Lower Extremity Overuse Injuries

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Overuse Injury

- Definition: An injury of the musculoskeletal system that results from the combined fatigue effect over a period of time beyond the capabilities of the specific structure that has been stressed.
- These injuries occur when several repetitive forces are applied to a structure (e.g., muscle or tendon); each less than the acute injury threshold of the structure.

Overuse injury

- The most common overuse injury that is attributed to running is *patellofemoral pain syndrome*
- Other common overuse running injuries include:
  - Stress fractures
  - Medial tibial stress (shin splints)
  - Patellar tendonitis
  - Iliotibial band syndrome
  - Achilles tendonitis

Overuse Injury

- Biologic structures (muscles, tendons, ligaments, bones) *adapt positively or negatively* depending on the level of stress that is placed on them
  - Positive remodeling → Repeated stresses that are less than the tensile limit of the structure

    *Provided there is an adequate time period between stress applications
  - Injury (negative remodeling) → Any single stress beyond the tensile limit or repeated stresses that are less than the tensile limit with insufficient time period between stress

Overuse Injury: Variables

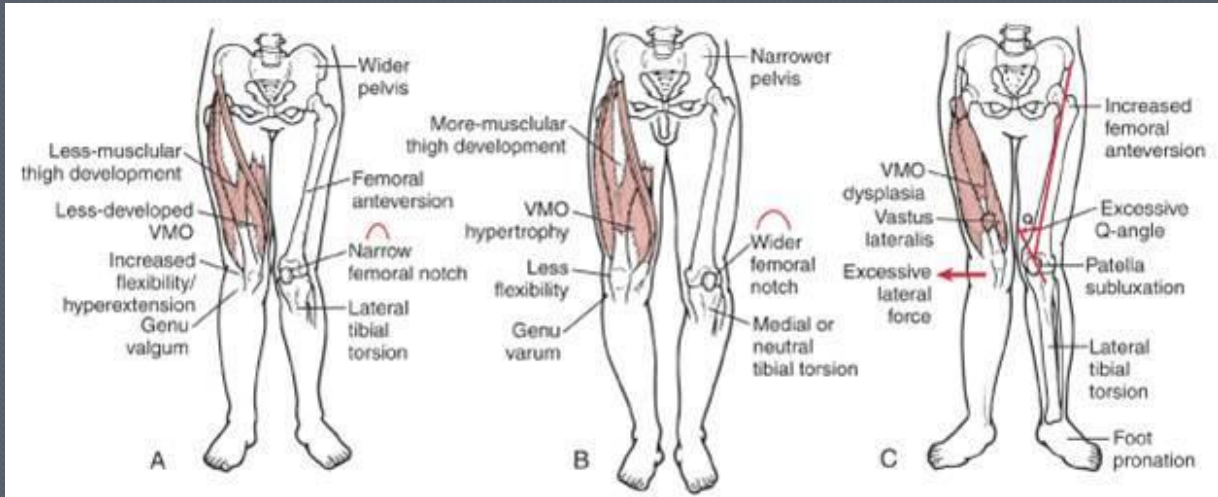
- In the literature, all that can be stated with certainty is that the etiology of overuse running type injuries is multifactoral and diverse.
- The variables that have been identified as risk factors varies from study to study, but can be placed in 3 general categories:
  - Training
  - Anatomic
  - Biomechanical factors

Overuse injury:
Training

- Excessive running distance.
- Rapid increases in weekly running distance.
- Too high of training intensity.
- Related training variables- include the running surface and shoes that are chosen to wear.

Overuse injury:
Anatomic or Anthropometric Variables

- Longitudinal arch height (pes cavus, pes planus)
- ROM
- Muscle imbalances
- Soft tissue restraints
- Leg length discrepancies
- LE alignment abnormalities (e.g. Q-angle, genu varus/valgus, patellar position (alta, baja), increased lordosis, femoral anteversion, tibial torsion)



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Overuse Injury:
Biomechanics

- Kinetic or rearfoot kinematic variables.
- Abnormally large external or internal stresses that are outside of the physiological "normal" ROM.
- Magnitude of impact forces, the rate of impact loading, the magnitude of active (propulsive) forces and the magnitude of knee joint forces and moments.

Common Overuse Injuries

- Iliotibial Band Friction Syndrome
- Patellofemoral Pain Syndrome
- Medial Tibial Stress Syndrome (Shin Splints)

Iliotibial Band Friction Syndrome

- *The most common cause of lateral knee pain in runners*
- Iliotibial Band Anatomy
  - Thickened strip of fascia that extends from the iliac crest to the lateral tibial condyle
  - Receives part of the insertion of the tensor fasciae latae & gluteus maximus
- Overuse leads to ITB Friction Syndrome
  - Bursa and inflammation develop between the ITB band and lateral femoral condyle

Iliotibial Band Friction Syndrome:
Contributing Factors

- Cavus Feet
  - Increases lateral stresses on ITB
- Varus knee position
  - Inc. lateral stress on ITB
- Downhill running
  - maintains knee flex longer

- "Downhill" leg on a pitched running surface
- Hard shoes, hard surfaces

Iliotibial Band Friction Syndrome:
Clinical Features

- Pain and tenderness over lateral femoral condyle about 2 cm above the joint line during exercise.
- Pain exacerbated by downhill running.
- Aggravated by rep. flexion-extension movements
  - walking downstairs, running, cycling, or skiing.
- Pain limits athlete to a particular distance.

Iliotibial Band Friction Syndrome:
Diagnose

- Positive Ober's Test- Test is sidelying with hip abducted, extended and knee flexed or extended

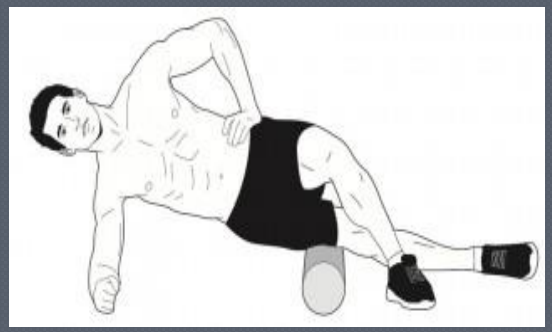
- Normal test result → leg adducts to the table
- Abnormal test result → leg does not approach the table

ITB Friction Syndrome:
Rehabilitation Protocol

- Rest from running until asymptomatic
- Ice before and after exercise
- Ensure relative rest from running and high flexion-extension activities of the knee
  - cycling, running, stair descent, skiing etc.
- Avoid downhill running
- Avoid running on pitched surfaces

ITB Friction Syndrome:
Rehabilitation Protocol

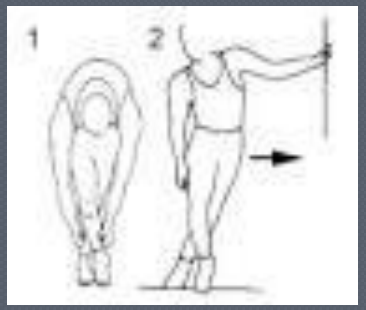
- Use motion control footwear or orthotics in the shoe to correct biomechanical issues.
- Build in correction in the short leg if leg length discrepancy is present.
- Use soft running shoes rather than hard ones (rearfoot and forefoot impact rating > 10 gm and 13gm)
- Iontophoresis, ultrasound if helpful
- Soft tissue mobs, MFR, Foam Roller



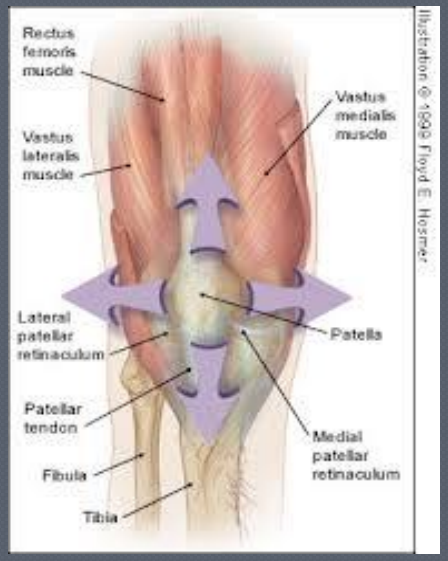
ITB Friction Syndrome:
Rehabilitation Protocol

- Perform stretching exercises:
  - Self-Ober stretch
  - Lateral fascial stretch
  - Posterior fascial stretch plus gluteus maximus
  - Glut Maximus and piriformis self-stretch
  - Standing wall lean for lateral fascial stretch
  - Rectus femoris self-stretch
  - Iliopsoas with rectus femoris self-stretch

ITB Friction Syndrome Stretching Exercises



Patellofemoral Pain Syndrome



- Pain or discomfort resulting from contact of the posterior surface of the patella with the femur
  - No set classification of involved anatomic structures (increased interosseous pressure of the patella, anterior synovium, fat pad impingement, lateral retinaculum)
- PFPS is clinically diagnosed based on history and PE rather than through imaging
  - Several theories support causes
- No clear cut consensus outlining treatment protocols

Patellofemoral Pain Syndrome:
Biomechanics

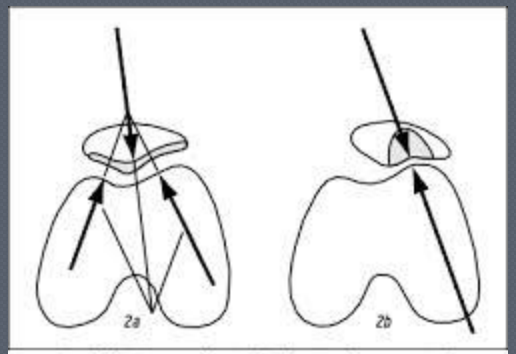
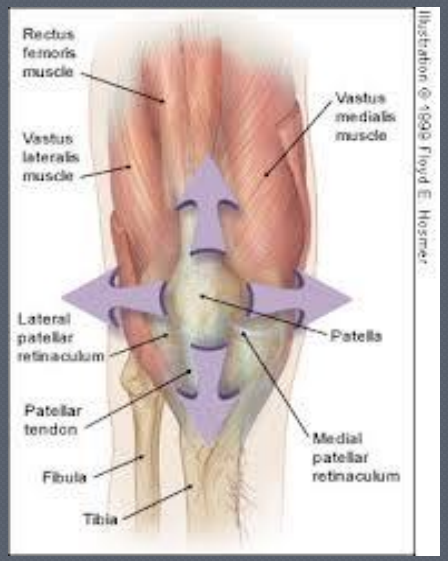


Figure 2a and 2b. Diagram showing distribution of compressive forces on back of kneecap with normal patellar tracking (2a) and abnormal patellar tracking (2b).

- The patella transmits force to the subchondral bone → The greater the tension generated by the quads, the greater the resultant PFJRF.
- Unbalanced forces resultant PFJRF.
  - Unbalanced forces on the PF joint lead to increased pressure and chondromalacia (thinning and softening of the articular cartilage) under the patella +/- femoral condyles

Patellofemoral Pain Syndrome:
Causes



- Theories for this includes:
  - 1) Increased levels of activity
    - Prolonged compressive or shearing forces (running or jumping) on the PF joint
  - 2) Malalignment of the patella as it moves through the femoral trochlear groove
  - 3) Quadriceps muscle imbalance
    - Increased pull of lateral quads/ retinaculum with acute or chronic lateral PF subluxation/dislocation
  - 4) Tight anatomical structures (ITB, retinaculum)
  - 5) Increased Q angle

Patellofemoral Pain Syndrome:
Signs & Symptoms

- Prepatellar/localized retropatellar pain
  - Pain is typically described as "aching with occ. sharp pains"
  - Often difficult for patients to describe a specific painful location
    - "Circle sign" → hands on anterior knee circle around the patella
  - May report "Giving way" of the knee
- Swelling is typically absent or minimal
  *Unless underlying pathology is present
- Pain occurs with load on knee extensor mechanism
  - Asc /desc stairs, squatting, kneeling, cycling, running
    - Desc. stairs is worse than ascending
  - "Movie sign" or "Theatre sign" → prolonged sitting with bent knees
- Pain with patellar compression or gliding
- Crepitus may be present

Patellofemoral Pain Syndrome:
Components of a complete & accurate diagnosis

- Tissue injury complex
  - Patellar cartilage and synovium, patellar tendon, infrapatellar fat pad
- Clinical Symptom Complex
  - Patellar pain, positive "theater" sign, Pain desc. Stairs
- Functional Biomechanical Deficit Complex
  - Insufficiency of medial quads, inflexible ITB, tight lateral retinaculum, tight hams/gastrocnemius/soleus, hamstring weakness, hip abd and ER weakness, excessive pronation
- Functional Adaptation Complex
  - Knee flexion contracture, lateral patellar tracking, jumping off the contralateral leg
- Tissue Overload Complex
  - Lateral retinaculum, patellar tendon, hip ER's, Medial Longitudinal Arch

Patellofemoral Pain Syndrome:
Diagnosis & Differential Diagnosis

- The diagnosis is made by ruling out other causes of knee pain:
  - Patellar tendonitis
  - Prepatellar bursitis
  - Plica syndrome
  - Sinding-Larsen-Johansson syndrome (involving the patellar tendon and the lower margin of the patella)
  - Osgood-Schlatter Disease (apophysitis of the tibial tubercle)

Patellofemoral Pain Syndrome:

Rehabilitation Considerations/Protocol

Acute Phase (0 to 7 days)

- Acutely painful
- The result of chronic repetitive overload
  - Leads to cellular damage and degeneration, with scar formation of the patellar tendon and lateral retinaculum
- In this phase focus on treating the tissue injury & clinical symptom complex
  - Begin with cryotherapy with IF ES to dec pain/edema
  - Iontophoresis/us if tendonitis/reactive plica present
  - Consider biofeedback or EMS to VMO to ensure proper contraction & inc proprioception.

Patellofemoral Pain Syndrome:
Acute Phase

- Treatment
  - McConnell or kinesiotaping, PF bracing to decrease or eliminate pain to progress with exercise.
  - Protected ROM and conditioning of other parts of the kinetic chain.
  - Initial muscle activity includes isometric exercises & avoiding painful arcs
- Criteria for advancement includes resolution of edema, improved ROM and pain decreased.

Patellofemoral Pain Syndrome:

Rehabilitation Considerations/Protocol

Recovery Phase (5-7 days to 5-7 weeks)

- Complexes involved
  - Tissue overload complex
  - Functional biomechanical deficits
- Treatment:
  - Aim to improve patellar tracking
  - Stretch quads, hamstrings, TFL/ITB, piriformis, and gastrocs/soleus.
    - Caution with hamstring stretching if pt. presents with recurvatum.
  - Manual medial glide and tilt of the patella/MFR may be employed to stretch the tight lateral retinaculum.
  - Continue McConnell or kinesiotaping for patellar glide, tilt or rotation.

Patellofemoral Pain Syndrome:
Recovery Phase

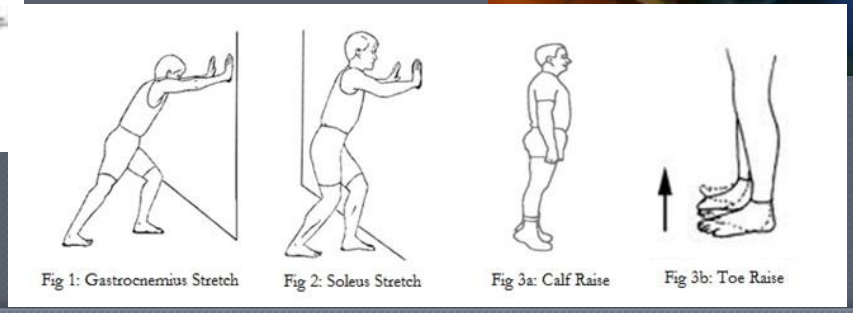
- Goal is to maximize quad & minimizing PFJRF
  - Typically done via short-arc (30 to 0 degrees) although strengthening only VMO is debatable. Progress with closed chain early are more likely to produce a VMO/VL ratio greater than 1.0
  - May be limited evidence that VMO strengthening is enhanced by hip adduction exs. Hanten and Schulthies have shown that during hip adduction, the electrical activity of the VMO was significantly > lateralis. (SLR, SAQ, QS)
- Treatment:
  - Correct LE malalignment problems
  - Orthotics may be necessary.

Patellofemoral Pain Syndrome:
Recovery Phase

- Treatment:
  - CKC exercises in lower knee flexion ranges promote co-contraction in quads, hams, gastroc/soleus muscles
    - Inc muscle tone reduces excessive forces across the patella
    - Partial squats eccentrically load the knee are essential
      - <45 degrees of flexion generates less PFJRF than during OKC
  - Strengthening the hip ER's, 4 way hip strengthening, hamstring strengthening, core strengthening, ankle (ant and post tibialis)

Patellofemoral Pain Syndrome

Recovery Phase



Patellofemoral Pain Syndrome:
Recovery Phase

- Treatment:

  Begin stair-stepper (small steps done rapidly), stationary bike (seat elevated) swim (crawl) for endurance training.

  - Functional activities (mini squats, wall slides, lunges, step-ups, step-downs, lateral step-ups, heel and toes raises). Proprioceptive ex- BOSU, balance board, foam, Biodex etc.

- Criteria for advancement to the next phase:
  - absence of pain or inflammation
  - ROM equal to non-involved side
  - strength >75% of noninvolved extremity

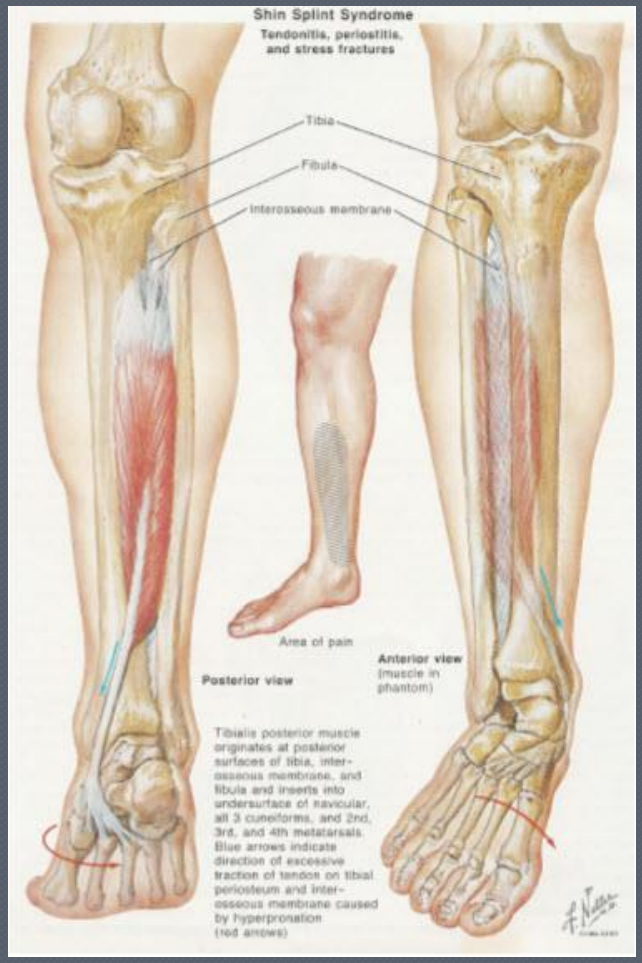
Patellofemoral Pain Syndrome:
Maintenance Phase

- The complexes involved include:
  - the functional biomechanical deficit complex and the subclinical adaptation complex.
- Activities are geared towards:
  - optimizing strength and flexibility,
  - proprioceptive retraining
  - balance, plyometrics
  - sports-specific activities
    - Agility drills, running, jumping, and kicking are stressed.
- Tape/brace as appropriate

Patellofemoral Pain Syndrome:
Criteria for Return to Play

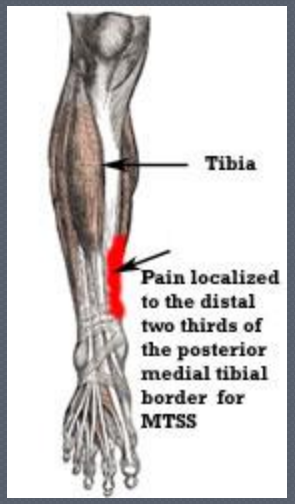
- Essential full ROM
- Normal strength and balance
- Sports specific activities achieved- cross cutting, figure-of-eight, carioca's

Medial Tibial Stress Syndrome
Shin Splints



Medial Tibial Stress Syndrome
(Shin Splints)

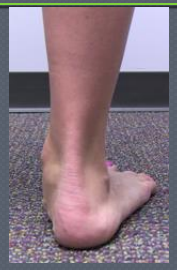
- Pain in the distal third of the posteromedial aspect of the shin is common in runners, dancers, and other athletes who regularly engage in ballistic activities.
- The exact etiology of medial leg pain remains controversial.
- Presently, MTSS is based on finding an area of point tenderness on the posteromedial tibia, with an area of diffuse tenderness over the posteromedial aspect of the distal third of the tibia.



MTSS

- In mild cases, pain is relieved by rest.
- In more severe cases, pain is present even at rest.
- A bone scan may become positive as the severity of symptoms increases. Biopsies usually reveal inflammatory change of the periosteum and fascia. Eventually, periosteal thickening may become evident on plain radiograph.

MTSS



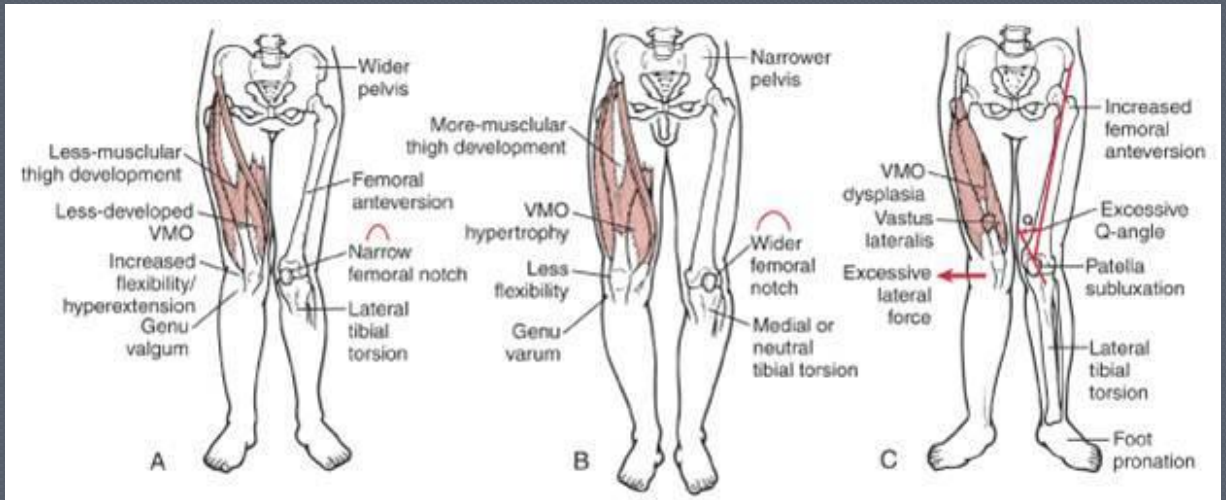
- Predisposing factors have been identified.
  - Increased valgus forces on the rearfoot result in inc. eccentric contraction of the soleus and post. tib mm, and is often the underlying cause.
  - Etiologies for inc. valgus forces are leaning too far into a curve, running on a track with tight corners, increasing ER of the hip, genu varum and large Q angle.

MTSS:
Common Training Errors

- Poor running shoes
  - Footwear should be checked and replaced when shock absorption deteriorates (250-500 miles)
- Inadequate warm-up
- Running on uneven terrain
- Advancing training too rapidly
- Running on hard surfaces
- Running in cold weather
- Low calcium intake

MTSS:
Biomechanics

- Excessive Pronation
- Pes planus
- Pes cavus
- LE leg length discrepancy
- Muscle imbalance



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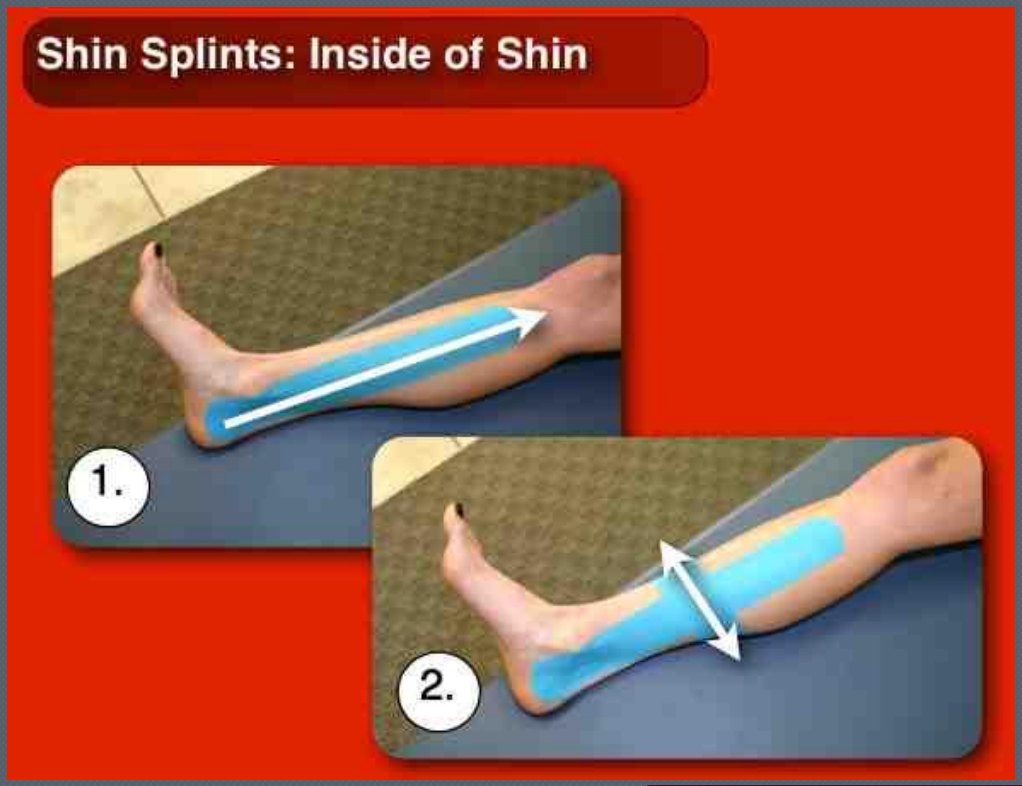
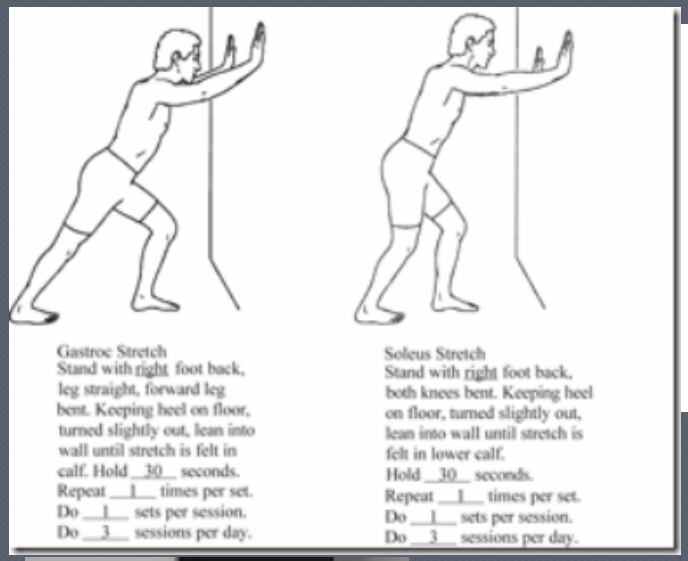
MTSS: Treatment

- Treatment is relatively generic and may be generalized to many other LE overuse syndromes and includes:
  - Prevention
  - Adequate relative rest of the involved area (not entire body)
  - Gentle, slow, sustained stretching
  - Ice
  - Physical modalities
    - US, IF ES to inc influx of nutrients & efflux metabolic by products to promote analgesia
  - Modification of training technique
  - Taping, orthotic prescription
  - Soft tissue mobilization, foam roller
  - Improvement of footwear

MTSS
Taping/ Orthotics

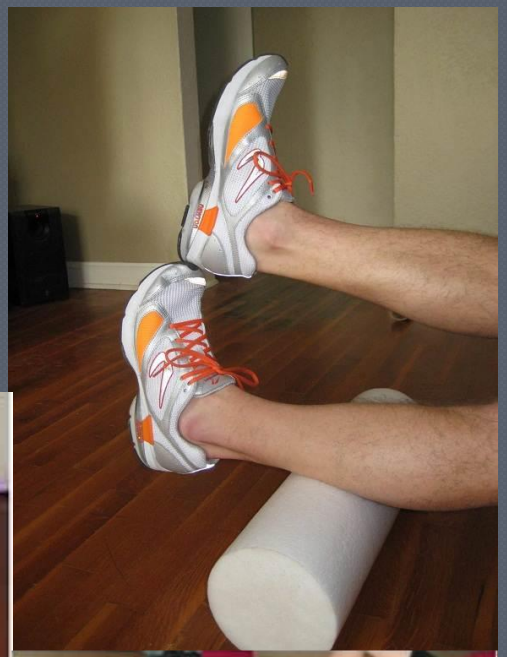


MTSS Treatment



Gastroc Stretch
Stand with right foot back, leg straight, forward leg bent. Keeping heel on floor, turned slightly out, lean into wall until stretch is felt in calf. Hold 30 seconds.
Repeat 1 times per set.
Do 1 sets per session.
Do 3 sessions per day.

Soleus Stretch
Stand with right foot back, both knees bent. Keeping heel on floor, turned slightly out, lean into wall until stretch is felt in lower calf.
Hold 30 seconds.
Repeat 1 times per set.
Do 1 sets per session.
Do 3 sessions per day.



MTSS: Treatment

- The initiation of rehab activities of a severe injury begin once symptoms begin to subside
  - Isometric exercises
  - Concentric/eccentric
- Maintain cardiovascular conditioning with low-impact activities (stationary bike, swimming)
- Once athlete has regained painless ROM and 90% strength of non-involved side, a gradual return to premorbid activities is indicated.
- Strict attention should be paid to proper LE alignment, flexibility and strength balance, footwear, warm-up and if running involved, terrain.

Lower Extremity Overuse Injuries

Thank you

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