The Knee and Running Injuries

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What hurts us in treating patients with knee injuries is not what we know – but rather what we know that isn't !

The Knee is basically in the lower extremity kinetic chain – stable joint above and below – forcing the knee to be the distributor – the dissipater of loads - requires the hip – thigh- lower leg to all function in proper sequence and effort level

Patellar malalignment – Big issue … - Reality: statics don't predict dynamic problems well and when a unilateral presentation – what do you think the other side looks like? (hint – mirror image !)

What is the role of imaging – confirm our manual assessments

Always start with knee screen – to rule out the big issues and confirm what we expect!

Diagnostics – Ask the right questions – to get the right answers

Only get a MRI when it might alter our care – not just to confirm a possible diagnosis !

General data related to manual Assessment

		Sensitivity	Specificity
Best test for: ACL	Lachman	80-90%	>95%
PCL	Post. Drawer	51-90%	>95%
MCL	Valgus Stress	86-96%	(? 85%)
LCL	Varus Stress	(? 50%)	(? 75%)
Meniscus	Single Wt.BRot	89%	>90% {But not in isolation !}

Screen clears the BIG THINGS – then we focus on the Running Activity and where it impacts the RUNNER !

Ideally on track – may use treadmill – both side view and posterior 2-D is clinical !

Don’t forget the BASICS (given to us by Tom McPoil, Lynn Wallace, Irene Davis)

The old Rules still apply

10% max increase per week

1 week per month is soft

Never do back-to-back challenge days

Need a rest day

Big 3 – Little 1

Pronation, Limb Length, and Flexibility - Strength

Whate we see at the Knee in Runners

PF Syndrome – Anterior Knee Pain – AKA – Runners Knee #1 - ~ 15 % of all running injuries More common in females- Typically in higher running volumes – most often neuromuscular - demonstrate dynamic valgus collapse Treatment: Neuromuscular approach – very important to remember proximal !

Iliotibial Band Syndrome ~ 10 % of all running injuries Now believed to be related to fat deposit that gets irritated Treatment: Cryo, proximal focus strength and stretching (be reasonable!) Training modifications – often shorten the step/stride length – alter speeds – Be careful out there …

Tendon Issues – Tedinopathy ~ 5% of running injuries Painful – inflammatory-like presentation BUT of a chronic nature – not a one time event If less than two weeks duration – deemed Acute > 2 weeks – Chronic Acute Treatment: Cryo, NSAID’s (for a couple of days!), Activity Modifications, eccentric maximals (relatively good outcomes) Chronic – As for acute treatment initially – but then major focus on eccentrics – 10-12 weeks required (outcome - less predictable!)

Menical Lesions 3-5 % of running injuries (Often linked to osteoarthritis – meniscus is a hugely chondro-protective elelment - Presentation is catching, locking, tightness – pain “in the knee” Treatment: NSAID’s, Strength (open chain – 30-90 degrees- no jogging – run on ball of the foot – may use 10-50-10 sequence Arthroscopic surgery MAY be required – MAY !!!

Osteoarthritis Relatively rare – when seen often related to previous injury – often meniscus removal Opinion: rare that it develops because of the running itself Management is multifactorial: But nearly always includes significant volume control – strength (total lower extremity), be very cautious in use of medial arch support – may try lateral wedges – hip and knee distractions …

Remember: sometimes it is easy – Sometimes it is hard !

Thank you for your attention and thanks to the Section for their support !

Enjoy the weather !

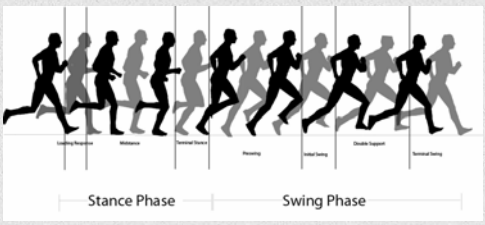
"Normal" Running Mechanics

Ben Keeton, PT, DPT, OCS

Overview

- Phases of Running
  - Mobility Needs
  - Stability Needs
- Cadence
- "Normal" is relative!

Gait Cycle



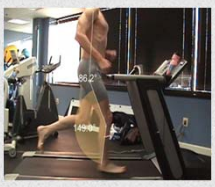
Stance Phase
Mobility Needs

- Talocrural Joint
  - IC = 10 degrees DF
  - MS = 20 degrees DF
  - TO = 25 degrees PF
- Subtalar joint
  - IC = 5-10 degrees inv
  - MS = 10 degrees ev
  - TO = 0-2 degrees inv.

Stance Phase
Mobility Needs

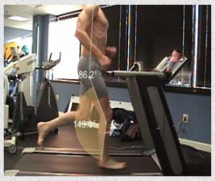
- 1st MTP
  - TO = 60-70 degrees Dorsiflexion

Stance Phase
Mobility Needs



- Knee
  - IC = 30-40 degrees flex
  - MS = 50-60 degrees flex
  - TO = 30-40 degrees flex

Stance Phase
Mobility Needs



- Hip
  - IC = 50 degrees flex
  - MS = 20 degrees flex
  - TO = 10 degrees ext

Stance Phase
Mobility Needs

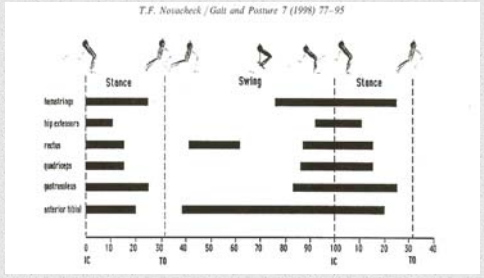
- Pelvis
  - IC = 5 degree tilt toward suspended leg
  - MS = Pelvis level
  - TO = 5 degree tilt toward suspended leg

Stance Phase
Mobility Needs

- Trunk
  - IC = 5-10 degrees flexed
  - Absorption = increases 2-5 degrees
  - TO = same as IC

Stance Phase

Stability Needs



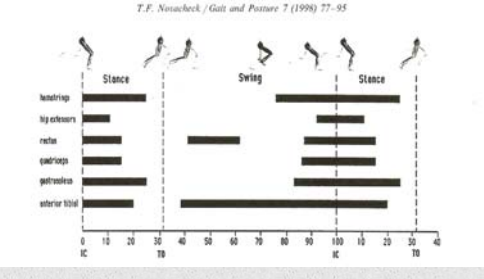
Swing Phase

Mobility Needs

- Talocrural Joint
  - Throughout swing = Remains 10 degrees DF
- Knee
  - Throughout swing = Achieves a max of 130 degrees flex
- Hip
  - Throughout swing = Achieves a max of 60 degrees flex

Swing Phase

Stability Needs

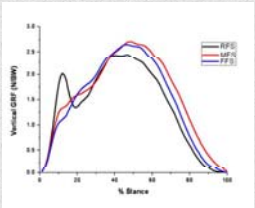


Cadence

- Stance time should be as long as possible without minimizing the elastic recoil. (Dicharry 2009).
- 180 contacts per minute is "gold standard"

Normal is Relative!

- Heel or Forefoot Strike?
- Shod or Barefoot?
- Many other factors to consider when interpreting "normal"



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Combined Sections Meeting 2013
San Diego, CA January 21-24 2013

Hip Region: Injury Patterns, Evaluation Considerations, and Intervention Strategies

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Objectives

- Summarize the normal and abnormal running kinematics and kinetics for the lumbo-pelvic region and lower extremity.
- Integrate the pathomechanics with injury patterns hip.
- Synthesize an evaluation and intervention plan for those with running related injuries of the hip
- Integrate anatomical, biomechanical and neuromuscular concepts relating to the etiology, examination, and intervention strategies for individuals running related injuries.

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Injury Pattern

- **Common Problems**
  - **Anterior/ Groin**
    - **Labral Tear**
    - **Pubalgia**
    - **Adductor Strains**
  - **Lateral**
    - **Trochanteric Bursitis**
    - **Gluteus Medius/Minimus Tendinopathy**
  - **Posterior**
    - **Sub-Gluteal Nerve Entrapment**

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Common Cause of Labral Tear

- **Femoroacetabular Impingement**
- **Instability**

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Femoroacetabular Impingement FAI

- **CAM**
- **Pincer**

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Femoroacetabular Impingement FAI

- **CAM**
  - **Cam impingement results from an abnormal bump, thickening, and/or loss of femoral-head neck offset**

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Femoroacetabular Impingement FAI

- **CAM**
  - **Cartilage injury occurs as the cam deformity enters the hip to causing sheering forces and cleavage type lesions to the articular cartilage**
  - **The transitional zone and labrum will also be susceptible to injury when compressed by the cam deformity**
  - **The location of injury will depend upon the location of the deformity and the direction the hip is moved. Cam deformities are most often found at the anterior-superior head-neck junction**

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Pincer: FAI

- **Pincer type impingement is an acetabular deformity that results in femoral head over-coverage**
  - Global over-coverage (profunda and protusio)
  - Focal over-coverage
    - Superior focal over-coverage
      - The anterior and superior acetabular rim extending laterally over the femoral head.
    - Excessive acetabular retroversion
      - Anterior over-coverage but posterior under-coverage of the femoral head. I
      - Internal rotation of the hip in 30-60º of flexion will cause the head-neck junction to come into contact with anterior labrum.
    - Excessive acetabular anteversion.
      - Posterior over-coverage will cause the head-neck junction to abut the posterior labrum when the hip is externally rotated in extension.

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Pincer: FAI

- **Pincer type impingement is an acetabular deformity that results in**
  - Causes edge loading type labral damage
  - Can also lead to subtle posterior subluxation of the femoral head with resulting in posterior contra-coup acetabular chondral damage

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FAI

- **CAM and Pincer deformities often occur together**
- **Femoral version**
  - Retroversion:
    - The anterior-superior head-neck junction will be closer to the anterior rim of the acetabulum.
    - The anterior-superior labral may be at risk for compression from the femoral head-neck junction with movements that incorporate hip internal rotation in 30-60º of flexion.
  - Anteversion
    - The posterior head-neck junction is closer to the posterior rim of the acetabulum.
    - Therefore the posterior-superior labrum is at risk for injury with movements that incorporate external rotation in extension

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Bony geometry

- **Femoral Anterversion/ Retroversion**
  - Gait
    - Toeing in- Anteversion
    - Toeing out- Retroversion
  - Craig's test
    - 15º Internal rotation normal
      - > 15º Anteversion
      - < 15º Retroversion
  - ROM
    - Increase internal rotation/ Decrease external rotation
      - Anterversion
    - Decrease internal rotation/ Increase external rotation
      - Retroversion

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Hip Instability

- **Ligamentous**
  - **Global**
  - **Focal Rotational**
- **Labral Tears**
- **Dynamic/ Muscular Weakness**
- **Osseous**
  - **Acetabular Dyspasia**

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Interaction

- **FAI**
  - **Labral Tear**
  - **Loss of suction**
  - **Leads to instability**
  - **Pain**
  - **Weakness/Compensations/Dysfunctions**
    - **Adductor**
    - **Trochanteric Pain Syndrome**
    - **Sub Gluteal Nerve Syndrome**

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Adductor Longus

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Weakness Impacting Mechanics

Gluteus Medius

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Link to Proximal Problems

- **Lumbo-Pelvic Instability/ Weakness**
- **Sacroiliac Joint Dysfunction**
- **Pubalgia**

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Athletic Pubalgia/ Sports Hernia

- **Term describing a spectrum of chronic pubic/inguinal pain**
- **A sports hernia, also known as athletic pubalgia, is a tear in the muscles of the lower abdomen.**

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- **There are different theories about how this hernia occurs.**
  - **One possibility is that tight or strong hip flexor muscles tilt the pelvis forward and stretch the lower abdominal wall muscles, eventually leading to small tears in the muscles and tissues.**
  - **Repetitive forces to pubic symphysis or tendinous insertions of the adductors and rectus abdominus**
  - **Disruption of inguinal canal components (external oblique apanuerosis, conjoined tendon, etc.)**
  - **Often noted in athletes participating in sports that require forceful, repetitive twisting and turning**

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ATHLETIC PUBALGIA

- Symptoms:
  - chronic pain, often occurring only during exertion.
  - Often described as sharp burning pain localized to the lower abdomen and inguinal region, that later radiates to the adductor region and potentially testicular region.

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PAIN PRESENTATION IN ATHLETIC PUBALGIA

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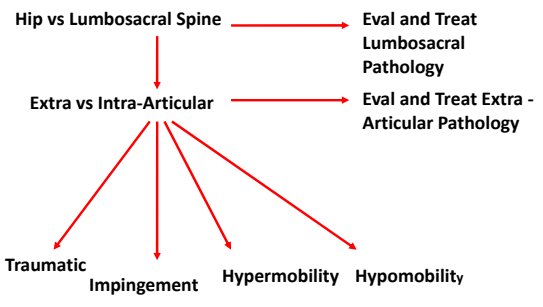

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Hip vs Lumbosacral Spine

- **Special Tests**
  - Lumbar ROM
  - Pelvis Landmarks
  - Standing Flexion
  - Long Sit
  - Prone Knee Flexion
  - Spring Testing

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Intra- vs Extra-Articular Pathology → **Evaluate and Treat Extra-Articular Pathology**

- **Special Tests**
  - FABERS
  - Scour Test
  - Flexion-Internal Rotation-Adduction Impingement Test

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Intra- vs Extra-articular Pathology

- **Diagnosing Intra-articular pathology:**
  - **Insidious onset of sharp or aching groin pain that limits activity.**
  - **Physical examination:**
    - **Limited hip flexion, internal rotation, and abduction range of motion**
    - **Positive Flexion-Adduction-Internal Rotation Impingement test**
    - **Positive FABER test**
- **Recommendation in FAI:**
  - **B grade- Evidence levels 2 and 3**
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    - » Johnston TL (2008) Arthroscopy
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    - » Tannast M (2007) J Orthop Res

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Evaluate and Treat Extra-Articular Pathology

- **Special Tests**
  - Modified Thomas Test
  - Ober's Test
  - Palpation
  - Resisted Testing

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Craigs Test

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Classification System for Physical Therapists

- **Lumbosacral**
- **Extra-articular**
- **Intra-articular**
  - **Impingement**
  - **Hypermobility**
  - **Hypomobility**
  - **Traumatic**

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Classification Based Treatment Lumbosacral

- **Mobilization**
- **Strengthening/Stabilization**
  - **Include in all activity**
    - **Running Posture**

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Pelvic and Trunk Stability

- **Gluteus Medius**
- **Quadratus Lumborum**
- **Erector Spinae**
- **Abdominals**

- **i.e. Scapula stabilization**

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Classification Based Treatment Impingement

- **Work within the Pain-free limits**
  - **Sagital**
  - **Frontal**
- **Gluteus Medius Strengthening**
- **Trunk Stabilization**
- **Joint Mobilization**
  - **Inferior**
  - **Posterior**

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Joint Mobilization

- Post capsule
- Distraction

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Classification Based Treatment Hypermobility

- **Hip Stabilization**
- **Proprioception**
- **Gluteus Medius Strengthening**
- **Trunk Stabilization**

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Strengthening

- Monster walk
- lunging

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Strengthening

- Ball extension
- Ball flexion

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Correction Position Faults

- Walk with Internal Rotation
- Step with Internal Rotation

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Overview

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Combined Sections Meeting **2013**

San Diego, CA January 21 – 24

Running Injuries

Current Concepts Related to Pathomechanics, Injury Patterns, Evaluation Considerations, and Intervention Strategies

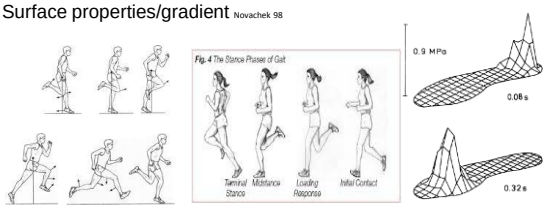
Foot and Ankle Region

Stephen Paulseth MS PT DPT SCS ATC

Landing Impact / Force Attenuation

Determinants:

Running velocity: Foot strikes avg 600 times/km Milner 06 , Pohl 09, Van Zent 07
Body mass
Touchdown kinematics
Shoe properties
Surface properties/gradient Novachek 98

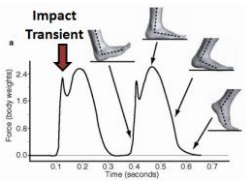


Objectives

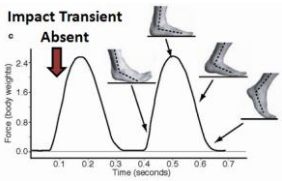
- Outline the injury patterns for the 3 functional units of the foot and ankle.
- Understand the requirements of landing and propulsion during the stance phase of running on the foot and ankle.
- Describe Midfoot/Forefoot and Hindfoot Instabilities and the subsequent related pathologies in runners.
- Understand the importance of a thorough evaluation of the foot and ankle including running gait analysis.
- Understand potential effects of non-optimal function, inefficiencies, and static and dynamic postural problems.
- *Get our patients to return to their running training regimen ASAP without a problem!*

Stance Phase Kinetics

Hindfoot strike



Forefoot strike



Lieberman DE et al 10

Functional Units of the Foot

Hindfoot: Tib-Fib, Talus and Calcaneus

Midfoot: Navicular, Cuboid and 3 Cuneiforms

Forefoot: Metatarsals and Phalanges.

Runner Injury Locations

(Taunton et al 02)

Breakdown of injury location

Location	Total (n)	Percentage of population
Knee	842	42.1
Foot/ankle	338	16.9
Lower leg	257	12.8
Hip/pelvis	218	10.9
Achilles/calf	129	6.4
Upper leg	105	5.2
Low back	69	3.4
Other	44	2.2
Total	*2002*	*100*

5 most common Dx:
Patellofemoral pain syndrome
Iliotibial band friction syndrome
Plantar fasciitis
Tibial stress fracture
Knee meniscal injuries

Normal vs Abnormal Running Gait

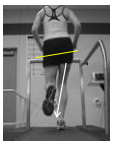
Impact/Landing Phase

Midfoot Injury Patterns

- Barefoot running with a forefoot strike pattern affords increased sensory feedback from the foot-ground contact and increased energy storage in the arch Altman and Davis 12
- Maximum foot deformation during gait occurs at the time of maximum ground reaction force Dicharry et al 09, Eslami et al 07
- Forefoot sagittal and frontal plane motion patterns via the talonavicular joint were linked to the collapse of the medial longitudinal arch Eslami et al 07
- Factors associated with multiple stress fractures were high longitudinal arch of the foot, leg-length inequality, and excessive forefoot varus Korpelainen et al 01
- Plantar arch helps to maintain mid-tarsal rigidity for powered plantar flexion during toe-off and absorbs some impact force Bramble 04
- During running, the elastic structures of the plantar arch function as a spring, returning approximately 17% of the energy generated during each stance phase Bramble 04

Foot Pronation

Triplanar motion consisting of :
- Talar Dorsiflexion
- Talar Adduction
- CALCANEAL EVERSION: Easiest to measure clinically and experimentally



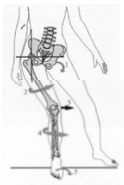
- *Well documented that pronation is a factor(s) in running-related lower extremity injuries*
- *Pronation is NORMAL at slower velocities during 1st half of Stance/Landing*

Related Pathomechanics include:
1. Contralateral pelvic drop
2. Femoral IR
3. Knee valgus
4. Tibial internal rotation
5. Foot pronation

Powers et al 03

Pronation

What is the foot position while the body is converting forces between landing and propulsion?



Midfoot Instability: *Compromised Propulsion?*

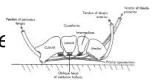
- *Pes Planus??*
- *Midfoot Sprain:*

Lisfranc, Mid-Tarsal joints Wolf 04

- *Adult Aquired Flatfoot Deformity*:

Hindfoot valgus, forefoot abduction, first ray elevation
First metatarsal movement operates at the end range of dorsiflexion and patients do not obtain full hindfoot inversion at push-off following LCL. McCormick 12, Barske et al 12, Richie 07

- *PTTD* Occurs in 15% of population Richie 07, Giederman et al 00



- *Fibularis Tendinopathy/Cuboid syndrome*

80% of dancers/athletes with pronated feet Leerar 01, Brandes 00

- *Plantar Fasciitis:*

Muscular weakness Wearing et al 07, Kibler et al 91
Toe flexors,Gastroc-Soleus, Fibularis?,FHL?weakness Allen et al 03 Kibler et al 91
Greater internal load from weakness increases fascial thickening Wearing et al 07

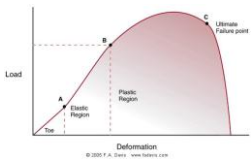
Related ROM:

Gastroc-Soleus tightness not 1st MTP dorsiflexion Allen et al 03, Kibler et al 91
Midfoot loading reduces direct insertion loading and pain but not tensile load. Wearing et al 07

Recipe for Failure?

- Problems occur due to static and dynamic mechanisms affecting the foot and ankle.
- Exertion increases fatigue, alters kinetics and kinematics
- Instability may be due to prior injury, weakness of the limb, static and dynamic postural alignment("foot type"), or chronic mis-use.

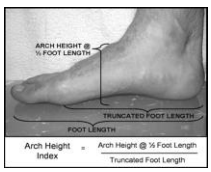
Low arch runners
- Medial Knee pain
- MTSS
- Soft tissue
  Bennett et al 2001, Willems et al 2007, Williams et al 2001
- Reduced forefoot abduction excursion and velocity early stance
- Greater vertical ground reaction force load rates
  Pohl 09, Wearing et al 07



High arch runners
- Lateral Knee pain
- Ankle and foot
- Bone
  Duffey et al 2000, Korpelainen et al 2001, Williams et al 2001, Barnes et al 11
- Higher static medial arch in symptomatic PF runners
  Ribeiro et al11, Taunton et al 02

Midfoot Stability Evaluation Considerations

- History/PMH
- Functional outcome scale- FAAM
- Training schedule, intensity, mileage, speed



Static Assessment
- Wear patterns/calluses- shoes and feet
- Arch Height Index
- MMT Gastroc-Soleus Houck unpublished data Fibularis Longus, FHL,Tibialis Posterior
- Navicular Drop Sit-stand McPoil et al 09 vs NCSP/RCSP- not validated. Dicharry et al 09, Eslami 12 MTSS predicted with 76% accuracy. Bennett et al 01
- 1st MT dorsal/plantar glides Good reliability/Validity, Clinical?
- 3-D Midtarsal Joint mobility

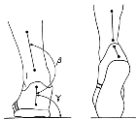
Evaluation

Dynamic Assessment

- Functional ankle dorsi flexion ROM Knee-Wall
- Bilateral heel raise vs Unilateral (balance and midfoot position)
- Dynamic Balance
- Overhead Squat
- Step Down
- Lunge with/without Rotation
- Lateral Heel Tap/Star Excursion
- Drop Land
- Gait Walk and Run







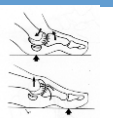
Hindfoot Instability

- Ankle sprain- mechanical laxity of hindfoot
- Foot posture
- Subtalar Instability- 10-25% of CAI Hertel et al 99
- Excessive Shank/Foot Ratio/Coupling-Supination or Pronation

↳ **Tarsal Delay**

↳ Propulsion Delayed?

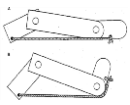
Forefoot Instability



- 1st Ray dorsi flexion/ primus elevatus Barske et al 12
- Prior trauma/sprain, PTTD, Fibularis function, FHL, pes planus, weakness

Results in possible:

- Hallux Limitus (35-60 % in those greater than 65 years) Zammit et al 09
- FHL / FHB tendinopathy- Knot of Henry Boruta et al 97, Richarson 87
- Metatarsal Stress fx Korpelainen et al 2001
- FHL tears Romash 94
- *Sesamoiditis (involved in 12% of hallux injuries) Richardson 87
- Metatarsalgia



Tarsal Delay

Hindfoot : Shank Coupling


Distal Fibular AP/PA glide over lateral talus

ATFL:PTFL Fiber angle
Transverse plane stabilizers and transmit Hindfoot : Shank coupling

Lateral talar trochlea
Fibular-talar glide surface

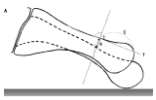

Forefoot Evaluation Considerations

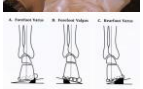
Static Assessment

- Lesser MTP stability with drawer test Peck CN et al 12
- Primus Elevatus- via WB radiograph Bouaicha et al 10
- Callus concentration
- 1st MT mobility- plantar/dorsi glides
- FHL strength varies with ROM
- Sesamoid mobility/position
- Forefoot position- varus/valgus
- Passive 1st MTP Plantar/Dorsi flexion in WB and NWB (functional limitus is difference)

Dynamic Assessment

- Gait analysis (42 degrees reported WNL) Nawoczenski et al 95
- Standing heel raise test- uni/bi



Functional Outcome of
Ankle Sprain → Talar/TarsalDelay

Hindfoot/Shank Coupling

- Horizontal ATFL/PTFL fibers control transverse plane motion at hindfoot via fibula/ankle
- Initial phase of LE/shank rotation can be delayed in hindfoot
- Magnitude of delay varies by foot type, laxity, prior injury
- Talar rotation > Tibial rotation
  Delay in ER is 0-10° and increases with Pf
- Greater delay with additional ligament laxity Huson 2000, McKeon et al 09

If not treated over time can lead to → *Ankle Osteo-Arthrosis*

Hindfoot Evaluation

Static Assessment
- Hindfoot stability: Ligamentous laxity ankle and subtalar joints
- ROM/Joint mobility (HF/MF/FF)
- MMT/Strength- Soleus
- Foot posture/ Arch Height Index

Dynamic Assessment
- Functional ankle dorsi flexion ROM Knee-Wall
- Tibial Rotation
- Bilateral heel raise vs Unilateral (balance and hindfoot inversion)
- Dynamic Balance
- Overhead Squat
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- Lunge with/without Rotation
- Lateral Heel Tap/Star
- Drop Land
- Gait Walk and Run

Navicular Whip/ Manipulation (Thrust)

Vector ~ Straight Dorsal

Increased Tibialis Posterior strength following manipulation
Paulseth et al 09

Interventions

Goal of treatment:
- reducing pain and inflammation
- reducing tissue stress to a tolerable level
- restoring muscle strength and flexibility of involved tissues. Cornwall McPoil 99
- optimizing the patient's running technique and training program

EVIDENCE
- Significant decrease in rearfoot/lower leg coupling variability during walking and running but not in individuals with functional ankle instability following a 4 wk balance re-training intervention. *Neuromuscular changes not laxity* McKeon et al 09
- Relationship between the hindfoot and tibia was more out-of-phase in the strike phase than the rest of stance in a group of runners. Hamill et al 99
- Proximal strengthening altered LE loading and reduced hindfoot eversion in 6 wks *Snyder et al 09*

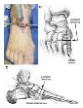
Cuboid Whip/Mob hand positioning

Vector ~ 45º Dorsal-Lateral

Commonly subluxated following lateral ankle sprain and enhanced Fibularis Longus strength following manipulation
Leerar 01, Mooney 94, Brandes 00

Interventions

- Manual Therapy
- Stretching
- Taping/ Foot Orthoses
- Specific functional exercises
- Patient Education/ Coaching/Prevention/Gait technique training
- Surgical? Midfoot Instability: Radiograhic talometatarsal angle greater than 15 degrees or 2mm displacement requires surgical intervention Myerson et al 86



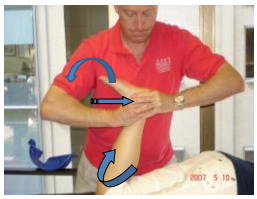
Lateral Subtalar Glides

Increase STJ eversion

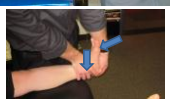
Manual Therapy

Increase Dorsiflexion

DF Functional Mob



Posterior Talar Glide



Evidence for Anti-Pronation Taping

Changes foot and leg posture

- Increase in navicular height
- Reduced LE internal rotation
- Reduction in calcaneal eversion
- Alteration in plantar pressure (med to lat)
- 5% increase in longitudinal arch height during jogging to 33% change in calcaneal eversion during walking

Reduction in pain

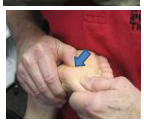
- 20% immediately following application in individuals with plantar fasciitis
- 5-20% 1-7 days following application in individuals with heel pain
- Reduction in peak tibialis posterior and tibialis anterior EMG activity, 45% and 24% respectively.

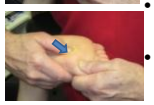
Franettovich 2008

[29 articles were identified]

Sesamoid Mobs

Interactive Foot and Ankle 2 © 2001 Primal Pictures Ltd





- Hallux held in ~20º DF (variable)
- Proximal- Distal Glides
- Medial and Lateral Sesamoid glides
- Plantar flex 1st MT
- Orient 1st MT- Rotation?
- Forefoot supinated?

Tape effects

+

- Normalizes LE kinematics including foot position
- Alters kinetics including muscular efficiency, joint stiffness and stability
- Enhances proprioceptive function
- Reduces PAIN
- Treatment Directed Test prior to foot orthoses

-

- Tape loses effectiveness in 10-30 minutes? Ator 91, Radford et al 06
- Mechanical properties of tape varies
- Skin irritation/allergies
- High-dye taping more effective than low-dye in controlling pronation

Vicenzino et al 05, **Franettovich 2008** [29 articles were identified], Alt et al 99, You et al 04, Ator91, Radford et al 06, Keenan 01, Cheung et al 11, Kelly et al 10, Bragg et al 02

Stretching

Stretching does not prevent running injuries Fields et al 10

BUT Stretch:

- to Improve Movement Patterns, Prepare for Running
- **Dynamic Stretch before** workout
  - To increase force, power
  - Facilitating stabilizing muscles
- **Static Stretch after** workout
  - To increase elasticity, flexibility, mobility especially Gastroc-Soleus

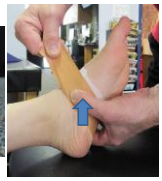
Heel Pad Unloading

Lateral to Medial overlapping strips

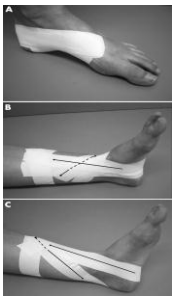
Close with heel horseshoe

Navicular Lift/Tab



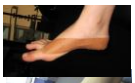


Calcaneal Sling, Reverse 6, High-Dye Taping



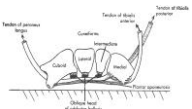
Vicenzino et al 05

Augmented Low-Dye




Navicular Sling Taping: Low-Dye





Variable direction of over-hang strip for Cuboid or Navicular bias

Form a sling from under Navicular and Cuboid and LIFT

Leave an over-hang strip

Join both sides over Navicular

Lift medial arch

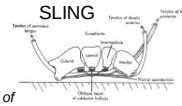
Sesamoid Taping



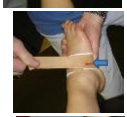
- Lesser MTP instability treated nonoperatively, using functional taping, shoe modifications, and injections. Peck et al 12

Cuboid Sling Taping: Low-Dye

SLING



Variable direction of over-hang strip for Cuboid or Navicular bias


Form a sling from under Navicular and Cuboid and LIFT

Leave an over-hang strip and join over Cuboid

Lift Cuboid as you pull tape over top of foot medially

Foot Orthoses

+	-
• May control LE coupling • Alters kinetics and muscular activation • Reduces injuries in runners • Reduces impact forces and relative velocity of foot and ankle joints • Total contact orthoses are more effective?	• Subtalar Neutral is a Myth • Static position is not related to dynamic function • Does not affect kinematics significantly

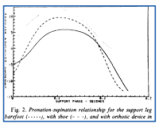
Nigg et al 01, Hirschmüller A et al 11, Mundermann A et al 03, Fields et al 10, Mattila et al 2011, Baur et al 2011, MacLean et al 10, Kelly et al 2011, Nawoczenski DA et al 95, Mundermann A et al 03, Mills et al 10, Cornwall and McPoil et al 99


Which type of shoe?

Motion control shoes

- ↓ force at the foot Cheung & Ng 08
- Delayed fatigue to VMO Cheung & Ng 09
- Delayed fatigue to tib ant and peroneus long Cheung & Ng 10

NO DATA DEMONSTRATES THAT MOTION CONTROL SHOES DECREASE INJURY

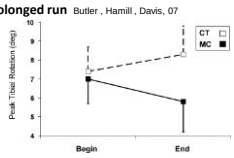


Neutral or cushion shoes

- Decrease midsole hardness
- ↓ vertical loading rates
- ↓ peak pressures
- ↓ impact shock

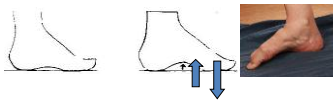
Butler et al 06, 07, Clarke et al 83, De Wit et al 95, Milani et al 99; Wegener 08

The effect of motion control (MC) and cushioning (CT) shoes on peak tibial rotation in low arched runners during a prolonged run Butler , Hamill , Davis, 07



Functional Exercises

Forefoot Lifts



Foot fists

Towel Flex/Extend

Inward Pivots/Supination/Hip IR

Right foot Involved- Move Left foot

A B

Outward Pivots/Pronation/Hip ER

Left foot Involved- Move Right

A B

Functional Exercises

Impact Phase

- Adequate ankle dorsiflexion
- Eccentric training for specific ankle/foot muscles
- Single limb balance
- Hopping and recovery
- Drop jumps
- Step downs

Propulsion Phase

- Foot Lunge series
- Hopping
- Proximal Stability
- Single limb balance
- Hopping and recovery

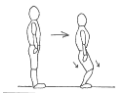
Functional Exercises

Step Down

Wall Nod

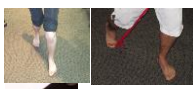
Sitting Soleus

Knee Press

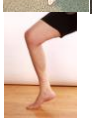


Foot Lunges

Retro Heel Raise



Forward Heel Raise



Foot Lunge with Hip ER Stabilization

Patient Education/Prevention

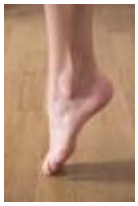
Coaching/Running Technique

- Treadmill running vs over-ground is associated with a lower magnitude of maximum plantar pressure and a lower maximum plantar force at the plantar areas Hong et al 12
- Reduce weekly mileage and carefully progress, especially with prior injury Fields et al 10, Macera 89
- The 10% increase in mileage per week rule is false Buist et al 08
- Reduced overuse running injuries with lower impact forces and a moderately rapid rate of pronation Hreljac et al 00

Pose vs Chi

Forefoot vs Hindfoot Strike

Thank You!



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