LESSON 3

Gait-related pathologies

In this lesson:

- How immobilization affects muscle, synovial joints, and periarticular soft tissues
- The role of neuroplasticity
- Why conventional footwear is a problem
- Symptoms of foot dysfunction

Your Critical Connection Resources

To download the resources, visit biopodsmedical.com

Slide Deck
guides you through the presentation. A good place for you to take notes.

Coursebook
provides more in-depth coverage of each lesson's topics.

Monograph
provides a deeper dive into all of the lessons.

Introducing **Your Instructors**

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President, American Chiropractic Association's Council on Occupational Health; Former CEO, Allied Health Chiropractic Centers; Certified by the American Chiropractic Board of Occupational Health; Certified in Chiropractic Spinal Trauma; Certified Chiropractic Sports Physician; Co-author, *Industrial Carpal Tunnel Manual for Physicians* and *Carpal Tunnel Syndrome*

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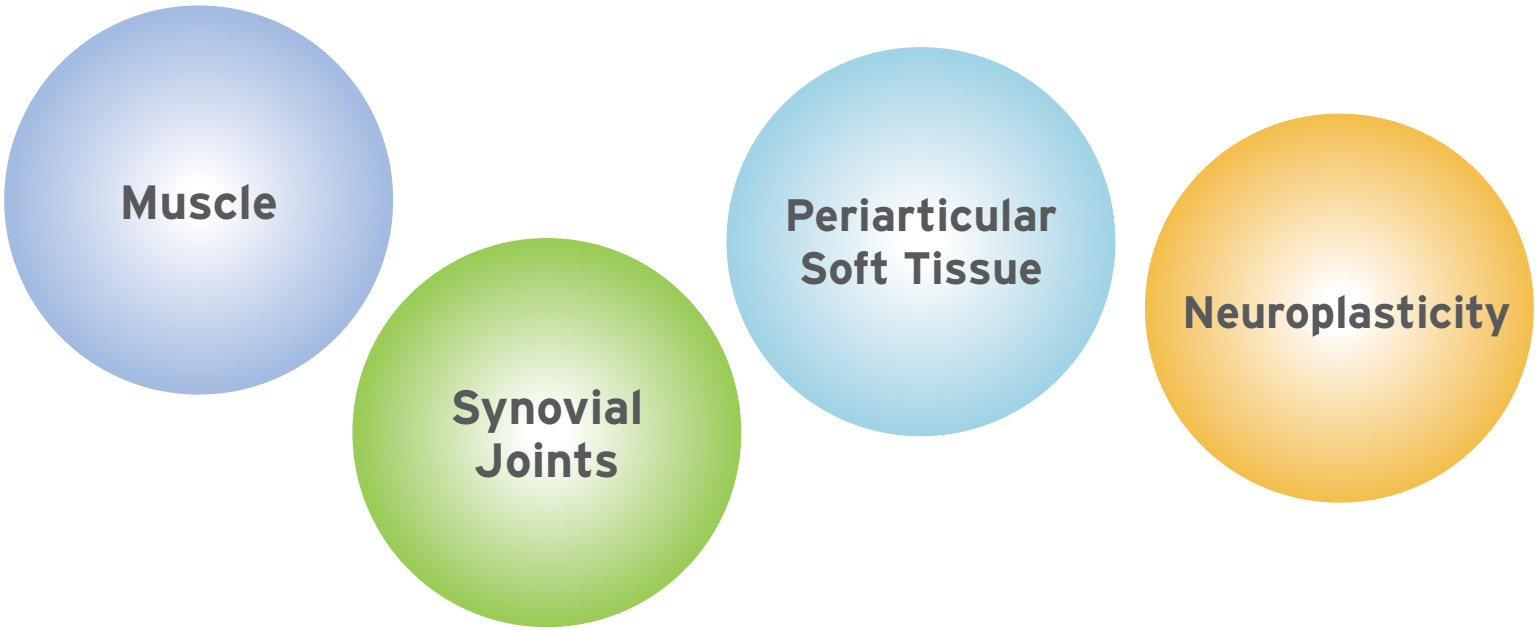
Diplomate, American Board of Sports Physicians; Certified Strength and Conditioning Specialist; Certified Professional Compliance Officer; Certified in Chiropractic Spinal Trauma and Nutritional Counseling; Volunteer rotations at the U.S. Olympic Training Center; Author, *Mental Toughness: Understanding the Game of Life*

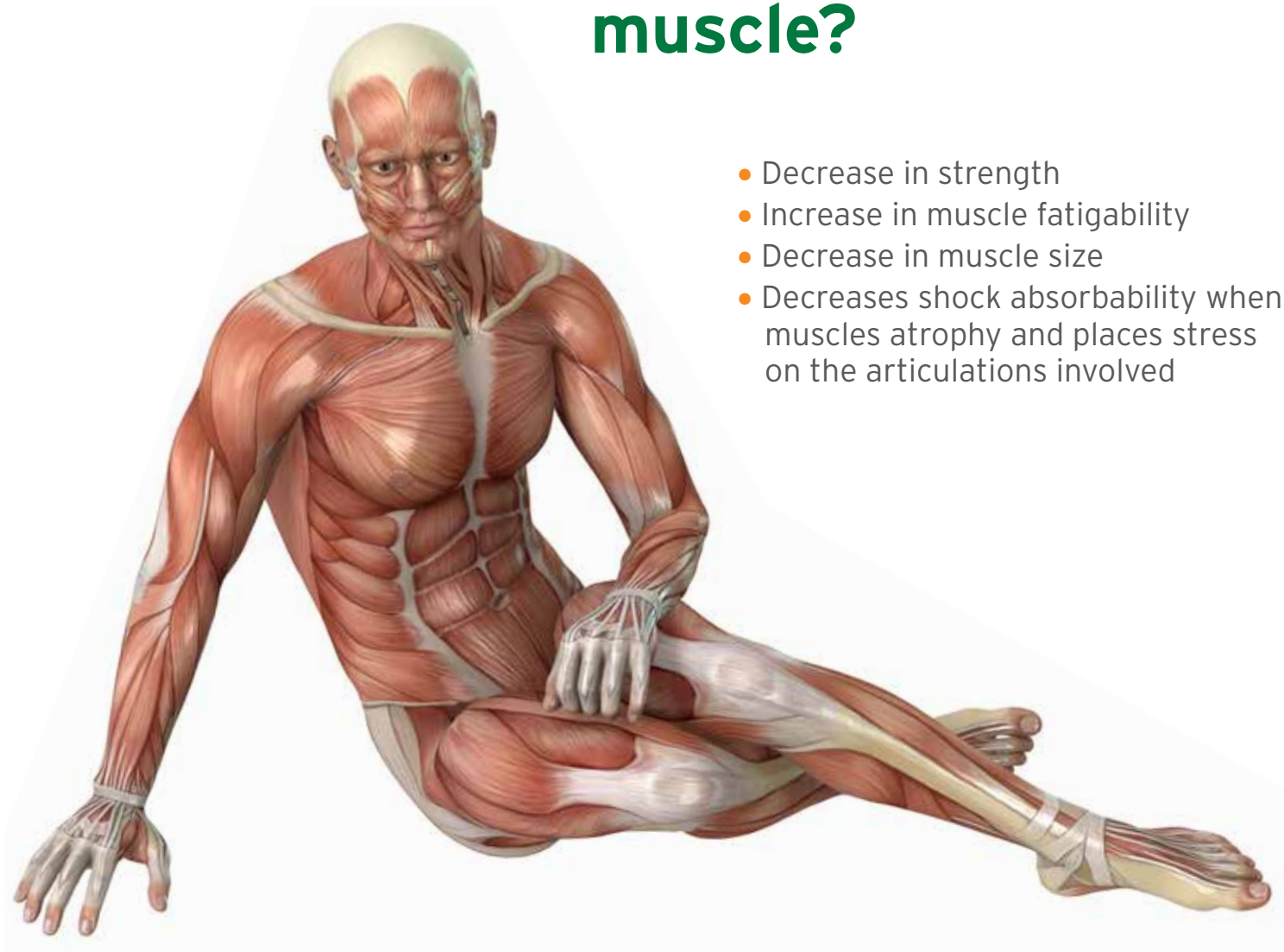
It's important to understand

the effects of immobilization on...



How does immobilization affect

muscle?



- Decrease in strength
- Increase in muscle fatigability
- Decrease in muscle size
- Decreases shock absorbability when muscles atrophy and places stress on the articulations involved

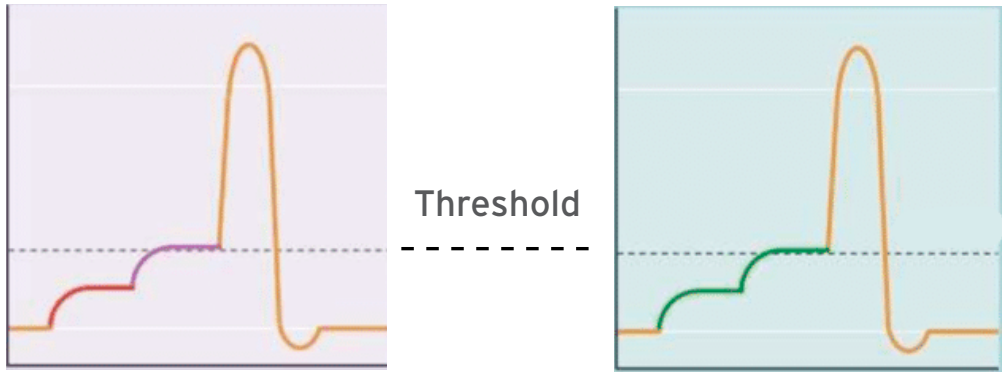
How does immobilization affect **synovial joints?**

- Stress deprivation
- Proliferation of fibro-fatty connective tissue within the joint space
- Adhesions between synovial folds
- Adherence of fibro-fatty connective tissue to cartilage surfaces
- Atrophy of cartilage
- Ulceration at point of cartilage
- Disorganization of cellular and fibrillar ligament and alignment
- Osteoclastic resorption of bone and Sharpey's fibres
- Increased force requirement for joint cycling
- Decreased collagen mass
- Increased collagen cross links
- Decrease in water content

How does immobilization affect **periarticular soft tissues?**

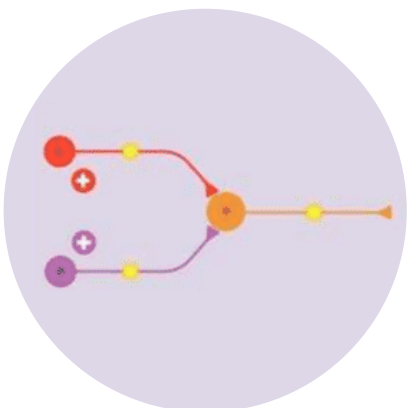
- Joint stiffness
- Restricted movement
- Excessive connective tissue in the synovial joints and joint recesses
- Poor biomechanics changes
- Poor collagen orientation
- Significant water loss
- Increase in collagen cross links

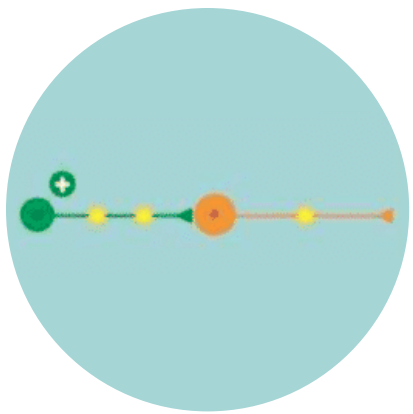
How does immobilization affect the **nervous system?**



Spatial Summation

Temporal Summation





The nervous system is affected by functional conditioning.

2 common responses:

- Spatial summation
- Temporal summation

How does immobilization affect the **nervous system?**

Long-term immobilization results in maladapted neuroplasticity (neuromuscular atrophy and loss of functional capabilities).

Some of the most common forms of

immobilization

Complications from

immobility

Immobility can cause many forms of pathology

→

It can lead to functional maladaptation

→

Functional maladaption can lead to acute and chronic pain

Now let's take a closer look at

conventional footwear

Cushioning

Supportive

Restrictive

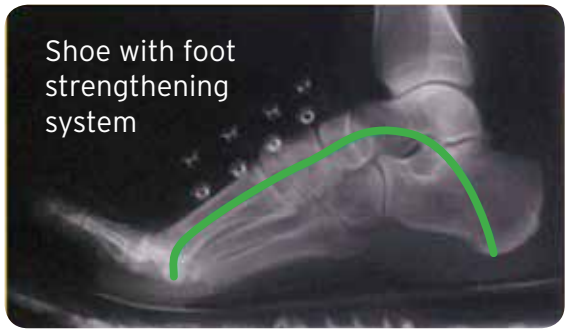
Cushioning properties attenuate sensory input to the sole of the foot and produce sensory input that is unvaried and uniformly spread over the surface of the sole of the foot at each step

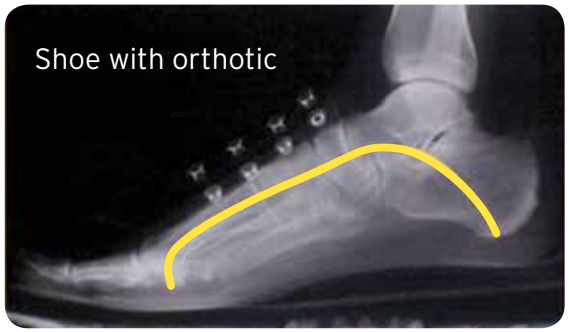
Supportive properties artificially support the arch instead of challenging muscles to do their job, and produce sensory input that is unvaried and uniformly spread over the surface of the sole of the foot at each step

Restrictive properties prevent the dynamic raising of the arch system and great toe required to stabilize the foot and ankle and inhibit the muscles from doing their job, conditioning them to stop working efficiently or forcing others to overwork

How conventional footwear

inhibits natural movement and function

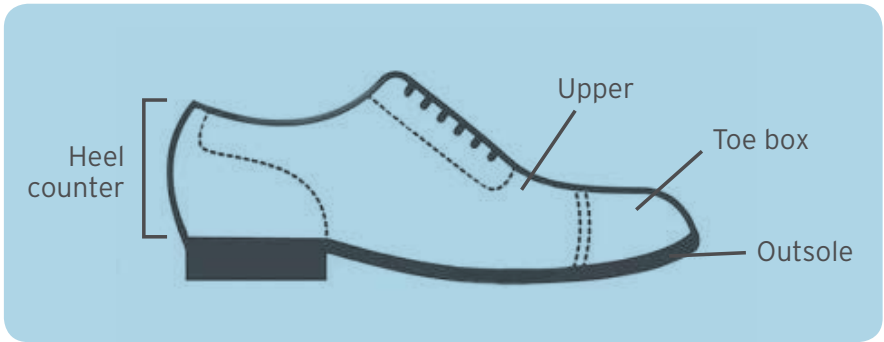




Mechanically, the structural strength of the stimulated arch system is more than seven times stronger when compared with the same arch system supported by an orthotic.

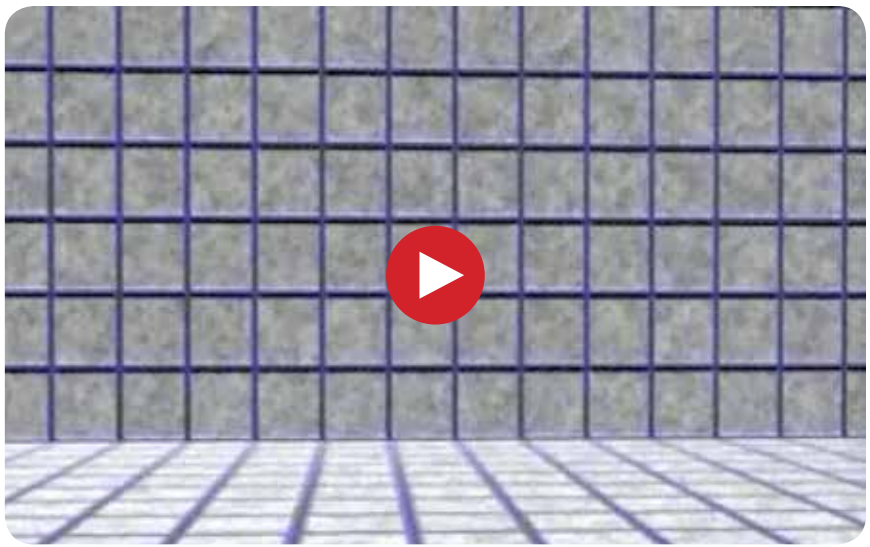
For more information, see BioPods Monograph, Medical and Scientific Overview, pp. 63-70.

Conventional footwear increases loading forces by **up to 400%**



Stiff midsoles or outsoles, flared or wide midsoles or outsoles and increased heel heights cause the immobilized or cushioned foot to manage increased loads and damaging stresses.

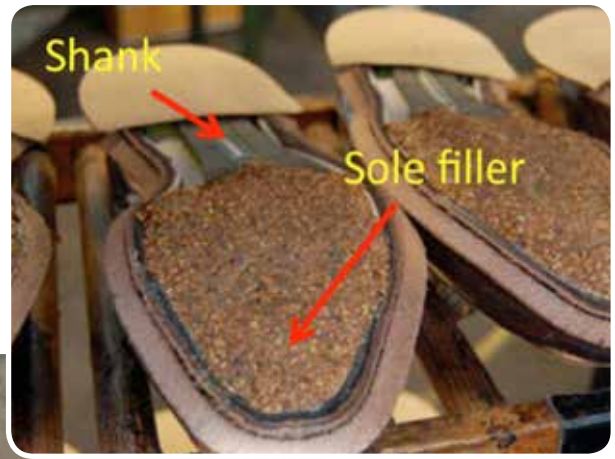
Let's take a look at a video...

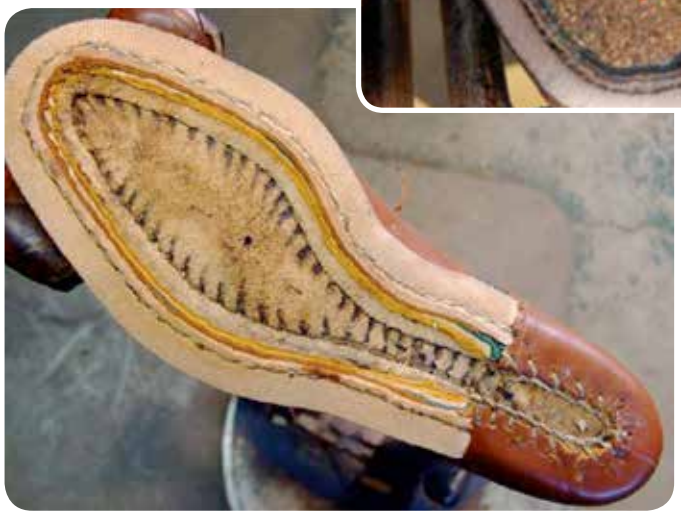


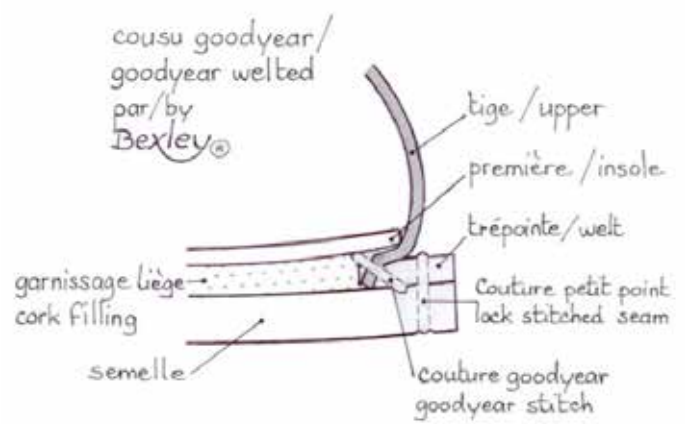
For more information, see BioPods Monograph, Medical and Scientific Overview, pp. 38-44.

"Quality" shoes have been made using Welt construction

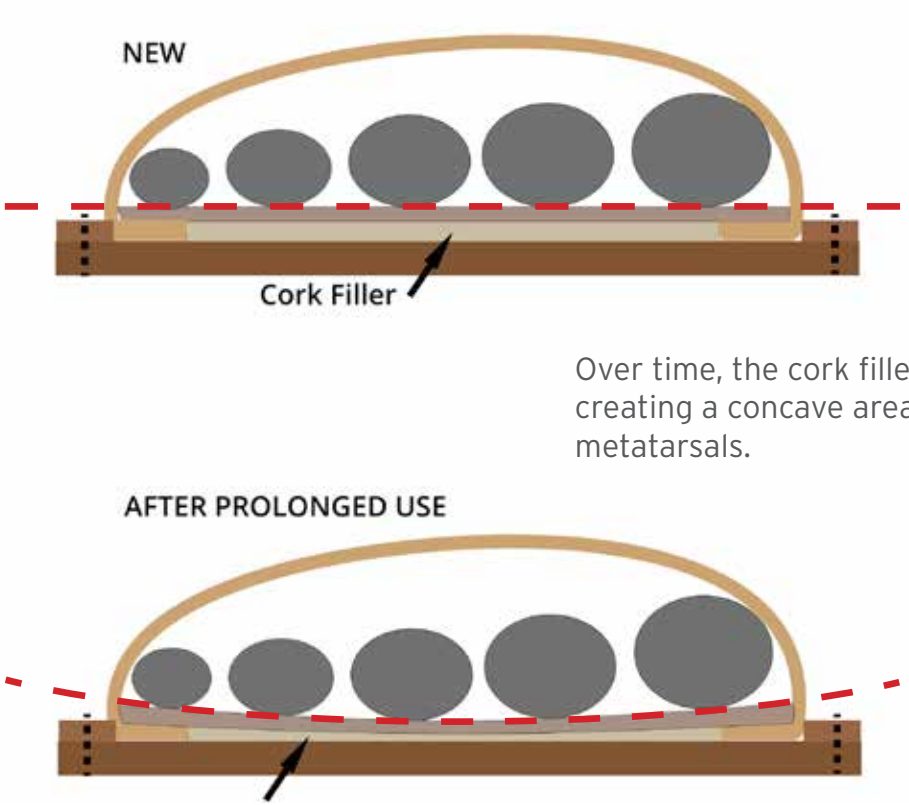
since the 1800's







After prolonged wear, **there's a problem**

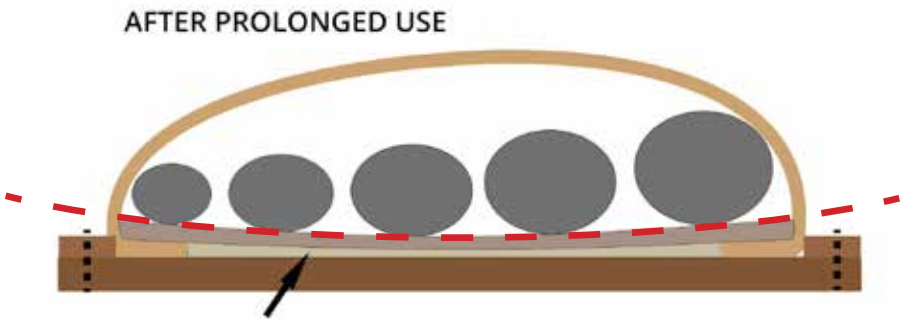


Over time, the cork filler compacts, creating a concave area under the metatarsals.

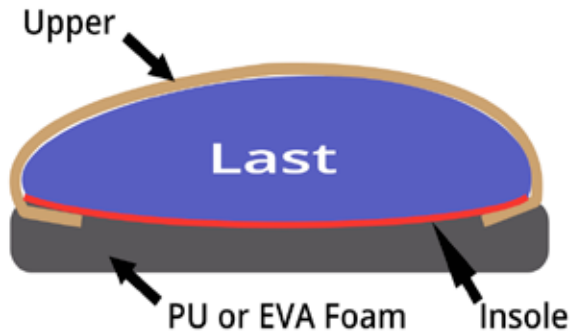
Prolonged wearing of shoes made with Welt design has caused **maladapted foot shapes.**

Over time, the foot models to the shape of the compacted cork, changing the mechanics and shape of the feet.

The new last design evolved to mirror that maladaptive foot shape.



Direct Injection, Storbel or Cemented Construction



Foot Dysfunction Indicators (FDIs)

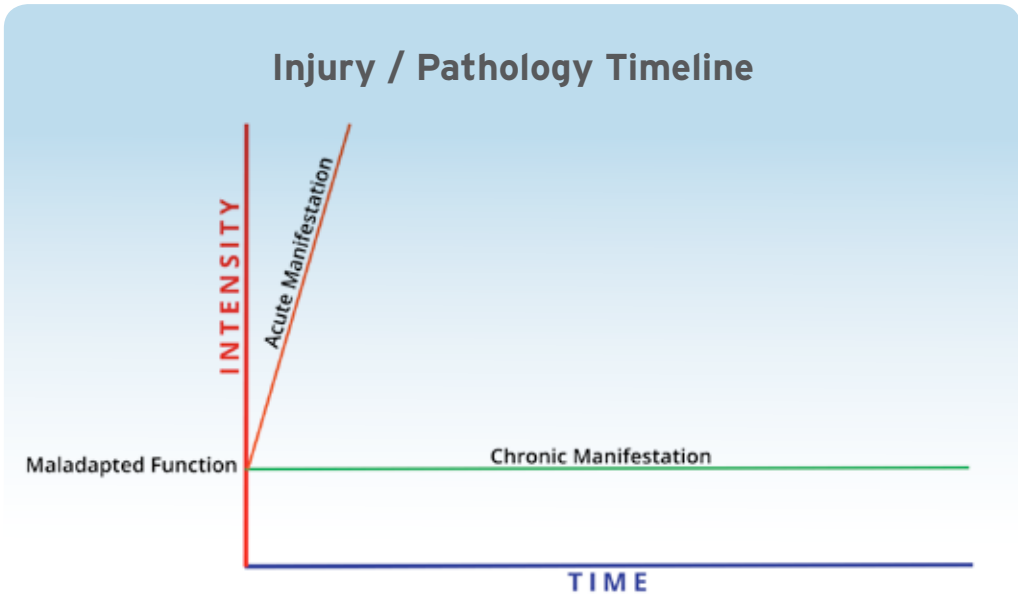
Bunions	Pigeon-toed	Supinated forefoot
Bunionettes	Hallux valgus	Everted calcaneus
Callus and corns	External hip rotation	Inverted calcaneus
Hammer toes	Forefoot splay	Bony protuberances of foot
Claw toes	Longitudinal toe rotation	Pelvic torsion
Flat feet	Overlapping toes	“Pump bumps”
Pes cavus	Loss of toe gaps	Fifth toe “flail”
Genu valgus	Misaligned subtalar joints	Excessive ankle plantar-flexion
Genu varus	High iliac crest	

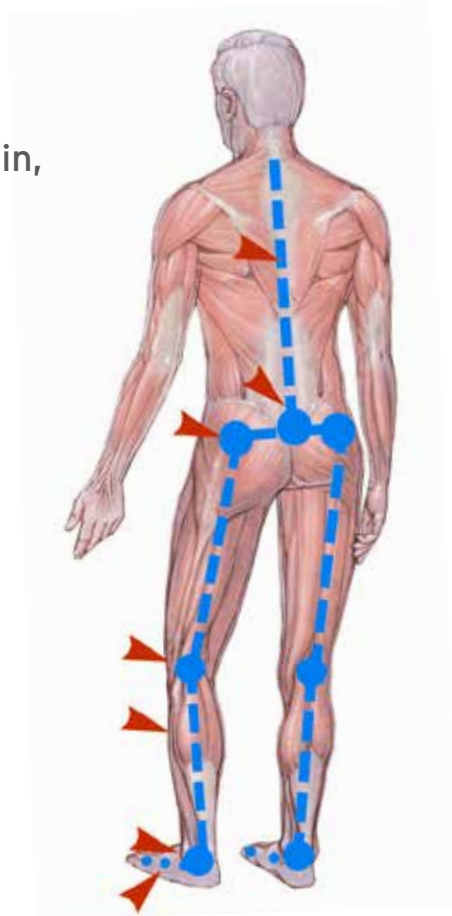
Common symptoms of foot-related pathologies **caused by footwear**

FEET	LOWER LEG	KNEE	ANKLE	HIP/BUTTOCK	LOWER BACK
Intertarsal muscle fibrosis	Fib head fixation and fibrosis	Patello-femoral syndromes • VLO or VMO distalfibrosis • Quad fascia fibrosis at patella • MCL and Jt line fascia fibrosis	M or L ligament fibrosis	Greater troch bursitis	Recurrent SI Jt fixation
Tarsal tunnel syndrome	Gastroc-soleus myotend fibrosis	Iliotibial band syndrome	Tib post and FHL tend at M malleol	Glut/Hams/Isch tub fibrosis	SI Jt ligament fibrosis
Metatarsalgia or sesamoiditis	FHL belly/myotend fibrosis	Infrapatellar tendonosis	Peroneii myotend fibrosis	Glut/ITB interface fibrosis	Iliolumbar lig fibrosis
Plantar fasciitis	Tib Post belly/myotend fibrosis	Hamst tend fibrosis, M or L	Subtal EHL TibA EDL tend fibrosis	Iloposoas myotend fibrosis	Iliac crest/QL/ Erector fibrosis
Tib Ant and Per L insertion fibrosis	Shin splints	Adductor tubercle fibrosis	Tib-tallus joint fixation	Deep glut fibrosis/ contracture	Glut fibrosis at iliac crest
AbHL muscle fibrosis			Achil tend or calc bursa fibrosis		
Dorsum sub-Q tissue fibrosis					
Cuboid fixation pain					
Morton's neuroma					
Tendonosis ant to subtalar joint					
Med talo/navic ligament fibrosis					

How do symptoms **manifest?**

Symptoms manifest at the weakest link in the kinetic chain, influenced by activities and footwear characteristics.





Kinetic chain
Structural links in chain
Areas prone to pathology

Foot dysfunction, pathology manifestation, and arch types

Foot Types

High Arched	Normal	Hypermobile	Pes Planus
			
Typically rigid Most pathologies manifest acutely <10% of population	Typically flexible Most pathologies manifest chronically	Typically very flexible Most pathologies manifest chronically	Typically rigid Most pathologies manifest chronically 10-15% of population
	Combined = 75-80% of population		

How did you do?

Let's test your knowledge.

You'll need to answer a few questions.