Uncommon Diagnoses and Complex Challenges

Notes and Caveats…

- Some of the conditions presented in the module are more common than others. But none would be considered “everyday” patients.
- We’ll spend the most time on two of the more common uncommon conditions – Charcot-Marie-Tooth disease and tarsal tunnel syndrome.
- Finally, many of the modalities and devices discussed in this session would be considered outside the scope of practice of a CPed (without privileging being provided by a CO or CPO). All the same, familiarity with these conditions and the modalities used to manage them will be helpful in the practice of pedorthics.

Charcot-Marie-Tooth Disease

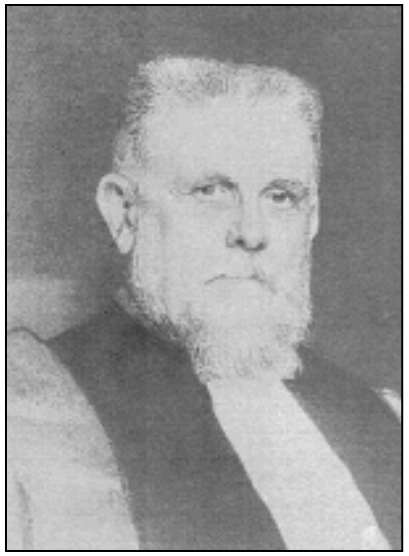
What is Charcot-Marie-Tooth Disease?

- Aka: Hereditary Motor and Sensory Neuropathy (HMSN) or peroneal muscular atrophy
- CMT comprises a group of disorders that affect peripheral nerves.
  - Peripheral nerves lie outside the brain and spinal cord and supply the muscles and sensory organs in the limbs.
  - Disorders that affect these nerves are called peripheral neuropathies
- CMT is passed on genetically. The risk of passing on CMT, and the severity of it within a family, depends greatly on the type of disorder

Charcot-Marie-Tooth Hereditary Neuropathy Syndrome

- Condition was first described in 1884 by Friedrich Schultze
- The classic descriptions were first published by Jean-Martin Charcot and his pupil, Pierre Marie, in 1886 in France.
- Also in 1886, it was described at London's Cambridge University by Howard Henry Tooth.
- In 1889, Johann Hoffmann summarizes treatment for CMT
- Other cases had been described earlier, but Charcot and Marie were the first to introduce the concept that the condition had a neuropathic basis
- Considered Charcot's final important contribution to orthodox neurology

Dr. Jean-Martin Charcot



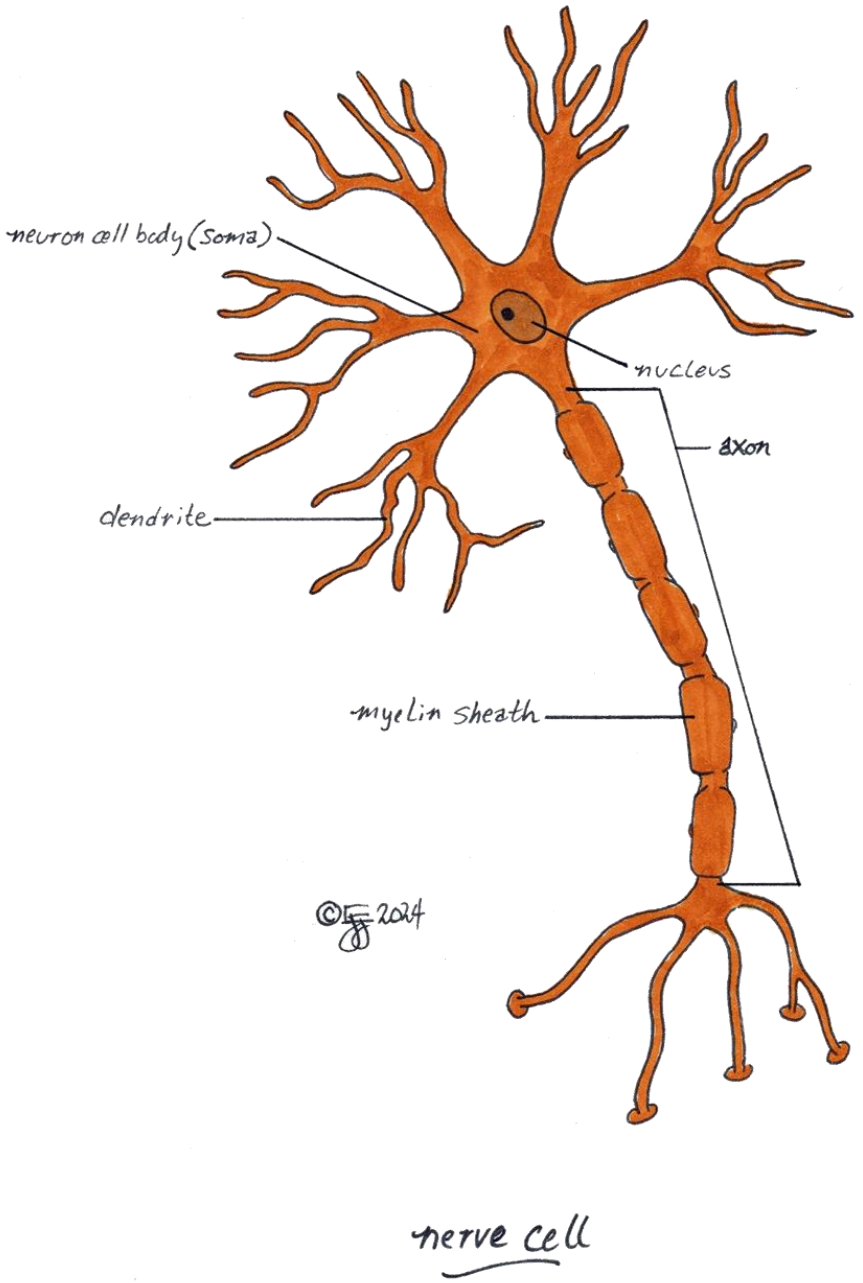
Dr. Pierre Marie

Charcot-Marie-Tooth Hereditary Neuropathy Syndrome

- Hereditary Motor/Sensory Neuropathy (HMSN)
- Disease characteristics
  - Hereditary neuropathy characterized by:
    - Chronic motor polyneuropathy
    - Sensory polyneuropathy
  - Affected patient usually exhibits
    - Slowly progressive distal muscle weakness and atrophy in hands and feet
    - Symmetric, progressive motor neuropathy of arms and legs
    - Mild to moderate sensory neuropathy
    - Depressed tendon reflexes
    - High-arched feet
  - Symptoms beginning in 1^{st} – 3^{rd} decade w/ positive family history suggests CMT

What Causes C-M-T?

- CMT is caused by mutations in the genes that produce the proteins involved in the structure and/or function of the peripheral nerve axon or the myelin sheath.
- These mutations affect the normal function of the peripheral nerves.
- Without intact axons and myelin sheaths, peripheral nerves are unable to activate their target muscles or relay sensory information from the extremities back to the brain.
- The nerves degenerate over time and may eventually lose the ability to communicate with their distant targets.



Charcot-Marie-Tooth Hereditary Neuropathy Syndrome

- Establishing the diagnosis
  - Three-generation detailed family history
    - Individuals w/ CMT may have a negative family history for many reasons including mild subclinical expression in other family members or gene mutation
  - Neurological examination to look for weakness, sensory loss and/or slowed reflexes
  - EMG/NCV if done correctly is almost always abnormal
  - Sural nerve biopsy (not routinely done, but can be helpful)
  - Molecular genetic testing (blood tests)
  - Note: There are several other genetic disorders with neuropathy that are *not* CMT

Charcot-Marie-Tooth Hereditary Neuropathy Syndrome

- Prevalence
  - Most common genetic cause of neuropathy
  - 20% of individuals presenting to neuromuscular clinics w/ chronic peripheral neuropathy have CMT (Boerkoel, et al 2002)
  - Prevalence in general population is 1 in 3,300 people
  - 26,000,000 worldwide
- There are several different sub-types of CMT that are classified based on inheritance patterns and molecular genetics

Charcot-Marie-Tooth Hereditary Neuropathy Syndrome

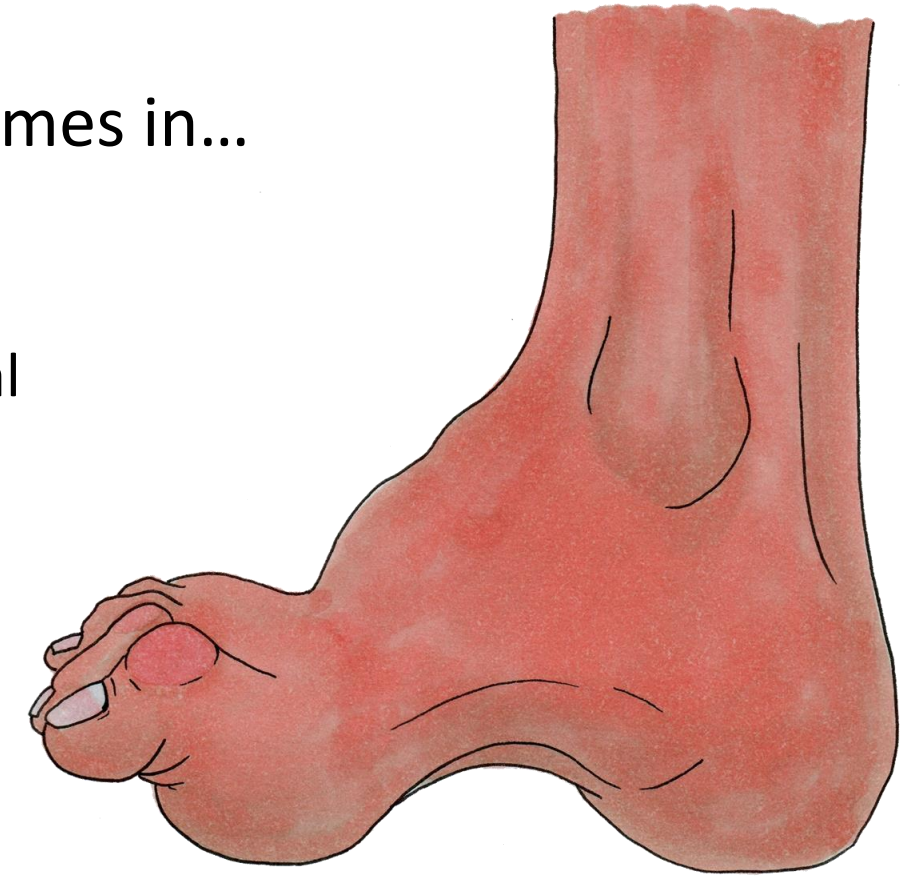
- CMT Type 1 affects approx 80% of CMT patients
  - Most common type
  - Subtypes share clinical symptoms and causes the breakdown of the myelin sheath (demyelination), leading to deterioration of the sheath and exposure of the nerve
    - (CMT1A, 1B, 1C, 1D,1E)
    - Autosomal dominant
- CMT Type 2 affects 20-40% of CMT patients
  - Main effect is on the nerve itself (axon)
    - (CMT2A,2B,2C,2D,2E,2F,2G,2H,2J,2K,2L)
- CMT types 3 and 4 are severe and complicated and, luckily, affect very few people
    - (CMT3,CMT4A,4B1,4B2,4C,4D,4E,4F,4H,4J)
    - Type 4 is autosomal recessive
- CMT X-linked affects approx 10-20%
  - Linked to the X chromosome and therefore affects more men than women
    - (CMTX1,X2,X3)
- Patients can have more than one type of CMT…especially w/ CMT X-linked.
- In rare cases, the mutation can occur spontaneously without being passed down through the family.

Charcot-Marie-Tooth Hereditary Neuropathy Syndrome

- Management
  - Treatment is symptomatic as there is not a cure for CMT
  - Individuals are often evaluated and managed by a multidisciplinary team that includes neurologists, physiatrists, orthopedic surgeons, physical and occupational therapists, orthotists and pedorthists.

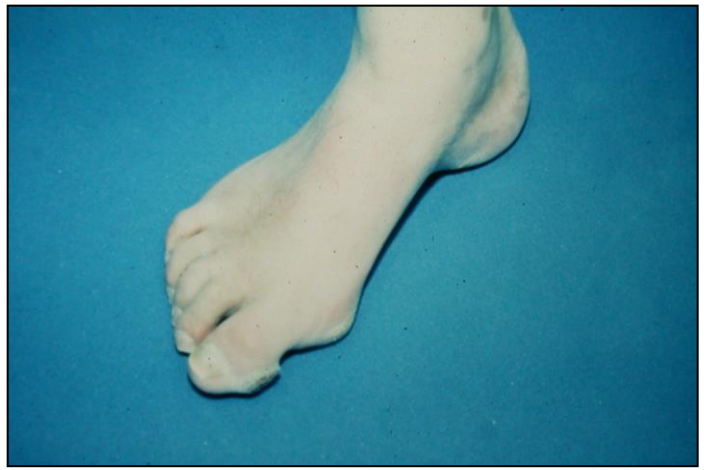
Charcot-Marie-Tooth Hereditary Neuropathy Syndrome

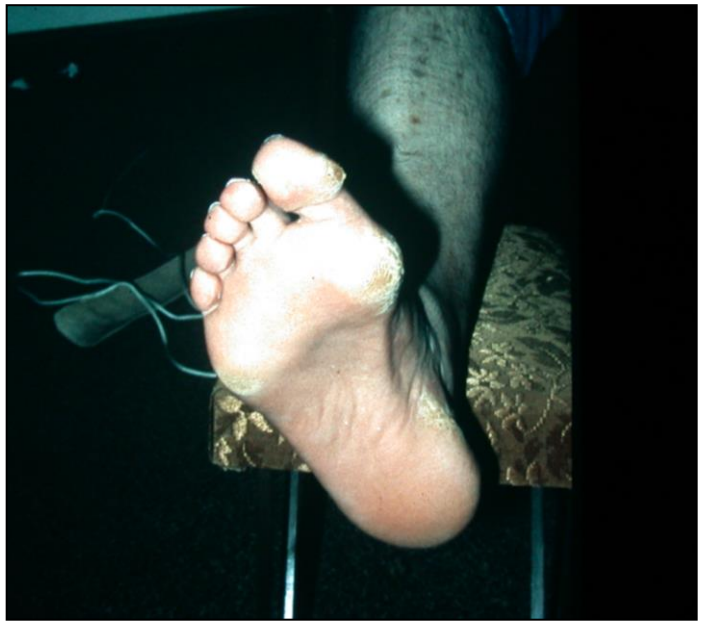
- This is where pedorthics/orthotics comes in…
  - Cavovarus feet
  - Prominent, painful metatarsal heads
  - Prominent painful base of 5th metatarsal
  - Hammer/Claw toes
  - Sensory neuropathy
  - Weak ankle dorsiflexors



Pedorthics and Charcot-Marie-Tooth Disease

- Pes Cavus
  - High peak pressures under forefoot and base of 5th MT
  - Lateral ankle instability
  - Often a rigid foot that is less than ideal for shock absorption and attenuation



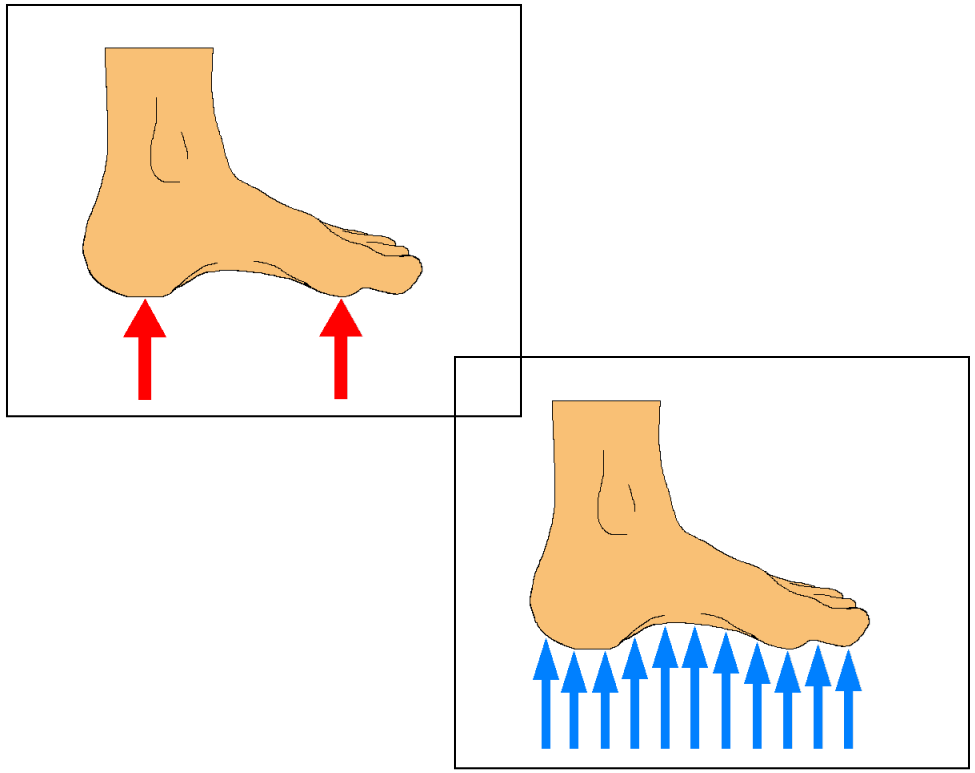


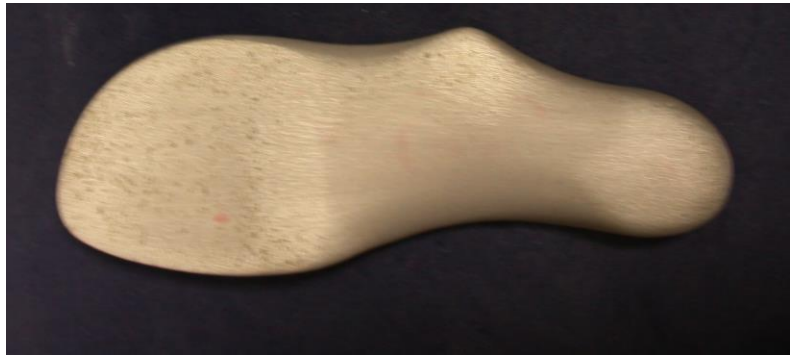
Pedorthics and Charcot-Marie-Tooth Disease

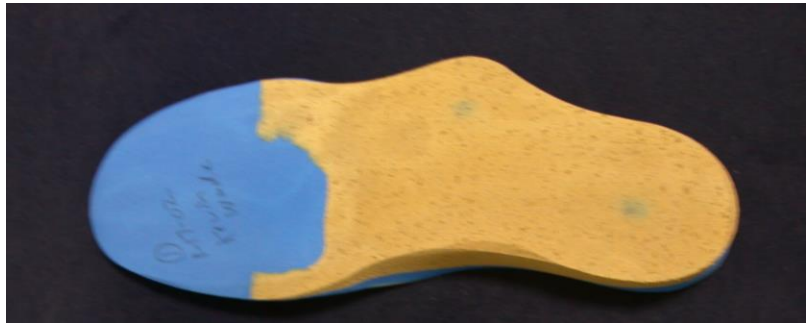
- Orthotic options
  - Custom, total contact, multidensity foot orthosis
    - Viscoelastic polymer under MT heads
    - MT head offloading
    - Shear reducing interface under areas of peak pressures

Pedorthics and Charcot-Marie-Tooth Disease

- Total contact concept





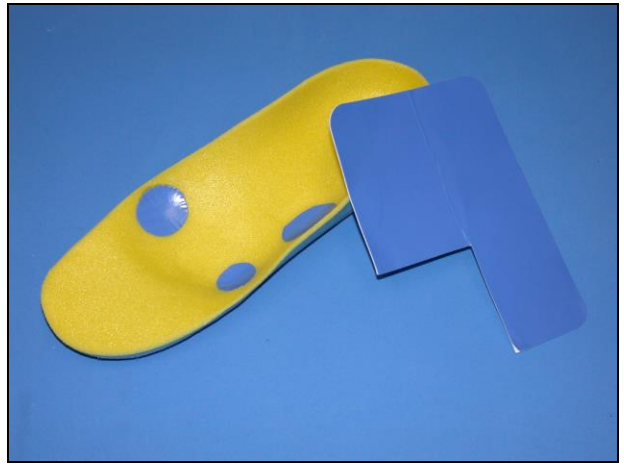


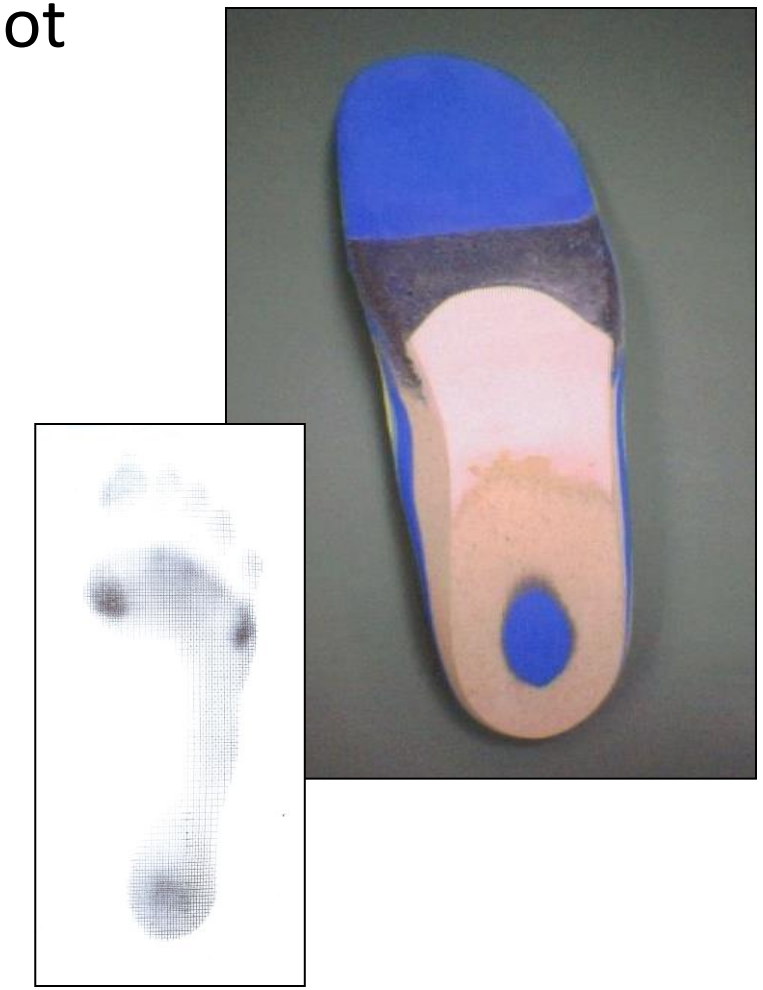
Pedorthics and Charcot-Marie-Tooth Disease

- Lateral midfoot and forefoot posting to compensate for plantarflexed 1st ray and lessen hindfoot varus

Pedorthics and Charcot-Marie-Tooth Disease

- Viscoelastic polymer under ball of foot
- Global MT head offloading
- Low friction interface to reduce shear…skin breakdown





Pedorthics and Charcot-Marie-Tooth Disease

- Lateral ankle instability
  - FO will help to some extent
  - High-top shoe or boot
  - OTC ankle brace
  - Custom AFO w/ laterally posted FO

Pedorthics and Charcot-Marie-Tooth Disease

- Shoes
  - Be sure shoe is appropriate for foot type
  - Most expensive shoe is NOT necessarily the best shoe!

"Anti-pronation"

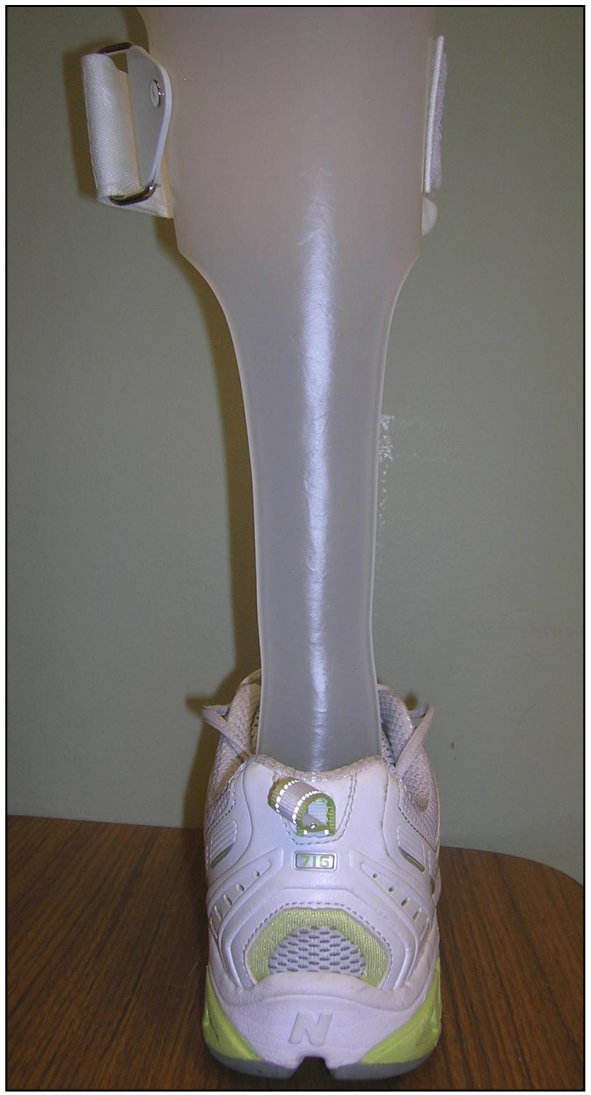
Lat Med

"Anti-supination"

Lat Med

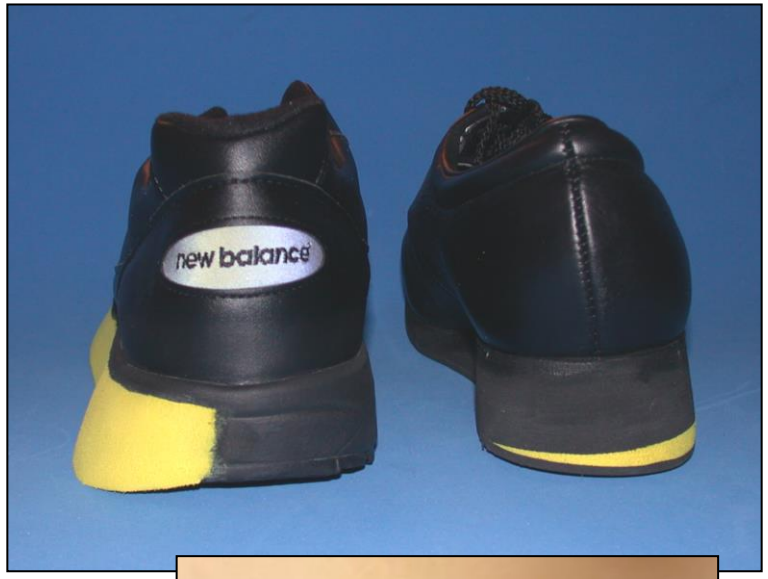
Pedorthics and Charcot-Marie-Tooth Disease

- If using an AFO or FO, try to find a neutral shoe



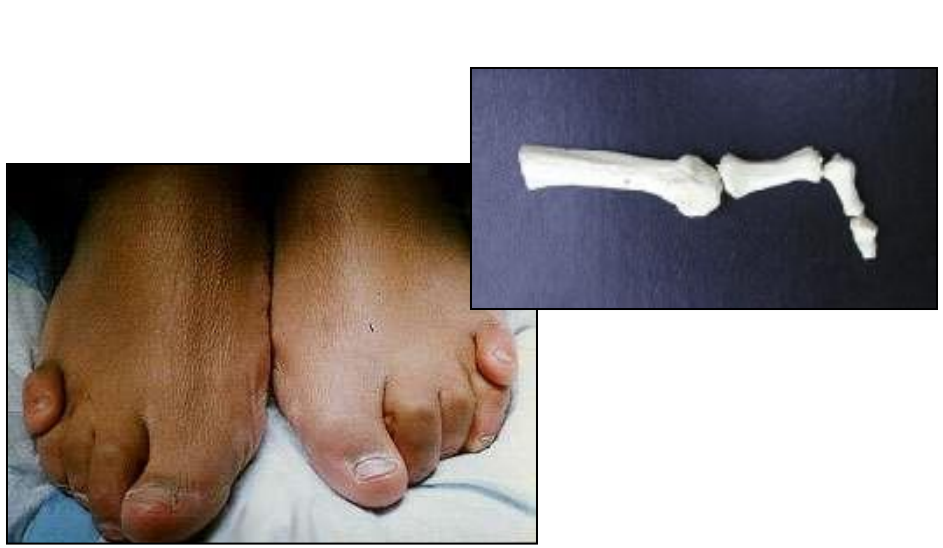
Pedorthics and CMT

- Shoe modifications
  - Flares Vs. Wedges
    - Correctable: Wedge (or Wedge + Flare)
    - Fixed: Flare
  - Rocker sole considerations
    - Rockers are effective for offloading the ball of the foot
    - Level of patient's motor and sensory neuropathy must be taken into account when considering rocker soles
    - Rockers would be contraindicated for someone with balance and proprioception concerns
    - Double rocker if base of 5th MT is symptomatic
  - Relast to accommodate prominent, painful base of 5th MT

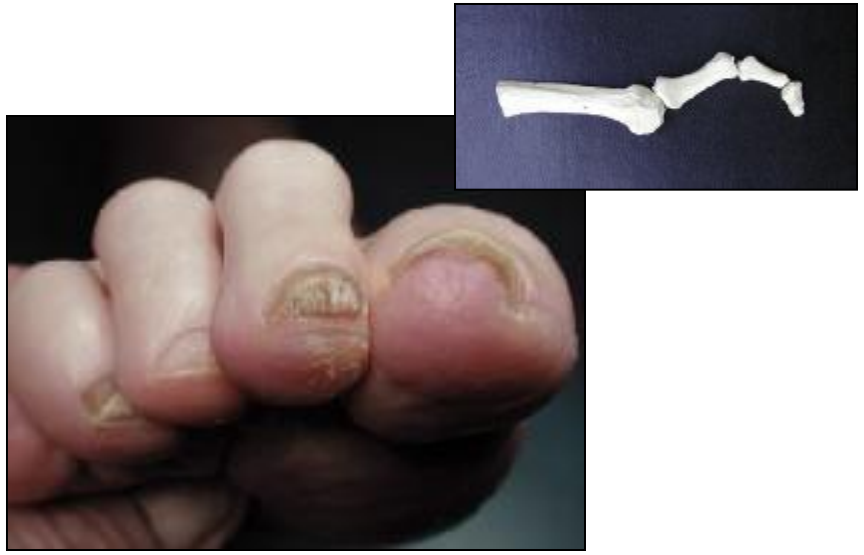


Pedorthics and Charcot-Marie-Tooth Disease

- Hammer toes
- *Definition*: Deformity of the lesser toes in which there is flexion of the proximal interphalangeal joint and varying degrees of extension of the MTP joint



- Claw toes
- *Definition*: extension at the MTP joint and flexion at the proximal interphalangeal joint and distal interphalangeal joint, due to incompetence of the foot intrinsic muscles

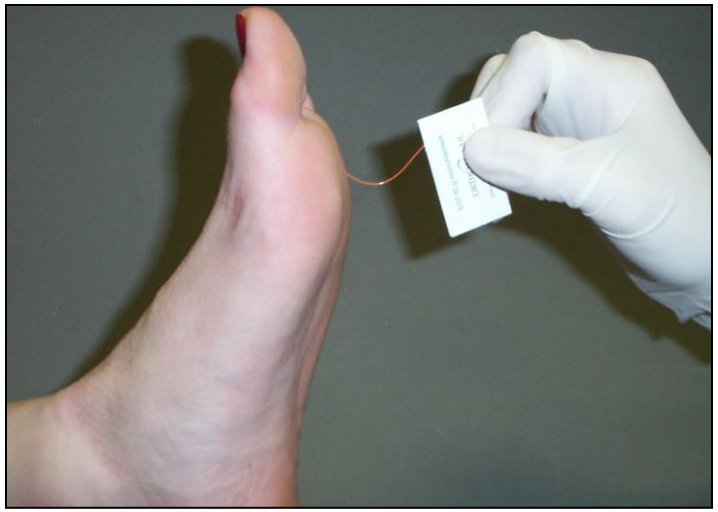


Pedorthics and Charcot-Marie-Tooth Disease

- Hammer toes and claw toes
  - Depth shoes
  - Bubble patch
  - Toe sleeves

Pedorthics and Charcot-Marie-Tooth Disease

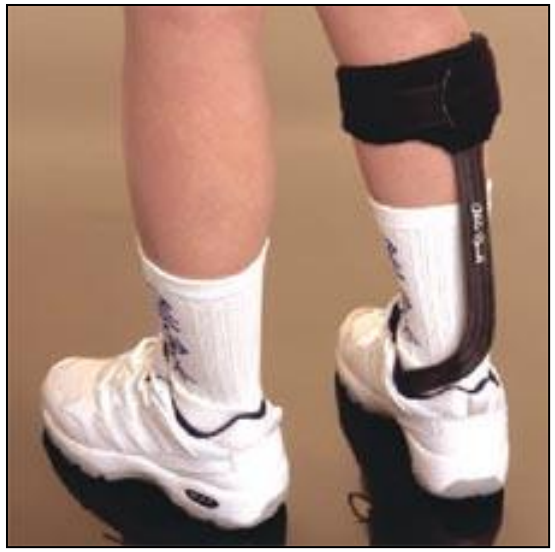
- Sensory neuropathy
  - Can progress slowly or rapidly as disease progresses
  - Once there is loss of protective sensation, these feet are at the same risk of ulceration as those with diabetes (not necessarily the same wound healing issues, though)



Pedorthics and Charcot-Marie-Tooth Disease

- Motor neuropathy
  - Tying shoes becomes difficult
    - Velcro closures
  - Post-surgical care
  - Foot drop

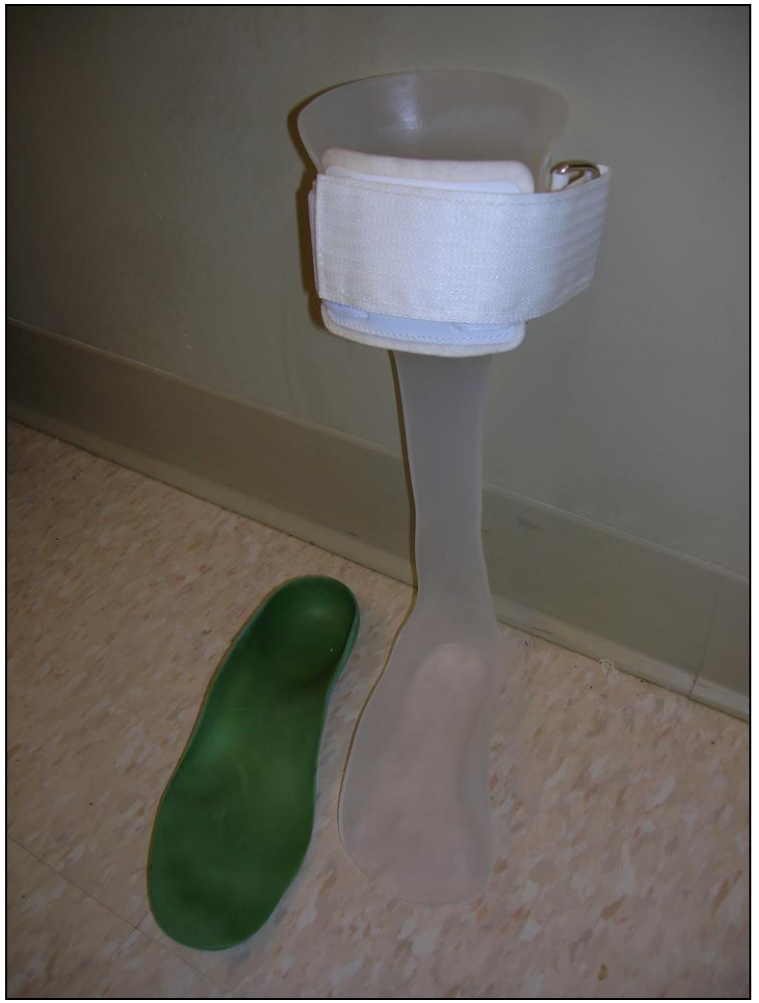
Pedorthics and Charcot-Marie-Tooth Disease



- Drop foot AFO
  - Custom Vs. Off-the-shelf

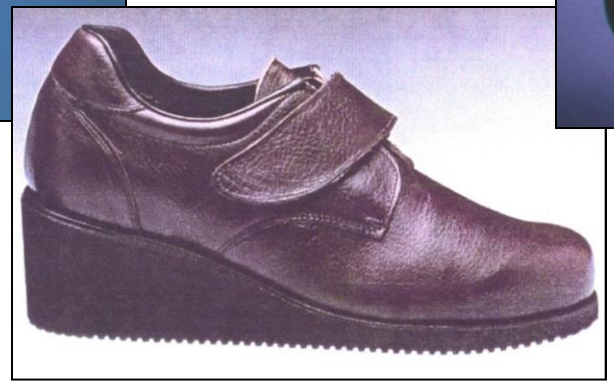
Pedorthics and Charcot-Marie-Tooth Disease

- Consider custom AFO molded and built around full FO instead of standard AFO liner



Pedorthics and Charcot-Marie-Tooth Disease

- Pes Equinus
  - Shoe modifications Vs. custom shoes



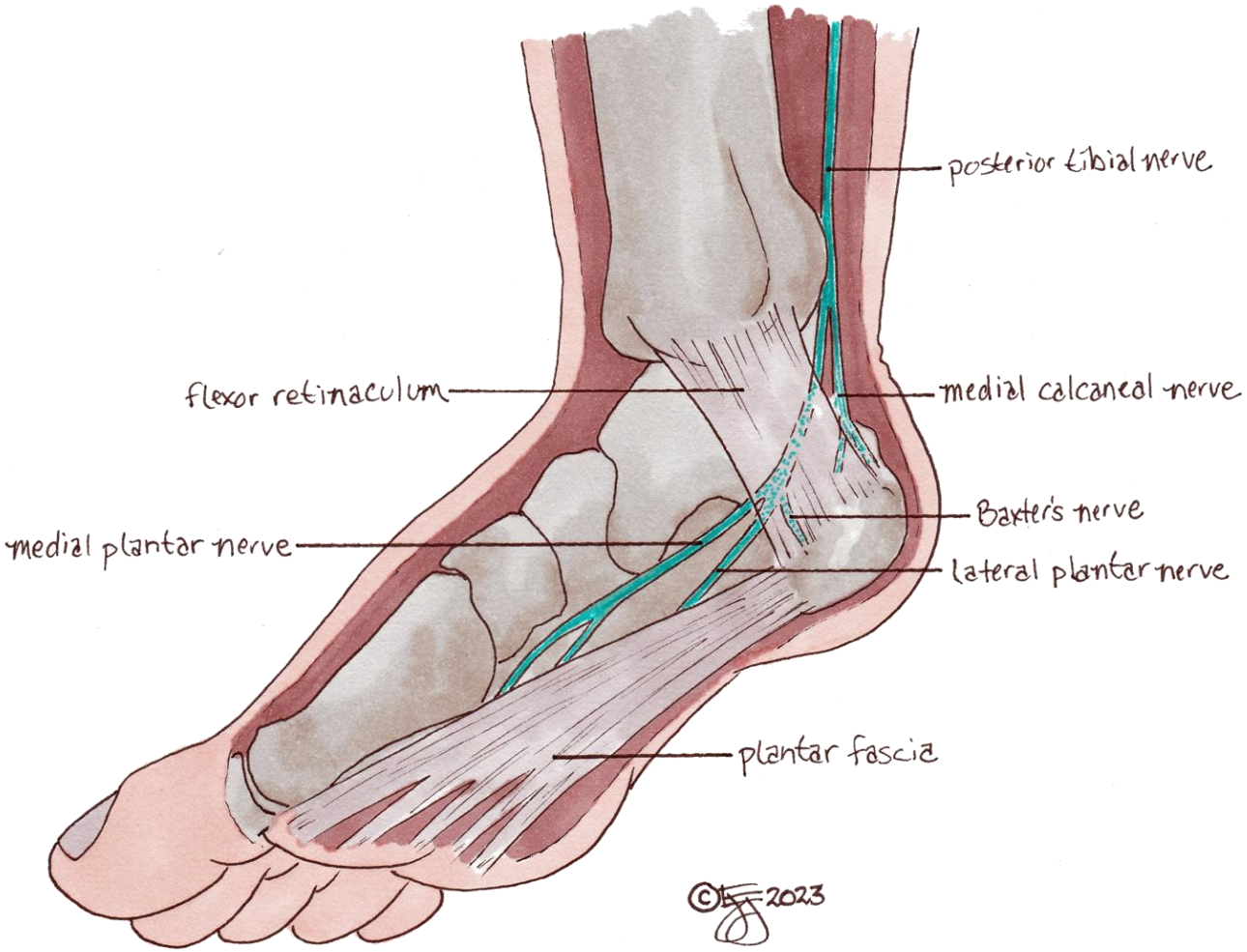
In Summary…

- CMT is a hereditary disease
- CMT causes motor and sensory polyneuropathies
- CMT is a variably progressive condition
- There is no cure for CMT
- CMT causes muscle imbalances, weaknesses and sensory problems that can be addressed and helped by a pedorthist and/or orthotist

Tarsal Tunnel Syndrome

Baxter's Nerve Impingement Vs. Tarsal Tunnel Syndrome

- Baxter's nerve entrapment
  - First branch of lateral plantar nerve
  - Baxter believes this to be the cause of as much as 20% of heel pain
    - Baxter DE. "Release of the Nerve to the Abductor Digiti Minimi" in Master Techniques in Orthopaedic Surgery of The Foot and Ankle, ed by HB Kitaoka, p 359, Lippincott Williams and Wilkins, Philadelphia, PA, 2002.

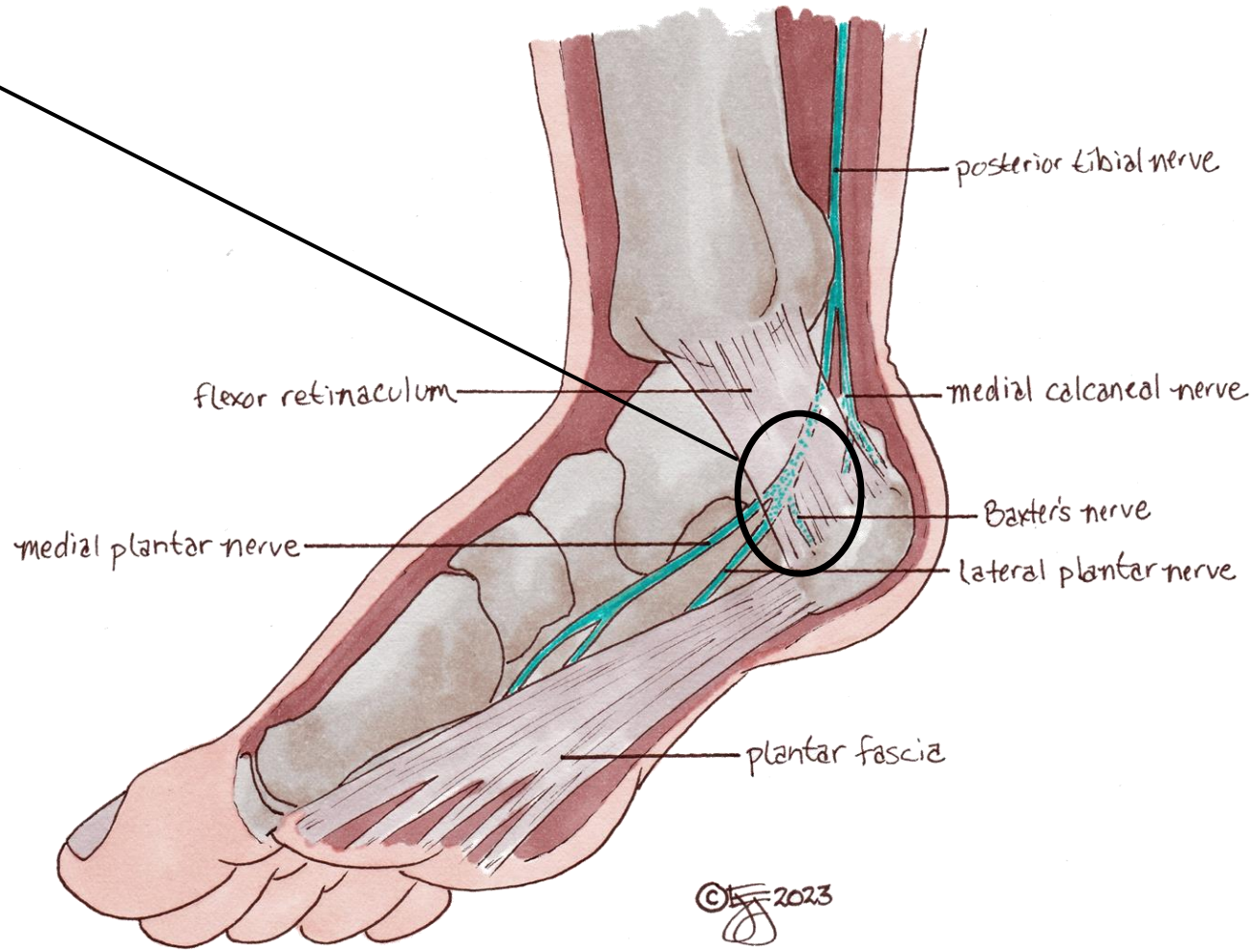


Baxter’s Nerve Impingement

- Baxter's nerve is a mixed sensory and motor nerve
- Baxter's nerve impingement can produce symptoms indistinguishable from plantar fasciitis
- While this diagnosis has been said to account for up to 20% of heel pain, it is often overlooked relative to other causes of heel pain

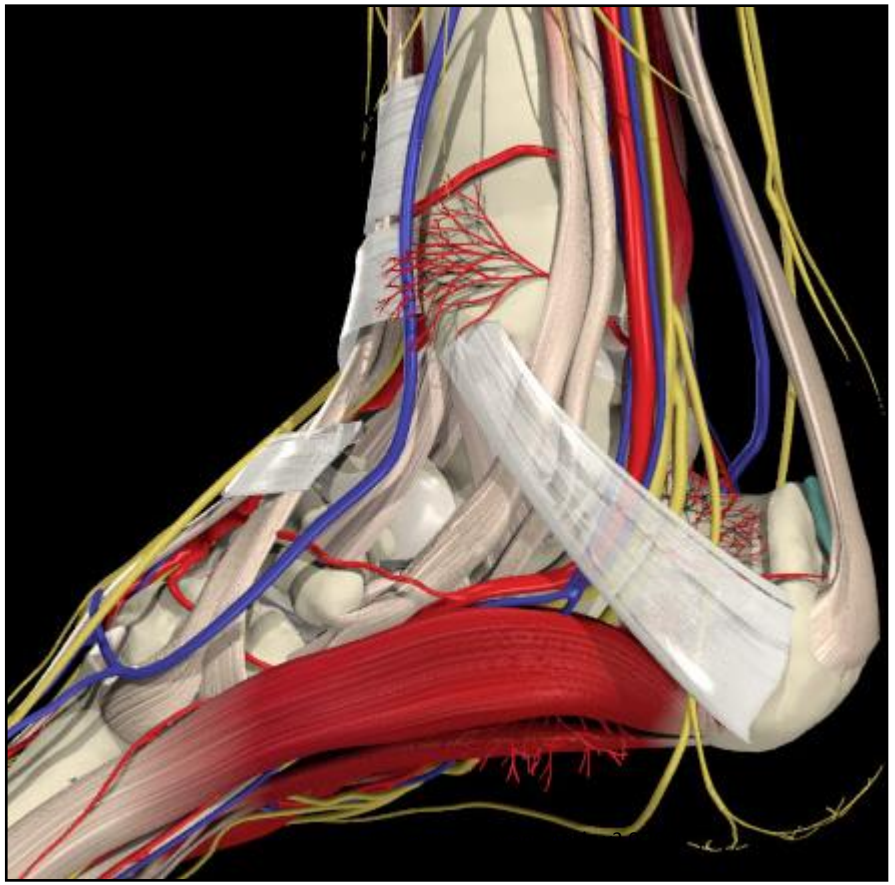
Tarsal Tunnel

- A narrow fibro-osseous space that runs behind and inferior to the medial malleolus.
- Bounded by the medial malleolus anterosuperiorly, by the posterior talus and calcaneus laterally, and is held against the bone by the flexor retinaculum which extends from the medial malleolus to the medial calcaneus and prevents medial displacement of its contents.
- Compression of the posterior tibial nerve in this area is called *tarsal tunnel syndrome.*

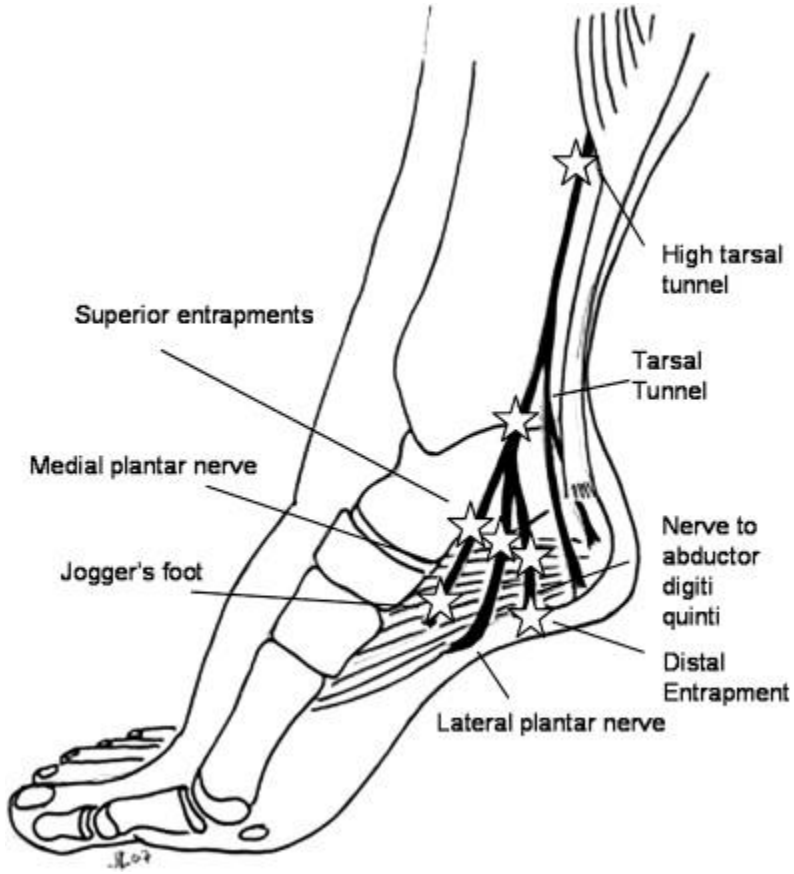


Tarsal Tunnel Syndrome

- Compression or impingement of the medial branch of the tibial nerve within a portion of the fibro-osseus tunnel created by the calcaneus and the laciniate ligament.
- Lack of longitudinal arch causes traction injury to nerve.



Possible sites of compression of medial branch of tibial nerve

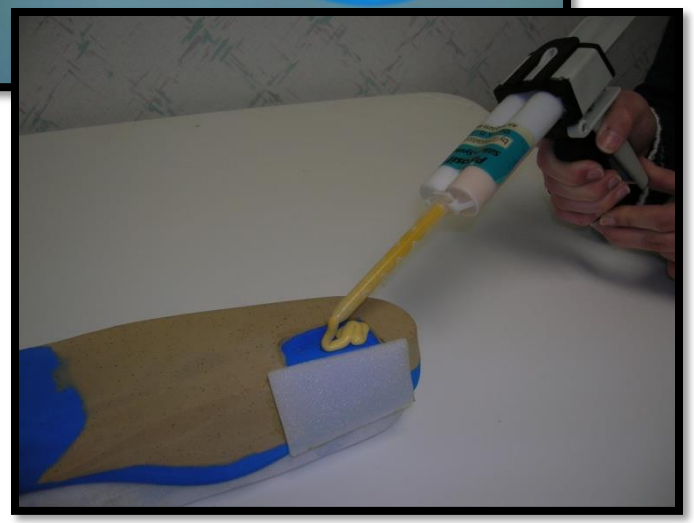


What to do?

- Control and decrease pronation to decompress nerve
- But…the nerve and the surrounding tissues are often hypersensitive, so a traditional orthotic device can actually exacerbate the problem
- As with any neurological condition, results are unpredictable

What to do?

- The Tarsal Tunnel Orthosis



Baxter’s Nerve Impingement

- Unfortunately, there is not much to be done from a pedorthic perspective.
- Possibly a semirigid FO with viscoelastic polymer under the entirety of the heel?

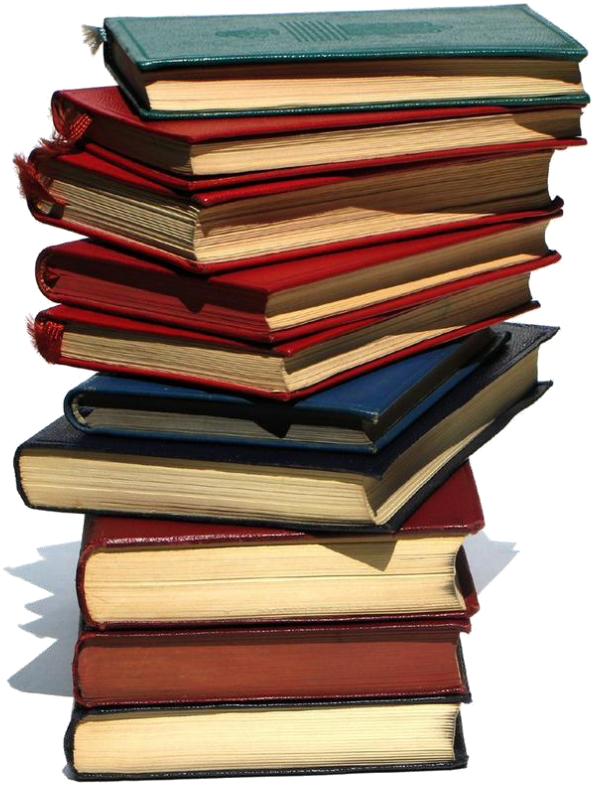
Rare Systemic Conditions and Diseases Affecting the Feet

In this section…

- Genetic disorders
- Autoimmune disorders
- Clarification of misunderstood diagnoses
- Other curiosities

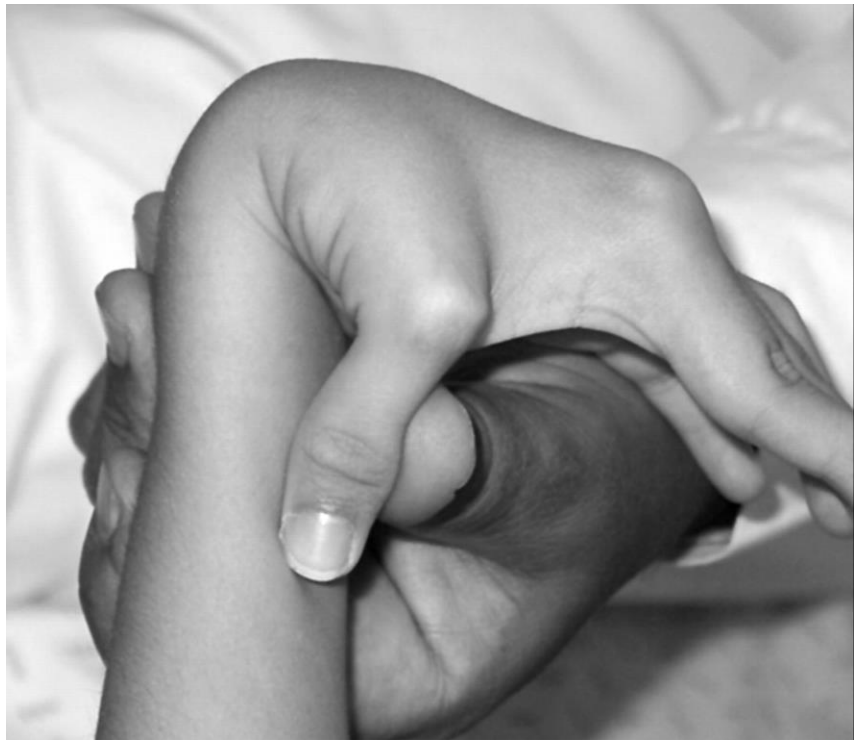
Definitions

- Genetic Disorder: Condition caused by abnormality in DNA (gene mutation)
  - Autosomal dominant: Abnormal gene needed from only one parent
  - Autosomal recessive: Abnormal gene needed from both parents
- Rare Disease: Affects less than 200,000 in US
- Autoimmune Disease: Illness that occurs when a body's tissues are attacked by its own immune system; patients with autoimmune diseases frequently have unusual antibodies circulating in their blood that target their own body tissues



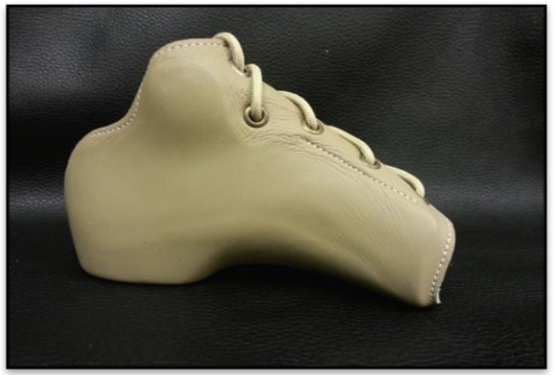
Ehlers-Danlos

- Aka: Cutis hyperelastica
- Ehlers-Danlos is a group of inherited connective tissue disorders
- Caused by a defect in the synthesis of collagen
- Most common (1 in 15,000) is Type III
  - Hypermobility
  - Chronic musculoskeletal pain
- Classified as a rare disease



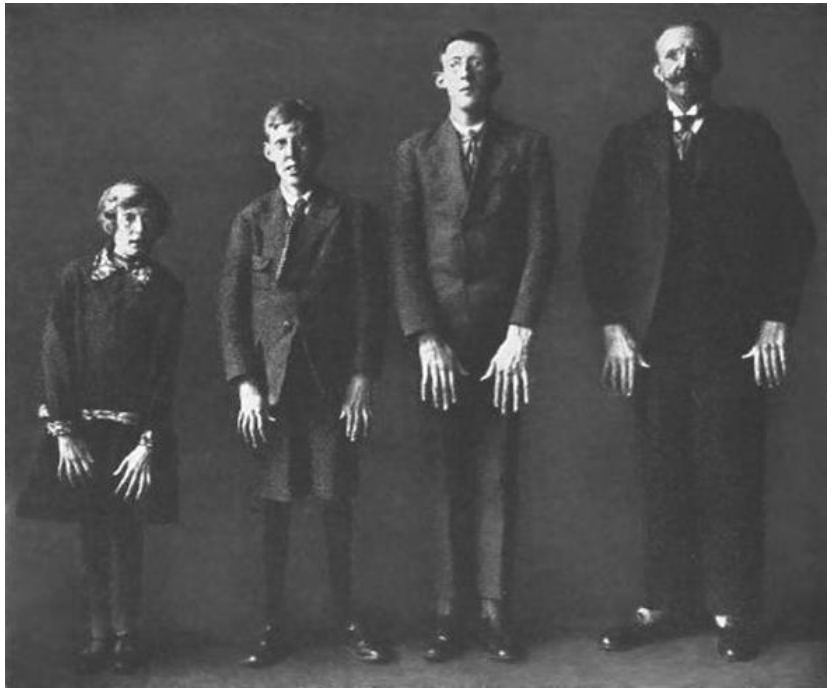
Ehlers-Danlos Syndrome

- With hypermobile joints comes the increased risk of joint subluxation and dislocation. Prevention is the most crucial aspect of medical management as each injury increases the likelihood of recurrence and complications such as osteoarthritis. Prevention revolves around robust patient counseling regarding limiting at-risk activities like contact sports or weightlifting.
- Usually, the goal of pedorthic intervention is joint stabilization and support.
  - Reinforced semirigid TCO
  - UCBL
  - SCFO (Arizona-type AFO)



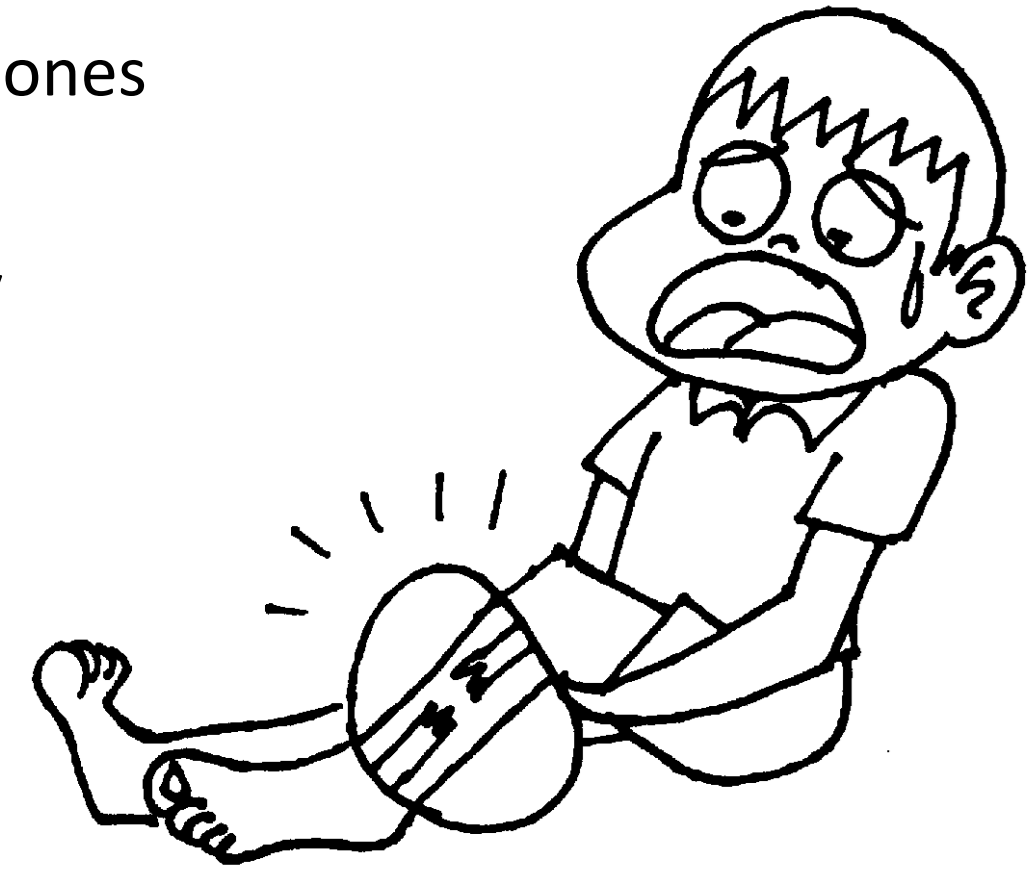
Marfan Syndrome

- Genetic disorder affecting connective tissues
- Affects 1 in 5,000 people
- Characterized by abnormal joint flexibility
- Severe pes planus, hammertoes
- Arachodactyly
- Chronic joint pain
- Classified as a rare disease
- Objectives of pedorthic management is much the same as for Ehlers-Danlos in the previous slide – joint stabilization and support.



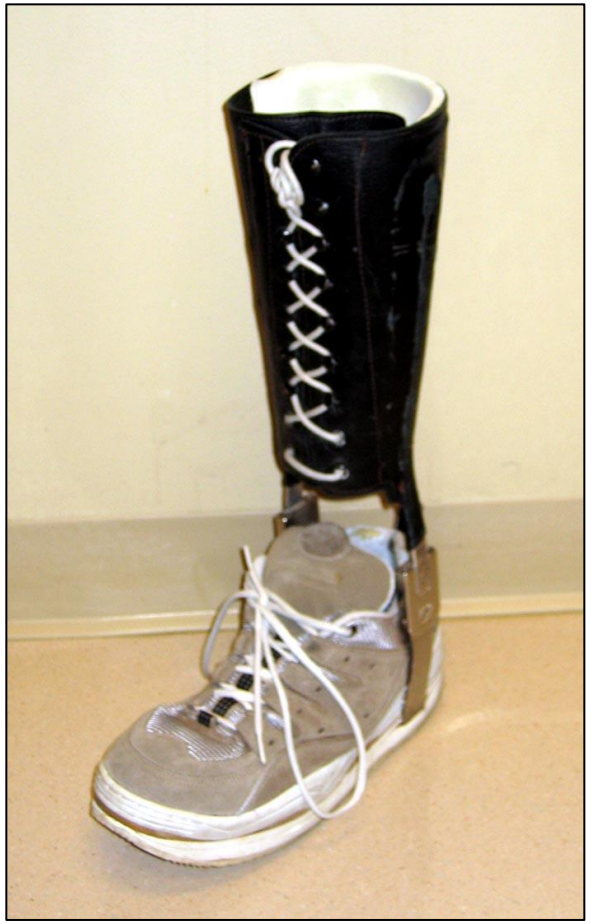
Osteogenesis Imperfecta

- “Brittle bone disease”
- Genetic disorder affecting bones
- Low muscle mass
- Joint and ligamentous laxity
- Classified as a rare disease



Osteogenesis Imperfecta

- Pedorthic Management:
- Goal is to protect foot, splint midfoot and forefoot, transfer dangerous stresses away from foot.
  - Footwear: Supportive in-depth shoes with shock-absorbing outsole. *NOT* overly flexible soles.
  - Shoe Modifications: Mild or heel-to-toe rockers with extended steel shanks
  - Foot Orthoses: semi-rigid total contact FOs, possibly reinforced with thermoplastic or resin/fiber material
  - SCFO: Solid ankle. Custom Arizona-style gauntlet
  - AFO: In severe cases, a molded Gillette-style calf lacer double upright AFO with ankle DF stopped at 0° may be needed to transfer harmful forces proximally away from foot.



Systemic Lupus Erythematosus

- Systemic lupus erythematosus (SLE) is an autoimmune disease that leads to chronic inflammation.
- Myalgia and arthralgia are primary symptoms of lupus, usually occurring in connective joints such as elbows, wrists, knees and ankles.
- Fatigue is the most common and bothersome complaint.
- The underlying cause of SLE is not fully known.
- Overdiagnosis is common because doctors mistakenly use a positive blood test alone to make diagnosis. 5% of population will test positive.

Systemic Lupus Erythematosus

- It may occur at any age, but appears most often in people between the ages of 10 and 50.
- African Americans and Asians are affected more often than people from other races.
- SLE has a modest recurrence rate in families: 8% of affected patients have at least one first-degree family member with SLE; this is in contrast to 0.08% of the general population

Systemic Lupus Erythematosus

- Incidence: 5 in 100,000.
- 2005 CDC estimates of 161,000 definite cases and 322,000 probable or definite SLE cases in the US.
- According to a 2008 report from the National Arthritis Data Working Group, approximately 250,000 Americans have definite SLE.
- The Lupus Foundation of American estimates prevalence to be up to 1.5 million cases (which likely reflects inclusion of milder forms of this disease).
- More than 90% of cases of SLE occur in women, frequently starting at childbearing age.

Systemic Lupus Erythematosus

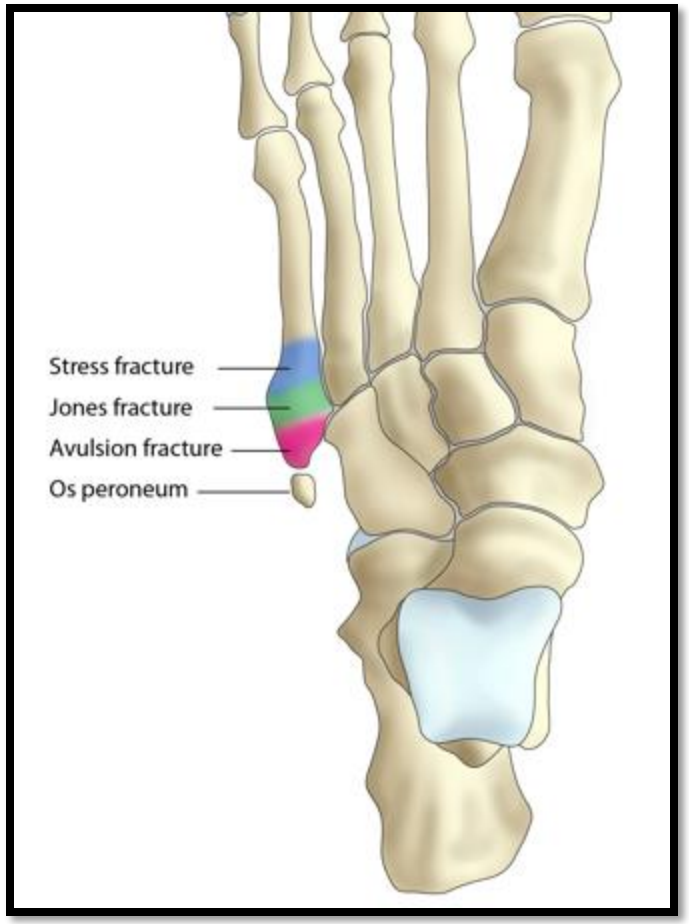
- Pedorthic Management:
  - Footwear: Well-fitting, supportive, in-depth shoes with shock-absorbing soles
  - Foot Orthoses: Total contact, cushion and support
  - Shoe modifications: mild rocker sole if forefoot pressure is an issue

Guillain-Barre Syndrome

- Autoimmune disease in which the body attacks its own nervous system
- Symptoms progress very rapidly
- Can be life-threatening
- Most people survive and recover completely but 1/3 of patients still have muscle weakness after 3 years
- Causes neuropathy

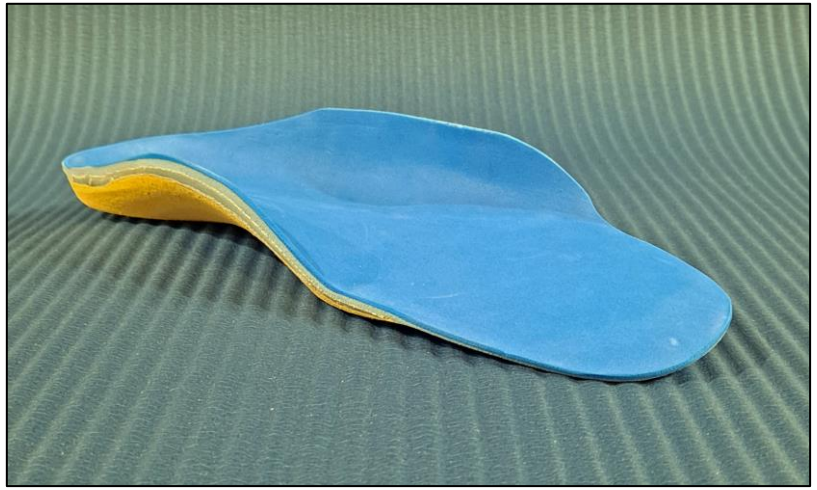
Jones Fracture

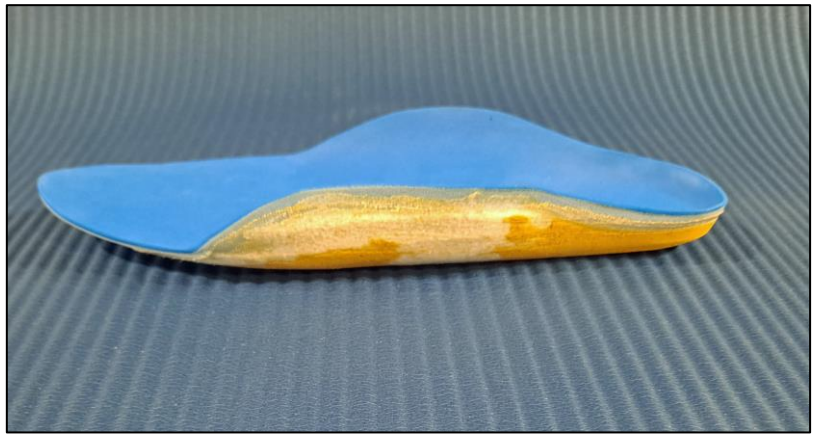
- Jones Fx Vs. Avulsion Fx Vs. 5th MT Stress Fx
- True Jones is a fracture of the base of the 5th MT at the metaphyseal-dyaphyseal junction that extends into the 4th-5th intermetatarsal facet. Jones fracture is located within 1.5cm distal to tuberosity of 5th MT.



Pedorthic Management

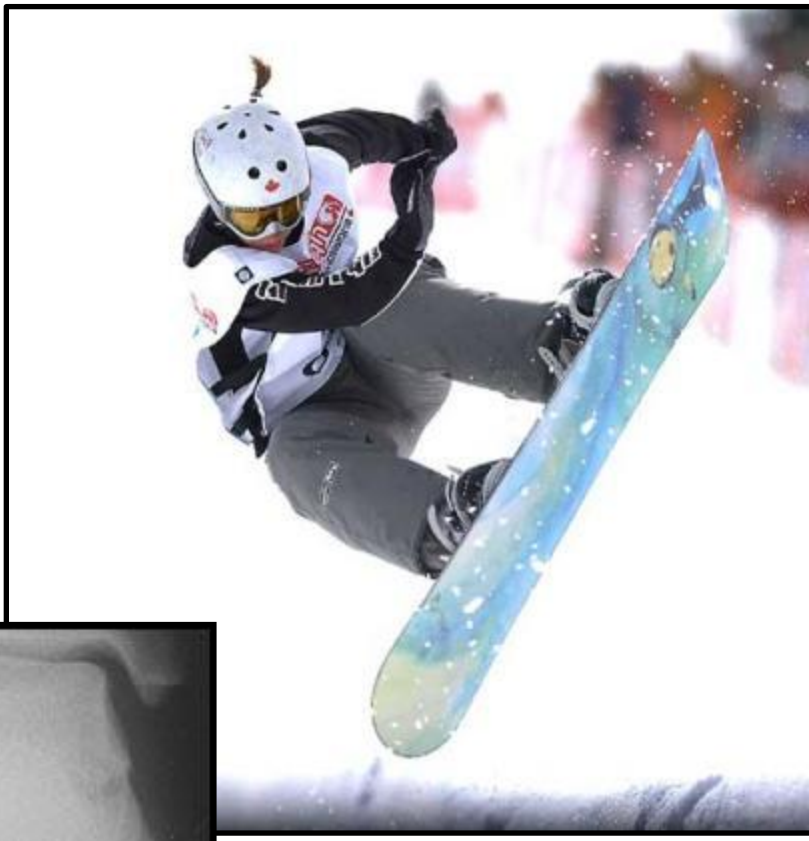
- Generally speaking, pedorthic intervention is not used for acute fracture.
- Rather it is used once fracture is either well on its way to being healed, or completely healed. Primary treatment is immobilization or surgery.
- Foot orthosis to protect and splint fracture site is used to prevent further insult to the fracture site and allow patient to return to work/athletics.
- Stiff soled shoe recommended. +/- Double rocker sole.

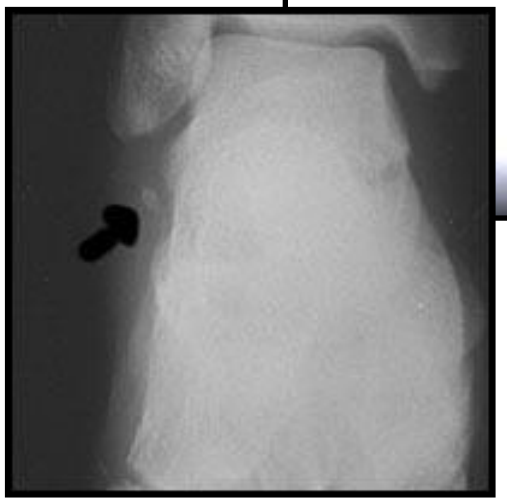




Snowboarder's Fx

- ¼ of all snowboarding injuries happen during first experience
- Fracture of lateral process of talus
- Often misdiagnosed as a severe ankle sprain
- Pedorthic management is typically not for acute Fx, but for post-healing therapy and comfort.
  - SCFO that provides frontal plane control at STJ and, preferably, ankle, as well.
  - Arizona-style gauntlet. Does *not* need to be particularly tall/extended.

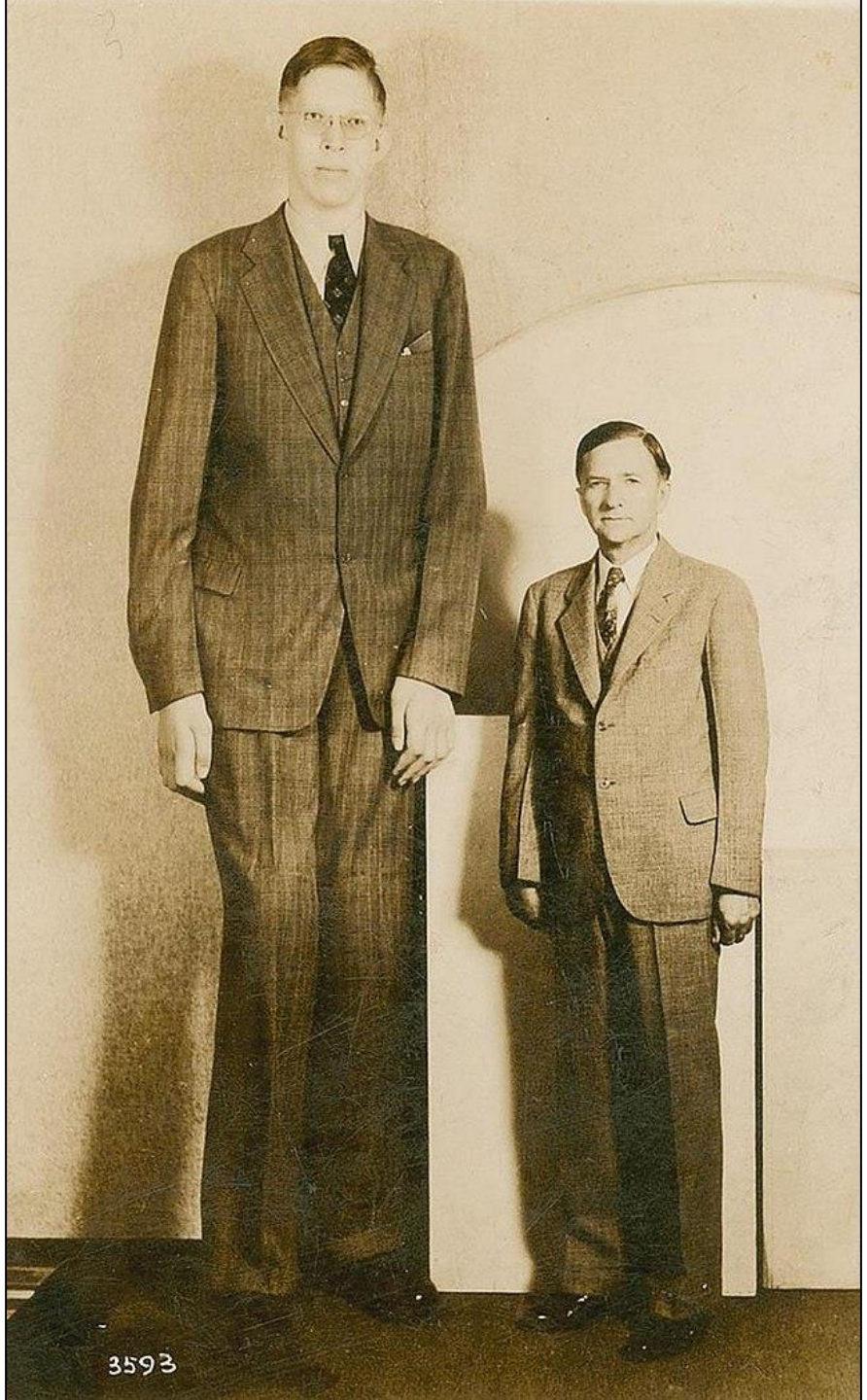




Type I

Height and Peripheral Neuropathy

- Height > 175.5cm (5’9”)
  - Prevalence of peripheral neuropathy in highest quartile is 2.3 x that in third quartile (5’6”) and twice that of second quartile (5’3”) (Cheng, et al, 2006)



Height and Peripheral Neuropathy

- Gadia MT, et al: Influence of height on quantitative sensory, nerve-conduction, and clinical indices of diabetic peripheral neuropathy. *Diabetes Care*. 1987 Sep-Oct;10(5):613-6.
  - The association between diabetic peripheral neuropathy and height has several important implications. Nerve length should be more strongly considered as a factor in the pathogenesis of diabetic peripheral neuropathy.
- Tseng CH: Prevalence of lower-extremity amputation among patients with diabetes mellitus: Is height a factor? *CMAJ.* 2006 January 31; 174(3): 319–323.
  - This study revealed a strong and statistically significant association between height and risk of lower-extremity amputation among diabetic patients. The association held even after adjustment for other risk factors for this type of amputation. Every additional 10 cm of height was associated with a 16% increase in the risk of amputation. Height is a risk factor for lower-extremity amputation among diabetic patients. This effect appears to be independent of other known risk factors.

Height and Peripheral Neuropathy

- Robinson LR, et al: Height is an independent risk factor for neuropathy in diabetic men. *Diabetes Res Clin Pract.* 1992 May;16(2):97-102.
    - …data do not confirm previous reports of associations between height and slowed motor conduction velocities in diabetic subjects. This study does, however, support the hypothesis that height is an independent risk factor for sensory polyneuropathy in diabetic subjects.
- Sorenson L, et al: Insensate versus painful diabetic neuropathy: the effects of height, gender, ethnicity and glycaemic control. *Diabetes Res Clin Pract*. 2002 Jul;57(1):45-51.
    - There was more insensate neuropathy in males and anglo-celtics, but stratification by height showed that these effects were due to height. Height has no influence on the development of pain. The insensate type is more explainable by duration, degree of hyperglycemia and length of peripheral nerves (i.e. height).

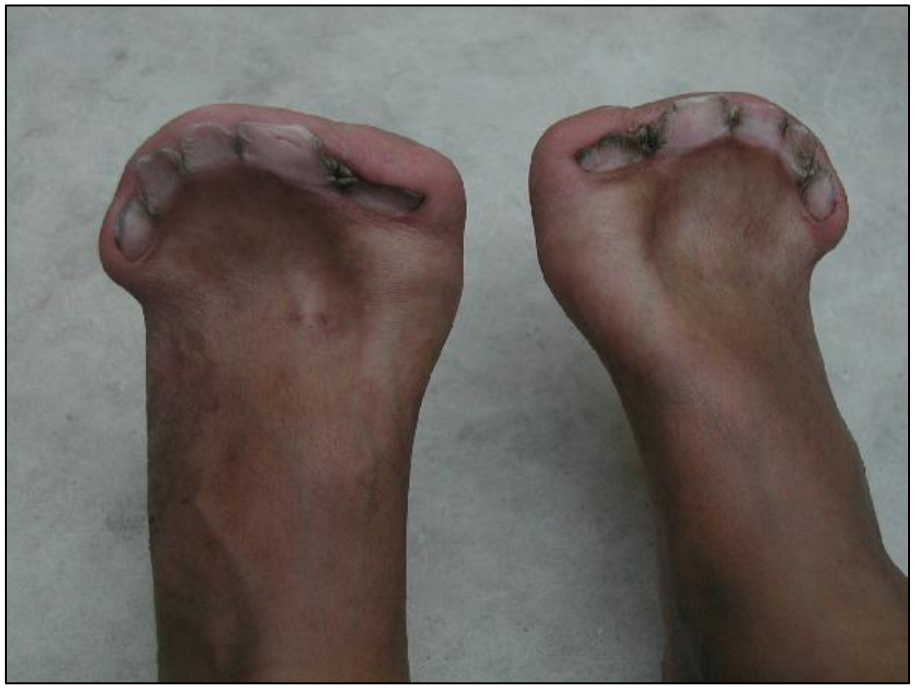
Height and Peripheral Neuropathy

- Pedorthic management would be essentially the same as for an insensate diabetic foot.
  - Properly shaped and fitted shoes
  - Custom, total contact FOs to better equalize plantar pressures
  - Rocker soles to decrease pressure under MTHs

- Keep in mind, your patients with a primary diagnosis of a peripheral neuropathy-inducing diagnosis (like diabetes) may experience a more-rapid-than-usual progression of their neuropathy ifs they are taller in physical stature.

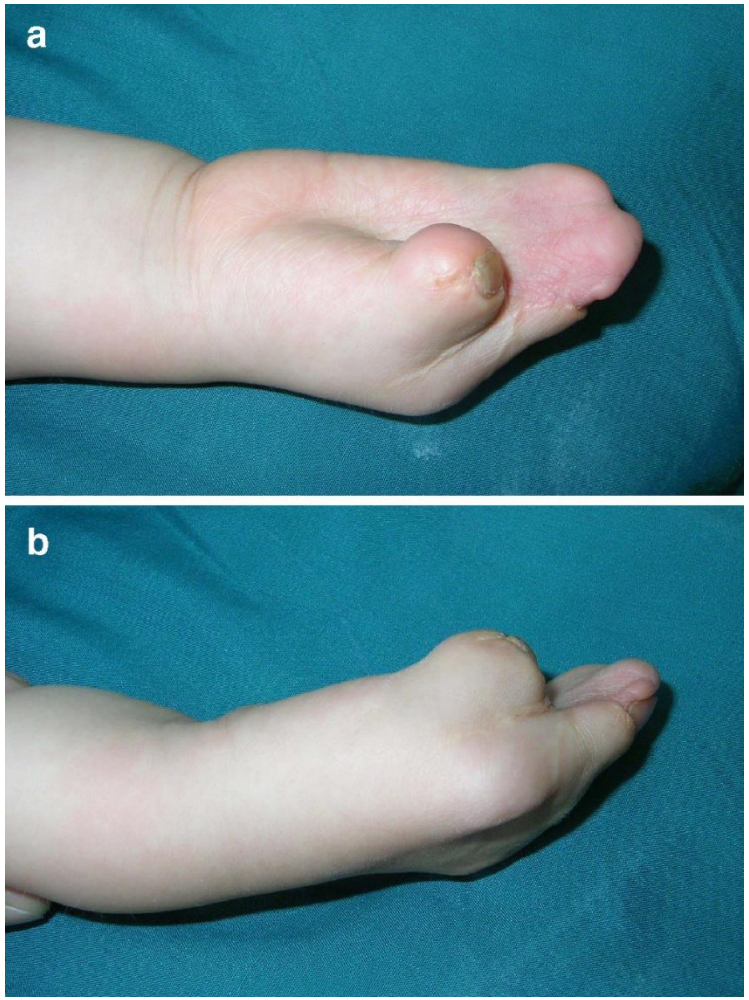
Apert Syndrome

- Described by Eugène Apert, 1906
- Form of acrocephalosyndactyly, a congenital disorder characterized by malformations of the skull, face, hands and feet.
- In embryology, the hands and feet have selective cells that die, called selective cell death or apoptosis, causing separation of the digits. In the case of acrocephalosyndactyly, selective cell death does not occur and skin, and rarely bone, between the fingers and toes fuses.
- Reported incidence varies: 1 in 65,000-200,000



Apert Syndrome

- The typical hand deformities in patients with Apert Syndrome distinguish it from the other acrocephalosyndactyly syndromes. The hands in patients with Apert syndrome always show four common features:
  1. a short thumb with radial deviation
  2. complex syndactyly of the index, long and ring finger
  3. Symbrachyphalangism, stiffness of the thumb
  4. simple syndactyly of the fourth webspace
- Males – Females affected equally
- Pedorthic management will be:
  - Primarily, accommodating the feet in properly shaped/modified shoes
  - Custom FOs to further improve foot-shoe interface and relieve painful plantar prominences

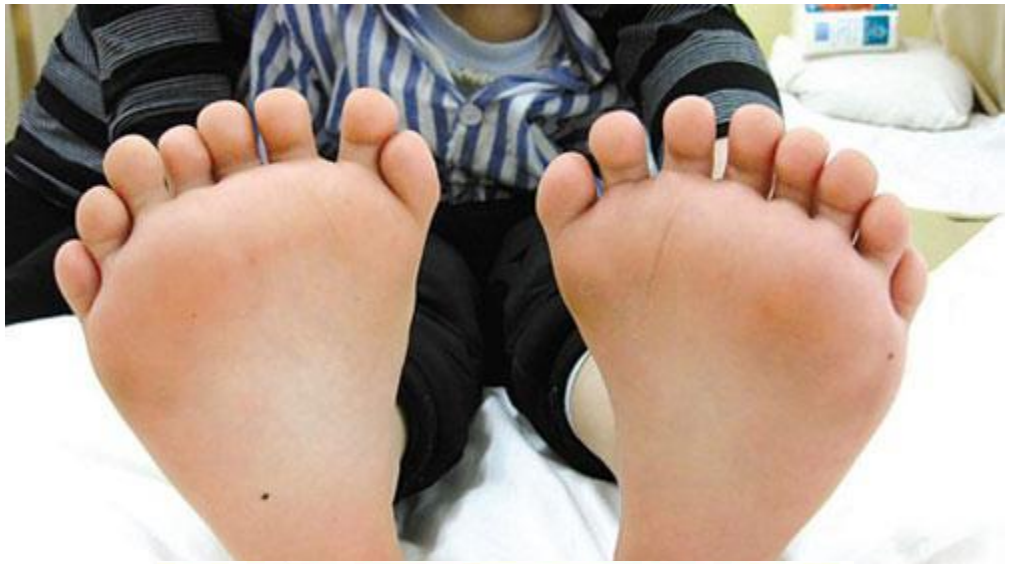


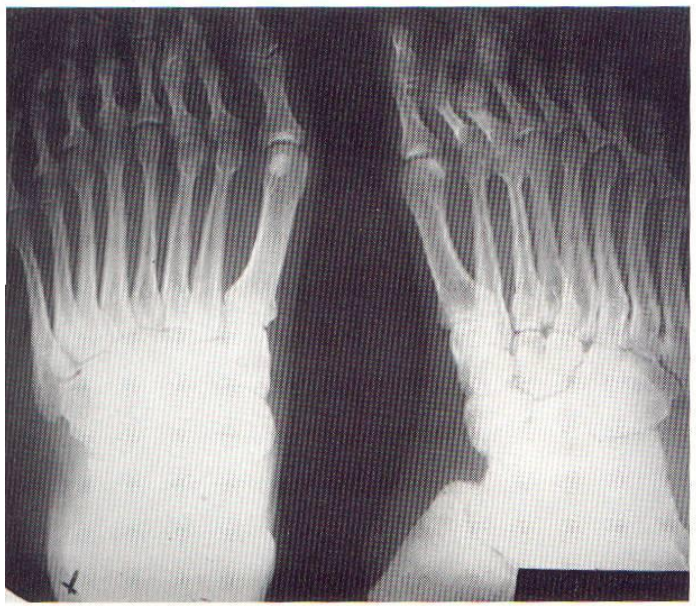
Acromegaly

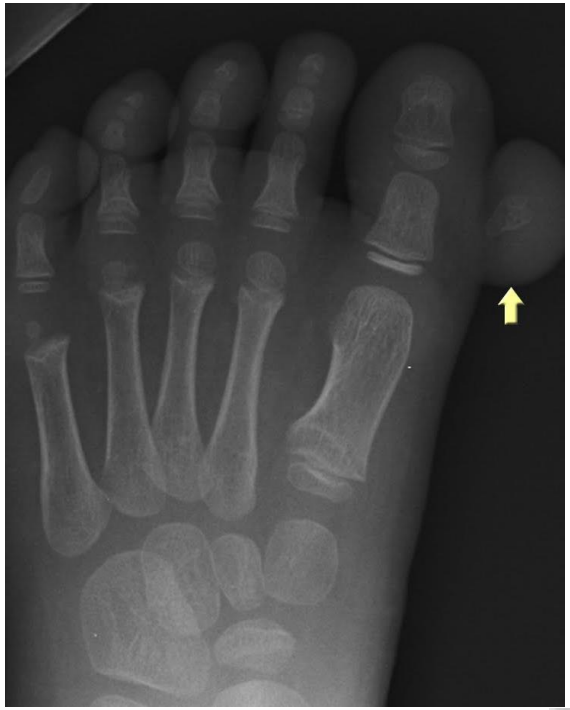
- Syndrome that results when pituitary gland produces excess growth hormone after epiphyseal plate closure at puberty
- Caused by tumor of pituitary gland
- Most commonly affects adults in middle age
- Affects 6 of 100,000
- Puffiness/sponginess of feet – especially in heel pads
- Pedorthic concerns are:
  - Properly fitting, properly shaped shoes with ample depth and adjustability to accommodate feet
  - Custom FOs to further improve foot-shoe interface and relieve painful plantar prominences

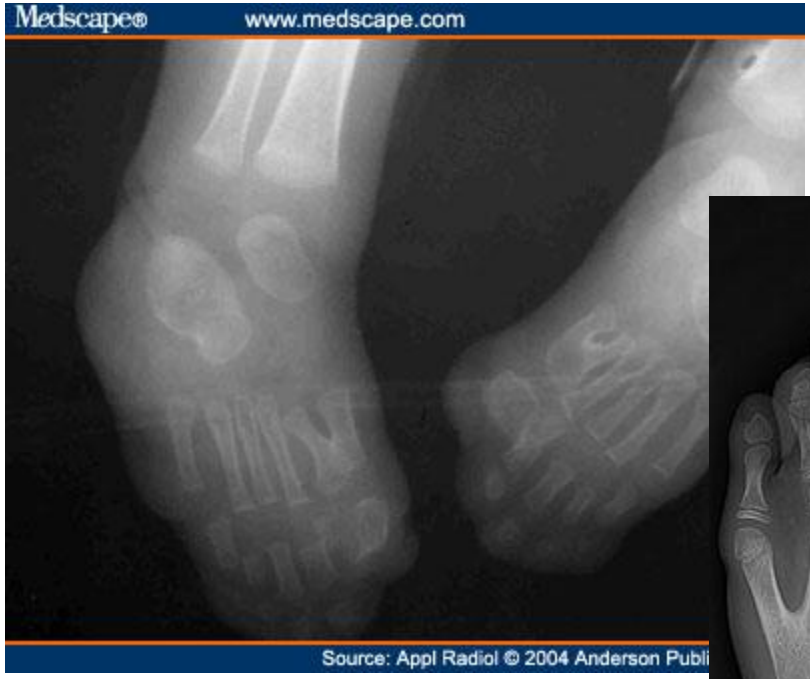
Polydactyly

- Extra digit(s) can be a small piece of soft tissue that can be removed, but it can also contain bone without joints or it may be a complete, functioning digit
- Associated with 39 different genetic mutations
- Obviously, can cause shoe fitting issues…





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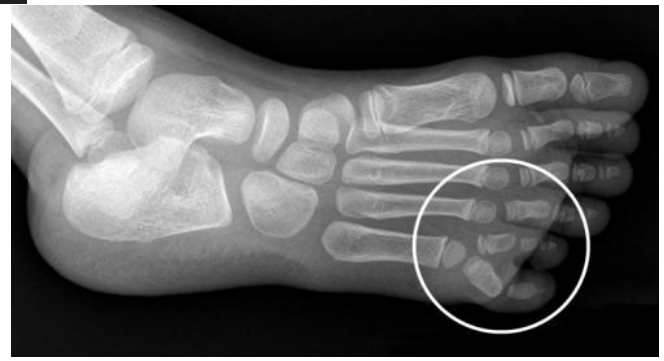
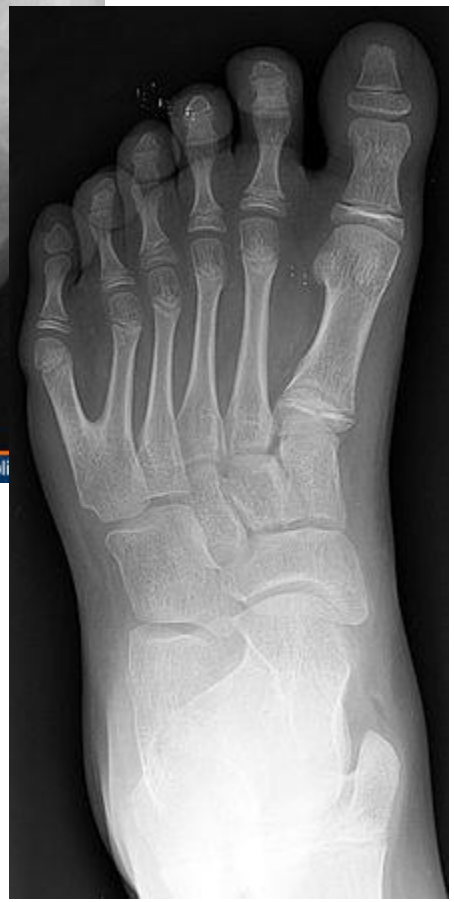
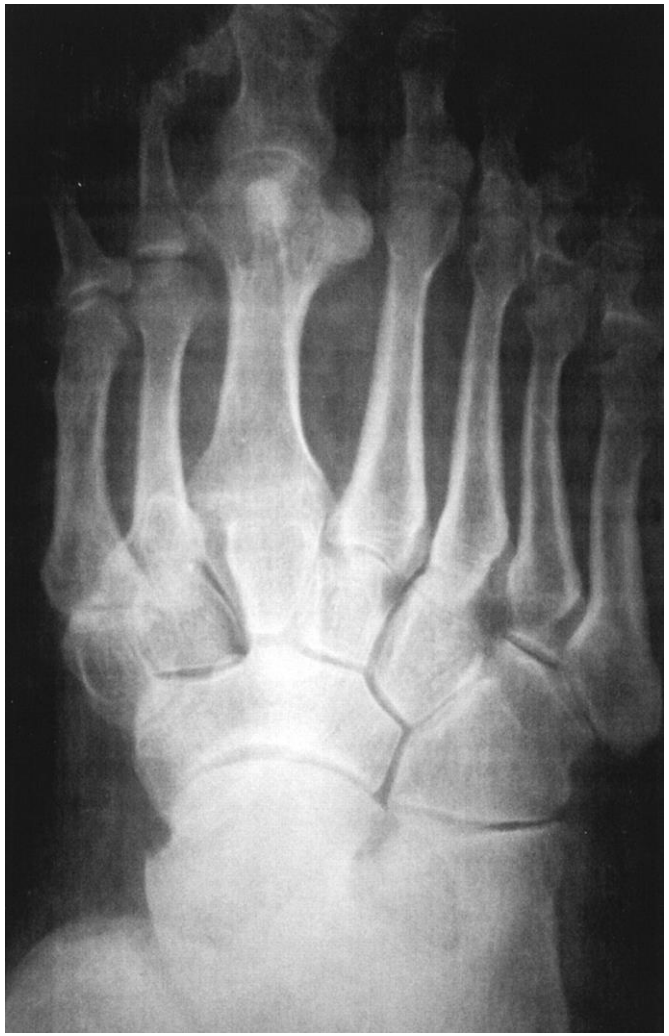




—Oblique radiograph of right foot of 60-year-old man with polydactyly shows abnormal configuration of foot with two fully developed extra toes and abnormal tarsal bones.



Theodorou S J et al. AJR 2003;181:1721-1722

Hereditary Insensitivity To Pain

- Congenital analgesia
  - *Insensitivity* to pain means that the painful stimulus is not even perceived: a patient cannot describe the intensity or type of pain.
  - *Indifference* to pain means that the patient can perceive the stimulus, but lacks an appropriate response: they will not flinch or withdraw when exposed to pain.
- Separate from HSAN as these patients exhibit no other neuropathies
- Patients can still feel discriminative touch (though not always temperature), and there are no detectable physical abnormalities.
- Unrecognized fractures that lead to Charcot
- 1 in 25,000 population – Rare Disease
- Pedorthic management would be essentially the same as for an insensate diabetic foot.
  - Properly shaped and fitted shoes
  - Custom, total contact FOs to better equalize plantar pressures
  - Rocker soles to decrease pressure under MTHs

Seronegative RA

- 1 in 7 RA pts don’t show RF
- 50% are negative in first 6 months of disease
- 15% are still negative after 2 years
- Generally, do not produce rheumatoid nodules
- Overall, joint destruction is less than seropositive RA
- May or may not cause peripheral neuropathy

- Pedorthic Management of the following arthritic conditions will be fairly consistent:
  - Footwear to accommodate deformities and FOs
  - Foot orthoses to cushion feet and offload areas of pain
  - Rocker soles t o decrease pressure

Reiter's Syndrome

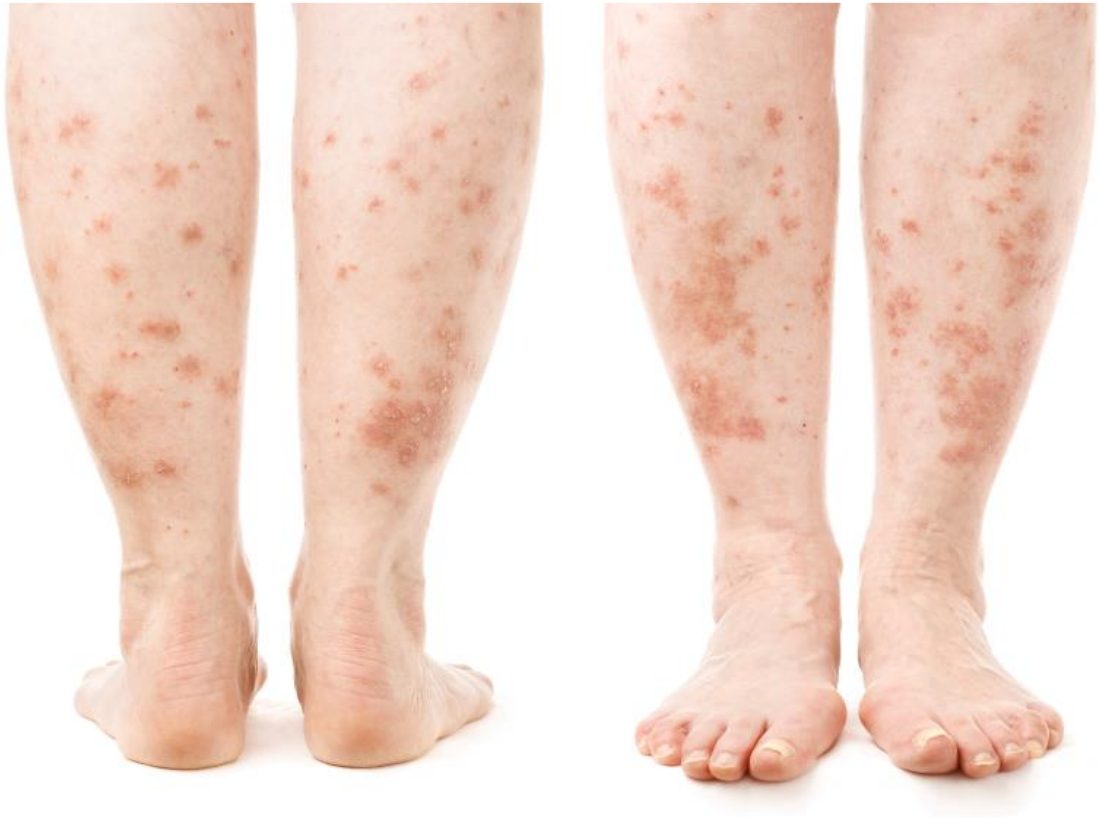
- Reiter's syndrome (reactive arthritis) is a condition that may be triggered by a bacterial infection in the urinary or gastrointestinal tracts.
- Most often affects young men, although men of any age and women may also be affected.
- Symptoms:
  - Pain, swelling, and inflammation of the joints (arthritis), especially where the pelvis attaches to the spine (sacroiliac joint) and in the fingers, toes, and feet.
  - Inflammation of the eye (iritis).
  - Inflammation of the urethra and possible discharge. (urethritis).
  - Skin rash or small sores (ulcers), especially on the penis, on the soles of the feet, or in the mouth.

Psoriatic Arthritis

- Most destructive type of arthritis
- Systemic disease
- Characterized by stiffness, pain, swelling, and tenderness of the joints and surrounding ligaments and tendons
- Foot can appear like an RA foot, except often involves IP joints
- 95% have joint swelling

Epidemiology

- Skin disease psoriasis precedes arthritis in 80% of patients
- 10%-30% of people w/ psoriasis develop arthritis
- 15% develop skin psoriasis and arthritis at the same time
- 15% develop skin psoriasis following the onset of psoriatic arthritis.
- Psoriatic arthritis can develop in people who have any level severity of psoriatic skin disease from mild to very severe.
- Psoriatic arthritis tends to appear about 10 years after the first signs of psoriasis. Onset tends to occur between the ages of 30 and 55, but the disease can also affect children.
- More than 80% of patients with psoriatic arthritis will have psoriatic nail lesions.



Prevalence

- Psoriatic arthritis affects an estimated 520,000 patients in the US.
- Affects men and women equally
- Like psoriasis, psoriatic arthritis is more common among Caucasians than Africans or Asians.

Psoriatic Arthritis

- Common symptoms:
  - Pain, swelling, or stiffness in one or more joints
  - Joints that are red or warm to the touch
  - Sausage-like swelling in the fingers or toes (dactylitis)
  - Pain in and around the feet and ankles, especially tendinitis in the Achilles tendon or plantar fasciitis in the sole of the foot
  - Changes to the nails, such as pitting or separation from the nail bed
  - Pain in the area of the sacrum
  - Extreme exhaustion that does not go away with adequate rest - may last for days or weeks without abatement
- Psoriatic arthritis may remain mild, or may progress to more destructive joint disease.
- Periods of active disease, or flares, will typically alternate with periods of remission.
- Because prolonged inflammation can lead to joint damage, early diagnosis and treatment to slow or prevent joint damage is recommended.

Psoriatic Arthritis

- Potential for peripheral neuropathy
  - *Charcot-like arthropathy: A newly-recognized subset of psoriatic arthritis.* Candia, et al, in Clin Exp Rheumatol. 2006 Mar-Apr;24(2):172-5.
  - *Psoriatic arthritis-associated polyneuropathy: a report of three cases.* Narayanaswami P, et al. J Clin Neuromuscul Dis. 2007 Sep;9(1):248-51.

Psoriatic Arthritis

- Classification (5 types):
  - Asymmetric: Affects around 70% of patients, generally mild. Does not occur in the same joints on both sides of the body and usually involves fewer than 3 joints.
  - Symmetric: Accounts for around 25% of cases, and affects joints on both sides of the body simultaneously. Most similar to rheumatoid arthritis and is disabling in around 50% of all cases.
  - Arthritis mutilans: Affects less than 5% of patients and is a severe, deforming and destructive arthritis. This condition can progress over months or years causing severe joint damage. Arthritis mutilans has also been called chronic absorptive arthritis, and may also be seen in rheumatoid arthritis.
  - Spondylitis: This type is characterized by stiffness of the spine or neck, but can also affect the hands and feet, in a similar fashion to symmetric arthritis.
  - Distal interphalangeal predominant: Found in about 5% of patients, and is characterized by inflammation and stiffness in the joints nearest to the ends of the fingers and toes. Nail changes are often marked.

Sarcoidosis

- Disease of undetermined etiology
- Tiny clumps of abnormal tissue (granulomas – clusters of immune cells) form in certain organs of the body causing inflammation.
- 25% have arthropathy (joint destruction)
- Can cause peripheral neuropathy
- More common in African Americans than Caucasians
- Females are affected more often than males.
- The disease typically begins between ages 20 and 40.
- A person with a close blood relative who has sarcoidosis is nearly five times as likely to develop the condition.
- Pedorthic management would be essentially the same as for an insensate diabetic foot.
    - Properly shaped and fitted shoes
    - Custom, total contact FOs to better equalize plantar pressures
    - Rocker soles to decrease pressure under MTHs

Enteropathic Arthritis

- Chronic, inflammatory arthritis associated with the occurrence of an inflammatory bowel disease
  - Ulcerative colitis
  - Crohn's disease
- About 1 in 5 people with Crohn's or ulcerative colitis will develop enteropathic arthritis.
- The most common effects of enteropathic arthritis are inflammation of the peripheral joints and abdominal pain.

Enteropathic Arthritis

- Gastrointestinal tract contains the largest immune system in the body. The immune system is somehow altered in people who have these conditions.
- Researchers believe that the long-lasting inflammation found in the intestines of people with IBD damages the bowel and allows bacteria to enter and circulate through the blood stream. The body's reaction to these bacteria may cause other problems including inflammation in the joints and/or spine, skin sores and inflammation of the eyes.
- Currently this hypothesis is neither fully understood nor confirmed by rigorous scientific study.

Sjögren's Syndrome

- Systemic chronic autoimmune disease in which people's white blood cells attack their moisture-producing glands.
- Causes dysfunction of other organs such as the kidneys, gastrointestinal system, blood vessels, lungs, liver, pancreas, and the central nervous system.
- Patients experience extreme fatigue and joint pain and have a higher risk of developing lymphoma.
- 4,000,000 Americans suffer from Sjögren's - it is one of the most prevalent autoimmune disorders.
- 9 in 10 patients are women.
- 50% of Sjögren's occurs alone, 50% occurs in the presence of another autoimmune connective tissue disease such as rheumatoid arthritis, lupus, or scleroderma.
- Pedorthic management would be essentially the same as for an insensate diabetic foot.
    - Properly shaped and fitted shoes
    - Custom, total contact FOs to better equalize plantar pressures
    - Rocker soles to decrease pressure under MTHs

Friedrich’s Ataxia

- Autosomal recessive genetic disorder. (You must get a copy of the defective gene from both your mother and father.)
- Symptoms are caused by the wearing away of structures in areas of the brain and spinal cord that control coordination, muscle movement, and other functions.
  - Foot problems, such as hammer toes and high arches
  - Loss of coordination and balance, which leads to frequent falls
  - Muscle weakness
  - No reflexes in the legs
  - Unsteady gait and uncoordinated movements (ataxia)
- Most patients need to use a wheelchair within 15 years of the disease's start.
- 20% of cases associated with DM
- Rare disease, estimates are 1 in 22,000-50,00
- Predominantly found in white population
- Almost always presents before age 20
- Pedorthic management would be essentially the same as for an insensate diabetic foot.
  - Properly shaped and fitted shoes
  - Custom, total contact FOs to better equalize plantar pressures
  - Rocker soles are not recommended as ataxia causes loss of coordination and balance
  - Medial and lateral flares may provide more stability and a wider base of support for safer ambulation

Muscle Weakness

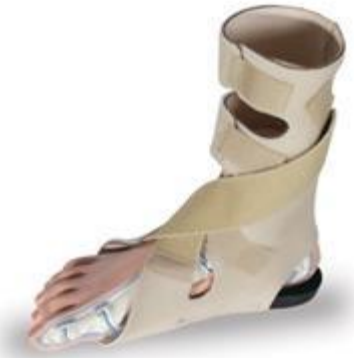
Foot Drop

- Often a flaccid deficit.
- Spasticity in the tibialis anterior makes pathology much more complex
- Associated with: peroneal nerve injury, cerebral vascular accident, sciatic nerve injury, Charcot-Marie-Tooth disease

Foot Drop

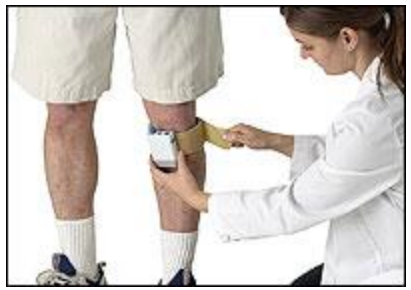
- Pedorthic/Orthotic modalities
  - Custom Vs. OTC AFO
  - Foot-up®
  - Freedom Soft® (shoeless system)





Foot Drop

- Neuroprosthetics for foot drop



The Leg Cuff

The Gait Sensor

The Remote Control

Dystonia

- Dystonia is a movement disorder which causes involuntary contractions of muscles, resulting in sustained twisting, repetitive movements and abnormal posture, which can be painful.
- May be focal, segmental, generalized, multifocal, or hemidystonia. Dystonias are a heterogeneous group of diseases, which may account for the difficulties in evaluation of the epidemiological data.
- Symptoms include tremors, voice problems or a dragging foot.
- Symptoms often start in childhood.
- Can be hereditary (primary) or may be associate with another disease (secondary). Either way, researchers agree that it is cause by a problem in the part of the brain that handles messages about muscle contractions.
- Pedorthic intervention will most likely be working with orthotist to optimize footwear with custom bracing.

Other Impairments

- Lack of Total Knee Extension
- Weak quads will cause knee to buckle
- GRAFO

Other Impairments

- Lack of Ankle Dorsiflexion/Plantarflexion
- What is normal?
  - 5-10° plantarflexion, immediately following initial contact
  - 10° dorsiflexion, at weightbearing
  - 20° plantarflexion, at pushoff
  - Neutral position, throughout swing

Lack of Ankle Dorsiflexion/Plantarflexion

- Why does it occur?
  - Ankle Sprain
  - Achilles Tendinitis
  - Various Fractures of the shank
  - Shortened Achilles/Gastroc Complex
- What might it cause?
  - Compensation at the hip and knee can leads to additional chronic injuries
  - A lack of toe clearance may cause additional ankle injuries
  - Plantar Fasciitis?
- Pedorthic Intervention
  - SCFO
  - Rocker soles

The End