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FOOT & ANKLE EXAM

Dhinu Jayaseelan, DPT, OCS, FAAOMPT
 Slides adapted from Eric Magrum DPT, OCS, FAAOMPT


Orthopaedic Manual Physical Therapy Series
 Charlottesville 2017-2018




Orthopaedic Manual Physical Therapy Series 2017-2018

Subjective Exam

- Body Chart / Intake → differential
 - Broad, inclusive of possible red flags
- Clarify pain location / type
- SINSS
 - Severity
 - Irritability
 - Nature
 - Stage
 - Stability





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Foot and Ankle Ability Measure (FAAM)

- Each item rated 0-4
- Item score totals:
 - ADL subscale (0 to 84)
 - Sports subscale (0 to 32)
- Higher scores represent higher levels of function for each subscale, with 100% representing no dysfunction
- MCID: 8 (ADL) 9 (Sports)

Foot and Ankle Ability Measure (FAAM)
 Authors: Eric Magrum, DPT, OCS, FAAOMPT
 Division of Orthopaedic Surgery, University of Virginia

Item	ADL	Sports
Walking	0	0
Walking on uneven ground	0	0
Walking up hills	0	0
Walking down hills	0	0
Going up stairs	0	0
Going down stairs	0	0
Walking on uneven ground	0	0
Stepping up and down curbs	0	0
Swimming	0	0
Cracking up on uneven terrain	0	0
Walking normally	0	0
Walking on uneven terrain	0	0
Walking approximately 30 minutes	0	0
Walking 15 minutes or longer	0	0



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Lower Extremity Functional Scale (LEFS)


- 20 item questionnaire
- Each item rated 0-4
- Higher scores indicate greater self-reported function
- Valid, reliable, responsive
- MCID: 9 scale points
- MDC: 9 scale points

Instructions

This test is intended to identify limitations you are having with difficulty at all levels the activities listed below. Marked as your lowest level of difficulty for which you are currently having problems. Please provide an answer for each activity.

Marked as your lowest level of difficulty at all levels:

Activities	ADL	Sports
1. Getting your shoes on/off	0	0
2. Getting into or out of the bath	0	0
3. Getting into or out of the car	0	0
4. Walking between rooms	0	0
5. Putting on your shoes or socks	0	0
6. Climbing	0	0
7. Lifting an object, not a bag or a box, from the floor	0	0
8. Performing light activities	0	0
9. Getting into or out of a car	0	0
10. Getting into or out of a car	0	0
11. Walking 2 blocks	0	0
12. Walking 4 blocks	0	0
13. Getting up or down 10 stairs	0	0
14. Climbing 10 stairs	0	0
15. Sitting for 1 hour	0	0
16. Running on uneven ground	0	0
17. Running on uneven ground	0	0
18. Doing some form of exercise	0	0
19. Running	0	0
20. Walking over or on uneven terrain	0	0



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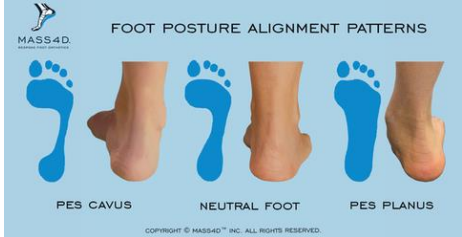
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Observation

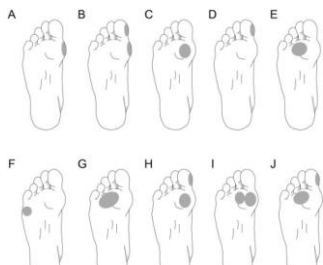


<http://disciple-snow.blogspot.com/2005/10/tyrone-prothro-broken-leg.html>

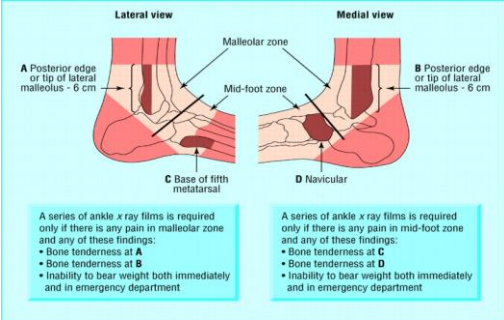
<http://achillesblog.com/kirk/2013/02/17/week-18-calf-strength-and-ankle-stability/>



<https://www.mass4d.com/blog/functional-foot-biomechanics/how-a-bad-foot-posture-causes-misalignments>



Ottawa Ankle & Foot Rules



A series of ankle x ray films is required only if there is any pain in malleolar zone and any of these findings:

- Bone tenderness at A
- Bone tenderness at B
- Inability to bear weight both immediately and in emergency department

A series of ankle x ray films is required only if there is any pain in mid-foot zone and any of these findings:

- Bone tenderness at C
- Bone tenderness at D
- Inability to bear weight both immediately and in emergency department

Ottawa Ankle Rules Interpretation

- **ANKLE** Radiographs should be ordered if a patient complaining of post-traumatic ankle pain has either of the following:
 - Unable to ambulate at least 4 steps (two on the injured ankle) both at the time of injury and in the ED
 - There is point tenderness upon palpation of the tip of distal 6cm of the posterior aspect of either malleolus



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Ottawa Foot Rules Interpretation

- **FOOT** Radiograph is indicated if the patient complains of midfoot pain and has either of the following:
 - Unable to ambulate four steps both at the scene and in the ED
 - There is point tenderness over the proximal 5th metatarsal or the navicular bone



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Diagnosis of Lower-Extremity Deep Vein Thrombosis in Outpatients

A 68-year-old man was referred to your outpatient clinic following a cemented right hip arthroplasty procedure 3 weeks before your examination. He reports that he has had pain in his right calf and thigh since being discharged from the hospital and that these symptoms limit his ability to ambulate. He also reports difficulty getting in and out of bed. You find that he has a swollen right lower extremity and that he complains of pain when you palpate his right posterior calf and knee. You suspect that he may have a deep vein thrombosis (DVT), but you also consider that it is likely that the lower-extremity symptoms are attributable to the recent surgical procedure. Do you contact the patient's physician?

Daniel L. Riddle and Philip S. Wells
PHYS THER. 2004; 84:729-735.



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Special Tests – Homans Sign

- Conventionally used test used to assess DVT
- Passive DF foot when knee is in full extension
- (+) pain in calf potentially suggestive of deep vein thrombosis



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Urbano, Hospital Physician 2001

Problems with Homans' Sign

- Was present in 33% of patients who had a true DVT, also present in 21% of patients without thrombosis
- More common in patients with clinically suspected DVT and (-) venogram than those with clinically suspected DVT and (+) venogram (O'Donnell, 1980)
- Deemed *unreliable, insensitive, non-specific*



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Urbano, Hospital Physician 2001

Risk Factors for Deep Vein Thrombosis

Strong risk factors
 Fracture (pelvis, femur, tibia)
 Hip or knee replacement
 Major general surgery
 Major trauma
 Spinal cord injury

Moderate risk factors
 Arthroscopic knee surgery
 Central venous lines
 Chemotherapy
 Congestive heart or respiratory failure
 Hormone replacement therapy
 Malignancy
 Oral contraceptive therapy
 Cerebrovascular accident
 Pregnancy/postpartum
 Previous venous thromboembolism
 Thrombophilia

Weak risk factors
 Bed rest > 3 days
 Immobility due to sitting (eg, prolonged air travel)
 Increasing age
 Laparoscopic surgery
 Obesity
 Pregnancy/antepartum
 Varicose veins

Category of Condition	Specific Examples
Musculoskeletal	Trauma, hematoma, myositis, tendinitis, Baker's cyst, synovitis, osteoarthritis, osteomyelitis, tumors, fractures
Neurological	Sciatica, lower-limb paralysis
Venous	Phlebitis, postthrombotic syndrome, compressed veins
Arterial	Acute arterial occlusions, aiv fistula
Generalized edema	Cardiogenic, nephrogenic, dysproteinemic
Cutaneous	Dermatitis, cellulitis, lipodema, panniculitis
Localized edema	Pregnancy, oral contraceptive intake, limb immobilization



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Riddle D. PTI 2004

Clinical Finding	Score ^a
Active cancer (within 6 months of diagnosis or palliative care)	1
Paralysis, paresis, or recent plaster immobilization of lower extremity	1
Recently bedridden >3 days or major surgery within 4 weeks of application of clinical decision rule	1
Localized tenderness along distribution of the deep venous system ^b	1
Entire lower-extremity swelling	1
Calf swelling by >3 cm compared with asymptomatic lower extremity ^c	1
Pitting edema (greater in the symptomatic lower extremity)	1
Collateral superficial veins (nonvaricose)	1
Alternative diagnosis as likely or greater than that of deep vein thrombosis ^d	-2

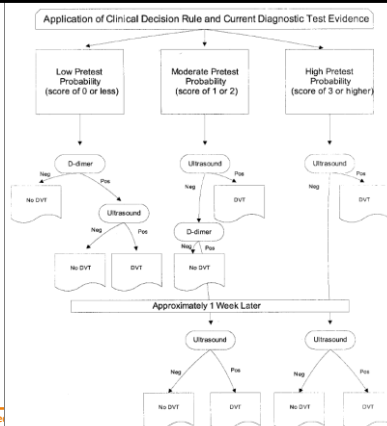
Score Interpretation:
 ≤0 = low probability of PDVT (3%)
 1-2 = moderate probability of PDVT (17%)
 ≥3 = high probability of PDVT (75%)



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Riddle D. PTI 2004



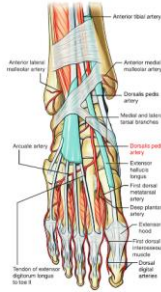
Orthopaedic

www.vompti.com

Riddle D. PTI 2004

Neurovascular Screen

- Pulses
 - Posterior Tibialis
 - Dorsalis Pedis
- DTRs
 - Achilles (S1)
- Pathologic Reflexes
 - Babinski
 - Clonus
 - Oppenheim
- Sensation testing
 - Monofilaments (5.07 Semmes = 10g)
 - Protective sensation 4 sites (great toe, 1st, 3rd, 5th met heads)
 - 94% Sn for abnormality (Smieja 1999)
 - Light touch
 - Sharp/dull discrimination



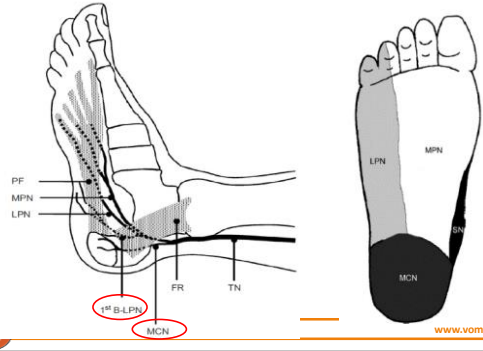
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<https://www.cartlab.com/anatomy/arteries-of-the-foot/#content-dorsum-of-the-foot>

A review of plantar heel pain of neural origin: Differential diagnosis and management

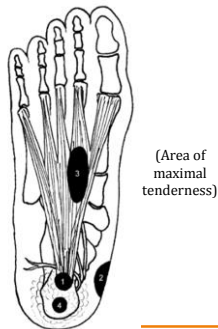
Manual Therapy 13 (2008) 103-111



www.vompti.com

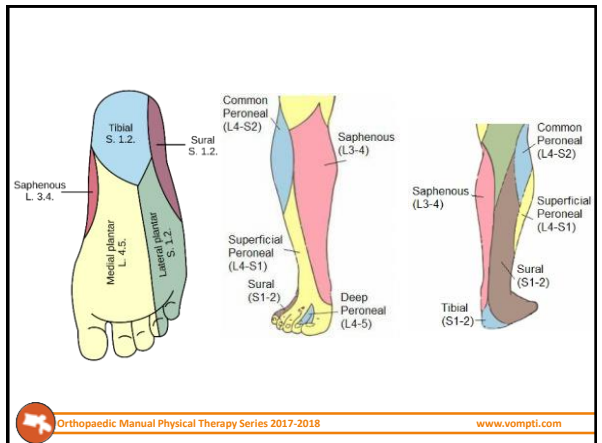
All Heel Pain is NOT Plantar Fasciitis

- 1 – Insertional plantar fasciitis
- 2 – Entrapment of 1st branch Lateral Plantar nerve
- 3 – Plantar fasciitis
- 4 – Fat Pad atrophy



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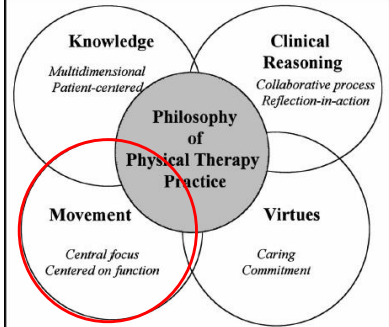
Observational Gait Assessment hudl



- Treadmill – views anterior; posterior, bilaterally
- Video - 30 seconds each view
- Assess large deviations
- Segment by segment (Foot/ankle, knee, hip, pelvic, trunk)
- Phase by phase (IC, LR, MST, TSt, PSw, ISw, MSw, TSw)
- Use forms – Framework until efficient (Rancho/USC)




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Expert Practice in Physical Therapy Jensen GM PT 2000






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Functional Biomechanical Screen


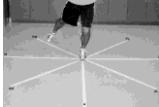

- Neuromuscular control may be the *most modifiable* risk factor for injury prevention
- NM Re-education programs
 - Successful at reducing injury/improving function
 - LQ Alignment
 - Shock Absorption
 - Balance
 - Stability
 - Muscle recruitment






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Functional Tests

- Progressively load the Kinetic Chain
 - Simple
 - Time efficient
 - Minimal equipment
 - Reproducible
- Dynamic/Functional
 - Simple
 - Time efficient
 - Minimal equipment
 - Reproducible

- Keys for further eval
- Compensations
- "Cause of the problem"
- Pattern recognition
- Guide treatment/ Exercise Prescription
 - Plane of mvt dysfxn
 - Proximal >Distal
 - Distal > Proximal


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Functional Biomechanical Screen

- Bilateral squat
- Single leg squat
- Step down test
- Swing leg drop test
- SEBT / Y Balance
- Observational gait analysis (walk, run)
- Tibial alignment
- Single limb stance
- PF/DF (bilat, unilat)
- Pronation / supination
- Navicular drop
- STJ neutral, relaxed, calcaneal stance

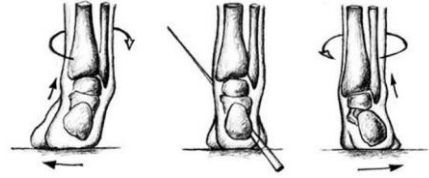
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Active Pronation/Supination



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- Standing Palpate medial and lateral talar head
 - Pronate - medial aspect talar head prominent
 - Supinate - lateral aspect talar head prominent
- Find symmetrical/congruent position
- Position to asses/measure relationships
- NOT position of the foot at mid stance
- NO functional significance

STJ Neutral Assessment

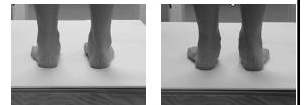


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Standing Rear Foot Assessment

- Assess Tibial Alignment
 - Normal 2-4 deg of Varum
- Asses Subtalar Neutral Position (STJn)
- Assess Relaxed Calcaneal Stance Position (RCSP)
- Calculate Functional Subtalar Excursion
 - STJn - RCSP
 - Normal 4-6 deg STJ EVR



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Navicular Drop Test – Mid Foot Mobility

- STJ neutral to Relaxed Calcaneal Stance
- Mark Navicular Tuberosity
- Mark location of Tuberosity on card in standing STJn to RCS
- (+) for “hyperpronation” if navicular drop >10 mm



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Differences in Static and Dynamic Measures in Evaluation of Talonavicular Mobility in Gait

JAY M. DICHARRY, MPT¹ • JASON R. FRANZ, MS² • UGO DELLA CROCE, PhD³
ROBERT P. WILDER, MD⁴ • PATRICK O. RILEY, PhD⁵ • D. CASEY KERRIGAN, MD, MS⁶

- Static measures of Navicular Drop not predictive of dynamic function
- STJn Navicular Drop: Over estimated dynamic mvt
- Functional Navicular Drop : Under estimated dynamic mvt

AUGUST 2009 | VOLUME 39 | NUMBER 8 | JOURNAL OF ORTHOPAEDIC & SPORTS PHYSICAL THERAPY



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Bilateral Heel Raise

- Ankle PF and Calcaneal Inversion
- MTP DF
 - WB 1st > 5th
- Equal height?
- Assess Post Tibial Tendon Dysfunction
- Unilaterally is MMT for Gastroc/Soleus



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Plantar flexion MMT – Gastroc/Soleus (S1/2 Myotomal)

- Standing > Supine
- Eliminate effect of small lever arm in NWB
- 25 single-limb heel raises, with knee extension, are normal strength in adult



The Standing Heel-Rise Test for Ankle Plantar Flexion: Criterion for Normal
Brenda Rae Lunsford and Jacquelin Perry
PHYS THER. 1995; 75:694-698.



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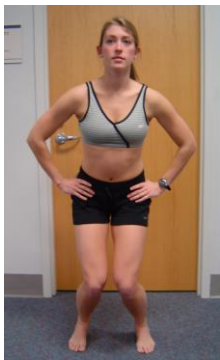
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Bilateral Squat

Dysfunction:

Sagittal plane stiffness

- Early heel rise
- Foot External rotation/STJ pronation
- Fem Int Rotation



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Weight Bearing Dorsiflexion ROM

- Inclinometer placed at tibial tuberosity
- Patient lunges forward
 - Heel remains in contact with the ground
- Normal values 30-50°
- Good reliability: ICC= .95-.99



Denegar 2002; Vicenzino 2006



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Single Leg Balance/Stance

- Length of time maintained
- Stability patterns
 - Lateral shift?
 - Hip/knee lumbar hyperextension
 - TC position sagittal plane
 - Lumbopelvic position/activity
 - Hip Strategy: Glut medius stability
 - Ankle strategy
 - First Ray stability
- Challenge more with eyes closed, unstable surface, alter head position (cervical rotation)



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Single Leg Stance

Dysfunction:

- Varus Knee
- Lateral Column loading
- Poor First Ray stability



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Single Leg Squat

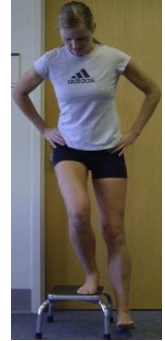
- Progressively increase dynamic load to kinetic chain
- Increased TC stability with DF
- ? Decr Proximal stability with LOB
- ? Decr TC mobility resultant STJ frontal plane mobility loss
- ? Decr Midtarsal transverse plane mobility loss
- Medial column versus Lateral column stability



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Step Down Test

- Continue to progressively load kinetic chain
- Additional TC sagittal plane mobility
- Eccentric quad strength
- Proximal stability – hip versus trunk



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Hop Test

- (+) Stress Fracture screen
- Asses Landing/loading mechanics
 - Landing pattern – fore/mid/rearfoot
 - Ankle/TC flexion
 - Decr Compliance/ Shock Absorption
 - Amount of mobility
 - Eccentric control
 - STJ/Midfoot/Forefoot



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Swing Test

Eric Magrum, DPT, OCS, FAAOMPT

PEARLS OF PRACTICE ■



Athletic Training & Sports Health Care | Vol. 2 ■ No. 5 ■ 2010



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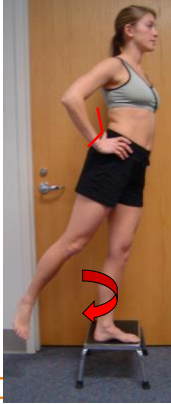
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Swing Test

Dysfunction (stance limb):


Transverse plane

Excessive Lumbopelvic rotation (swing)
 Resultant Stance
 STJ pronation
 Fem IR



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Star Excursion (Y) Balance Test



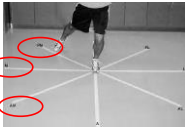
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Simplifying the Star Excursion Balance Test: Analyses of Subjects With and Without Chronic Ankle Instability

J Orthop Sports Phys Ther • Volume 36 • Number 3 • March 2006

CONCLUSION

Performance of all 8 reach directions of the SEBT is likely unnecessary when evaluating for functional deficits related to CAI because of considerable redundancy among the reach directions. The PM reach direction distances were most strongly associated with the performance of all the reach directions in subjects with and without CAI. However, the **PM, AM, and MD** directions were all able to identify statistically significant differences between limbs with and without CAI.



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Using the Star Excursion Balance Test to Assess Dynamic Postural-Control Deficits and Outcomes in Lower Extremity Injury: A Literature and Systematic Review

- Reliable, Valid tool
- Responsive to change
- Pre participation tool:
 - Identify risk
 - > 4 cm difference predictive LE injury
- Return to Sport Tool
 - Marker of improved NM control following injury-rehab
- EMG Differences:
 - Vastus Med > Anterior
 - Vastus Lat < Lateral
 - Medial HS > Ant/Lateral
 - Biceps Fem > Post, Post/Lat
- Kinematic Differences:
 - CAI: Sagittal plane
 - Hip, Knee, Ankle

Journal of Athletic Training 2012;47(3):339-357

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Functional Biomechanical Screen

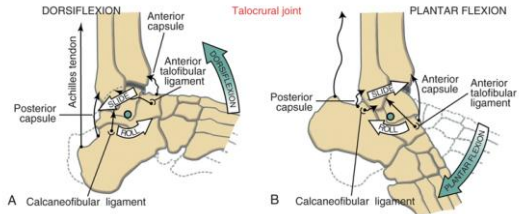
- Bilateral squat
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Weekend 4



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DF: Anterior roll, Posterior slide PF: Posterior roll, Anterior slide

Neumann, 2016



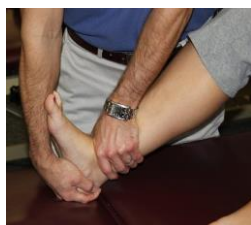
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PROM with Overpressure Dorsiflexion



DF with Knee Extended



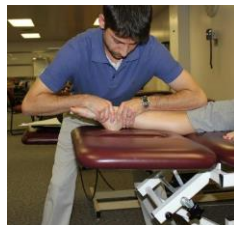
DF with Knee Flexed



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PROM with Overpressure Plantar flexion

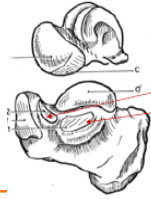


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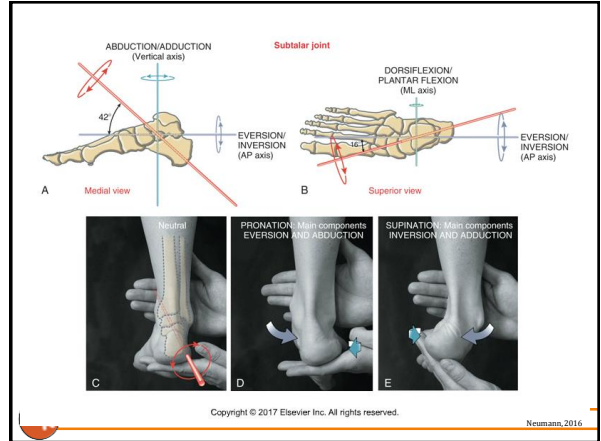
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Subtalar Joint - Arthrokinematics

- Sliding among 3 different facets
- STJ axis acts as a screw-in mechanism consisting of translation of talus in conjunction with rotation
- Posterior STJ
 - Convex Calcaneus on Concave Talus
 - Lateral Glide with Inversion
 - Medial Glide with Eversion
- Anterior STJ
 - Concave Calcaneus on Concave Talus
 - Lateral Glide with Eversion
 - Medial Glide with Inversion



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Neumann, 2016

Rear foot Assessment : Prone

- Prone STJ assesment
 - Bisect Posterior Calcaneus
 - Bisect Distal 1/3 of Leg
- Subtalar Joint ROM
- Normal : 30 degrees
 - 20 Calc INV
 - 10 Calc EVR



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Rear foot Assessment : Prone

- Prone STJ Neutral Alignment
 - Bisect posterior calcaneus
 - Bisect distal 1/3 of Leg
 - Congruent position of talus in mortise
 - Load lateral column (DF) - mid foot slack
 - Assess rear foot to forefoot relationships



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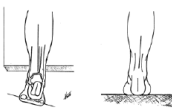
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Rearfoot Deformities – RF Varus

- Calcaneus abnormally inverted relative to tibia
- Normal is $< 3^\circ$, RF varus if $>$ than 3°
- Initial Goal with gait – Control medial column to ground – Decelerate loading response
- Greater ROM to control



OKC (Neutral) CKC (Relaxed)



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Rear foot Varus

- Compensated with Early and Excessive Pronation
 - Requires Posterior Tib and Anterior Tib as well as Gluteals to fire earlier than typical to control rotation
 - Unilaterally creates a functional short leg
 - Anterior Innominate
- Possibly Related To: Loading in Transverse/Frontal plane excessive mobility, decreased eccentric control
 - MTSS \rightarrow Tibial Stress fracture continuum
 - Patellofemoral Pain Syndrome
 - Gluteal Tendonopathy
- Biomechanical Treatment
 - Foot orthosis with medial (varus) rearfoot posting (if excessive)



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Forefoot to Rearfoot Assessment Prone STJn

- Place STJ in neutral
- Load FF by DF 4th and 5th MT to resistance (DF Midfoot slack)
- Assess Forefoot plantar plane perpendicular to Rearfoot/Calc bisection plane
 - FF Varus
 - FF Neutral
 - FF Valgus



FF Varus www.vompti.com



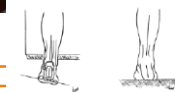
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Forefoot Varus

- Abnormal position of MT heads in frontal plane
- Medial side of FF appears higher: Inverted
- Late pronation – through stance (medial column to ground)
- Osseous vs. Soft Tissue restriction



OKC (Neutral) CKC (Relaxed)



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Forefoot Varus

- Prolonged pronation, Midstance to Terminal Stance
- Force can be primarily distal as versus RF dysfunctions which most commonly create proximal pathology ???
- Potentially related to:
 - Heel Pain/Achilles Pathology
 - Sever’s Calcaneal Apophysitis
 - Plantar Fasciitis
 - HAV
 - Metatarsalgia/Morton’s Neuroma
- Orthotic Management:
 - Medial forefoot post up to 50%, but rarely more than 6 degrees



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Foot Deformities – Forefoot Valgus

- Abnormal position of MT heads in frontal plane
- Assess ? PF 1st Ray
- Lateral side of FF higher - **Eversion**
- Premature Supination
- Post laterally up to 50% of deformity, not more than 6 degrees
- Associated with: Lateral ankle sprains, peroneal pathology



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Forefoot Valgus (Rigid/Hypomobile)

- Must supinate too soon (when should be pronating) to get lateral aspect of foot on ground
- Often leads to lateral ankle sprains and reduces foot mobility which makes uneven terrain difficult
- Compensatory supination creates increased knee extension and varus – stresses lateral/posterior structures
- Possibly Related To:
 - ITB/Peroneal/Proximal Fibular
 - Biomechanical Treatment:
 - Post laterally and cut out 1st ray
 - Taping to decrease RF Supination
 - Shock Absorption

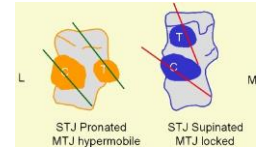


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Transverse Tarsal/Midtarsal Joint

- ROM in all 3 planes between the 2 axes
- Movement of talonavicular joint (LMJA) comprised the most mobility within the midfoot region
- Midtarsal joints must “unlock” during gait to absorb shock
- Mobility/Stability influenced by **STJ** positioning: “Coach”
 - MTJ: “Star Player” (Hoke)
- In STJ Pronation = axes parallel to allow increased motion
- In STJ Supination = axes approach right angles to increase stability

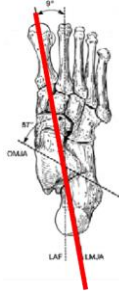


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Mid Tarsal Joint Longitudinal Axis (LMJA)

- Talonavicular Jt
 - "Little STJ"
 - 15° off Transverse Plane
 - 9° off Sagittal Plane
 - Almost perpendicular to frontal plane
 - Medial Column
 - INV - EVR



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Mid Tarsal Joint Oblique Axis (OMJA)

- Calcaneocuboid Jt
 - "Little Ankle"
 - 52° off Transverse plane
 - 57° off Sagittal plane
 - Lateral Column
 - 2nd best place for DF/PF

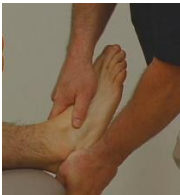


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Mid Tarsal Mobility Assessment

- | | |
|--|--|
| <ul style="list-style-type: none"> • Longitudinal Axis • Invert/Evert Midfoot/Medial Column • Asses in STJ Pronation/Supination | <ul style="list-style-type: none"> • Oblique Axis • DF-ABD /PF-ADD Mid Foot/Lateral Column • Assess in STJ Pronation/Supination |
|--|--|

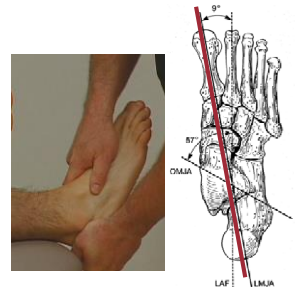


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Mid Tarsal Mobility - LMJA ROM

- Stabilize Rear Foot/STJ
- Grasp Navicular and medial column
- Invert/Evert Midfoot along LMJA by sup/pro forearm
- Axis 9 deg medially to longitudinal axis of foot so therapist's forearm should be in line with axis
- "Mobile Adapter" - EVR
- "Rigid Lever" - INR



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Mid Tarsal Mobility - OMJA ROM

- Stabilize Rear foot/STJ
- Opposite hand grasps cuboid/lateral column mid foot
- Assess PF/ADD - DF/ABD
- "Mobile Adapter" - EVR
- "Rigid Lever" - INV



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Tarsometatarsal Joints: First Ray

- Functions to:
 - Dissipate shock of heel contact during early stance phase
 - Support of medial longitudinal arch during WB
- STJ Pronation
 - Proximal end of metatarsal moves plantar and distal end moves dorsally to absorb initial shock
 - "Unlocked" Position - Flexible and loose to adapt
- STJ Supination
 - First ray plantar flexes, helping foot become rigid lever and stabilizing medial and longitudinal arch in mid and late stance phase
 - "Locked" Position - Stable and rigid for propulsion



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Stable Lever for Transfer of High Forces

- 1st Ray composed of the 1st MT and medial cuneiform
- 1st MTP joint is biaxial condylar joint that gains stability from the joint capsule, collateral ligaments, and plantar plate
- 2 sesamoid bones are located in intrinsic muscles underneath MT head
- 1st MT articulates with medial cuneiform and base of 2nd MT
- Hallux carries 60 % of body weight at end of stance phase
- Rigid lever at terminal stance
- TC Plantarflexion with rotation around body of talus
- Stable medial column for propulsion



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Hallux Valgus and the First Metatarsal Arch Segment Volume 90 Number 1 Physical Therapy

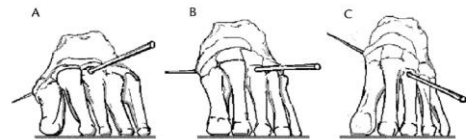


Figure 2. The first metatarsal axis represented in 3 different foot postures: (A) pronation, (B) neutral, and (C) supination. Orientation of the axis changes as a function of arch height.


- Collapse of med long arch shifts the joint axis of the 1st MT from horizontal to vertical
- Vertical orientation of the axis predisposes the 1st MT to abduction - medial directed GRF
- Abduction of 1st MT further decreases the ability of the arch to support the body weight
- Increased Transverse plane with Limited Sagittal plane mobility
- Instability of 1st MTP - ? Cause or Effect



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Path of the center of pressure on the plantar surface of the foot

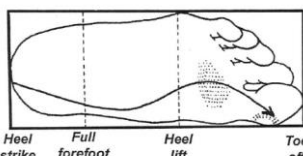


TOE OFF

HEEL CONTACT

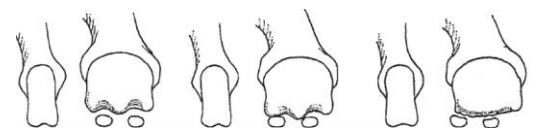
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Neumann, 2016

Excessive Pronation
No peroneal longus stabilization of 1st Ray → Shift to 2-3 MTs → Push off medial aspect 1st MTP




Heel strike Full forefoot load Heel lift Toe off

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Michaud TC 2017




Hyper mobility with resultant sesamoid tracking dysfunction



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Sesamoid Function


- Improves efficiency of Intrinsic - FHB (quad at patella)
- Improve force production at Terminal stance
- Improve stability – “tripod”
- Spreads forces across base MT head
- Distributes pressure away from lateral MTs
- Functionally lengthen the 1st MTP at propulsion
- FHB contracture – decreases ability of distal excursion



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1st and 5th Ray Position/Mobility

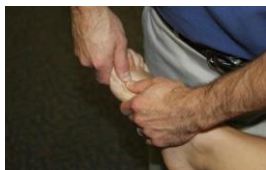
- 1st Ray
 - Stabilize MT heads 2-5 with pincer grip
 - Translate 1st MT head DF/Inv and PF/Ever
- 5th Ray
 - Stabilize MT 1-4 with pincer grip
 - Translate 5th MT head DF/Ever and PF/Inv



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Assess 1st MTP ROM

- 65-70° of 1st MTP extension necessary for toe-off
- 45° Flexion at MTP and 90° at IP

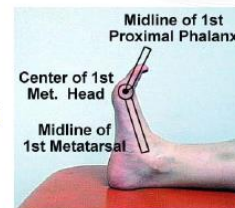


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Clinical-Biomechanical Relationships

- Reduced first ray dorsiflexion ROM correlated to increased rearfoot eversion (pronation)



Cornwall et al., 2006



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Windlass Mechanism

- Causes shortening/tightening of the plantar fascia
- Rigid lever at push off
- Stiffens the tissues along the medial longitudinal arch
- Improves propulsion and efficiency
- "Stiff Spring"

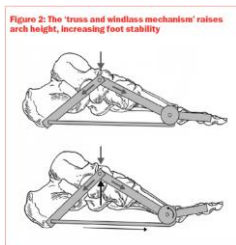


Figure 2: The 'truss and windlass mechanism' raises arch height, increasing foot stability



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Passive Accessory Mobility:

Neutral Zone
Amount of Movement
End Feel
Contractile Tissue Response
Provocation



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Foot & Ankle: Joint Assessment

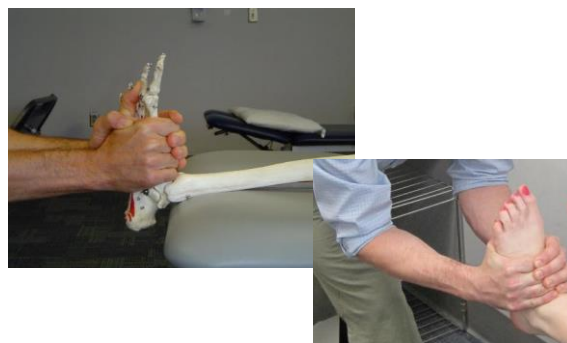
- Talocrural: Distraction: Anterior, Posterior glide
- Proximal/Distal Tib-Fib: Anterior, Posterior Glide: EVR with Sup glide: INV with Inf glide
- Subtalar: Distraction; Anterior, Posterior, Medial, Lateral glide
- Midfoot: Plantar glide, Medial-Lateral rotation (Navicular-Talus; Medial Cuneiform-Talus; Med Cuneiform- 1st MTP)
- Cuboid on Calc: Plantar, Dorsal glide
- 1st MTP: Plantar, Dorsal, Distraction, Medial, Lateral glide



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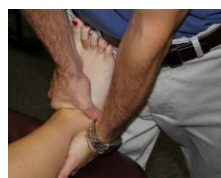
Talocrural Distraction



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Talocrural Jt. Posterior Glide



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Talocrural Jt. Anterior Glide



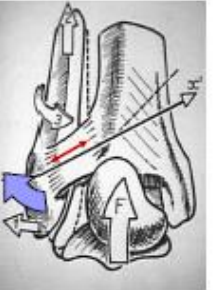
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Distal Tibiofibular Jt Mechanics





Plantarflexion




Dorsiflexion

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Distal TF Joint Posterior Glide



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Distal TF Joint Superior Glide







Sup (Post) Glide with Calc EVR
Infer (Ant) Glide with Calc INV

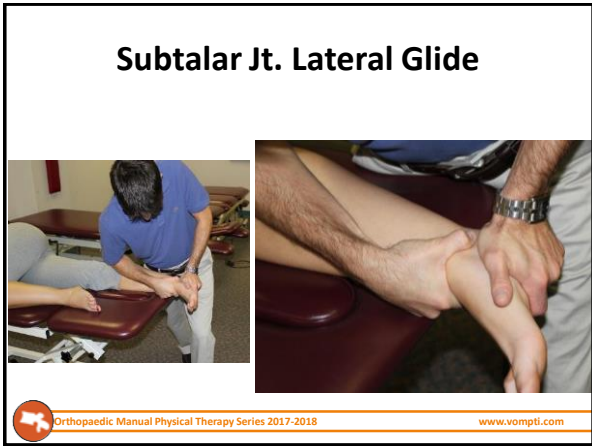
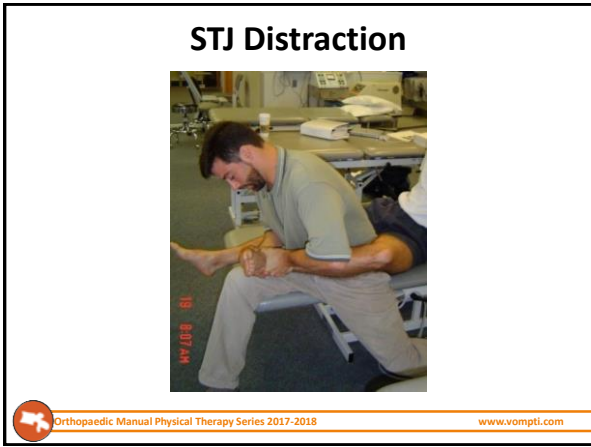
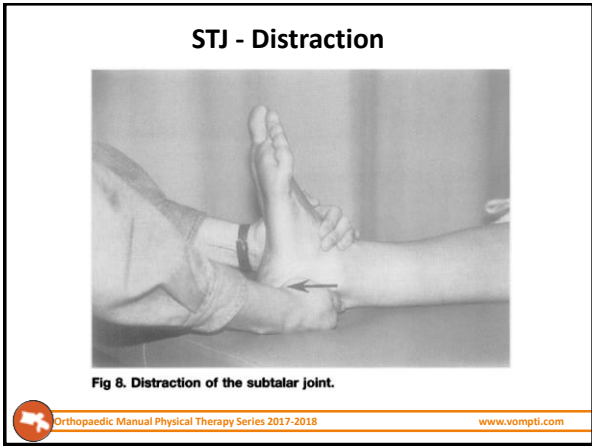
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Proximal TF Joint Anterior, Posterior Glide

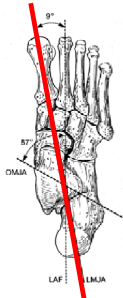
- Anterolateral, Posteromedial
- Joint Mechanics:
 - Supination
 - Posterior Translation
 - Pronation
 - Anterior Translation-
- Assess CKC



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Subtalar Jt. Medial Glide



Medial Column Mid foot Mobility Assessment

Navicular on Talus

Medial -Lateral Rotation
Plantar-Dorsal Glide



Medial Column Mid foot Mobility Assessment

Medial Cuneiform on Navicular



Medial -Lateral Rotation
Plantar-Dorsal Glide



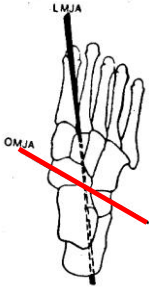
Medial Column Mid foot Mobility Assessment

First MT on Medial Cuneiform

Medial -Lateral Rotation
Plantar-Dorsal Glide



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Lateral Column Mid Foot Assessment


Cuboid on Calcaneus

Plantar- Dorsal Glide

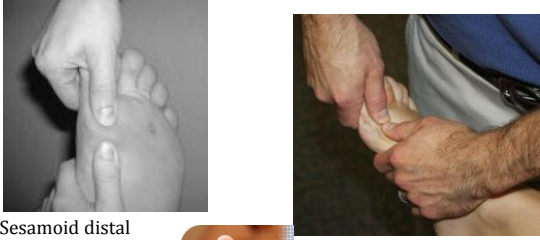


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MTP/IP Accessory Assessment (Dorsal/Plantar Glide)




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Sesamoid distal mobilizations


STM - Intrinsic: FHB, ABD Hal, ADD Hal

MTP DF Mobility : Traction to Proximal Phalanx - Plantar Mobilization MT Head




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VOMPTI Special Tests



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Tears in lateral collateral ligaments (LCL)



Grade I Grade II Grade III

Posterior talofibular ligament

Anterior talofibular ligament


Calcaneofibular ligament

<http://www.southfloridasportsmedicine.com/child-ankle-instability.html>

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Anterior Drawer

- Evaluate integrity of ATFL and anterior capsule of TCJ
- Supine, foot off table
- 10-20 deg of PF
- Compare bilaterally
- (+) 3 - 5mm or more noted in affected side
- Improved reliability: 3 point scale: Normal, Hypo, Hyper mobile



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Anterior Drawer Test




Study	Reliability	Sensitivity	Specificity	LR+	LR-	QUADAS Score (0-14)
Hertel et al. ¹³	NT	78	75	3.1	0.29	8
Phisitkul et al. ²²	NT	100	100	Inf	Inf	7

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Talar Tilt Test

- Assess ATFL (slight inc), and CFL ligament (sig. inc); 10-20° of PF
- Stabilize distal lower leg proximal to the malleolus
- Invert rearfoot
- Palpate lateral aspect of the talus to determine if tilting occurs, compare bilat.

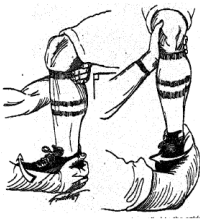


"Pucker sign"

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External Rotation Stress Test


- Syndesmosis Injury
- Seated, Supine or Prone
- Passive IR tibia and DF ankle and then ER the foot
- Watch tibial ER when ER foot
- (+) for symptom reproduction in lower leg syndesmosis region



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Squeeze Test

- Determine presence of syndesmosis injury
 - Rarely (+), not as Sensitive as ER Stress Test
- Squeeze together proximal tibia and fibula, (+) for symptom reproduction in area of syndesmosis



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Morton's Test

- Used to determine if neuroma or metatarsal stress fracture present
- Gently squeeze MT heads together
- (+) for symptom reproduction



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Tinel's Sign

- Assess neural mechanical sensitivity
- Tap on areas where nerve may be entrapped
 - Tarsal tunnel
 - Proximal Tib - Fibula
 - Superficial Peroneal Nerve
- (+) shooting symptoms distally into extremity



Eliciting a Tinel's sign in tarsal tunnel syndrome



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Neurodynamic Mobility Assessment

DF/Inversion-Sural



PF/Inversion-Common Peroneal



DF-Tibial + EVR



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