

Vibration Training

Nick Grantham, Lead strength and conditioning coach, West Midlands region of The English Institute of Sports, writes:

In the past 10 years there has been an increasing interest in the somewhat strange concept of vibration training and its potentially positive impact on athletic performance. Can simply standing on a vibrating platform improve one's strength, power and flexibility? Is this a gimmick providing a short-term fix, or can athletes and coaches expect to see some valuable long-term training adaptations? Is vibration a useful rehab tool? Here's the balance of research to date.

The origins of vibration training stretch back almost 40 years. Early work by the Russian space agency looked at the use of vibration training to combat the effects of zero gravity on the musculoskeletal systems of its cosmonauts. It didn't take long for Russian scientists working within sport to start using the same methods with a variety of athletes (rowers, track and field, gymnasts and ballet dancers) ⁽¹⁾. Although this pioneering research indicated that vibration training had the potential to enhance both strength ⁽²⁾ and flexibility ⁽³⁾, it was another 10 years or more before the international sports science community dusted off the old research papers and began to take a closer interest in this training intervention. Since the late 1990s several types of vibration training methods have been trialled, ranging from the effect of vibrating cables and dumbbells on isolated limbs, to the use of vibrating platforms to invoke 'whole-body' vibration training.

As research into this area has taken off, so too has the commercial market for vibration platforms. A brief internet search will reveal half a dozen different makes of platform, each offering a unique training modality. Sports professionals have widely and enthusiastically embraced the concept, with team sports advocates including American football (Tampa Bay Buccaneers), ice hockey (Anaheim Mighty Ducks), baseball (Chicago Whitesox) and football (AC Milan). Endurance athletes are keen to get in on the act: Alberto Salazar, the former marathon runner and head coach of the Oregon Project (Nike's team of elite marathon runners), has incorporated vibration platform sessions into his athletes' gruelling training schedules; and even the legendry Lance Armstrong apparently uses a platform. The Austrian skiing star Herman Maier is a fan, as is the lead physiotherapist for the Scottish Rugby Union team, Stephen Mutch, who has used it as part of the rehabilitation programme for players competing in this year's Six Nations tournament.

The concept

The concept We do not clearly understand the exact mechanisms for enhanced athletic performance and injury prevention. Potential adaptations include:

- increased excitation of peripheral and central structures (pre-activation of the musculoskeletal system, resulting in improved readiness for the training stimulus);
- increased synchronisation of motor units;
- stimulation of GTO (golgi tendon organs), inhibiting activation of antagonist muscles;
- increased hormonal secretion;
- variation of neurotransmitter concentrations (dopamine, serotonin);
- excitation of sensory receptors such as muscle spindles, leading to improvements in the stretch reflex cycle [\(2\)](#).

Training effects: the evidence

The main problem in trying to make sense of the bottom line on all the research is that there has been such a wide variety of devices, protocols and subject groups tested. The research falls into three main areas: performance enhancement, rehabilitation and health.

Performance enhancement

Enhanced physical preparation is arguably the birthplace of vibration training and is where most of the research has been conducted. It was in the late 1990s that claims started to circulate that 10 minutes of vibration training could produce the same training effect as completing 150 leg presses or half squats with loads of three times body mass twice a week for five weeks; and that 10 days of vibration training was the equivalent to completing 200 drop jumps from a height of 60cm, twice a week for 12 months!

Here was a new training method that could potentially revolutionise the way athletes trained. Between 1998 and 2005 more than 15 papers examining the performance enhancement potential of vibration training have been published, with widely varying results. Some studies have found little or no significant performance gains. But for every paper that fails to show improvements there are several that show vibration training in a more positive light, with beneficial adaptations such as increased muscular power [\(3\)](#), flexibility [\(3\)](#), strength [\(2\)](#), balance and hormone release being demonstrated.

One recent study from Norway may be a straw in the wind for future research and training techniques, despite its modest findings. In one of the few studies to have incorporated external resistance equipment into vibration training, researchers wanted to compare the performance enhancing effects of doing barbell squats on a vibration platform as against doing the same exercise on solid ground. Fourteen recreationally trained men took part over five weeks, with one group performing their squats on the platform and a second group squatting on a normal surface. Both groups followed the same training regime at 6-10 repetition maximum (RM).

Testing at the start and end of the study consisted of 1RM barbell squat and maximum jump height in counter movement jump (standing vertical jump). Both groups significantly increased their 1RM performance, and although the vibration platform group did not outperform the other group to a statistically significant level, the Norwegian team concluded that the results 'point toward a tendency of superiority of squats performed on a vibration platform'⁽⁴⁾. Expect more weight-training research before too long.

Rehabilitation

Professionals working in sports rehabilitation have been quick to set about establishing a role for vibration training within injury treatment and rehab. Initial work has already investigated the effect on bone health and ACL (anterior cruciate ligament) rehabilitation strategies. At the start of this year it was reported that the Edinburgh and Scotland flanker Allister Hogg had used vibration training during his rehab from a knee injury.

Recent work by Haas and Schmidtbleicher ⁽⁵⁾ investigated the effect of vibration training (5 x 60 seconds) on ACL rehabilitation during the 6th and 10th weeks post injury/surgery. Eight professional athletes with ACL ruptures took part in the study, during which the proprioceptive capacity of each leg was monitored before and after participants used a two-dimensional oscillating platform. The athletes were asked to stand on each leg for 45 seconds while EMG activity was recorded. All subjects showed improved balance control compared to pre-test measures with the most significant improvements occurring in the anterior-posterior direction, and it was concluded that vibration training could be used to optimise recovery from an ACL injury.

Animal studies opened up another promising line of injury prevention and rehab research in 2001, when they showed that vibration loading may be an efficient and safe way to improve mass and mechanical competence of bone. But a more recent study in 2003 failed to live up to the promise of the earlier work. In Finland a group of researchers took 56 healthy young men and women and introduced vibration training into their weekly routine over an eight-month period. The subjects were randomly assigned to a vibration group (4 min/day, 3-5 times per week) or a control group. Pre- and post-trial assessments measured mass, structure and estimated strength of bone at distal tibia and tibial shaft. Bone mineral content was measured at the lumbar spine, femoral neck, trochanter, calcaneus and distal radius; and serum markers of bone turnover were also taken. Despite the promising animal studies, the Finnish research group failed to demonstrate any significant effects on the bones of young healthy humans ⁽⁶⁾. Here, again, the research continues.

Health

Researchers are also exploring the possible health benefits of vibration training. Initial studies indicate that whole-body vibration may have a positive impact on proprioceptive control of posture in stroke patients ⁽⁷⁾. Balance was assessed in 23 chronic stroke patients over four trials. Subjects were asked to stand quietly on a dual plate force platform (unlike most commercially

available units, this one has two vibrating plates, allowing the user to place one foot on each plate), with eyes open and closed, and while performing a voluntary weight- shifting task so that the researchers could assess their balance skills. Four assessments were carried out at 45-minute intervals. Between the second and third assessments, four repetitions of 45-second whole-body vibrations (30Hz oscillations at 3mm amplitude) were given. The findings were encouraging:

subjects showed an increase in their weight- shifting speed while maintaining the precision of movement.

Recent research in the US has also shown that whole-body vibration training may be effective in the rehabilitation of patients with spinal cord dysfunction [\(8\)](#). A series of case studies conducted at the New York School of Medicine assessed the impact of whole-body vibration training on three subjects with various spinal injuries. The subjects were otherwise unable to stand without the use of long leg braces locked at the knees. The researchers monitored standing time with and without whole body vibration, degree of volitional trunk movement, trunk and body control, ability to transfer, and carry-over to voluntary walking. By the end of the study all three subjects were able to stand with minimal assistance (progressively increasing the duration of standing time) and two were able to walk independently, using walking aids. The American research team concluded that whole-body vibration training may be an effective tool in treating patients with motor dysfunction of spinal origin.

Vibration training has also been used to improve the symptoms of Parkinson's disease [\(9\)](#). Research has shown that patients using vibration training (3-5 sets, 45-60 seconds with 30-60 seconds recovery at a frequency of 4-7 Hz) have experienced improvements in one or more symptoms (tremor, rigidity, balance, postural stability), and that these improvements were seen as quickly as 10-60 minutes after the intervention and lasted for 2-48 hours.

Training variables

Frequency (measured in Hz, the repetition rate of the oscillations): a higher frequency increases the forces being generated and thereby the loading of the musculoskeletal system;

Amplitude (measured in mm, peak to peak displacement of the vibration): a higher amplitude increases the extent of the movement and thereby increases training intensity;

Duration (measured in seconds or minutes): how long each bout of vibration training lasts;

Position: the body position can be either static or dynamic, working through a variety of ranges of movement;

External loading: such as the barbell squats performed in the Norwegian study described above ⁽⁴⁾.

Based on the best available research to date, the table below provides an overview of potential vibration treatments.

Variable	Loading
Frequency	15 to 44Hz
Amplitude	3 to 10mm
Duration	40 to 240s
Repetitions	3 to 10

Note, however, that the research is in its infancy and the scientists are still trying to find out what are the most effective combinations to enhance athletic performance. Some researchers even suggest that the ideal vibration training method is dependent on the individual athlete ⁽⁴⁾. As ever, there is no one-size-fits-all or magic quick fix in training and rehab.

Conclusion

Should we all rush out and buy vibration platforms for our clinics? Despite the mounting body of evidence in support of this modality, the jury is still out. Marco Cardinale and Carmelo Bosco sum it up in their review paper, in which they recommend that studies should continue to explore the effects of long-term vibration training on different physiological parameters and should define appropriate training protocols ⁽¹⁾.

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