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Rehabilitation of the Foot and Ankle

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Overview

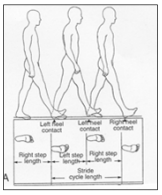
- Basic walk/run biomechanics: traditional
- EBM for 3 diagnosis of overuse foot/ankle injuries: plantar fasciitis, Achilles tendonitis, posterior tibialis tendonitis
- Controversial discussion of minimalistic biomechanics and shoes
- Future directions

How Far Did You Run?

Overuse Foot/Ankle Injuries in Sports

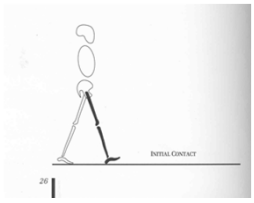
1. Plantar Fasciitis
2. Achilles Tendinitis
3. Tibial Stress Syndrome

Normal Gait



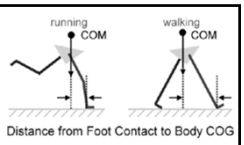
Weight Acceptance @ Initial contact

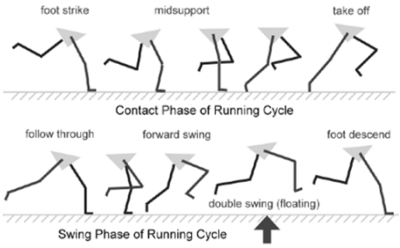
- **Initial contact** **ROM** **Muscle Action**
  - Hip @ 20^0 flexion hip extensors
  - Knee @ 5^0 flexion quadriceps
  - Ankle @ 0^0 tibialis anterior
- **Critical event**
  - **Heel first contact**



Running

- Key ranges of motion





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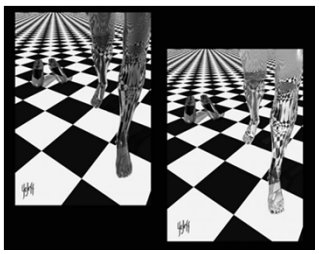
EBM Approach for Foot/Ankle Injuries

- Diagnosis
- Tests and Measurements
- Interventions for physical therapy
- Outcome Instruments

Evidence-Based Practice and Gait Analysis

- Observational
- Video
- 3-D systems
- Pressure plate systems
- Global Positioning System (GPS)



Plantar Fasciitis Diagnosis

- Clinical Assessment
- No gold-standard

Plantar Fasciitis Tests and Measurements

- Tenderness at the medial calcaneal tubercle
- < 10 degrees of ankle dorsiflexion
- < 65 degrees of 1st MTP extension (weak evidence)

Plantar Fasciitis Risk Factors

- Decreased ankle dorsiflexion
- Obesity
- Work-related weight-bearing

Plantar Fasciitis Interventions (Low cost)

- Icing
- Strapping the foot (low dye)
- Calf and plantar fascia stretches
- Avoidance of flat shoes
- Avoidance of barefoot walking
- Use of over-the-counter arch supports
- Heel cushions
- Limitation of extended activities

Low Dye Taping

- Supports rearfoot alignment
- Reinforces plantar fascia
- Lifts and supports medial longitudinal arch

Taping Techniques

- McConnell Patella
- Kinesio Patella
- Ankle Sprain
- Low Dye

Plantar Fasciitis Interventions (Higher Cost)

- Custom orthotics
- Night splints
- Immobilization with casts or other devices

Night Splints

- Keeps plantar fascia on a stretch vs. plantar flexed and shortened
- Dorsal options available. Example: Strasburg sock.

FootMaxx Pressure Plate System

- Patient walks across pressure plate barefooted to capture a dynamic foot print
- Scanning the foot

Scan of Feet

- Pressure points are differentiated with a scale of colors.
- Points of higher impact are indicated in red.
- Gait line is drawn over the print

- Pressure Points

Neutral Foot Slipper Cast

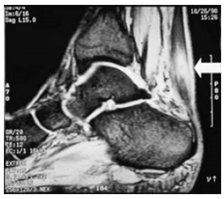
- Cast in subtalar neutral
- Mail neutral cast to lab
- Positive cast made
- Orthotic made from positive mold
- Both returned to clinic and patient

Plantar Fasciitis Outcome Instrument

- American Academy of Orthopedic Surgeons (AAOS) Foot and Ankle questionnaire
- www.aaos.org – Click on “Research”, and “Outcomes” for access to an array of outcomes assessment instruments

Achilles Tendinitis Diagnosis

- Ultrasound: 0.80 sensitivity and 0.49 specificity
- MRI: 0.95 sensitivity and 0.50 specificity
- Clinical assessment may provide yardstick compared to imaging



Achilles Tendinitis Tests and Measurements

- Point tenderness on the tendon
- Localized swelling
- Crepitation during movement

Achilles Tendinitis Risk Factors

- Tight heel cord
- Achilles contractures
- Hyperpronation
- Repetitive heel running
- Change in shoes or running surface
- Increase in intensity or distance
- Hill climbing

Achilles Tendinitis Interventions

- Stretching exercises
- Modification of training schedules
- Braces and insoles
- Questionable role of eccentric versus concentric strengthening (weak evidence)

Achilles Stretches with slant board

- Slant board to keep foot in neutral
- Obtain a negative heel for more aggressive stretch
- Avoids twisting midfoot with edge of step stretches

Achilles Tendinitis Outcome Instrument

- Victorian Institute of Sport Assessment-Achilles questionnaire (VISA-A)
- AAOS Foot and Ankle questionnaire not specific for Achilles tendinitis

Medial Tibial Stress Syndrome Diagnosis

- Bone scan is gold standard: 84% sensitivity and 22% specificity
- MRI: 79% sensitivity and 33% specificity

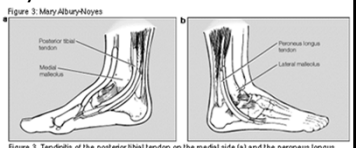
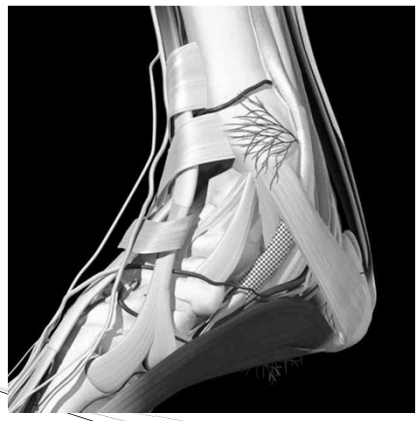


Figure 3. Tendinitis of the posterior tibial tendon on the medial side (a) and the peroneus longus tendon on the lateral side (b) can easily occur in the adult recreational athlete unaccustomed to hours of stress. With inflammation of these tendons, pain and tenderness are usually present along the tendon inferior and distal to the malleolus.

Posterior Tibialis Tendon



Medial Tibial Stress Syndrome Tests and Measurements

- Pain along the posteromedial tibial border, usually in the distal third of tibia

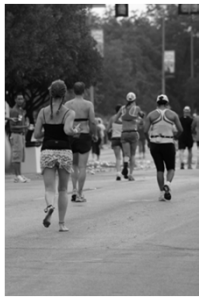
Medial Tibial Stress Syndrome Risk Factors

- Excessive and/or prolonged pronation
- Recent changes in:
  - Distance
  - Speed
  - Form
  - Stretching
  - Footwear
  - Running surface

Medial Tibial Stress Syndrome Interventions

- Shock-absorbing insoles (best evidence)
- High-Dye and low-Dye taping podiatry study (weak evidence)
- Clinical experience and observational interventions:
  - Motion control shoes, ankle strapping **OR**
  - Minimalistic shoes to strengthen intrinsics and change running biomechanics from rearfoot strike to forefoot strike with less impact forces

Fit Flop – Barefoot Running



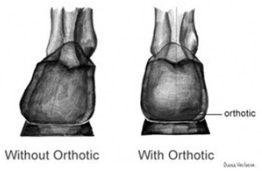
Harvard Website

- http://barefootrunning.fas.harvard.edu/

How Should We Run?

Orthotics

- Alter rearfoot alignment
- Decrease stretch on posterior tibialis in over-pronators



Medial Tibial Stress Syndrome Outcome Instrument

- AAOS Foot and Ankle questionnaire
  - Includes Shoe Comfort Scale
  - Population groups are not identical

Run video Research 2010

- > 95% were rearfoot strikers

Run video research 2010.wmv

AA Pilot Investigation to Assess Running Styles and Shoe Preference in a Cohort Marathon Runners Runners

n to Assess Running Styles and Shoe Preference in a Cohort of Marathon Runners

Sarah Idriss, Iesna Juarez, Tiffany Reid, Jennifer Seay, Jacqueline Smith, Julianne Stafford
UT Health Science Center at San Antonio Department of Physical Therapy

PURPOSE

The purpose of this pilot study was to describe the incidence of different running styles (forefoot, midfoot, rearfoot landing) among a group of recreational runners training for a half and full marathon. Through an extensive review of literature, no investigations with normative values were found related to this topic. This preliminary investigation was undertaken to add to the body of knowledge related to running styles and shoe characteristics (shoe age and shoe changes) during training and incidence of injury. It is anticipated that results from this investigation will lead to future research related to biomechanical assessments of running styles, and identification of relevant variables that may contribute to incidence of injury and injury prevention in the recreational runner population.

SUBJECTS

439 runners ranging in age from 18-65 years were filmed within this investigation, however, not all runners completed the required questionnaires. A smaller cohort comprised the second sample of runners (75% female, 27% male) who completed the questionnaire (n=56). Recruitment was done during the initial meetings for marathon training sessions sponsored by a local running store.

METHODS

During the first 3 training sessions runners were filmed and asked to complete an initial questionnaire regarding age, gender, current injuries and shoe age. Initial analysis will provide proportional values for running style. Each participant was provided with an identifying number which was written with a grease pencil on their lower extremities in accordance with standard triathlon racing procedures. Instructions were reviewed with all participants about running along cones demarcating the filming zone in order to obtain video of their running style. A 200 meter chute of the training route was marked with red cones and served as the filming area after the first mile. Runners ran along this area and had a posterior and lateral video view taken of their lower extremities with two video cameras positioned along the lateral border and one video camera at the posterior border of the path.

PROCEDURES ORDER

1) Flyers announcing the investigation were placed at a local running store for the third annual USA Fit training regimen.
2) Investigators presented the project at the Introductory Training Session where questions were answered, and consent forms were distributed to interested participants.
3) The "running chute" with cameras for filming, was set prior to the start of the second training session. Filming and questionnaire completion was performed at the initial training session with similar opportunities at the third and fourth training sessions.
4) Participants were reminded to complete subsequent surveys every two months for a total of four surveys completed.

DATA ANALYSIS

Video footage was assessed by two physical therapists experienced in biomechanical analysis of the lower extremity for elite and recreational runners. The zoom and frame capture features of the video footage were used to identify the running style with agreement needed by two investigators. A descriptive analysis was done to begin establishment of normative data from a large cohort or recreational runners. Data that was recorded and summarized to describe this sample included: Running style, age, gender, shoe age, shoe brand and existence of injury.

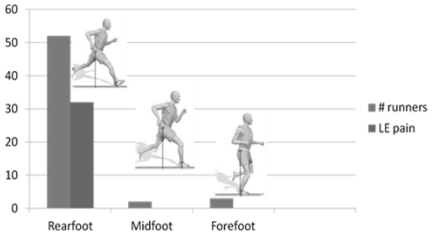
INITIAL RESULTS

Out of 439 recreational runners, video footage demonstrates that 95% were rearfoot strikers (n=417). 2.5% were midfoot strikers (n=11) and 2.5% were forefoot strikers (n=11). Of the 439 runners filmed, 57 completed all four surveys. Assessment of the questionnaires revealed that 32 of 52 rearfoot strikers presented with lower extremity pain. 3 forefoot strikers and 2 midfoot strikers had no lower extremity pain. The majority of runners, 62.5% upon inception of training, had shoes that were less than 6 months old (n=35). The most common shoe brands were Asics and Brooks followed by New Balance and Reebok running shoes.

CLINICAL RELEVANCE

There is a high level of interest and discussion in the current popular culture regarding barefoot running, minimalistic shoes and changing of running styles. Current research is scant with quantification of foot strike patterns done with elite runners only. As clinicians are beginning to work with recreational runners looking to emulate the styles of elite runners, there is a growing need for research regarding running style norms to identify potential for running style injuries. Additionally, identification of related contributory factors to injury such as training errors, prior history of injury and shoe age is equally as important. Though it is possible that attempts to change natural running styles could be contributing to training errors, it is difficult to assess this question without the preliminary normative data and specific variable identification for precise investigation. Successful completion of this preliminary descriptive and future correlational investigation will lead to further randomized controlled trials regarding cause and effect of running styles and potential injury factors.

1st Questionnaire & Video Analysis



Prevalence of running style and injury characterized by the presence of pain

Descriptive Study to Assess the Running Styles, Shoe Preference, and Injury Incidence in a Cohort of Recreational Runners.

Julie Barnett PT, DPT, MSC; Catherine Ortega PT, EdD, ATC; Barry Morgan PT; Manuel Montes SPT; Kaitlyn Warren SPT; Tricia Franks SPT; Kyle Farrell SPT et al.

UT Health Science Center
Department of Physical Therapy

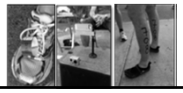
Purpose

Purpose of this study was to gain normative information in a cohort of recreational runners to include:

- incidence of running striking pattern
- prevalence of footwear
- prevalence of LE pain

Subjects

Participants were recruited from two Solers Sports stores during initial training sessions for the 2013 San Antonio Rock 'n' Roll marathon. Age range 25-64 (44); females (57.1%) & males (42.9%); mileage range 6-30mi (18); runners currently experiencing pain 35.7%; shoe types (stability/neutral > cushion and motion control > minimalist)



Methods

Participants were given an identification number and marked with a grease pencil. Video cameras were placed along lateral and posterior borders of the filming chute.

Data Collection

1.Paper flyers announcing the study placed in the stores several weeks prior to the initial data collection.
2.Participants completed initial questionnaire which was re-sent through email every 2 months until the race
3.Participants were videotaped for footstrike pattern and biomechanical analysis

Statistical Analysis

Descriptive analysis was performed for the establishment of normative data for age, gender, shoe type / brand, strike pattern, and injury incidence/existence of injury.

Results

-Out of the 149 participants that completed the initial survey, 14 subjects completed the final survey.
-90 runners attended the running video chute

Clinical Relevance

Majority of individuals filmed during the study were still running in stability shoes (44%) vs cushion shoes (28%). Of those wearing minimalist shoes, the majority still ran with a RFS pattern (60%). Physical therapists should take into consideration BOTH foot strike pattern and shoe type when performing gait analysis.

Vibram -> Neutral -> Motion Control

Barefoot/Minimalistic recommendations

- Body Mass Index (BMI): WNL. Not overweight.
- Neutral lower extremity, (LE) biomechanics
- No prior history of serious LE injuries
- Start with graduated training program: walk, walk/jog, jog schedule
- Consider cross-training with 2 pairs of shoes: minimalistic AND more stability shoe

Barefoot Research: inconclusive outcomes at this time

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