Is Unstable Surface Training Advisable for Healthy Adults?

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SUMMARY

UNSTABLE SURFACE TRAINING HAS BECOME POPULAR AMONG HEALTHY ADULTS AND PERSONAL TRAINERS WORKING WITH HEALTHY ADULTS. ALTHOUGH UNSTABLE SURFACE TRAINING HAS BEEN SHOWN TO INCREASE CORE MUSCLE ACTIVITY AND STABILITY, ITS APPLICATION IS STILL VERY LIMITED. UNSTABLE SURFACE TRAINING DECREASES FORCE OUTPUT OF LIMB MUSCLES, ALTERS NEUROMUSCULAR RECRUITMENT PATTERNS, AND CAN INTERFERE WITH STABLE SURFACE TRAINING ADAPTATIONS. SPECIFICITY OF TRAINING SHOULD BE CONSIDERED, AND IF UNSTABLE SURFACE TRAINING IS USED, IT SHOULD BE DONE APPROPRIATELY.

Unstable surface training (UST) and UST devices have become popular among healthy adults involved in fitness training programs. Exercisers, personal trainers, and fitness instructors regularly supplement or replace traditional stable surface exercises with unstable surface exercises. Additionally, manufacturers of UST devices extensively market the benefits of UST device use.

UST is an effective tool, commonly used in rehabilitation, to help reduce recurrence of ankle sprains (19) and anterior cruciate ligament knee injuries (6). Balance training on an UST may help decrease the risk of subsequent injury for individuals who have suffered an ankle or a knee injury (6,19). Although UST has been shown to help restore proprioceptive and reactive deficits in patients with a history of ankle or knee injury, the effect of applying UST to healthy adults has only recently been studied.

Traditional stable surface resistance exercises are commonly performed on an unstable surface for the purpose of enhancing core (the muscles of the torso) activation and stability (2,4,7,12,14,17). This is based on studies showing enhanced electromyographic (EMG) activity of some muscles (i.e., rectus abdominis) when traditional stable surface resistance exercises are performed on an unstable surface (2,4,7,12,14,17). Many trainers now supplement or replace stable surface training with UST for healthy adults.

Although UST may be a means of increasing core muscle activity and stability, ultimately, UST has several limitations. UST potentially conflicts with the advantageous neuromuscular training adaptations produced by stable surface training. A better understanding of UST can help personal trainers and exercise instructors appropriately apply UST and develop safe and effective exercise training programs for healthy adults.

Using an unstable surface to add instability to a traditional stable surface exercise, such as performing a chest press on a stability ball, as opposed to a bench, increases the activation of some core muscles (2,3,13,14). However, adding instability to a stable surface exercise affects other characteristics of the exercise, such as maximal force output of the targeted muscles (1,3,10,13). Muscular force output is significantly diminished when exercises like the squat and the bench press are performed on an unstable surface (1,3,10,13). Anderson and Behm (1) found a 59.6% decline in the maximum isometric force output when the bench press was performed on an unstable surface versus a stable surface. Using an unstable surface to modify a traditional stable surface exercise may decrease the training stimulus to the target muscles and may make it challenging to provide a progressive overload if not combined with stable surface training. Additionally, attempting to increase training loads while using UST devices could increase the risk of device failure and injury.

In addition to diminished maximal force output, neuromuscular recruitment patterns of joint agonists and antagonists are altered when exercise is performed on an unstable surface (1,2). Studies measuring EMG activity show that myoelectric activity does not decrease when resistance exercise is performed on an UST, although force output is diminished (1,3,13). The maintenance of EMG activity is

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interpreted as the joint agonists playing a greater role as a joint stabilizer. Joint antagonist muscle activity can also be elevated to a greater extent with UST, indicating its greater involvement in joint stabilization as well (1,2). This neuromuscular recruitment pattern differs from stable surface training, where antagonist muscle activity stays the same or decreases with training (9). The long-term impact of this altered neuromuscular recruitment may be overlooked.

Although a few prospective training studies have been undertaken, Cressey et al. (8) demonstrated that just the addition of UST to an effective stable surface training program can attenuate strength, power, and performance improvements. This may be the result of conflicting neuromuscular recruitment patterns of concurrent stable surface training and UST.

The specificity of training on an unstable surface may not transfer to movements on a stable surface (11). The specific neuromuscular recruitment patterns with UST are task specific and may vary from the neuromuscular patterns of daily activities and sports. Stanton et al. (16) found that although there was evidence of core stability improvement after 6 weeks of stability ball training, there were no significant differences with myoelectric activity of the abdominal and back muscles, treadmill maximal oxygen uptake, running economy, or running posture in the UST or control group. The authors conclude, "Swiss Ball training may positively affect core stability without concomitant improvements in physical performance in young athletes. Specificity of exercise selection should be considered" (16).

In studies showing increased core activation (2,4,7,12,14,17) or stability (7) with UST, the subjects were beginners and the resistance used while performing the exercises was fairly low. In one study, the subjects who performed a bench press on varying levels of instability used only 9.1 kg of resistance (14). More recent research (20) has evaluated EMG activity of core muscles with greater levels of resistance. Willardson et al. (20) compared core muscle activation during back squats, dead lifts, overhead presses, and curls on stable and unstable surfaces. The resistance used in this study was more typical of the levels recommended to develop strength in healthy adults (50–75% of one-repetition maximum strength levels). No differences in core muscle activation were evident when these exercises were performed on an inflatable dome or on stable ground (20).

UST is sometimes described as "functional" strength training, in the sense that the strength and stability improvements from UST will more readily transfer to sports and daily activities than those from stable surface training. This assumption is inaccurate. The alteration in neuromuscular recruitment (1,2), diminished force output (1,3,13), and failure to improve daily movements or performance (8,16) make UST less "functional" than traditional stable surface resistance training.

UST can be used to activate the abdominal muscles, specifically the rectus abdominis, when resistance exercises are performed on an unstable surface in the supine position (12,17). However, performing a resistance exercise while standing on an unstable surface is not as effective at activating core muscles as performing stable surface resistance exercises with resistance greater or equal to 50% of an individual's one repetition maximum (15,18,20).

If a greater core muscle training stimulus is desired, then modifications can be made to stable surface resistance exercises. Increasing resistance of a stable surface free weight exercise (like the dead lift) will increase core muscle activation to a greater extent than performing core-specific exercises on an unstable surface (15,20). Unilateral (limb) training on a stable surface is another effective way to increase core muscle activation (4). Additionally, verbal cues, such as "brace yourself as if you were going to be punched in the stomach," can be used with traditional stable surface exercises to help activate the abdominal muscles to a greater extent (5).

UST and UST devices have become very popular among healthy adults and personal trainers working with healthy adults. Although UST is an effective tool used to restore proprioceptive and reactive deficits in the rehabilitation of individuals with ankle and knee injuries (6,19), the effective application of UST to healthy adults appears to be very limited. UST can be used to activate and train core muscles, specifically in the supine position and with untrained individuals (2,4,7,12,14,17). However, adding instability to traditional stable surface exercises may conflict with the benefits derived from stable surface exercise, especially with individuals who are experienced with stable surface exercise (8).

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