Science Articles About Balance Training

**ACL and Lower Leg Involvement:** Anterior Tibialis is important for balance, women have weak hip abductor strength and control of the knee when landing, landing should increase knee flexion angle, 75% of ankle injury in elite field hockey occurred during a match. ACL patients have decreased muscle activation and greater postural sway.


Increasing knee flexion angle during deceleration and acceleration tasks and preventing excessive quadriceps contraction while increasing hamstrings muscle cocontractions, especially at near-full knee extension, may protect the ACL. Combined valgus and knee internal rotation moments also produced higher ACL tensile force.


ACL deficient subjects displayed more postural sway on a single limb balance on the injured leg and had impaired postural control in the antero-posterior direction with prolonged reaction time when subjected to antero-posterior perturbations.


Patients with ACL reconstructions show decreased muscular activity of the lower leg and especially of the vastus lateralis and gastrocnemius on balance board tests.


Elite field hockey players in 2004 with previous ankle injuries showed decreased ability to maintain balance and poor peak isokinetic torque of the dorsiflexors of injured leg. All injuries occurred on turf and 75% during a match.


Women display weak hip abduction peak torque and valgus peak joint displacement when landing from a jump. Hip abduction strength is more important for neuromuscular control of the knee for women compared to men.


Tibialis anterior vs soleus and gastrocnemium may be better source of proprioceptive feedback.


Elderly adults in the training group for 4 weeks, 4 days a week and for 40 minutes were subject to dorsiflexor electrostimulation training then tested on three static balance tests. The training group showed decreased postural sway and greater ankle stability.
**Effects of Fatigue:** Fatigue protocols decreases postural stability and static and dynamic balance.


After fatigue protocol on trunk extension and flexion, no significant affect of lactic acid on balance. Trunk muscle fatigue was significant for decreasing static and dynamic balance.


Latent impairment of balance ability 24 hours after plyometric exercises of 200 counter-movement jumps to elicit symptoms of muscle damage. Skill based activities may be compromised and increase risk of injury after high-intensity plyometric training.


Impairments in postural sway and control were evident 10 and 30 minutes following a bout of lower leg fatiguing exercises.


Subjects with chronic ankle instability engaged in lower leg fatigue protocols followed by testing on the SEBT for dynamic postural control. Fatigue and CAI disrupted stability especially in the sagittal plane reaching distance.

**Shoulder Injuries:** Close chain exercises are beneficial, fatigue protocol decreases joint sense, swiss ball push-ups increase rectus abdominis and triceps activation. Injury rate is 3 times more likely during competition with 57% player to player and 22% contact with ground for high school athletes.


Baseball players threw using a fatigue protocol of Borg RPE scale or 160 throws at maximal effort. Fatigue hampers SMS acuity and in arm cocked position the glenohumeral joint acuity failed to recover in 10 minutes, where other joint angles and mechanics recovered within 4-7 minutes.


Softball players on a 12 week training program for 3 days a week showed better throwing velocity by 2 mph vs 0.3 mph for closed chained exercises compared to open chained exercises. Closed chained exercise group increased shoulder torque and power.


Push-ups on a swiss ball show increased rectus abdominis and triceps activation while feet are on the ground. The pectoralis activation did not increase. No muscles showed increased activation when the feet were on the ball while completing a push-up. Push-up plus increased activation of the external oblique.

Shoulder injury 3 times more likely during competition. Common injuries were sprain/strain followed by dislocation/separation and contusions. Player to player contact accounted for 57% of injury, 22% contact with playing surface and 10% non-contact. There are specific sport by sport and gender differences in injury rate, type and mechanism. Football injuries from tackling, being tackled and blocking. Girls soccer injuries from dribbling and goaltending. Basketball injuries from defending and rebounding. Volleyball injuries from serving and spiking. Wrestling injuries from takedowns. Baseball injuries from throwing.

**Body Weight:** Increased body weight decreases postural stability. Balance may be affected by body weight fluctuations.


During static posture obese men had less balance on anterior/posterior and medial/lateral axis. Obese women only had anterior/posterior balance deficits in static posture. Weight was directly correlated to AP balance.


Anorexia patients did not have significant postural sway compared to bulimia nervosa patients when compared to controls. Body weight fluctuations of the BN patients may affect patients significantly in the anterior/posterior plane.


Extremely obese individuals showed greater postural sway and decreased balance maintenance compared to lean counterparts. Subjects were divided into body weight reduction with or without 6 sessions of balance training. Both groups increased postural stability and balance maintenance however the weight reduction and balance training did better.

**Spinal Health:** Spinal position affects stability and functional exercises should be multi-planar with strategic contraction rhythm for spinal stability. Whole body training is better for fall prevention.


Patients with lumbar kyphosis and osteoporosis had more postural sway and may increase risk factor for falls. Thoracic kyphosis was not significant.


Maximal muscle activation can be seen in single-plane tasks. Multi-plane exercises, “functional-exercises”, could not perform maximal contractions because it would upset the balance of the 3 spinal axis and decrease spinal stability. Strength training muscles may not help in “functional exercises” that are multi-planar.

Program designs using whole-body responses are effective to reduce falls and improve functional mobility in older adults. Propriospinal pathways of the lumbar and cervical patterns will allow for the coordination of the spinal cord.

**Core Strength:** Balance training will improve reactive ability to reduce lower body injury, core training should be in post-season and can be tested with endurance tests. Swiss ball prone bridges increase rectus abdominis and external oblique activation.


Holding a back extension, side bridge and trunk flexion for core strength measures moderately correlated to better strength and performance for sprinting, vertical jump, shuttle run, power clean, bench press, squat, and power clean 1RM. Concluded core training does not contribute significantly to strength and power.


Sitting balance performance and trunk muscle times may be good indicators of core stability.


Review of literature concludes pre-season exercises should include free weights standing on a stable surface to increase core strength and power. Post-season training of Swiss ball exercises for isometric muscle action, small loads, and long tension are recommended to increase core endurance. Balance board and stability disc exercises performed with plyometric exercises will improve proprioceptive and reactive capabilities to reduce lower extremity injury.


During prone bridge exercises the rectus abdominis and external oblique have increased activation compared to supine bridge exercises which do not show increased trunk activity.

**Balance Training Effects:** Balance training programs are effective to prevent reoccurring ankle injury for athletes and elderly. Training is effective for symmetry of weight distribution for sedentary subjects after 4 weeks.


SpineForce device rotating platform is a motorized wobble board. Static postural control was positively effected with training and would be good for a population with low initial physical activity level.


Proprioceptive training was effective in reducing the rate of reoccurring ankle sprains of male soccer players compared to controls, strength training or foot orthotics.

- Cohort study taking players with high body mass index and previous ankle sprain completed 5 minutes of balance pad single leg standing 5 days a week for 4 weeks in pre-season and twice per week during the season. Results show a 77% reduction in injury incidence for noncontact inversion ankle sprains.


- High school soccer and basketball players were placed on a balance training program vs the control that only did standard conditioning. Balance training reduced the rate of ankle sprain and the risk of ankle sprain by 50%.


- Postural stability is decreased in mediolateral postural sway and vertical deviation of aiming point.
- Postural balance is important in shooting performance.


- After 8 weeks of postural stability training body sway was analyzed for elderly subjects. Improvements in mediolateral balance and postural sway were found.


- A 12 week balance training program at 3 times a week for 20 minutes a session showed improved balance ability on a Biodex for both groups that trained after soccer practice and before soccer practice compared to a control group. The group training after practice improved more than the group training before practice.


- Six week at 3 times a week of wobble board exercises for sedentary subjects showed significant improvements in symmetry of body weight distribution at the 4th and 6th week.

**Dynamic Postural Control:** Posture controls is better in the morning. Female basketball players lack postural control compared to gymnasts and soccer players.


- Participants used single limb stance for static postural control and Star Excursion Balance Test for dynamic posture. Dynamic postural control was better in the morning compared to the afternoon. Static control did not differ during time of day.


- Using BESS test and SEBT, gymnastics had better BESS scores compared to soccer and basketball.
- Basketball had inferior SEBT scores compared to soccer and gymnastics.
Concentration: Postural control equates with drawing accuracy of children and distraction of baseball players in clinical and on field sites.


Children tested on drawing accuracy and movement of the head, shoulder and elbows showed inaccurate drawing was a result of postural instability of the head and shoulder vs fidgeting caused by inattention or hyperactivity.


Healthy collegiate baseball players performed worse on the BESS test for MHI during sideline testing.