Addressing Proximal Strength in the Management of Chronic Ankle Instability

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- No disclosures

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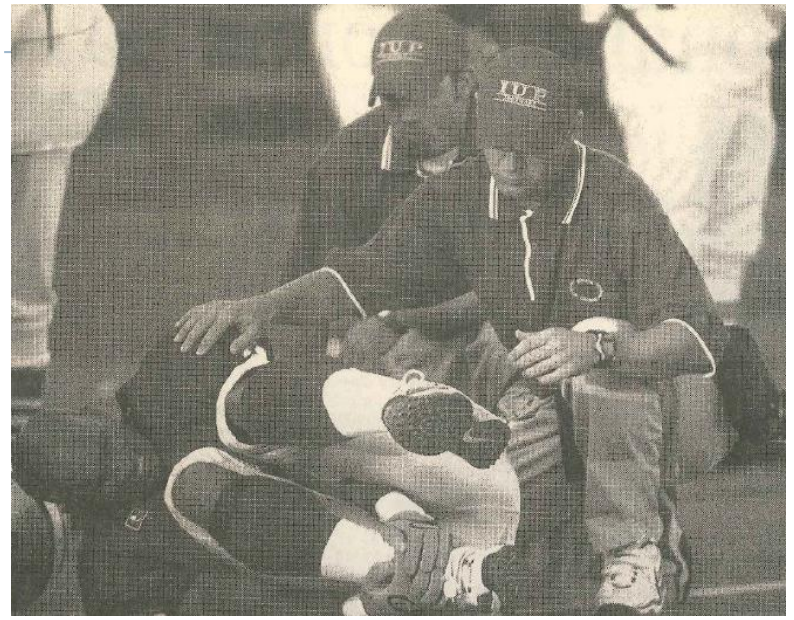

INDIANA UNIVERSITY

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URSINUS

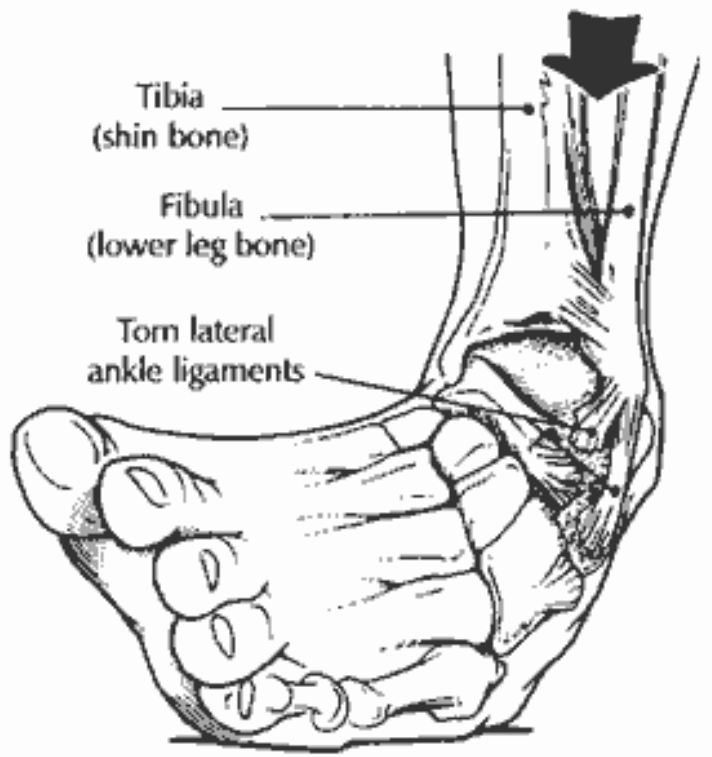
JOLIET JUNIOR COLLEGE WOLVES

Hinsdale Orthopaedics

BUFFALO DESTROYERS

Background

- Lateral ankle injuries are the most common in athletic activities
- 16-21% of athletic injuries
- 28,000 ankle sprains occur daily



(Yeung, Chang, So, & Yuan, 1994; Fernadez, Yard, & Comstock, 2007; Hootman, Dick, & Agel, 2007).

Background

- Some patients have prolonged or recurrent symptoms following initial injury
- Clinicians spend valuable time in treating these recurrent injury and symptoms.
- Treatment strategies vary based on patient deficits

Background

- Residual symptoms may include a feeling of "giving way" which is key factor in identification of Functional Ankle Instability (FAI) (Freeman, 1965).
  - Currently referred to as Chronic Ankle Instability (CAI)
- Individuals with CAI have deficits in proprioception, strength, and self-reported function (Arnold, Wright, & Ross, 2011; Hertel, 2000; Hertel, 2002).
- Individuals with CAI demonstrate hip weakness (Powers et al. 2004)

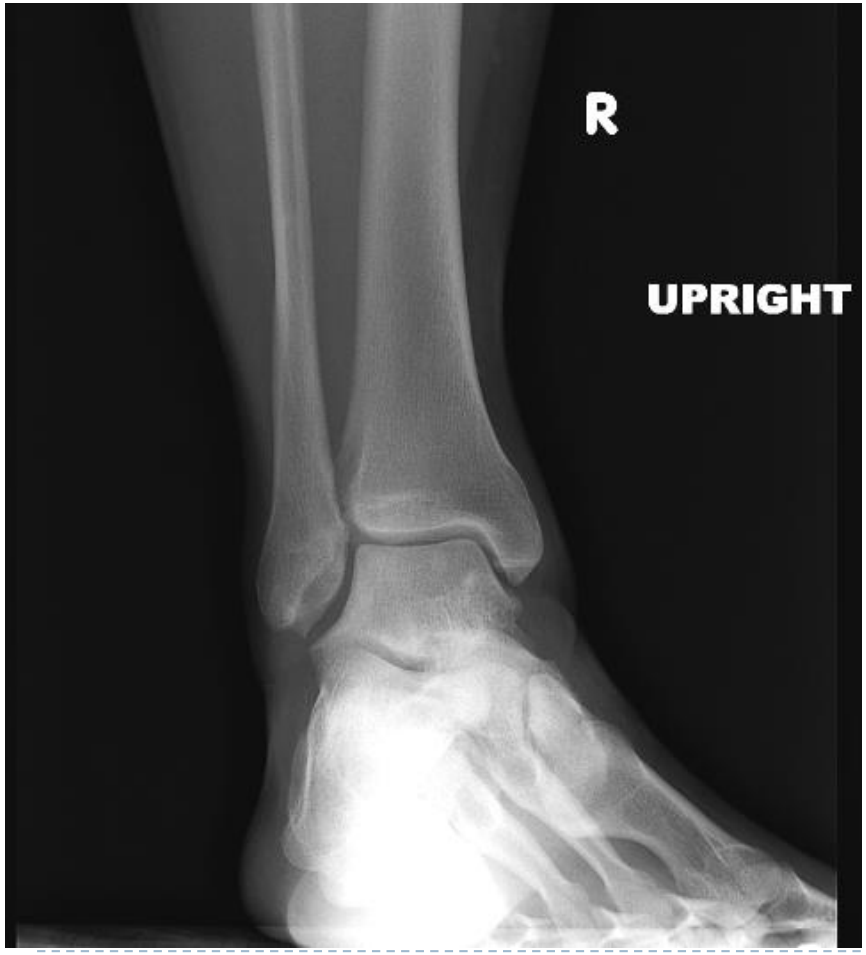
Background

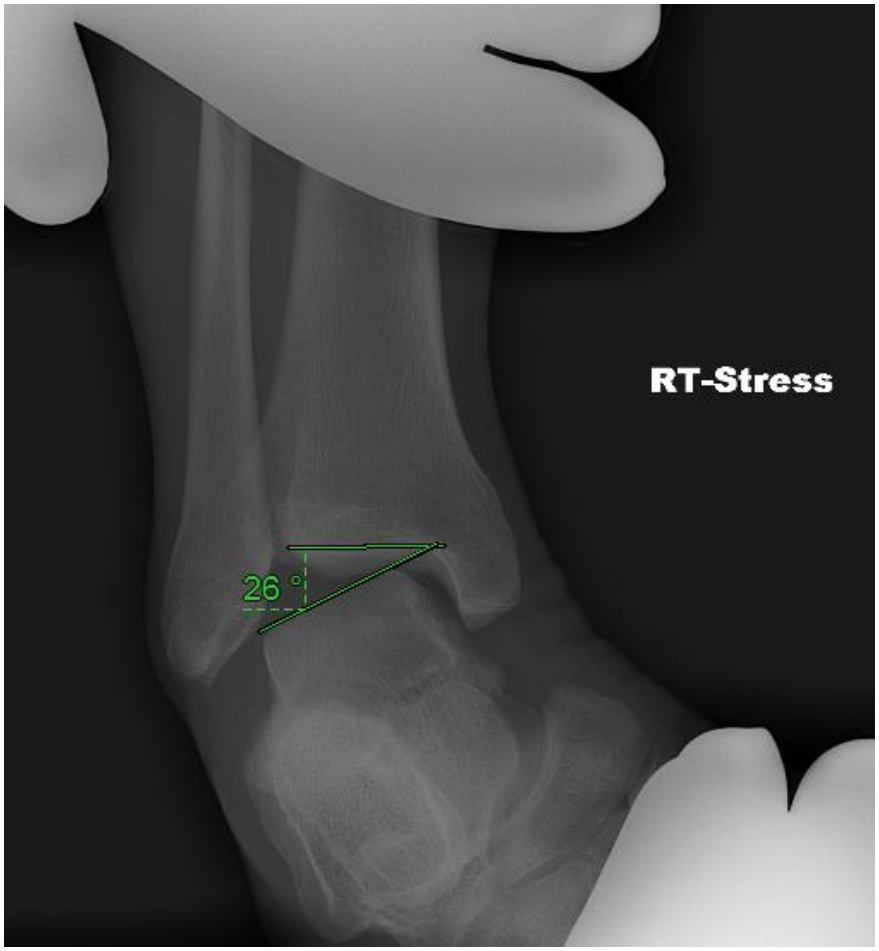
- Proprioception and Neuromuscular Control
  - Force sense; Joint position sense; Kinesthesia
    - Contributes to Postural Control (Balance) (Riemann & Lepart, 2002)
      - Static Balance
      - Dynamic Balance

- Strength training effects neural factors (Moritani & DeVeries, 1979)
  - Ankle strengthening improves ankle joint position sense (Docherty, Moore, & Arnold, 1998)

Failing Rehabilitation

- Talar Tilt Stress Radiograph

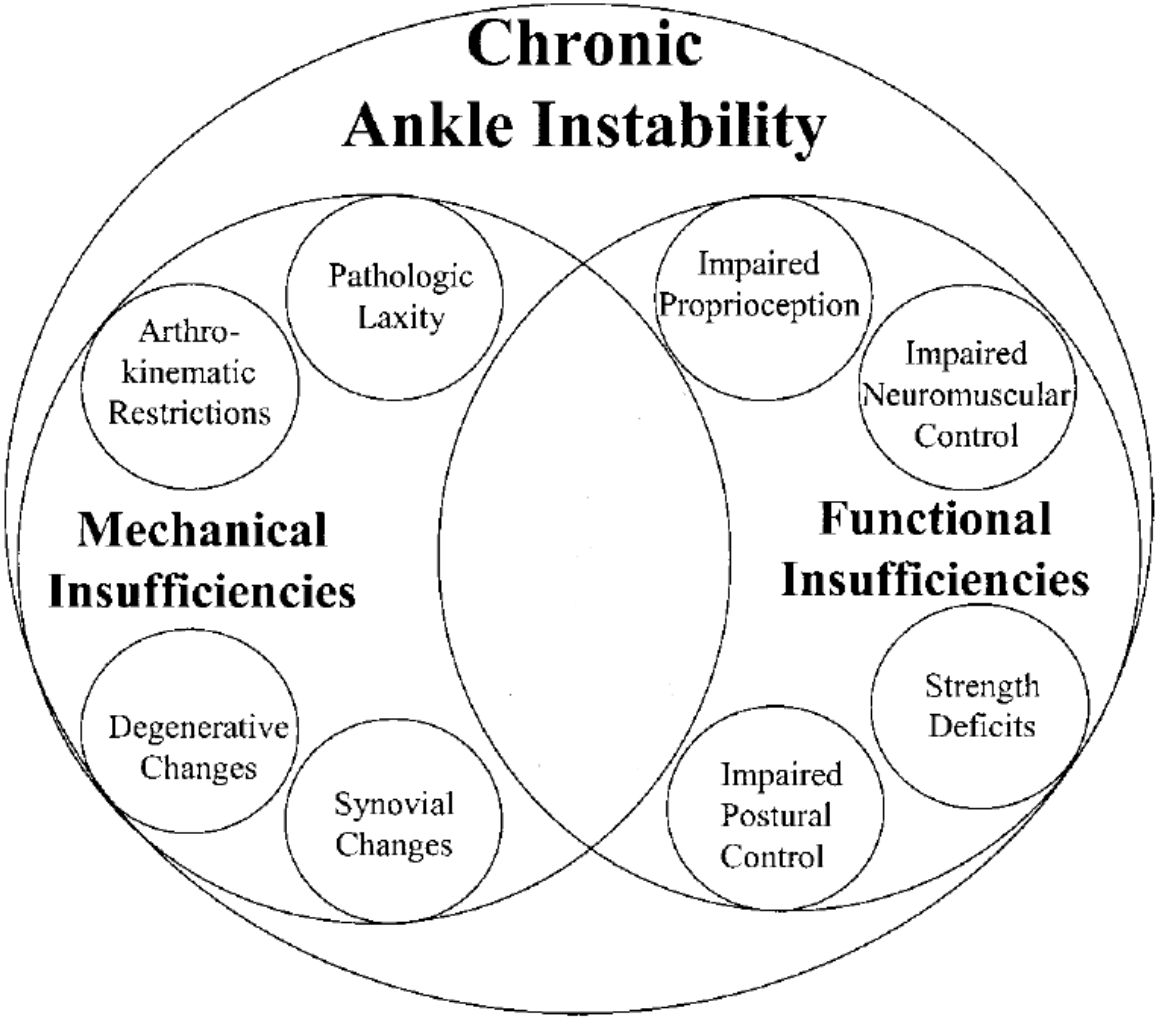




Failing Rehabilitation

- Anterior Drawer Stress Radiograph

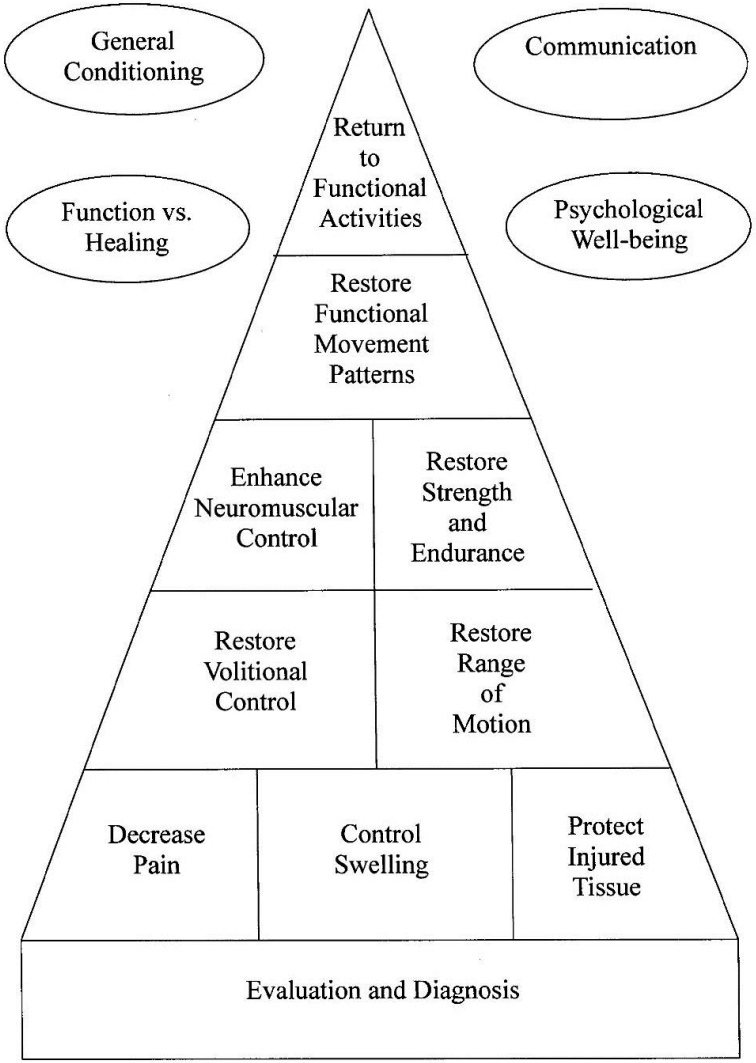
Ankle Instability Paradigm (MAI vs. FAI)



Modified Brostrom

Arthrobrostrom

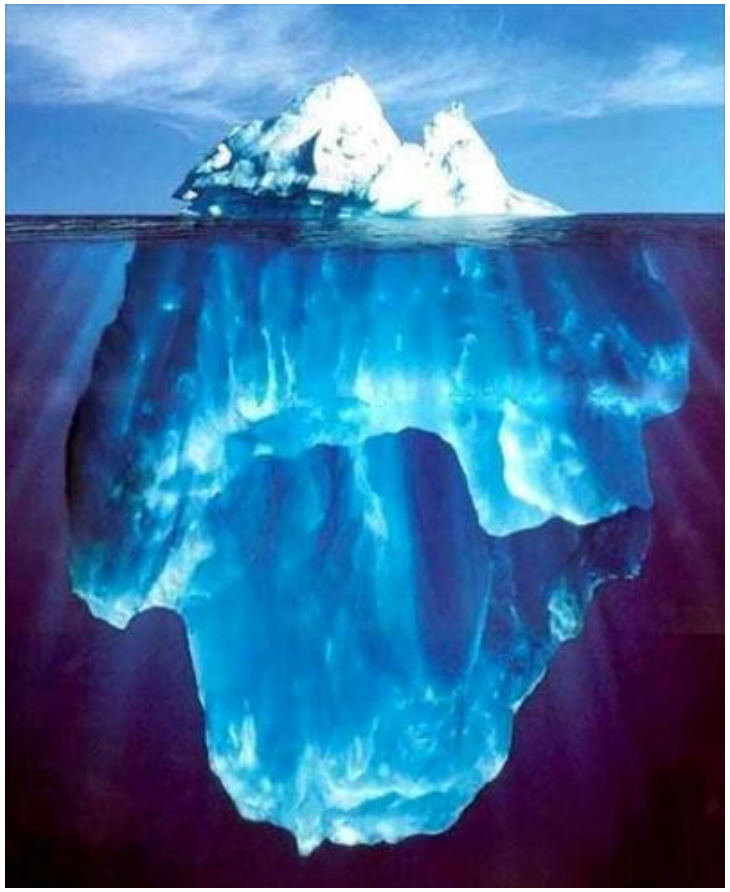
Rehabilitation Paradigm



Current Trends

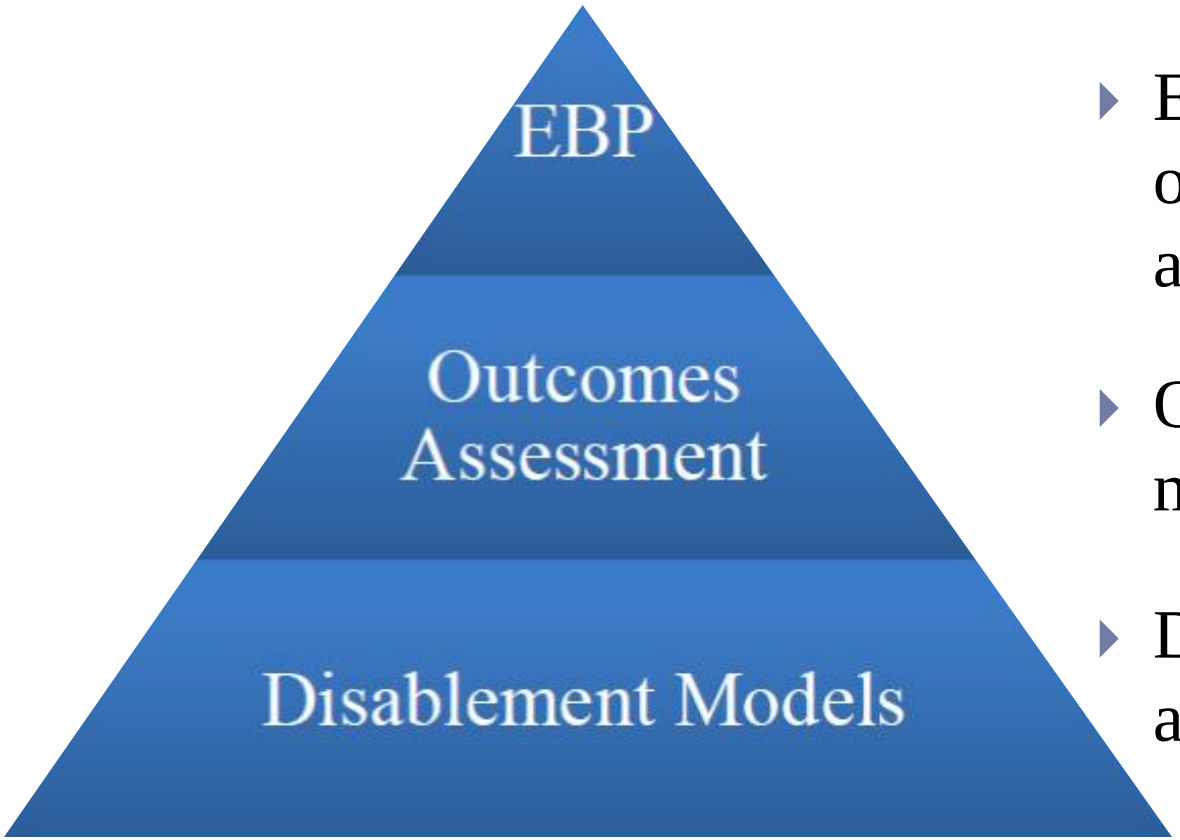
- CAI rehab protocols focus on ankle components despite multi-joint functions
  - 4-way ankle Theraband exercises
- Hip joint utilized during closed kinetic chain activities including postural control
  - Effect balance assessments
- Hip strengthening incorporated to address knee pathology (Ferber, Kendall, & Farr, 2011; Khayabashi et al. 2012)
  - Well established protocols for PFPS and ACL injury prevention

EBM and patient care



- EBP is the “tip of the iceberg” regarding patient care.
- EBP can be as overwhelming as the copious amount of research

EBM and patient care



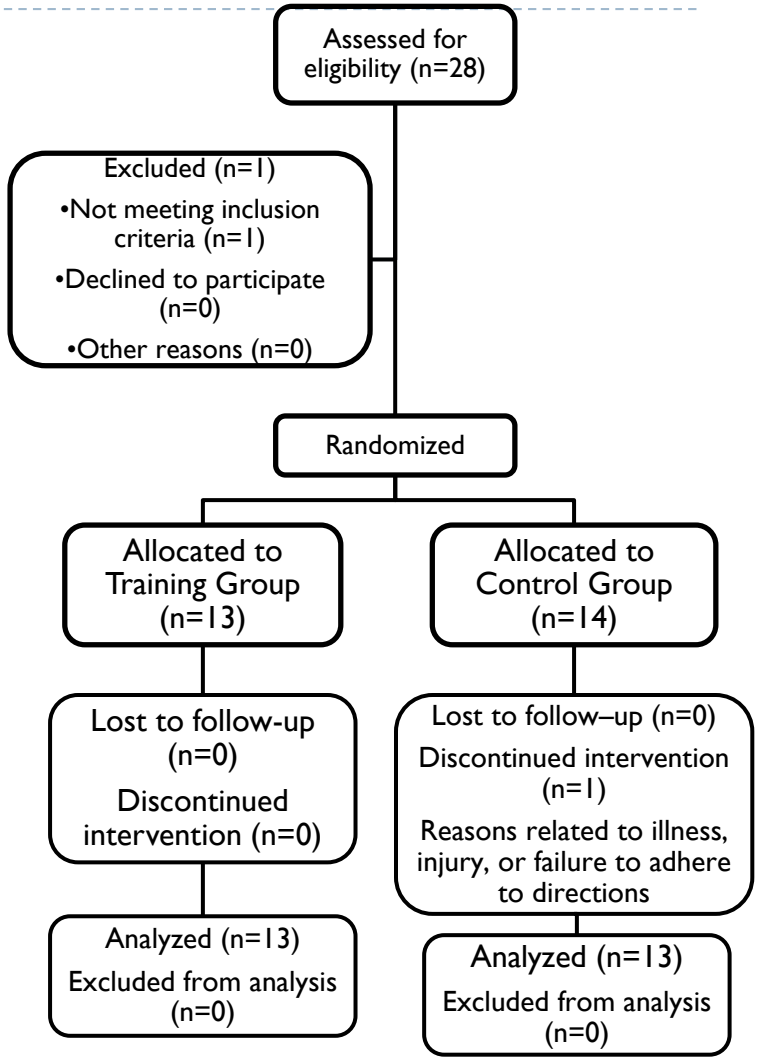
- EBP is the product and optimal practice approach
- Outcomes are the mechanism
- Disablement models are the Framework

Significance

- Adequate physical rehabilitation for CAI can improve quality of life
  - Improving hip strength can improved postural control
  - Reducing postural control deficits can improve symptoms associated with CAI
  - Improving symptoms of CAI can improve quality of life

Methods

- Research Design
  - Randomized controlled clinical trial
- Study Participants
  - 26 college aged subjects
    - Training group
      - 6 men, 7 women
    - Control group
      - 6 men, 7 women
  - Physically active
  - Unilateral FAI according to two discriminative tools



CAI Discrimination and EBM

- Ankle Instability Instrument - valid and reliable; history of later ankle sprain, giving way during at least 2 of 4 conditions
  (Docherty, Gansneder, Arnold, & Hurwitz, 2006)

- Cumberland Ankle Instability Tool - valid and reliable; 9-item, 30 point scale assessing severity of FAI; threshold score is 27.5
  (Hiller, Refshauge, Bundy, Herbert, & Kilbreath, 2006)

- Combination of AII and CAIT most accurate
  (Donahue, Simon, & Docherty, 2011)

Participant Demographics

	Control Group (n = 13) Mean (SD), Minimum - Maximum	Training Group (n = 13) Mean (SD), Minimum - Maximum
Age (years)	20.9 (1.26), 19.0 – 23.0	20.1 (1.69), 18.0 – 25.0
Height (cm)	171.0 (13.6), 152.0 – 194.0	164.5 (12.3), 153.5 – 194.0
Weight (kg)	76.554 (17.97), 54.0 – 121.6	78.51 (17.78), 56.2 – 118.8

Procedures

- Demographic data collected
- Pre-testing for all subjects (counterbalanced)
  - Foot and Ankle Ability Measure
  - Balance Error Scoring System
  - Star Excursion Balance Test
  - Hip strength
    - External Rotation
    - Abduction
- Participants were randomly assigned to either training or control group after meeting criteria

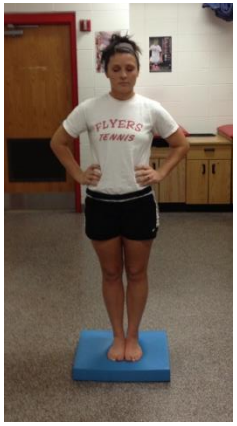
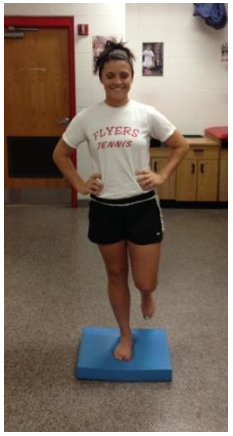
Self-Reported Function

- Foot and Ankle Ability Measure- reliable and valid for subjects with instability (Carcia, Martin, & Drouin, 2008)
  - Activities of Daily Living Subscale
    - 21-item 5-point Likert scale
  - Sport subscale
    - 8-item 5-point Likert scale
  - Higher score represent a higher level of function

Static Balance Assessment

- Balance Error Scoring System (BESS)
  (Riemann, Guskiewicz & Shields, 1999)
  - 3 stances on 2 surfaces

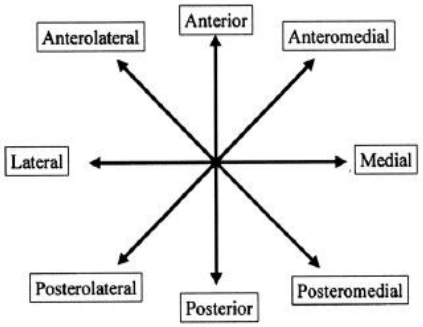


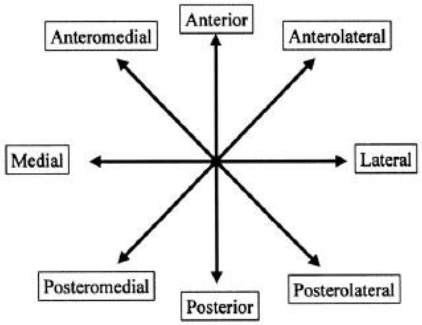

  - Reliable and valid for screening static balance in individuals with FAI (Dochtery, Valovich McLoed, & Shultz, 2006)

Dynamic Balance Assessment

- Star Excursion Balance Test
  (Kinzey & Armstrong, 1998)



Left Limb Stance Grid



Right Limb Stance Grid

  - Reliable and valid for screening dynamic balance in individuals with ankle instability (Olmstead, Carcia, Hertel, & Shultz, 2002)

Hip Strength Assessment

- Hand-held dynamometer
  - Reliable for hip strength assessment
    (Thorborg, Petersen, Magnusson, & Holmich, 2010)
    - External Rotation
    - Abduction

Strength Training Procedures

- Training Group- Theraband supervised 4 weeks, 3 times per week
  - External Rotation
  - Abduction
- Control Group- no change to previous activity
- Post-test- Same protocol as pre-test

Hip ER Strengthening Protocol

Week	Tubing	Sets x Reps
1	Green	3x20
2	Blue	3x20
3	Black	3x20
4	Silver	3x20

Hip Abduction Strengthening Protocol

Week	Tubing	Sets x Reps
1	Green	3x20
2	Blue	3x20
3	Black	3x20
4	Silver	3x20

- Strength dependent variables- two separate Repeated Measures Analysis of Variance (RMANOVA) was conducted
  - One within factor (test: pre and post) and one between factor (group: training and control).
- FAAM-ADL and FAAM-sport scores dependent variables- a RMANOVA to analyze the primary outcome indicators
  - One within factor (test: pre and post) and one between factor (group: training and control).

- BESS dependent variable, a RMANOVA was conducted
  - One between factor (group: training and control) and one within factor (test: pre and post) for the total error scores.
- Three directions (anterior, posteriomedial, posteriolateral) of the SEBT dependent variable, a RMANOVA was conducted
  - between factor (group: training and control) and within factors (test: pre and post).

Results

- Primary findings indicate that the hip strengthening protocol:
  - Increases hip strength in abduction and external rotation directions
  - Improves dynamic balance as measured by the SEBT
  - Improves static balance as measured by the BESS
  - Improve self-reported function as measured by the FAAM

Strength Testing

	Pretest (N)	Post-test (N)
Abduction strength		
Training group	360.1 ± 71.7	446.3 ± 77.4†
Control group	313.7 ± 56.9	314.7 ± 49.6
External rotation strength		
Training group	173.5 ± 36.9	222.1 ± 48.7†
Control group	166.6 ± 40.5	169.4 ± 34.6

Neuromuscular Control

	Pretest	Post-test
BESS		
Training group	23.92 ± 9.1 errors	9.9 ± 6.3 errors†
Control group	22.77 ± 6.1 errors	21.15 ± 6.3 errors
SEBT-A		
Training group	85.7 ± 8.6 cm	93.1 ± 7.4 cm†
Control group	89.2 ± 7.6 cm	90.2 ± 7.8 cm
SEBT-PM		
Training group	83.9 ± 10.9 cm	96.3 ± 8.9 cm†
Control group	86.0 ± 9.8 cm	88.0 ± 8.8 cm
SEBT-PL		
Training group	83.0 ± 14.1 cm	95.4 ± 11.1 cm†
Control group	84.4 ± 10.6 cm	86.6 ± 9.6 cm

Self-reported Outcomes

	Pretest (%)	Post-test (%)
FAAM-ADL		
Training group	85.9 ± 11.7	92.4 ± 12.3
Control group	91.6 ± 7.8	93.8 ± 6.9
FAAM-Sport		
Training group	72.1 ± 16.8	88.0 ± 10.9 †
Control group	84.6 ± 9.2	84.8 ± 10.9

Effects on Strength

- Proximal muscle strengthening improves balance and postural control
  - Abdominal training (Gage, 2009)
  - Hip strengthening (Piegaro, 2003)
- Hip strengthening increases hip strength is in agreement with previous research (Dolak, et al., 2011; Khayabashi, et al., 2012; Leavey, et al., 2010; Willy & Davis, 2011).
- Our strength increases were less than other studies
- Speculation that longer protocol produces greater gains

Effects on Neuromuscular Control

- In agreement with previous literature demonstrating proprioceptive improvements following strengthening (Blackburn, et al., 2000; Docherty, et al., 1998)
- Hip strengthening improving static and dynamic balance in agreement with previous research (Leavey, et al., 2010; Saxena, et al., 2012)

Effects on Self-reported Outcomes

- In agreement with previous studies demonstrating interventions improve outcomes for individuals with FAI (Hale, et al., 2007; Rozzi, et al., 1999; Schaefer & Sandrey, 2012).
- In agreement seeing improved outcomes following hip strengthening provides improvement
  - PFPS (Khayabaski, et al., 2012)

Conclusion

- The 4-week hip strength training protocol increased hip strength in participants with chronic ankle instability
- The protocol also improved static and dynamic balance
- Hip strengthening improves sport related self-reported function in participants with CAI
- It still unclear if hip strengthening can improve functions related to activities of daily living in individuals with CAI
- Clinical practice should incorporate proximal muscle strengthening for individuals with CAI.

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Thank you