Athletes’ Performance Mission

To provide the finest performance methods, specialists, and facilities seamlessly integrated to efficiently and ethically enhance our athletes’ performance.

Athletes’ Performance Goals

Relationships & Results

Optimum Performance Pyramid

Adapted from Gray Cook 2001
Understanding Injury: Prediction & Prevention

Non-Contact Injuries

Contact Injuries

Injuries

There are two main categories of injury

1. Acute
   - Contact & non-contact
   - Mechanism of injury

2. Chronic (overuse)
   - Insidious onset
   - No mechanism of injury
   - Repetitive microtrauma
Microtrauma

*A series of minor stresses to the body resulting in limited area tissue damage or tears, each of which alone does not cause discernable damage. However, their accumulation over time can lead to a significant injury.

Injury Prediction

<table>
<thead>
<tr>
<th>Acute Contact Injuries</th>
<th>Acute Non-Contact &amp; Chronic Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unpredictable!</td>
<td>Predictable?</td>
</tr>
<tr>
<td>Possible causes...</td>
<td>Mobility?</td>
</tr>
<tr>
<td></td>
<td>Stability?</td>
</tr>
<tr>
<td></td>
<td>Asymmetries?</td>
</tr>
<tr>
<td></td>
<td>Poor functional movement?</td>
</tr>
</tbody>
</table>

Can We Predict Injuries?

What we know so far...

- All movement is based off of key fundamental movement patterns
- Efficient movement patterns are essential for our athletes to be able to perform at their best ???
- Poor movement can be a predictor of injury ???
- In order to be able to PREDICT, and then PREVENT injury, we must focus on the fundamental movement patterns
  - Squatting
  - Stepping
  - Lunging
  - Reaching
  - Leg Raising
  - Push-up
  - Rotary Stability

Challenges in Predicting Injury

- Pre-participation physicals and screenings which look at the body in pieces haven’t had large success in predicting injury
- Researchers suggest that there will always be a certain level of unpredictability
- Most injuries are multi-factorial, with wide individual variations
- Traditional methods are inconsistent and not standardized

What is the Function Movement Screen?

The Functional Movement Screen is a standardized screening tool that allows us to rate the quality of an individual’s movement patterns in a systematic, repeatable way.

1. The FMS is a 7 movement screen that looks at the key fundamental movement patterns of our athletes
   - Deep Squat
   - Hurdle Step
   - In-line lunge
   - Shoulder Mobility
   - Active Straight Leg Raise
   - Trunk Stability Push up
   - Rotational Stability
What is the Function Movement Screen?

2. Identifies “Red Flags” or compensatory movement patterns that may put the athlete at a greater risk of injury.

3. Allows us to quickly rank the quality of the fundamental movement patterns of our athletes – isolating their ‘weakest links’.

Goals of the FMS

1. Identifies Movement Compensations
   - Identify the ability of our athletes to move efficiently
   - Proactive injury prevention by identifying injury risk (red flags)
   - Help to determine their “weakest links”

2. Prevent Injury & Improve Performance
   - Target “weak links” with appropriate FMS solutions
   - Enhance the quality of their movement
   - Decrease “energy leaks” and increase efficiency of movement
   - Increase performance!

Research Findings


Asymmetries increase the chance of injury!
Preliminary Findings with FMS

- If FMS score ≤ 14 then probability of suffering a time loss injury increased from 15% (pre-test probability) to just over 50%.
- “Trends Based on Results from one NFL football team over 1-year period.

Low FMS scores (<14) have been shown to greatly increase injury potential.

Highlight the Fundamental Need for Screening

- Demonstrate Limitations and Asymmetries
- What is the “Primary Problem”
- Create a “Feedback System for Functional Exercise”
- Help predict poor efficiency and breakdown

Understand the difference!

Assessment vs. Screen

Assessment
- To judge someone’s ability
- Performed by the Physical Therapists/ Athletic Trainers

Screen
- A filter
- To catch major problems to be assessed
- Check for risk

*The FMS is simply a screen designed to catch fundamental movement pattern compensations, not an assessment tool to determine the root cause of the compensations.

Key Considerations

Musculoskeletal “Hardware”

Neurological “Software”

The FMS cannot separate these two systems – we can’t tell if it’s hardware or software issue - all we can tell from the screen is if they can perform the pattern or not.

Consider Squatting: What’s limited – Mobility or Stability?
Is this a Mobility or Stability Problem?

Pattern recognition: Experts vs. Novices

Experts
- Advanced pattern recognition

Novices
- Distracted by irrelevant details

“Can’t see the forest from the trees”

Don’t over analyze when screening the athlete! Trust the screen!

Key Concept: Performance vs. Durability

Performance vs. Durability

The FMS Draft: Take your pick!

Performance: (Quantitative)

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<td>4.6</td>
<td>4.7</td>
</tr>
<tr>
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<td>345</td>
<td>325</td>
</tr>
<tr>
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<tr>
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<td>+2 in.</td>
<td>+1 in.</td>
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Durability: (Qualitative)

Key Concept: Quality of Movement vs. Quantity of Movement

“You have to fix the flat before you race!”

“You have to fix the flat before you race!”

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Durability: (Qualitative)
Quality vs. Quantity

Quality = LOW
Quantity = HIGH

Question:
What do you think happened to this young star athlete over time?

• Back Injury
• Knee problems
• Early retirement

People will always sacrifice quality of motion to maintain quantity of motion. This leads to...
- Compensatory movement patterns
- Micro-trauma
- Muscle Imbalances
- Aches, Pain → Injury

It is our responsibility to ensure our athletes have an appropriate quality of movement before we overload them with quantity!

“We now use this program with every player as a pretest and evaluation tool before we even begin to train them. This individualizes our training as we can now focus more on improving weaknesses, imbalances and asymmetries in an effort to improve functional movement patterns. It’s the foundation of our program. Everything we do builds off of it. We wouldn’t think of not using this program.”

Jon Torine
Head Strength Coach
Indianapolis Colts

Key Points

- Inefficient movements cause compensations which move a joint in a less efficient manner.
- The body will always sacrifice quality for quantity. Movement patterns will follow the path of least resistance
- Compensatory movements lead to microtrauma
- It is our responsibility to ensure our athletes are moving with high quality!

The Functional Movement Screen™

How do you screen movement?
1. Squatting
2. Stepping
3. Lunging
4. Reaching
5. Leg raising
6. Push-up
7. Rotary Stability
The Functional Movement Screen™

“Think of it as a filter - what do you need to catch?”

Consists of...
- 7 movements scored from 3 - 0
  - 3 performs functional movement pattern
  - 2 perform functional movement pattern with a compensation
  - 1 inability to perform the movement pattern
  - 0 pain with movement

Functional Movement

Screen #1 DEEP SQUAT TEST

**Purpose** - The Deep Squat is used to assess bilateral, symmetrical mobility of the hips, knees, and ankles. The dowel held overhead assesses bilateral, symmetrical mobility of the shoulders as well as the thoracic spine.

**Description** - The individual assumes the starting position by placing his/her feet shoulder width apart. The individual then adjusts their hands on the dowel to assume a 90-degree angle of the elbows with the dowel overhead. Next, the dowel is pressed overhead with the shoulders flexed and abducted, and the elbows extended. The athlete is then instructed to descend slowly into a squat position. As many as 3 repetitions should be performed. The squat position should be assumed with the heels on the floor, head and chest facing forward, and the dowel maximally pressed overhead. If the criteria for a score of III are not achieved, the athlete is then asked to perform the subsequent test with heels on the 2x6.

Deep Squat

**DEEP OVERHEAD SQUAT**
- Upper torso is parallel with tibia or toward vertical
- Femur below horizontal
- Knees aligned over feet
- Dowel aligned over feet

Deep Squat 3

Deep Squat 2
Deep Squat 1

Poor performance of this test can be the result of several factors.

1. **Heels off the ground** - Ankle mobility
2. **Hip Mobility** - Tight Glutes, Hypomobile post hip capsule
3. **Hip Stability** - Genu Valgus, Femoral IR, Tibial ER - Glute med weakness, foot intrinsic weakness
4. **T-Spine Mobility/Core Stability** - Forward torso - Weak core muscles, hypomobile T-spine
5. **Shoulder Mobility** - Tight Lats, Pec Minor, low trap/serratus anterior
6. **Motor Control** - Decreased Balance/Proprioception/Timing

Screen #2 HURDLE STEP ©

**Purpose** - The Hurdle Step is used to assess bilateral mobility and stability of the hips, knees, and ankles.

**Description** - The individual assumes the starting position by placing his/her feet shoulder width apart. The hurdle is then adjusted to the height of the athlete's tibial tuberosity. The dowel is positioned across the athlete's shoulders below their neck. The individual then aligns their toes directly beneath the hurdle. The athlete is then asked to step over the hurdle and touch the heel while maintaining his/her stance leg in an extended position. Finally, the athlete is instructed to return to the starting position. The Hurdle Step should be performed slowly and as many as 3 times bilaterally. If one repetition is completed bilaterally meeting the below criteria a III is given.

Hurdle Step 3

**HURDLE STEP**

1. Hip, knees and ankles aligned
2. Min to no lumbar spine movement
3. Dowel and hurdle remain level

FMS ™:

Hurdle Step
Clinical Implications For Hurdle Step
The ability to perform the Hurdle Step test requires:
1. Stance leg stability of the ankle, knee, and hip & max (CKC) extension of the hip.
2. Leg (OKC) dorsi-flexion of the ankle and flexion of the knee and hip.

Poor performance of this test can be the result of several factors:
1. Ankle Stability – instability – loss of balance and proprioception
2. Hip Stability – Trendelenberg, overactive QL trunk SB – Weak Core and glute med
3. Hip Mobility – IR/ER of leg over band hits band. Tight Hip ER/IR and glute tightness
4. Motor Control - Decreased Balance/Proprioception/Timing

Purpose - The In-Line Lunge is used to assess bilateral mobility and stability, as well as ankle and knee stability.
Description – Use the same tibial length measurement from the Hurdle Step. The athlete then places one foot on the end of the 2x6 board. The athlete places the dowel behind their back touching the head, thoracic spine, and sacrum. The hand ipsilateral to the back foot should be the hand grasping the top of the dowel; the contra-lateral hand grasps the bottom. The tester then measures the tibial length from the end of the individual’s toes and a mark is made on the board. The athlete is then asked to take a step and place their heel on the mark. The athlete then lowers their back knee enough to touch the board behind the front foot. The feet should be on the same line and pointing straight throughout the movement. The lunge is performed up to three times bilaterally in a slow controlled fashion. If one repetition is completed successfully then a three (III) is given.
FMS™:
In-Line Lunge 3

IN-LINE LUNGE CONT
Clinical Implications For In-Line Lunge
The ability to perform the In-Line Lunge test requires:
1. Stance leg stability and mobility of the ankle (dorsiflexion), knee (flexion), hip (extension) and 1st MTP Extension.
2. Bilateral OKC hip abduction.
3. Step leg mobility of hip flexion and adduction, also knee flexion ankle dorsiflexion. The athlete must also display adequate balance during this test.

Poor performance of this test can be the result of:
1. Inadequate hip mobility & stability of either the stance or step leg.
2. The stance leg knee or ankle may not have the required stability or mobility as the lunge is performed.
3. Imbalance may be present between adductor weakness and abductor tightness about one or more hips.
4. Tightness of the Hip Flexor Complex on the stance leg may be the cause for poor performance.
5. Motor Control - Decreased Balance/Proprioception/Timing

Screen #4 SHOULDER MOBILITY©

**Purpose** - The Shoulder mobility test is used to assess bilateral shoulder range of motion combining internal rotation with adduction and external rotation with abduction.

**Description** - The tester first determines the athlete’s hand length by measuring the distance from the distal wrist crease to the tip of the third digit. The athlete is instructed to make a fist with each hand, placing the thumb inside the fist. They are then asked to assume a maximally adducted and internally rotated position with one shoulder, and a maximally abducted and externally rotated position with the other. During the test the hands should remain in a fist and they should be placed on the back in one smooth motion. The tester then measures the distance between the two fists. Perform the Shoulder Mobility test as many as 3 times bilaterally.
**SHOULDER MOBILITY CONT**

1. 3 – within one hand length
2. 2 – within 1 and ½ hand length
3. 1 – more than 1 and ½

*A shoulder stability (active shoulder impingement) screen should be performed even if the athlete scores a III. The athlete places his/her hand on the opposite shoulder and then attempts to point the elbow upward. If there is pain associated with this movement, a score of zero is given. It is recommended that a thorough evaluation of the shoulder be done. This screen should be performed bilaterally. If the athlete does receive a score of zero both scores should be documented for future reference.*

**FMS™:**

**Shoulder Mobility 3**

- Fist placement is within one hand length apart

**FMS™:**

**Shoulder Mobility 2**

- Fist placement is between one and one and a half hand lengths apart

**FMS™:**

**Shoulder Mobility 1**

- Fist placement is greater than one and a half hand lengths apart

**FMS™:**

**Clearance ~ Shoulder Impingement**

A score of zero is given if active shoulder stability test is positive

**SHOULDER MOBILITY CONT**

**Clinical Implications For Shoulder Mobility**

The ability to perform the Shoulder Mobility test requires shoulder mobility in a combination of motions including abduction/external rotation and adduction/internal rotation. Poor performance of this test can be the result:

1. Increased external rotation is gained at the expense of internal rotation in overhead throwing athletes.
2. Postural changes of forward or rounded shoulders caused by excessive development and shortening of the pectoralis minor and/or latissimus dorsi muscles.
3. Scapulothoracic dysfunction may be present resulting in decreased glenohumeral mobility.
**Screen #5 ACTIVE STRAIGHT LEG RAISE**

**Purpose** - The Active Straight Leg Raise test is used to assess active hamstring and gastrocnemius flexibility, while maintaining a stable trunk and pelvis in addition to down leg hip flexor extensibility.

**Description** - The individual first assumes the starting position by lying supine with his/her arms at their sides, palms up and head flat on the floor. A dowel is placed under the knees of the athlete. The tester then identifies the athlete’s anterior superior iliac spine (ASIS) and mid-point of the patella. Next, the athlete is instructed to lift the test leg with a dorsiflexed ankle and an extended knee. During the test the opposite knee should remain in contact with the 2x6 and head should remain flat on the floor. Once the athlete has achieved their end range position, a dowel is aligned along the medial malleolus of the test leg, perpendicular to the floor. The Active Straight Leg Raise test should be performed as many as 3 times bilaterally.

Dowel resides between mid-patella and ASIS

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**ASLR CONTINUED**

1. Dowel between mid-patella and ASIS
2. 3 – past dowel
3. 2 – b/w dowel and knee
4. 1 – below knee

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**FMS™:**

**Active Straight Leg Raise 3**

- Ankle/Dowel resides between mid-thigh & ASIS
- Knee should remain in contact with board
- Toes pointed up
- Head flat on floor

**FMS™:**

**Active Straight Leg Raise 2**

- Ankle/Dowel resides between mid-thigh and mid-patella/joint line

**FMS™:**

**Active Straight Leg Raise 1**

- Ankle/Dowel resides below mid-patella/joint line
**Screen #6 TRUNK STABILITY PUSH-UP**

**Purpose** - The Trunk Stability Push-Up is used to assess trunk and pelvic stability in the sagittal and transverse planes while a symmetrical upper extremity motion is performed.

**Description** - The individual assumes a prone position. The hands are then placed shoulder width apart at the appropriate position per the below criteria, knees fully extended. The individual is asked to perform one push-up in this position. The body should be lifted as a unit; there should be no "lag" in the lumbar spine when performing this push-up. If the individual cannot perform a push-up in this position, the hands are lowered to the appropriate position per the below criteria, and a push-up is performed. The Trunk Stability Push-Up can be performed as many as 3 times.

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**TRUNK STABILITY PUSH-UP CONT**

1. **Females**: Thumb in line with chin, then collar bone
2. **Males**: Thumb in line above forehead then chin
3. Elbows and knees off the ground

* Lumbar extension should also be cleared after this test, even if a score of II is given. Spinal extension can be cleared by performing a press-up in the push-up position. If there is pain associated with this motion, a zero is given and a more thorough evaluation should be performed.

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**FMS™:**

**Trunk Stability Push Up 3**

- Males perform 1 repetition with thumbs just above forehead
- Females perform 1 repetition with thumbs in-line with chin

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**FMS™:**

**Trunk Stability Push Up 2**

- Males perform 1 repetition with thumbs in-line with chin
- Females perform 1 repetition with thumbs in-line with clavicle

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**FMS™:**

**Trunk Stability Push Up 1**

- Males unable to perform 1 repetition with thumbs in-line with chin
- Females unable to perform 1 repetition with thumbs in-line with clavicle
**TRUNK STABILITY PUSH-UP CONT**

Clinical Implications For Trunk Stability Push-Up

The ability to perform the Trunk Stability Push-up requires symmetric trunk stability in the sagittal plane during a symmetric upper extremity movement. Many functional activities in sport require the trunk stabilizers to transfer force symmetrically from the upper extremities to the lower extremities and vice versa. If the trunk does not have adequate stability during these activities, kinetic energy will be dispersed, leading to poor functional performance as well as increased potential for micro-traumatic injury. Poor performance during this test can be simply attributed to poor symmetric stability of the trunk stabilizers.

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**Screen #7 ROTATIONAL STABILITY**

**Purpose** - The Rotational Stability test is used to assess multi-planar stability while a combined upper and lower extremity motion is performed.

**Description** - The individual assumes the starting position in quadruped with their shoulders and hips at 90 degrees relative to the upper torso. The knees are positioned at 90 degrees and the ankles should remain dorsi-flexed. The 2x6 is the placed between the knees and hands so they are in contact with the board. The individual then flexes the shoulder and extends the same side hip and knee. The leg and hand are only raised enough to clear the floor by approximately 6 inches. The elbow, hand, and knee that are lifted should all remain in line with the 2x6. The torso should also remain in the same plane as the 2x6. The same shoulder and knee are then flexed enough for the elbow and knee to touch. This is performed bilaterally for up to 3 repetitions. If a III is not attained then the directions should be followed as indicated in the FMS text.

**ROTATIONAL STABILITY**

1. Performs 1 unilateral repetition while keeping torso parallel to board
2. Knee and elbow touch in line with the board

Spinal Flexion can be cleared by assuming a quadruped position, rocking back and touching the buttocks to the heels, chest to the thighs and reaching the hands forward. If pain is associated with this movement a score of Zero is given.

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**FMS™: Rotary Stability**

**Scoring:**

- a III is attained
- a II is attained
- a I is attained
- inability to perform the test

**Rotary Stability**
FMS™: Rotary Stability 2

- Performs 1 diagonal repetition while keeping torso parallel to board and keeping elbow and knee in line with the board.

FMS™: Rotary Stability 1

- Unable to perform 1 diagonal repetition while keeping torso parallel to board and keeping elbow and knee in line with the board.

FMS™: Clearance ~ Spine Flexion

ROTATIONAL STABILITY CONT

Clinical Implications For Rotational Stability

The ability to perform the Rotational Stability test requires:

1. Asymmetric trunk stability in both SP & TP during asymmetric upper and lower extremity movement. If the trunk does not have adequate stability during these activities, kinetic energy will be dispersed, leading to poor performance as well as increased potential for micro-traumatic injury.

Poor performance during this test can be simply attributed to poor asymmetric stability of the trunk stabilizers.

Managing Limiting Factors

- Pain on any of the screens (Any 0's)
  - Upper/Lower Quarter Screen
  - Work Corrective Strategies and Re-Test in 2 Weeks
- Asymmetrical 1's (L 1, R 3)
- Asymmetrical 1's (L 1, R 2)
- Symmetrical 1's (L 1, R 1)
  - Work Corrective Strategies and Re-Test in 2 Weeks
- Asymmetrical 2's (L 2, R 3)
- Symmetrical 2's (L 2, R 2)
  - Work Corrective Strategies and Re-Test in 2 Weeks
- Perfect Score of 21
  - Continue maintenance program

To Learn More...