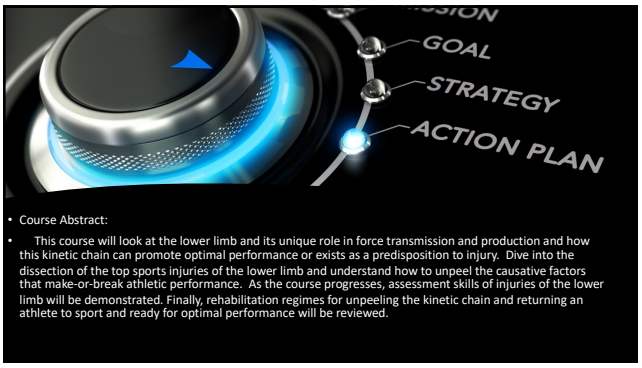
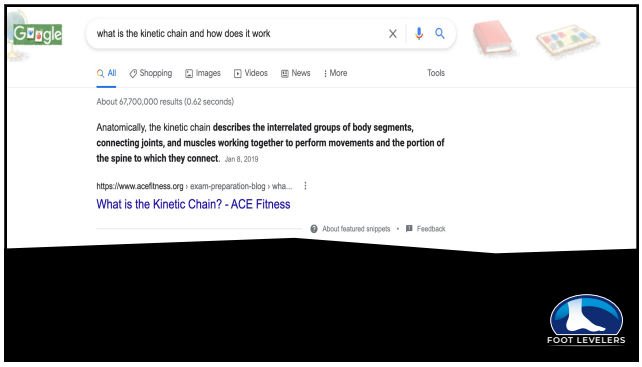

Dynamic Assessment and Care of Injuries in Sport
Christine Foss MD, DC, M.S. Ed., ATC, DACBSP, DACRB, ICSC
FOOT LEVELERS

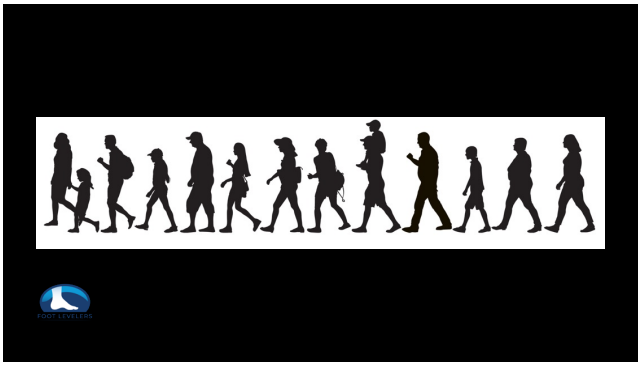
1


GOAL
STRATEGY
ACTION PLAN
• Course Abstract:
• This course will look at the lower limb and its unique role in force transmission and production and how this kinetic chain can promote optimal performance or exists as a predisposition to injury. Dive into the dissection of the top sports injuries of the lower limb and understand how to unpeel the causative factors that make-or-break athletic performance. As the course progresses, assessment skills of injuries of the lower limb will be demonstrated. Finally, rehabilitation regimes for unpeeling the kinetic chain and returning an athlete to sport and ready for optimal performance will be reviewed.

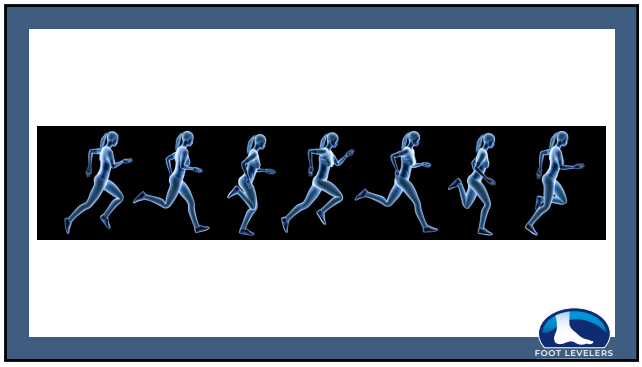
2


what is the kinetic chain and how does it work
All
Shopping
Images
Videos
News
More
Tools
About 67,700,000 results (0.62 seconds)
Anatomically, the kinetic chain describes the interrelated groups of body segments, connecting joints, and muscles working together to perform movements and the portion of the spine to which they connect. Jan 8, 2019
https://www.acefitness.org › exam-preparation-blog › wha...
What is the Kinetic Chain? - ACE Fitness
About featured snippets
Feedback
FOOT LEVELERS

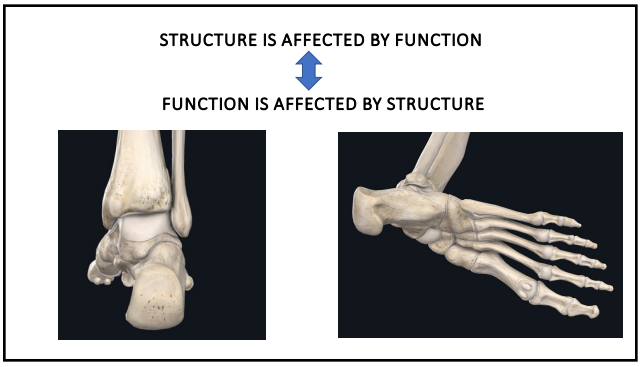
3


FOOT LEVELERS

4


FOOT LEVELERS

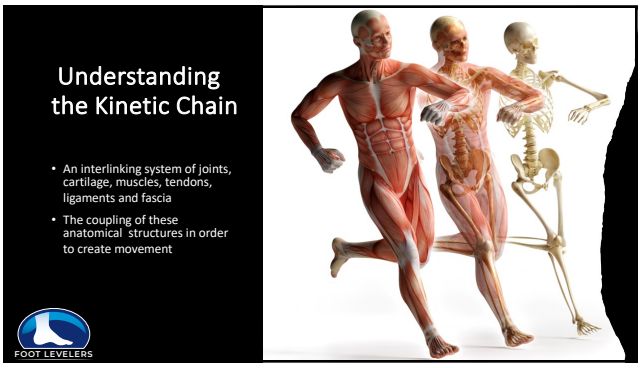
5


STRUCTURE IS AFFECTED BY FUNCTION
FUNCTION IS AFFECTED BY STRUCTURE

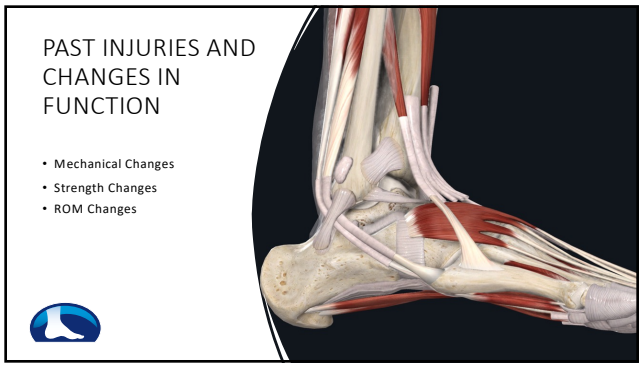
6


The Kinetic Chain
• Significance of the evaluation of the kinetic chain in the instance of sports injuries
FOOT LEVELERS

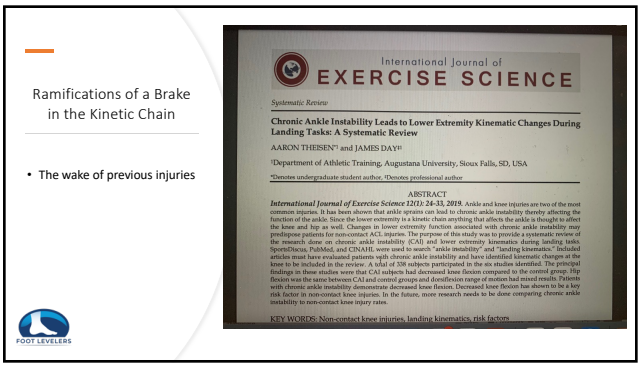
7


Understanding the Kinetic Chain
• An interlinking system of joints, cartilage, muscles, tendons, ligaments and fascia
• The coupling of these anatomical structures in order to create movement
FOOT LEVELERS

8


PAST INJURIES AND CHANGES IN FUNCTION
• Mechanical Changes
• Strength Changes
• ROM Changes

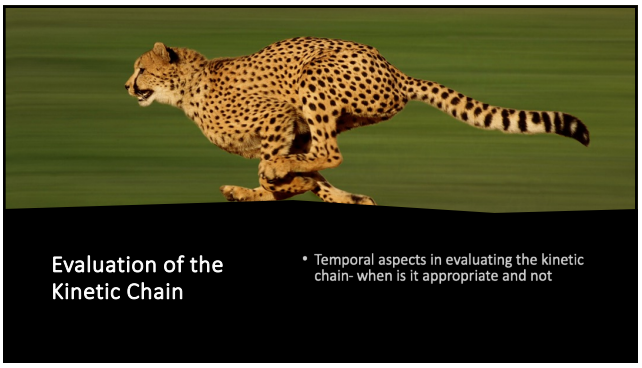
9


Ramifications of a Brake in the Kinetic Chain
• The wake of previous injuries
International Journal of
EXERCISE SCIENCE
Systematic Review
Chronic Ankle Instability Leads to Lower Extremity Kinematic Changes During Landing Tasks: A Systematic Review
AARON THEISEN and JAMES DAY
ABSTRACT
FOOT LEVELERS

10


FOOT LEVELERS

11


Evaluation of the Kinetic Chain
• Temporal aspects in evaluating the kinetic chain- when is it appropriate and not

12

ALL HUMANS ARE NOT CREATED EQUAL

- WE USE OUR BODIES DIFFERENTLY
- WE HAVE STRUCTURAL DIFFERENCES
- AMERICAN ACADEMY OF PEDIATRICS- "NORMAL "

13

Functional Anatomy

- Understanding what needs to happen for normal motion to occur.
- This could be in gait or for a particular skill or series of skills.

14

Functional and Structural Faults

15

Steps in Assessing the Kinetic Chain

- 1. AN ACCURATE DIAGNOSIS OF THE PRIMARY COMPLAINT
- 2. ASSESS THE FUNCTIONAL DEFICITS/COMPENSATIONS THAT COULD HAVE CONTRIBUTED TO THAT COMPLAINT
- 3. FIX THE PRIMARY COMPLAINT
- 4. FIX THE KINETIC CHAIN

16

Epidemiology of Hip and Groin Injuries in Collegiate Athletes in the United States

Yehuda E. Kerbel,*† MD, Christopher M. Smith,‡ MD, John P. Prodromo,† MD, Michael I. Nzeogu,† MD, and Mary K. Mulcahey,§ MD

Investigation performed at the Department of Orthopaedic Surgery, Drexel University College of Medicine, Philadelphia, Pennsylvania, USA

Background: Hip and groin pain is a common complaint among athletes. Few studies have examined the epidemiology of hip and groin injuries in collegiate athletes across multiple sports.

Purpose: To describe the rates, mechanisms, sex-based differences, and severity of hip/groin injuries across 25 collegiate sports.

Study Design: Descriptive epidemiology study.

Methods: Data from the 2009-2010 through 2013-2014 academic years were obtained from the National Collegiate Athletic Association Injury Surveillance Program (NCAA ISP). The rate of hip/groin injuries, mechanism of injury, time lost from competition, and need for surgery were calculated. Differences between sex-comparable sports were quantified using rate ratios (RRs) and injury proportion ratios (IPRs).

Results: In total, 1984 hip/groin injuries were reported, giving an overall injury rate of 53.06 per 100,000 athlete-exposures (AEs). An adductor/groin tear was the most common injury, comprising 24.5% of all injuries. The sports with the highest rates of injuries per 100,000 AEs were men's soccer (110.84), men's ice hockey (104.90), and women's ice hockey (76.88). In sex-comparable sports, men had a higher rate of injuries per 100,000 AEs compared with women (59.53 vs 42.27, respectively; RR, 1.41 [95% CI, 1.28-1.55]). The most common injury mechanisms were noncontact (48.4% of all injuries) and overuse/gradual (20.4%). In sex-comparable sports, men had a greater proportion of injuries due to player contact than women (17.0% vs 3.6%, respectively; IPR, 4.80 [95% CI, 3.10-7.42]), while women had a greater proportion of injuries due to overuse/gradual than men (29.1% vs 16.7%, respectively; IPR, 1.74 [95% CI, 1.46-2.06]). Overall, 39.3% of hip/groin injuries resulted in time lost from competition. Only 1.3% of injuries required surgery.

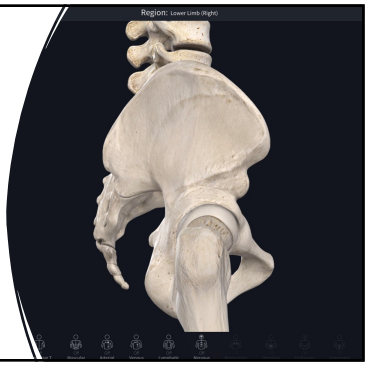
Conclusion: Hip/groin injuries are most common in sports that involve kicking or skating and sudden changes in direction and speed. Most hip/groin injuries in collegiate athletes are noncontact and do not result in time lost from competition, and few require surgery. This information can help guide treatment and prevention measures to limit such injuries in male and female collegiate athletes.

Keywords: hip/pelvis/thigh injuries; femoroacetabular impingement; groin pain; epidemiology

17

The HIP

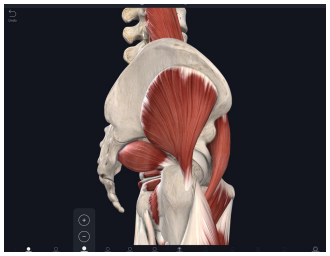
- Understanding the anatomy of the hip
- A multidirectional joint
- Muscles.



18

Layers of Muscle in the Hip

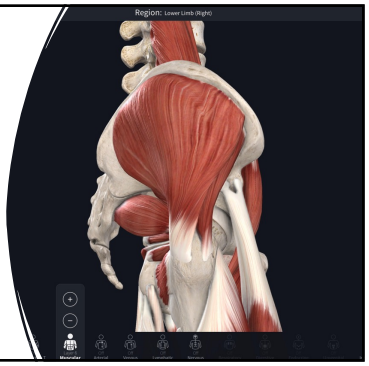
- Glute Minimus
- Function
- Injuries



19

Glute Medius

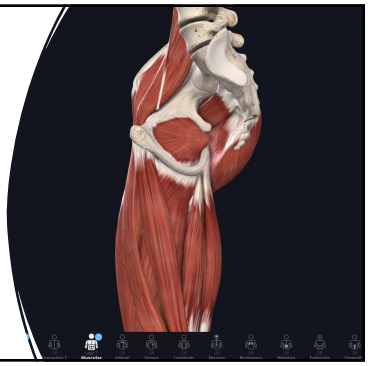
- Function
- Injuries
- SSX
- Imaging techniques



20

Adductor Complex

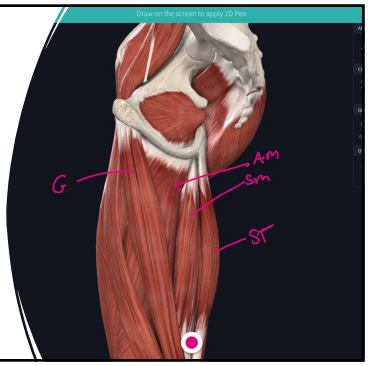
- Pectineus
- Adductor Brevis
- Adductor Longus
- Adductor Magnus
- Gracilis



21

Medial Hip

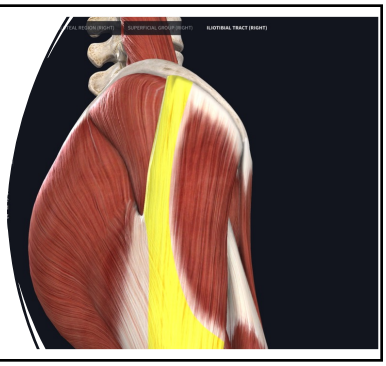
- Sartorius
- Semimembranosus
- Semitendinosus



22

The Lateral Hip

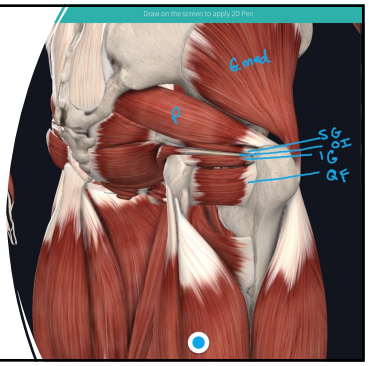
- Tensor Fascia Lata
- Glute max
- The investment of max and TFL forming the ITB, ITTract



23

The External Rotators of the Hip

- Glute med,
- Glute max
- Piriformis
- Superior Gem.
- Inferior Gem…..
- Obturator Internus
- Quadricep femoris



24

Muscular Considerations of the Kinetic Chain

Do we put them in the same orthotic?

Do they need the same orthotic on the right foot as the left?

25

Pic of pelvic obliquity

26

Corrections for performance

Individualized corrections so that pelvic obliquity can be corrected

No two feet are alike

- Heel position
- Pronation/hyperpronation/supination
- Plantar vault status

Pelvic listings are not symmetrical

Muscle activation is not symmetrical

Muscle inhibition/facilitation/strength/weakness noT symmetrical

27

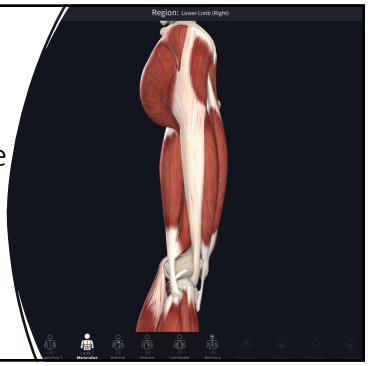
Assistance in Correcting the Kinetic Chain

- Begin the fix on day one
- Support with an individualized orthotic that is custom created for each foot and circumstance
- Support with a corrective plan that will reset the optimal function of the kinetic chain.
  - -CMT
  - -Therex
  - -Ancillary Care

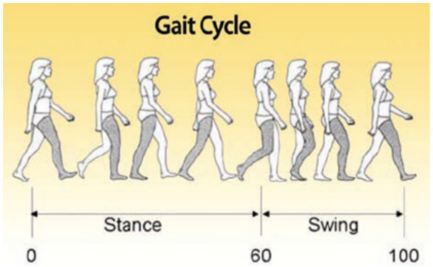
28

Begin Thinking About the Transfer of Force in the lower limb

- Understand anatomy and the functional aspect of the anatomy



29



T. Michaud
Human Locomotion

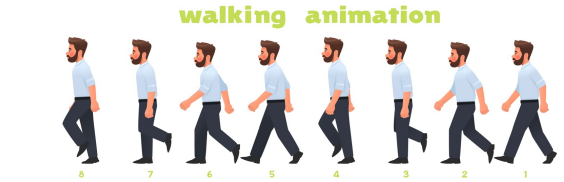
30

How to enhance performance

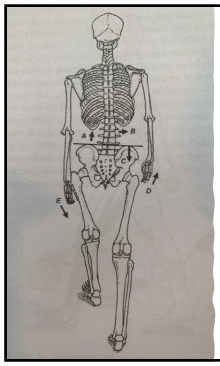
- The first step is to:
  - Correct kinetic chain faults
  - Top Down/bottom up approach is the fastest plan of attack
  - Breakout here to look at unwinding

31

5 Stages of the Stance Phase
3 Stages of the Swing Phase



32



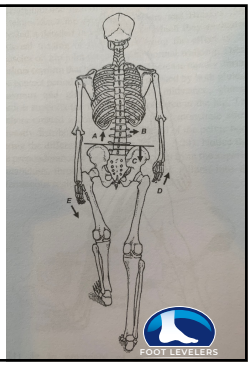
The Events of Human Motion

- Beginning with …
- T Spine rotation, lat activation, glute activation, hamstring activation…..

33

Dynamic Lumbar Motion

- Left foot strikes the ground the lumbar spine rotates 3 degrees and laterally flexes 1 degree to the right (A and B)
- Following heel strike, the contralateral pelvis drops 4 degrees (C)
- The lumbar spine flexes forward for shock absorption
- Arm swing in opposite direction of pelvis
- The upper thoracic spine rotates in the opposite direction as the lumbar spine
- The transition from right rotation of the lumbar spine to left rotation of the upper thoracic spine typically occurs at the eight thoracic vertebrae
- Shortly after heel strike, the lumbar spine reverses directions in all planes in order to dampen movement of the pelvis
- *T Michaud



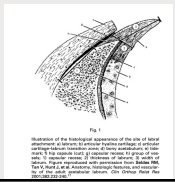
34

Bony and Biomechanical Considerations in Hip Injuries

35

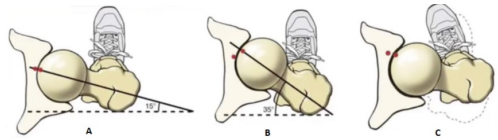
The Acetabular Labrum

- The labrum Fx
- Femoral anteversion causes hip instability and increases stress on the labrum
- Sport and labrum predisposition



36

Femoral Anteversion, Age, Structure and Function



A) Normal Femoral anteversion at skeletal maturity B) Normal femoral anteversion in preschoolers 4-6 years C) Femoral anteversion and in-toeing

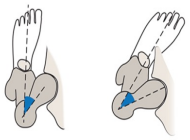
https://westernkidshealth.com/w-sitting-why-the-drama/

37

When the foot is positioned directly forward….

*Ramifications of Femoral Anteversion:

1. Overload of the anterior hip joint
2. Labrum overload
3 . Anterior hip joint capsule overload

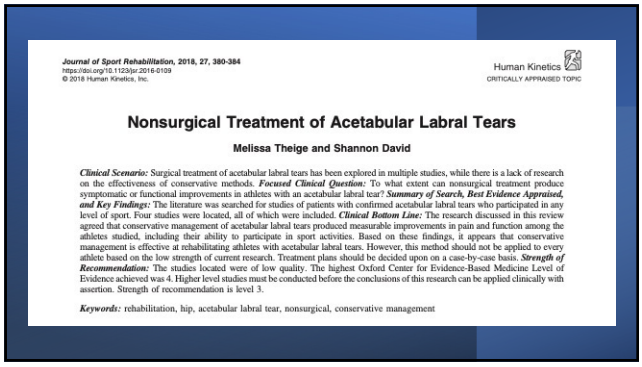


Top-view illustrations of excessive femoral anteversion

Left: Position of an anteverted femoral head with the foot facing straight forward. In this position, the femoral head subluxes out of the front of the hip joint.

Right: Most patients with excessive hip anteversion compensate by walking in-toed. This position keeps the femoral head within the socket, which minimizes pain.

38



Journal of Sport Rehabilitation, 2018, 27, 380-384
https://doi.org/10.1123/jsr.2016-0109
© 2018 Human Kinetics, Inc.

Human Kinetics
CRITICALLY APPRAISED TOPIC

Nonsurgical Treatment of Acetabular Labral Tears

Melissa Theige and Shannon David

Clinical Scenario: Surgical treatment of acetabular labral tears has been explored in multiple studies, while there is a lack of research on the effectiveness of conservative methods. ***Focused Clinical Question:*** To what extent can nonsurgical treatment produce symptomatic or functional improvements in athletes with an acetabular labral tear? ***Summary of Search, Best Evidence Appraised, and Key Findings:*** The literature was searched for studies of patients with confirmed acetabular labral tears who participated in any level of sport. Four studies were located, all of which were included. ***Clinical Bottom Line:*** The research discussed in this review agreed that conservative management of acetabular labral tears produced measurable improvements in pain and function among the athletes studied, including their ability to participate in sport activities. Based on these findings, it appears that conservative management is effective at rehabilitating athletes with acetabular labral tears. However, this method should not be applied to every athlete based on the low strength of current research. Treatment plans should be decided upon on a case-by-case basis. ***Strength of Recommendation:*** The studies located were of low quality. The highest Oxford Center for Evidence-Based Medicine Level of Evidence achieved was 4. Higher level studies must be conducted before the conclusions of this research can be applied clinically with assertion. Strength of recommendation is level 3.

Keywords: rehabilitation, hip, acetabular labral tear, nonsurgical, conservative management

39

THE QUESTION IS WHAT THEN.. WHY

40

Hip Exam

- Testing for all structures in the region
- Joint
- Cartilage
- Tendons
- Muscle
- Fascia

41

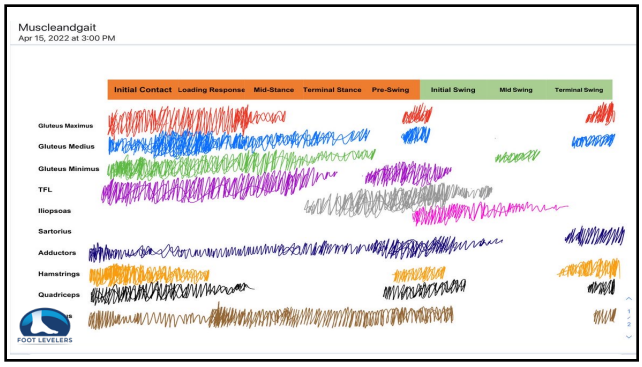
ROM of the HIP

- Flexion- 120°
- Extension- 20°
- Internal Rotation- 30°
- External Rotation- 45°
- Abduction -45°
- Adduction -20°

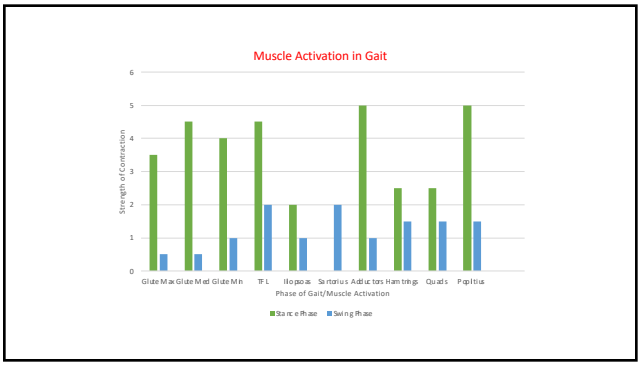
42

43

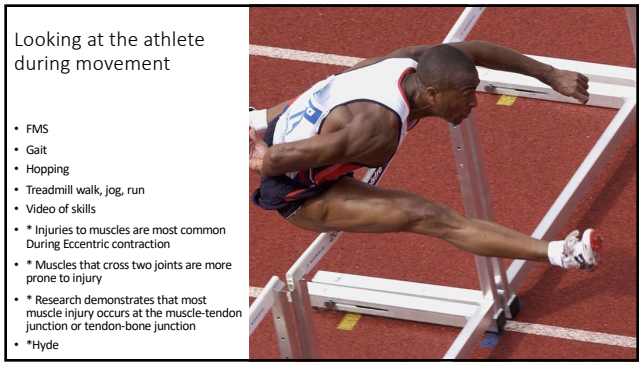
44



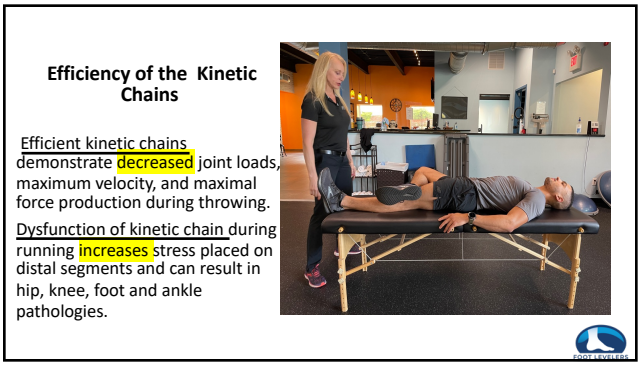
45



46



47



48

What to Fix?

- Breaks in the kinetic chain
- Structural Variants
- Functional Variants
- Muscle Weakness
- Muscle Facilitation
- How to support your work

49

The Effects of Prontion on the Kinetic Chain

Region	Saggital Plane	Frontal Plane	Transverse Plane
Lumbosacral	Extension	Lateral Flex to same side	Protraction
Mid tarsal Joints	Dorsiflexion	Inversion	Abduction
Mid tarsal Joints	Dorsiflexion	Inversion	Abduction
Mid tarsal Joints	Dorsiflexion	Inversion	Abduction

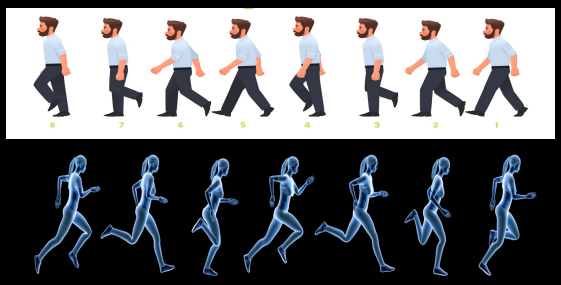
50

Demands of Running

- Increased hip flexion
- Increased knee flexion
- Increased ankle dorsiflexion

51

Cadences of Gait



52

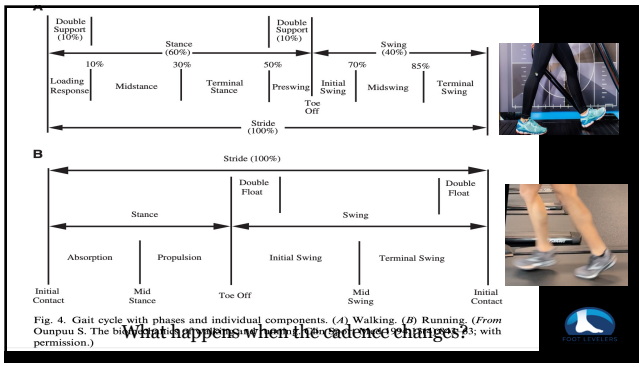


Fig. 4. Gait cycle with phases and individual components. (*A*) Walking. (*B*) Running. (*From* Ounpuu S. The biomechanics of running: a kinematic and kinetic analysis. 1993; with permission.)

What happens when the cadence changes?

53

RUNNING VS. WALKING

RUNNING PROMOTES

- Increased velocity
- Increased ground reaction forces
- Float phase
- No double stance phase
- Decreased stance phase and increased swing phase
- Overlap of swing phase rather than stance phase
- Increased ROM of all LE
- Increased Eccentric muscle contraction
- Variable initial contact
- Decreased center of gravity
- Decreased base of support

54

Alignment with Gait

- The body aligns itself to land in the optimal position
- Muscles stabilizing are in the midline with max length/tension relationships

55

Hip Motion with Walking Gait

- Hip flexion
- 30° flexion - 10° extension

56

Knee Motion with Gait

180° of extension to 138°

57

Breaks in the Kinetic Chain and Predispositions to Injury

- Meniscus
- MCL/LCD tear acute or chronic
- ACL- hx of surgery
- Arthrotide – OA, RA, etc.

58

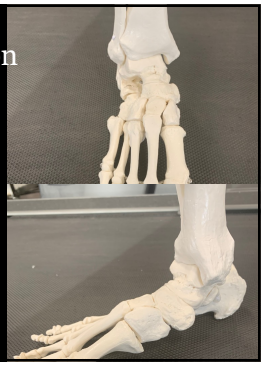
What do you see?

59

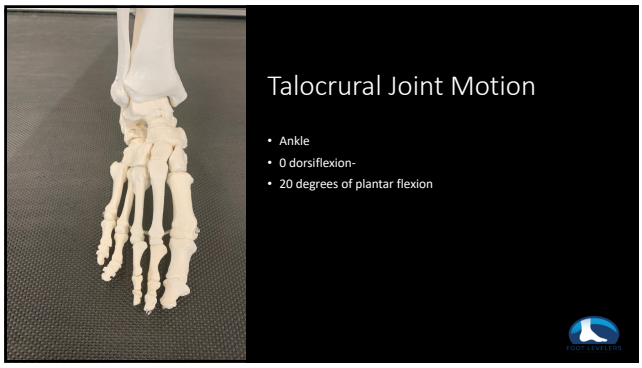
Uncorrected Hyper-Pronation

- Excessive pronation is the most common problem that is observed on running analysis.
- Hyper pronation causes increased ground reaction forces in the medial aspect of the lower limb kinetic chain, including such structures as the medial tibia.
- Increased demand on muscles causes them to work harder to control the excessive pronation, this may lead to tendonitis.
- With excessive pronation also promotes excessive internal rotation of the tibia and femur. This is a precursor to patellofemoral maltracking.

- Dugan, Sheila A., and Krishna P. Bhat. "Biomechanics and analysis of running gait." *Physical Medicine and Rehabilitation Clinics* 16.3 (2005): 603-621.



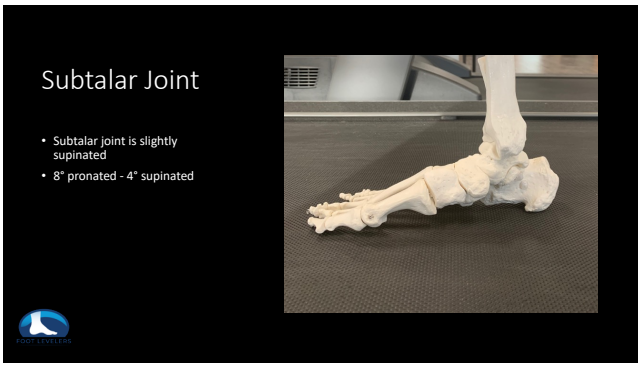
60



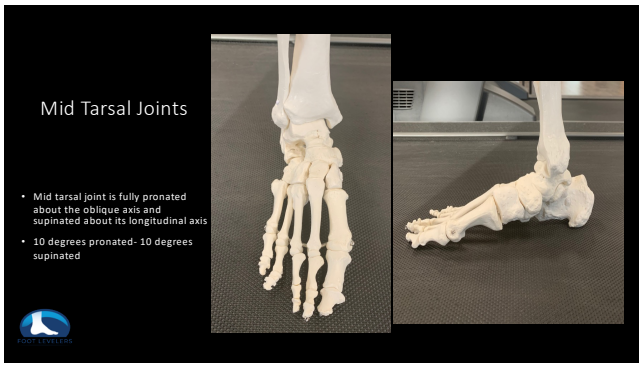
61

62

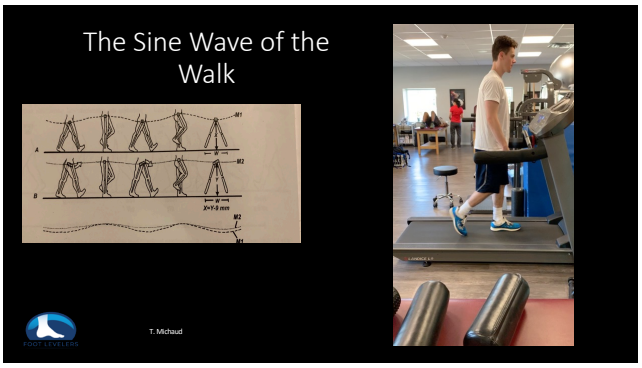
63



64



65



66

Ankle Kinetic Chain Faults

- Let's not forget about..
- -Joint dysfunction

67

Find the Fault

68

Now What?

- What happens to the gait cycle
- What happens to the kinetic chain
- What will statically happen up the chain?

69

70

Injuries to the Ankle and Foot

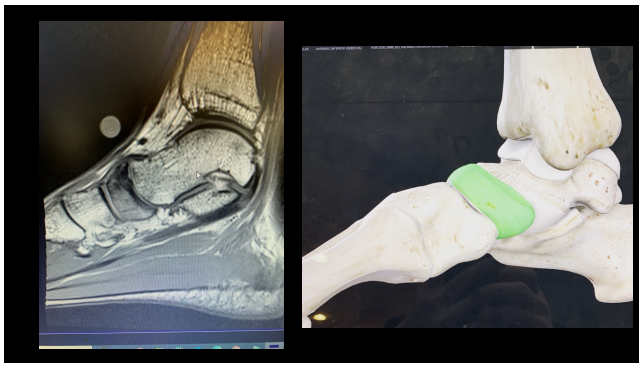
- Overuse injuries in the ankle
- Diet
- Recovery days
- Footwear
- Training load

71

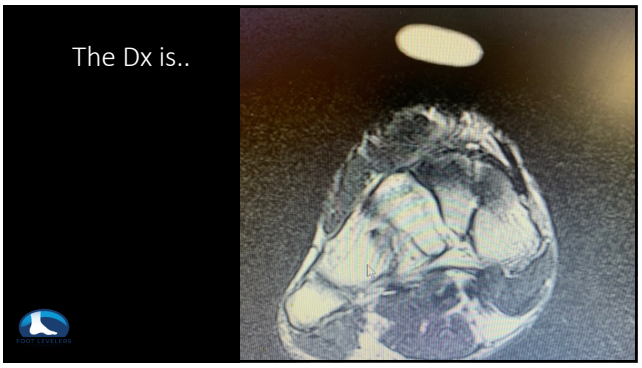
Lateral Assessment

- Stride length
- Stride quality
- ROM of joints

72



73

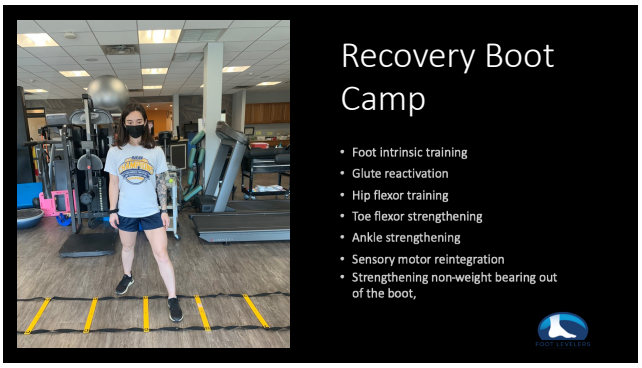


74

75

76

77



78

The "Controlled Fall" of Gait

Foot	Tibia	Talus	Foot
Dorsiflexion	Internally Rotates	Everts	Pronation
D	IR	E	P
Plantar flexion	Externally Rotates	Inverts	Supination
[illegible]	ER	I	S

79

80

The Anterior Sling

Anterior Oblique System

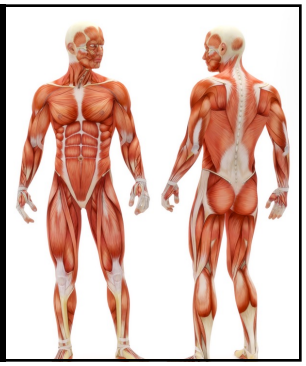
- The anterior oblique sling system includes the **external and internal oblique, opposing leg adductors complex, and hip external rotators**.
- The oblique plays a key role in mobilizing and stabilizing gait. It functions by pulling the leg through during the swing phase.
- The anterior sling system helps stabilize the pelvis and spine during acceleration, deceleration and multi-directional movements.
- The anterior oblique system contributes to rotational forces and hip flexion and stabilizes the lumbo-pelvic-hip complex.

81

The Posterior Sling

The Posterior Oblique System

- This system includes the gluteus maximus, latissimus dorsi and thoracolumbar fascia. The glute max and lat attach to the thoracolumbar fascia, which connects to the sacrum. Their fibers run perpendicular to the hip joint so when the opposite glute max and lat contract, the tension built up stabilizes that hip joint, enhancing energy transfer.
- The posterior oblique subsystem contributes to propulsion when we walk, run or sprint.
- It is also a key contributor to rotational forces such as swinging a golf club or baseball bat or throwing a ball. If there is any dysfunction in the posterior oblique subsystem, the hip joint will become unstable, leading to back pain. Someone with weak glutes and/or lats will most likely have a motor unit recruitment



82

First Day of Running Post Injury Week 10

83

Look at the Footwear that is USED for Sport AND Daily Wear

- Look at quality of the shoe
- Look at wear patterns
- Ask about orthotic use
- Ask about taping or strapping for practice
- Ask about past injuries
- Ask about pain in the feet, ankles, hips low back after practice
- Pull the Picture together and RETEST your theory

84

85

When Does the Return to Sport Plan Begin

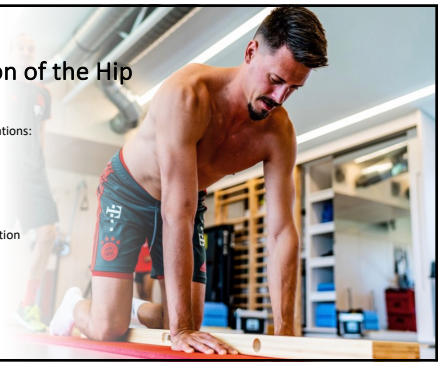
- What is your measure of readiness?
- How will you progress and return the athlete to play
- What is your timeline
- What is the level of play
- Measure injury with demand of the sport for that region

86

Rehabilitation of the Hip

Rehab Protocol Considerations:

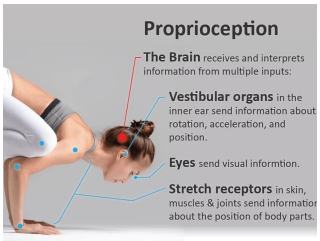
- ROM
- Joint function
- Muscular Endurance
- Strength
- Sensory Motor Integration
- Stability
- Perturbations



87

Subacute phase of care

- Muscle synergy, contraction
- Proprioception
- Continue with edema reduction
- Continue with ROM
- No progression into jog without full ROM of LE injury
- No progression of activity in return to sport without full ROM of affected region



88

Strength

- When to start strengthening
- What are the limiting factors
- When is it appropriate to progress the strengthening program

89

Ramifications of Increased Speed

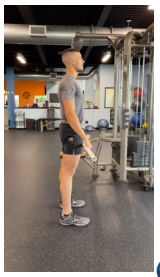
- The lower extremity joints increase their range of motion to decrease the vertical shift in center of gravity
- Therefore, faster runners require more flexibility and eccentric muscle strength than slower runners.

90

Squat Progression

- Correcting movement faults from the start of movement
- Assisted, queuing
- Non assisted
- Weighted

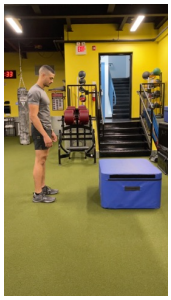
91



92

Plyometrics

- Plyometrics
- When is this added to the program
- What is the progression protocols



93

The law of reciprocal inhibition

IF A MUSCLE IS FACILITATED, THE ANTAGONISTIC MUSCLE GROUP IS MOST TIMES INHIBITED

EXPERIMENT – BICEP/TRICEP

94

Strengthening the Hip

95

OUT-TRAIING THE ATHLETE FROM SPORT

- REHAB PROTOCOLS THAT CEMENT IN A CONDITION I.E STRENGTHENING THE FACILATATED MUSCLE
- What Therex is appropriate for this athlete
- THE CONVERSION OF MUSCLE FIBER TYPE 1 TO TYPE 2

96

CONSIDER THE SPORT YOU ARE REHABILITATING

- WHAT TYPE OF MUSCLE FIBER DOES THAT ATHLETE USE
- FAST TWITCH- GYMNAST
- SLOW TWITCH – ENDURANCE ATHLETE
- WHY IS THIS IMPORTANT?

97

Correcting Movement Faults

- What is your goal
- What is your timeline
- What is the sport
- What is the overall strength status of the athlete
- Where are you in the return to play plan

98

Returning the Athlete to Play

99

MUSCLE SYNERGY RESTORATION

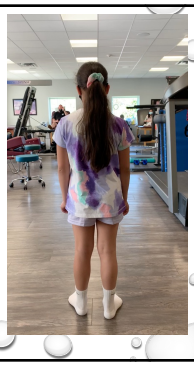
- HIP ACTIVATION
- 1. GLUTEI
- 2. TFL
- 3. QL
- YOU MAY FIND
- 1. QL
- 2. GLUTEI
- 3. TFL

100

Protocol to fix an inhibited muscle

Stretch	Stretch the facilitated MUSCLE
ACTIVATE	ACTIVATE THE INHIBITED MUSCLE AFTER THE STRETCH
HOLD OFF	HOLD OFF ON STRENGTHENING THE FACILITATED MUSCLE UNTIL YOU HAVE CORRECTED THE INHIBITION.

101



102

Return to Sport

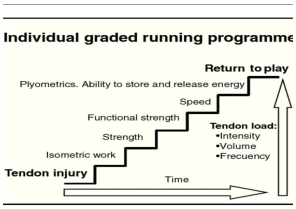
- CAN THEY WALK WITHOUT A LIMP- ok to start progression in walking therex
- CAN THEY RUN WITHOUT A LIMP- OK TO BEGIN SHORT DISTANCE RUNNING TYPE THEREX
- SPORTS SPECIFIC THEREX AS YOU INCREASE FUNCTION
- Begin with straight movements
- Proprioception
- Strength in the region and globally
- Add in time and intensity
- Continued strengthening plan

103

Introducing Sport Specific Drills

- Do this as early as you can, safely.
- Build on the foundational movement with sport specific drills
- Timing, reaction, anticipation
- Cross train to gain core control of needed movements

- Graphic from Jill Cook



104

Achieving Optimal Performance

- Looking at faults that may need correction
- Catching injuries BEFORE they happen with good screening tools
- Use preseason to strengthen, rehab and correct technique issues
- Stay ahead of breaks in patterns due to overuse, injury or dysfunction

105

106