# DEVELOPING A MULTIFACETED RETURN TO PLAY PROGRAM

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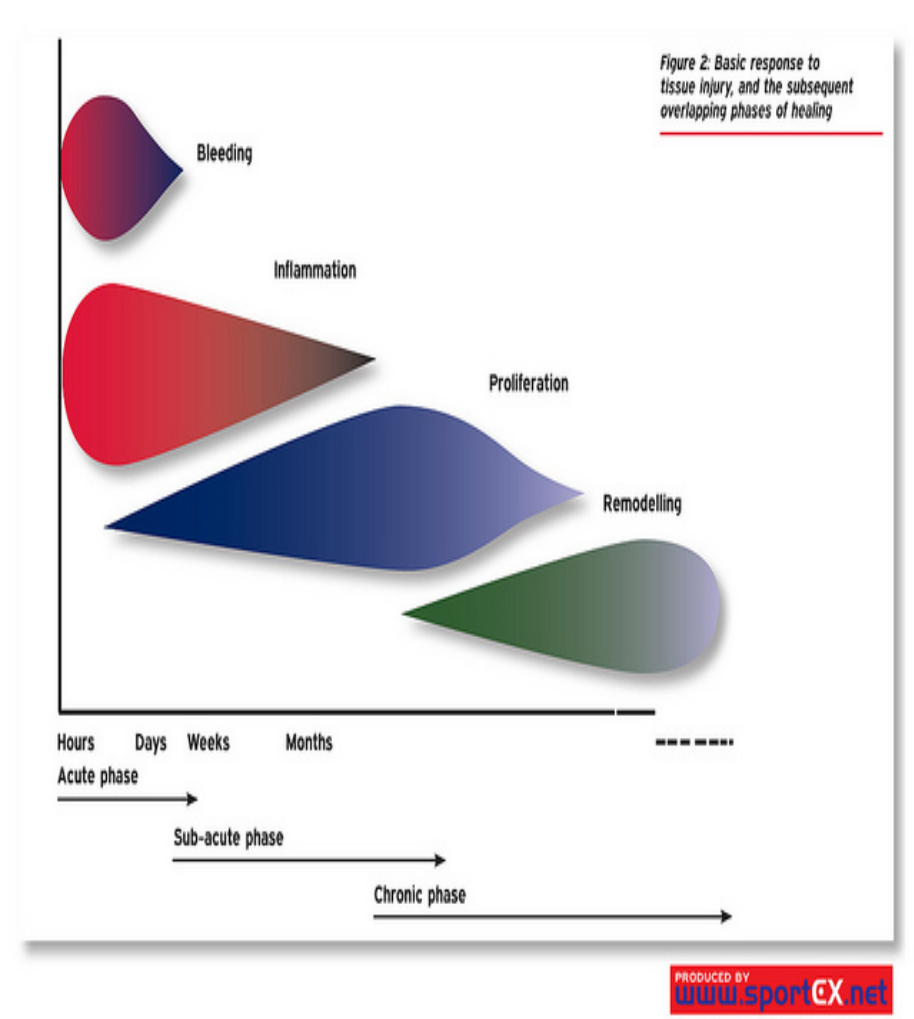
# OBJECTIVES

- Review of the tissue healing response and inflammatory process
- Rehab and Performance Training
- The Facets of Return to Play
- Planning and Monitoring
- Return to Play Testing
- Summary
- Discussion

# TISSUE HEALING

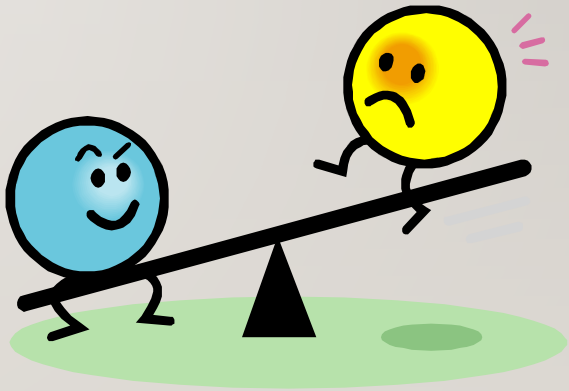
- Hemostasis (Seconds to Hours)
- Inflammation (Hours to Days)
- **Repair (Days to Weeks)**
- **Remodeling (Weeks to Months)**



# EXERTION AND ITS RESPONSE

- Neutrophilia and lymphopenia [1,2]
- Decrease in NK cell cytotoxic activity [1,3]
- Decrease in mitogen induced lymphocyte proliferation [4]
- Decrease in DTH response [5]
- Increase in pro- and anti-inflammatory cytokines (IL-6 and IL-1ra)[6,7]
- Decrease in granulocyte oxidative burst activity[8]

Inflammatory cytokines help regulate a rapid migration of neutrophils, and then later monocytes into areas of injured muscle cells and other metabolically active tissues to initiate tissue repair. [1,6,7,8]



# THE IMPORTANCE OF BLOOD FLOW

- Increase the size and number of open capillaries
  - Receive more nutrients, O2, and improve cell metabolism
- Release endorphins
  - Decrease pain
- Increase circulation of lymph
  - Helps eliminate edema, wastes, and toxic debris

# REHAB AND PERFORMANCE TRAINING

- **Rehabilitation**
  - "To *restore* or bring to a condition of health or useful and constructive activity"

- **Performance**
  - "The *ability* to perform and/or the execution of an action"
- **Training**
  - "The *process* by which an athlete *prepares* for competition by exercising, practicing, etc…"

# REHAB AND PERFORMANCE TRAINING

## TRADITIONAL MODEL

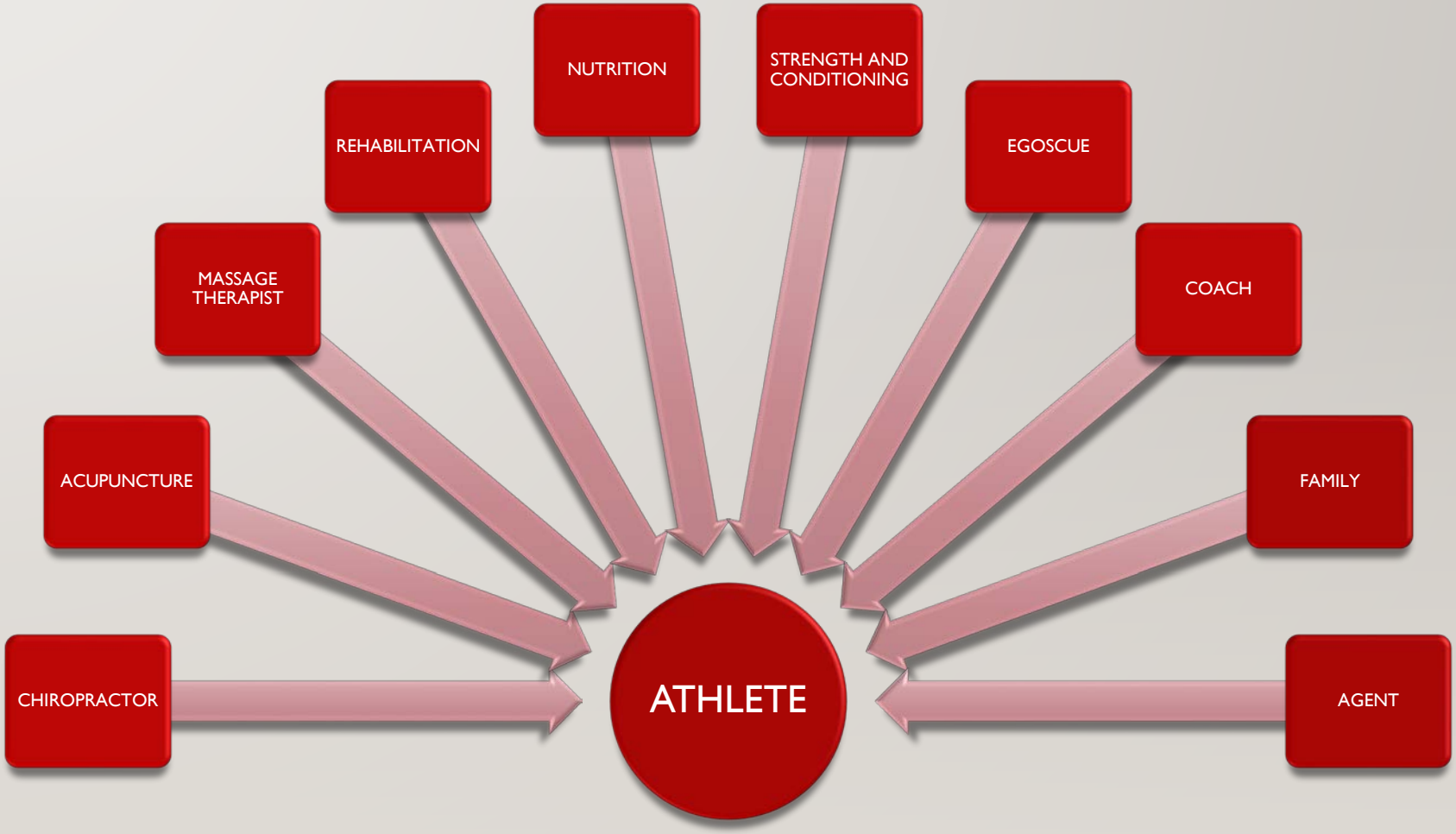
- **Rehabilitation**
  - ROM
  - Strengthening (30% 1RM)
  - Gait mechanics
  - Single plane movements
- **Performance**
  - Strengthening (70% 1RM)
  - Multi-joint/plane movements
  - Dynamic Movement
  - Sport Specific Movement

## NEW MODEL

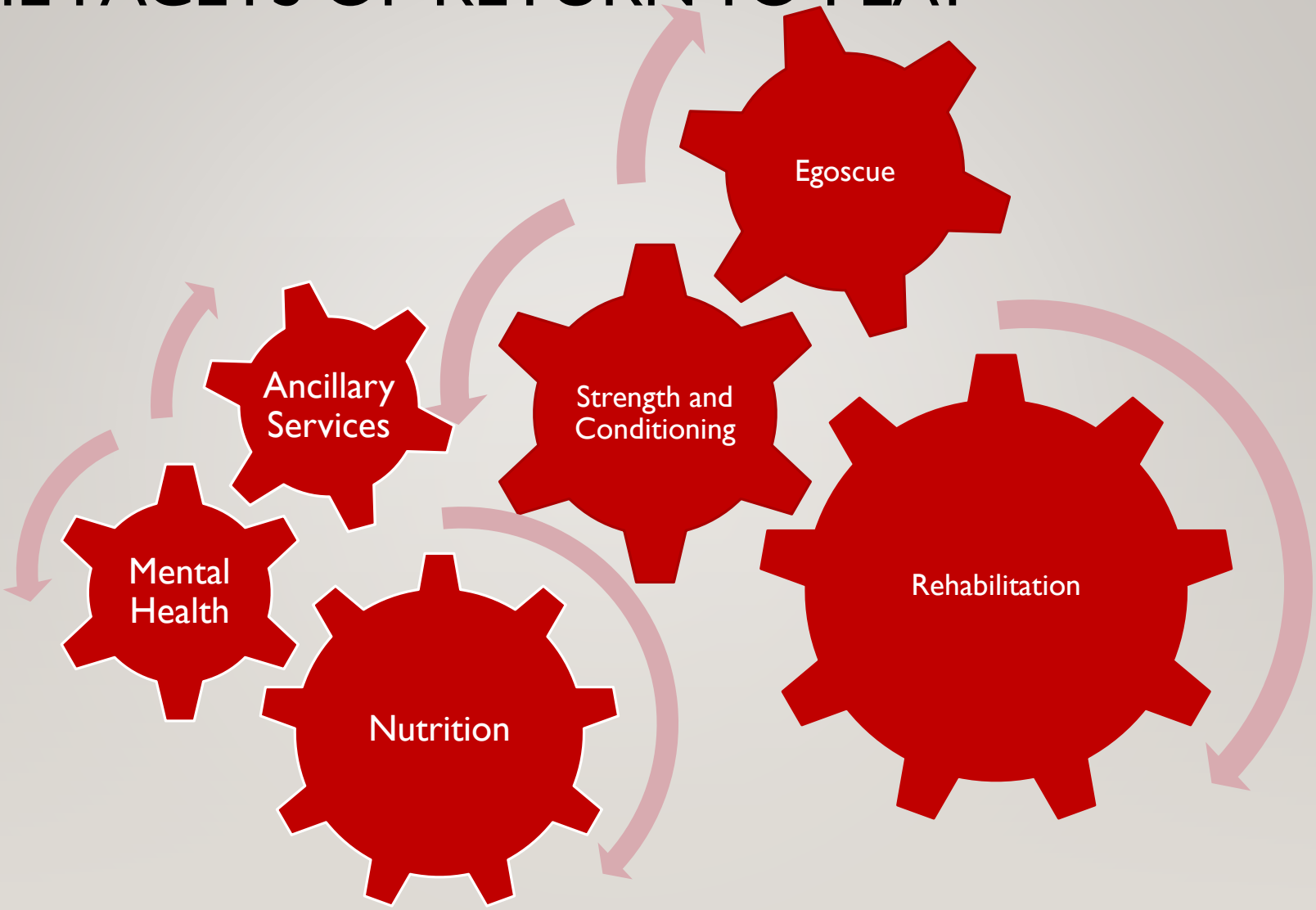
- The *process* by which an athlete *restores* proper muscle endurance and neuromuscular control, premorbid health, as well as the *ability* to perform sport specific movements in preparation for returning to athletic competition.

So you are saying that IT'S THE SAME THING, JUST A DIFFERENT INTENSITY?!?!

# THE FACETS OF RETURN TO PLAY



# THE FACETS OF RETURN TO PLAY



# INJURIES HAPPEN

## Case example

- 22 y/o Defensive back with ACL Rupture during second week of training camp

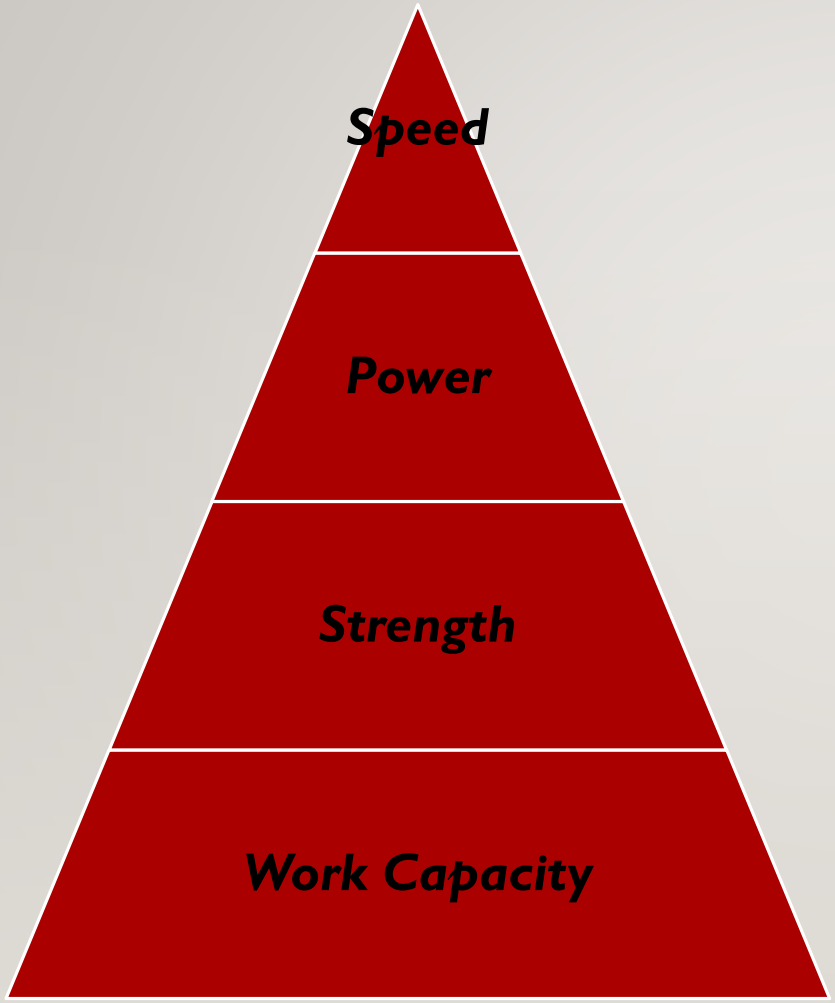
## What Next?


Where do we begin?

# INJURIES HAPPEN

- Immediate post surgery
  - Mitigate swelling, initiate ROM, restore quad function
- Week 2 and beyond
  - ROM, neuromuscular re-education, strength, gait, pillar strength, proprioception, UE strength, conditioning, movement patterns

# BUILDING A STRONG FOUNDATION



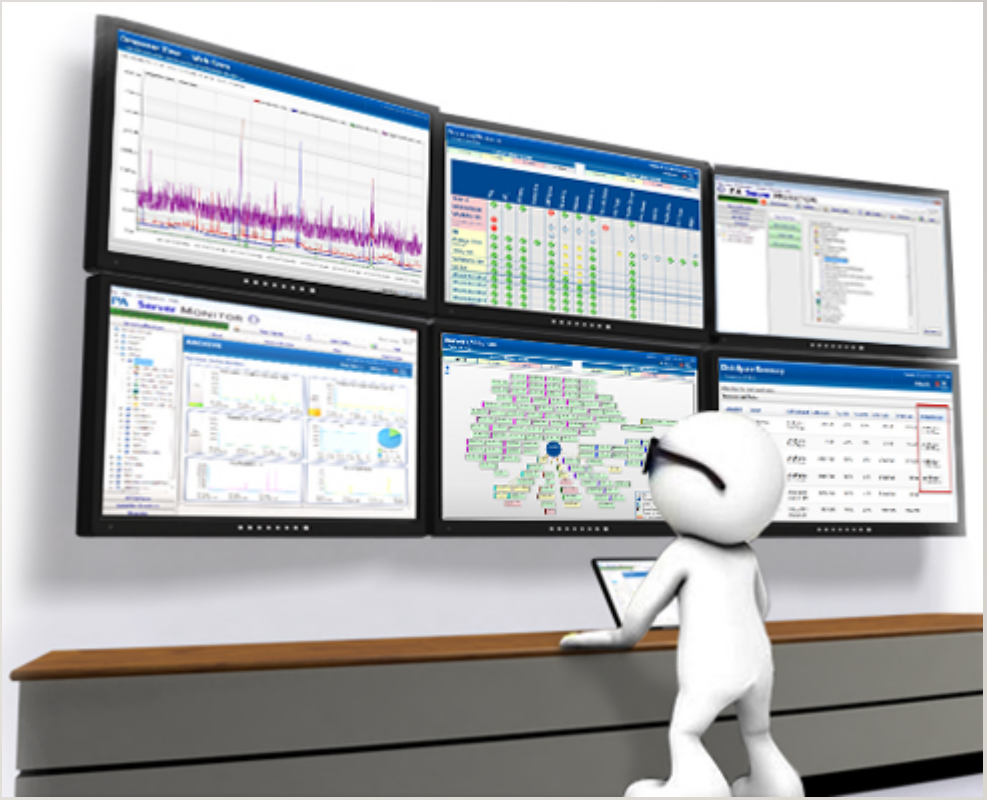

- Vermeil's Hierarchy of Athletic Development
  - Speed
    - Acceleration
    - Absolute Speed
  - Power
    - Plyometrics
    - Explosive Lifts
  - Strength
    - Total Body Strength
    - Lower Extremity Strength
  - Work Capacity
    - Mitigate edema
    - Restore ROM
    - Restore quadriceps function
    - Restore Postural Alignment
    - Modify Nutritional Program
    - Joint Mobility
    - Tissue pliability

# THINGS TO CONSIDER

- Time of the season
  - Is the athlete returning before the season ends?
- Rehabilitation
  - Key time frames during progression (when to get in pool, when to run)
- Strength and conditioning
  - When and what do you implement?
- Nutrition
  - What is the current body composition?
  - What changes need to be made to meal plan?
- Player level
  - ****PREVIOUS INJURY****
  - Developmental vs. veteran
- Mental
  - Outside factors (contract status, family situation)
  - **What does the athlete want and what are their expectations?**

# THINGS TO CONSIDER

- What to monitor
  - **Girth**
  - **Postural Alignment**
  - **Range of Motion**
  - **Strength**
  - **Body Composition**
  - **Mental Fatigue**



# THINGS TO CONSIDER

- Communication between team is essential
  - Preach the same message, same goals
  - Reinforce how each facet is assisting each other
  - Avoid overlapping interventions
  - Avoid tissue and joint overload
    - Coordinate volume and intensity with other facets
  - Mitigate mental fatigue

**Player:** **DOS:**
**Dx:** R Knee ACL Recon w/ Hamstring Graft & Medial Meniscus Repair
**Guidelines:** ROM 0-115* Flexion x 6 weeks; Crutch assited gait w/ brace x 6 weeks; Minimize knee flexion >90*, Egoscue 15 min prior to activity and immediately post-activity.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 ARIZONA | 2 OCTOBER | 3 | 4 | 5 | 6 7w | 7 |
| OFF | PHASE 3, D1W1 | PHASE 3, D2W1 | RECOVERY DAY | PHASE 3, D3W1 | PHASE 2, D4W1 | OFF |
| May start isolated hamstring ex. | GIRTH, MMT<br>UPPER CORE LIFT<br>EGOSCUE RE-EVAL | EGOSCUE MENU | UPPER BODY CONDITIONING<br>EGOSCUE MENU | UPPER CORE LIFT<br>EGOSCUE MENU<br>WEIGH IN | UPPER BODY CONDITIONING<br>EGOSCUE MENU | EGOSCUE MENU |
| 8 INDY | 9 | 10 | 11 | 12 | 13 8w | 14 |
| OFF | PHASE 3, D1W2 | PHASE 3, D2W2 | RECOVERY DAY | PHASE 3, D3W2 | PHASE 3, D4W2 | OFF |
| Initiate Lower Body w/ S&C. Criteria to Progress: No edema, ROM 0-125*, 60% Quad Strength, normal gait | GIRTH, MMT<br>LOWER HYPERTROPHY LIFT<br>EGOSCUE RE-EVAL | UPPER CORE LIFT<br>EGOSCUE MENU | STRETCH TO WIN, CRYO<br>EGOSCUE MENU | LOWER AUXILIARY LIFT<br>EGOSCUE MENU<br>WEIGH IN | UPPER AUXILIARY LIFT<br>EGOSCUE MENU | EGOSCUE MENU |
| 15 WASHINGTON | 16 | 17 | 18 | 19 | 20 9w | 21 |
| OFF | PHASE 4, D1W1 | PHASE 4, D2W1 | RECOVERY DAY | PHASE 4, D3W2 | PHASE 4, D4W2 | OFF |
| Initiate HydroWorx Mvmt Sessions | GIRTH, MMT<br>LOWER HYPERTROPHY LIFT<br>EGOSCUE RE-EVAL | UPPER CORE LIFT<br>EGOSCUE MENU | STRETCH TO WIN, CRYO<br>EGOSCUE MENU | LOWER AUXILIARY LIFT<br>EGOSCUE MENU<br>WEIGH IN | UPPER AUXILIARY LIFT<br>EGOSCUE MENU | EGOSCUE MENU |
| 22 DALLAS | 23 | 24 | 25 | 26 | 27 10w | 28 |
| OFF | PHASE 4, D1W2 | PHASE 4, D2W2 | RECOVERY DAY | PHASE 4, D3W2 | PHASE 4, D4W2 | OFF |
| | GIRTH, MMT<br>LOWER HYPERTROPHY LIFT<br>EGOSCUE RE-EVAL | UPPER CORE LIFT<br>EGOSCUE MENU | STRETCH TO WIN, CRYO<br>EGOSCUE MENU | LOWER AUXILIARY LIFT<br>EGOSCUE MENU<br>WEIGH IN | UPPER AUXILIARY LIFT<br>EGOSCUE MENU<br>BODY COMPOSITION | EGOSCUE MENU |
| 29 PHILADELPHIA | 30 | 31 | | | | |
| OFF | PHASE 5, D1W1 | PHASE 5, D2W1 | | | | |
| | GIRTH, MMT<br>LOWER HYPERTROPHY LIFT<br>EGOSCUE RE-EVAL | UPPER CORE LIFT<br>EGOSCUE MENU | | | | |

*Rehabilitation *Strength and Conditioning *Target Points *Testing *weeks post op *Egoscue *Nutrition

# STRATEGIES TO ENSURE A STRONG FOUNDATION

- Daily
  - Palpation
  - Joint mobility
  - Soft tissue mobility
  - Mental Health
- Weekly
  - Postural Evaluation
  - Girth
  - Range of Motion
  - Strength
  - Body Weight
- Monthly
  - Sparta
  - Body Composition (4-6 Weeks)

# STRATEGIES TO ENSURE A STRONG FOUNDATION

- Girth Measurement
  - Joint line, 5cm, 10cm, and 20cm above joint line
    - Monitor Inflammation
      - Joint line and 5cm above joint line
    - Quadriceps Atrophy
      - 10cm and 20cm above joint line
  - What is an acceptable difference?
    - Symmetry is the goal
    - 2.54cm or 1in at 20cm above

# STRATEGIES TO ENSURE A STRONG FOUNDATION

- Manual strength testing
  - Quadriceps strength
  - Straight leg raise
    - Lag? Or strength vs. mobility issue
  - Sidelying hip abduction
    - TFL/AG or PG dominant?
    - Lumbopelvic stability

# STRATEGIES TO ENSURE A STRONG FOUNDATION

- Prone Hip Extension
  - Hamstring/lumbar vs. Hip dominant
- Bridge
  - Double leg and single leg
    - Lumbopelvic stability
    - Hamstring/lumbar vs. Hip dominant
    - Kinesthetic awareness of hip joint
- Core/Pillar Assessment
  - TS or RS within FMS
  - May also utilize plank or reverse hyperextension hold

# TIME OF REASSESSMENT

- What are we evaluating/what is the goal?
  - RTP vs. progress assessment
    - RTP is all encompassing
      - Hop Test
    - Progress assessment
      - ROM
      - Girth
      - Y-Balance
      - FMS
      - Sparta
      - Strength

# WHEN TO RUN

- Criteria to Advance:
  - Full pain-free AROM
  - 2/3 FMS Squat
    - no lateral shift; proper hinge
  - SL Squat = 60 degrees with appropriate alignment
  - SL Max Leg Press = >70% well leg
  - Walk without limp or significant fatigue on treadmill x 15 minutes at a fast pace
  - Complete Hydroworx and Alter-G progression
  - Complete running mechanics program on land without difficulty and/or pain
  - Sparta Single Leg Landing Test

# WHEN TO RUN

- Bridge the gap
  - Perform land based techniques 2 weeks prior in a gravity minimized environment
    - Promote neuromuscular patterning
    - Progressive loading
    - Athlete confidence

# PROGRESSIVE LOADING IN SPECIFIC ACTIVITY

Monitor Volume

- Zebra
- Catapult
- Sparta
- Simple math
  - Calculate yardage
  - Total work

# FUNCTIONAL TESTING

When is my guy going to be ready?

How do you know he is ready?

Are you sure?

He looks like he could play now!

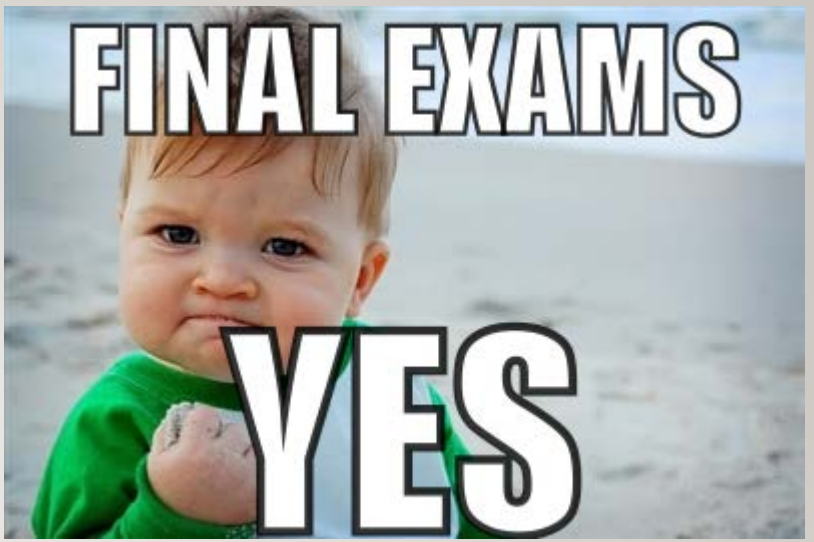
What if he plays just a little bit?

Don't worry, I will take the heat if he does not perform well.

# FUNCTIONAL TESTING

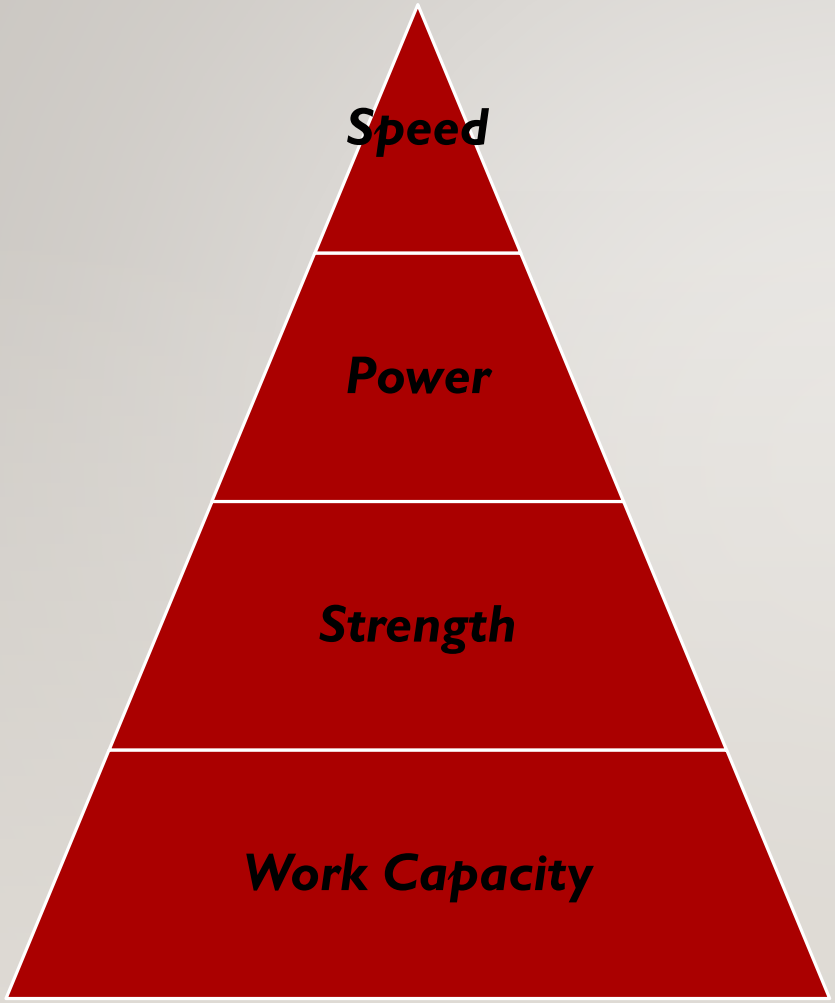
- Multitude of tests available
- Must be standardized, reliable, valid and responsive to change with time as well as be clinically relevant
- Outcome measures in clinical practice should be inexpensive, take an acceptable amount of time to administer, be convenient for clinicians to use and be acceptable to the patient.[9]
- No consensus regarding which test or combination of tests is most appropriate for evaluating recovery after ACL reconstruction.[10]
- Makes sense that a multiple tests are necessary.

# FUNCTIONAL TESTING




- Subjective
  - Questionnaire
- Movement Test
  - FMS
- Neuromuscular Control (Balance) Test
  - Y-Balance Test
- Strength Test
  - Biodex, Single Leg Press, Timed Lateral Step Down
- Dynamic Test
  - Hop Tests

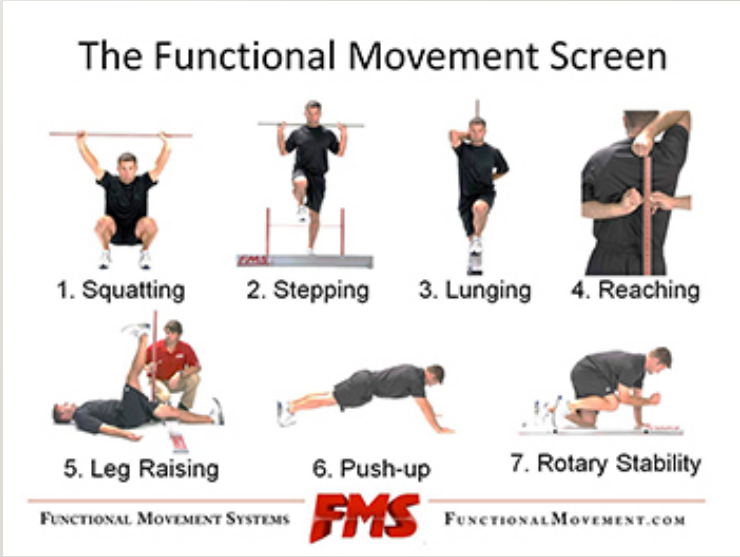
# FUNCTIONAL TESTING




- Vermeil's Hierarchy of Athletic Development
  - Same principles should apply to testing
  - Speed (Sport Specific Testing)
    - Sport Specific Testing (COD, etc..)
  - Power
    - Hop Test
  - Strength
    - Y-Balance
    - SL Leg Press or Biodex
  - Work Capacity
    - FMS
    - Y-Balance
    - Muscular Endurance
    - Joint Mobility
    - Tissue pliability

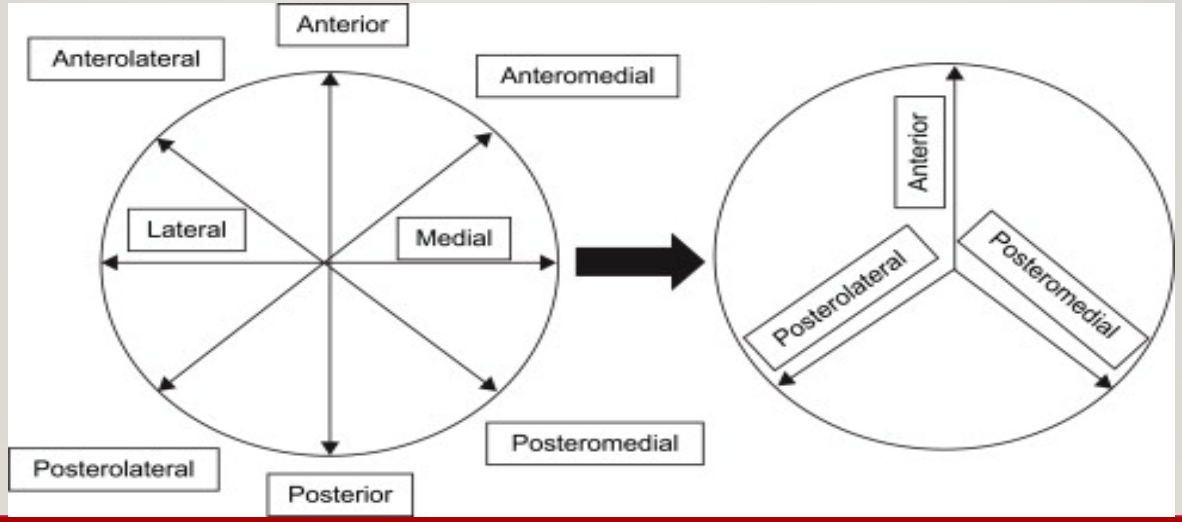
# FMS

- Instrument used to rate and rank movement.
- Looking for asymmetries between left and right side
- Corrective exercises are utilized to improve symmetry and movement patterns (part to whole approach)
- Graded on a 0-3 scale, highest score=21
  - 0 is given for any movement that is painful
  - Score of 14 or < indicates high risk of injury
  - Score of 15 or > low risk of injury



# Y-BALANCE TEST

- Based on research using Star Excursion Balance Test (SEBT) - First described by Gary Gray 1995.[11]
- 3 directions, Anterior, Posterior Medial, Posterior Lateral
- 6 Trial Reps each direction
- 3 reps each direction, must maintain balance throughout rep to count. Take longest distance
- Looking for symmetry between both sides (4 cm or less for anterior direction, 6 cm or less for posterior directions)



# STRENGTH TESTING

Isokinetic Testing

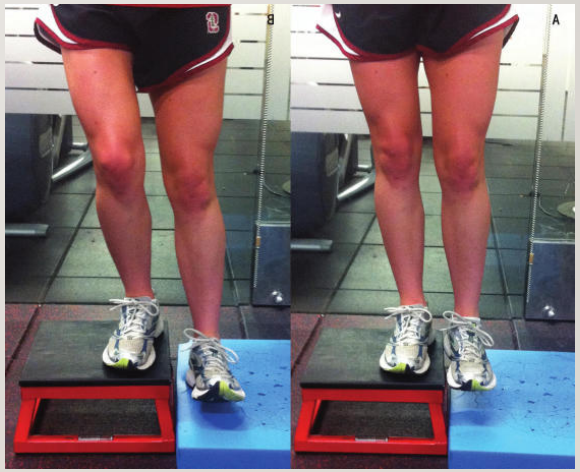
- Regarded as an objective measurement showing reproducibility in testing procedures.
- An emphasis only on isokinetic strength measurements when deciding if an athlete is physically prepared to return to sports may not be sufficient.
- Not a true test of functional performance.
- Can be challenging to get to 85% of non-injured leg secondary to other leg gaining strength as well during rehab
- Some correlation to functional testing has been reported.[10]

# STRENGTH TESTING

- SL Leg Press
  - Anecdotal evidence
  - More feasible than Biodex
  - Protocol[11,12]
    1. Instruct the athlete to warm up with a light resistance that easily allows 5 to 10 repetitions.
    2. Provide a 1-minute rest period.
    3. Estimate a warm-up load that will allow the athlete to complete three to five repetitions by adding 10 to 20 pounds (4-9 kg) or 5% to 10% for upper body exercise or 30 to 40 pounds (14-18 kg) or 10% to 20% for lower body exercise.
    4. Provide a 2-minute rest period.
    5. Estimate a conservative, near-maximal load that will allow the athlete to complete two to three repetitions by adding 10 to 20 pounds (4-9 kg) or 5% to 10% for upper body exercise or 30 to 40 pounds (14-18 kg) or 10% to 20% for lower body exercise.
    6. Provide a 2- to 4-minute rest period.
    7. Make a load increase: 10 to 20 pounds (4-9 kg) or 5% to 10% for upper body exercise or 30 to 40 pounds (14-18 kg) or 10% to 20% for lower body exercise.
    8. Instruct the athlete to attempt a 1RM.
    9. If the athlete was successful, provide a 2- to 4-minute rest period and go back to step 7.

# STRENGTH TESTING

- Timed Lateral Step Down[13]
  - Continuous single leg squats
  - Step height at 60* knee flexion
  - Metronome at 80 bpm
  - End test following 3 faulty movement patterns, athlete stops, or 180 seconds have passed



# SPARTA

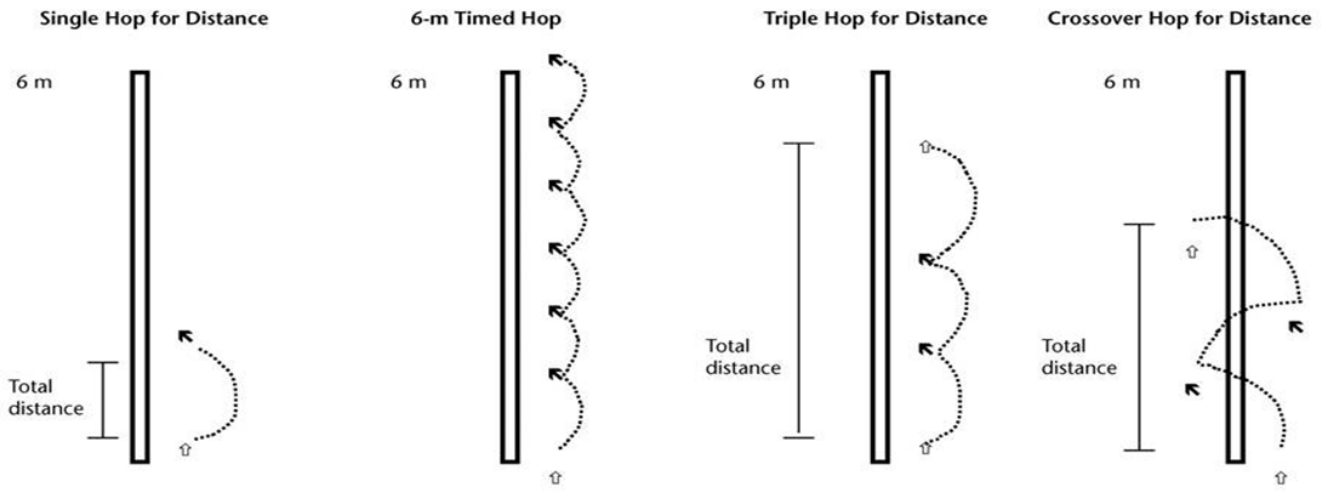
- Sparta Force Plate
  - Analyzes ground reaction forces
    - Ability to load eccentrically, contract concentrically, and finish a movement
  - Assists in providing need based training
  - Single leg landing test
    - Effective tool when determining when to run in a load compromised athlete

# HOP TEST

- Hop Testing
  - Quick and Inexpensive
  - Does not require significant equipment
  - Hop testing has been shown to have high specificity 94-97%...but low sensitivity 38-58%
    - Too many ACL deficient knees could be labeled "normal"
  - Score sensitivity increased to 82% when a combination of 4 hop tests were used. [10,14]

# HOP TEST

**Diagrammatic representation of the series of 4 hop tests: single hop for distance, 6-m timed hop, triple hop for distance, and crossover hop for distance.**




Reid A et al. PHYS THER 2007;87:337-349

Physical Therapy
Journal of the American Physical Therapy Association

# HOP TESTING

- Limb Symmetry Index (LSI)

$$\frac{\text{Mean score of Involved limb}}{\text{Mean score of Noninvolved limb}} \times 100 = \text{LSI}$$

–LSI of less than 85% considered abnormal

*Goal is 95% of contralateral side

# HOP TEST

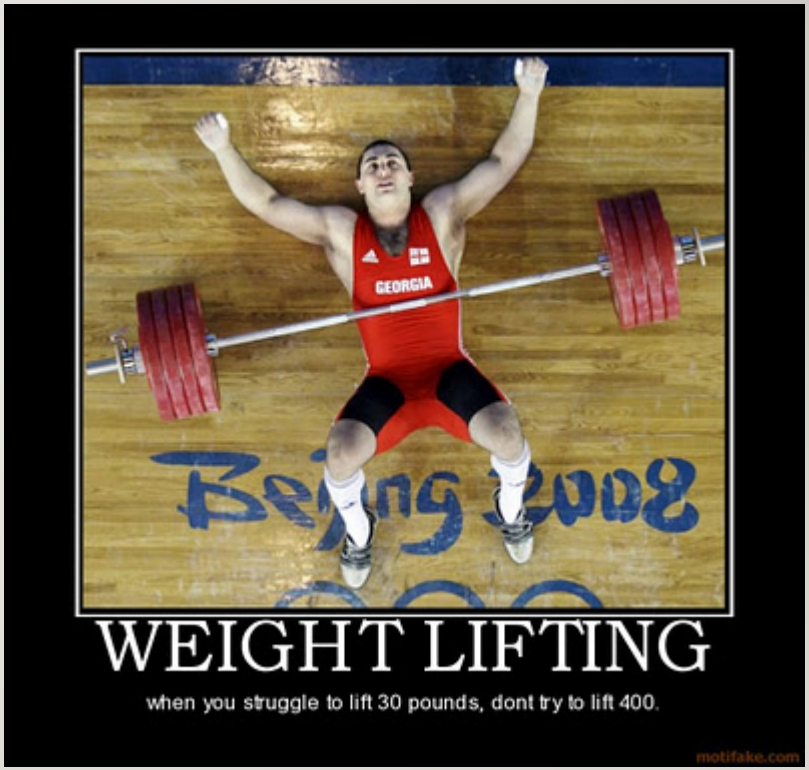
- What is a passing grade?
  - Current scoring is 85-90%
  - SO everything is good then?
    - Not yet…

# SPORT SPECIFIC TESTING

- Compare vs. baseline or pre-participation screening
  - Can the individual sprint at greater than 95% of premorbid capacity?
- Don't forget about change of direction? How to asses?
- Position specific testing
  - Ex. Defensive Back
    - Can the individual perform/cover the entire route tree and duties of his position?
      - Without fatigue or compensation?
      - With symmetrical mechanics?
      - Sufficient stability
    - Can the individual ABSORB LOAD and PRODUCE FORCE in a dynamic environment?
- **Eye Test!**

# TAKE HOME MESSAGES

- Progress as tolerated
  - Jumping from 30% to 70% does not work well.
  - Threshold and Intensity
- **Periodize** and *progress* programs, mindful of healing process
- Monitor and evaluate continuously
- Utilize reliable and reproducible testing measures
- Communicate!



# DISCUSSION

- What do you utilize for return to sport testing and/or monitoring?
- Challenges?
- Thoughts on the future?

# THANK YOU!

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