30-40 cases.

The team will evaluate if anti-poliovirus antibodies may be effective in blocking the infectivity of poliovirus strains derived from PPS patients.

If positive, the results of the above tests will allow the team to propose "specific serotherapy" for treating PPS. In the meantime, they want to understand the possible role of poliovirus antibodies in the current therapy that is mainly based on the infusion of human immunoglobulins. ■

References

Baj A, Colombo M, Headley J, McFarlane J, Liethof M-a, Toniolo A. Post-poliomyelitis syndrome as a possible viral disease. *Int J Infect Dis.* 2015;35:107-116.

Farbu E, Gilhus NE, Barnes MP, Borg K, de Visser M, Howard R, Nollet F, Opara J, Stalberg E. Post -polio syndrome. In: *European Handbook of Neurological Management.* Volume 1, 2nd Edition. NE Gilhus, MP Barnes, M Brainin (Eds.). Blackwell Publishing, Oxford, 2011; pp. 311-9.

Ikemoto A, Hirano A. Immunohistochemical studies on clustered pericapillary bodies in the spinal cord of post-poliomyelitis patients. *Acta Neuropathol.* 1996;92:164-9.

Koopman FS, Uegaki K, Gilhus NE, Beelen A, de Visser M, Nollet F (2011). Treatment for postpolio syndrome. *Cochrane Database Syst Rev.* (2):CD007818.

Leon-Monzon ME, Dalakas MC. Detection of poliovirus antibodies and poliovirus genome in patients with the post-polio syndrome. *Ann N Y Acad Sci.* 1995;753: 208-18.

McKinlay MA, Collett MS, Hincks JR, Oberste MS, Pallansch MA, Okayasu H, Sutter RW, Modlin JF, Dowdle WR. Progress in the development of poliovirus antiviral agents and their essential role in reducing risks that threaten eradication. *J Infect Dis.* 2014;210:S447-53.

Semino-Mora C, Dalakas MC. Rimmed vacuoles with beta-amyloid and ubiquitinated filamentous deposits in the muscles of patients with long-standing denervation (postpoliomyelitis muscular atrophy): similarities with inclusion body myositis. *Hum Pathol.* 1998;29:1128-33.

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Brogårdh C, Flansbjer U-B, Lexell J. No effects of whole body vibration training on muscle strength and gait performance in people with late effects of polio: a pilot study. *Arch Phys Med Rehabil.* 2010; 91:1474-1477.

del Pozo-Cruz B, Adsuar JC, Parraca JA, del Pozo-Cruz J, Olivares PR, Gusi N. Using whole body vibration training in patients affected with common neurological diseases: a systematic literature review. *J Altern Complement Med.* 2012;18:29-41.

del Pozo-Cruz B, Hernández Mocholí MA, Adsuar JC, Parraca JA, Muro I, Gusi N. Effects of whole body vibration therapy on main outcome measures for chronic non-specific low back pain: a single-blind randomized controlled trial. *J Rehabil Med.* 2011;43:689-694.

Marin PJ, Rhea MR. Effects of vibration training on muscle strength: a meta-analysis. *J Strength Cond Res*. 2010;24:548-556.

Rittweger J, Karsten J, Kautzsch K, Reeg P, Felsenberg D. Treatment of chronic low back pain with lumbar extension and whole body vibration exercise. *Spine.* 2002;27:1829-1834.

von Stengel S, Kemmler W, Engelke K, Kalender WA. Effects of whole body vibration on bone mineral density and falls: results of the randomized controlled ELVIS study with postmenopausal women. *Osteoporos Int.* 2011;22:317-325.