SHARKS TAKING A BITE OUT OF ATHLETIC INJURIES

Peter A. Sprague, PT, DPT, OCS

Associate Professor

Physical Therapy Department

College of Healthcare Sciences

Nova Southeastern University

#1 RISK OF INJURY IN ATHLETIC POPULATION

- History of previous injury

- "Looking at 70 teams in 18 countries, over 8 seasons (9,000 injuries), we have found that **previous injury** is by far the greatest predictor of future injury in football (soccer)"

- "…and there's not a single thing we can do about it."

JAN EKSTRAND, MD, PHD
2009 SOCCER INDUSTRY MEDICAL SYMPOSIUM

- Br J Sports Med, 2011 - 5770 athletes s/p ACL recon
- Status at final follow-up (mean = 41.5 months)
  - 90% achieved normal ROM, strength, laxity
  - 85% normal knee function on outcome measure scales
  - 44% returned to competitive sport

Return to sport following anterior cruciate ligament reconstruction surgery: a systematic review and meta-analysis of the state of play

Clare L Ardern,[1] Kate E Webster,[1] Nicholas F Taylor,[1,2] Julian A Feller[1]

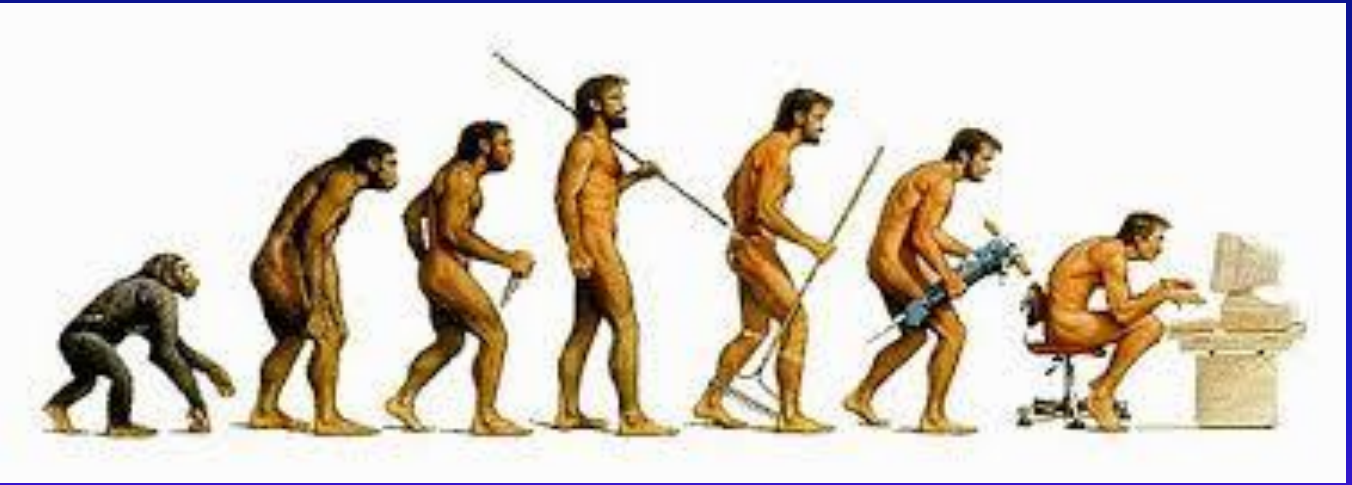
NSU SPORTS MEDICINE
INTERDISCIPLINARY TEAM


JEFFERY CROSS

WHAT CAUSES MOVEMENT DYSFUNCTION??

- Habitual movements or postures

- Lack of physical activity

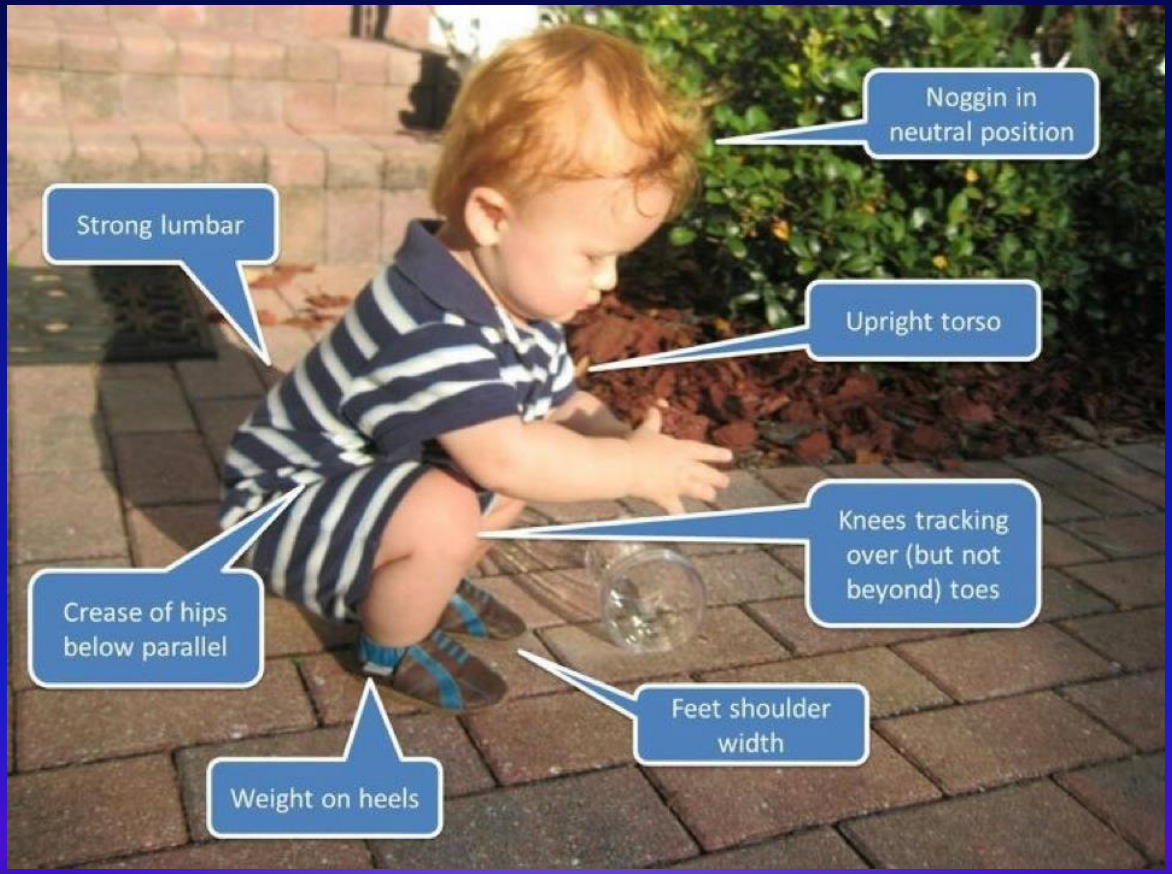


#1 RISK OF INJURY IN ATHLETIC POPULATION

- History of previous injury


JEFFERY CROSS

Functional Movement - the ability to produce and maintain a balance between mobility and stability along the kinetic chain while performing fundamental patterns with accuracy and efficiency (Mills, *Phys Ther Sport*, 2005)

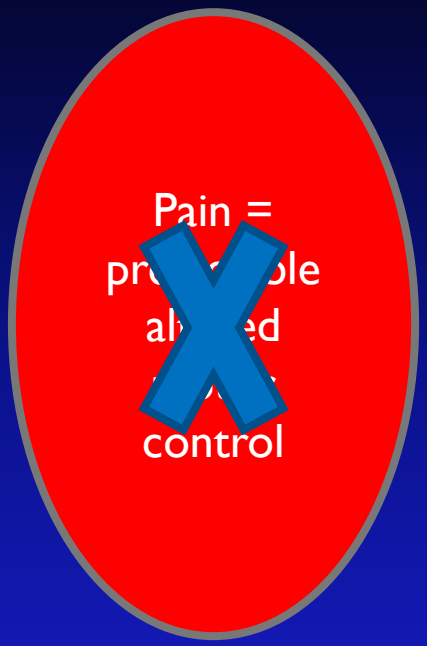

Noggin in neutral position
Strong lumbar
Upright torso
Knees tracking over (but not beyond) toes
Crease of hips below parallel
Feet shoulder width
Weight on heels

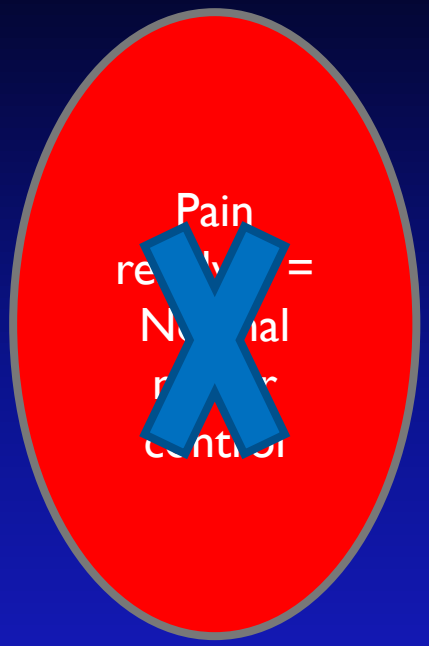
NSU SPORTS MEDICINE
INTERDISCIPLINARY TEAM

CONTEMPORARY MOTOR CONTROL THEORIES

- Many theories have been described for normal motor control

- 2 major theories emerged in regard to motor control response to pain/injury
  - Vicious cycle theory (Roland. *Clin Biomech,* 1986)
  - Pain adaptation theory (Lund. *Can J Physiol Pharm*, 1991)





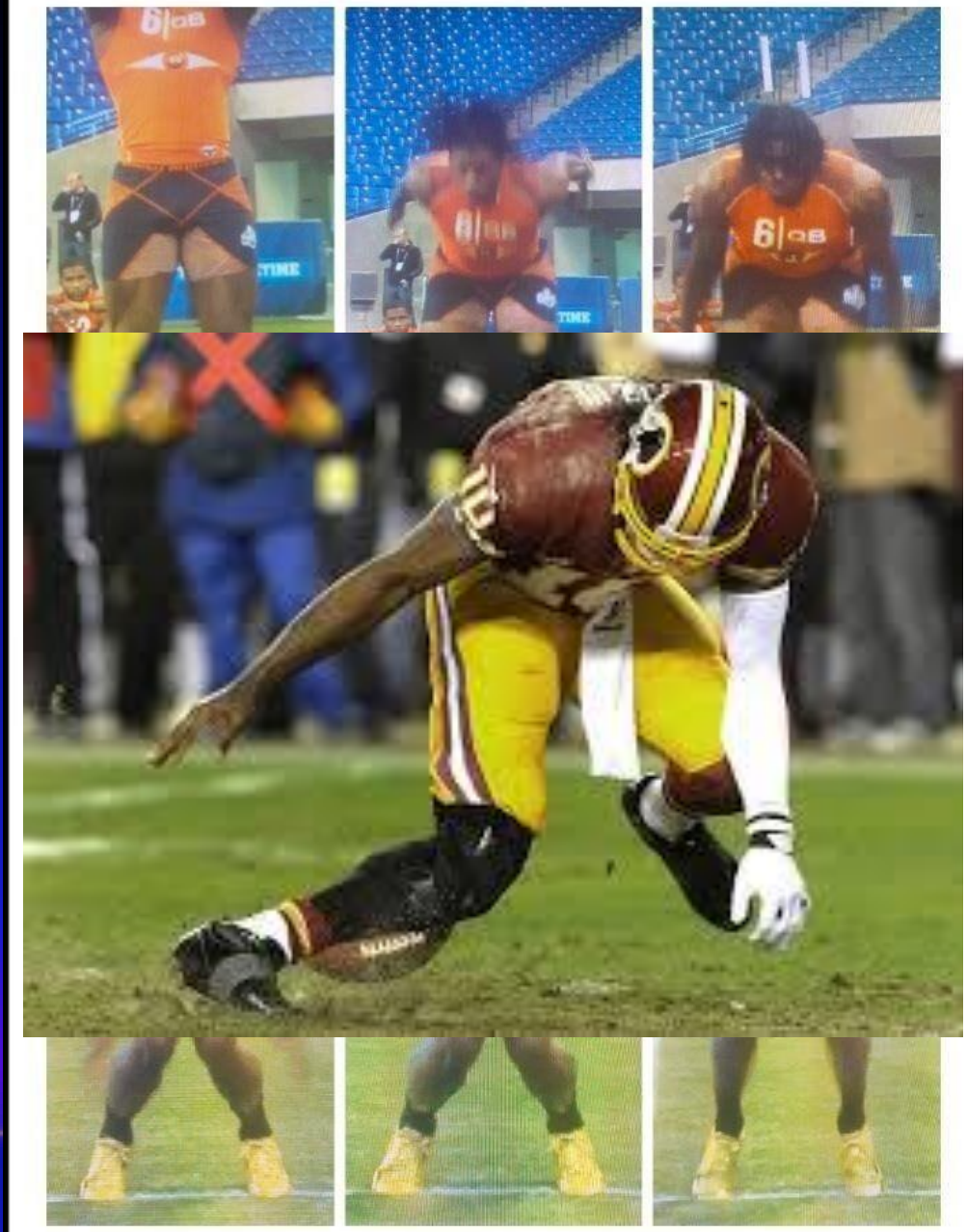
Pain = unpredictable motor impairments
Pain resolves = motor control impairments remain

ABERRANT MOVEMENT = INJURY?

- Altered neuromuscular and biomechanical patterns of movement are associated with musculoskeletal injury
    - Altered movement patterns in the LE are associated with injury
        - ACL (Hewett, 2005; Paterno 2010)

Gluteals control femoral IR and pelvic drop

Gluteals found to be inhibited in runners with PF pain (Bolga, 2011; Dolak, 2011; Nakagawa, 2012; Ramskov,2015)



NSU SPORTS MEDICINE
INTERDISCIPLINARY TEAM

IMPAIRMENTS IN FUNCTIONAL MOVEMENT IN ATHLETES

- Increase injury risk in athletes (Chorba,*Phys Ther,*2005; Kiesel, *N Am J Phys Ther,*2007; Zazulak, *Am J Sports Med, 2007;* Zazulak, *Am J Sports Med*, 2007; Powers,*J Orthop Sports Phys Ther,*2010)

- Found with recurrent low back pain (Cholewicki,*Spine,*2005)

- Increase the risk of subsequent athletic injuries (Paterno,*Am J Sports Med,*2010; Distassi,*J Orthop Phys Ther,*2013)

- Impairs athletic performance (McGill, *J Strength Cond Res,2012*)

GREENE ET AL. AM J SPORTS MED, 2001

History of Low Back Pain is Greatest Predictor of Future Low Back Injury in Athletes

- 679 NCAA division I athletes

- Altered motor responses
  - Latency in responsiveness
  - Latency in relaxation

CHOLEWICKI ET AL, SPINE, 2005

- History of low back pain – muscles activity is delayed
- Once the muscles do contract, they are delayed in relaxation

INEFFICIENT MOVEMENT

- Athletes with history of low back pain (resolved/asymptomatic) demonstrate significantly lower shuttle run times than matched controls without LBP history
  - Nadler et al, Arch Phys Med Rehab, 2002

DEFICITS IN NEUROMUSCULAR CONTROL AND CORE PROPRIOCEPTION INCREASE RISK OF CATASTROPHIC KNEE INJURY

- Zazulak et al, AM J Sports Med, 2007
- Zazulak et al, Am J Sports Med, 2007

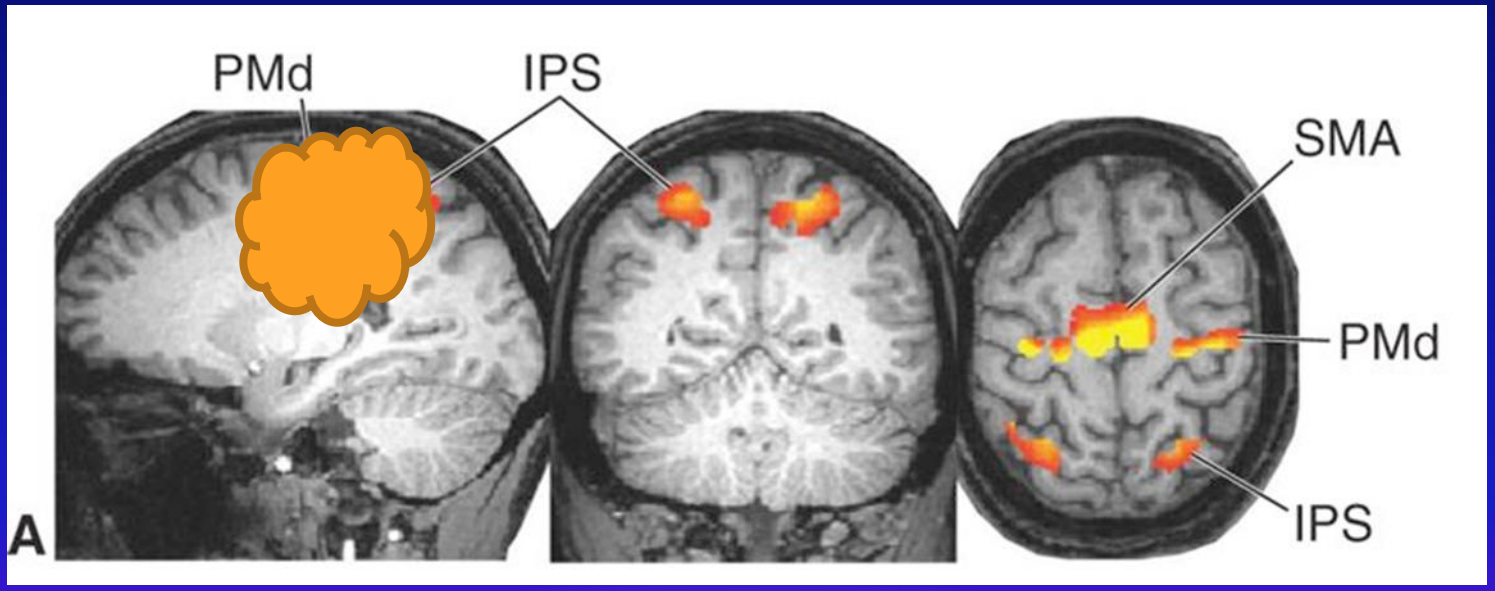
- Regional Interdependence

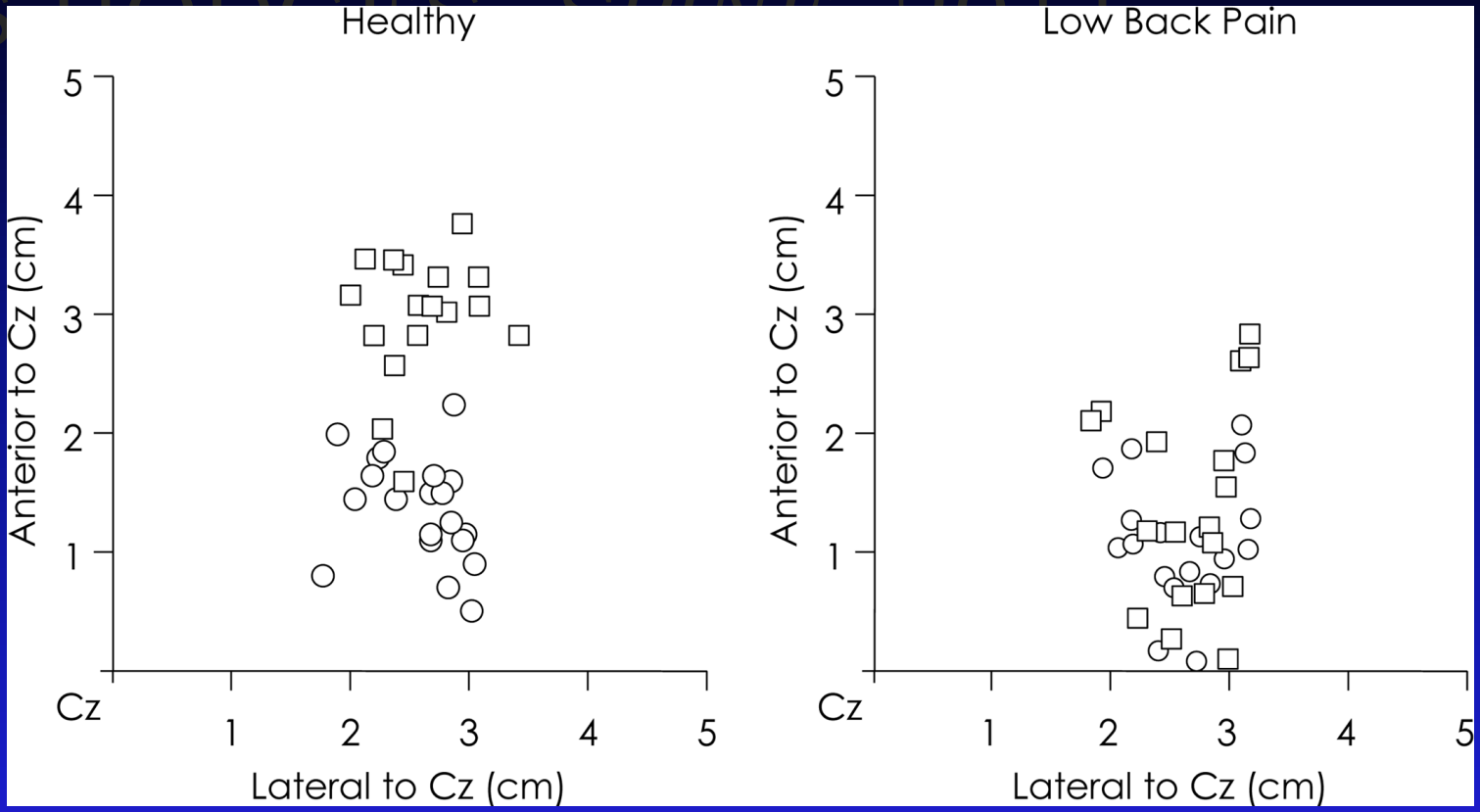
NSU SPORTS MEDICINE
INTERDISCIPLINARY TEAM

WHERE DO THESE CHANGES OCCUR???

MUSCLE ACTIVITY CHANGES IN THE PAIN POPULATION

- Central changes are observed in the pre-motor cortex in the pain population
  - Neural plastic changes





Tsao, Daneels, Hodges. *Spine*, 2011

HOW DO WE ADDRESS THESE ISSUES?

- Examine for total body movement dysfunction
- Retrain with authentic movement

MEASURING FUNCTIONAL MOVEMENT

- Functional Movement Screen – screening tool for musculoskeletal system
- 7 functional movement patterns

FMS SCORING

- Ordinal Scale Scoring
  - 0-3
  - 0 – unable to perform movement due to pain
  - 1 – unable to perform modified version of movement
  - 2 – performs modified version of movement
  - 3 – performs movement without dysfunction
- Composite total is 21
- http://graycookmovement.com/?p=51

FUNCTIONAL MOVEMENT SCREEN

- Reliable across formally trained raters (Minick, 2010; Butler, 2011: Frohm, 2011; Schneiders 2011, Teyhan 2012) and untrained raters (Teyhan,2012)

- Predicts injury in composite scores $\leq$ 14 in the following populations:
  - Firefighters (Butler, 2012)
  - NFL Players (Kiesel, 2007)
  - Collegiate Athletes (Chorba, 2007)
  - Marines (O'Conner, 2011)

- Specificity 0.71-0.94, Sensitivity 0.12-0.58

FACTOR ANALYSIS OF FMS COMPOSITE SCORE

- Low Cronbach alpha score (0.39)

LIKELIHOOD OF INJURY INCREASES WITH FMS TEST *ASYMMETRY* IN NFL PLAYERS AND COLLEGE ATHLETES (KIESEL, 2013, MOKHA 2016, 2017)

Predicting Musculoskeletal Injury in National Collegiate Athletic Association Division II Athletes From Asymmetries and Individual-Test Versus Composite Functional Movement Screen Scores

Monique Mokha, PhD, ATC, CSCS*; Peter A. Sprague, DPT, PT, OCS†; Dustin R. Gatens, MS, ATC‡

Departments of *Health and Human Performance, †Physical Therapy, and ‡Athletics, Nova Southeastern University, Davie, FL

Figure 1. Improvements in the Deep Squat Test

Score of One Deep Squat

Score of Two Deep Squat

APPLYING THIS TO PRACTICE

MOKHA, SPRAGUE, GATENS, RODRIGUEZ, *INT J ATH THER TRAIN, 2015*

MOKHA, SPRAGUE, GATENS, ISBS, 2016.

- Effects of Functional Pattern Training on Hip and Knee Mechanics in Healthy Runners
  - 26 subjects, running mileage > 20 miles per week
  - Running gait analysis
  - Functional Movement Screen Assessed
  - Corrective exercises prescribed based upon movement screen results
- **RESULTS:** FMS scores improved (PRE 12.8±1.1; POST 16.0±1.4, $t(8)=-6.183$, $p<.001$). Peak HIR (PRE 25.9±13.1^0; POST 15.3±6.4^0) and KVAL (PRE 18.7±6.2^0; POST 7.8±10.7^0) decreased, $p>.05$. Peak HADD stayed stable (+0.7^0), $p>.05$. **CONCLUSION:** 6 weeks of functional pattern training significantly improves FMS scores and reduces faulty running biomechanics such as excessive HIR and KVAL. Correcting limited and asymmetrical functional movement patterns appears to positively change higher level movement patterns such as running.

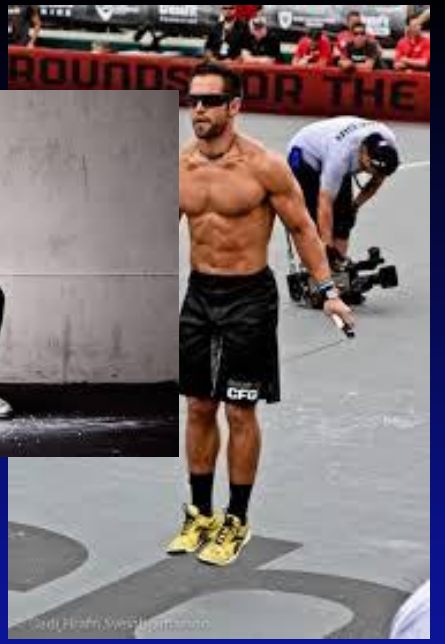
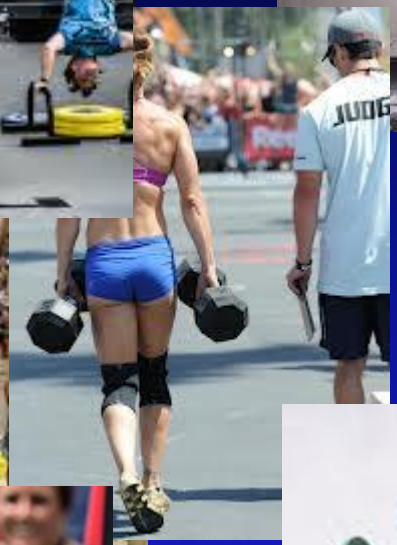
NSU SPORTS MEDICINE
INTERPROFESSIONSAL TEAM NSU
PHYSICAL THERAPY GO SHARKS!

BIOMECHANICS OF PERFORMANCE AND INJURY IN COLLEGIATE RUNNERS

NSU SPORTS MEDICINE INTERPROFESSIONSAL TEAM NSU PHYSICAL THERAPY GO SHARKS!

CHAOS THEORY




NSU COLLEGE OF OSTEOPATHIC MEDICINE

MULTIPLE VARIABLES

- Biopsychosocial variables
- Movement related variables
- Cognitive processes
- Body composition
- Injury history

- **ACSM, 2017**
- **Predicting Musculoskeletal Injuries from Psychological, Neurocognitive and Physical Factors in Collegiate Athletes Without Injury History**
  Monique Mokha, Peter Sprague, Dustin Gatens, Steve Orris, Steve Russo
  Nova Southeastern University, Davie-Ft. Lauderdale, FL, USA

- Musculoskeletal injury (MSI) risk in athletes is thought to be multifactorial in nature and to include psychological, neurocognitive and physical sources. However, most researchers lack the time and resources to assess these multiple factors in large groups of athletes. Examining multiple factors at once may yield improved injury prediction. **PURPOSE:** To determine if body fat percentage (high or low BF%), ImPACT reaction time (RT in sec), ImPACT visual motor speed (VMS in sec), Functional Movement Screen (FMS) scores, Beck's depression indices (BDI), and/or Beck's anxiety indices (BAI) could predict MSI in athletes without MSI history. **METHODS:** Seventy-one [(males, n=35; age, 19.9±1.5 yrs; height, 1.77±0.08m; mass, 73.2±14.6kg) (females, n=36; age, 19.1±1.1 yrs; height, 1.68±0.06m; mass, 70.1±9.4kg)] NCAA Division II athletes without MSI history participated in this prospective cohort study. Data were collected during pre-participation examinations as part of standard protocol. Injuries were tracked for an academic year by each team's certified athletic trainer via computer software. Pearson Chi-square analyses were used to determine if MSI could be predicted by BF%, RT, VMS, BDI, BAI, presence of a "1" on the FMS, or presence of an asymmetry on the FMS, $p \leq .05$. BF% was dichotomized as high or low for males (>15%) and females (>25%). **RESULTS:** Twenty-seven subjects (38.0%) sustained a total of 54 MSI. Two of the 7 independent variables were statistically significant predictors of MSI. Athletes with asymmetry on any of the FMS tests ($\chi^2=12.299$, $p<.001$) or high BF% ($\chi^2=5.820$, $p<.015$) were more likely to sustain a MSI. The relative risks for an FMS asymmetry and high BF% were 1.89 (CI: 1.22-2.94, $p=.001$) and 1.99 (1.06-3.75, $p=.015$), respectively. **CONCLUSION:** Athletes without a history of MSI may be at risk of MSI if they have high BF% or an asymmetry on any of the FMS tests. The neurocognitive and psychological test components may not yield significant injury prediction value in this group. Since BF% and FMS scores are modifiable risk factors clinicians may justify their assessment during pre-participation examinations.

BROWARD SHERIFF'S OFFICE

- "Looking at 70 teams in 18 countries, over 8 seasons (9,000 injuries), we have found that **previous injury** is by far the greatest predictor of future injury in football (soccer)"

a lot

- "…and there's ~~not a single thing~~ we can do about it."

JAN EKSTRAND, MD, PHD
2009 SOCCER INDUSTRY MEDICAL SYMPOSIUM


NSU