Instability Resistance Training
Fad, Fact or Fiction
Instability Training Devices

• Swiss Balls: perfect for man or beast
Instability Training Devices

- Balance boards
- Rocker or wobble boards
- BOSU balls
Instability Training Devices

- Foam rollers
- Dyna disc or balance cushion
Are they effective?
The reality is somewhat grey!
Positive: Instability Training
Positive: Instability Training
Negative: Instability Training

• Core stability is inherent with heavy traditional closed chain training.
Willardson 2004 (SCJ)

- “the optimal method to promote increases in balance for any given sport is to practice the skill itself on the same surface on which the skill is performed in competition”
Objective

• To provide research-based evidence to illustrate the appropriate application of instability resistance training.
Instability Training Specificity

- Resistance training is mode specific
  - Velocity (Behm and Sale 1993)
  - Angle,
  - Contraction type,
  - Training mode (review by Behm 1995),
- Is it stability specific?
- Can relatively static stability exercises enhance dynamic sport performance?
Behm et al. 2004 (JSCR) reported a positive correlation (0.65) between maximum hockey skating speed and static balance test in hockey players under 17 years.
Kean, Behm and Young 2006 (JSSM)

- 5 weeks of static balance training resulted in 33% improvement in static balance and 9% increase in vertical jump height
How is an increase in vertical jump possible with only balance training?

- Decrease the sway and direct your forces in a more optimal direction
Kean, Behm and Young 2006

• also reported increased quadriceps EMG activity upon landing from a stride which could provide greater knee protection.
Ballet Training

• Ballet training emphasizes proper landing technique

Most sports emphasize jumping technique not landing.

• Ballerinas have significantly less knee injuries than similar jumping-related sports such as netball (Leonie Otago: personal correspondence)
Ballet vs Netball Players
(Behm and Otago 2001)

• Ballet dancers had a longer duration to maximum EMG activity post-landing.
Ballet vs. Netball

• This may reflect the specificity of the landing technique.
• It could be interpreted that ballet dancers develop more active stiffness for a greater duration than netball players providing greater protection for their knees.
Effect on Motor Control

• Anticipatory Postural Adjustments (APA) are very important prior to execution

• Need stabilization of core, increasing stiffness of limbs (Carpenter et al. 2001),

• Training on unstable surfaces promotes APAs (Gantchev and Dimitrova 1996)
Effect on Motor Control

- Repeated exposures to unstable surfaces allows for modification and knowledge of the surface resulting in proactive \( \text{(Marigold and Patla 2002)} \) or feed forward \( \text{(Pavol and Pai 2002)} \) adjustments.

- Application: Let athletes become accustomed to playing on a wet or muddy or icy surface.
Unstable squats
Anderson and Behm 2004b (CJAP)

• Study examined unstable vs. stable squats
  (using body mass, 65 lbs, 60% of body mass)
• Highest trunk EMG activity with the greatest instability
  1. Dyna-discs, 2. Olympic weights 3. Smith machine

Similar findings by Norwood et al. (2007 JSCR) with push-ups using single and dual instability. The greater the instability the greater the activation.

EMG activity of soleus increased but quadriceps were not affected by instability (Anderson and Behm 2004b)
Unstable Callisthenic Exercises
(Behm et al. 2004 JSCR)

Study examined a number of common rehab exercises for the back under stable and unstable conditions.

Instability provided greater trunk muscle activation overall (27-54%)
Side Bridge best for Abdominal stabilizers
Back extension (superman) best for back stabilizers
Unilateral Dumbbell Exercises

(Behm et al. 2004 JSCR)

• Unilateral chest presses increased activation of the torso muscles by 50-65% compared to bilateral presses

• Use only 1 dumbbell and do not hold onto the second dumbbell since it acts as a counterbalance.
Single Leg Training

• Any sport involving running, skating etc. involves power from one leg.
• Many sports involve unilateral arm movement (i.e. baseball, tennis, boxing)
• If balance is not optimal then power and force decreases.
• For training specificity, resistance should be applied unilaterally
• For example, single leg presses, hopping, lunges, single arm dumbbell presses
Stable Machines and Devices

• Abdominal exercises performed on instability devices had a greater ROM than traditional sit-ups (Siff 1991, Sands and McNeal 2002)

• Floor exercises performed on balls result in greater gains in torso balance and activation (Cosio-Lima et al. 2003)
Positive Summary

- Instability resistance training can improve
  - anticipatory postural adjustments (APA),
  - anticipatory limb adjustments (feedforward mechanisms),
  - balance,
  - trunk and postural limb muscle activation,
  - promote greater ROM,
  - unilateral training specificity
  - sport environment specificity,
  - reduce joint injuries,
  - Increase vertical jump in recreationally active subjects
Factors Affecting Strength Adaptations

• Need high intensity load to promote strength adaptations (Kraemer and Fleck 1988)

• 40-120% of 1 RM recommended to promote strength gains (Kraemer and Fleck 1988)
Force output when unstable?
Effect of Instability Exercises on Force Output
Behm, Anderson and Curnew 2002

- Stable and unstable leg extension (LE) and PF

- LE force decreased 70%, EMG decreased 44%

- PF force decreased 20%, EMG decreased 3%

- LE very unstable,
- PF only moderately unstable
Unstable chest press

Anderson and Behm 2004

– Chest press study showed a 60% decrease in force with unstable platform,

– EMG activity was similar with stable conditions

– Indicates that muscles perform more of a stabilizing role when unstable
Stability Resistance Training

– Could be advantageous for rehabilitation by decreasing stress on tissues while maintaining high muscle activation
Instability reduces power output (Drinkwater, Pritchett and Behm 2007 IJSPP)
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- Impairments in
- Peak concentric and eccentric power
- Concentric force
- Concentric velocity
- Squat depth
Co-ordination

- Stiffening strategy adopted with instability (Carpenter et al. 2001)
- Postural threats reduce the rate and magnitude of movements (Adkin et al. 2002)
- Unstable conditions resulted in 30-40% greater co-contractions (Behm et al. 2002)
- Would an instability training program reduce these effects?
Do traditional resistance exercises enhance core stability? (Hamlyn and Behm 2007 JSCR)

• Subjects performed 3 reps of squats and dead lifts at 85% of 1 RM
• Also performed unstable sidebridge and superman exercises
• Squat and dead lift had 50-70% greater trunk activation
Do highly trained individuals need static instability training? (Wahl and Behm 2007 JSCR)

- Subjects with a mean of 8 yrs of free weight training experience performed exercises on
  - 1. Dyna discs,
  - 2. BOSU balls,
  - 3. Swiss balls
  - 4. Wobble boards
  - 5. stable floor
Wahl and Behm 2007

• No difference in trunk EMG between stable and unstable surfaces when using Dyna discs and BOSU balls.

The more highly unstable Swiss balls and wobble boards did provide higher muscle activation.
Instability vs. stability training
(Sparkes and Behm 2007)

• Untrained individuals were involved in 8 weeks of either traditional stable or instability resistance training

• No difference in force increases between the groups (13.3%)
Instability vs. stability training
(Sparkes and Behm 2007)

• Study indicates that relatively untrained individuals can benefit from instability training using lower forces

• Alternatively increases in strength from stable training is as effective as unstable training for the untrained
Negative Summary

• Decreased force, power and velocity with instability
• Increased stiffness strategy (i.e. co-contractions)
• With high instability; decreased muscle activation
• With untrained, instability may not provide additional strength benefit
• With highly trained, moderate instability may not be of benefit
Recommendations

• Use instability resistance training as an alternative and a progression in the program

• Lower loads but high activation can provide a modulation in the periodized program
Recommendations

• Lower loads but high activation can provide recruitment of ST and FT fibers with rehabilitation exercises

• Activation of core or trunk stabilizers for recreational fitness enthusiasts who do not wish to perform squats or dead lifts
Recommendations

• Use static instability exercises as a progression to more dynamic instability activities.
Danke.

Questions?