

Screening Swimmers for Injuries

What we know about injury screening for swimmers

About me



Dr. G. John Mullen, DPT, CSCS

G. John Mullen received his Doctorate in Physical Therapy at the University of Southern California (USC). At USC, he was a clinical research assistant performing research on adolescent diabetes, lung adaptations to swimming and swimming biomechanics. G. John has been featured in *Swimming World Magazine*, *Swimmer Magazine*, and the *International Society of Swim Coaches Journal*.

G. John is currently a strength and conditioning consultant club and collegiate swimmers. He is the rehabilitation specialist for *Swimming World Magazine*. He is also the owner of COR, a personal training and physical therapy practice in Santa Clara, CA. He is the chief editor of *Swimming Science* and the creator of the *Swimmer's Shoulder System*, *Dryland for Swimmers*, and *Swimming Science Research Review*.

Risk of Injury is Specific

- Older person: Falling, don't care about shoulder mobility!
- Rower: repeated Bending and herniated disc
- Power Lifter: Low back, muscle avulsion, restricted movement and tightness is better
- Olympic lifter: Shoulder, knees, hips
- Runner: Football mechanics, pelvic platform kinematics
- Swimmer: Shoulder, low back, hip, knee (breaststroke)
- There are generalists and specialists:
 - Specialists likely more prone to overuse injuries and potentially require specific screens.
 - Generalists: more prone to accidental injury and perhaps need a general screen.
 - Swimmers are specialists.

Why We Need/Want Screening!

Shoulder

- Shoulder injury rates are estimated between 3 - 73% (Richardson 1980; Neer 1983; McMaster 1987; Allegrucci 1997; Bak 1996)
- Prevent Injuries=more kids swimming=faster swimming=better health
- Shoulder pain decreases swimming potential and enjoyment (short- and long-term)

Low Back

- Low back disc degeneration ~50 - 75% in swimmers (Kaneoka 2007; Hangai 2008)

Knee

- Knee pain noted in 87% of swimmers (Rovere 1985)

What is a Screen?

- In medical terms, a screen is a test or series of tests applied to a pain free population to determine risk of future symptoms.
- Think about a physical, a movement screen is meant as a physical for musculoskeletal injuries.



"First we're going to run some tests to help pay off the machine."

Functional Movement Screen (FMS)

Functional Movement Screen: Developed by Lee Burton

- The Functional Movement Screen (FMS) is a set of seven physical tests of coordination and strength, especially “core” strength, invented in 1997 and now in widespread use around the world.
- The tests are:
 - Deep Squat
 - Hurdle Step
 - In-Line Lunge
 - Shoulder Mobility
 - Active Straight Leg Raise
 - Trunk Stability Push-up
 - Rotary Stability

How the FMS 'works'

FMS scoring

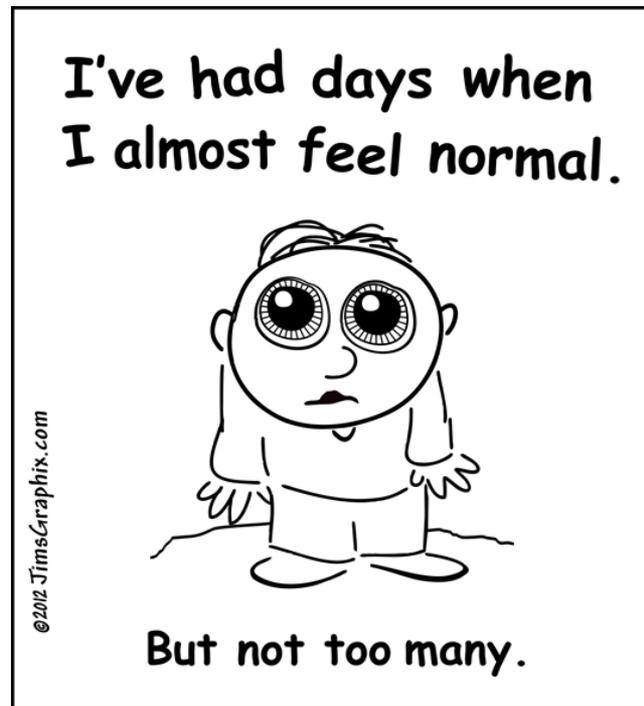
- 3 - Optimal -using full range of motion and proper movement.
- 2 - Acceptable - doesn't look pretty, but can do it.
- 1 - Dysfunctional - measurable limitations in mobility and motor control not complicated by pain.
- 0 - Pain - the report of pain provoked by a movement pattern.

- Researchers working with the test have suggested that scores ≤ 14 points predict individuals who are at a greater risk of injury than those with a score that is >14 points.
- More recently, Gray Cook suggests 0 and 1 are main findings.

Research on the FMS

Normal FMS Score

- The normal FMS score in healthy but untrained populations ranges from 14.14 ± 2.85 points to 15.7 ± 1.9 points. This suggests that most untrained people are slightly above the cut-off score of ≤ 14 points, which is thought to be indicative of prevalent compensation patterns and also believed to be predictive of increased risk of injury and reduced performance.



Is it Reliable?

- For a test to be usable, it needs to be reliable. Reliability describes whether a test can be repeated either by the same person at a slightly different time (intra-rater) or by different people at the same time (inter-rater) and produce the same result.
- Out of the 8 studies reporting on intra-rater reliability, 7 studies reported at least moderate reliability, while 1 study found that student raters demonstrated poor reliability. This suggests that the FMS probably displays an acceptable degree of reliability for a field test in most populations.
- McGill (2013) if a test is reliable, it is simple and by default it will reveal very little about mechanisms, nor guide expert intervention.

Predict Injury Risk?

- One of the original principles of the FMS is that it measures the prevalence of compensation patterns that are thought to be injurious. At least 18 studies have assessed whether the FMS score can predict the incidence of injury. Of these 18 studies, 11 have assessed the relative risk of individuals with an FMS score of ≤ 14 points being injured in comparison with individuals with an FMS score of > 14 points. Out of these 11 studies, 4 found that the FMS could not predict injury risk. In the remaining 7 studies, the relative risk was between 1.65 - 11.67 times, which suggests that the FMS may well differentiate between individuals who are at a greater or lesser risk of injury.

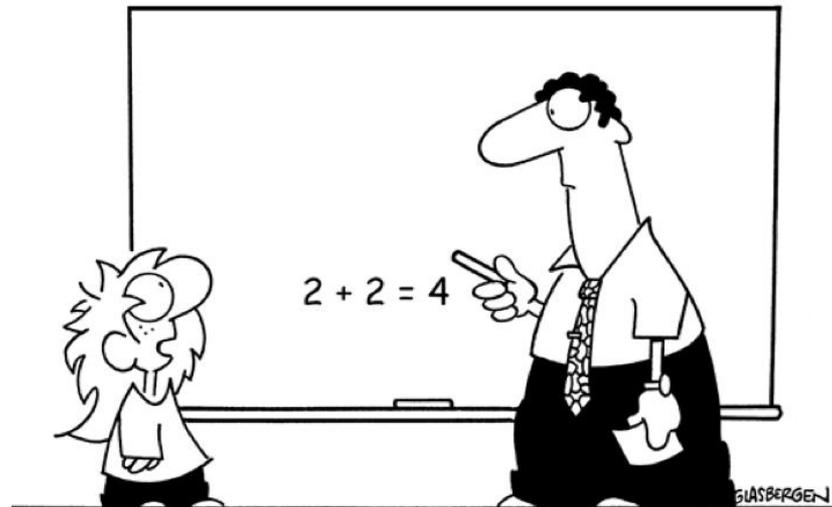
Predict Athletic Performance?

- One of the original concepts behind the FMS is that it measures the prevalence of compensation patterns that are thought to be inefficient and therefore predictive of a reduced level of performance. In the 8 trials that have assessed correlations between athletic performance and FMS sum scores, only 2 have found any correlation between athletic performance and FMS score. Both of those trials found some degree of correlation between countermovement jump performance and FMS sum score. This suggests that either the FMS does not detect detrimental compensation patterns or that the compensation patterns that it does detect are not detrimental to performance.

Research on the FMS

Is the FMS Valid?

- Validity describes whether a test actually measures solely what it is setting out to measure. In the case of the FMS, the purpose of the test is to identify compensation patterns as they are performed in sport.
- The validity of the FMS has been scrutinized by various studies.



“How can I trust your information when you’re using such outdated technology?”

Why FMS May Not Work for Swimmers

- No ground-reaction force
- Horizontal position
- Arms mainly provide propulsion
- No contact
- Tests are performed at slower speeds than swimming
- Non-swimming movements are tested



What May Work?

Injuries are Complicated!

Teams I've consulted

- Since 2011, non-traumatic injuries dropped 92%.
- Assess every swimmer every two weeks for mental, biomechanical, structural.

Components:

- Movement, power production, neural factors
- Joint, muscle nerve
- Psychosocial inventory
- Individually adjust!!!!

Implementation

- Diet, physical training, mental optimization, psychosocial assistance

Screens I've used for Swimmers

Shoulder Internal Rotation

The standing shoulder internal rotation is similar to the most common injury mechanism in swimming. You can also add some overpressure when they are in the second part of this test.



Part I

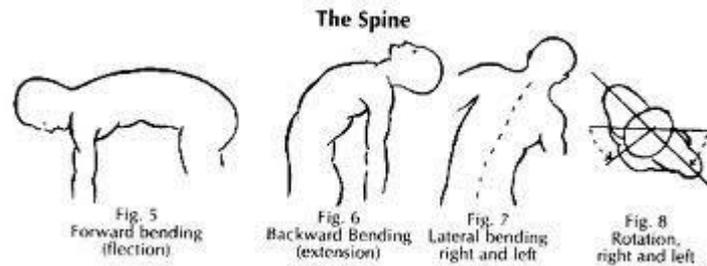


Part II

Screens I've used for Swimmers

Spinal Flexion and Extension

Simple spinal forward bending and backward bending assess are similar injury mechanisms as swimming, flip turn and dolphin kicking.



Screens I've used for Swimmers

Breaststroke Kick Test

Mimicking the breaststroke kick on land with added resistance provides similar knee stress as swimming.



Screens I've used for Swimmers

Detailed Swimming Assessment

What causes the pain is the best mechanism for screening!

Here are some of my detailed swimming assessments and helpful pieces:

- [Dr. Detective: Digging for Clues Behind Shoulder Labrum Pain](#)
- [Dr. Detective: The Case of Low-Back Pain Inflammation](#)
- [Swimmer's Shoulder Return to Swimming Program](#)
- [Breaststrokes Knee Pain Solution!](#)

Wrap-up

- The practice of screening has not kept pace with science of pain and injury.
- Screen only for specific injuries (you will need more tests)- insufficient evidence for general injury.
- Screens must incorporate the injury mechanisms
- The health of every system in the body depends on good movement. A tool for good movement is an amazing tool, if it can be created and verified.

Contact Information and Questions!

- Thanks!

If you have any questions contact me at info@trainingcor.com

*For more information, checkout www.swimmingscience.net and
www.trainingcor.com.*

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Selected References

- Kaneoka K, Shimizu K, Hangai M, Okuwaki T, Mamizuka N, Sakane M, Ochiai N. Lumbar intervertebral disk degeneration in elite competitive swimmers: a case control study. Am J Sports Med. 2007 Aug;35(8):1341-5. Epub 2007 Apr 3.
- Hangai M, Kaneoka K, Hinotsu S, Shimizu K, Okubo Y, Miyakawa S, Mukai N, Sakane M, Ochiai N. [Lumbar intervertebral disk degeneration in athletes.](#) Am J Sports Med. 2009 Jan;37(1):149-55. doi: 10.1177/0363546508323252. Epub 2008 Sep 17.
- Rovere GD, Nichols AW. [Frequency, associated factors, and treatment of breaststroker's knee in competitive swimmers.](#) Am J Sports Med. 1985 Mar-Apr;13(2):99-104.