Examination and Treatment of the Running Athlete

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Upon completion of this course the participant will be able to:

- Perform an examination of the running athlete
- Identify biomechanical faults and training-related risk factors for running injuries
- Select proper shoewear for the running athlete
- Weigh the pros and cons of orthotics
- Perform taping techniques for biomechanical faults at the foot
- Develop a return to running program

8:00 – 8:20	Introduction / Injury demographics
8:20 – 8:40	Running Gait
8:40 – 9:15	Common Injuries
9:15	Break
9:30 – 9:50	LQ exam
9:50 – 10:15	Exercises for runners
10:15 – 10:30	Taping
10:30	Break
10:45 - 11:05	Shoewear, orthotics
11:05 – 11:15	Video Exam
11:15 – 11:45	Practice video exam
11:45 – 12:00	Wrap-up and Questions/Answers

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Running

- Popular form of exercise
  - 15 million Americans
  - Cross Country: 7th most popular sport
  - 40 year old females
- Why run?
  - Weight control
  - Stress reliever
  - Fitness
  - Social event

My interest in running

- I do/did run
- Biomechanics
- Clientele
  - motivated
  - well-informed
  - obsessive

Injuries

- Estimated that 65% get injured
- High School sports (Rauh 2000)
  - Girl's cross country (#1: 17.3%)
  - Boy's cross country (#5: 10.5%)

Injury Location

(Taunton et al, 2002)

- Knee (42%)
- Foot and ankle (17%)
- Lower leg (13%)
- Hip/pelvis (11%)
- Achilles tendon (6%)
- Upper leg (5%)
- Low back (3%)
- Other (2%)

Gender Differences

- McKean et al, 2004
  - 2886 runners
  - No differences in injury RATE
  - Females – more likely to seek treatment
  - Males – more multiple injuries than females

Gender Differences

- Males
  - Groin
  - Calf / Achilles
- Females
  - Hip
  - ITB
  - 2x more likely to develop PFPS, stress fx

Marathon runners injury risk

(Fredericson & Misra, 2007)

- Rapid increase in weekly mileage
- Training > 40 miles/week
- Previous injury
- Illness two weeks before race
- Alcohol consumption

Master Runners

- Long distance running does not cause knee OA
  - Chakravarty et al. – Radiographs
  - Krampla – MRI
- Lower risk of chronic disease (Kettunen)
- Reduced disability in later life

Master Runners

- Running Kinematics
  - Decreased stride length
  - Increased stride frequency
  - Less knee flexion/extension excursion
  - Greater toe out at heel strike
    - (Fukuchi & Durate)

Master Runners

- Running Kinetics
  - Loss of shock absorbing capacity
    - Optimize cushioning
    - More days off ???

Master Runner

- Injuries
  - Multiple injuries
  - Metatarsalgia
  - Plantar fascia
  - Meniscal injury
  - Foot
  - Achilles

References

- Chakravarty et al. Reduced disability and mortality among aging runners. Arch Intern Med. 2008;168:1638-46
- Chakravarty et al. Long distance running and knee osteoarthritis. AJ Prev Med 2008;35:133-138
- Frecericson M, Misra AK.
- Fukuchi & Durate Comparison of three-dimensional lower extremity running mechanics of young adult and elderly runners. J Sports Sci. 2008;26:1447-1454
- Krampla
- McKean et al. Gender differences in running injuries. Clin J Sports Med 2004;14:337
- Rauh et al. High school cross country running injuries: a longitudinal study. Clin J Sports Med 2000;10:110-6
- Taunton et al. A retrospective case-control analysis of 2002 running injuries. *Br J Sports Med.* 2002; 36:95-101.

Running Gait

- Recreational Walker (>15 min/mi)
- Power Walker (12 – 15 min/mi)
- Fitness Runner (8 – 12 min/mi)
- Competitive Runner (6 – 8 min/mi)
- Elite Runner (<6 min/mi)
- Switch to running at 4.5 mph

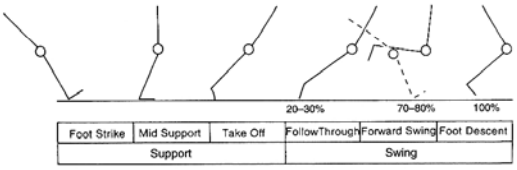
Running Gait

- Not standardized
- Symmetry important
- Requires
  - Single leg stance
  - Power
  - Swing leg

Compared to Walking

- Double float period
- Base of support
- Increased hip motion
- GRF 4 – 7 x BW
- Reduced stance time
  - 0.2 sec. vs. 0.6 sec.


Running Cycle



Contact Phase (38%)

- Foot Strike
  - Heel
  - Midfoot
  - Forefoot
- Rigid foot
- Foot slightly ahead
- Knee flexed

Contact Phase

- Mid-support Phase
  - Foot pronated
  - Hip/knee flexion, IR
  - Dorsiflexion

Contact Phase

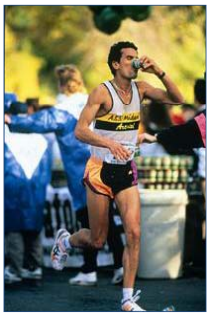
- Take-off
  - Foot supinated
  - Great toe ext
  - Propulsion

Swing Phase (62%)

- Follow-through
  - End of backward momentum

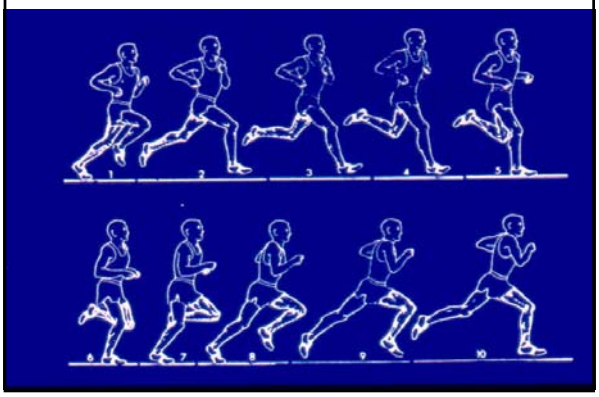
Swing Phase

- Forward Swing
  - Limb drives forward



Swing Phase

- Foot descent
  - Deceleration
  - Limb prepares for foot strike



Running Videos

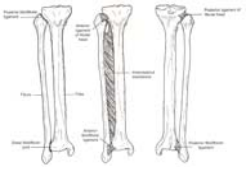
Common Injuries in runners

Injury

- Training errors
  - –Volume
  - –Sudden change in volume
- Shoewear
- Flexibility
- Strength
- Biomechanics

Medial Tibial Stress Syndrome

- Shin splints; Exercise related leg pain
- Bone-stress reaction
  - posterior medial tibia
  - periositis- not primarily



Muscles

- Tearing at muscle-bone interface
  - Posterior Tibialis
  - Soleus
  - Flexor Digitorum Longus

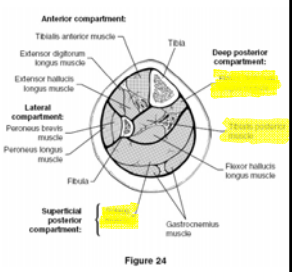
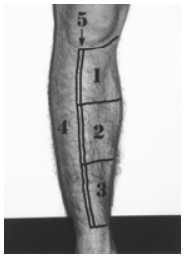


Figure 24

Signs and Symptoms

- Pain/tenderness distal 2/3 tibia
- Pain with running
- Rest improves
- Diffuse tenderness
  - 12 cm proximal
  - 4 cm proximal
  - focal with stress fx



Provocative Tests

- Passive ankle dorsiflexion
- Resisted plantarflexion
- Toe raises
- Jumps

Diagnostics

- Radiographs
- Bone Scans
- MRI

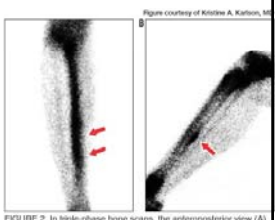


FIGURE 2. In triple-phase bone scans, the anteroposterior view (A) shows the classic longitudinally oriented, diffuse tracer uptake (arrows) that is visible only on delayed-phase images and virtually ensures the diagnosis of medial tibial stress syndrome. A lateral view of a tibial stress fracture (B) appears as a focally intense, fusiform area of tracer uptake (arrow).

Diagnostics

- Compartmental Pressures
  - –Pre-ex (>15 mmHg)
  - –Post-ex- 1min. (. 30 mmHg)

Biomechanical Factors

- Hyperpronation / Velocity
- Hip: increase ER
- Genu Varum
- Dorsiflexion ROM
- Muscle inflexibility

© 1999 Floyd E. Hosmer

Contributing Factors

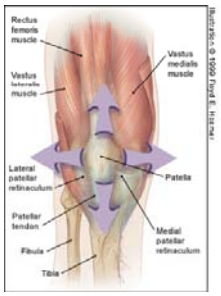
- Repetitive Overload
- Running surface
- Shoe error
- Training error
- Gender
- BMI
- Previous injury

Return to Running

- 50%
- level surfaces
- warm-up
- 10% per week
- duration before intensity

Patellofemoral Pain Syndrome

- Most common complaint
- Repetitive overload
- Mal-tracking
  - Patella
- Proximal influence
- Distal influence

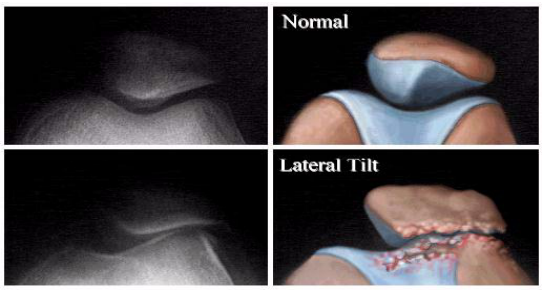


Signs and Symptoms

- Pain and tenderness
- Agg factors:
  - –Squatting
  - –Stair descent
  - –Kneeling
  - –Prolonged sitting
  - –Downhill running

Diagnostic Testing

- Standard X-ray
  - –Standing A/P
  - –Standing lateral in 30 deg flexion
  - –Standing notch view and axial
  - –Bilateral sunrise



PFPS

- Patellar tracking
  - Delayed activation of VMO
- Quadriceps strengthening is important
  - Open chain
  - Closed chain
- Patellar taping

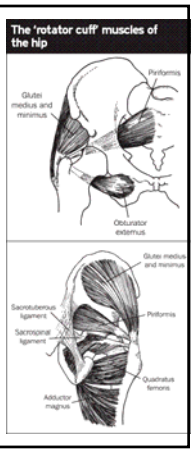
PFPS

- Dynamic Q-angle (Powers, 2003)

Normal Internal Rotation Adduction

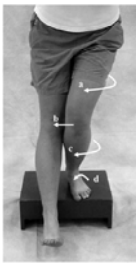
PFPS

- Hip strength
  - Overwhelming evidence
    - Bolgla et al., 2008
    - Willson & Davis, 2009



PFPS

- Distal Influence
  - Foot drives the LE (Tiberio, 1987)
- CPR (Sutlive et al. 2004)
  - Forefoot valgus ≥ 2°
  - Passive great toe extension ≤ 78°
  - Navicular drop ≤ 3 mm
  - Orthotics (shock attenuation)



PFPS

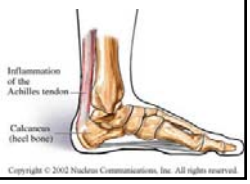
- Treatment Strategy
  - Reduce knee joint loading
  - Strengthen hip
  - Single leg stability

Management

- Orthotics
- Knee sleeves/braces
- Taping

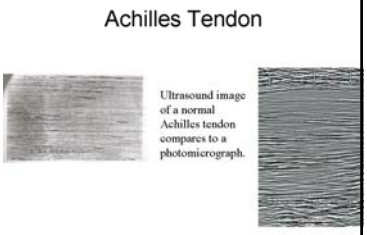
Achilles tendonitis/tendinosis

- Tendonitis – acute
- Tendinosis – chronic
- Signs and Symptoms
  - –Pain
  - –Pain with activity



Diagnostic Testing

- Radiographs
- Dx Ultrasound



Biomechanical Factors

- Overpronation
- Weak Hips
- Ext Rot femur / IR of tibia
- Anteriorly positioned talus

Contributing Factors

- Heel height change
- Training errors (hills)

Management

- Rest
- Ice
- NSAIDS ???

Management

- Alfredson et al., 1998
  - eccentric exercise program
    - N = 15
    - mm strength
    - Pain
    - 12 weeks
    - Return to run
    - Control

Figure A: Courtesy of Karim M. Khan, MD, PhD

3 x 15 straight, bent resistance speed

FIGURE A. Calf and leg strengthening exercises may be prescribed. Exercises for calf muscles (1), and for muscles of the thigh (2) are shown.

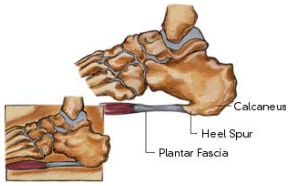
Management

- Soft tissue mobilization
- Cross friction massage
- Orthotics / heel lift

Joint Mobilization

Plantar Fasciopathy

- Main stabilizer of MLA
- Heel pain- medial tubercle
- Calcaneal spur
- R/O stress fx



Plantar Fasciopathy

- Pain with first step
- Subsides with warm-up
- Radiographs

Biomechanical Factors

- Pes planus
- Pes cavus
- Hallux limitus
- Decreased df
- Tight hamstrings

Contributing Factors

- Shoewear
- Training errors
  - Hills
  - Speed
- Body weight
- Standing occupation

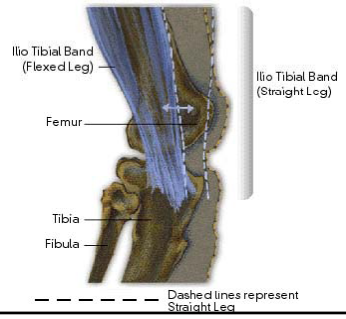
Management

- Modalities: iontophoresis
- Massage
- Stretching
- Orthotics
- Night splints
- Shock wave therapy

Iliotibial Band Syndrome

- 2nd cause of knee pain
- TFL and Glut Max
- Insertion
  - Patella
  - Gerdy's tubercle
  - Fibular head

Dynamic Anatomy



Impingement zone
20 – 30 deg flexion

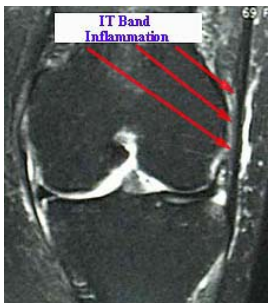
Signs and Symptoms

- Pain: LFC
- Agg factors
  - –Impingement zone
- Noble Compression test

Noble Compression test

Diagnostics

- MRI



Biomechanical Factors

- Prominent LFC
- Weak hip abductors
- ITB tightness
- Genu varum
- LLD

Iliotibial Band Syndrome

- Ferber et al, 2010
  - 35 ITB and 35 controls
  - 3-d kinematics
  - Greater peak knee IR, peak hip add, limited STJ eversion
  - Increase stress to ITB

Contributing Factors

- Training errors
  - –Flexed gait
  - –Overstriding

Management

- Relative rest, ice
- Steroid injection
- US, friction massage

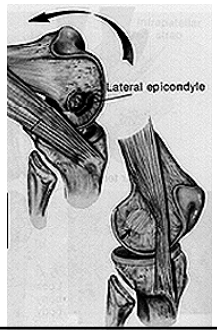
Management

- Strengthen
  - –Glut Med
  - –Hip ER
- Joint Mob
  - –Sup tib-fib
  - –STJ eversion
- Cho-pat bracing

Iliotibial Band Syndrome

- Running
  - Avoid downhill running
  - Avoid banked surfaces
  - Start with sprints
    - Greater flex angle

Surgery



Thank You!

Lower Quarter Exam

The Exam

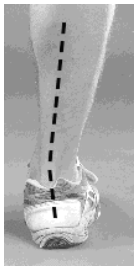
- Lumbar spine – motion
- LE ROM, strength
- Muscle length tests
- Present items beyond normal exam

MTP extension

- 60 – 70 degrees in terminal stance
- Hip extension
- Windlass mechanism

Standing Calcaneal Position

-Bisect tibia
-Bisect calcaneus
-Angle



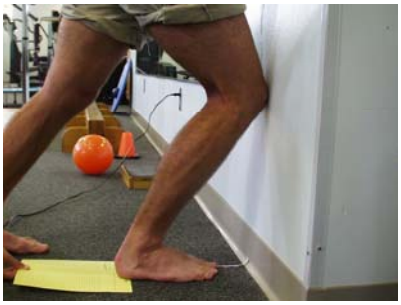
Navicular Drop Test

Treatment Direction Test

- Treatment Direction Test (Vicenzino)
  - determine aggravating factor
  - observe foot during aggravating activity
  - apply tape and check activity for improvement of pain

Soleus length test

- Standing
- 10 cm



Single leg stance

- Extend arms overhead
- Hold, close eyes – 10 seconds

Single leg squat

- Balance
- Calcaneus should evert
- Frontal Plane Projection Angle (FPPA)
  - FPPA strongly associated with hip ER/abd strength
  - Associated with PFPS
    - (Willson et al)

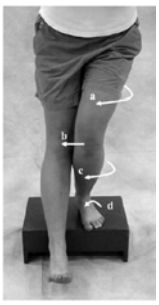
Single leg squat

Step-ups

- Single leg activity, concentric

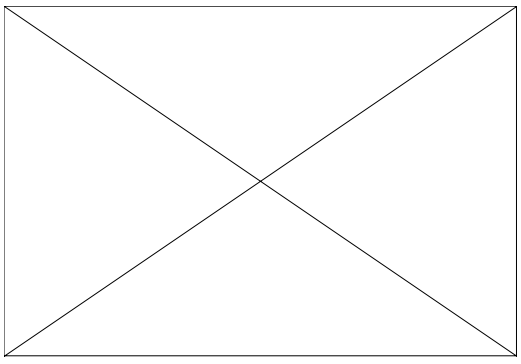
Step-down

- Hip
- Knee
- Tibia
- Foot



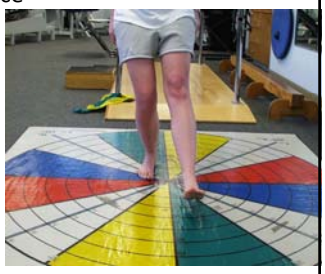
Single leg hop test

- Ability to stabilize on one leg
- Watch landing strategy (pelvis, hip, knee)



Star excursion balance test

- Side to side difference

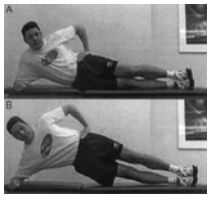


Plank test

- Prone
- Core mm: abdominals, multifidus
- Timed test (60 sec)
- Look for drop, scapulae, lumbar spine

Side plank test

- Side (right vs. left)
- Glut med, abdominals
- Hold for specified time (30 – 60 sec)
- Look for hip drop



Functional Movement Screen

- Screen to identify potential injury-inducing faulty movement patterns
- Developed by Gray Cook, PT
- Not just quantity, but quality
- Objective measure to use as an Asterisks (*)

OH Deep Squat

-Heels on floor
-Head/chest
-Dowel overhead
-Df, flex knee/hip
-Ext t-spine
-Flex/abd shlds
-Shifting (frontal)

In-line Lunge

-Line on floor
-Dowel rod
-Step-out to mark
-Back knee touches
-SLS stability
-Step-leg mobility
-Balance

Active SLR

-Lying supine
-Arms anatomical
-Dorsiflexion
-Dynamic ham flexibility
-Hip mobility
-Lower abdominal

Hurdle Step

-Tibial tuberosity
-Step-over
-Touch with heel
-SLS stability
-Step leg mobility
-Balance

Cadence

- 160- 190 steps/min
- Use metronome to train

References

- Cook G. Athletic Body in Balance. Champaign, Il: Human Kinetics, 2003.
- Vicenzino B. Foot orthotics in the treatment of lower limb conditions: a musculoskeletal physiotherapy perspective. *Man. Ther* 2004; 9:185-196.

Exercises and Training Considerations

Areas consistently weak

- Gluts
- Abdominals
- Quadriceps
- Foot intrinsics

Strength

- Build stable foundation
  - Core stability
  - Prevent frontal/transverse plane instability
- Sport specific movements
  - Single leg activities
  - Plyometrics

NWB Glut Med

- Clams
  - Moderate EMG: glut med
- Hip abduction

NWB: Glut Max

- Prone hip extension with knee bent
- Quadruped hip extension

NWB Core

- Deep core

Core

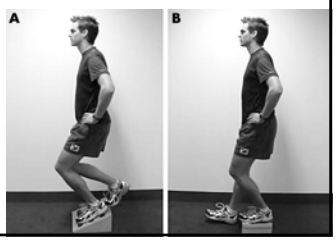
- Planks
- Bridging

Core (advanced)

- Leg curls on physioball

Quadriceps

- Decline squats
- Step down



WB hip exercises (bilateral)

- Squats
- Lunges


WB Core


WB- single leg

- Unilateral wall squat (G max)
- Forward step-ups



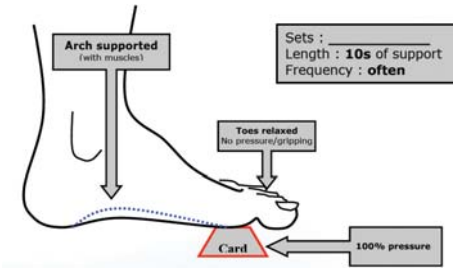
Frontal plane stability

- Hip hiker
- Lateral band walks

Transverse plane stability

- Single limb deadlift
- Lunge with rotation

Intrinsic foot exercise



Sport Specific

- Sagittal plane with reciprocal arm and legs

Plyometrics

- Decreased knee add moments by 50%
- Decreased peak landing forces by 22%
  (Hewett)

Plyometrics

- Forward hops
- Bounding
- Step hops

Areas consistently tight

- Calf muscles
- ITB
- Hamstrings
- Rectus femoris
- Hip flexors
- Piriformis

Stretching

- Consider dynamic stretching
- Specific biomechanical fault
  - Static stretching

ITB stretching

Dynamic stretching

Running Guidelines

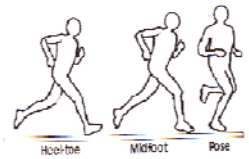
- Training considerations
  - Very strong evidence that links running volume and injury
  - > 40 miles/week (Macera et al, 1989)
  - Be careful with sudden changes
    - Intervals
    - Hills

Running Mechanics

- Increase cadence (180 steps/min)
  - Allows for mid-foot striking, less braking
  - Metronome
- Decrease stride length (uphill running)
- Increase knee ROM during swing phase
  - Decreases moment arm
- Emphasize push-off with each step
  - Gluts, hams – helps to keep foot contact

Pose Running (ff running)

- Shorter stride length
- Smaller vertical oscillation
- Lower eccentric work at the knee



Return to Running

- To decrease impact
  - Treadmill at 3% incline
- Increase no more than 10% week
- Increase duration before intensity
- Warm-up
- Example in handout

TAPING

Goals of taping

- Stabilize
- Inhibit
- Facilitate
- What type of tape

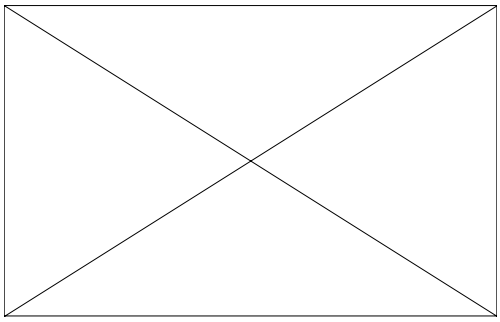
Tape Application

- Clean area
- Trim hair
- Inspect area, use spray adhesive
- Question subject about allergies
- Leukotape can get wet, White tape = no
- Remove tape slowly

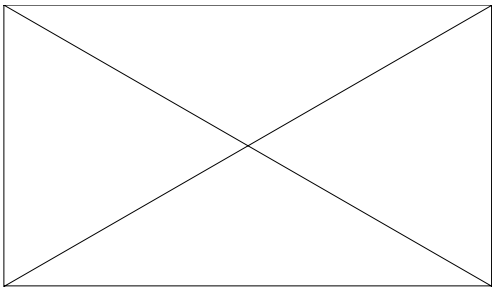
Low Dye Taping

- Used to support MLA
- Helpful for over-pronators
- One-inch tape white tape

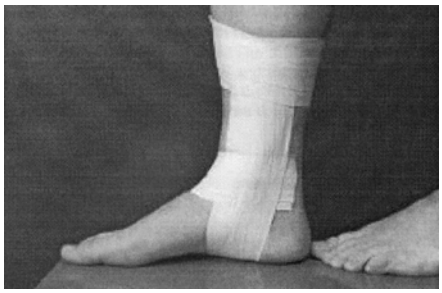
Low Dye Taping



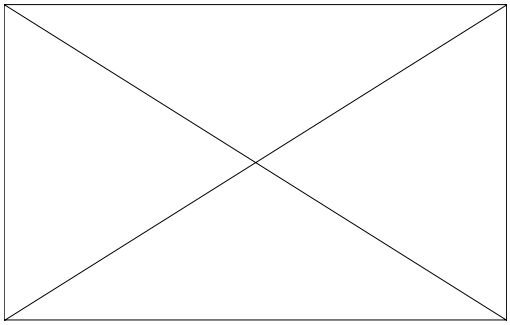
Low Dye with Leukotape



Reverse 6 antipronation taping



Reverse 6 taping



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Shoewear

- Purpose
  - Protect the foot
  - Support the foot
  - Add shock absorption ???
  - Traction

Shoe Features

- Good to have basic understanding
- Ever-changing
- Running store - expert

Last – shape of shoe

- Straight: min to no ff add
- Semi-curved: slight ff add
- Curved: significant ff add

Last construction

- Full board: most stable
- Combo: ½ board, ½ slip
- California: peripheral slip
- Banana: central slip, most mobile

Outsole

- Blown rubber
  - Lighter, less durable
- Carbon rubber
  - Typically in rearfoot
- Adds traction
- Separation of rearfoot and forefoot

Midsole

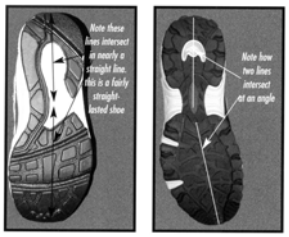
- Ethyl Vinyl Acetate (EVA)
  - Light, compressible
- Polyurethane
  - Dense, heavier
  - Better durability
- Shock absorption
- Rearfoot control

Shoe Types

- Cushion
- Stability
- Motion Control
- Minimalist

Shoewear

Pes Planus
- stability
- motion control



Pes Cavus
- shock absorbing

Minimalist Shoes

- Allows for active foot
- Protection of foot
- Need to ease into shoe

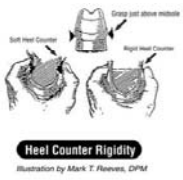
Shoe recommendation

- Arch height is not a good predictor of shoe type selection
  - Knapik et al, 2009
- Let comfort dictate shoe selection

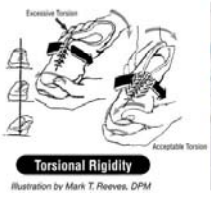
Shoe Analysis

- Sole wear - reflects abrasion, not motion
- Heel counter
- Toe box

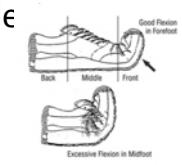
Heel Counter



Rigidity



Fle



Shoewear

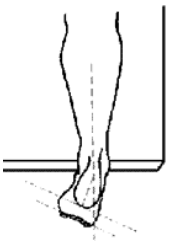
- Dependent on bodyweight
- 300 – 500 miles
- Alternate shoes
- Storing
- Ages on shelf

Barefoot Running

- Latest fade
- Anecdotal – less injury ???
  - Achilles, plantar fascia
- Little research
- Eliminates heel strike
- Increased pre-activation of triceps surae

What about orthotics?

- Root method and subtalar joint neutral

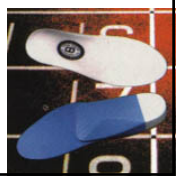


Tissue stress model

- Orthotic is temporary
- Rest tissue
- Motion control
- Shock attenuation

Orthotics

- Evidence to show they are beneficial
  - Knee pain
    - MacLean et al., 2006
  - Shin splints
    - Loudon & Dolphino, 2010
  - Achilles tendon
  - Primary overuse incidence
    - Collins et al, 2007



Orthotics

- No benefit
  - Nawoczenski et al,1995
- No difference between custom vs. off-the-shelf
  - Davis et al, 2008

Orthotic Prescription

- Try taping first
- Off-the-shelf
- Pronator vs. supinator
- Custom-made orthotics

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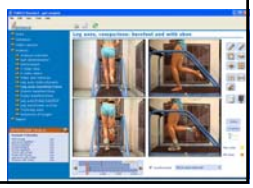
- Knapik et al. Injury reduction effectiveness of selecting running shoes based on plantar shape. *J Strength Cond Research* 2009;23:685- 697.
- MacLean et al., Clin Biomech, 2006, 21:623-620.
- Nawoczenski et al., JOSPT, 1995; 21:317-327.

Video Analysis

- 3-d motion analysis is gold standard
- Kinematic data – special software
- Data needs processing and interpretation
- Not practical in clinic



Clinic Video Analysis

- 2-d is a good option
- Benefits
  - Running is quick
  - Slow motion / freeze frame
  - Measurements
  - Play-back to runner

Video analysis

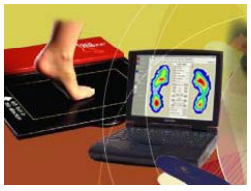
- One component of full exam
- Looking for abnormal movement
- Asymmetrical movements
- Focus treatment

Equipment

- Treadmill
- Digital video camera
- Tripod
- Playback medium (monitor/VCR)
- Software: Dartfish

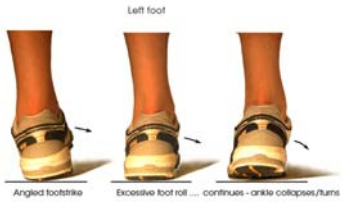
Walk / Running Exam

- Warm-up
- Posterior View
- Lateral View
- Anterior View



Posterior View

- Start top to bottom (or vice-versa)
- Zoom-in on foot
- Wider view



Posterior View

Head motion
Center of Mass
Thoracic spine
Scapular position
Lumbar spine
Pelvis

Posterior View

- Pelvis
- STJ position
- Foot cross midline
- Inc. foot pivot
- Heel strike

Lateral View

Trunk lean
Elbow / hands
Hip extension
Low knees

Lateral View

- Over-striding
- Leg symmetry
- Inc. foot slap
- MTP extension

Anterior View

Head position
C of Mass
Shoulders / arms
Hip rotation

Anterior View

- Knee alignment
- Tibial rotation/varum
- Heel strike
- Outward toeing

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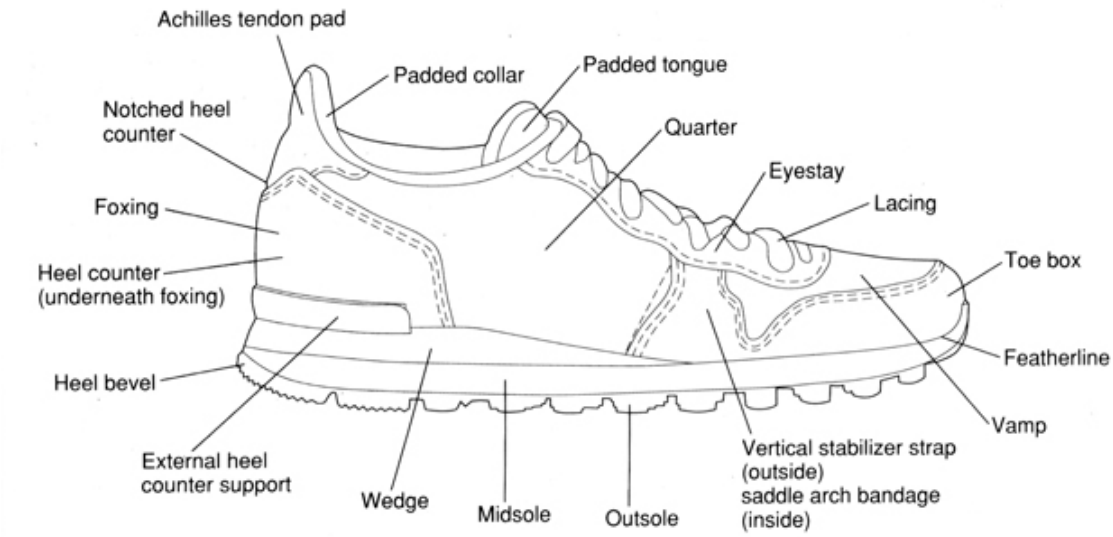
Shoewear



Shoe shape

- Straight
- Semi-curved
- Curved

Shoe construction

- Board last
- Slip last
- Combination last

Midsole- layer between foot and ground

- Density- single, dual
- Brand patents: Nike: air; Asics: gel; Reebox: Evalite; Brooks: Hydroflow

Outsole- contacts the ground

- Traction
- Protects midsole
- Qualities: durable, flexible, lightweight
- Studs/waffle: cross-country, trail running; ripple: asphalt
- Composition: blown rubber, solid rubber

Midfoot support- device in arch that provides stability

- Asics: Trusstic; Adidas: Torsion bar; Mizuno: Wave

Upper

- Quarters: side
- Vamp: top
- Needs strength, durability, breathability

Heel counter- rigid material surrounding heel, provides rearfoot stability, usually durable plastic

Insole- sock liner, insert

Toe box- depth in toe region

- At least $\frac{1}{4}$ inch extra shoe depth to accommodate for foot swelling

Shoe types

Motion Control	**Stability**	**Cushioned (Shock Absorbing)**
Rigid	Blend of control and cushioning	Lightweight Shock absorbing
Straight last	Semicurved last	Semicurved to curved last
Denser midsole Materials with anti-pronation features	Dual Density Midsoles	Softest midsoles
Board last	Combination last	Slip last

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Return to Running

Slow Progression

Week	Day 1	Day 2	Day 3
1	6 x: walk – 4.5 min run – 0.5 min	6 x: walk – 4.0 min run – 1 min	6 x: walk – 3.5 min run – 1.5 min
2	6 x: walk – 3 min run – 2 min	6 x: walk – 2.5 min run – 2.5 min	6 x: walk – 2 min run – 3 min
3	6 x: walk – 1.5 min run – 3.5 min	6 x: walk – 1 min run – 4 min	6 x: walk – 0.5 min run – 4.5 min
4	Run – 30 min	Run – 30 min	Run – 30 min

After four weeks, resume a gradual transition back to continuous running. Follow the 10% rule for intensity and duration.

(Adapted from Johnston et al. *Can Fam Physician* 2003; 49:1101-1109)

Quicker Progression

Week	Day 1	Day 2	Day 3	Total
1	2 x (5 min run/5 min walk)	2 x (5 min run/5 min walk)	2 x (5 min run/5 min walk)	30 min
2	2 x (7.5 min run/ 5 min walk)	2 x (7.5 min run/ 5 min walk)	2 x (7.5 min run/ 5 min walk)	45 min
3	2 x (10 min run/ 5 min walk)	2 x (10 min run/5 min walk)	2 x (10 min run/ 5 min walk)	60 min
4	2 x (12.5 min run/ 5 min walk)	2 x (12.5 min run/ 5 min walk)	2 x (12.5 min run/ 5 min walk)	75 min
5	2 x (15 min run/ 5 min walk)	2 x (15 min run/ 5 min walk)	2 x (15 min run/ 5 min walk)	90 min
6	2 x (17.5 min run/ 5 min walk)	2 x (17.5 min run/ 5 min walk)	2 x (17.5 min run/ 5 min walk)	105 min

(From Gunderson Lutheran Sports Medicine)

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TREADMILL RUNNING ASSESSMENT

Name_____ Tape # _____ Date_____

Footwear_____Orthotics_____

Treadmill speed:_____ Incline: _____

FRONT

- ❑ head position (high manubrium)_____
- ❑ center of mass (vertical) _____
- ❑ shoulders (level)_____
- ❑ arms cross midline_____
- ❑ excessive hip rotation (inc fem rot)_____
- ❑ knee alignment(varus/valgus)_____
- ❑ tibial rotation_____
- ❑ heel strike: heel_____ mid_____ forefoot_____
- ❑ outward toeing_____

SIDE

- ❑ trunk (lean) _____
- ❑ elbow position (80 – 100 degrees)_____
- ❑ tight hands_____
- ❑ proper hip extension (15 - 20 deg)_____
- ❑ low knees (dec hip flex)_____
- ❑ over striding_____
- ❑ asymmetrical leg swing_____
- ❑ increased foot slap_____
- ❑ MTP extension (60 – 70 deg)_____

REAR

- ❑ lateral head motion_____
- ❑ center of mass_____
- ❑ thoracic rotation_____
- ❑ scapular position_____
- ❑ lumbar SB_____
- ❑ lateral pelvic tilt_____
- ❑ pelvic tranverse rot_____
- ❑ pronation/supination_____
- ❑ foot crosses midline (inc hip add)_____
- ❑ increased foot pivot_____

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TREADMILL RUNNING ASSESSMENT

Name_____ Tape # _____ Date_____

Footwear_____Orthotics_____

Treadmill speed:_____ Incline: _____

FRONT

- ❑ head position (high manubrium)_____
- ❑ center of mass (vertical) _____
- ❑ shoulders (level)_____
- ❑ arms cross midline_____
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- ❑ tibial rotation_____
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REAR

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- ❑ center of mass_____
- ❑ thoracic rotation_____
- ❑ scapular position_____
- ❑ lumbar SB_____
- ❑ lateral pelvic tilt_____
- ❑ pelvic tranverse rot_____
- ❑ pronation/supination_____
- ❑ foot crosses midline (inc hip add)_____
- ❑ increased foot pivot_____

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