

Society of Skeletal Radiology 2010

The Flatfoot

Terminology, Treatment, & Importance of Cobey View

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I have nothing to disclose...



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...although I do have to thank



Richard Lange, MD

- UW Orthopedic Surgeon
- Specialized in adult foot & ankle reconstructive surgery
- Supplied cases ...and insight

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References

- Journal of Foot & Ankle Surgery:
Lee et. al., 2005 v44, n2, p78-113
➢ www.sciencedirect.com
➢ www.acfas.org/press/cpg/adultff-cpg.htm
➢ www.guideline.gov/summary/summary.aspx?ss=15&doc_id=6827
- Surgery of the Foot and Ankle,
Michael Coughlin & Roger Mann
➢ www.amazon.com/dp/0323033059
- Advanced Reconstruction Foot and Ankle
Nunley (Editor), Pfeffer (Author)
➢ www.amazon.com/dp/0892033142

Objectives

- 1) To learn the terminology commonly used by podiatrists and foot & ankle surgeons when describing flatfoot.
- 2) To understand the causes of flatfoot, and to simplify these into three primary causes.
- 3) To discuss the staging and treatment of posterior tibial tendon dysfunction.
- 4) To know at least as much about flatfoot as a podiatrist.

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Flatfoot: Terminology, Treatment, & Importance of Cobey View

Flatfoot: Definitions

pes planus L “foot” “flat, even, level”
aka “weak foot”, “fallen arches”

- Loss of medial longitudinal arch



Lee, J Foot&Ankle Surg, 2005, v44 p80

www.flickr.com

- Diagnosed: Visual Exam

➤ WHEN STANDING

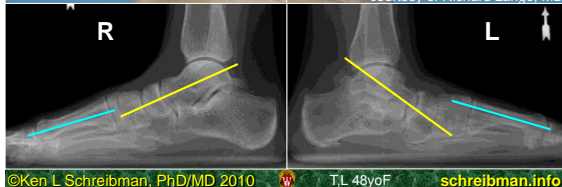
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Flatfoot: Dx by Visual Exam



courtesy of Richard Lange, MD



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Flatfoot: Definitions

Rigid Flatfoot

- Arch is stiff and always flat
- Whether standing or not

Flexible Flatfoot

- Arch is flat when standing
- Suspended foot regains normal arch

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Regarding the flexible flatfoot:

- it is uncommon in toddlers
- it is commonly symptomatic
- it is treated with orthotics
- when standing on toes, the arch reappears ✓
- when standing on toes, the calcaneus everts

Coughlin & Mann, Surgery of the Foot and Ankle, 7th Ed, p734

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Flexible Flatfoot

Infants are born with flat feet
Toddlers typically have flat arch



www.wikipedia.org/Flatfeet

Usually asymptomatic

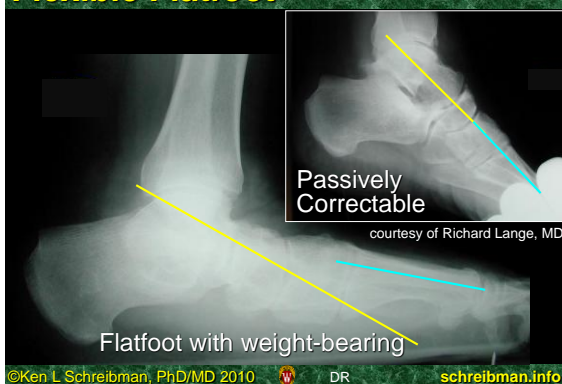
- Requires no treatment
- Orthotics tend to cause discomfort
- >15% Adults

Internet Journal of Orthopedic Surgery, 2007, v6.1

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Flexible Flatfoot



courtesy of Richard Lange, MD

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DR


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Flatfoot: Visual Exam

Arch with & without weight-bearing
 ➤ Rigid vs Flexible
 Heel from behind


Normal



Normal

- Heel neutral
- Achilles straight

Flatfoot



Flatfoot

- Heel everts
- Achilles curved medial
- "Helbing sign"

Lee, J Foot&Ankle Surg. '05, v44 p80
Lee, J Foot&Ankle Surg. '05, v44 p81

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Flatfoot: Heel Valgus (pronation)

Normal Flatfoot




www.harlick.com/order/faq.php

Standing:
Bilateral flatfeet
Heel valgus (mild)



Standing on toes:
Arch reconstitutes
Heels go into varus
=Flexible Flatfoot



Internet Journal of Orthopedic Surgery, 2007, v6.1

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Regarding the flexible flatfoot:

- it is ~~un~~common in toddlers
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Coughlin & Mann, Surgery of the Foot and Ankle, 7th Ed, p734

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Flatfoot: Several Deformities

Loss of plantar arch

- Observe: Medial, Standing Foot

Hindfoot valgus

- Observe: Posterior, Standing Feet
- Measure: Cobey view

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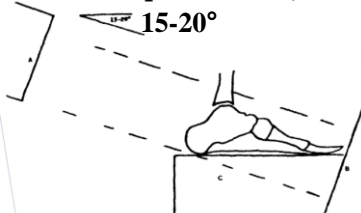
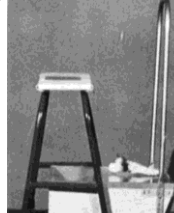
Cobey view?



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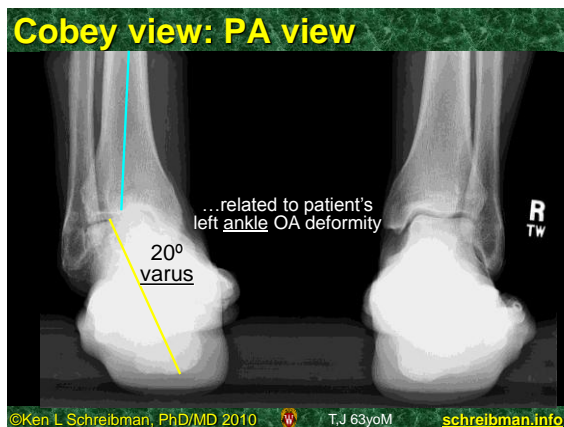
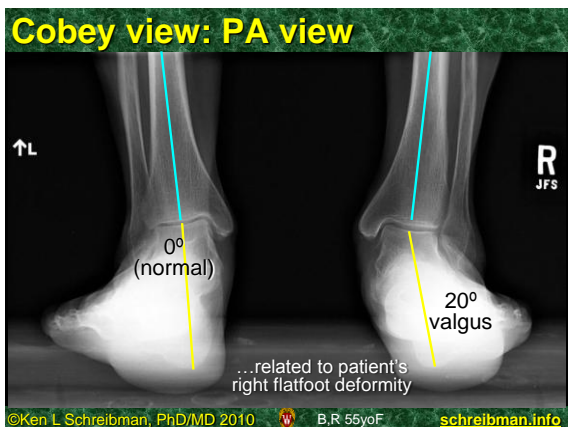
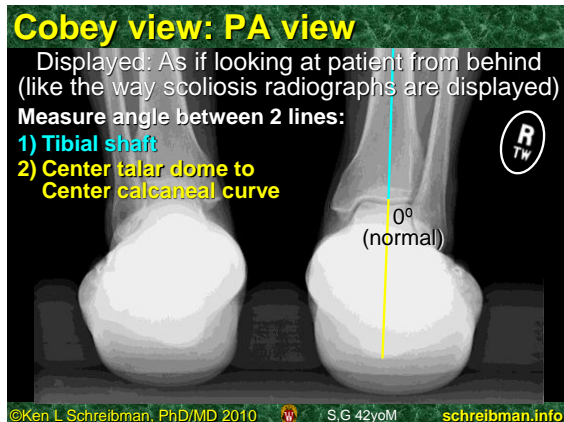
Cobey view: PA view

Posterior Roentgenogram of the Foot
 JAMES C. COBEY, M.D., M.P.H.
 Yale Orthopedics Department
 Clin Orthop Relat Res, 1976, 118, 202-207

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Flatfoot: Terminology, Treatment, & Importance of Cobey View



Flatfoot: Several Deformities

Loss of plantar arch

- Observe: Medial, Standing Foot

Hindfoot valgus

- Observe: Posterior, Standing Feet
- Measure: Cobey view

➤ Observe: Posterior, Standing Feet

"too many toes" sign

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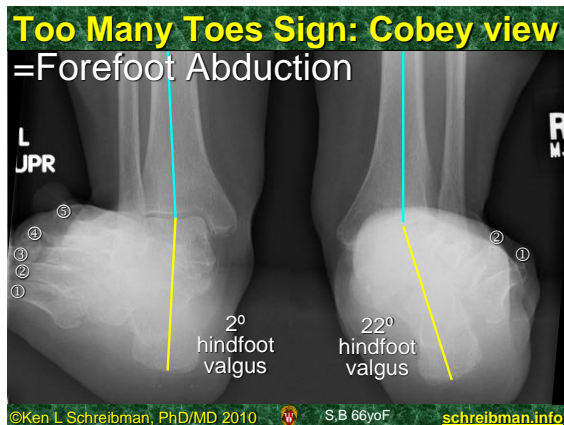
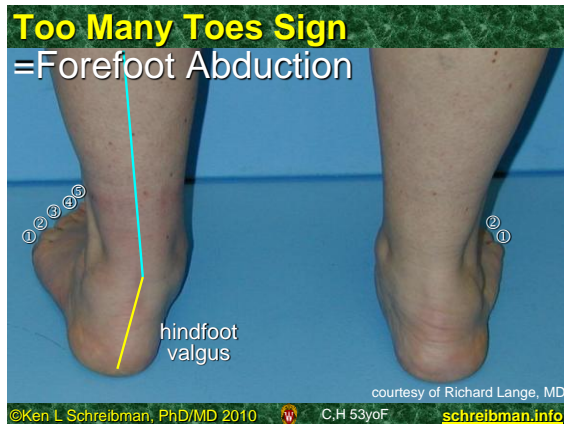
The "too many toes" sign indicates:

- Forefoot abduction ✓
- Posterior tibial tendon dysfunction
- Flatfoot deformity
- Tarsal coalition
- Parents were related

Advanced Reconstruction Foot and Ankle, Nunley et. al., page 109

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Flatfoot: Terminology, Treatment, & Importance of Cobey View



Flatfoot: Several Deformities

Loss of plantar arch

- Observe: Medial, Standing Foot

Hindfoot valgus

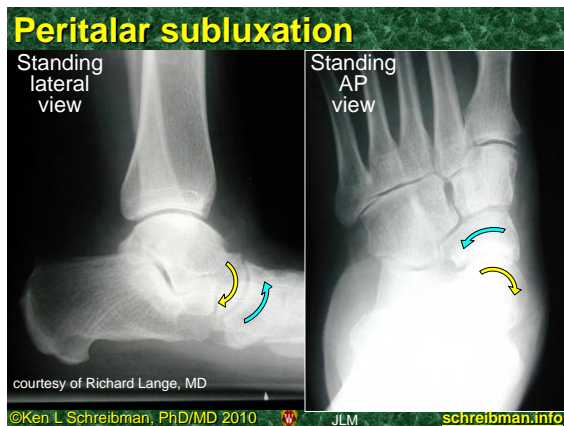
- Observe: Posterior, Standing Feet
- Measure: Cobey view

Forefoot abduction

- Observe: Posterior, Standing Feet
- “too many toes” sign

Peritalar subluxation

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Flatfoot: Etiologies

List of 54 causes of Flatfoot www.wrongdiagnosis.com

* Acquired tarsal coalition - flat foot	* Haim-Munk syndrome	* Chromosome 10, trisomy 10p - Flatfoot
* Acromesomelic dysplasia, Marfanoid	* Hypertrophic osteodystrophy - flat foot	* Chromosome 10p duplication syndrome
* Anorchism	* Ichthyophthalmia - flat foot	* Craniofacioscapular dysplasia - flat
* Anthonoposis multives concentica ty	* Kniest syndrome	* Duplication 10p - Flatfoot
* Anthonoposis distal, type 2b - flat fo	* Low birth weight /dwarfism /dysmama	* Dyspareunia syndrome - flat foot
* Blum-Scheffers syndrome - flat foot	* Marfanoid mental retardation syndrome	* Ehlers-Danlos syndrome, classic type
* Chromosome 10, trisomy 10p - Flatfoot	* Mearesco-Roggen syndrome - flat foot	* FACES syndrome - flat foot
* Chromosome 10p duplication syndro	* Mental retardation - cobblema - stiness	* Familial hypertrypsinemia - flat fo
* Craniofacioscapular dysplasia - flat	* Mental retardation - epilepsy - bulbous no	* Fitzsimmons-Guilbert syndrome - flat
* Duplication 10p - Flatfoot	* Microbrachycephaly - ptosis - cleft lip - flat	* Fried syndrome - flat foot
* Dyspareunia syndrome - flat foot	* Microcephaly, hiatal hernia and nephrotic	* Frontonasal dysplasia - Hippeel Feet
* Ehlers-Danlos syndrome, classic type	* Nephrosis neuronal dysmigration Syndro	* Furlong-Kurtzinski-Hennessy syndro
* FACES syndrome - flat foot	* Neurofibromatosis type 1 - flat foot	* Gaucher-Vissacqz-Sanchez-Mangano
* Familial hypertrypsinemia - flat fo	* Olfactory neuroblastoma - flat foot	* Giedrich syndrome - flat foot
* Fitzsimmons-Guilbert syndrome - flat	* Olfactory neuroblastoma - flat foot	* Paraplegia - brachydactyl - cone-shaped
* Fried syndrome - flat foot	* Olfactory neuroblastoma - flat foot	* Pyletic growth factors deficiency - flat fo
* Frontonasal dysplasia - Hippeel Feet	* Paraplegia - brachydactyl - cone-shaped	* Polydactyl - megal syndrome - flat foot
* Furlong-Kurtzinski-Hennessy syndro	* Pyletic growth factors deficiency - flat fo	* Tal-Haushamer camptodactyly syndrome - flat foot
* Gaucher-Vissacqz-Sanchez-Mangano	* Polydactyl - megal syndrome - flat foot	

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Objectives: Simplify Flatfoot

Causes

Child (congenital)

- Flexible
- Normal variant
- Rigid

Adult (acquired)

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The most common cause of rigid flatfeet in children is:

- Tarsal coalition ✓
- Congenital vertical talus
- Neuromuscular foot
- Skew-foot

Internet Journal of Orthopedic Surgery, 2007, v6,1

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The most common cause of rigid flatfeet in children is:

- Tarsal coalition ✓
- Congenital vertical talus

"is the major cause of painful rigid flatfoot deformity in children, adolescents"
Clinics in podiatric medicine and surgery 2000 Jul; 17(3): 531-55.

Occurs in association with other congenital anomalies:
 myelomeningocele, arthrogryposis, developmental dysplasia of the hip

Internet Journal of Orthopedic Surgery, 2007, v6,1

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Clinics in podiatric medicine and surgery 2000 Jul; 17(3): 531-55.

Occurs in association with other congenital anomalies:
 myelomeningocele, arthrogryposis, developmental dysplasia of the hip

Occurs in association with other neuromuscular conditions:
 cerebral palsy, Duchenne muscular dystrophy, polio

"Z-foot", "serpentine foot": hindfoot valgus
 forefoot varus

Rare, unknown etiology, seen in children with myelodysplasia

Internet Journal of Orthopedic Surgery, 2007, v6,1

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Objectives: Simplify Flatfoot

Causes

Child (congenital)

- Flexible
- Normal variant
- Rigid
- Tarsal coalition

Adult (acquired)

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Flatfoot: Terminology, Treatment, & Importance of Cobey View

The most common cause of adult acquired flatfoot is:

- A. neuropathic
- B. neuromuscular
- C. post traumatic
- D. tarsal coalition
- E. posterior tibial tendon dysfunction ✓

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Objectives: Simplify Flatfoot

Causes	Treatment
Child (congenital)	
➤ Flexible	Normal variant ...none
➤ Rigid	Tarsal coalition ...resection
Adult (acquired)	
➤ Posterior tibial tendon dysfunction	...depends upon the stage

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All of the following are important when staging PTT dysfunction, except:

- A. Pain, swelling along PTT = 1
- B. Reducible flatfoot = 2
- C. Irreducible flatfoot = 3
- D. Ankle joint involvement = 4
- E. Tendon torn by US/MR ✓

Journal of Foot & Ankle Surgery: Lee et. al., 2005 v44, n2, p78-113
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PTT Dysfunction: Stages

- 1=Tenosynovitis, no deformity
 - Pain, Swelling along PTT
- 2=Reducible Flatfoot
 - Hindfoot valgus, forefoot abducted
 - Single heel raise with difficulty
 - Heel doesn't undergo normal inversion

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PTT Dysfunction: Stages

- 1=Tenosynovitis, no deformity
 - Pain, Swelling along PTT
- 2=Reducible Flatfoot
 - Hindfoot valgus, forefoot abducted
 - Single heel raise with difficulty
 - Heel doesn't undergo normal inversion
- 3=Fixed, non-reducible Flatfoot
 - Unable to perform single heel raise
 - Lateral symptoms predominate
- 4=Ankle valgus
 - Secondary OA at ankle joint

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PTT Dysfunction: Stages

Courtesy of Richard Lange, MD
Univ Wisconsin Orthopedics
RH Lange

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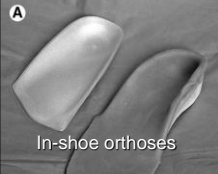
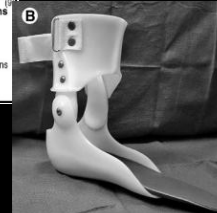

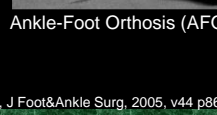
Flatfoot: Terminology, Treatment, & Importance of Cobey View

PTT Dysfunction: Stages

Posterior Tibial Tendon Dysfunction ADULT Acquired Flatfoot				
Significant History • Middle Aged Female • Unilateral Acquired Deformity • No History of Trauma				
Stage 1 (3) • Medial Rearfoot Pain • Localized swelling to course of TP • No positional change in arch X-Ray • No radiographic angular changes • No degenerative changes MRI • Tenosynovitis Ultrasound • Fluid around tendon	Stage 2A - Early (4) • Medial Rearfoot Pain • Tendon swelling, warmth, tenderness • +/- able to perform single heel raise • Rearfoot valgus; too many toes X-Ray • Peritalar subluxation • Increased Talar 1st MT angle MRI • Tenosynovitis • Attenuation of tendon • Tendinosis Ultrasound • Attenuation of tendon • Tendinosis	Stage 2B - Late (5) • Same as 2A - Early • Positional change in arch; rearfoot valgus • Lateral pain; sinus tarsi, subtalar tenderness X-Ray • Peritalar subluxation • Increased Talar 1st MT angle • Progressive angular changes on radiographs MRI • Same as 2A - Early • TP Rupture • Early DJD (subchondral edema) Ultrasound • Same as 2A - Early • Tendon Rupture	Stage 3 (6) • Lateral symptoms predominant • Fixed non-reducible deformity • No heel inversion on double heel raise • Unable to perform single heel raise X-Ray • Same as 2B - Late • Degenerative changes in rear foot complex MRI • Same as 2B - Late • DJD Ultrasound • Same as 2B - Late	Stage 4 (7) • Ankle valgus X-Ray • Same as Stage 3 MRI • Same as Stage 3 Ultrasound • Same as 2B - Late

Lee, J Foot&Ankle Surg, 2005, v44 p92
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PTT Dysfunction: Treatment

Stage 1 (3)	Stage 2A - Early (4)	Stage 2B - Late (5)	Stage 3 (6)	Stage 4 (7)
Initial Treatment Options • Patient Education • Orthotic Management • Immobilization • Antiinflammatory Medications • Physical Therapy • Shoe modifications				
 <p>In-shoe orthoses</p>		 <p>Ankle-Foot Orthosis (AFO)</p>		
 <p>Medial heel wedge Advanced Reconstruction p111</p>		 <p>Lee, J Foot&Ankle Surg, 2005, v44 p86</p>		

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PTT Dysfunction: Treatment

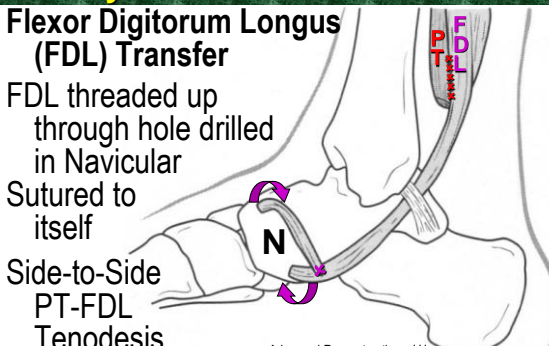
Stage 1 (3)	Stage 2A - Early (4)	Stage 2B - Late (5)	Stage 3 (6)	Stage 4 (7)
Initial Treatment Options • Patient Education • Orthotic Management • Antiinflammatory Medications • Physical Therapy • Shoe modifications				
Clinical Response (10)				
SATISFACTORY (11) → Continue NonSurgical Options		UNSATISFACTORY → Consider Surgical Options (BELOW) (12)		
Stage 1 Surgical Options (13) • Synovectomy Therapeutic Tenogram	Stage 2A - Early Surgical Options (14) • Synovectomy • Tendon Transfer • Calcotomies • Arthrodesis • Adjunctive Procedures: TAL, Gastro recession	Stage 2B - Late Surgical Options (15) • Same as Stage 2A • Isolated Rearfoot Fusions • Medial Column Fusion	Surgical Management may be an initial Treatment Option in more advanced Stages due to inherent disability.	

Lee, J Foot&Ankle Surg, 2005, v44 p92
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PTT Dysfunction: Treatment

Flexor Digitorum Longus (FDL) Transfer

FDL threaded up through hole drilled in Navicular
 Sutured to itself
 Side-to-Side PT-FDL Tenodesis

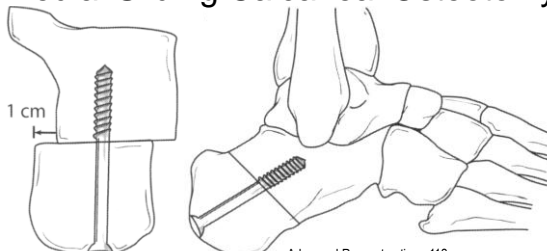


Advanced Reconstruction p111
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PTT Dysfunction: Treatment

Reconstruction of the PTT alone does not correct hindfoot valgus.

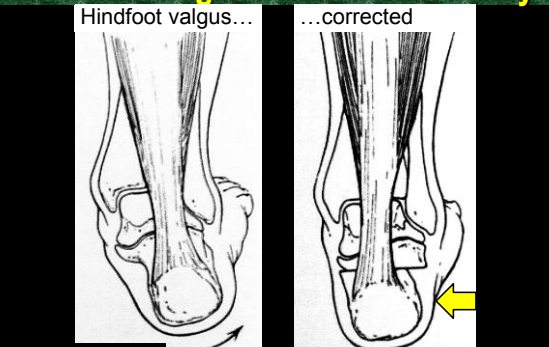
Medial Sliding Calcaneal Osteotomy



Advanced Reconstruction p112
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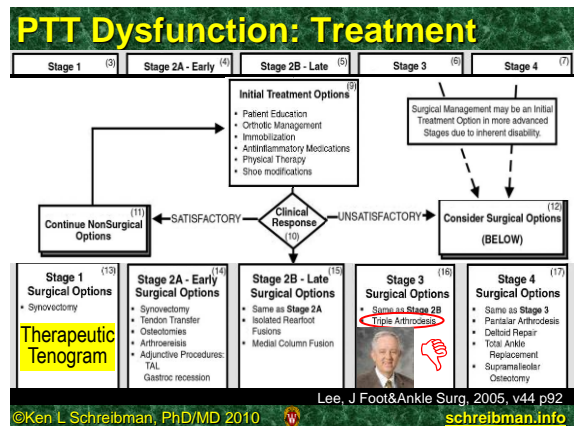
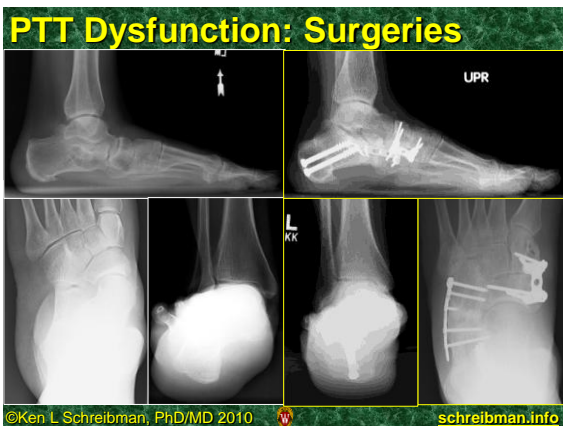
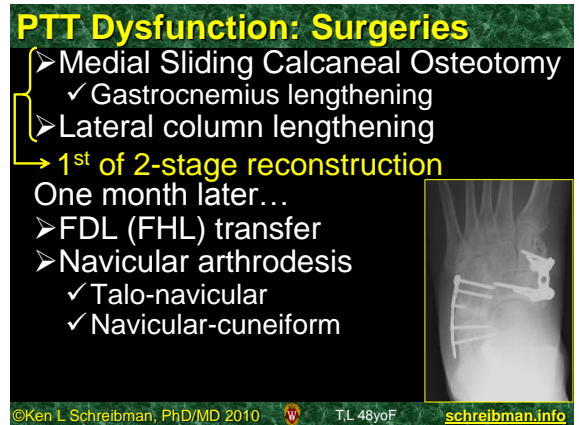
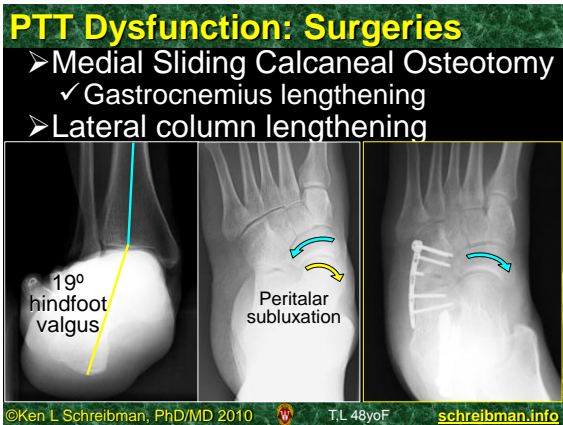
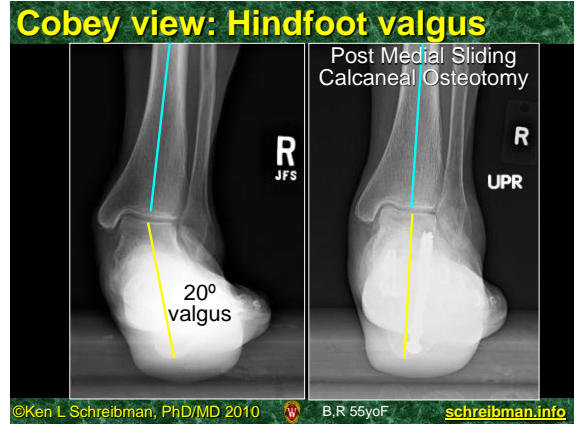
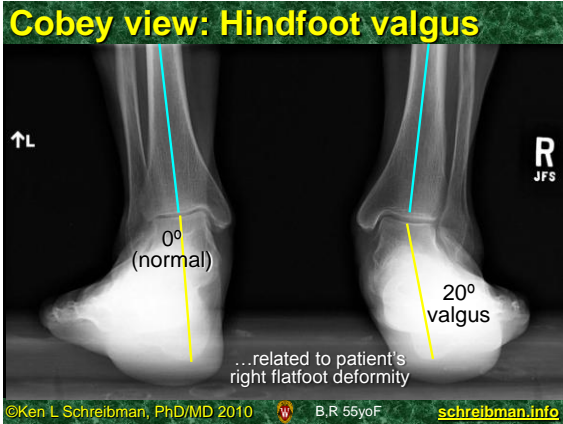
Medial Sliding Calcaneal Osteotomy

Hindfoot valgus...
 ...corrected



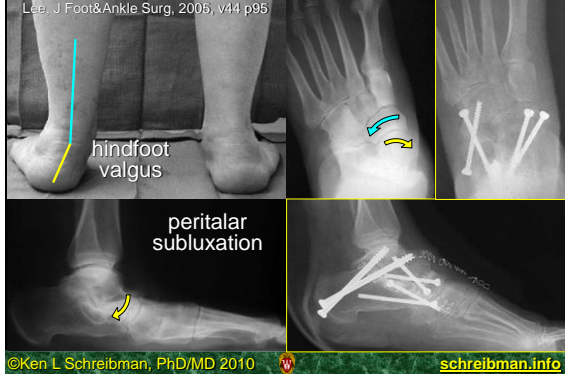
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Triple arthrodesis (STJ, TNJ, CCJ)



Footnote

James Cobey

- D.C. orthopedic surgeon
- 37 years of experience
- 2006 testified US Senate Finance Committee, issue of patient safety and specialty hospitals.
- 1997 shared Nobel Peace Prize



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