

# Using whole body vibration in the pediatric population: a primer for the chiropractor

Tracy Barnes DC DICCP CKTI  
Private Practice, Louisville KY USA  
tabarnes@aol.com

## ABSTRACT

**Objective:** To present a history of whole body vibration (WBV) and survey current literature as it relates to the use of this therapy with children. Clinical relevance for Doctors of Chiropractic who work in the pediatric realm will be noted. **Methods:** Primary source material came from a literature search of PubMed and google scholar. The search focused on whole body vibration therapy in use with children aged 0-18 years with keywords: 'whole body vibration and pediatrics; whole body vibration and children, WBV and pediatrics, WBV and children, WBV contraindications.' **Results:** Based on the results of this review, WBV appears to be safe and well tolerated in the pediatric population. Multiple effects have been found for WBV including decreasing muscle spasticity, improving muscle strength and balance and increasing bone density It has been studied in children diagnosed with a variety of disorders including cerebral palsy, Down syndrome, movement disorders, bone mineral density and more. Appropriate frequency levels for treatment are presented. Contraindications were minimal. **Conclusion:** WBV can safely be introduced to children and may provide positive therapeutic gains.

**Key Words:** whole body vibration and pediatrics; whole body vibration and children, WBV and pediatrics, WBV and children, WBV contraindications, whole body vibration therapy (WBVT).

## Introduction

The use of vibration as therapy goes back to the ancient Greeks and then progresses to various therapies of the 1800's until the use of vibration machines for Russian cosmonauts in the 1970's.<sup>1</sup> In 2022, whole body vibration is a well-researched therapy with possible benefits such as increasing muscle strength, balance and bone mineral density for multiple populations. Today's Doctors of Chiropractic may benefit from understanding and utilizing this therapy for many of their patients from children to the elderly.

## History

The ancient Greeks are said to be the first to employ what modern vernacular terms whole body vibration (WBV) therapy. One of the treatments for injured soldiers on battlefields was a bowstring like instrument that was placed over a wound and vibrated when set in motion. Speculation is that this 'treatment' aided the body in moving 'pus' to the surface for release. In addition, "Greek physicians used flutes, lyres, and zithers (harp like instrument) to heal their patients.<sup>1</sup> They used vibration to aid in digestion, treat mental disturbance, and induce sleep. Aristotle (323—373 BCE), in his famous book *De Anima*, wrote that flute music could arouse strong emotions and purify the soul."<sup>2</sup>

In the 1850's, Dr. Gustav Zander, the father of mechanotherapy from the University of Stockholm is widely reported to have developed machines that moved and vibrated individual body parts as well as the whole body.<sup>3</sup> Zander, a physician, gymnastics teacher and inventor

was said to have created some 70 different machines in his lifetime.<sup>3</sup> Among them were chest and body percussive machines, back strengthening machines, scoliosis aids and more. In an age of blood-letting and noxious humors, Zander's treatments were ahead of his time. His mechanical devices served in many cases, as the precursor to modern gym equipment.<sup>4</sup>

French physician and neurologist Jean-Martin Charcot was also using vibration therapy in the 19th century to help his patients.<sup>5</sup> He lectured multiple times about the benefits of vibration for those with neurologic disease including Parkinson's. He is credited with developing the first 'vibration chair.' This invention came about after he began noting that his patients felt better after long rides in carriages or overnight on trains. He reproduced this experience by having his patients sit for 30 minutes in an automated vibratory chair. His junior colleague, Gilles de la Tourette created a helmet that vibrated with the idea that the brain responded positively to pulsation.<sup>5</sup>

Following the lead of Russian scientists who used vibration therapy to treat their cosmonauts' muscle and bone loss while in space, NASA embarked on an investigation of its own to see if vibration could decrease anti-gravity related bone loss.<sup>6</sup> NASA-funded scientists developed a vibratory plate that was used in space flight. Astronauts were held to the plate with elastic straps and could continue some work tasks while exposed to 10 to 20 minutes of vibration (90 Hz).<sup>6</sup> The scientists found that these subtle vibrations slowed bone loss in animal model studies on sheep and

rats. One of the studies showed with only 10 minutes a day of low level vibration could be “an effective biomechanical intervention for the prevention of bone loss that plagues long-term space flight, bed rest, or immobilization caused by paralysis.”<sup>7</sup>

### What is Whole Body Vibration (WBV)?

The look of vibration therapy machines has changed from the days of Dr Zander’s device where the patient stood in front of a gyrating punching bag type device or was seated in Dr. Charcot’s oscillating lounge chair. Today’s WBV devices are plates, usually made of metal and plastic that provide a high-frequency mechanical stimulus that is transmitted through the body. This vibratory movement loads bone and sensory receptors and can be considered weight-bearing exercise.<sup>8</sup>

The vibration platforms can deliver vibration over a range of frequencies (5-90 Hz) and amplitudes or displacements that are generally termed ‘peak to peak’ which indicates the lowest and highest positions of movement. Vibrations can also move in a vertical or side to side, oscillating movement. Consensus has not yet shown the optimum combination of all these movements although most research on children follows a ‘less is more’ idea in terms of frequency and amplitude. Multiple studies assessing WBV in children and adolescents use a 20-30 Hz range intervention.<sup>8</sup> It has been the author’s experience that some children are not able to comfortably tolerate higher frequencies and anecdotally have complained of stomach aches when using vibrations above 50 Hz.

Users can adopt a variety of positions on the plate from standing to sitting to placing hands on it. Those who have difficulty with independent standing can make use of a stabilizing bar often mounted on the vibration plate or their feet can be placed on the plate from a standing support. In this way, WBV can be used by a large majority of children who would be seen in a chiropractic office for care. In addition, WBV plates can be used for active exercise and has been shown to be safe as a passive intervention for those with motor impairment or poor balance function.<sup>9</sup>

### WBV and Bone Mineral Density

Since the earlier days of animal and astronaut studies, hundreds of others have looked at vibration therapy for its use with various populations. In 2020, Swolin-Eide et al published a systematic review in the *Current Osteoporosis Report* looking at vibration therapy specifically for children. Their review of 10 years of research on the use of vibration and bone loss in children showed first and foremost that WBV is a safe modality for children. In fact, no serious side effects had been noted in multiple studies on the use of WBV and children with Duchenne’s muscular dystrophy, Down syndrome, cerebral palsy(CP), cystic fibrosis, type

2 diabetes and obesity. They noted that studies of children with CP reported that 80% of the participants experienced redness of the feet after the first treatment session. They also concluded that “WBV appeared to be a safe non-pharmacological anabolic approach to increase bone mass in some pediatric populations” and they called for more research to further evaluate WBV’s use.<sup>10</sup> Based on these findings, the author proposes that WBV can safely be used with children in a supervised setting.

While some reviews show WBV to be no better than minimal intervention and note that the quality of some studies on WBV is low,<sup>14</sup> other randomized controlled research shows WBV to improve bone mineral content and density in children with and without Down syndrome (DS).<sup>16</sup> In one study, 26 adolescents (half with DS and half without) aged 12-18 years used a vibration plate 3x/week for approximately 10 minutes at a frequency of 25-30 Hz. After 20 weeks, their study showed clinically relevant gains in bone mineral content of multiple skeletal areas, such as pelvis, legs and spine in both groups of adolescents.<sup>16</sup>

### WBV and Muscle Function

The results of the 10-year review also note that WBV shows the most beneficial effect in muscle strength, balance, and walking speed in children affected by “Down syndrome or severe motor disabilities with low bone mass and reduced activity levels.”<sup>10</sup> Other studies have indicated a positive effect on muscle cells as well as osteocytes. Research published in the *Medical Sciences and Sports Exercise Journal* compared the effect of WBV versus resistance training in a 12-week program aimed at human knee extension strength. This study involved 67 females who were approximately 21 years of age and randomized into three groups. While one group was control and another did resistance training; the third group performed static and dynamic exercise on a vibration plate set at 35-40 Hz for some 20 minutes, three times per week. Results here were clear that increases in strength that were shown after WBV training was “not attributable to placebo effect.”<sup>11</sup>



Rhys, age 13 years old, who suffers from hypertonic hamstrings, uses WBV to help improve his range of motion.

When looking specifically at children, a pilot trial study was published in 2013 aimed at investigating WBV and muscle strength of kids with cystic fibrosis. They used a home-based WBV program for seven children aged eight to 15 years. Parents supervised the children standing on a vibration plate at 20 — 22 Hz for 20 — 30 minutes once per day for four weeks. Outcomes showed no adverse effects and “indicated that WBV may be a potentially effective exercise modality to safely increase leg strength and explosive power in children with CF.”<sup>12</sup>

Children with spastic cerebral palsy may benefit from WBV as shown in an 8-week intervention using WBV for 10 minutes at 3x/week. “The results suggested that an 8-week WBV intervention normalized muscle tone, improved active joint range and enhanced ambulatory performance in children with cerebral palsy for at least three days. These indicated that regular WBV can serve as an alternative, safe, and efficient treatment for these children in both clinical and home settings.”<sup>19</sup>

The literature review on WBV for children with disabilities that was published in the 2014 *Journal of Adolescent Health* noted that most of the 22 papers they looked at “showed positive effects of WBV on health-related physical fitness in children and adolescents with disabilities. Overall, 10-20 minutes at least three times per week, for a minimum of 26 weeks, with frequencies between 15 and 35 Hz might be an appropriate protocol to achieve improvement in body composition and muscular strength.”<sup>8</sup>

A 2019 pilot study out of China looked at the effects of WBV on lumbar and abdominal activation in healthy young adults aged approximately 21 years. They used surface electromyography (sEMG) to measure actions of multifidi, rectus abdominis, erector spinae and abdominal oblique muscles with multiple frequencies of vibration. Their findings support the use of 15 Hz vibration as the “best vibration stimulation for core muscles in all of the exercises.”<sup>13</sup> A 2018 literature review of 24 studies on WBV’s effect on neuromuscular performance concluded that WBV “can bring about improvement in muscles strength, power, and flexibility.”<sup>15</sup>

### WBV and Other Benefits

Not only does WBV seem to have benefits for the neuromuscular and osseous systems, but other studies have looked at the benefits for WBV on cognition. (See Table 1). Fifty-five healthy children aged 8 to 13 years participated in a study where they sat in a chair that was mounted to a vibration plate. They sat for one to three sessions of three minutes each at a frequency of 30 Hz. Researchers used performance tools to analyze inhibition as a function of attention before and after the children were exposed

Research shows WBV may be useful for those with:

- Muscle spasticity<sup>23</sup>
- Bone mineral deficiency<sup>10</sup>
- Impaired muscle performance<sup>12,16</sup>
- Athletic performance<sup>17,26</sup>
- Balance issues<sup>13</sup>
- Proprioception deficit<sup>13</sup>
- ADHD<sup>19</sup>
- Cognitive dysfunction<sup>18</sup>
- Restless legs<sup>27</sup>
- Fatigue<sup>28</sup>
- Pediatric cancers<sup>29</sup>
- Cerebral palsy<sup>14,15</sup>

**Table 1.**

to the vibration. They concluded that WBV improves inhibition in healthy children and recommended more studies for children diagnosed with ADHD.<sup>17</sup> There is one study available that followed an adult with ADHD for 10 consecutive days using WBV as a treatment modality. Post neuropsychological assessments revealed a ‘high clinical value’ in the use of WBV for those with impairments such as ADHD.<sup>18</sup>

### Contraindications for WBV use

Reports of adverse effects of WBV use with children, are difficult to find. As previously mentioned, one study found that the children with CP that used WBV experienced some redness of the feet.<sup>10</sup> Certainly caution is warranted when using WBV in children who may have balance issues, are diagnosed with epilepsy or seizure disorders or who have had recent surgeries. WBV machines are available that have bracing bars attached to their base and should be used with any child whose balance is in question. Clinicians should also take care to provide support as needed in all uses of WBV. This author recommends placing the vibration plate in reach of a stable piece of furniture or walker if available



Gordon, age 10 years old, is able to successfully read and continue home-school work while using WBV therapy.

and never allowing children with balance issues to use the device unattended. More study is needed in areas of understanding the most beneficial frequency, timing and amplitude of the vibration. Additional research is also needed in clarifying the mechanism of action of WBV on the body and which bodily systems are stimulated by its use.

Matute-Llorente, et al. say in their conclusion that: “Because no serious adverse events have been observed, WBV might be defined as a safe treatment to be applied in children and adolescents with disabling conditions. Further research is recommended to explore the minimum dose of exposure to WBV required to elicit an optimal response in children and adolescents for improving health-related physical fitness. These may be translated into a more specific WBV protocol.”<sup>48</sup>

A systematic review of WBV use for children with cerebral palsy done by Saquetto et al notes, “Overall, whole-body vibration seems to be well tolerated among children with cerebral palsy, although the incidence of long-term hazards requires more research.”<sup>24</sup>

### WBV in the Chiropractic Setting

As a Doctor of Chiropractic with a specialty emphasis in pediatrics, this author uses WBV platforms in her office on a daily basis. In the waiting room, multiple vibration plates are available for patients of all ages to place their feet on or stand on. During treatments when more than one patient in a family is in the treatment room, those not receiving hands-on care can stand, sit or place feet on a vibration platform. This is especially helpful in cases where one young person needs a calming stimulus prior to their treatment. Experience has shown that kids of all ages enjoy using the vibration plates. Many have purchased plates for use at home and have found them useful to place feet on when studying, after sports or prior to bedtime.

Vibration plates can be found for sale in multiple places



Michael, age 9 years old, tried to do a somersault on a trampoline prior to this visit for treatment of neck to midback pain. He says the vibration plate is ‘super relaxing.’

online and range from approximately \$100 to over \$1,000. The author’s experience has been that vibration plates of good quality are available for \$150-\$200 and are useful for families to have at home for daily use. When looking to buy a vibration machine, it is recommended to assure the weight limit is appropriate to the patient. Some WBV plates have an upper weight limit of 250lb. Also of importance is assuring that those with balance issues or decreased proprioception have someone or something nearby to assist with fall prevention. And in starting a WBV program, studies recommend starting with a low Hz setting and spending no more than 10 minutes on a plate per day to begin with.

### Conclusion

Based on available research, implementing the use of a WBV plate can be a beneficial adjunct to a Doctor of Chiropractic’s office for children as well as adult patients. There are a plethora of children with diagnoses ranging from Down syndrome to cerebral palsy to cancer and more who could benefit from this therapy. Chiropractors who specialize in the care of children may be asked by families if this therapy can help their child. This paper seeks to provide information to address those questions with knowledge. As with many treatment modalities, more high quality research is needed to better understand the uses of WBV.

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