



Enhancing Clinical Assessment with Sport Specific Functional Screening



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Outline:

**Functional Movement
Assessment**

**Musculoskeletal Screening
(MSK)**

**Identify Weak Links within
inter-segmental body system**

Sporting Injuries

- Major concerns in competitive sports
 - Affect or alter health
 - Alter functional and sporting movement
 - Lost of training and competition time
 - Lost of Income
 - Lost of investment and resources

Sporting Injuries

- Poses challenges to the injured athletes, coaches and support staff
 - Planning and managing rehabilitation program
 - Modification of training and competition plans
 - Making Safe Return to training and competition assessment & decision
 - Minimise risk of further injury
 - Minimise or delay risk of recurrent injury

Understanding Sporting Injuries

- Prevalence of specific injury in sport
 - On-going data collection
- Understand injury mechanism and causation
 - Identifying Risk Factors
- Implement Injury Prevention Strategies
 - Sport Safety
 - Change of Sports Rule
 - Pre-participation Screening to identify Risk
 - Others
 - Injury Prevention program or exercise

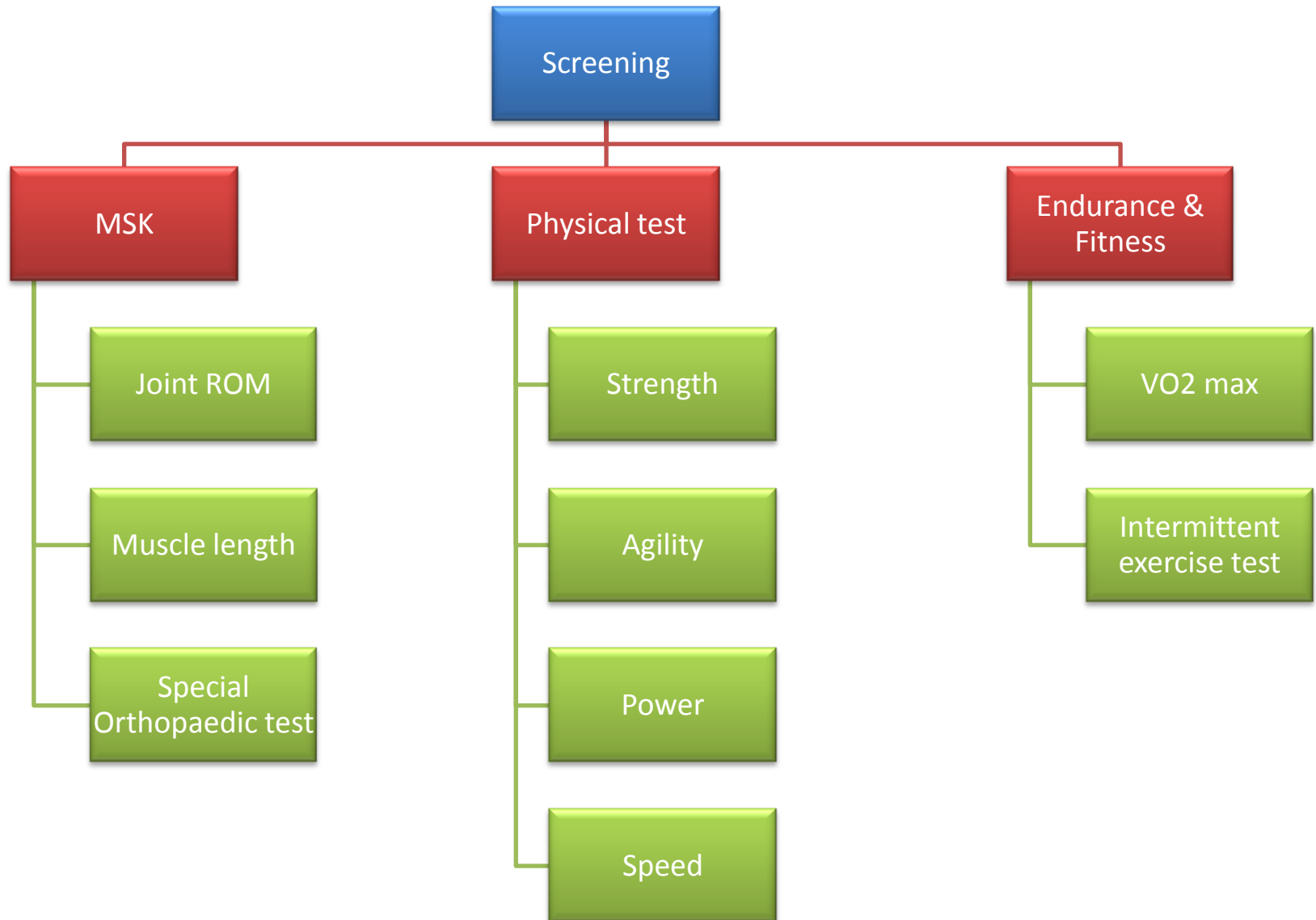
(Van Mechelen et al. 1992)

Risk Factors in Sport Injury

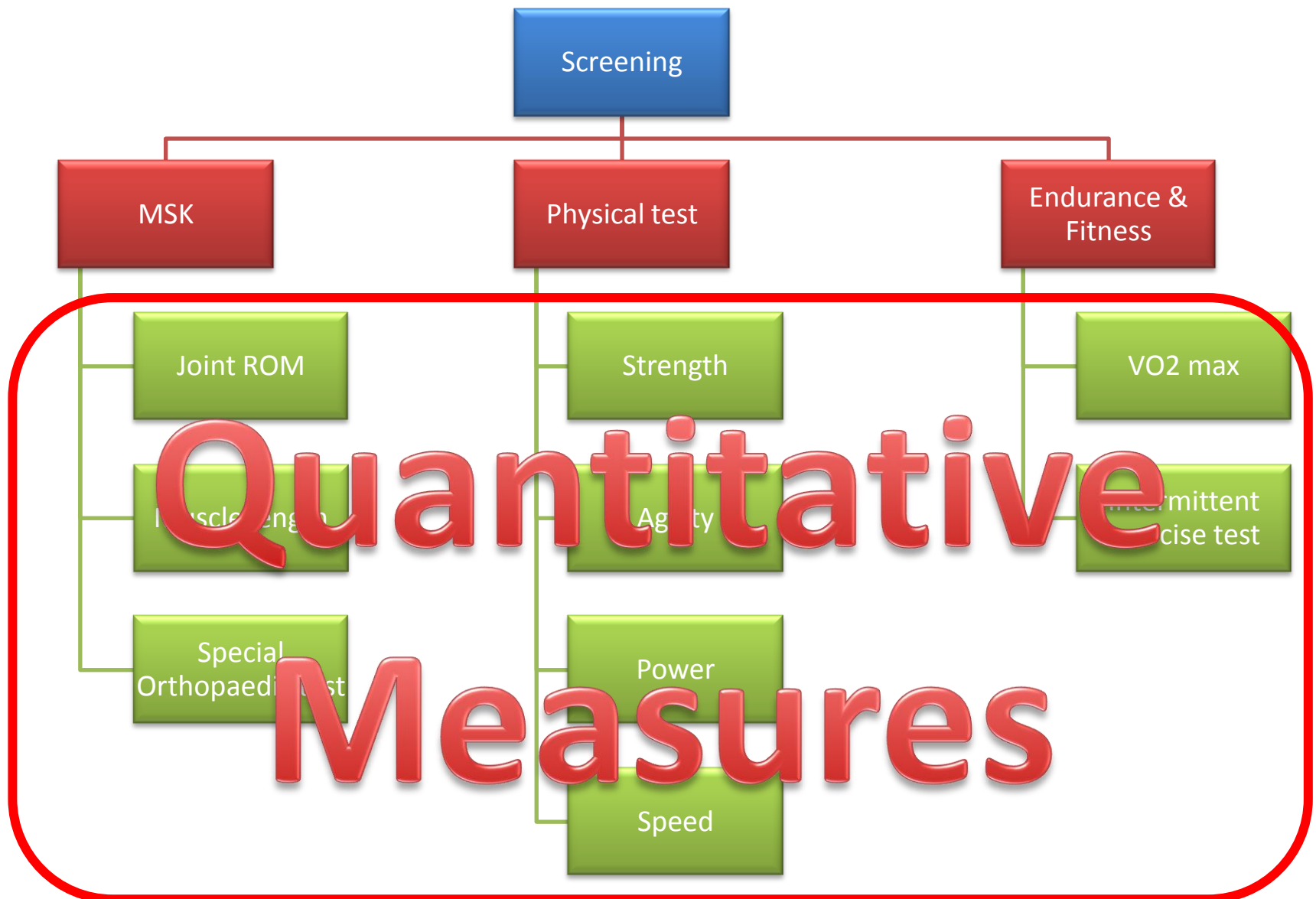
- Understanding of Injury causation factors are limited
 - Many risk factors can be implicated
 - Limitation of study designs
 - Human movement and injury in sports is complex

Murphy et al (2003), Barker et al (1997), Neely FG (1998)

Traditional Pre-participation Screening



Traditional Pre-participation Screening



Traditional Pre-participation Screening

- Focus on isolated objective testing for joints and muscles
- Lack the examination of functional movement
 - Movement pattern and competency
 - Functional mobility or stability differences
- Assume that Quantity values = Quality outcome

Quantity \neq Quality

Sporting Movement and the Kinetic Chain Links

- Sporting Task
 - Integrated, multi-segmented, sequential joint motion, and muscle activation system
 - Kinetic Chain System
 - Proper utilization of the kinetic chain allows maximal force to be developed in the core which can then be efficiently transferred to the peripheral joints to execute desired movement tasks.

Sciascia & Cromwell (2012), Lintner et al (2008), Davis et al (2009).

Sporting Movement and the Kinetic Chain Links

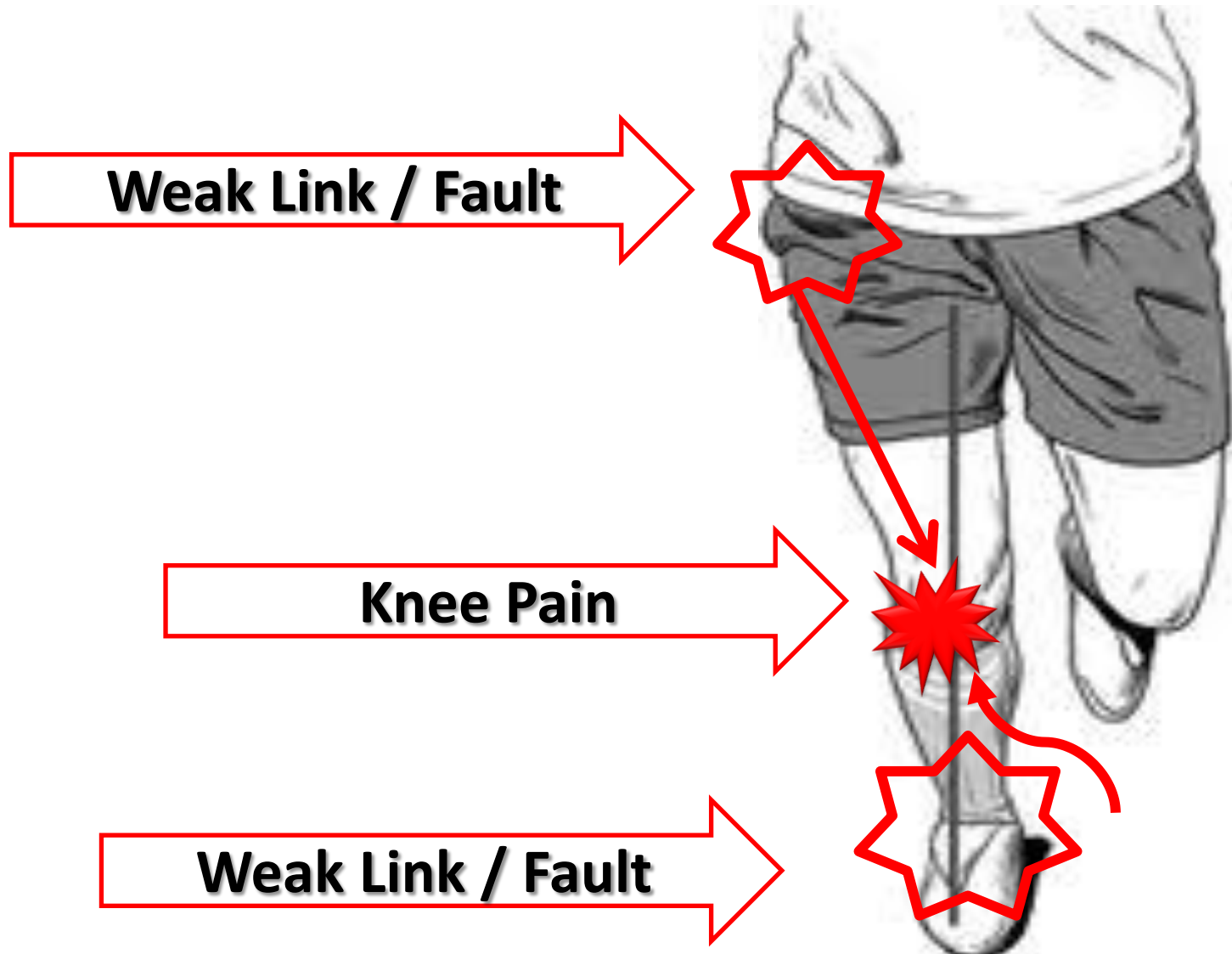
- Kinetic Chain Links
 - Comprises of different body segments or joints
- For effective and efficient sporting task to occur, kinetic chain links must have optimal amount of
 - Muscle flexibility
 - Strength
 - Proprioception
 - Endurance
 - Neuromuscular Co-ordination
 - Ability to perform the task consistently

Sciascia & Cromwell (2012), Lintner et al (2008), Davis et al (2009).

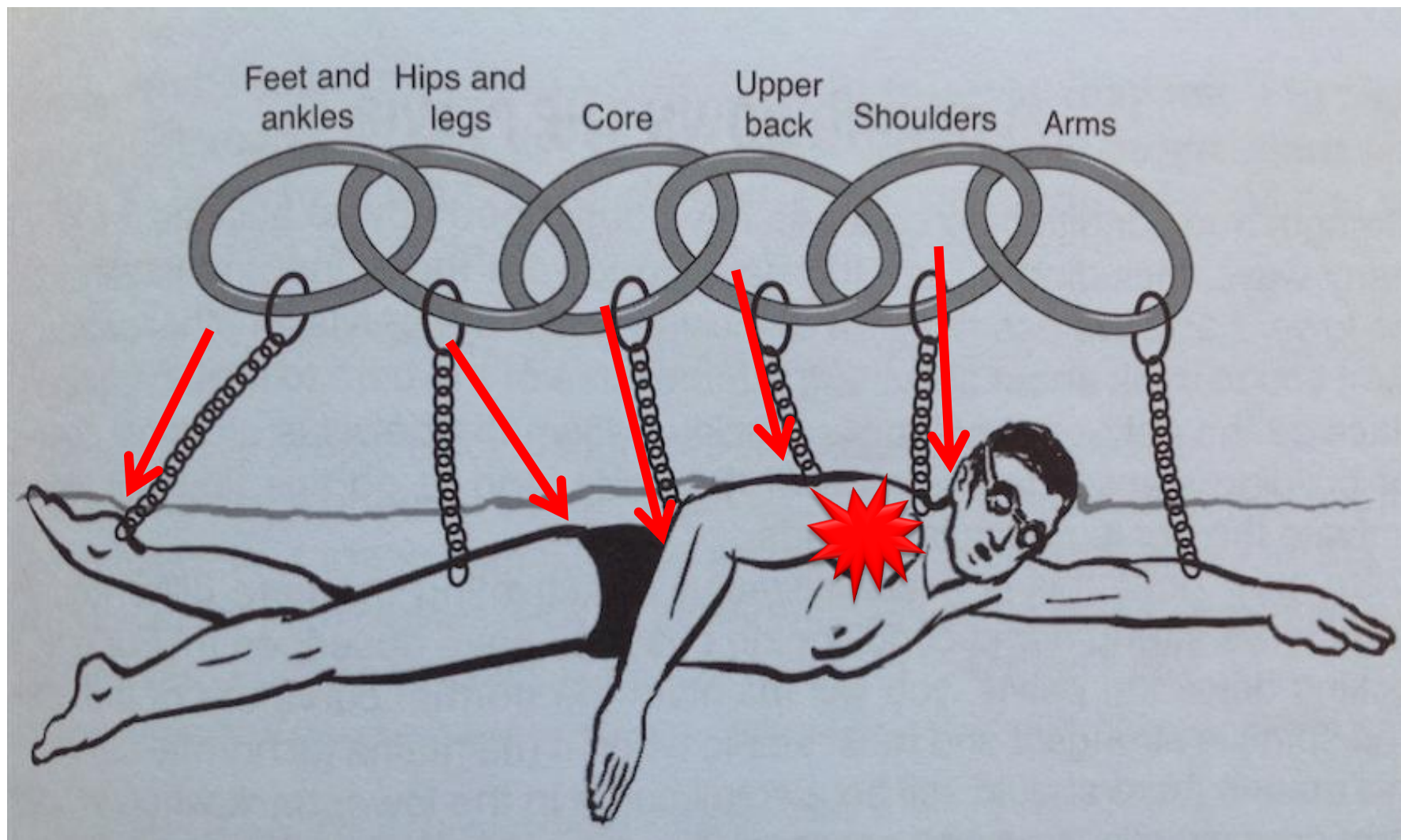
Weak Kinetic Chain Link

- Weak link in the kinetic chain system can lead to
 - An altered body fundamental movement pattern
 - Decrease Performance
 - Movement compensation
 - Movement Inefficiency
 - Pain and injury to any part of the inter-linked segment
 - Increase load and stress to one or more parts of the body segment in the kinetic system

Anterior Knee Pain



Shoulder Injury



(Image source: *Complete Conditioning for Swimming*. Dave Salo and Scott A. Riewald (2008))

Sports Specific Movement Assessment

- Baseline measurement
- Identify Risk Factors
- Identify basic sporting movement pattern faults

Identifying Movement Pattern Fault

- Take into consideration of
 - Movement pattern
 - Muscle activation timing
 - Neuromuscular control
 - Positional sense and movement awareness
 - Reaction to perturbation
- In addition to
 - Structural limitation
 - Joint range of motion
 - Strength

Assessing Functional Movement

Approach to Movement Pattern Assessment

Analyze Movement Pattern

- Functional Movement Tests

Identify Weak Link

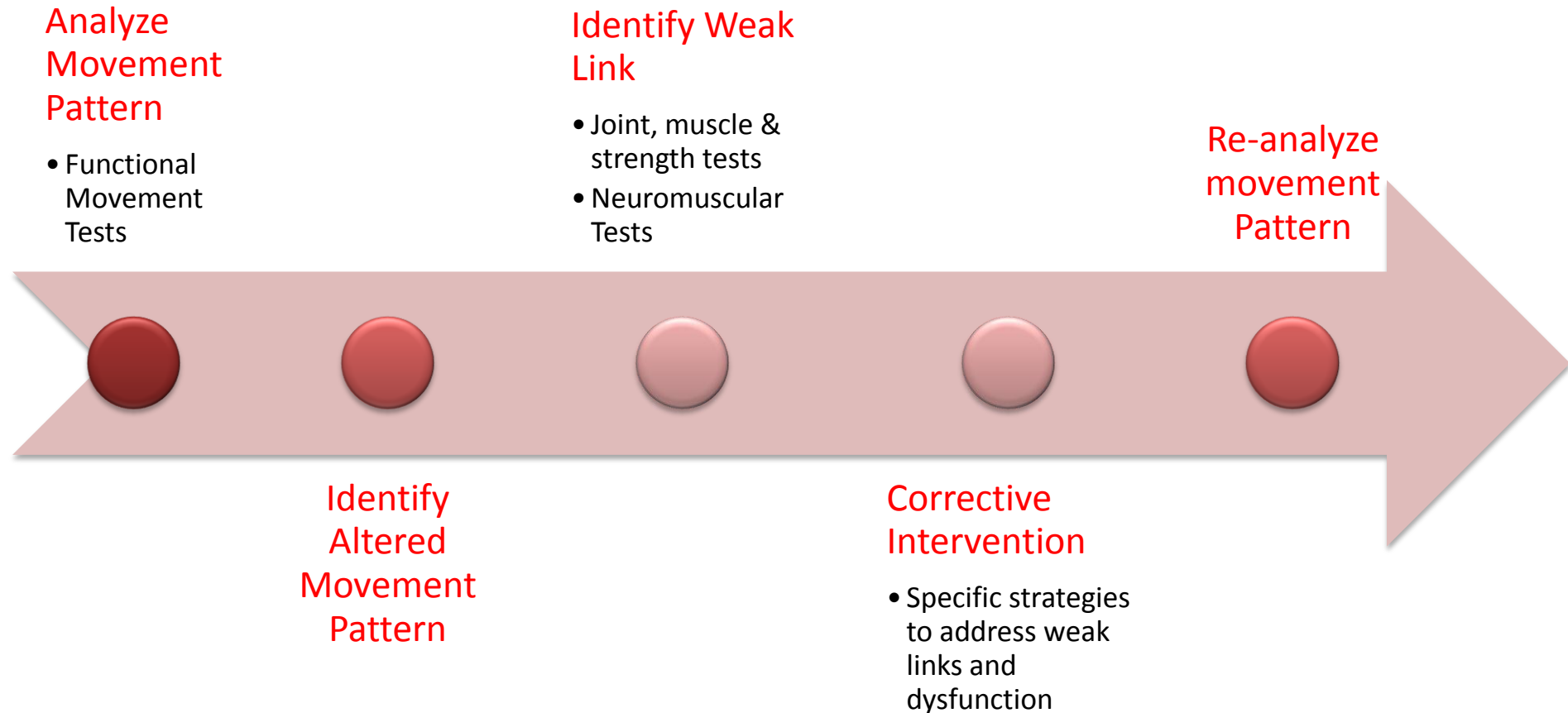
- Joint, muscle & strength tests
- Neuromuscular Tests

Re-analyze movement Pattern

Identify Altered Movement Pattern

Corrective Intervention

- Specific strategies to address weak links and dysfunction



Movement Pattern Assessments

Functional Movement Screen (FMS)
Star Excursion Balance Test & Single Leg
Hop Test
Seated Hip ROM Test

Functional Movement Screen (FMS)

- Screen fundamental movements based on
 - Proprioceptive and kinaesthetic awareness principles
 - 7 specific movement test
 - which requires appropriate function of the body's kinetic linking system.
 - Proprioception of each segment of the kinetic chain is involved
 - Scoring of movement graded
 - 0 – 3

FMS Score

- 0 – pain anywhere in the body while performing the test
- 1 – unable to complete the movement pattern or unable to assume the position to perform the movement
- 2 – able to complete the movement but compensate in someway
- 3 – performs movement correctly without any compensation, complying with standard movement expectations associated with each test.
- Specific comment also noted for scoring 0 – 3.

7 Fundamental Movements

- The Deep Squat
- Hurdle Step
- In Line Lunge
- Shoulder Mobility
- Active Straight Leg Raise
- Trunk Stability Push-Up
- Rotary Stability

Deep Squat (3)

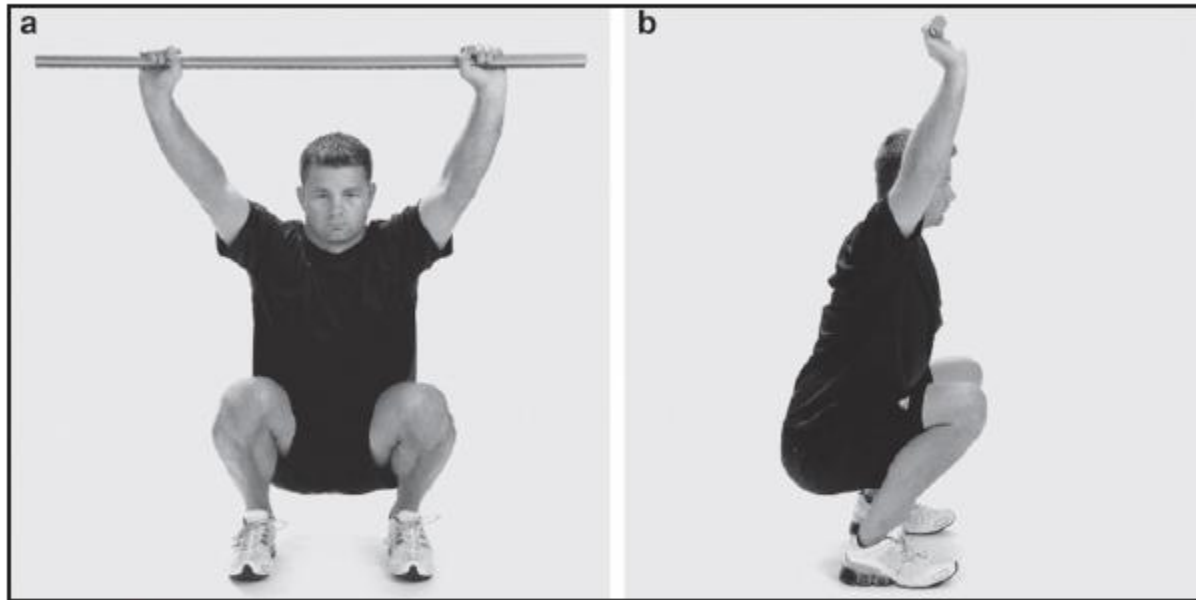


Figure 1. Performance of the Deep Squat test, scored as a "3", viewed from the front (a), and from the side (b). Note: The upper torso is parallel with the tibia or toward vertical, the femur is below horizontal, the knees are aligned over the feet, and the dowel is also aligned over the feet.

Deep Squat (2)



Figure 2. Performance of the Deep Squat test, scored as a "2", viewed from the front (a), and from the side (b). Note: The upper torso is parallel with the tibia or toward vertical, the femur is below horizontal, the knees are over the feet, the dowel is also aligned with the feet, however the heels are elevated on a 2" board.

Deep Squat (1)

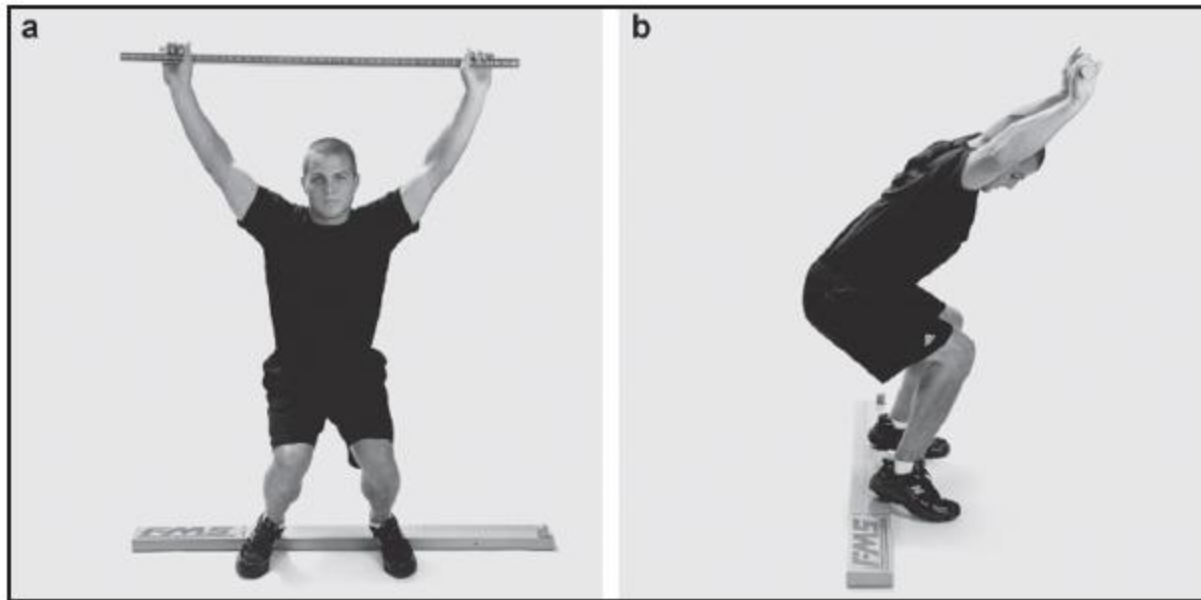


Figure 3. Performance of the Deep Squat test, scored as a "1", viewed from the front (a), and from the side (b). Note: the tibia and the upper torso are not parallel, the femur is not below horizontal, the knees are not aligned over the feet, or lumbar flexion is noted. Heels are elevated on a 2" board.

Hurdle Squat (3)

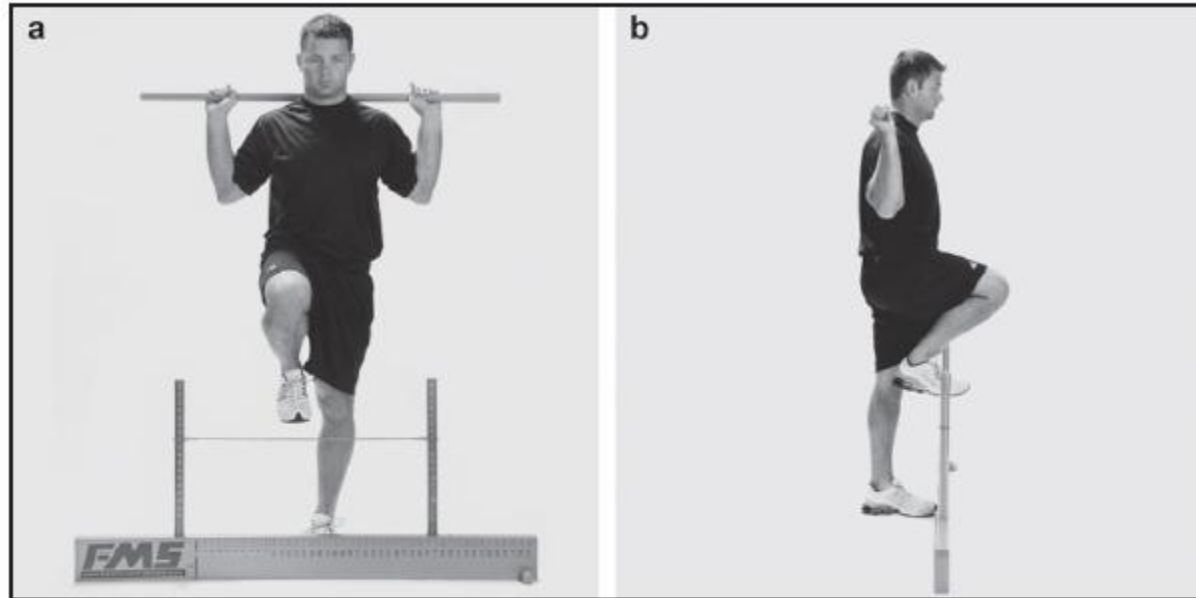


Figure 4. Performance of the Hurdle Step, scored as a "3", viewed from the front (a), and from the side (b). Note: hips, knees and ankles remain aligned in the sagittal plane. Minimal to no movement is noted in the lumbar spine, and the dowel and hurdle remain parallel.

Hurdle Squat (2)

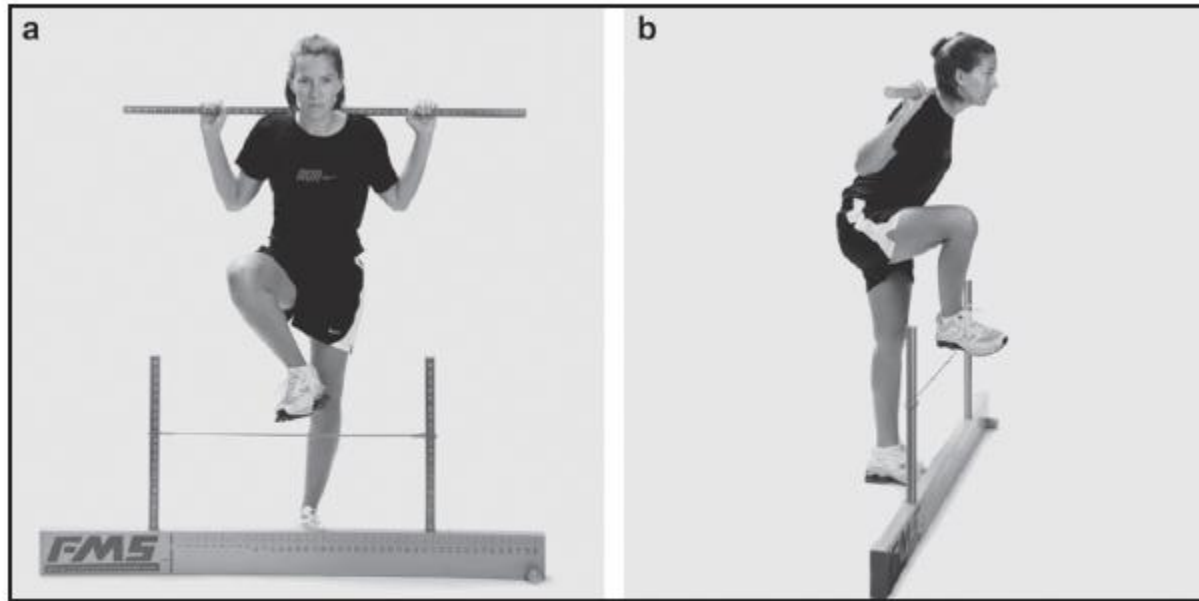


Figure 5. Performance of the Hurdle Step, scored as a "2", viewed from the front (a), and from the side (b). Note: Alignment is lost between the hips, knees, and ankles. Movement is noted in the lumbar spine, or the dowel and hurdle do not remain parallel.

Hurdle Squat (1)



Figure 6. Performance of the Hurdle Step, scored as a "1", viewed from the front (a), and from the side (b). Note: An athlete must be scored as a "1" if contact with the hurdle occurs during the test, or a loss of balance is noted.

In-Line Lunge (3)

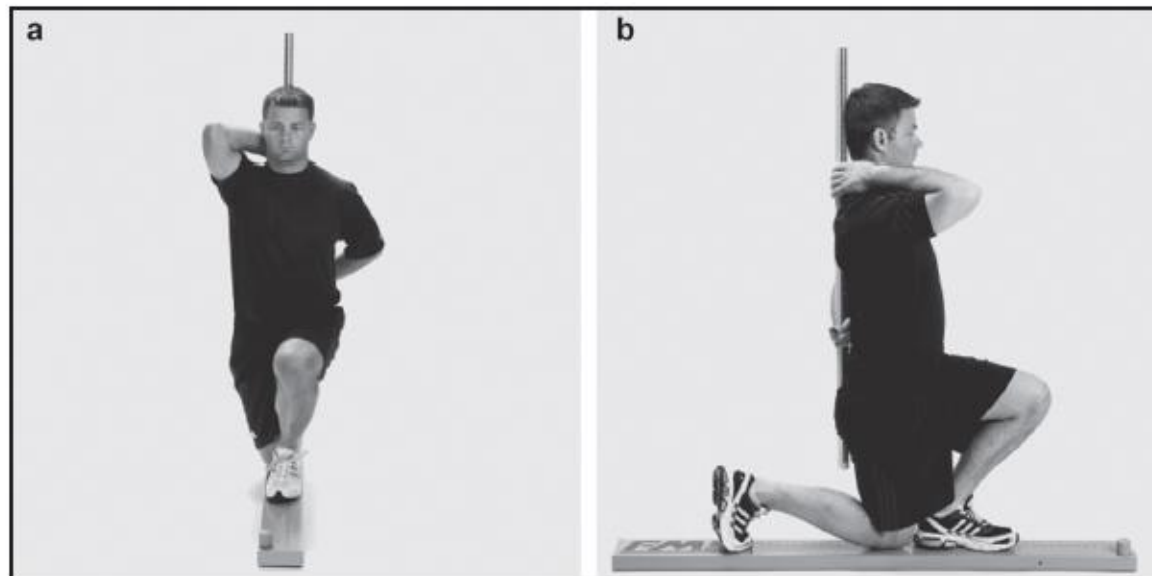


Figure 7. Performance of the In Line Lunge, scored as a "3", viewed from the front (a), and from the side (b). Note: the dowel remains vertical, and in contact with the spine, there is no torso movement noted, the dowel and feet remain in the sagittal plane, and the knee touches the board behind the heel of the front foot.

In-Line Lunge (2)

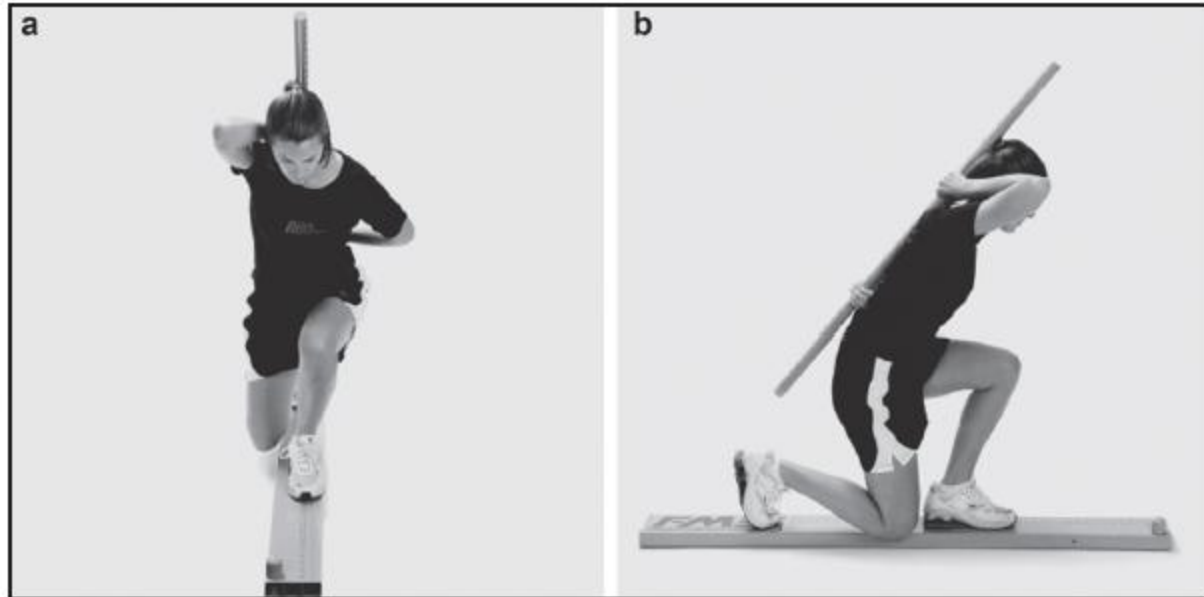


Figure 8. Performance of the In Line Lunge, scored as a "2", viewed from the front (a), and from the side (b). Note: Dowel contacts are not maintained, the dowel does not remain vertical, movement is noted in the torso, the dowel and feet do not remain in the sagittal plane, or the knee does not touch behind the heel of the front foot.

In-Line Lunge (1)

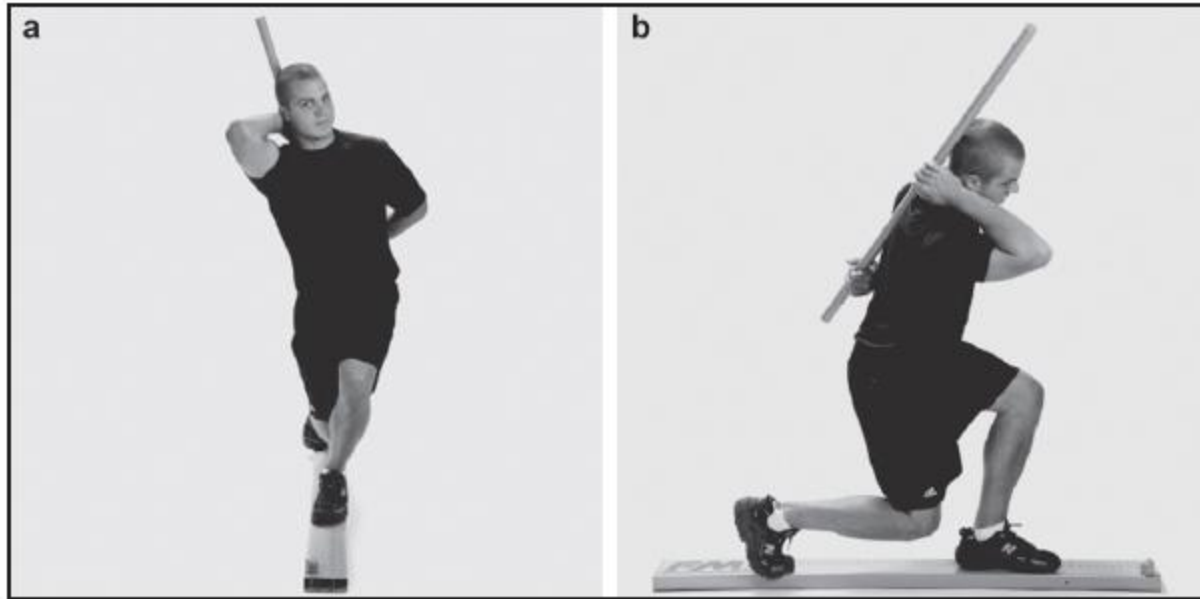


Figure 9. Performance of the In Line Lunge, scored as a "1", viewed from the front (a), and from the side (b). Note: A score of "1" is awarded if the athlete loses balance.

Shoulder Mobility (3)



Figure 1: Performance of the shoulder mobility test, scored as a "3". Note: Fists are within one hand length.

Shoulder Mobility (2 & 1)



Figure 2: Performance of the shoulder mobility test, scored as a "2". Note: Fists are within one and one half hand lengths.



Figure 3: Performance of the shoulder mobility test, scored as a "1". Note: Fists are not within one and one half hand lengths.

Active Straight Leg Raise (3)



Figure 5: Performance of the active straight leg raise test, scored as a "3". Note the vertical line of the malleolus of the tested leg resides between the mid-thigh and the ASIS. The non-moving limb must remain in neutral position.

Active Straight Leg Raise (2 & 1)



Figure 6: Performance of the active straight leg raise test, scored as a "2". Note the vertical line of the malleolus of the tested leg resides between the mid-thigh and the knee joint line. The non-moving limb must remain in the neutral position.

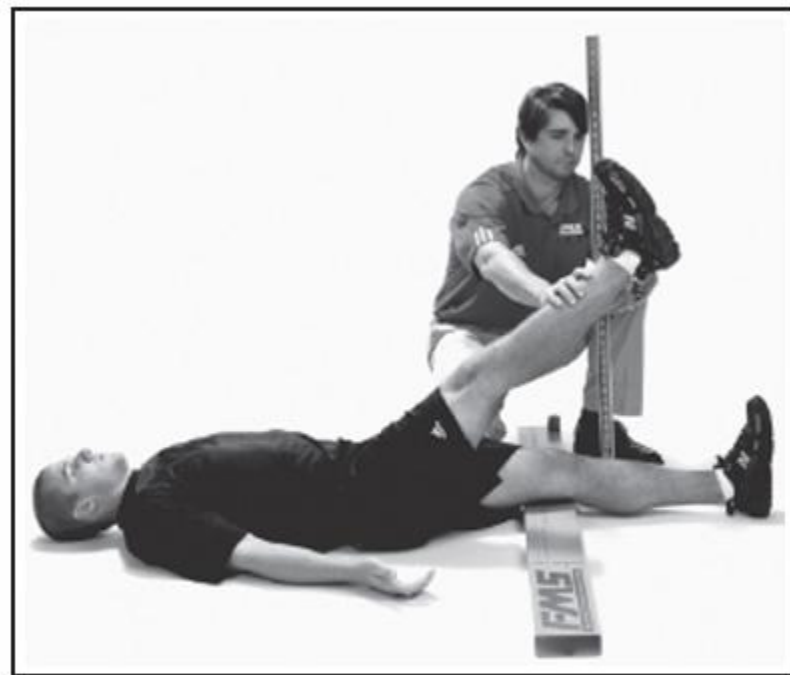


Figure 7: Performance of the active straight leg raise test, scored as a "1". Note the vertical line of the malleolus of the tested leg resides below the knee joint line. The non-moving leg must remain in the neutral position.

Trunk Stability Push-Up

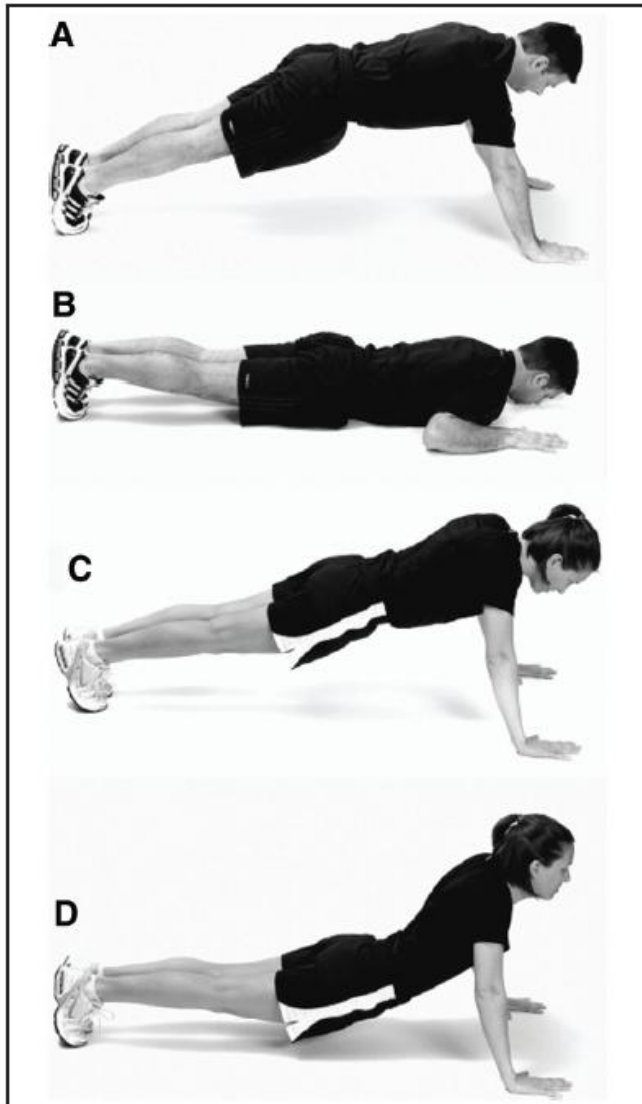


Figure 8: Performance of the trunk stability pushup test. A. The body lifts as a unit with no lag in the spine. Men perform a repetition with thumbs aligned with the top of the head; women perform a repetition with thumbs aligned with the chin to score a "3".

To score a "2", the body lifts as a unit with no lag in the spine. B. Men perform a repetition with thumbs aligned with the chin. C. Women perform a repetition with thumbs aligned with the clavicle. D. A score of "1" is given if the subject is unable to perform a repetition (with the body lifting as a unit) in the hand positions in B, men thumbs aligned with the chin; women with the clavicle.

Rotary Stability (3)



Figure 10: Performance of the rotary stability test, scored as a "3". The subject performs a correct unilateral repetition. A. Extended position (does not have to be > 6-8" off the ground). B. Flexed position, elbow and knee must meet. Note: must maintain narrow upper and lower extremity weight bearing over the 2 x 6 board without major weight shift away from the board.

Rotary Stability (2 & 3)



Figure 11: Performance of the rotary stability test, scored as a "2". The subject performs a correct diagonal repetition. A. Extended position (does not have to be > 6-8" off the ground). B. Flexed position, elbow and knee must meet. Note: must maintain narrow upper and lower extremity weight bearing over the 2 x 6 board without major weight shift away from the board.

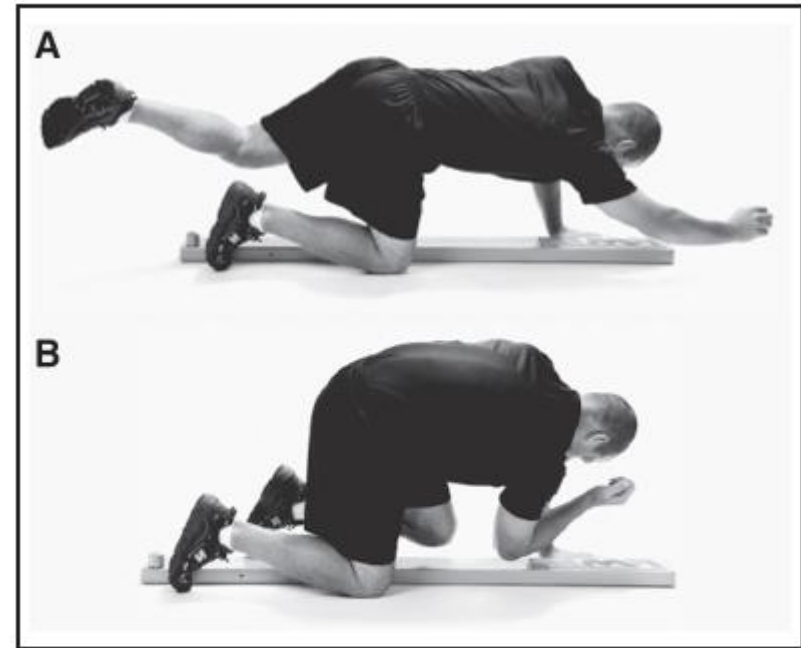


Figure 12: Performance of the rotary stability test, scored as a "1". The subject is unable to perform a diagonal repetition. A. Extended position. B. Flexed position.

FMS Test

- Score analysed through real time or video analysis
 - Fair to excellent inter-rater reliability for total score (ICC's 0.37-0.98)
 - Fair to good reliability for scoring of individual test movements (ICC's 0.30-0.89).
 - Well trained tester had stronger intra-rater reliability

Gribble et al (2012)

- Score of 14 or less on the FMS possessed dysfunctional movement patterns that may correlate with greater risk of injury

Kiesel et al (2007)

- Female collegiate athletes had approximate four-fold increase in risk of Lower extremity injury

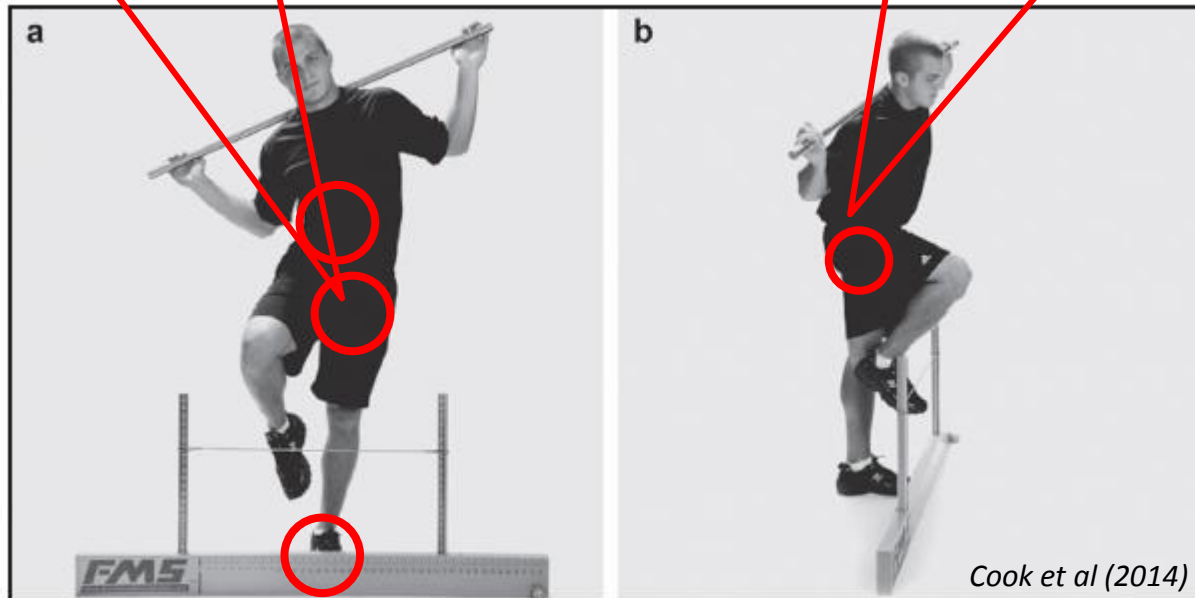
Chorba et al (2010)

Identify Weak Link through MSK test

Altered Movement Pattern



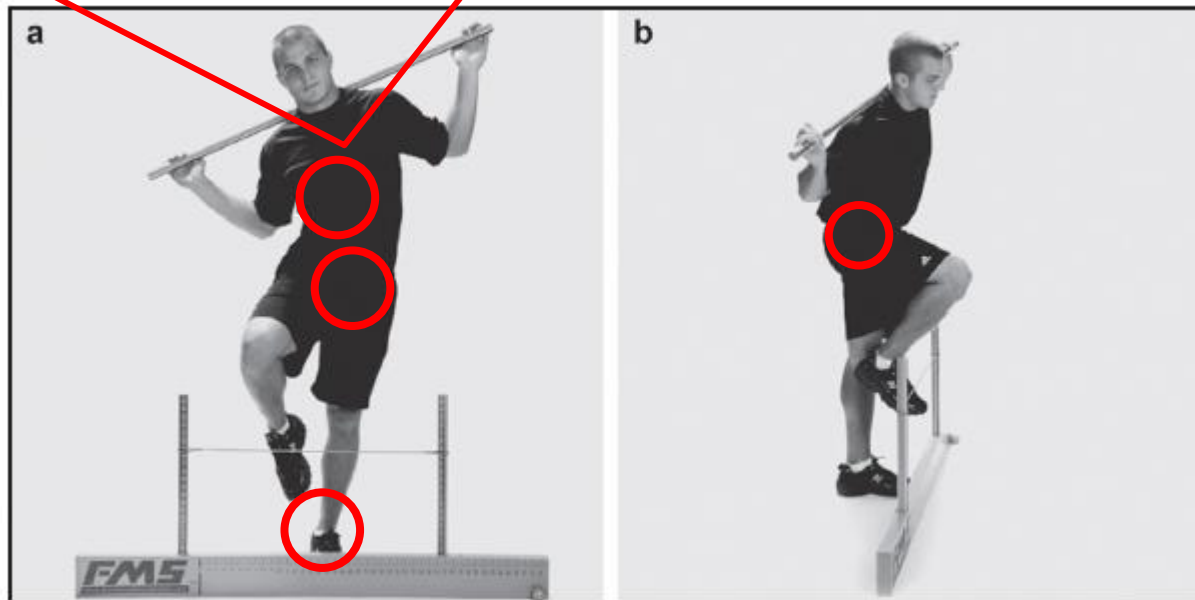
Identify Weak Link through MSK test



Identify Weak Link through MSK test



www.womenshealthmag.com

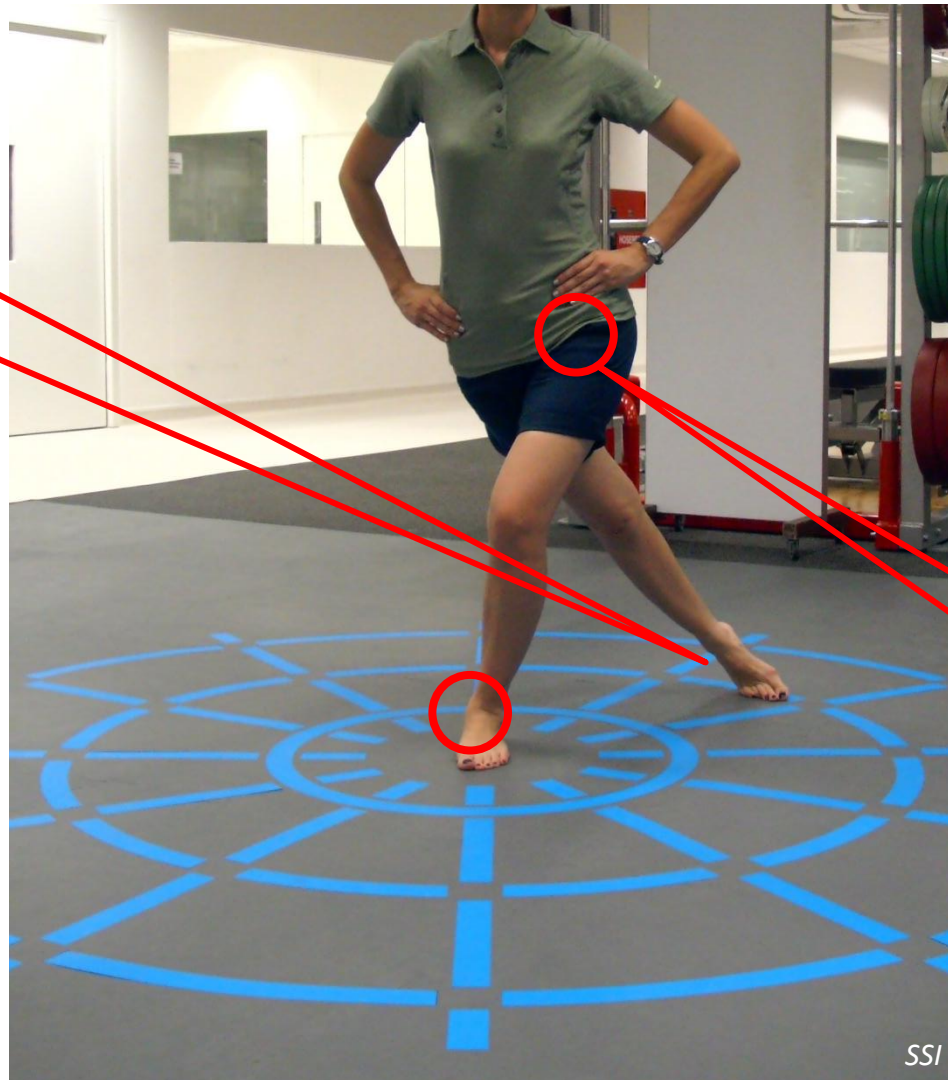


Star Excursion Balance Test (SEBT)

**Compare
Reach
Distance**

**Analyse
Movement
Pattern**

**MSK Tests to
identify faults**



Single Leg Hop Test

**Compare
Reach
Distance**

**Analyse
Movement
Pattern**



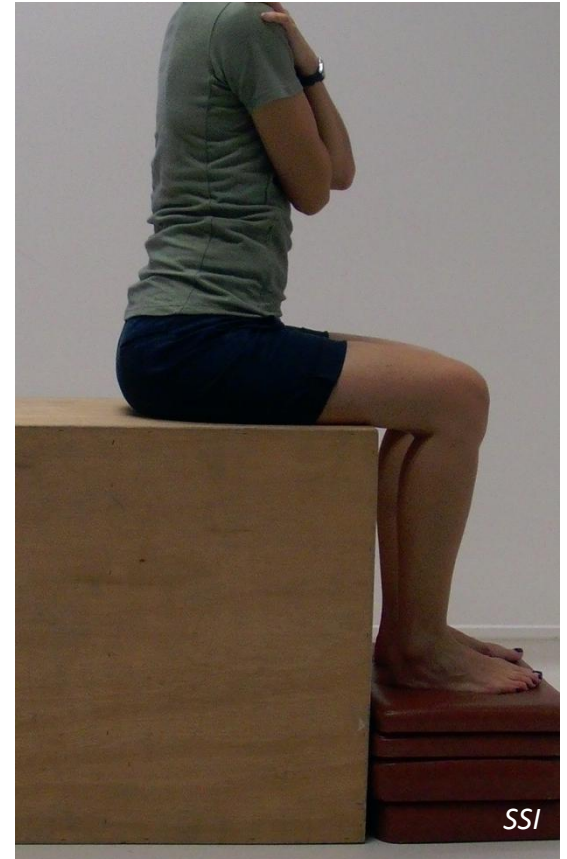
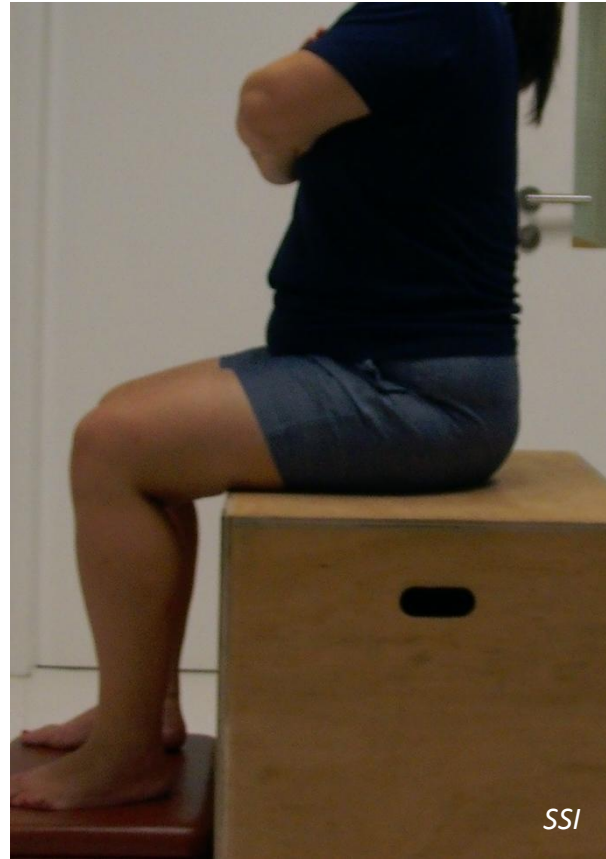
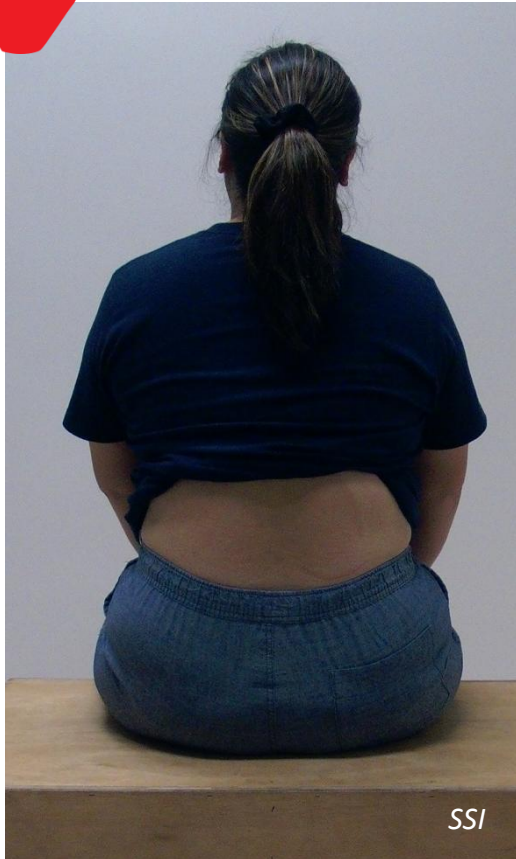


Seated Hip ROM Test

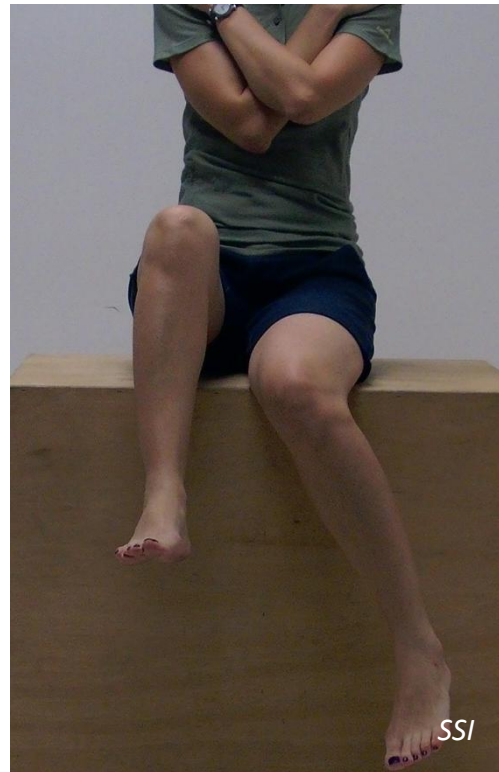
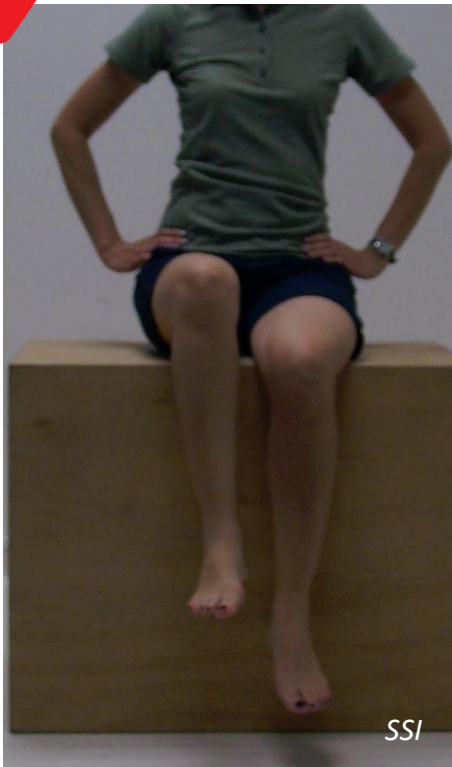
Fundamental Movements

- Sitting Posture
- Hip Flexion in sitting
- Hip Internal / External Rotation in Sitting
- Forward flexion + Trunk rotation on ergo
- Forward flexion + Trunk rotation on Bosu

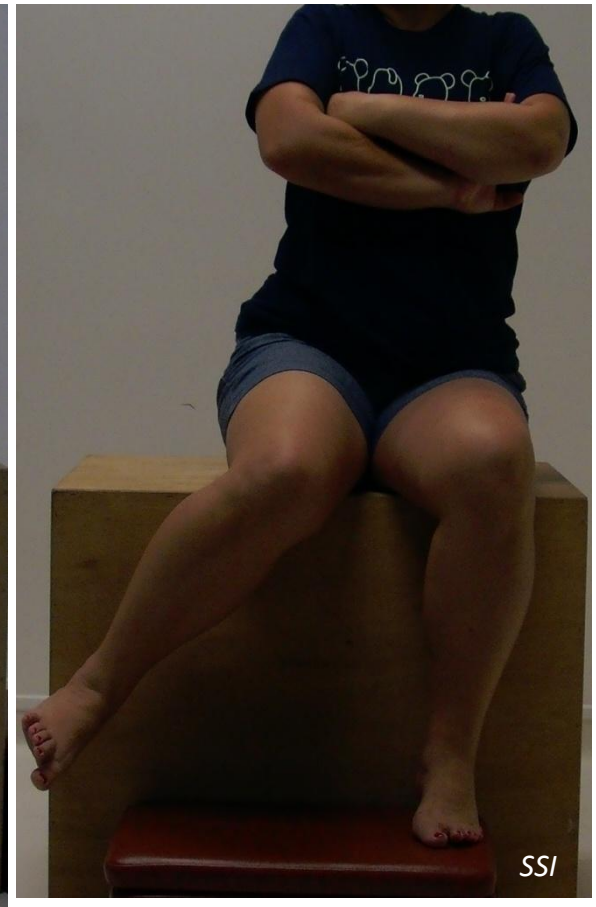
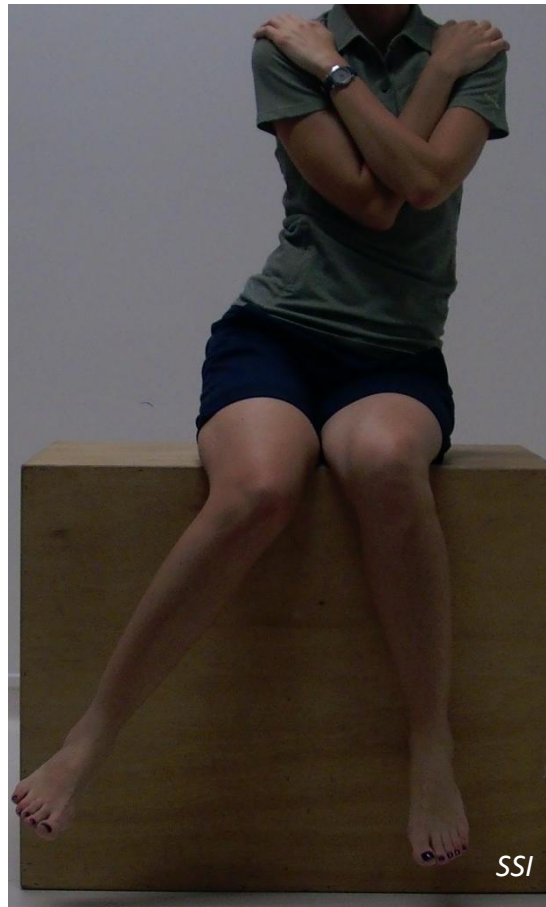
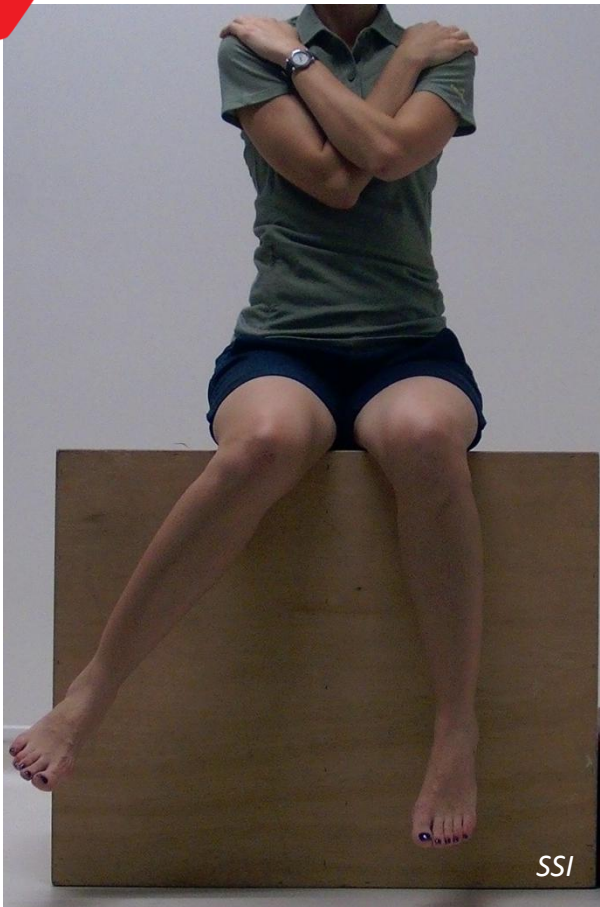
Sitting Posture



Hip Flexion in Sitting



Hip IR in Sitting



Forward Flexion With Rotation



Forward Flexion on Bosu



**Movement Assessment & MSK
Screening**



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graph TD; A[Movement Assessment & MSK Screening] --> B[Identify Faults and Weak Links]; B --> C[Rectify Faults to Improve Functions]; C --> D[Physiotherapy Treatment Intervention, core training program, neuro-muscular training etc.]; D --> E[Re-assessment of Movement Function];
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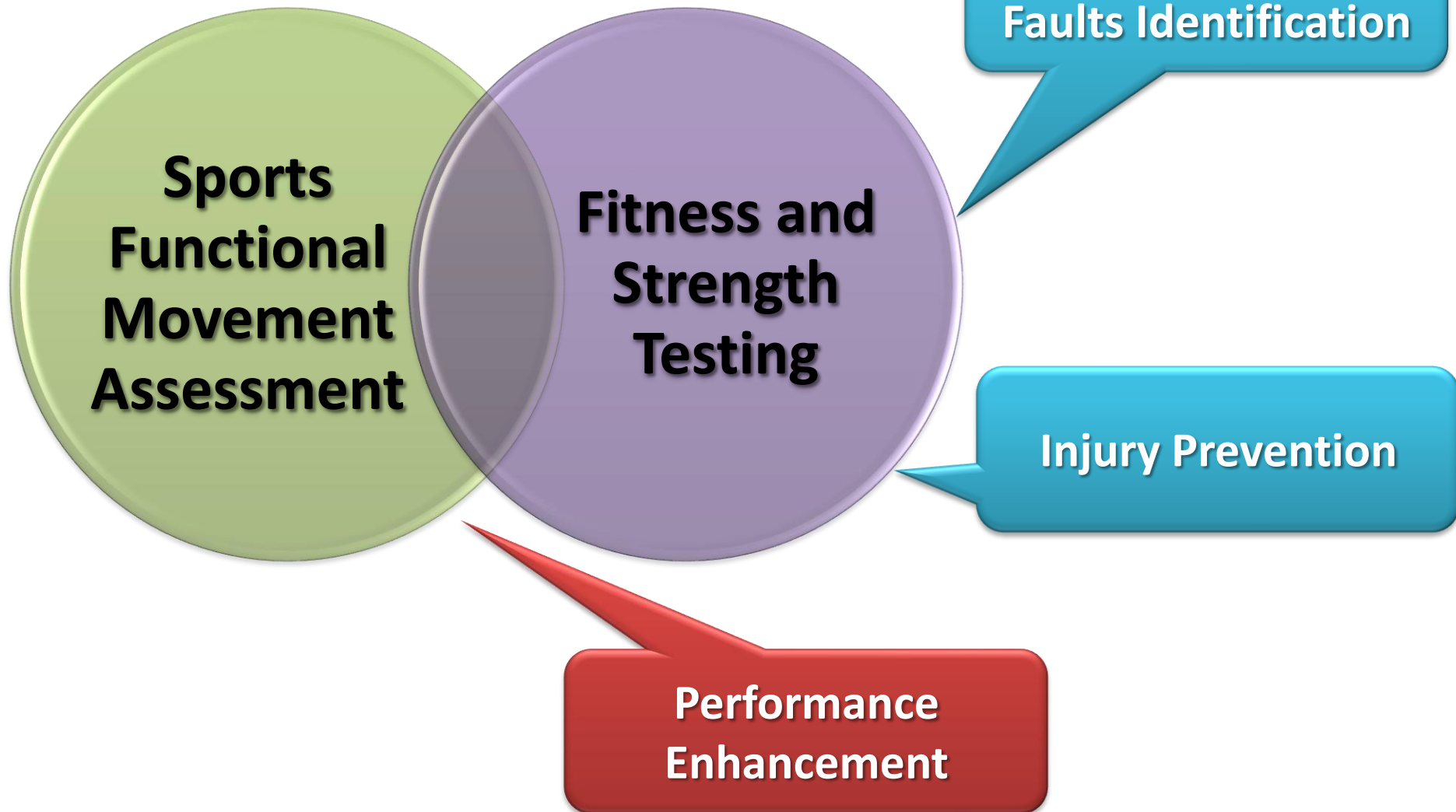
Identify Faults and Weak Links

Rectify Faults to Improve Functions

**Physiotherapy Treatment Intervention,
core training program, neuro-muscular
training etc.**

Re-assessment of Movement Function

The Next Step



References

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Image References

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Thank you