

ICSC Ankle Evaluation & Functional Assessment

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The Ankle



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BASIC ANATOMICAL CONSIDERATIONS

- 33 JOINTS
- 26 BONES
- THREE ARCHES
- BASE OF SUPPORT IN AMBULATION
- The first contact with the ground to determine the transfer of energy through all the anatomical chains

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PAST INJURIES AND CHANGES IN FUNCTION


- Mechanical Changes
- Strength Changes
- ROM Changes

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THE FUNCTION BEGINS WITH THE STRUCTURE

- HOW MANY THINGS NEED TO HAPPEN FOR THE FOOT TO TRANSMIT FORCE UP THE CHAIN OF THE BODY TO BE FUNCTIONALLY CORRECT?
- How is that athlete using his/her foot and ankle the same and differently than normal?
- How do these changes impact performance?
- How does this effect the entire chain?

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Remember all the layers of the region

- Bone
- Ligaments
- Tendons
- Muscle
- Fascia




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What structures could potentially be injured

- Anterior Talofibular Ligament
- Calcaneofibular Ligament
- Posterior Talofibular Ligament
- Tibiofibular Ligament
- Deltoid Ligament
- Posterior Tibialis
- Extensor Tendons
- Talar Dome
- Peroneal Tendons
- Distal Tibia/Fibula
- Metatarsals
- Tarsals



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Tom, Dick and Harry Tom, Harry and Dick


- **Tendons of the Medial Ankle**
- Tibialis Posterior
- Flexor Digitorum Longus
- Flexor Hallucis Longus
- **Tendons of the Anterior Ankle**
- Tibialis Anterior
- Extensor Hallucis Longus
- Extensor Digitorum Longus

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Stability of the Ankle

- Anterior Talofibular ligament
- Calcaneal fibular ligament
- Posterior talofibular ligament
- Deltoid Ligament

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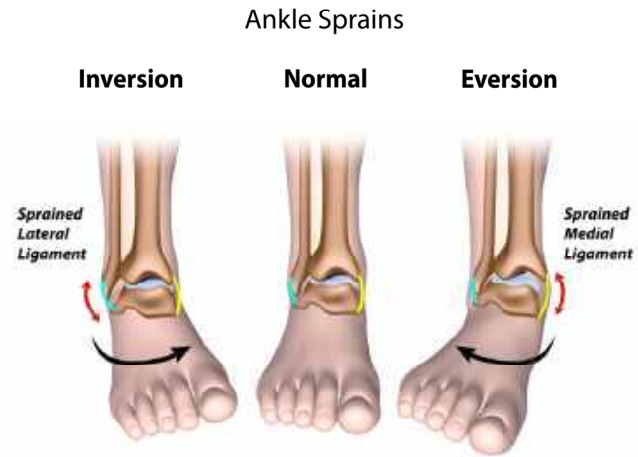
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Establish the Mechanism of

- Don't forget about pertinent facts prior to and after the injury
- Did you have a previous injury
- Were you able to keep playing



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Ligament Testing of the Ankle

ATF

CF

PTF

TF

Deltoid

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Anterior Drawer Test of the Ankle

- Testing the anterior talar fibular ligament
- 20 degrees of plantar flexion
- The patient must relax for the test to be reliable

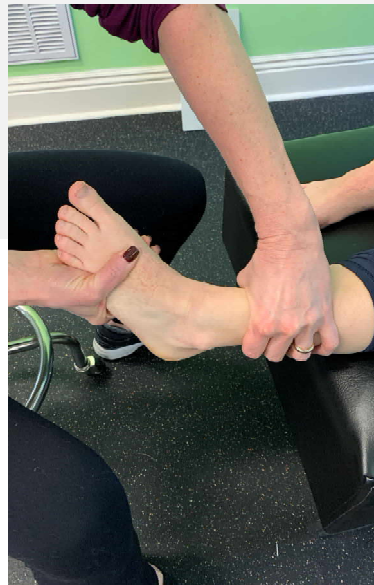
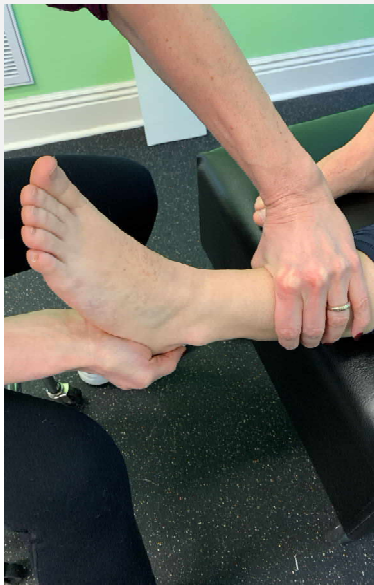


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Talar Tilt Test

- Test of the CFL of the ankle
- Ankle at 90 degrees
 - Consideration in also testing in plantar flexion to also assess ATFL
- Grade?



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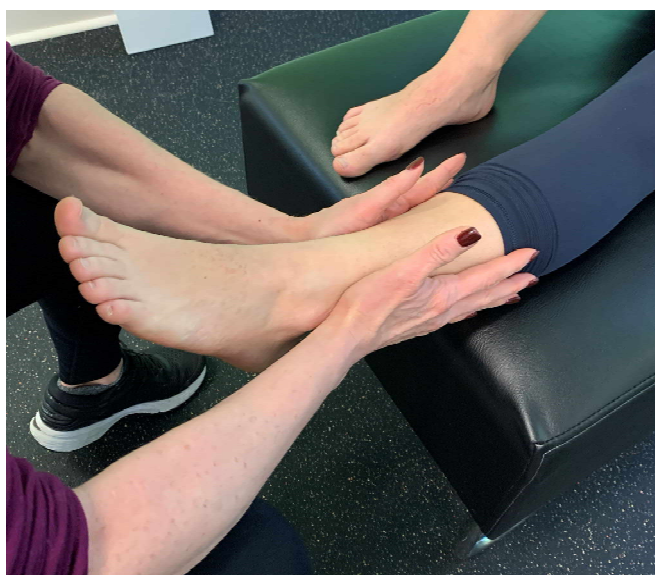
Valgus Stress Test of the Ankle

- Testing the Deltoid ligament of the ankle
- Nuances of the deltoid ligament injury and recovery phases



Squeeze Test

- Syndesmotoc Injury
- Compression of Tib-Fib
- Diagnosis of the High Ankle Sprain
- Sprain Duration



Anvil Test

Gross Fracture Test



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Ankle Evaluation protocol

- Acute injury
- History of previous injury
- ROM
- Strength
- Rule out Fx
- Palpatory findings
- Patterns of edema
- Patterns of ecchymosis
- Ligament stability
- Ability to ambulate
- Ability to continue play



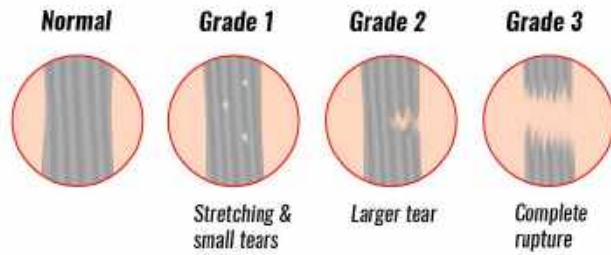
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What is your diagnosis?

- Grades of Ankle Sprains
- Grade 1-
- Grade 2-
- Grade 3-
- *What ligament(s) are affected



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THE STRUCTURE IS AFFECTED BY FUNCTION..
the function is affected by the structure



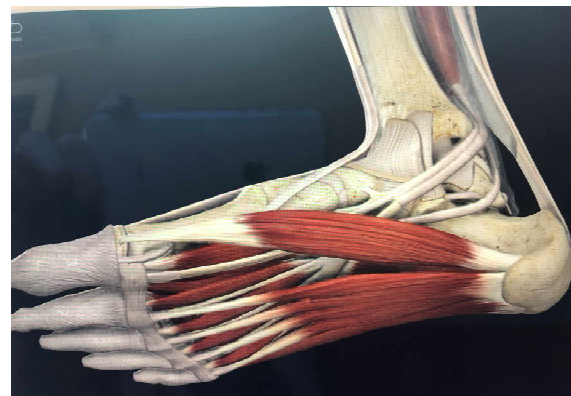
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Functional Evaluation of The Foot and Ankle



- Understanding the anatomy
- The chain of command
- Mechanism(s) for use
- Past injury...Changes in patterns
- Biomechanical deficiencies
- Footwear
- Anatomical variants
- GOALS

PRONATION/SUPINATION





THE LAYERS OF THE FOOT AND HOW THEY INTERACT



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THE MOTION BEGINS..



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The Phases of Gait

1. Stance Phase- 60% of the gait cycle
60 % of the gait cycle
- Divided into 4 phases
 1. Heel contact
 2. Midstance
 3. Active Propulsion
 4. Passive Propulsion
2. Swing Phase



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THE GAIT CYCLE

THE STANCE PHASE OF THE GAIT (100%) →

MIDSTANCE OF GAIT

- Second Interval
- Foot Flat to Heel Lift**
- Ankle dorsiflexes
- Subtalar joint inverts
- Lower limb external rotation
- Inversion due to ankle oblique axis and plantar aponeurosis and metatarsal break
- Stability of transverse tarsal joint increased by inversion.
- **The mid foot goes from flexible to rigid

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The “Controlled Fall” of Gait

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

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What Happens to the Gait Cycle When You Run?

- The motion of the foot and ankle are not altered
- The Gait cycle is shortened
- Stance Phase is shortened
- Vertical forces are up to 3 times your body weight
- Range of motion is increased 50%
- Change in phasic activity of the muscles of the lower extremity



The Ankle

What to look at:

Gait

Shoes and wear pattern

Posture

Practice/Game Shoe

Knee, hip and foot

Putting It All Together



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HOW INJURIES CHANGE OUR GAIT



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SIGNIFICANCE OF THE GREAT TOE IN GAIT

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Research on the Great Toe



- [J Orthop Res.](#) 2009 Apr;27(4):549-54. doi: 10.1002/jor.20661.
- **The role of the great toe in balance performance.**
- [Chou SW¹, Cheng HY, Chen JH, Ju YY, Lin YC, Wong MK.](#)
- **Author information**
- **Abstract**
- The objective of this study was to evaluate great toe function in maintaining static and dynamic balance. Correlation among great toe length, body height, and balance performance parameters were also investigated. Thirty females (aged 22.1 +/- 1.9 years) were tested in two great toe conditions: unconstrained and constrained. Balance testing was done in the following order: (1) static balance, single-leg stance with right or left foot, eyes open or closed; (2) static balance, stance with both feet, eyes open or closed; (3) dynamic balance, left/right or forward/backward, rhythmic weight shifting; and (4) dynamic balance, target reaching test, eight targets within 90% limit of stability. Significant differences were found in sway velocity between the two toe conditions with eyes open or closed in single-leg stance ($p < 0.05$). No difference was found between the two conditions while standing with both feet. For rhythmic weight shifting, significant differences in sway velocity were found in toe conditions and in weight-shifting directions ($p < 0.05$). As to target reaching, significance was only noted in directional control scores. Great toe length was correlated with subject's height ($r = 0.553$, $p < 0.05$). Our results indicate that constraining the great toe deteriorated the subjects' single-leg stance performance and worsened the directional control ability during forward/backward weight shifting. The importance of the great toe in balance may be taken into account in toe amputation or transfer in the future.
- PMID: 18932241 DOI: [10.1002/jor.20661](https://doi.org/10.1002/jor.20661)

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FUNCTIONAL CONTRIBUTION OF THE TALUS

- MOVEMENT OF THE TALUS WITH GAIT
- NO MUSCULAR ATTACHEMENT..
- WHAT IS THE SERIES OF EFFECTS OF FAULTY TALAR PATTERNS.



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THE TALUS



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OCD of the Talar Dome

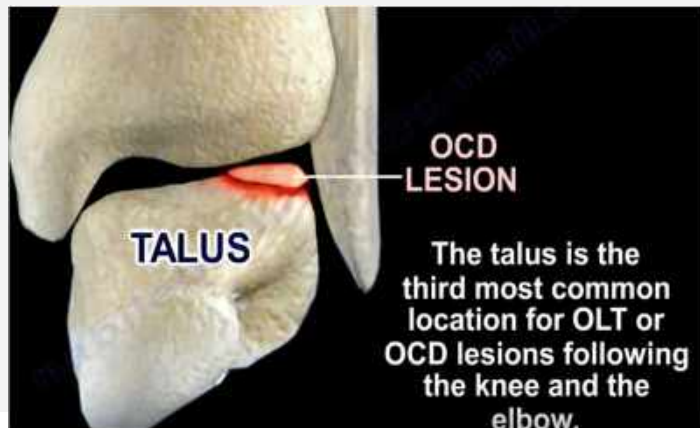
- Most common site of OCD lesions of the talus is the medial aspect of the talar dome
- This injury most commonly occurs during a coupled plantar flexion, inversion and rotation injury of the ankle.



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Talar Dome



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MRI Findings

- Osteochondral defects
- Several types
- Location and mechanism of injury
- Stability
- Size
- Sport...Goals



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Ottawa Ankle Rules

Determines when to get an X ray

Imaging- Ottawa Ankle Rules

An ankle X-Ray series is only required if there is any pain in the malleolar zone and...

•Bone tenderness at the posterior edge or tip of the lateral malleolus (A)

OR

•Bone tenderness at the posterior edge or tip of the medial malleolus (B)

OR

•An inability to bear weight both immediately and in the emergency department for four steps



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Ottawa Ankle Rules

Medial ankle and midfoot zone

Imaging- Ottawa Ankle Rules

A foot X-Ray series is only required if there is any pain the midfoot zone and...

- Bone tenderness at the base of the fifth metatarsal (C)
- OR
- Bone tenderness at the navicular (D)
- OR
- And inability to bear weight both immediately and in the emergency department for four steps.



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Thompson Test

TEST FOR ACHILLES TENDON RUPTURE




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Thoughts...







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THE SERIES OF EVENTS..

- Looking at gait, static and dynamic assessment tools, predict what injuries your athlete/patient is predisposed to.
- Begin with a strategy of correction
- Give homework to speed up recovery
- Check the homework!!!
- Retest to see progress.




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What is your plan

- Wrap or tape
- Brace
- Imaging
- Referral

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Eval of the Ankle

- Observe for patterns of edema, ecchymosis, deformity
- Active ROM
- Passive ROM
- Palpate all regions for tenderness
- MMT all planes
- Anterior Talar Tilt (dorsi and plantar flexed)
- Anterior Ankle Drawer Test
- Valgus or eversion stress test or Talar Eversion Stress Test
- Squeeze Test (start up on the mid shaft) looking for laxity and pain distally
- Wedge Test (Distal Tib-Fib) (Cotton Test)
- Check the talus
- Anvil
- Thompson test
- * Vascular and neuro assessment

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Treatment Progression

- Edema Reduction
- ROM
- Strength and Proprioception
- Straight planes first then lateral movements as the patient progresses

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Treatment Day 1

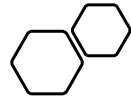
- Ice
- Compression
- Elevation
- E-stim
- Crutches, boot or Aircast
- Home instruction- keep it elevated, ice every 2 hours, Wiggle the toes.
- Follow up the next day

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Rehab Progression

- Begin with ROM "alphabets", Wiggle toes, elevation
- Passive ROM
- Strengthening of the ankle in all planes
 - TheraBand progression non weight bearing then progress to weight bearing exercises
 - Toe Raises –three positions
 - Toes straight
 - Toes in
 - Toes out



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Rehab Progression Proprioception

BAPS Board Progression- seated,
standing, standing on injured leg

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Rehab Progression Wobble Board

- Proprioception/Strength/ROM progression considerations

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Return to Sports Plan

- What is your measure of readiness?
- How will you progress and return the athlete to play



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Progress the return to play

- Wrap, brace or tape? How does this change over time?



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Extension of 1st MTP
tightens tape to resist
lengthening and then
Recoils you're assist
propulsion

A WORD ABOUT TAPING...

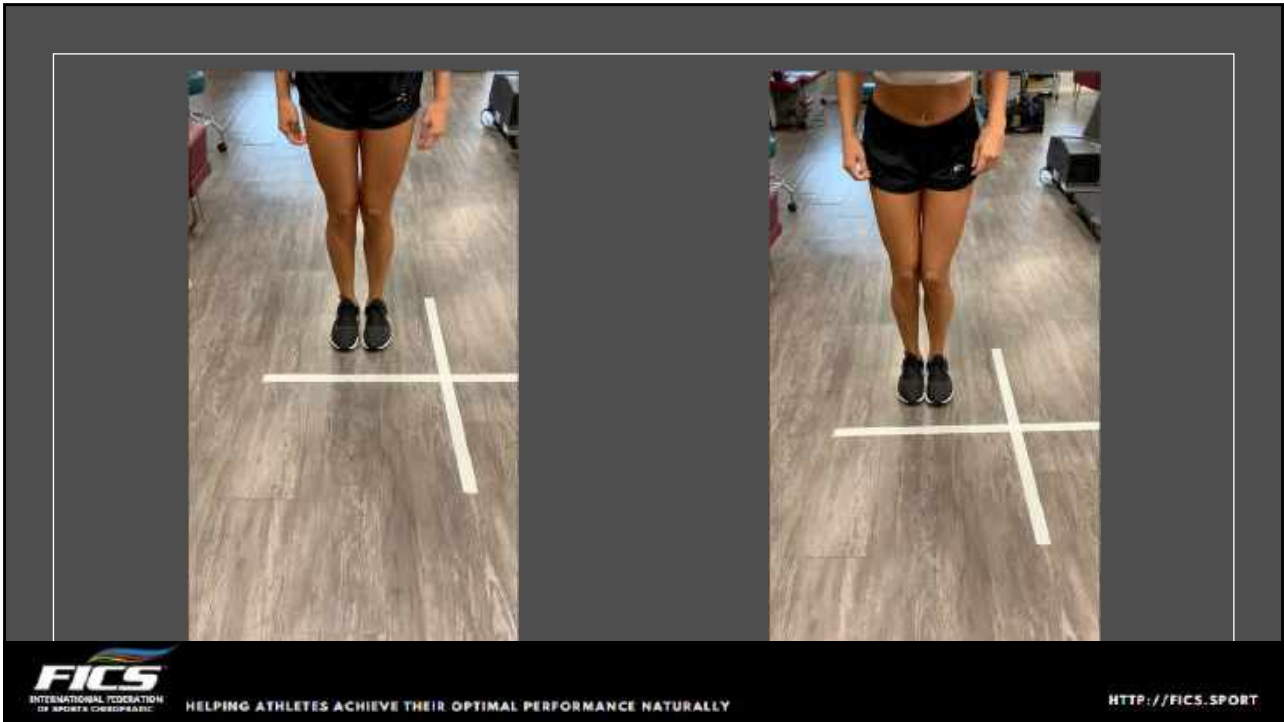
- Why are you taping
- What is the goal
- Safety of the Athlete
- Functionality



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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

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Medial Tibial STRESS SYNDROME

- Tibial stress fractures can be considered a Type 1 medial s=tibia stress syndrome
- Result of repetitive activity such as running, aerobics and sprinting.
- The incidence may be predictable. Individuals with narrow-width tibias, and a higher degree of external hip rotation seem to be at greater risk.
- Women with a BMI less than 21kg/m squared, ere are significantly higher risk for tibial stress fractures and spinal injuries.
- *The Tibial is the most common site of stress fracture in the lower extremity followed by fibula

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SHIN SPLINTS

- Corpus ID: 51847775
- **MEDIAL TIBIAL STRESS SYNDROME**
- N. Shaheed Published 2016

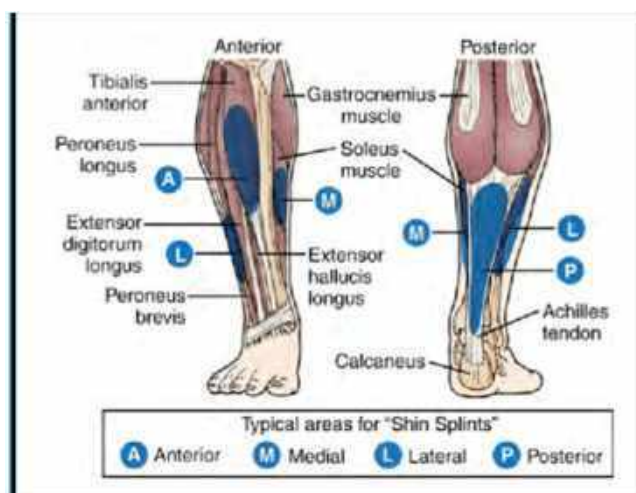


Figure 1. Typical area for shin splints.

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Tibial Stress Fractures

- Most common tibial site is 12-15cm proximal to medial malleolus.
- Marked by a region of pinpoint tenderness
- Midshaft stress fractures are the most difficult to manage because they have a higher frequency of delayed union, nonunion and complete fracturing. Therefore, increase rest time for this location.



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Stages of Medial Tibial Stress Syndrome

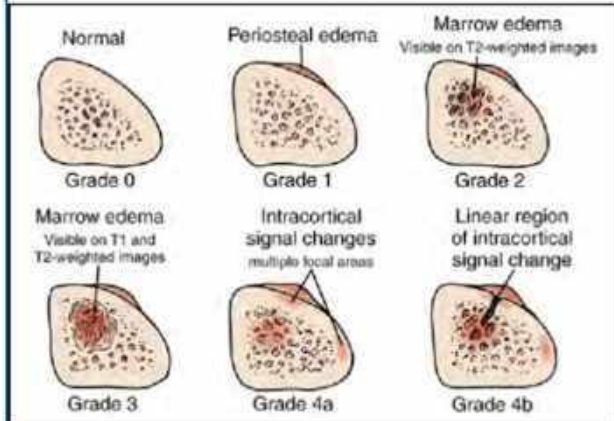


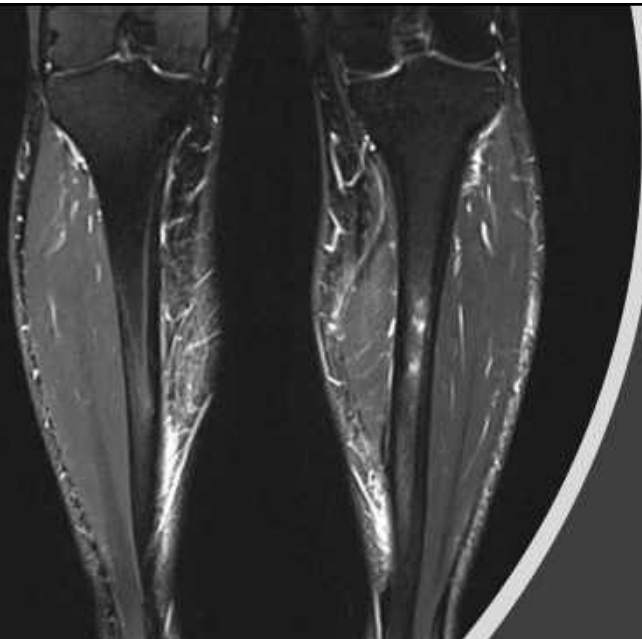
Figure 2. Fredericson classification for medial tibial stress syndrome on magnetic resonance imaging.



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MEDIAL TIBIAL STRESS SYNDROME

When is it time to consider changes in training

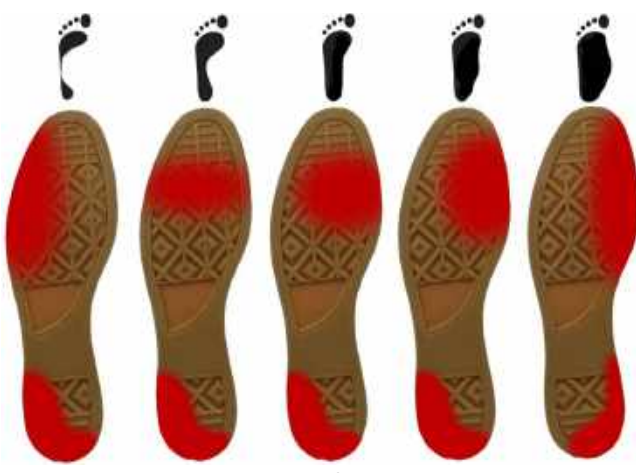


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A. Supinator
B. Optimal or Normal
C. Mild Pronation
D. Moderate Pronation
E. Severe Pronation



A B C D E

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HOW DO WE
BETTER
UNDERSTAND AND
DOCUMENT THE
CASCADE OF
EVENTS THAT
CREATE INJURY

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The Reality

- What are the long-term effects of biomechanical faults



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Parent Considerations



HOW TO EFFECTIVELY COMMUNICATE TO THE PARENTS.



THE BEST BET IS TO BE HONEST AND PUT THE ATHLETE'S BEST INTEREST ABOVE EVERYTHING ELSE.



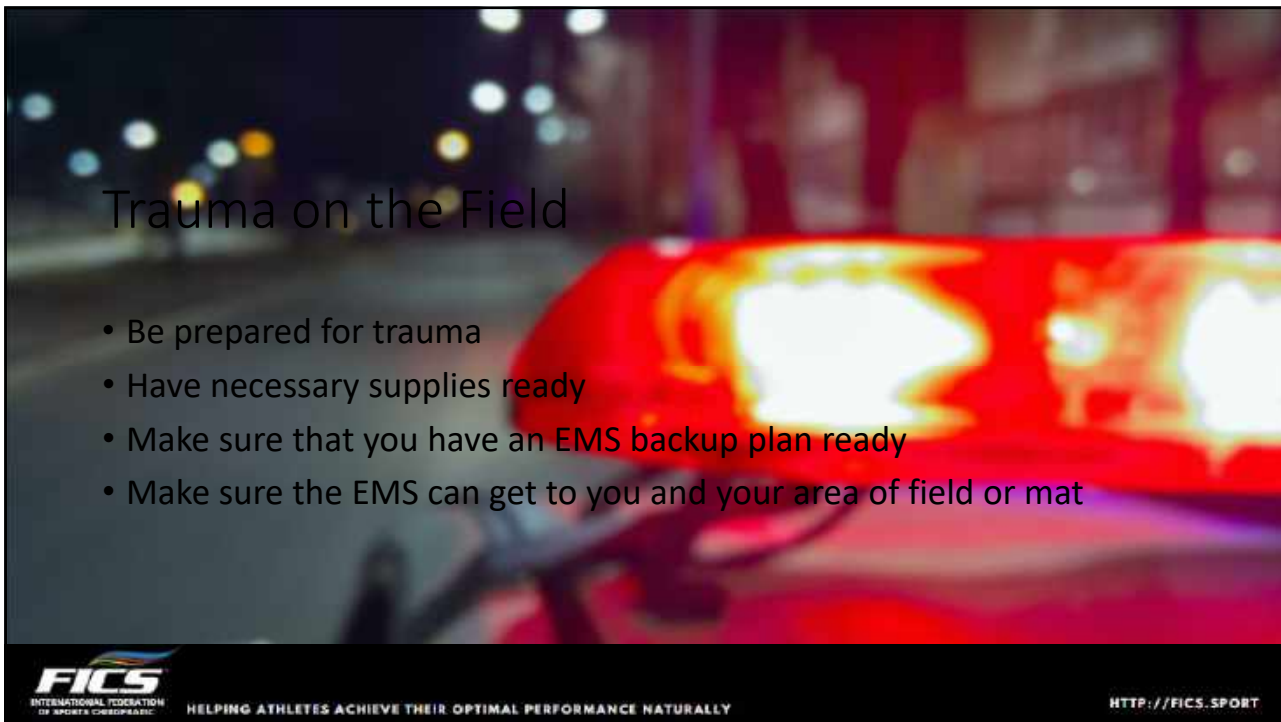
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Trauma on the Field

- Be prepared for trauma
- Have necessary supplies ready
- Make sure that you have an EMS backup plan ready
- Make sure the EMS can get to you and your area of field or mat



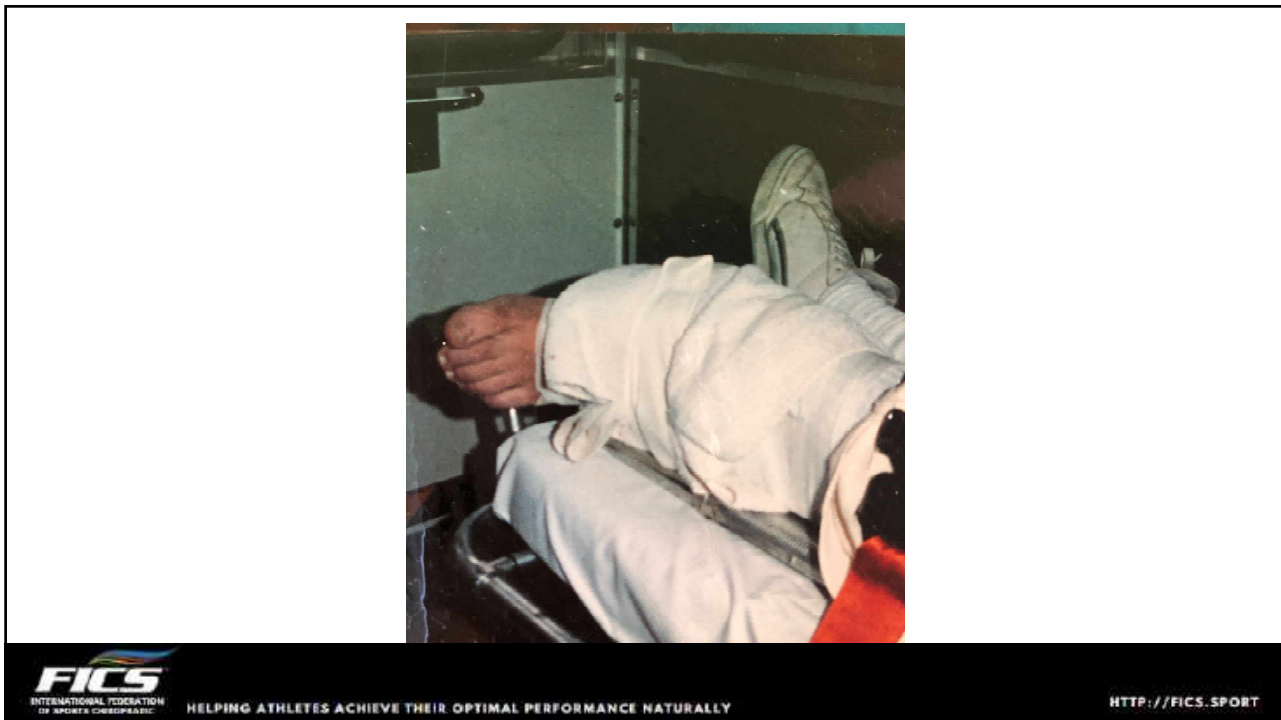
The background image shows the blurred red and white emergency lights of an ambulance at night, suggesting a medical emergency on a field.

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A photograph showing a person lying on a stretcher, likely an athlete, with their legs raised and supported. The person is wearing white clothing and white sneakers. The stretcher is positioned in what appears to be an ambulance or a medical transport vehicle.

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Injury Reporting and Communication Skills



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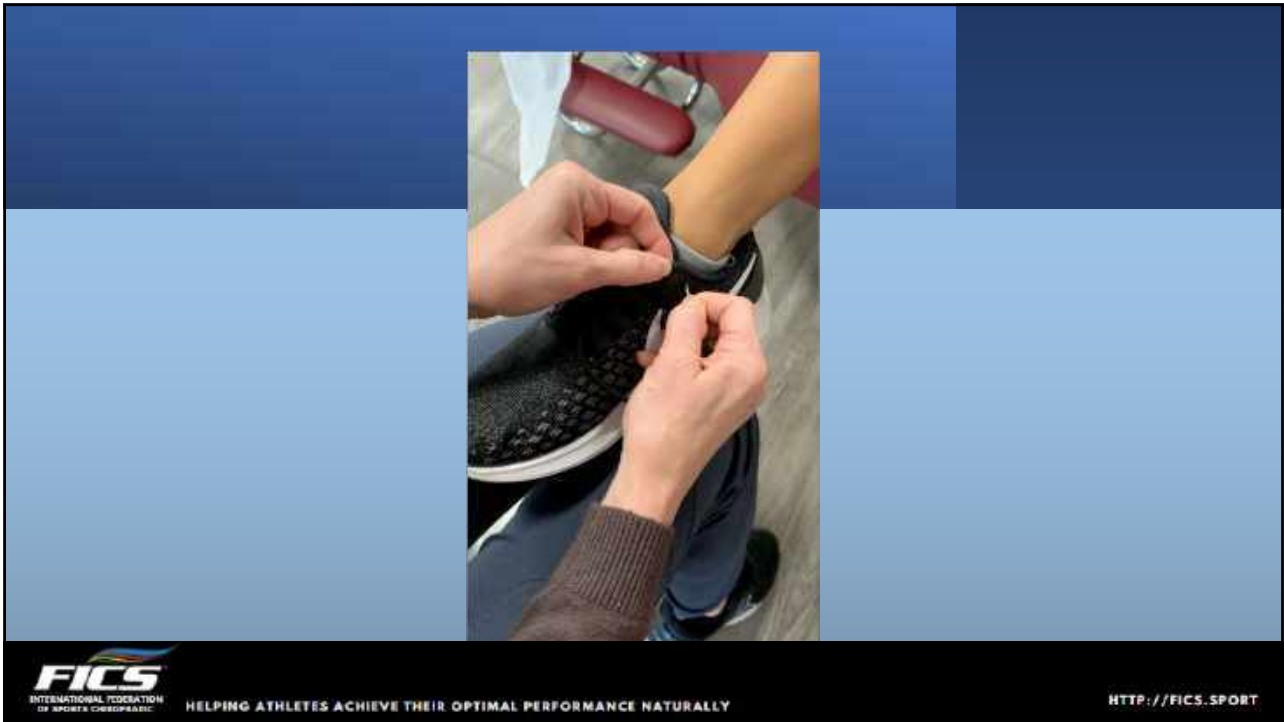
LOOKING AT PATTERNS OF EDEMA



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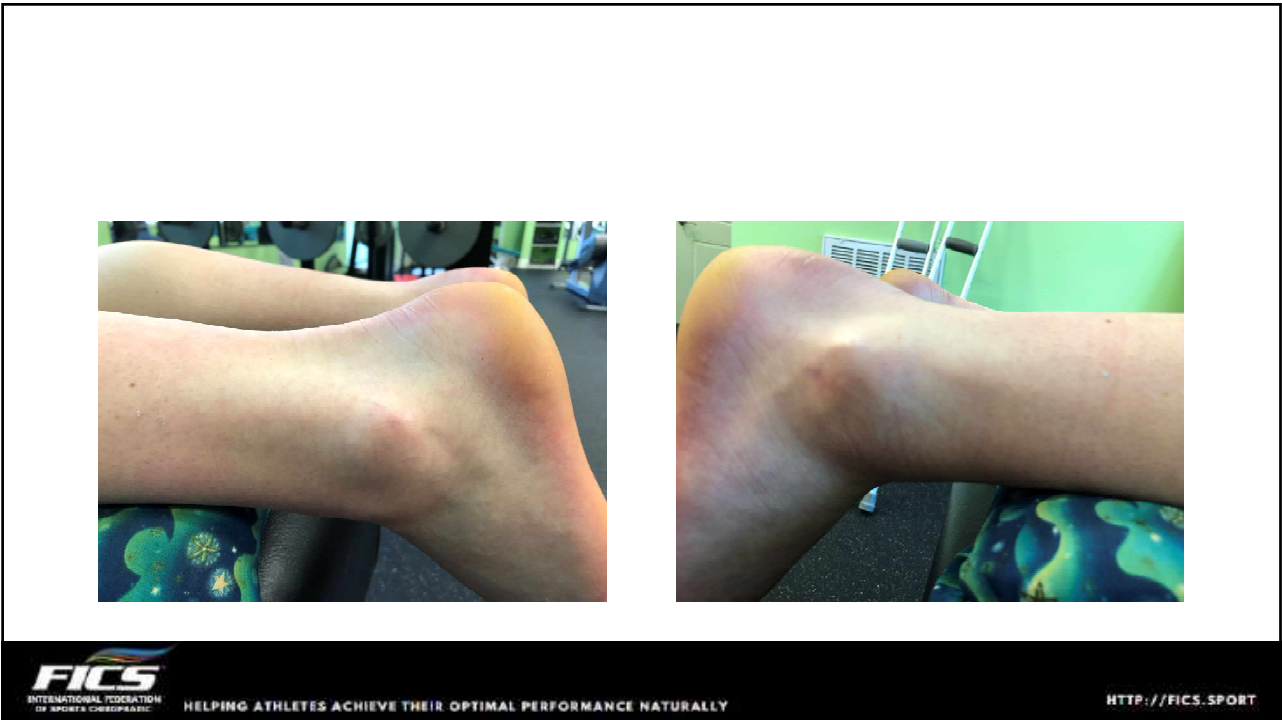
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Thoughts?



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The Calcaneus

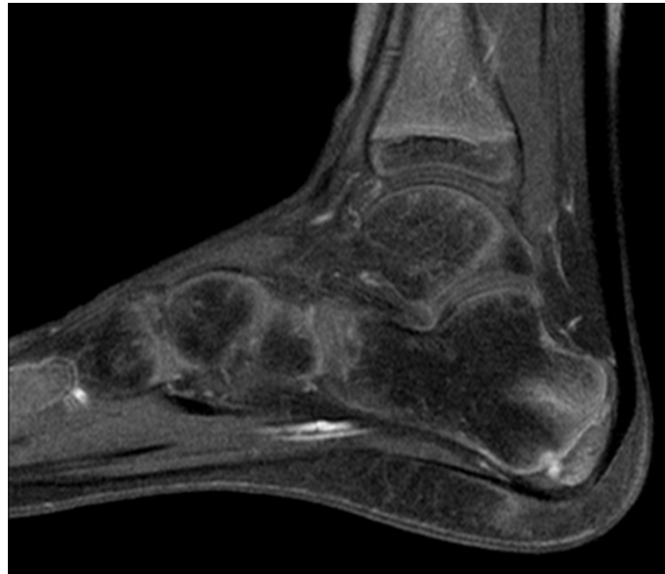
- What structures could be affected based on location?
- Consider the age of the athlete
- Consider the type of activity
- Consider location of pain
- Consider Onset or mechanism of injury



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Severs Disease

- Very common for running and jumping in youth sports.
- Managing this diagnosis needs to include patient education
- Exam findings and treatment options



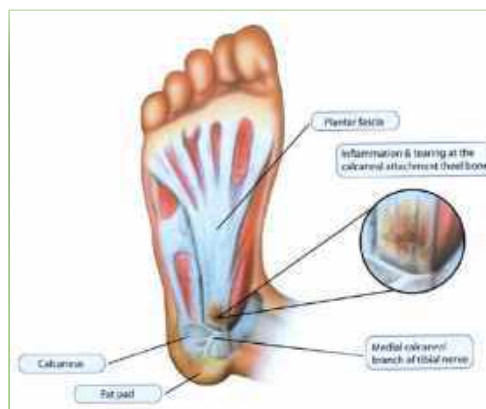
Sesamoid Bones of the Great Toe

- Two small ossicles that are found inside the flexor hallucis tendon.
- They act as a fulcrum for the flexor hallucis brevis
- They help create a mechanical advantage for plantar flexing the toe.
- Also helps with the leverage of hallux dorsiflexion. (windlass effect)



Plantar Fascia

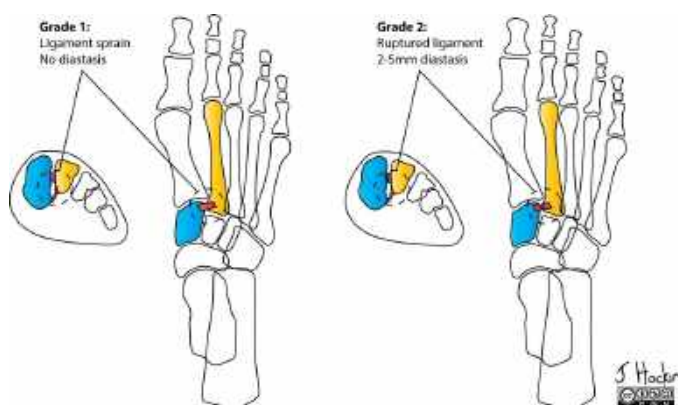
- Origin on the calcaneal tubercle
- Plantar Fasciitis can occur at the proximal, mid or distal fibers of the fascia.
- Most times however pain in over the medial calcaneus
- Onset can be insidious like in runners or acute in jumping sports.



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Lisfranc
Lisfranc ligament-
from medial
cuneiform to the
base of the second
metatarsal



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Lisfranc



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Does the Age and gender of the athlete matter

- What are some considerations for the pediatric athlete
- What are some considerations for the older athlete
- What may be different in the female athlete

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Different injuries for a variety of age groups



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A Word About Footwear

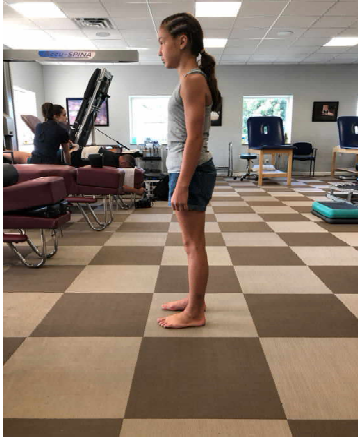


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12 yo gymnast with complaint of left ankle pain



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Previous plan of care?



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MRI Right Ankle

- Contusion and trabecular micro fracturing of the medial malleolus with remodeling suggesting acute on chronic fracture.
- Edematous remodeling of the posterior distal tibia.
- Contusions of the calcaneus, fibula, talus and cuneiforms with non-displaced fracture of the medial navicular.
- Injury date?

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WHAT BOTHERS YOU ABOUT THIS PIC?

- *Take the time to look at everything
- *Notice tone, pallor, affect, motivation, comorbidities, previous injury patterns
- *Understand the persona of the patient
- * What about coaching issues?

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"ROLLED ANKLE" TWO DAYS POST INJURY



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THINK OF WHAT STRUCTURES MAY BE INJURED AND THE RAMIFICATIONS

- PATTERNS OF EDEMA
- REGIONS OF TENDERNESS
- IMAGING FINDINGS
- ABILITY TO BEAR WEIGHT
- MECHANISM OF INJURY
- HISTORY OF PREVIOUS INJURY

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POSTERIOR ANKLE ANATOMY



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MARATHON RUNNER WITH "ACHILLES" TENDON PAIN



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Looking at all phases and speeds of Gait

- What could be the "King Pin"
- Where do you start..
- History, previous treatment, diet, training regime, footwear, goals



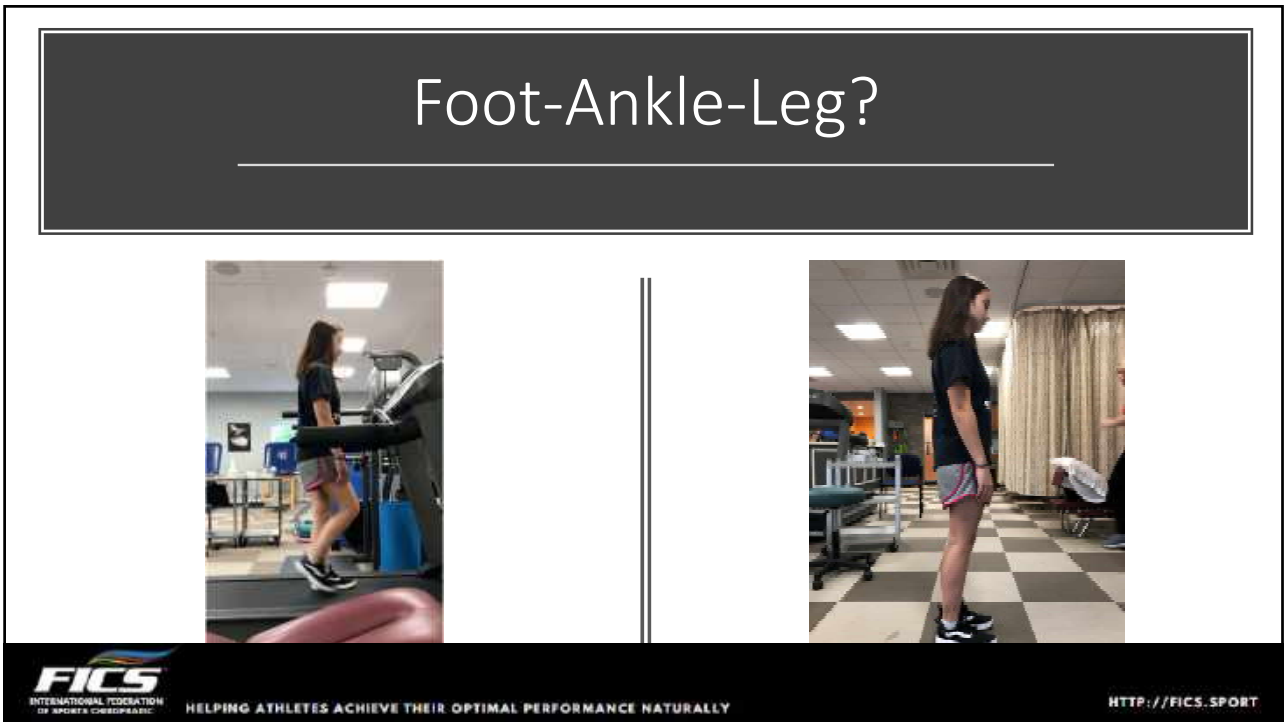
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Considerations in lower extremity pathology

- What is the cascade of events that may cause an injury?
- How can you unpeel that injury
- What can you do to prevent that injury from happening again?

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STRESS FRACTURES OF THE BASE OF THE FIFTH METATARSAL

- Two-year history of pain and repeated stress fractures to the base of the 5th metatarsal

What do you look at first?

Training regime

Diet

Footwear

Terrain

Gait

Goals



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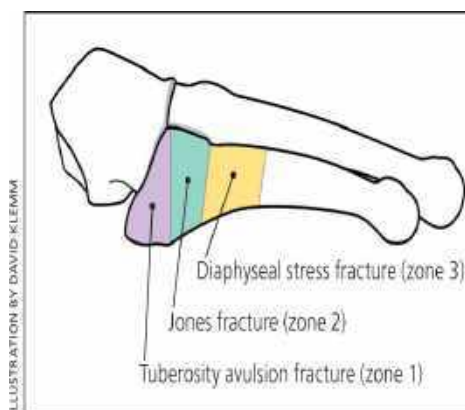
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The base of the Fifth metatarsal Fx considerations

The importance of fracture location



Zone 1- Proximal Tubercle

- Non union uncommon
- Consider age and Salter Harris fx

Zone 2- Metaphyseal-diaphyseal jx

- nonunion risk 15-30%
- Acute injury

Zone 3- Proximal diaphyseal

- Stress fx in athletes
- Non union risk 15-30%

*Look at hind foot position

This may predispose pt to 5th Metatarsal fxs

Eval of the Ankle

- Observe for patterns of edema, ecchymosis, deformity
- Active ROM
- Passive ROM
- Palpate all regions for tenderness
- MMT all planes
- Anterior Talar Tilt (dorsi and plantar flexed)
- Anterior Ankle Drawer Test
- Valgus or eversion stress test or Talar Eversion Stress Test
- Squeeze Test (start up on the mid shaft) looking for laxity and pain distally
- Wedge Test (Distal Tib-Fib) (Cotton Test)
- Check the talus
- Anvil
- Thompson test
- * Vascular and neuro assessment





Thank You!

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