

Unstable Training Environments:

Vibratory stimulus and its effects on performance physiology

By Juan Carlos Santana

The popularity of functional training has forced many fitness professionals to take a second look at some of the traditional training concepts. Discussions regarding functional training have often grown heated at conferences and seminars. One of the topics generating a significant amount of debate is the efficacy of training in unstable training environments. More specifically, the topic of vibration training has received much attention in recent months. Vibratory stimulus is a form of unstable training. Therefore, a brief and general discussion of unstable training environments can serve as a foundation for discussion.

Some confusion surrounding unstable training environments revolves around the assumption that functional training exclusively uses training in unstable environments to enhance strength and performance. Additionally, fitness professionals may have adopted a wrong image of what functional training is when observing some prominent fitness figures performing exercises that resemble circus acts. Dangerous exercises, such as squatting 135 pounds while standing on a stability ball, have been incorrectly referred to as “functional.” Luckily, these extreme and dangerous applications are not the norm of functional training but rather the exception. It is important to note that functional training involves much more than unstable training. Functional training encompasses a multi-disciplinary approach to training. It involves the use of a wide variety of modalities and specific movement patterns for the purpose of enhancing performance and rehabilitation; the use of unstable training just happens to be one of those modalities.

The use of unstable training environments is not new or mysterious. Using unstable training environments, for the purpose of displaying and developing stability, balance and athleticism, has a long history and some well documented science behind it. Unstable training environments have been utilized for many centuries by a variety of populations. Martial artists have trained in a variety of unstable training environments throughout the ages to enhance stability, balance, strength and power. Training barefooted, in sand and walking on a variety of wooden poles were some of the simple ways martial artists created unstable training environments. The theatre and circus also have a rich history using unstable training environments. Standing and walking (often while juggling) on giant balls, ropes, a partner’s shoulders, animals (e.g. horses) were used to demonstrate incredible stability, balance and athleticism. Needless to say, this approach to training developed athletic bodies with unbelievable grace, strength and power. Most of us in the fitness and conditioning world would love for our

clients and athletes to develop such qualities and employ some stability training (in unstable training environments) in that endeavor.

Functional training utilizes unstable training environments to enhance performance, through enhanced stability and balance. However, there is much debate as to the efficacy of this training approach. One of the reasons for this debate may be that many exercises performed on unstable training environments have been labeled "functional" just because they are hard to perform and look different (e.g. barbell squats on a stability ball). This exaggerated methodology and misrepresentation of functional training may be what has fueled the arguments against the use of unstable training environments. Perhaps some clarity may be useful in bringing strength and conditioning professionals to a common ground of discussion.

Stability and balance training on an unstable training environment is no more effective than any other performance enhancement method; specificity still governs the training adaptation. The use and effectiveness of this training approach has been proven on the field, in the gym and in the lab. However, this does not mean it is the magic potion. For example, training on unstable environments would certainly not be my first choice to develop hypertrophy or explosiveness; there is nothing like high volume training, Olympic lifts and plyos for that. Having said that, I would certainly incorporate a measured dose of stability training (i.e. using unstable training environment) within any hypertrophy or power program to help direct and control the size and power my program will surely provide.

The scientific data shows the efficacy of unstable training environments. For example, a recent study (Vera-Garcia) showed increased core muscle recruitment during an abdominal curl when performed on an unstable environment, when compared to a stable surface. Research has also demonstrated the efficacy of using unstable training environments when rehabbing the ankle complex (Eils). Training under vibratory stimulus, which can be seen as a form of an unstable training environment, has also been shown to enhance performance parameters, such as a vertical jump (Bosco). Vibratory stimulus deserves a more detailed review due to its current popularity.

One of the new methods of unstable training is vibration training. Multiple studies have now been conducted on the effects of vibration training on different parameters of performance and physiology (Bosco, Cardinale, Delecluse, Torvinen, Rittweger). The curiosity with vibration dates back to 1965 (Hagbarth) when the "Tonic Vibration Reflex (TVR)" was first described. This phenomenon described a reflex muscle contraction that ensued after mechanical vibrations were felt by muscles. It is believed that vibration training may enhance activation of the muscle spindles, leading to an enhancement of the "reflex loop." Furthermore, it is believed that the higher EMG readings illustrated during vibration training, when compared to voluntary contractions, could be related to

an increase in motor unit synchronization. The reflex muscle activity noted in vibration training is thought to be a response of the central nervous system to strong perturbations (i.e. a disturbance of motion, course, arrangement, or state of equilibrium).

Most of the vibration frequencies studied have been between 26Hz and 44Hz. Various implements have been researched, from vibrating dumbbells to total body platforms. The studies have shown some positive adaptations to vibration training, although the mechanism of action and the optimal protocol still evade scientists. There are also questions concerning the application that must be answered before going out and spending \$20,000-\$30,000 for a vibration platform. Below are some practical questions we need to consider before we jump onto the very expensive "Vibration Band Wagon."

1. Is all vibration training created equal? What frequency is optimal? Is the optimal dose of vibration different across muscle groups or body positions?
2. If high vibration frequencies are superior to lower vibration frequencies, is the difference worth an extra \$20,000-\$30,000?
3. Can any unstable training, such as a push-up on a stability ball or single leg work with the Bodyblade[®], provide enough perturbation as to elicit a vibration reflex, or something similar?
4. Can other and less expensive means be employed to provide vibration stimulus?
5. Can the improvements noted in vibration studies be obtained with a combination of other functional modalities?

These questions are just the beginning when it comes to the factors that must be considered before jumping into a purchase of a \$20,000-\$30,000 vibrating platform. Personally, I find all of the vibration research interesting and worth continuing. However, I suspect that much of the same can be done with stability balls, balance equipment and the proper use of the Bodyblade[®]. I have seen people start to shake when put on the appropriate balance equipment. Anyone that has seen a beginner do a "hands on ball" push-up on a stability ball knows what I'm talking about. The same vibratory stimulus can be provided to experts in control of the stability ball by lightly tapping the ball in all directions while a push-up is performed on it. We have also found the Bodyblade[®] to provide excellent vibratory stimulus. Although the Bodyblade[®] vibrates at 4.5Hz, it does provide excellent active and dynamic vibration. The dynamic and active vibration the Bodyblade[®] provides may have a similar effect as higher vibration frequencies not dynamically created by muscles. This issue should be looked at in a controlled research study that would compare high-passive-frequency (e.g. 40 Hz) to low active frequency vibration (e.g. 4.5 Hz).

We must remember that all training modalities are tools. Perturbation training, as a form of training on unstable training environments, is just one of the many tools in today's fitness and performance environment. The neural control developed from this approach to balance and stability training has been well documented in our practice, as well as throughout many facilities

housing qualified trainers and coaches. Although the exact mechanisms of action and optimal protocols have yet to be determined, vibratory training is one of the many promising modalities that make functional training as exciting as it is.

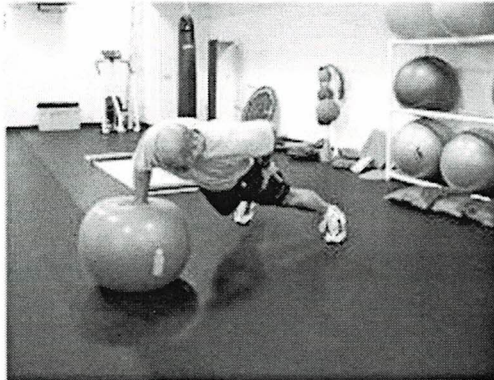


Figure 1

The vibration that occurs during the learning stages of this exercise may provide enough of a vibratory stimulus to induce a neural response that would enhance motor unit recruitment.

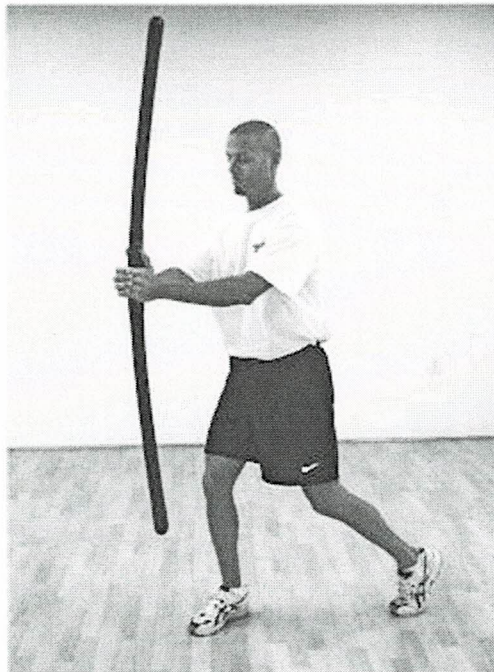


Figure 2

The Bodyblade[®] can easily provide active and dynamic perturbation. This is a great low cost exercise piece of equipment that delivers huge training adaptations!

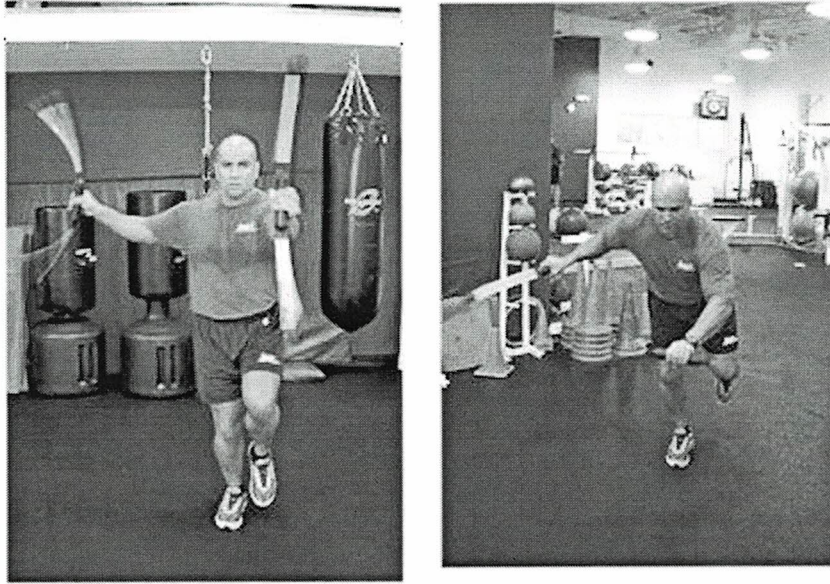


Figure 3a and 3b

The Bodyblade® can easily provide active and dynamic perturbation in two planes of motions, simultaneously. How is this for vibration training?



Figure 4

Standing on a BOSU ball can provide enormous ankle stability due to the unstable training environment.



Figure 5

Standing on various rocker boards and balance pads (e.g. AirX Pad) provides natural perturbation. How much perturbation is provided, and is it enough to elicit a significant training adaptation, is still a research question to be addressed. We believe the answer is YES! We see our athletes develop great strength after training in this fashion for 2-3 weeks.

If you would like to know more about the Bodyblade® please email moreinfo@bodyblade.com or call 800.77BLADE (25233).

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