Whole-Body Vibration Training in Women

Indexing Metadata/Description

› Procedure: Whole-Body Vibration Training in Women
› Area(s) of specialty: Orthopedic Rehabilitation, Women’s Health, Sports Rehabilitation
› Description/use: Whole body vibration (WBV) training involves the use of a vibrating platform that elicits rapid repeating eccentric/concentric contractions of the muscles using the tonic vibration reflex to stimulate muscle fibers to promote strength and endurance.\(^1\) Vibration acts as a mechanical stimulus to increase motor unit recruitment when standing on a vibration platform that produces vertical vibration or oscillation around a horizontal axis.\(^22\)

› Indications:
  • WBV training is indicated to
    - decrease pain and improve function\(^2\).\(^23\)
    - increase muscle strength (e.g., pelvic floor muscles)\(^3\)
    - improve bone mineral density\(^2\)
    - improve balance and proprioception\(^2\)
    - increase peripheral blood flow\(^24\)
  • WBV is also indicated to enhance sports performance (e.g., increase vertical jump, power, strength)\(^3\)
  • WBV might decrease cardiovascular risk in postmenopausal women by improving aortic hemodynamics and muscle strength\(^25\)
  • WBV plus L-citrulline supplementation has been associated with improving arterial stiffness and leg muscle function in obese postmenopausal women\(^26\)
  • This Clinical Review focuses on the use of WBV specifically in women. For general information about WBV and WBV in other populations, please see
    - Clinical Review...Whole Body Vibration: An Overview; Item Number:T709253
    - Clinical Review...Whole Body Vibration Training in Older Adults; Item Number:T709251
  • CPT codes: There are no specific CPT codes for WBV training
  • Reimbursement: There is currently no reimbursement for this type of treatment

Indications for procedure

› WBV training is indicated for patients with the following conditions
  • Acute or chronic pain
  • Fibromyalgia\(^2\)
  • Muscle weakness (e.g., pelvic floor muscles)\(^2\)
  • Decreased bone mineral density\(^3\)
  • Impaired balance and proprioception\(^3\)
  • Neurological disorders\(^12\)
    – Cerebral palsy, Parkinson’s disease, stroke, spinal cord injury
  • COPD exacerbations\(^27\)
• Knee osteoarthritis

WBV is also indicated to enhance sports performance (e.g., increase vertical jump, power, strength)

Guidelines for use of procedure

› Patients stand on the WBV platform and perform exercises on the platform
› Patients need to be supervised during WBV training in order to achieve optimal effects on physical fitness and protocol adherence
› The therapist sets the frequency, amplitude, and duration of the platform device vibration

Contraindications/Precautions to procedure

› **Contraindications**
  
  • Kidney or bladder stones, gallstones
  • Arrhythmia
  • Pregnancy
  • Epilepsy
  • Tumors
  • Pacemaker
  • Recent surgery
  • Acute deep vein thrombosis
  • Acute rheumatoid arthritis
  • Serious cardiovascular disease
  • Severe diabetic neuropathy
  • Acute migraines
  • Complex regional pain syndrome (CRPS)
  • Acute inflammation, infection, fever
  • Recent implants (e.g., joint, corneal, cochlear)
  • Acute hernia
  • Acute disc related problems
  • Spondylosis, gliding spondylolisthesis
  • Osteonecrosis
  • Severe osteoporosis

› **Precautions**
  
  • Erythema, itching of the legs, edema, and shin pain have been reported from vibration training
  • Vibration can act as a perturbation that interferes with postural control, which can lead to an immediate deterioration in balance
  • Direct-to-consumer marketing for whole-body vibration platforms might raise concerns about consumers’ ability to distinguish low-intensity platforms intended for osteoporosis therapy from platforms intended for high-intensity exercise
  • Patients with a diagnosis for which this procedure is used might be at risk for falls; follow facility protocols for fall prevention. Ensure that patient and family/caregivers are aware of the potential for falls and educated about fall-prevention strategies. Discharge criteria should include independence with fall-prevention strategies

Examination

› **History**
  
  • *History of present illness/injury for which the procedure is indicated*
    
    – **Mechanism of injury or etiology of illness**: Is the patient experiencing acute or chronic pain? What is the current reason for referral? What diagnosis has the patient been given?
    
    – **Course of treatment**
    
    - **Medical management**: When was the patient’s condition diagnosed? What medical intervention has been provided to date?
- **Medications for current illness/injury**: Determine what medications clinician has prescribed; are they being taken? Are the medications effective? Patients with fibromyalgia might be taking pharmacologic treatment for pain relief.

- **Home remedies/alternative therapies**: Document any use of home remedies (e.g., ice or heating pack) or alternative therapies (e.g., acupuncture) and whether or not they help.

- **Previous therapy**: Document whether patient has had occupational or physical therapy for this or other conditions and what specific treatments were helpful or not helpful.

- **Aggravating/easing factors**: What activities aggravate the patient’s symptoms and what activities ease the patient’s symptoms? How long before the symptoms come on or are eased?

- **Body chart**: Use body chart to document location and nature of symptoms.

- **Nature of symptoms**: Document nature of symptoms (e.g., constant vs. intermittent, sharp, dull, aching, burning, numbness, tingling).

- **Rating of symptoms**: Use a visual analog scale (VAS) or 0–10 scale to assess symptoms at their best, at their worst, and at the moment (specifically address if pain is present now and how much).

- **Pattern of symptoms**: Document changes in symptoms throughout the day and night, if any (A.M., mid-day, P.M., night); also document changes in symptoms due to weather or other external variables.

- **Sleep disturbance**: Document number of wakings/night. Determine if patient is experiencing any sleep problems.

- **Other symptoms**: Document other symptoms patient might be experiencing that could exacerbate the condition and/or symptoms that could be indicative of a need to refer to physician (e.g., dizziness, bowel/bladder/sexual dysfunction, saddle anesthesia).

- **Respiratory status**: Document any history of respiratory compromise, including dyspnea, use of supplemental oxygen, and chronic cough. Obtain recent pulmonary function test results where available.

- **Barriers to learning**: Are there any barriers to learning? Yes__ No__

  - If Yes, describe _______________________

  - **Medical history**

    - **Past medical history**

      - **Previous history of same/similar diagnosis**: Has the patient had any previous injuries or undergone surgery related to this diagnosis?

      - **Comorbid diagnoses**: Ask patient about other problems, including diabetes, cancer, heart disease, complications of pregnancy, psychiatric disorders, orthopedic disorders, etc.

      - **Medications previously prescribed**: Obtain a comprehensive list of medications prescribed and/or being taken (including over-the-counter drugs).

      - **Other symptoms**: Ask patient about other symptoms he or she might be experiencing.

  - **Social/occupational history**

    - **Patient’s goals**: Document what the patient hopes to accomplish with therapy and in general.

    - **Vocation/avocation and associated repetitive behaviors, if any**: (e.g., does the patient participate in recreational activities?) Patients participating in WBV training might be using this type of training to improve their skill sets in physical activities such as dance and volleyball.

    - **Functional limitations/assistance with ADLS/adaptive equipment**: (include limitations with self-care, home management, work, community leisure): Patients with fibromyalgia might limit their activity secondary to fear of falling.

    - **Living environment**: Inquire about stairs, number of floors in home, with whom patient lives (e.g., caregivers, etc.). Identify if there are barriers to independence in the home; any modifications necessary?

  - **Relevant tests and measures**: (While tests and measures are listed in alphabetical order, sequencing should be appropriate to patient medical condition, functional status, and setting)

    - **Anthropometric characteristics**: Measure patient’s height and weight, and determine body mass index (BMI). Compare to normative data.

      - Underwater weighing or skinfold caliper testing can be used for more precise body composition analysis, especially for those participating in high-level sports.

    - **Assistive and adaptive devices**: If patient is using any assistive devices, assess proper fit and adjust the device as needed. Provide any training and education for proper use for any assistive devices.
• **Balance:** Assess patient’s static and dynamic sitting and standing balance. Use the Romberg balance test, tandem stance time, Berg Balance Scale (BBS), Tinetti Balance Scale, 10m tandem gait time and tandem gait step number, Timed Up and Go test (TUG) test, Biodex Stability System, Star Excursion Balance Test \(^{(13)}\)

• **Cardiorespiratory function and endurance:** Assess patient’s cardiorespiratory endurance using the 6-minute walk test (6MWT) for distance or graded cycling exercise test. Use the Borg Rating of Perceived Exertion (RPE) Scale to determine exercise intensity. Monitor vital signs before, during, and after activity. Cardiovascular fitness is an important assessment for those participating at a high level of sports competition \(^{(6)}\)

• **Functional mobility:** Assess patient’s basic functional mobility (bed mobility, transfers, and stair negotiation). The FIM can be used

• **Gait/locomotion:** Assess patient’s gait for ability to ambulate safely. Note any gait asymmetry or deviation
  – The Dynamic Gait Index (DGI), gait velocity measured with the 10 meter walk test (10MWT), and cadence (steps per minute) can be used to assess dynamic walking ability \(^{(13)}\)

• **Joint integrity and mobility:** Joint mobility will be an important factor for patients participating in high-level sports function when exercising on the WBV platform \(^{(6)}\)

• **Muscle strength:** Perform bilateral lower extremity myotomal testing or manual muscle testing (MMT)
  – Strength and vertical jump can be assessed using an isokinetic dynamometer or a force plate \(^{(1)}\) A good measure for power is to measure vertical jump height using the jump force rate of development or jumping mechanography
  – Assess muscle power with 5-repetition chair-rising time, especially in older individuals or those with disabilities \(^{(13)}\)

• **Palpation:** Patients with fibromyalgia might have pain and tenderness with palpation over various parts of the body \(^{(2)}\)

• **Posture:** Assess patient’s sitting and standing posture, noting any asymmetry or abnormality

• **Range of motion:** Assess ROM of the upper and lower extremity joints using a goniometer. The sit and reach test can be used to measure lower extremity flexibility

• **Reflex testing:** Perform bilateral biceps and patellar deep tendon reflex tests using a reflex hammer and note any asymmetry or abnormality

• **Self-care/activities of daily living** (objective testing): Assess patient’s ADLs or IADLs using the Barthel index or Lawton Instrumental Activities of Daily Living Scale

• **Sensory testing:** Assess patient’s bilateral upper and lower extremity sensation and proprioception with light-tough, sharp-dull, joint position. Note asymmetry or abnormality

• **Special test specific to diagnosis:**
  – Provide patients with quality of life questionnaires such as the Fibromyalgia Impact Questionnaire (FIQ) or the SF-36 for quality of life

**Assessment/Plan of Care**

› **Diagnosis/need for procedure:** Alternative treatment for patients looking for variation in training to help improve vertical jump height, improve balance and proprioception, and improve muscle strength and endurance. Alternative treatment intervention for patients who have chronic pain, fibromyalgia, decreased bone mineral density (BMD), or pelvic floor muscle weakness

› **Prognosis:** Prognosis depends on diagnosis

› **Referral to other disciplines:** Athletic trainer, pain specialist, primary care physician

› **Other considerations:** Patients might also participate in aerobic exercises, a stretching program, and relaxation exercises such as diaphragmatic breathing, progressive muscular relaxation to address their primary complaints (muscle weakness, pain, fatigue) \(^{(2)}\)

› **Treatment summary**
  • Results of published research are mixed on the effects of WBV on BMD, strength, balance, and pain. Further research needs to be conducted to assess the efficacy of WBV on these factors as well as the optimal WBV frequency, amplitude, and duration in order to develop the best possible training protocols
  • It is difficult to recommend a combination of WBV training with other exercises to augment training effects in athletes due to the inconsistency in the results of published literature \(^{(20)}\)
• BMD
  – Researchers of a 2016 meta-analysis and systematic review investigated the effects of WBV on reduction of bone loss and fall prevention in postmenopausal women. They concluded that low-magnitude WBV therapy can significantly improve bone loss in the lumbar spine in postmenopausal women; WBV can also be used as an intervention for fall prevention (36)
  - Eight studies with a total of 1,014 patients were included in the data
  – Belgian researchers concluded that there was no difference between WBV training and vitamin D supplementation in enhancing muscle mass, strength, and hip BMD in women older than 70 years of age (18)
  - Based on a study of 113 institutionalized women > 70 years of age who were randomly assigned to either a WBV or a no-training group, receiving either a conventional dose (880 IU/day) or a high dose (1,600 IU/day) of vitamin D
  - The women participated in a 6-month treatment intervention. Those in the WBV group performed static and dynamic exercises (5 different squat techniques) with a gradual increase in training load according to the overload principle, 3 times a week
  - After 6 months of treatment, dynamic muscle strength, hip BMD, and vitamin D serum levels improved significantly in all groups, but isometric muscle strength and muscle mass did not change
  - There was no statistical difference between the WBV group and either of the vitamin D supplementation groups
  - There was no difference in hip BMD, muscle mass, or strength between the high dose and standard dose of vitamin D; however, there were higher serum levels of vitamin D in the higher dose group
  – Eight months of WBV training twice a week did not increase BMD of octogenarian women, in a randomized controlled trial conducted in Spain (30)
  - Thirty-seven women were assigned to a vibration group that trained on a vibration platform twice a week, or to a control group that did not participate in any training
  - Bone mass was measured by dual energy X-ray absorptiometry (DEXA) at the hip region
  - No statistically significant changes in bone mass were found in any hip region (total hip, femoral neck, trochanter, intertrochanter, Ward’s area)
  – Bone quality was not improved in osteopenic postmenopausal women after 12 months of WBV, in a study conducted in Canada (31)
  - Twenty-two women who received WBV training for 2–3 sessions per week were compared to 20 women who were controls
  - Bone outcomes were measured with CT scans at baseline, 4, 8, and 12 months
  - Total BMD, cortical area, cortical thickness, and cortical porosity all significantly decreased over time in both groups
  - WBV training did not lead to improved bone quality compared to controls and there were no detected benefits related to balance and muscle strength outcomes
  – Australian researchers concluded that proper use of the WBV platform might improve BMD (8)
  - Seventy healthy older adult women participated in the study
  - Tests showed an increase in BMD of the femoral neck with settings of 30 Hz for 2x10 minutes for 12 months
  – WBV training might help maintain BMD but not increase it (8)
  - Based on a study in Greece involving 32 postmenopausal women who were assigned to WBV training, exercise, or control groups
  - Women in the WBV group received intervention on WBV platform 3x a week for 6 months with the first 4 months set at 35 Hz with 1.5 mm amplitude and the last 2 months set at 40 Hz with 1.5 mm amplitude
  - WBV group performed single limb balance with knees slightly bent for 3 sets of 45–60 seconds for the first 4 months followed by 60–80 seconds in the last 2 months and the recovery period set at 1 minute. The exercise group performed strengthening exercises twice a week and cardiorespiratory endurance once a week
  - There were no statistically significant differences between the WBV group, training group, and control group in terms of body composition, BMD, and muscle strength

• Strength
  – WBV in conjunction with squat training can improve physical function (strength and balance) in older adults with knee osteoarthritis and/or spondylosis
  - Based on a Japanese randomized controlled trial in which 35 ambulatory patients (mean age of 72.4 years) were divided into 2 groups: WBV exercise alone, WBV exercise plus squat training
  - A 4-minute WBV exercise (frequency 20 Hz) was performed twice a week in both groups and the squat training group performed 20 squats per minute over a 6-month period
- WBV alone improved patients’ body balance and 10-m walking velocity; however, WBV squat exercise group was more effective at improving chair-rising time (5-repetition chair-rising time) and 10-m tandem gait step number.

Researchers of a randomized controlled trial in China compared WBV with eyes open, visual-field-deprived WBV (eyes closed), and a control group (0 Hz, eyes open) and concluded that visual-field-deprived WBV and WBV produced the greatest balance and lower extremity strength gains in older adult participants.

- Forty-five older adult subjects with an average age of 69.2 participated in this study.
- WBV training (20 Hz, 4 mm) was performed 3 times per week, 5 minutes each session for 3 months.
- Participants were assessed at baseline, 3 months, and 6 months. Assessments included knee flexor and extensor dynamometry and limits of stability via Biodex Balance System (Biodex Medical Systems, Inc., Shirley, NY).

Post-training knee flexor and extensor muscle strength significantly improved in the visual-field-deprived WBV group, with strength gains of 19.40% and 37.89%, respectively. Only the knee extensor strength of the WBV group improved, increasing by 15.40%. There was no significant strength improvement found in the control group.

- Balance outcomes were significantly improved at 3 and 6 months in the visual-field-deprived WBV and WBV groups compared to the control group. The greatest balance improvement was seen in the visual-field-deprived WBV group.

- A stochastic pattern of vibration might be more effective than a sinusoidal pattern in strengthening weakened pelvic floor muscles and can achieve higher pelvic floor muscle activation.

- Based on a Swiss study involving 23 women with normal pelvic floor muscle strength and 26 women with weak pelvic floor muscles.
- Vibrating footplates used with amplitude set at 1–10 mm with 5–30 Hz.
- Patients were asked to perform maximum voluntary contractions (MVCs) of their pelvic floor muscles on the vibration platform with settings of 2, 4, 6, 8, 10, and 12 Hz on the stochastic platform and 5 Hz 2 mm, 5 Hz 4 mm, 15 Hz 2 mm, 15 Hz 4 mm, 25 Hz 2 mm, and 25 Hz 4 mm on the sinusoidal platform.
- Patients were asked to stand on the platform for 5 seconds with the above settings, then 5 seconds on the platform with MVCs of pelvic floor muscles.
- With increasing vibration intensities, muscular activation of pelvic floor muscles showed significant increase, notably in the stochastic vibration group, which showed a 12 Hz (127.2%) increase in MVCs compared with only a 74.6% increase using 25 Hz with the settings for sinusoidal vibration.

- WBV training might improve body composition and muscular strength in obese women.

- Based on an Italian study of 50 obese women who were assigned to either a 10-week WBV training program which they performed twice a week or a nonexercise control group.
- Each session consisted of 14 minutes of WBV training with a 5-minute rest. Vibration amplitude varied from 2.0 mm to 5.0 mm and frequency from 40 Hz to 60 Hz.
- Subjects in the WBV group had statistically significant lower BMI, total body and trunk fat, skinfold thickness, and body circumference. In addition, these subjects also had increased lower limb muscular strength as measured by 1 repetition maximum with leg press, leg curl, and leg extension.

- German researchers conducted a study to systematically analyze the impact of vibration frequencies, amplitudes, and knee angles on quadriceps femoris and hamstring activity during WBV in order to better develop training protocols for WBV treatment.

- Fifty-one healthy men and women subjects participated in the study and were randomly allocated to 5 different vibration-frequency groups.
- The highest levels of muscle activation were found at high frequencies and large amplitudes. WBV frequency of 30 Hz led to significant increase in muscle activation (especially the quadriceps femoris) compared to the other frequencies.
- Knee angle only significantly affects the quadriceps femoris and not hamstrings.
- EMG muscle activity ranged from 18.2% to 74.1% maximal voluntary contraction in the quadriceps and from 5.2% to 27.3% maximal voluntary contraction in the hamstrings.

- WBV with low frequency might increase trunk extensor strength in healthy adults.

- Researchers in China assessed trunk extensor strength in healthy adults immediately after 3 sessions of WBV with differing frequency.
- There was a significant increase in trunk extensor strength immediately after exercising with WBV at low frequency (25 Hz) compared to high frequency (40 Hz) and a significant decrease in trunk extensor endurance after high frequency.
- Statistical gender differences occurred; males were more sensitive than females in trunk extensor endurance for lower frequency WBV.
6-week strength training in conjunction with WBV does not further improve maximum dynamic strength in long-distance runners compared to the same strength-training program without WBV. Based on a Brazilian randomized controlled study of 22 long-distance runners who were placed in 3 groups: strength training, strength training with WBV, and control group.

- Strength training included half-squats, twice a week, with a gradual increase in the number of sets (3, 4, 6) and repetitions (8–10, 6–8, 4–6) with the program changing every 2 weeks over a 6-week period. Loads were calculated to ~70% of 1 repetition maximum as subjects’ strength improved over the training period.
- Subjects performed the strength training on the WBV platform but the platform was turned on only for the WBV group. The frequency increased from 30–35Hz, 35–40Hz, and 40–50Hz, every 2 weeks over the 6-week period for the WBV group.
- Both strength-training groups statistically improved maximum dynamic strength (~18%).
- There was a statistical difference in aerobic endurance (~25%) in the strength-training group compared to the other two groups.

Researchers from Brazil suggest that WBV training can improve strength of the vastus lateralis (VL) muscle in women. Frequency of WBV set to either 30 Hz or 50 Hz while participants held a semi-squat position.

- Surface EMG (sEMG) measured the amplitude of the VL with WBV or no vibration.
- Researchers concluded that there was a significant difference in sEMG amplitude of the VL during WBV training with no differences between the two frequencies.

A short-term WBV training program along with creatine supplementation can improve isotonic strength of the lower extremities and improve dynamic balance in older adult women. Based on a study conducted in Iran involving 22 healthy women between the ages of 60 and 80.

- Participants were randomly assigned to either the WBV group plus creatine (n = 11) or the WBV with placebo (n = 11).
- The WBV group plus creatine performed their activity for 10 days while also consuming 20g of oral creatine supplements daily for the first 5 days and reduced to 5g for the next 5 days.
- The WBV group with placebo performed their activities for 10 days.

Muscle power

- In a meta-analysis assessing the effects of vibration on muscular power in healthy individuals, vertical platforms elicit a significantly larger treatment effect for chronic adaptations of muscle power than oscillating platforms. No positive impact on acute power output was noted for either vertical or oscillating platforms.

Pain management

- WBV training might decrease pain and fatigue in women with fibromyalgia. Based on a randomized controlled trial in Spain involving 36 women who were randomized to a combination group (i.e., WBV training and exercise), an exercise group, or a control group.

- Traditional exercises included a 15-minute warmup, 30 minutes of aerobic exercise, 25 minutes of stretching exercises, and 20 minutes of relaxation therapy. Patients performed static squat with 100° knee flexion and the dynamic squat between 90° and 130° of knee flexion; isometric ankle plantarflexion with knee extension; alternating knee flexion-extension between 100° and 130° of knee flexion; and static squat at 100° of knee flexion shifting the body weight from 1 leg to the other. Exercises were performed for 30 seconds each and were repeated 6 times with a 3-minute recovery period.

- Women in the combination group participated 2x a week for 4.5 minutes for the first 2 sessions followed by 18 minutes for the remaining 10 sessions.
- The exercise group performed the same exercises without the vibration stimulus and the control group did not perform exercise or WBV training.
- Settings for the WBV platform were 30 Hz with 2 mm amplitude.
- The combination group had improvements in pain and fatigue scores, but the control group and exercise group did not.

Authors of a 2018 systematic review conducted in Brazil investigated the effects of WBV training on pain, fatigue, and quality of life in women with fibromyalgia and found inconclusive evidence on improving pain, fatigue, and quality of life.
WBV might assist with decreasing pain in patients with chronic Achilles tendinopathy (14).

- Based on a study conducted in Germany that involved 58 recreational runners with chronic Achilles tendinopathy who were randomized into 3 groups (WBV, eccentric training, or wait-and-see approach).
- Subjects participated in training sessions 3 times a week for 12 weeks. WBV group participated in a 1-minute warm-up in which subjects moved from bipedal stance, heel rises, and stepping in place with slight knee flexion on vibration platform set at 13 Hz to 18 Hz and amplitude of 0.4 mm to 0.6 mm. Training phase gradually increased from 4–5 minutes to 6–7 minutes and the vibration frequency and amplitude increased from 16 Hz to 21 Hz and 0.5 mm to 0.8 mm while subjects performed bilateral heel-rise activities. Cool down included unilateral gastrocsoleus static stretching off the base of the vibration platform.
- The exercise group participated in eccentric gastrocsoleus strengthening with their heels off the edge of the vibration platform, three sets of 15 repetitions on each leg. Those who did not have any symptoms after 3 sets performed a fourth set with gradual increased load by wearing a backpack in which weights were placed.
- Pain improvements at the midsection of the tendon were greater in the vibration and exercise groups compared to the wait-and-see group. However, pain improvements at the musculotendinous junction were greatest in the eccentric training group.

- Balance

  - WBV in conjunction with squat training can improve physical function (strength and balance) in older adults with knee osteoarthritis and/or spondylosis (13).
    - Based on a Japanese randomized controlled trial in which 35 ambulatory patients (mean age of 72.4 years) were divided into 2 groups: WBV exercise alone, WBV exercise plus squat training.
    - A 4-minute WBV exercise (frequency 20 Hz) was performed twice a week in both groups and the squat training group performed 20 squats per minute over a 6-month period.
    - WBV alone improved patients’ body balance and 10-m walking velocity; however, WBV squat exercise group was more effective at improving chair-rising time (5-repetition chair-rising time) and 10-m tandem gait step number.

  - Researchers of a randomized controlled trial in New Zealand concluded that WBV in conjunction with traditional physiotherapy might improve function but not fall risk in frail older persons (13).
    - Fifty-six patients at an inpatient rehabilitation facility with a mean age of 82.01 years were randomly assigned to receive WBV (frequency 30–50 Hz, amplitude 2–5 mm) and traditional physiotherapy or traditional physiotherapy only.
    - Traditional exercise consisted of 30–45 minute therapy sessions, 5 days a week until discharge. WBV consisted of 3 sessions a week until discharge.
    - Outcome measures included the Functional Independent Measure (FIM) and Modified Falls Efficacy Scale (MFES). The Psychological Profile Assessment (PPA) was the primary outcome measure selected to assess fall risk.
    - Compared to the control group, WBV in conjunction with typical physiotherapy demonstrated statistically superior outcome scores on the FIM and MFES but not on the PPA.

  - WBV in conjunction with a traditional exercise program is a safe intervention but yields similar benefits for balance, strength, gait, and functional ability as traditional exercise alone in institutionalized older adults (12).
    - Approximately 160 participants from 10 centers in Spain were included in this study; approximately half of the participants were included in the WBV plus exercise group; approximately half were assigned to the control group and participated in exercise on a stable surface only.
    - All participants in both groups performed the same exercises. The groups differed on whether they performed the exercises on a stable surface or a vibrating (WBV) surface. WBV had a frequency of 30–35 Hz and an amplitude of 2–4 mm. Interventions were performed in 30 minute sessions, 3 times per week for 6 weeks.
    - Outcome measures were taken at baseline, 6 weeks, and 6 months after the study. The primary outcome measure was balance. Secondary measurements were strength and number of falls. Specific measures included the Tinetti, TUG, Sit-to-Stand (STS) test, and number of falls.
    - Tinetti scores significantly improved over time in both groups with no statistical significance noted between groups. TUG scores did not improve in either group over the assessment periods. Muscle performance (STS) testing improved in both groups over time with no statistical significance between groups. Fifty-seven falls were reported over the assessment period with no significant differences noted between groups.

  - WBV training might improve balance and ankle function in female dancers (7).
    - Based on a 6-week randomized controlled trial in the United Kingdom involving 38 female dancers with ankle instability.
Subjects were asked to perform single-leg exercises (heel raises, leg squats), increasing the duration and vibration frequency as training progressed.

Settings for the WBV platform were at 30 Hz for 10 minutes and progressed each week until frequency was set at 40 Hz.

At the end of the study, the vibration group had a greater improvement in anterior, anteromedial, and anterolateral ankle stability than the control group. However, there were no statistically significant differences in posterior, posteromedial, and posterolateral ankle stability between the groups. There were also no statistically significant differences in the mean power frequency between the vibration group and the control group.

- Function and gait parameters
  - Researchers of a randomized controlled preliminary study in China concluded that WBV training and quadriceps strengthening exercise (QSE) were effective in improving gait parameters and function in patients with medial compartment knee osteoarthritis.[34]

  - Thirty-nine patients were randomly assigned to receive WBV training and QSE or QSE alone.
  - Outcome measures were taken at baseline, 12 weeks, and 16 weeks and included the visual analogue scale (VAS) for pain, Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), TUG, 6 minute walk distance test (6MWD), and 3-dimensional gait analysis.

  - Compared to baseline, both groups showed significant improvements in VAS, WOMAC, TUG, 6MWD, and spatiotemporal gait parameters at 12 and 16 weeks. Compared to the control group, the WBV and QSE showed superior improvements in the WOMAC (physical function), TUG, 6MWD, and cadence at 12 weeks. No differences were found between groups in the VAS, WOMAC (pain, stiffness scales), or spatiotemporal parameters at 12 and 16 weeks.

- See Description, Indications of device/equipment, and Guidelines for use of device/equipment, above.

### Problem | Goal | Intervention | Expected Progression | Home Exercise Program
--- | --- | --- | --- | ---
Decreased BMD (osteoporosis, osteopenia) | Improve BMD | **Therapeutic intervention**
Have patients stand on the vibrating platform with knees slightly bent. Apply a frequency of 35–40 Hz with an amplitude of 1–1.5 mm | Increase frequency and amplitude as needed to progress intensity | Provide home exercise program (HEP)

Decreased muscle strength and endurance | Improve muscle strength and endurance | **Therapeutic exercise**
Patients performing exercises on WBV platform with settings of at least 30 Hz. Patients can perform exercises such as squatting with knees flexed | Increase amplitude and settings as needed to progress exercises | Provide HEP to focus on strengthening the weak muscles

Decreased balance and proprioception | Improve balance and proprioception | **Therapeutic intervention**
Have patients stand on the vibrating platform with knees bent to 120° with settings of 20 Hz and 2–3 mm amplitude(2) | Discontinue use of modalities as appropriate | Provide recommendations for home centered around balance and proprioception exercises
| Decrease pain and symptoms associated with fibromyalgia | Improve pain tolerance and symptoms of fibromyalgia | **Therapeutic intervention**<br>Patients perform exercises on the vibrating platform with knees slightly flexed. Settings for WBV should be at 30 Hz with 2 mm amplitude. Exercises should be performed for 30 seconds each, with 3-minute resting period | Discontinue use of WBV training as appropriate | Provide information for decreasing pain and symptoms of fibromyalgia |

### Desired Outcomes/Outcome Measures

- Increased BMD
- Decreased pain and fatigue
  - VAS pain
- Improved muscle strength and endurance
  - Graded cycling exercise test
  - Isokinetic dynamometry, MMT
  - 6MWT
- Improved vertical jump height
  - Jumping mechanography
  - Vertical jump test
  - Jump force and jump rate of force development
- Improved balance and proprioception
  - BBS
  - Biodex Stability System, Star Excursion Balance Test
- Improved function
  - FIQ
  - TUG test
  - Lawton Instrumental Activities of Daily Living Scale
  - Barthel Index
  - DGI
  - FIM
- Improved quality of life
  - SF-36

### Maintenance or Prevention

- Patients should participate in regular exercise and use WBV training only as a supplementary technique

### Patient Education

- Patients and therapists must familiarize themselves with the WBV device to prevent any injuries
- Patients who wish to learn more about WBV training can visit [https://www.mayoclinic.org/healthy-lifestyle/fitness/expert-answers/whole-body-vibration/faq-20057958](https://www.mayoclinic.org/healthy-lifestyle/fitness/expert-answers/whole-body-vibration/faq-20057958)
References


