SECTION 1

biopods®

The Science

In this Section:

- Common foot care myths
- Wolff's Law
- Davis' Law
- Neuroplasticity
- Neuromuscular adaptation
- Neuromuscular mechanics

Conventional Footwear. **It's a Problem.**

In North America

- More than 66% of the population experiences some type of foot-related discomfort
- 85% will see a medical professional for foot-related issues over their lifetime

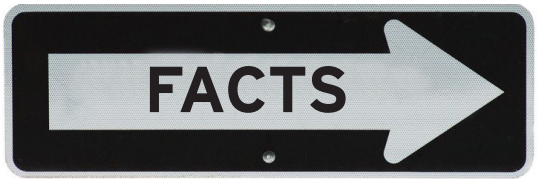
By contrast,

in environments where people don't wear shoes

- Less than 3% will exhibit foot-related issues– none of them debilitating!

Conventional treatments and products don't help, either.

They treat the symptoms, not the cause.



MYTHS	FACTS
Cushioning reduces damaging shock and stress.	Continual use of cushioning products can weaken and destabilize the feet.
Orthotics correct faulty foot biomechanics.	Prolonged use of orthotics results in functional atrophy and dependence on artificial support
We should always wear supportive shoes.	Tight supportive footwear is a leading cause of lower limb maladaptive neuromuscular mechanics.

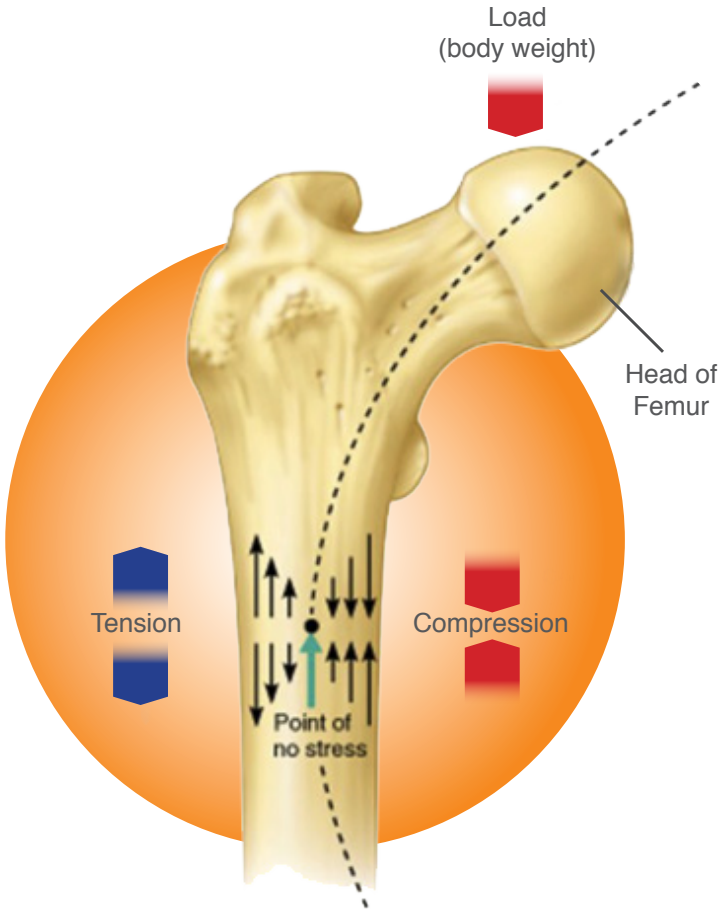
3 scientific principles that dispel the myths

Wolff's Law of Bone Transformation

Davis' Law

Concept of Neuroplasticity

Wolff's Law of Bone Transformation

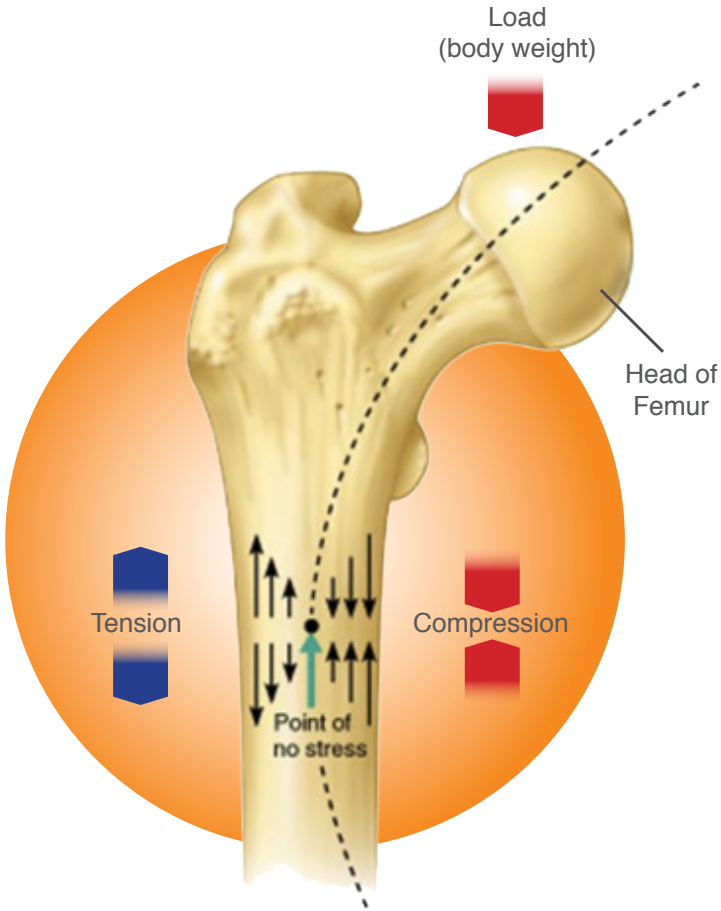


Bone in a healthy person will adapt to the loads under which it is placed. Stresses on a bone change its structure and strength.

When loading or stress on a bone increases,
the bone will remodel itself over time to become stronger or resist that sort of loading.

When loading or stress on a bone decreases,
the bone will remodel itself over time to become weaker and less dense due to the lack of stimulus needed for continued remodeling.

Wolff's Law of Bone Transformation



When loading or stress on a bone is intermittent

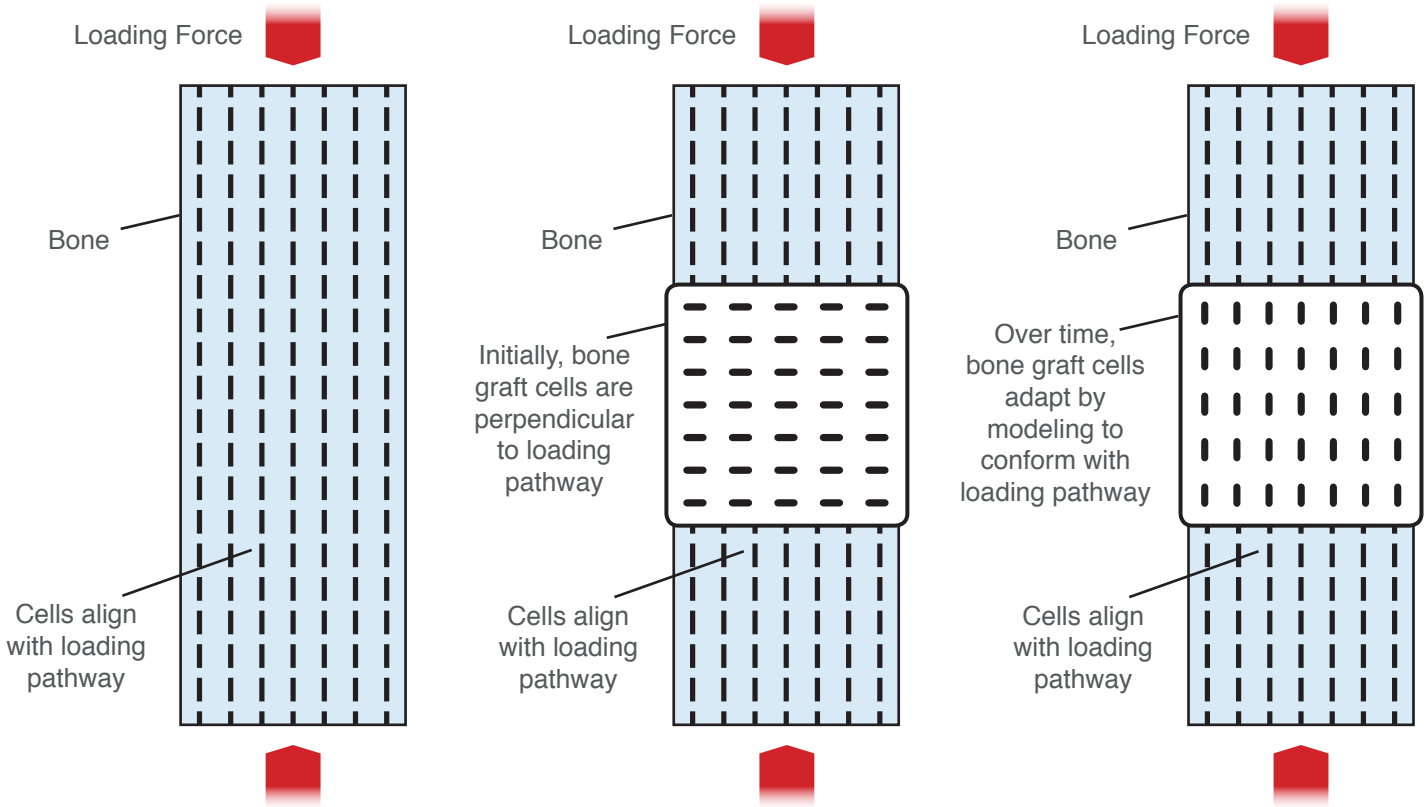
the bone will remodel itself over time to "fill in" the space or grow toward the source of the loading.

When loading or stress on a bone is constant

the bone will remodel itself over time to "pull away" from the source of the loading.

In other words **Bones remodel in response to stimuli.**

A variable stimulus creates the greatest adaptation.
A constant and unchanging stimulus does not produce the same adaptation in the bone.



Extreme Examples of Bone Loss

Astronauts in microgravity

When astronaut returns to Earth:

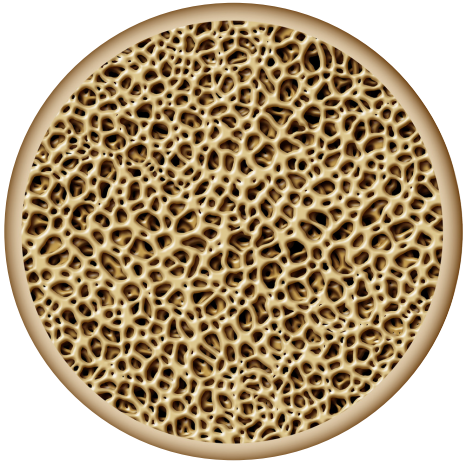
- Heart is smaller and weaker
- Balance system is used to a new set of signals
- Body fluids diminished
- Muscles atrophied

In microgravity your bones do not need to support your body:

- All of your bones, especially the weight-bearing bones in your hips, thighs and lower back, are used much less than they are on Earth
- The size and mass of these bones continue to decrease as long as you remain in microgravity at a rate of about 1-2% a month

Extreme Examples of Bone Loss

Osteoporosis



Healthy bone

Osteoporotic bone

Wolff's Law and the Mechanostat Model:

Bone in a healthy person will adapt to the loads under which it is placed.

Real world examples

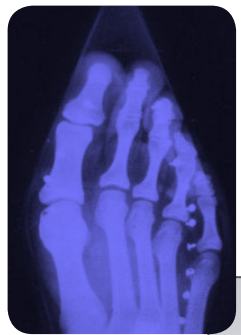
Braces on Teeth change bone structure of mouth

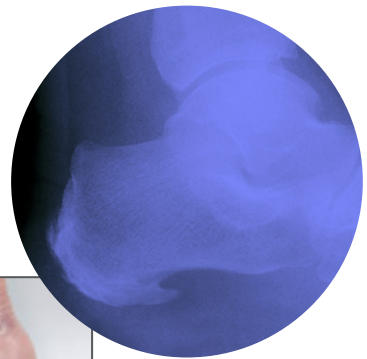
Fracture Cast causes atrophied bone structure

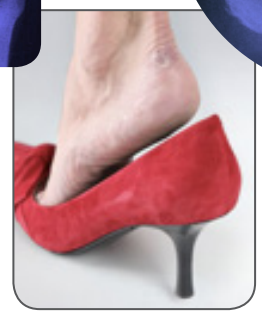
Foot Binding is another example of adverse loading on the feet

High Heels change the loading of body weight on the feet

Heel Spur is the formation of additional bone on the heel



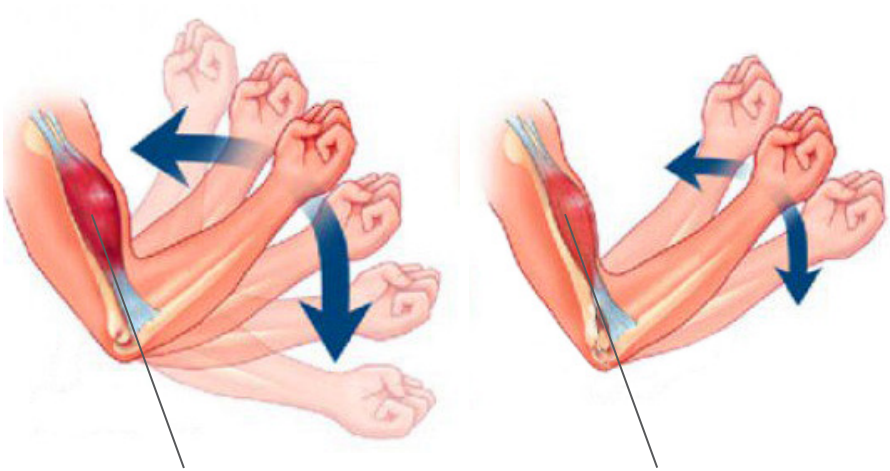




Davis' Law of Soft Tissue Adaptation

Muscles, tendons, and fascia in a healthy person will adapt to the loads under which they are placed.

Effects of Atrophy on Muscle

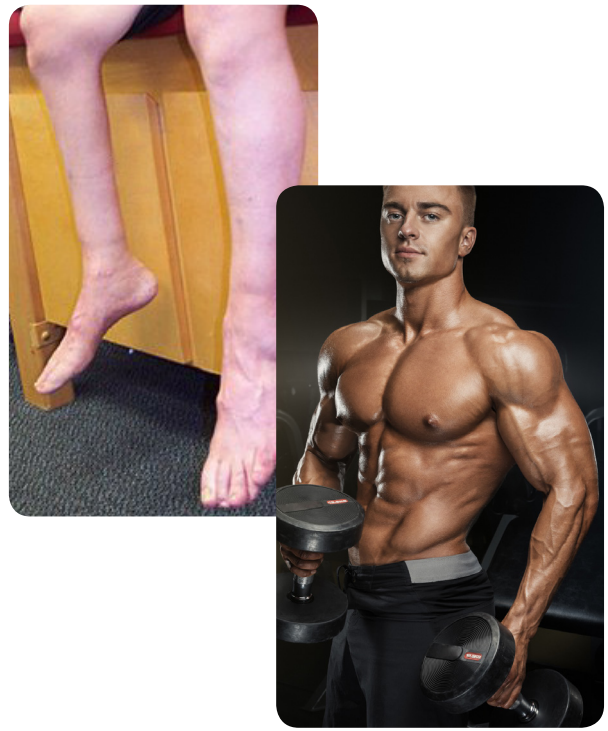


Normal muscle

Atrophied muscle

- Decreased size
- Decreased strength
- Decreased mobility

From Atrophy to Adonis



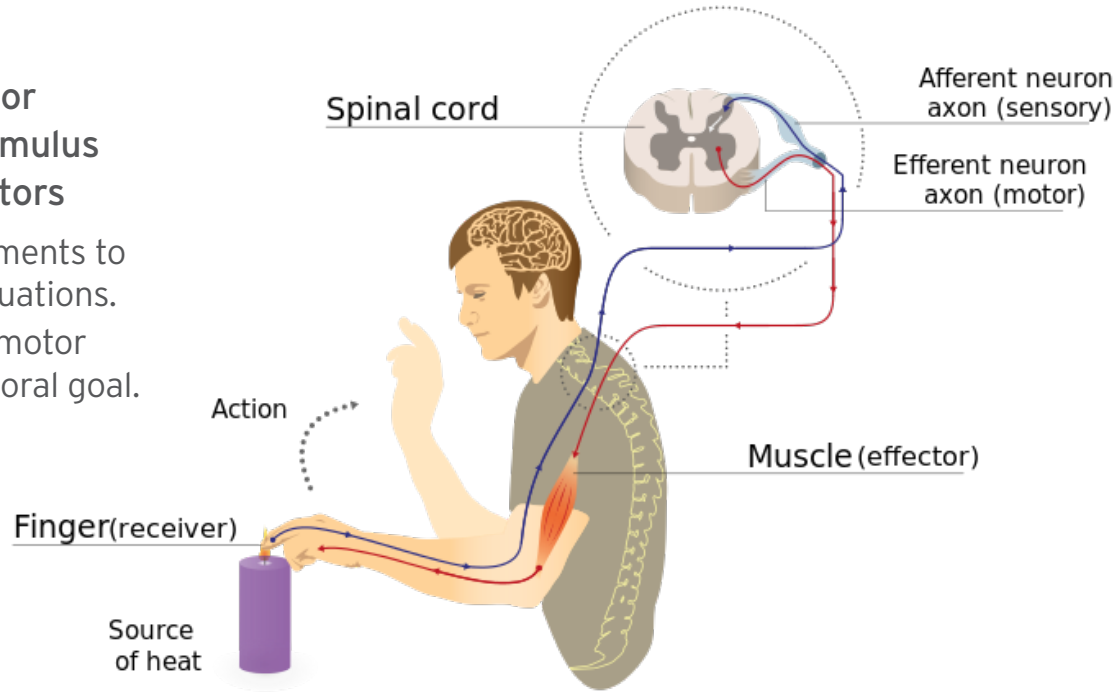
Neuroplasticity and Sensory Motor Systems

With every movement, the central nervous system receives information from sensory receptors to generate the right muscle activations.

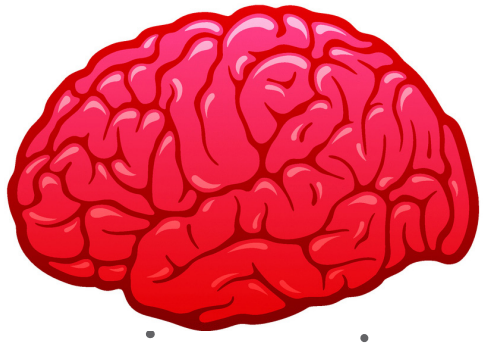
- Sensory information from muscles, joints, and skin is needed to regulate movement.
- Lack of this somatosensory input results in imprecise movements. And tasks that require fine coordination aren't possible.

Reflexes: coordinated motor responses initiated by a stimulus applied to peripheral receptors

- Some reflexes initiate movements to avoid potentially harmful situations.
- Others automatically adapt motor patterns to achieve a behavioral goal.



Types of Reflexes



Stretch reflex

Helps the body maintain its balance

Nociceptive reflex

Protects the body from injury (sneezing, coughing and pulling hand away from a hot stove)

Conditioned reflex

Acquired as the result of experience (walking, running, driving a car)

Proprioceptive reflex

Induced by stimulation of proprioceptors (involved in stretch, nociceptive and conditioned reflex activities)

Proprioception: The Unconscious Perception of Body

Proprioceptive reflexes– their primary function is to adjust motor output according to the biomechanical state of the body and limbs

- Ensures a coordinated pattern of motor activity during an evolving movement
- Provides a mechanism for compensating for the intrinsic variability of motor output

Motor reflexes– provide for optimal self-protective responses

- May be disrupted as a result of trauma
- May also be disturbed in the course of otherwise normal motor development

Proprioceptive sense can be sharpened through the study of many disciplines that enhance mind-body integration.

Sensory Integration and Neural Adaptation

- **Sensory Integration–** the automatic natural process by which the brain organizes sensory information that comes from our surroundings and from our own bodies [touch, hearing, vision, taste, smell, vestibular (inner ear balance), and proprioceptive], and utilizes that information for adaptive and fulfilling interaction with the environment.

- **Sensory Modulation–** Prioritization – the brain is constantly organizing sensory input (i.e., locate, sort, and order) with priority attention "alertness" given to new or varied stimulus.

- **Neural Adaptation–** occurs when sensory processing automatically (without conscious effort) becomes less sensitive to repeated stimuli.

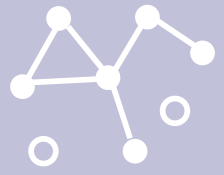
It happens all the time, i.e., when you walk into a dark room and can't see anything, but after a while you can begin to make out shapes and outlines; or when you first smell coffee when you enter a room and don't notice the smell after a few minutes.

Neuroplasticity: How the brain changes

Neuroplasticity

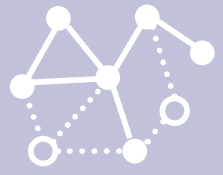
The ability of the brain to reorganize itself, both in structure and how it functions

How the Brain Changes



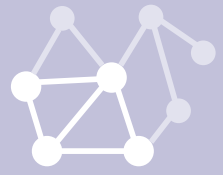
Neurogenesis

Continuous generation of new neurons in certain brain areas



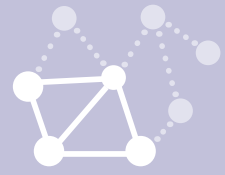
New Synapses

New skills and experiences create new natural connections



Strengthened Synapses

Repetition and practice strengthens natural connections



Weakened Synapses

Connections in the brain that aren't used become weak

Poor Technique vs. Proper Technique

Poor Technique = Maladaptive Function

Stressor

Stress

Stress Responses

Adaptive responses

Behavior

Avoidance actions:
- Reflexes
- Locomotion
- Shelter seeking
- Defense

Physiology

Decreased:
- Ammonia
- Lactate

Increased:
- pH
- Immune function
- Ion balance

Maladaptive responses

Behavior

Reduced or lost:
- Reflexes
- Locomotion
- Shelter seeking
- Defense
- Feeding

Physiology

Increased:
- Ammonia
- Lactate
- Ion imbalance

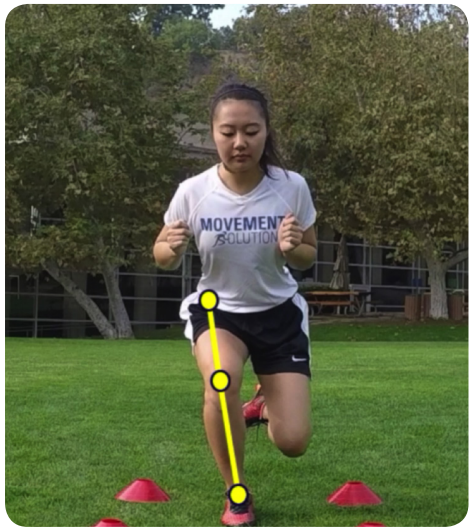
Decreased:
- pH
- Immune function

Proper Technique = Enhanced Function

Reflex improvement

Proprioception and Reflexes

Incorrect



Correct

Results of training with Poor Technique:

- An imbalance of strength and flexibility in opposing muscle groups
- The least robust physical "Sweet Spot" capabilities
- An increased risk of injury (actually predisposed to injury)

Results of training with Proper Technique:

- A balance of strength and flexibility in opposing muscle groups
- The most robust physical "Sweet Spot" capabilities
- A reduced risk of injury

Everyone has a ‘sweet spot’

for optimal musculoskeletal function.

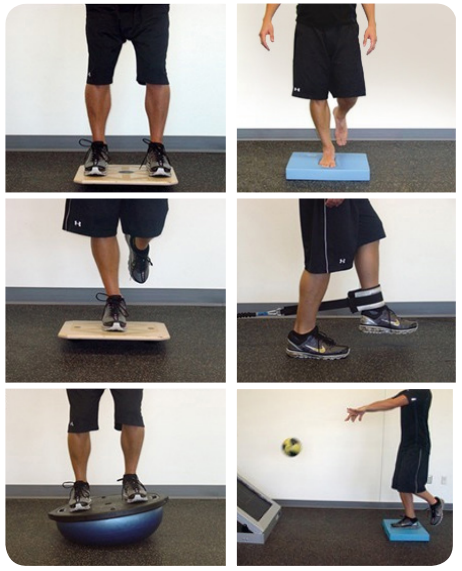
Poor Technique = Maladaptive Function

Proper Technique = Enhanced Function

Immobilization has marked adverse effects on all systems of the body.

Maladaptation
and degenerative
stresses

Atrophy caused by
lack of activity



Progression of neuromuscular
rehabilitation exercises

SECTION 2

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Optimal "Natural" Foot and Lower Limb Function

In this Section:

- Sensory input, Right Stimulus, Right Movement
- The Windlass Mechanism
- Dynamic arch system
- Cuboid Pulley Mechanism
- Functional dome-shaped system
- Barefoot gait mechanics
- Barefoot gait and the shock myth

Barefoot gait mechanics: Let's look at what happens when we walk or run barefoot on natural terrain.

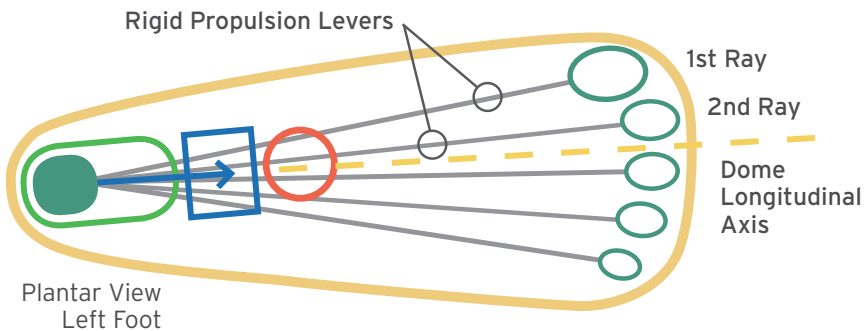
With each step, the soles of the feet experience subtle variations in terrain.

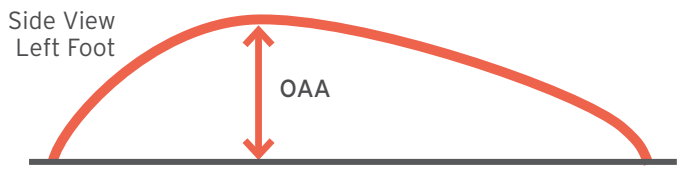
- Our body's protective reflex mechanisms are on high alert
- Before the feet hit the ground, preventive muscle activations are triggered throughout the feet, legs, hips and back
- Muscle activations align and stabilize our skeletal structure and create muscle efficiency throughout our feet, legs, hips, and back
- Our bodies adapt to the contours of the terrain and manage contact, weight-bearing, and propulsion forces

A dynamic **dome-like structure**

Functional Foot 'Dome'

- Ground Contact Points
- Calcaneus
- OAA **Optimal Arch Apex**
- **Talus** (showing trochlear/tibial plane of glide)
- **Navicular** (in a fixed position within the propulsion Lever, and thus can act as the pivot point for its 'universal-joint-like' capacity via its multiple articulations



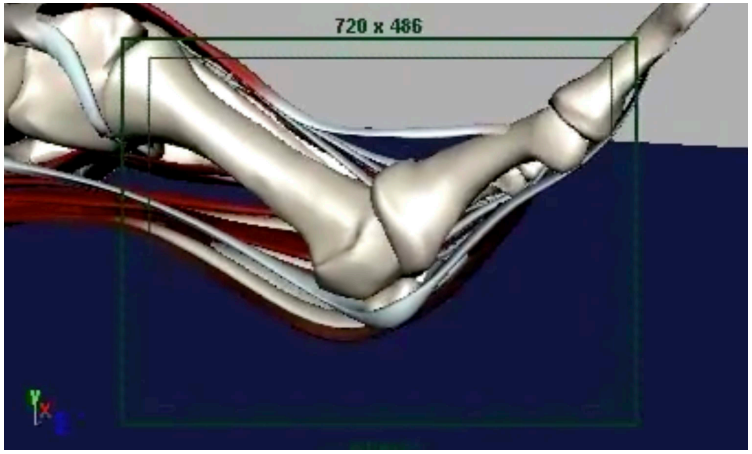


Optimal "natural" foot and lower limb

Before the feet contact the ground, in anticipation of "uncertain" forces, the body is in a high alert state. Preventive muscle activations are triggered throughout the feet, legs, hips, and back to facilitate safe and efficient locomotion

- optimal alignment and stabilization of the skeletal structure throughout the feet, legs, hips, and back,
- optimal muscle efficiency throughout the feet, legs, hips, and back,
- optimal adaptation to the contours of the terrain, and
- optimal management of contact, weight-bearing, and propulsion forces

The Windlass and Cuboid Pulley Mechanisms

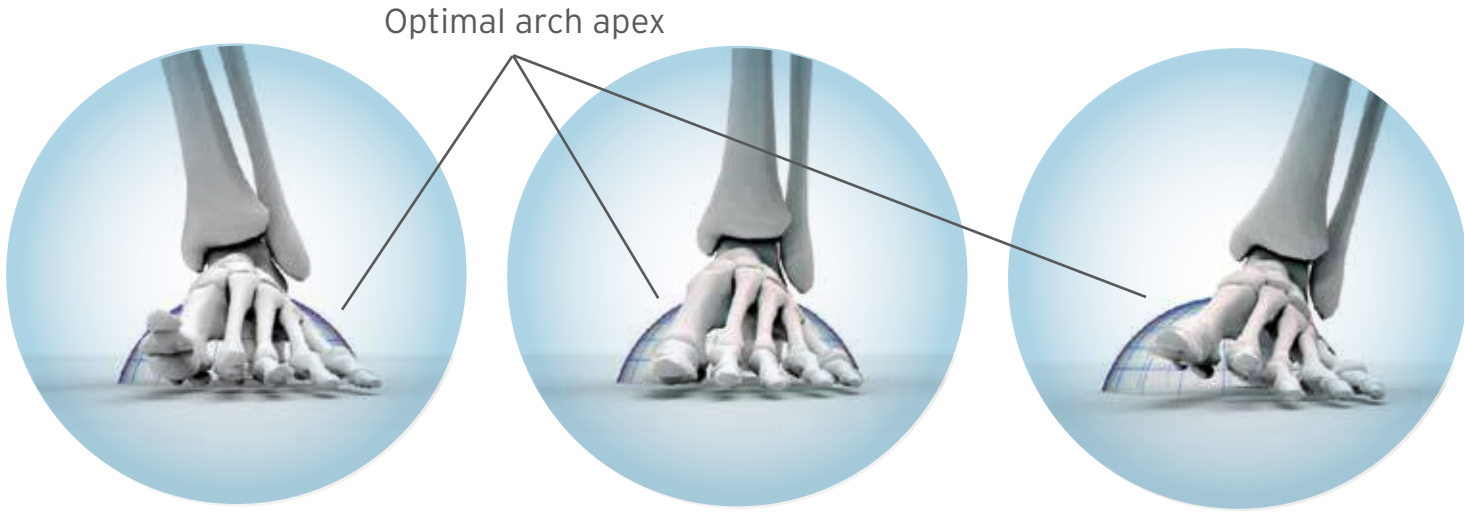


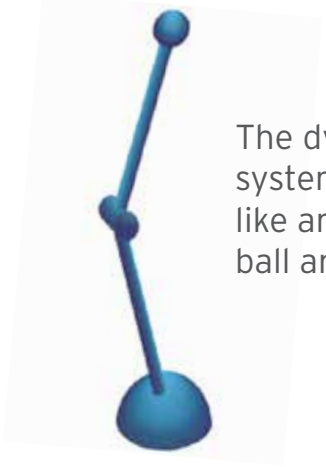
The Windlass Mechanism works with the Cuboid Pulley Mechanism to transform the foot from a loosely packed bag of bones to a rigid spring-like lever that manages the loading forces during gait.

These mechanisms are integral to the protective neuromuscular activity that occurs during healthy optimal gait. Prior to the foot touching the ground, in anticipation of the unexpected, the toes and arches rise synergistically and remain raised throughout ground contact. The height of their rising is proportionate to the activity intensity protective reflex response.

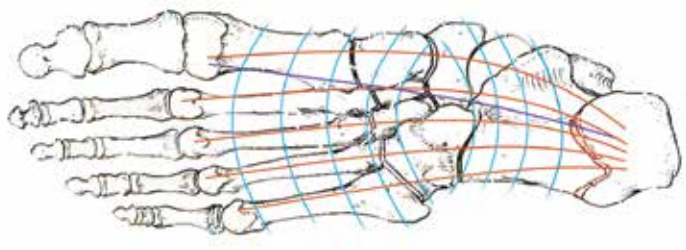
Freedom of movement of the toes and arches is essential for effective Windlass function in the foot.

How the **dynamic arch system** functions





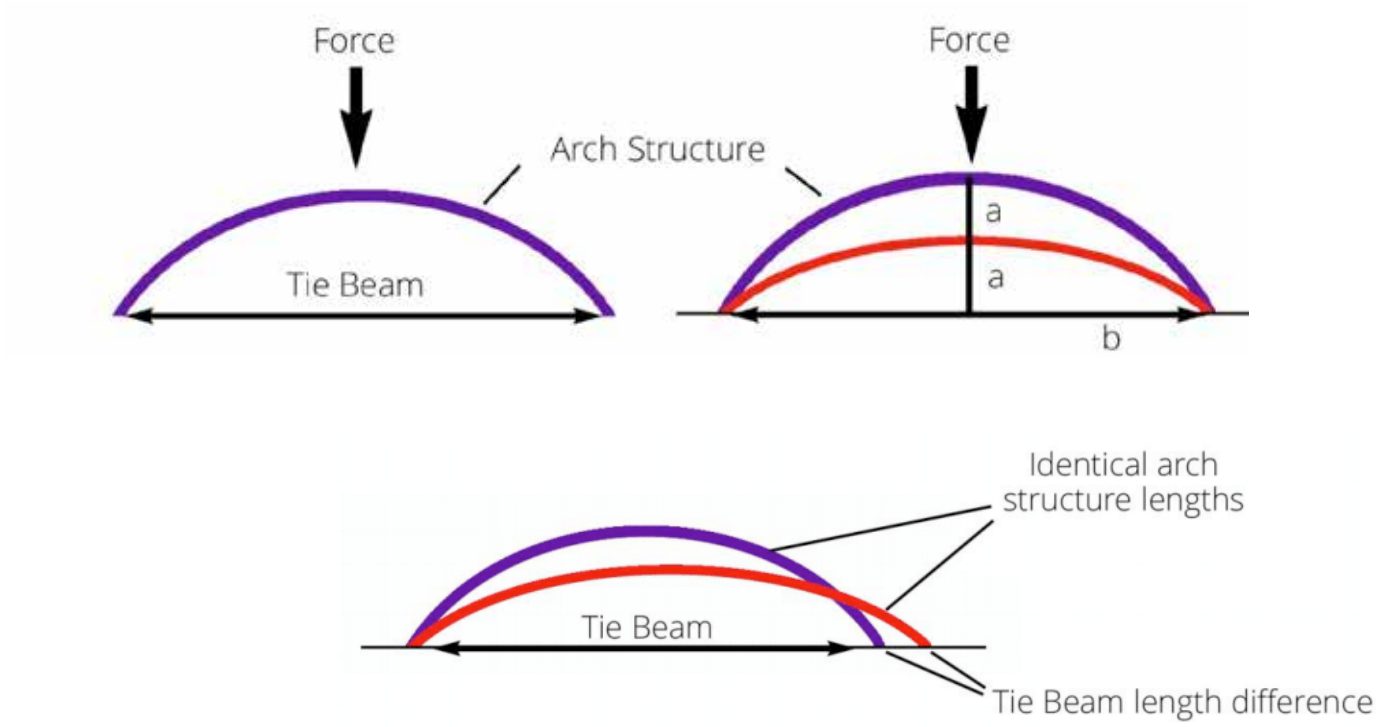
The dynamic arch system functions like an imaginary ball and socket joint



Bones of the foot form a dome-like shape with a multiplicity of arches

The dynamic arch system:

Enhanced structural integrity



The dynamic arch system:

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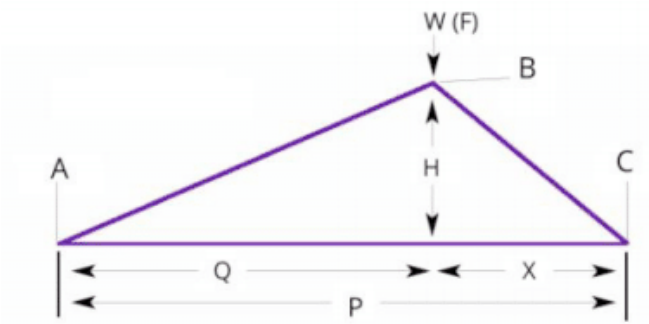
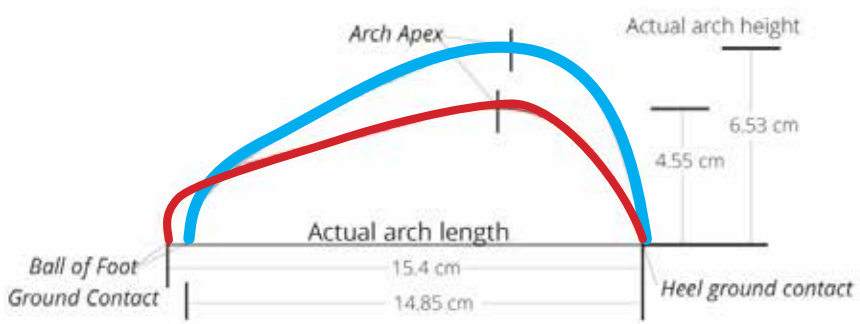
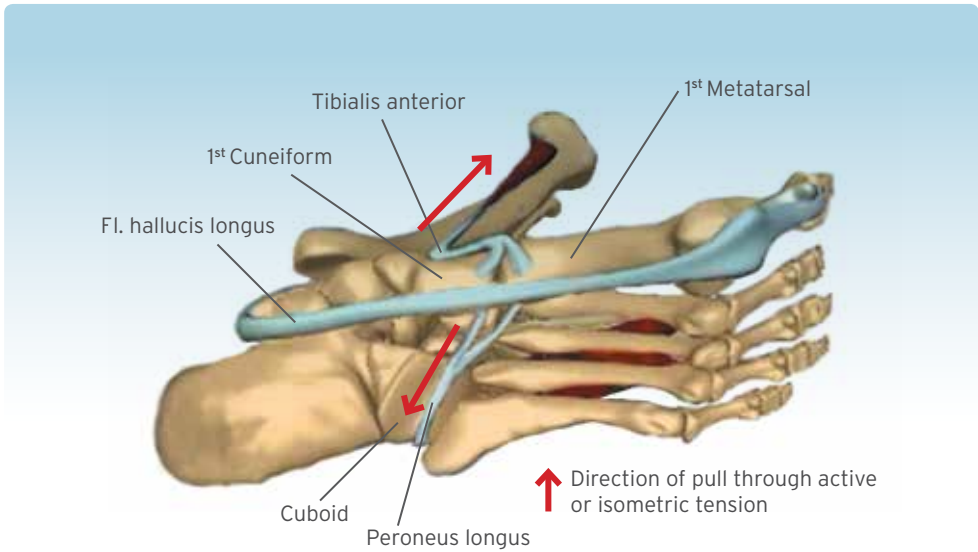




The Cuboid Pulley Mechanism



The Cuboid Pulley Mechanism works with the Windlass Mechanism to transform the foot from a loosely packed bag of bones to a rigid spring-like lever that manages the loading forces during gait.

Freedom of movement of the toes and arches is essential for effective Cuboid Pulley mechanics.

As the foot touches the ground, the toes and arches are raised.

The sesamoid bones

The sesamoid bones act as a cam to increase Windlass Mechanism dynamics and to stabilize the arch system during loading. As the foot touches the ground, the toes and arches are raised.

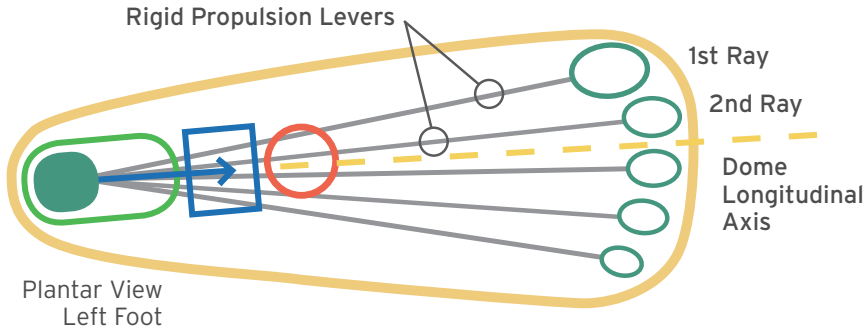
Freedom of movement of the toes and arches is essential for effective Cuboid Pulley mechanics.

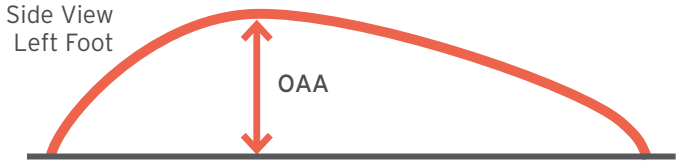
As the foot touches the ground, the toes and arches are raised.

Optimal dome dynamics

Functional Foot 'Dome'

- Ground Contact Points
- Calcaneus
- OAA **Optimal Arch Apex**
- **Talus** (showing trochlear/tibial plane of glide)
- **Navicular** (in a fixed position within the propulsion Lever, and thus can act as the pivot point for its 'universal-joint-like' capacity via its multiple articulations





Barefoot gait mechanics

Extrinsic foot muscles are located in the shin and calf.

- Muscles in the shin raise the toes and arch
- Muscles in the calf in concert with muscles in the shin create, maintain, and control the stability of the foot and ankle during walking or running.

Small **Intrinsic** foot muscles are involved with fine motor control activities. When the extrinsic muscles fail to function properly, they will attempt to "pick up the slack" and become overworked and fatigued.

So, let's take another look at **barefoot gait.**

When we're barefoot, the soles of our feet experience the subtle variations in the terrain with each step. As a result:

- Our body's protective reflex mechanisms are on high alert
- Preventive muscle activations are triggered throughout our feet, legs, hips, and back in anticipation of the unknown experience with the next steps and preparing for safe and efficient locomotion before the next foot hits the ground
- So, our musculoskeletal structure is prealigned and stabilized with optimal muscle efficiency, optimal adaptation to the contours of the terrain, and demonstrates optimal management of gait-related forces.

SECTION 3

biopods®

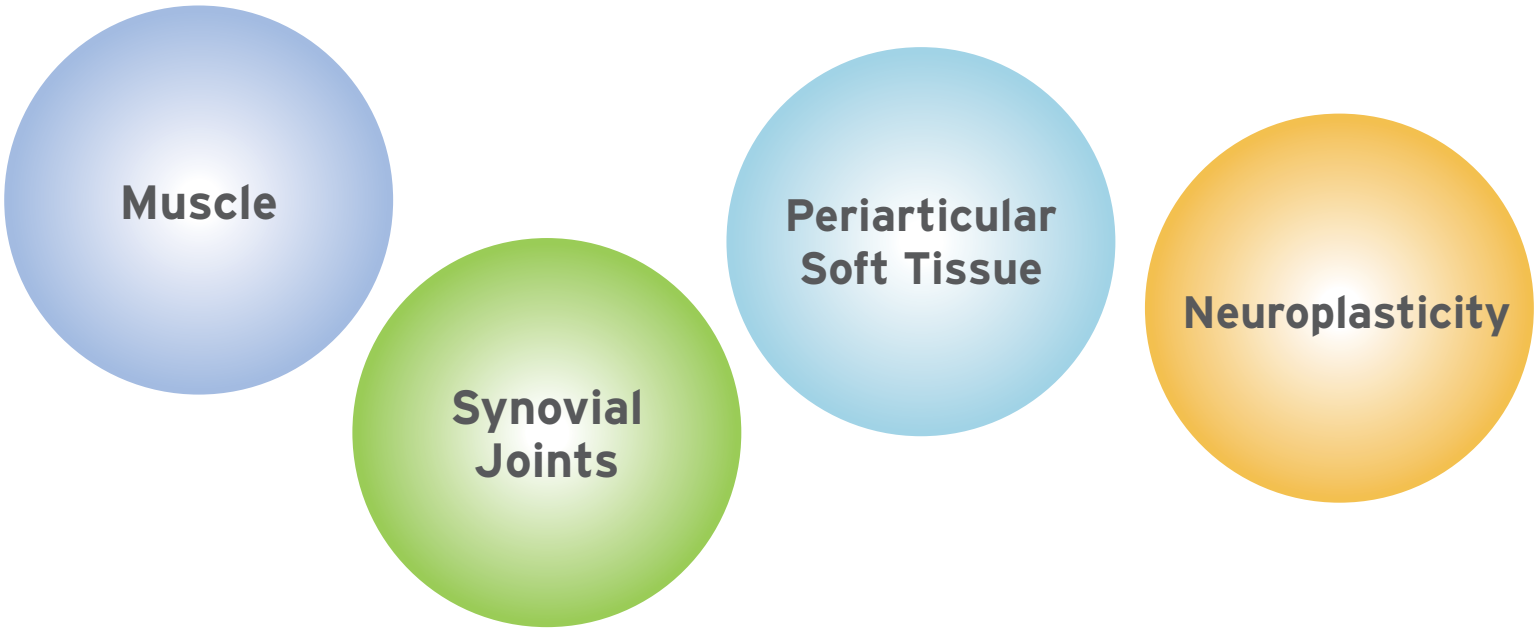
Gait-related pathologies

In this Section:

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

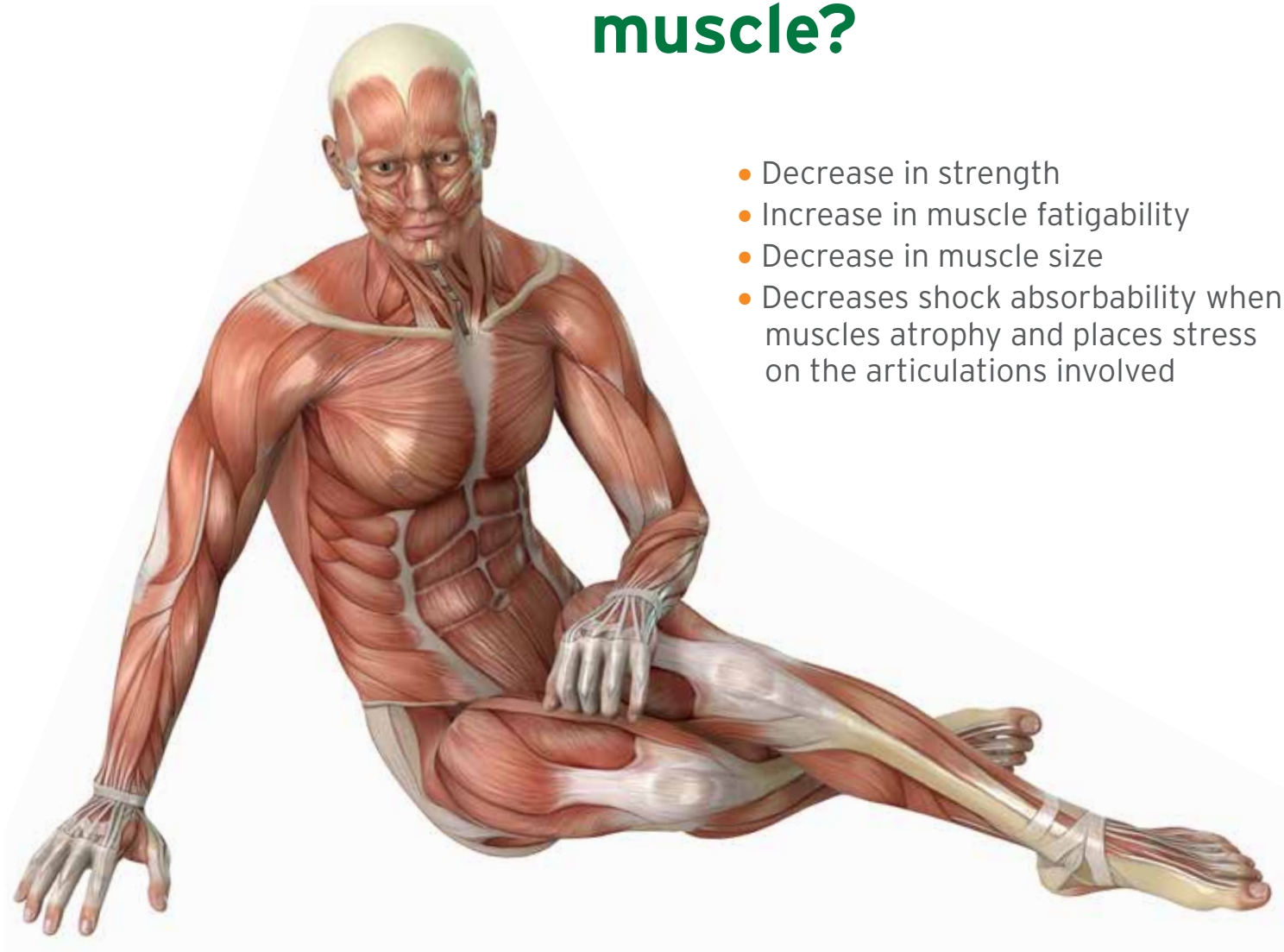
It's important to understand

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

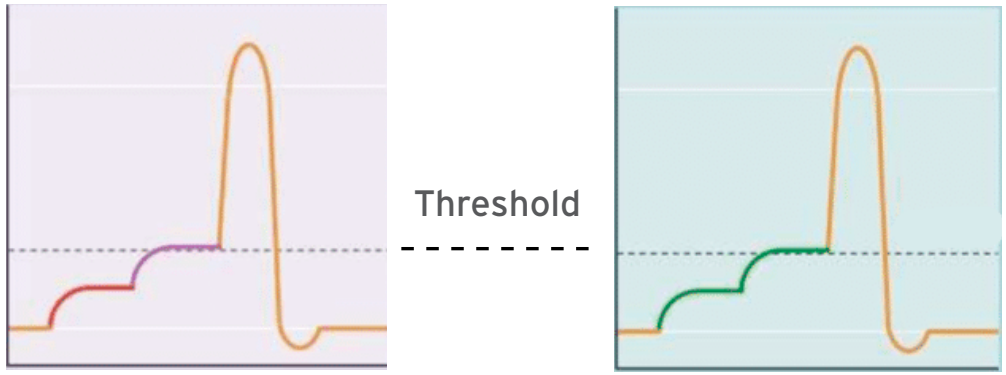
How does immobilization affect **synovial joints?**

- 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?**

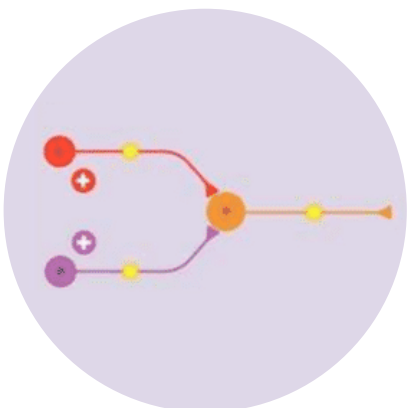
- Joint stiffness
- Restricted movement
- Excessive connective tissue in the synovial joints and joint recesses
- Poor biomechanics changes
- Poor collagen orientation
- Significant water loss
- Increase in collagen cross links

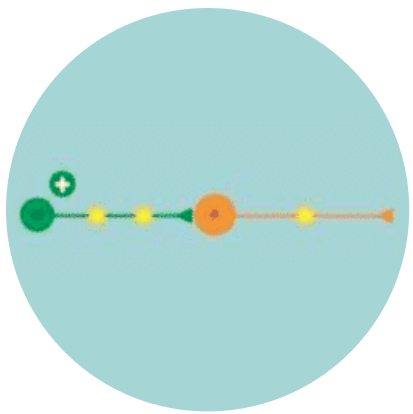
How does immobilization affect the **nervous system?**



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

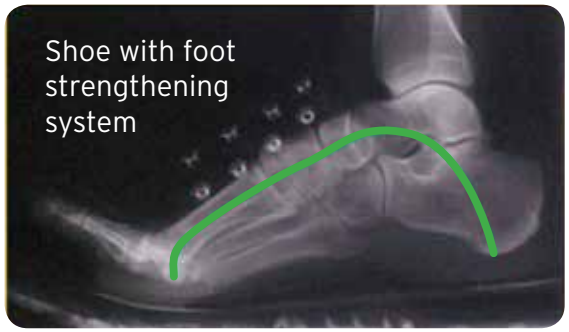
Cushioning properties attenuate sensory input to the sole of the foot and produce sensory input that is unvaried and uniformly spread over the surface of the sole of the foot at each step

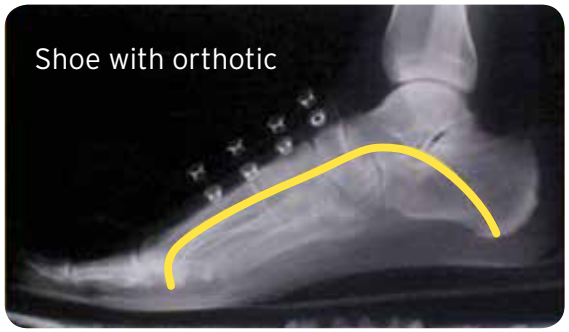
Supportive properties artificially support the arch instead of challenging muscles to do their job, and produce sensory input that is unvaried and uniformly spread over the surface of the sole of the foot at each step

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

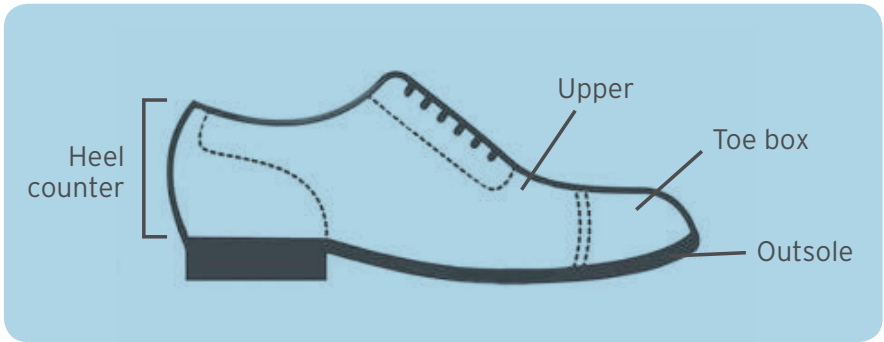




Mechanically, the structural strength of the stimulated arch system is more than seven times stronger when compared with the same arch system supported by an orthotic.

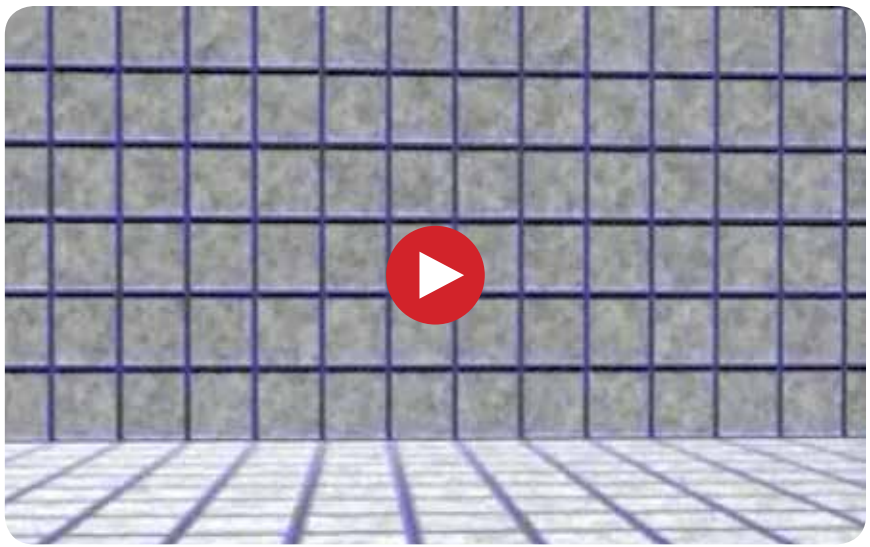
For more information, see BioPods Monograph, Medical and Scientific Overview, pp. 63-70.

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.

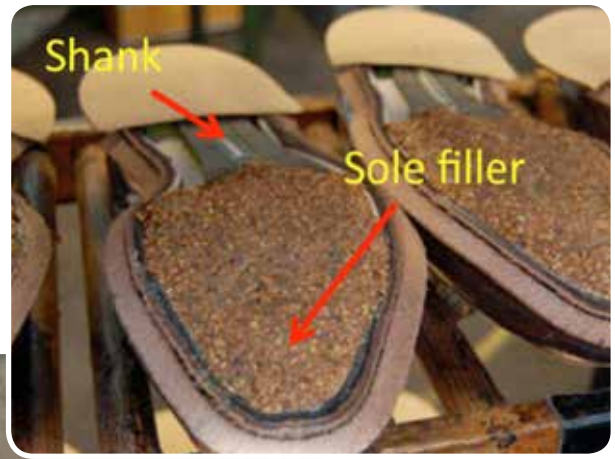
Let's take a look at a video...

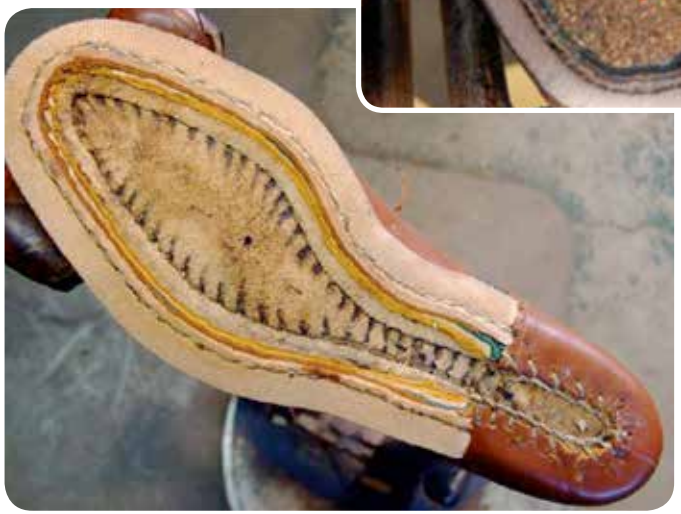


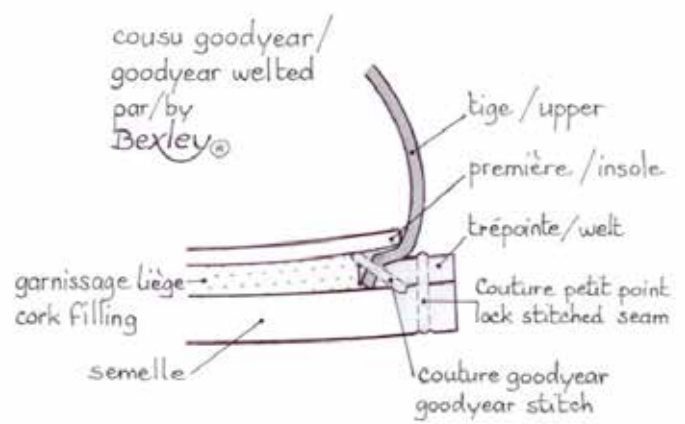
For more information, see BioPods Monograph, Medical and Scientific Overview, pp. 38-44.

"Quality" shoes have been made using Welt construction

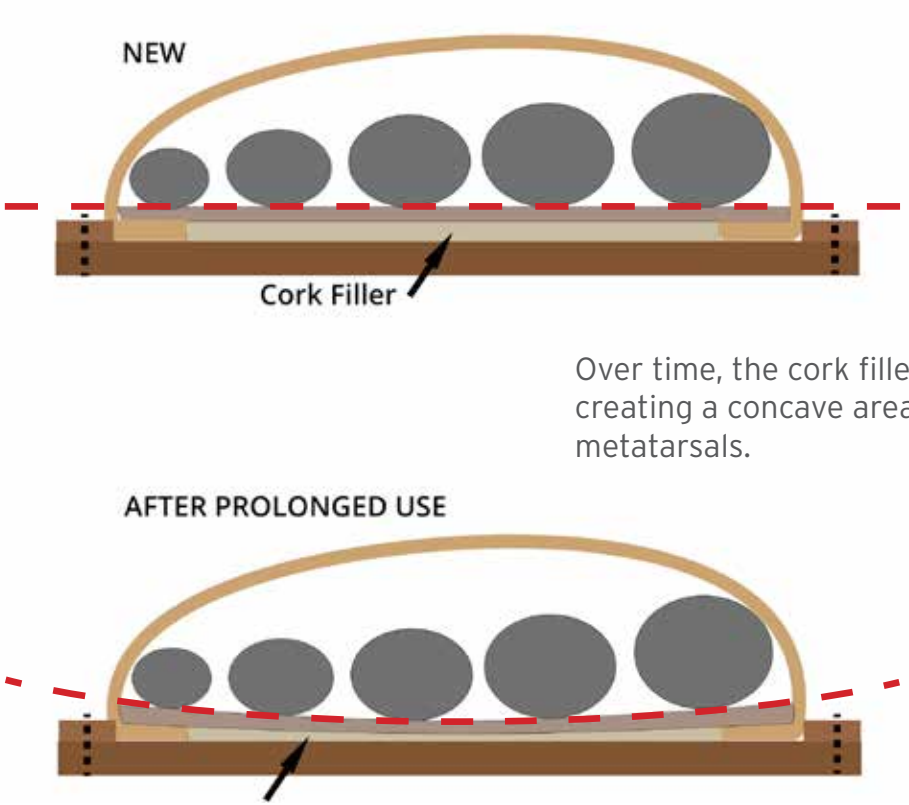
since the 1800's







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

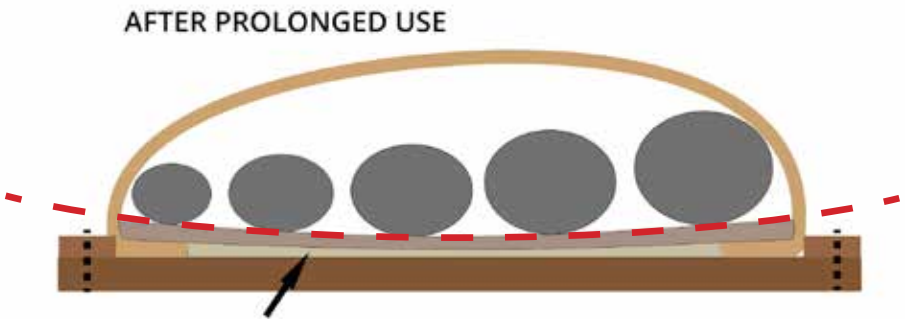


Over time, the cork filler compacts, creating a concave area under the metatarsals.

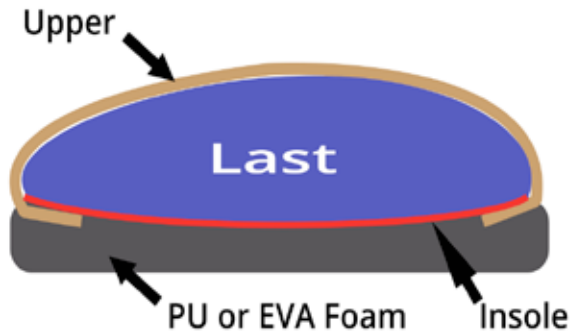
Prolonged wearing of shoes made with Welt design has caused **maladapted foot shapes.**

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)

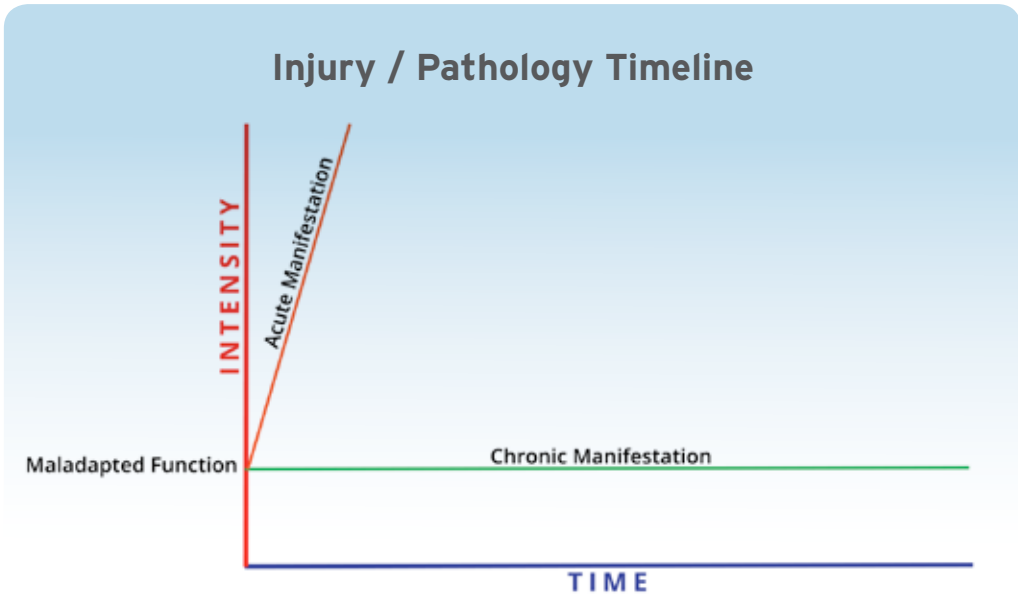
Bunions	Pigeon-toed	Supinated forefoot
Bunionettes	Hallux valgus	Everted calcaneus
Callus and corns	External hip rotation	Inverted calcaneus
Hammer toes	Forefoot splay	Bony protuberances of foot
Claw toes	Longitudinal toe rotation	Pelvic torsion
Flat feet	Overlapping toes	“Pump bumps”
Pes cavus	Loss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

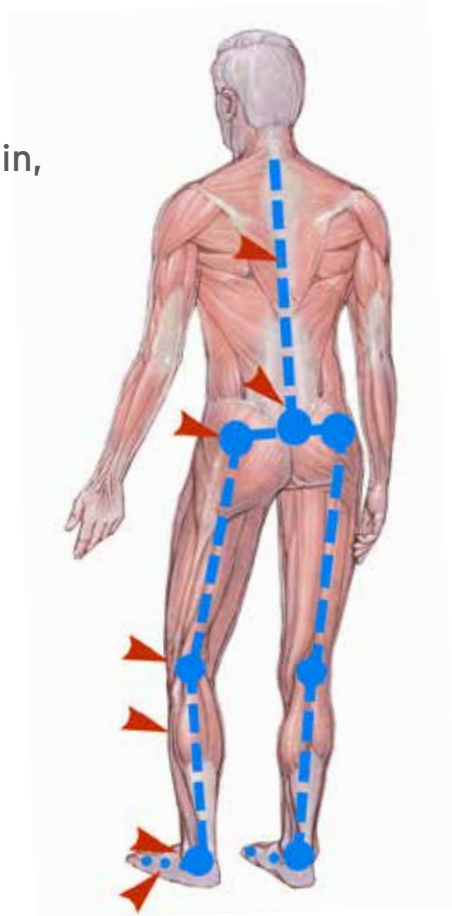
Common symptoms of foot-related pathologies **caused by footwear**

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		

LESSON 4

Neuromuscular Pathology Treatment Options

In this Section:

- Conventional treatment methods
- Biopods technologies and related complementary treatment modalities
- The Biopods clinical protocol

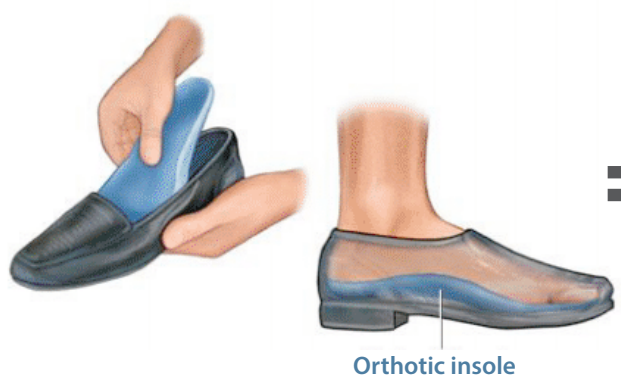
Conventional treatment methodologies




Palliative	Therapeutic
Ice	Chiropractic manipulation/adjustments
Heat	Acupuncture
Creams, ointments and rubs	Deep tissue massage/Ultrasound
Compression wraps and braces	Shock wave therapy
Electrotherapy	Laser
Exercise	A.R.T./Graston Technique®
Oral anti-inflammatories and/or analgesics	Exercise
Cushioning or supportive insoles (custom orthotics)	Stimulating/rehabilitative insoles (BioPods)

Long-term support, bracing, or cushioning

is not recommended.



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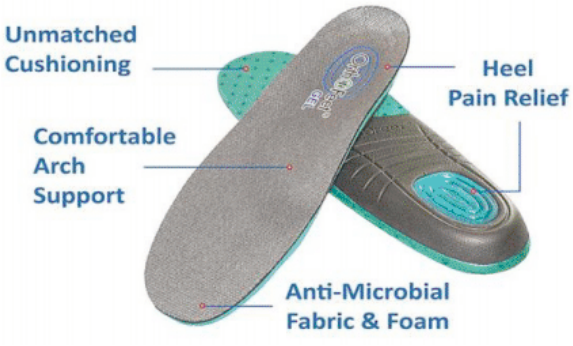

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Conventional treatment methodologies:

post-knee surgery options

Old School:
Plaster cast, leg casted
for at least six weeks

Today:
Mobility splint, mobility exercises
begin a day or two after surgery

Conventional treatment methodologies:

rehabilitative exercise programs

Rehabilitative exercise programs have been the recommended first treatment option in virtually all areas of musculoskeletal medicine—except for feet, until now.

Post Operative Rehabilitation

- Rapid post-operative mobilization
- Range of motion exercises started
- Continuous Passive Motion (CPM)
- Passive extension— by placing pillow under foot
- Flexion— by dangling legs over the side of bed
- Muscle-strengthening exercises
- Weight-bearing is allowed on first post-op day

How effective are

foot rehab exercises?

Common foot rehab exercises have little relevance for restoring ideal gait mechanics because they focus on the toe flexors and don't engage the extensors.

Some of the most common foot rehabilitation exercises:

- Roll a ball or cylinder under arches
- Plantar-flex the toes
- Grasp an object or towel with toes

What therapeutic exercise should include:

- Multidirectional movement
- Condition "automatic" movement memory
- Condition real-life responses
- Condition for flexibility, strength, endurance, agility, coordination and balance

The inadequacies of
conventional supportive insoles

As a form of treatment, supportive, cushioning, and custom made insoles are palliative at best.

With Orthotic

Without Orthotic[1]

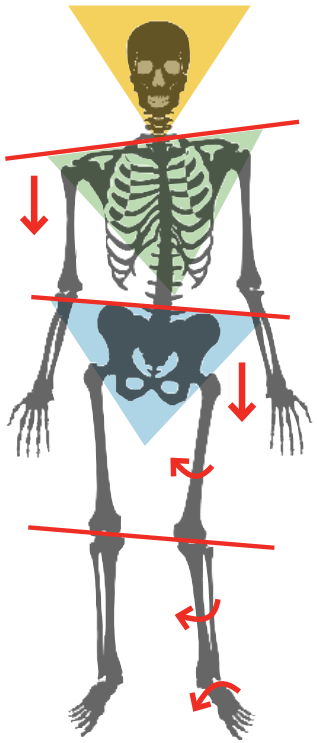
THE CLAIMS	The alleviation of symptoms by correcting pronation.
THE PROCESS	Casting or force plate measurements of a dysfunctional foot, in fact, "modeling" it.
THE THEORY	Rear or forefoot "postings" create "subtalar neutral."
THE REALITY	At best, creates a new foot/ground interface angle.
THE RESULT	Possible symptom relief, but with a new "wrong" foot alignment destined for further maladaptation.

Arch geometry adjusted for orthotic height

* 1 - Same subject in same footwear.

The inadequacies of

conventional supportive insoles



Most importantly, while products that support and/or cushion the feet may provide some temporary relief, they further dampen the Right Stimulus to the soles of the feet that is required by the brain for healthy neuromuscular function throughout the feet, legs, hips, and back.

The resulting maladaptive function becomes the functional norm.

Biopods are designed to re-create a

"barefoot-like sensory experience."

Biopods achieve this by integrating the two essential parameters of a shod "barefoot-like experience"

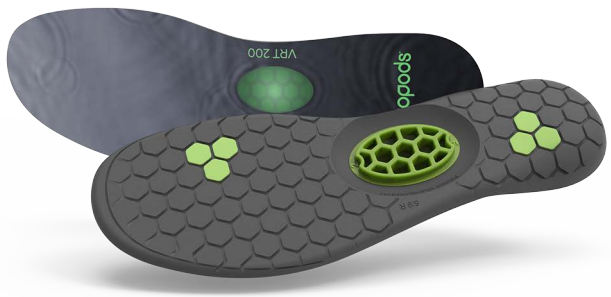
- **Right Stimulation** – Varied stimulation of the soles of the feet as if barefoot on natural terrain
- **Right Movement** – A shoe environment that permits the natural dynamic movement of the foot (use of the loosest, softest, most supple footwear possible)

Optimal results are achieved with footwear that allows the unimpeded pre-ground contact raising of the arch and toes needed to create the Windlass Effect.

Introducing

Biopods disruptive technologies

Easily incorporated into insole and footwear products



Biopods rehabilitate and restore

"natural" neuromuscular function

Here's what they do that others don't:

- Provide varied, subtle, sensory stimuli to the sole of the foot
- Safely stimulate and retrain "natural" protective reflex responses throughout the feet, legs, hips, and back for
  - a stronger, more stable arch structure
  - improved alignment and muscle function
  - efficient management of activity-related loading forces
  - enhanced performance.
- Work like an exercise program for the feet, legs, hips, and back
- Address the cause of the majority of structural dysfunction and associated pathologies.

Biopods enhance performance and **reduce risk of injury**

Biopods reduce stress at joints and lever-arm mechanics and improve neuromuscular function

- Improve structural alignment
- Enable more efficient muscle use –energy is directed to performance instead of compensating for poor alignment
- Enable efficient structural dynamics for an optimally aligned and more efficient stride
- Reduce oxygen consumption

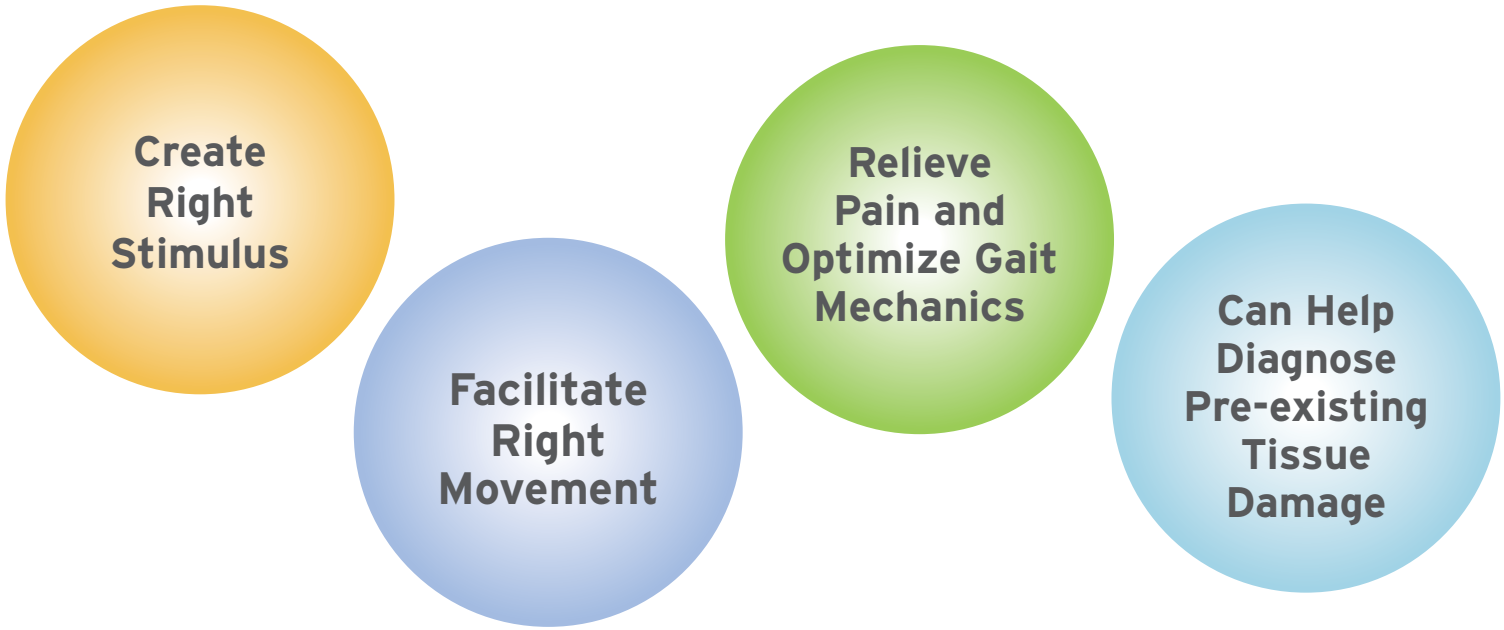
Recommendations
for using Biopods

- All the time: All ages and during all gait-related activities
- As a "first step therapy" for treatment of most foot-related pathologies
- As complement for virtually all lower extremity rehabilitative therapies, including pre- and postsurgery
- To rehabilitate before bracing

Biopods:

A New Paradigm

Products that incorporate Biopods Technolgies:



Biopods Clinical Protocols

Biopods Foot Dysfunction Indicators

1. Bunions
2. Bunionettes
3. Callus & corns
4. Hammer Toes
5. Claw Toes
6. "Flat" Feet
7. Pes Cavus (excessively high arch)
8. Genu Valgus
9. Genu Varus
10. "Pigeon-Toed"
11. Hallux Valgus
12. External Hip Rotation
13. Forefoot Splay
14. Longitudinal Toe Rotation
15. Overlapping Toes
16. Loss of Toe Gaps
17. Misaligned Subtalar Joint Alignment
18. Pronated Forefoot with Inverted Calcaneus
19. Supinated Forefoot with Everted Calcaneus
20. Everted Calcaneus
21. Inverted Calcaneus
22. Bony Protuberances of the Foot (multiple sites possible)
23. High Iliac Crest
24. Pelvic Torsion
25. "Pump Bumps"
26. Fifth Toe "Flail"
27. Excessive Ankle Plantar flexion (when non-weight-bearing)

Foot Dysfunction Indicator (F.D.I.)	Pathomechanics of the F.D.I.'s
Bunion	Non-rigid lever propulsion, with inefficient Windlass, and a consistently restricted toe box creates a valgus/compressive force onto the distal joint of the hallux; over sufficient time, bone, joint, and connective tissues remodel themselves according to the prevailing forces applied
Bunionette	Rigid upper material, compressing the 5th metatarsal, during toe off that has a torsional component; due to inefficient Windlass and 1st ray non-rigidity for propulsion; varus stress over sufficient time will induce bone and soft tissue remodeling with a varus angle, upon the distal joint of the 5th ray
Callus & Corn	Tight rigid footwear, combined with inefficient Windlass and non-rigid 1st ray lever, results in non linear propulsion; torsional stress will induce multiple opportunities for friction – the cause of callus and corn
Hammer Toe	When the absence of "Right Stimulus" fails to activate proper firing of many muscles of the foot and/or when footwear restricts toe movement (dorsiflexion), the toe flexor muscles can overpower their extensor counterparts, thereby causing "hammer toe"
Claw Toe	Absence of "Right Stimulus" fails to activate proper firing of many muscles of the foot; inappropriate flexor muscle activity with no extensor muscle activity to balance the forces, causes the "claw toe"
"Flat Feet"	Habitual, inefficient, Windlass Effect cannot create any functional arch (let alone an Optimal Arch Apex) and eventually stays flat (i.e., habitually pronated)
Pes Cavus	Tight rigid footwear, from a very young age, creates an environment in which the tibialis anterior and the peroneus longus are in simultaneous contracture, a permanent state of a high, rigid Windlass Effect results
Genu Valgus	A chronic state of pronation, due to inefficient Windlass Effect, will readily lead to internal rotation of the tibia and femur with contracture of the iliopsoas, and will put the ipsilateral knee into a valgus position

Biopods Clinical Protocols

Virtually everyone who walks on two feet and wears shoes will benefit.

- Benefits of Biopods
  - Preventative
  - Therapeutic
  - Performance enhancing
  - All while providing optimum comfort

Clinical Protocol - **Step 1**

Evaluate based on Biopods Inclusion Criteria

A

A nontraumatic presenting complaint of a weight-bearing body part

B

At least one Foot Dysfunction Indicator confirmed

C

Palpation confirmation of tissue damage and/or pathology at site of pain

D

Maladapted foot function/physiology

If any of the following criteria is observed, Biopods should be a therapeutic component of a rehabilitation plan:

A + **B**

A + **C** and/or **D**	**B** alone
B + **C** and/or **D**	**D** alone

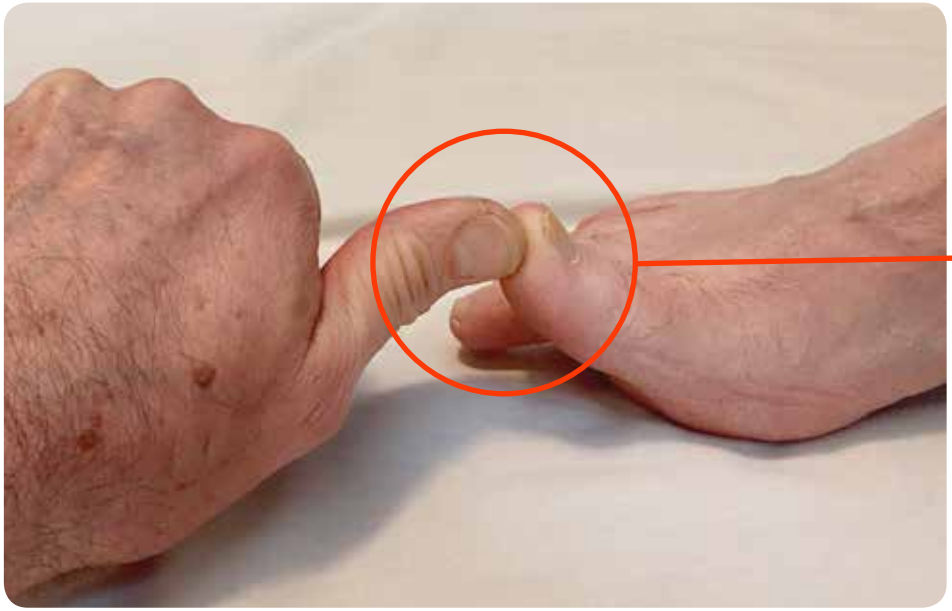
Contraindications

One absolute contraindication: Hallux rigidus, or complete immobility of the hallux due to genetics, arthritic, traumatic, or surgical fusion.

Verify complete immobility by attempting to move the great toe by passively challenging the hallux into its extended position.

If the great toe is completely rigid, Biopods products will have little or no benefit and may be uncomfortable.

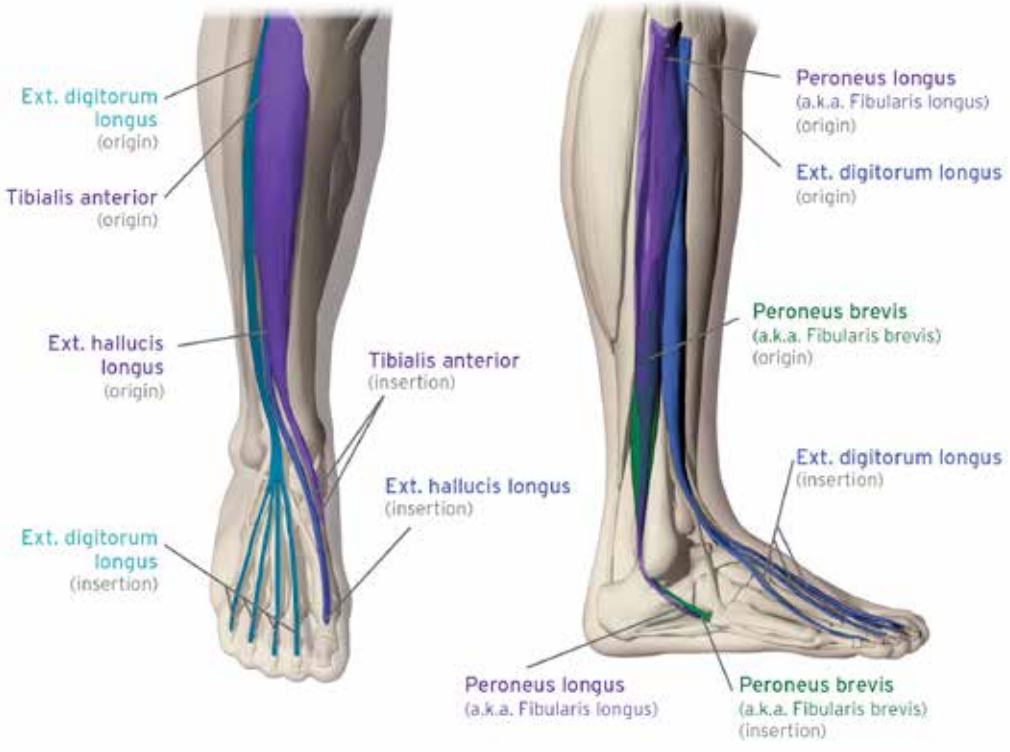
Challenging applications



If you can demonstrate at least moderate, passive extension in the great toe, Biopods Products may be employed.

Challenging applications requiring additional considerations

1. Absence of voluntary neurologic control of extensor hallucis longus muscle activity offers an unpredictable outcome. Success will depend on the cause (e.g., peripheral neuropathy, MS, ALS, Parkinson's).

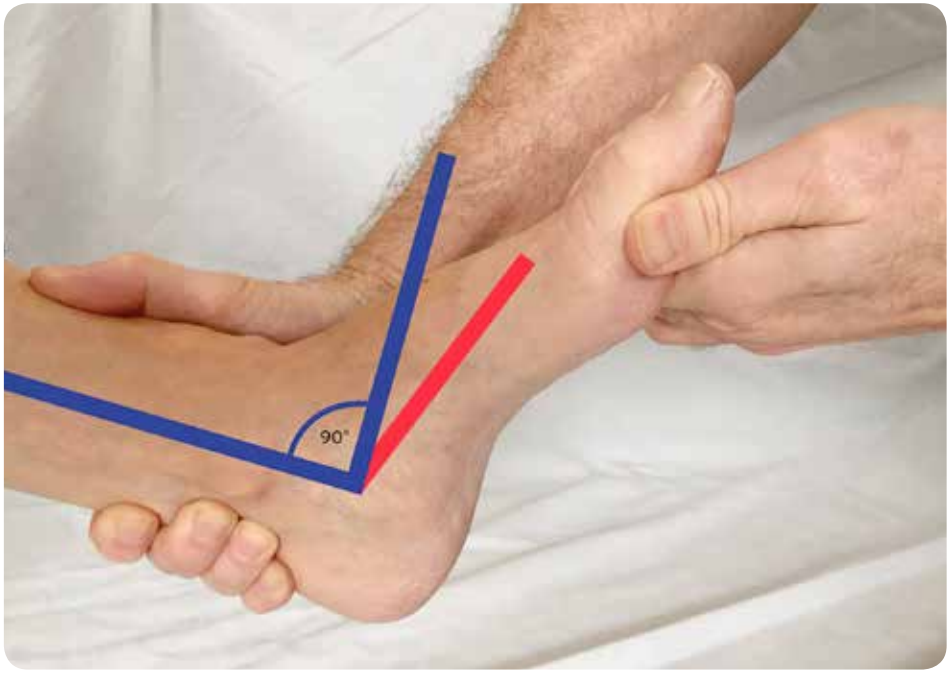


Because, in some cases, they may induce reflex activation of the extensor hallucis longus, Biopods Products are a clinical trial worth pursuing.

You may need to have your patient test various stimulus intensity levels.

Challenging applications requiring additional considerations

2. Inability to dorsiflex one or both talonavicular joints beyond the 90º position indicates that mobilization or manipulation would be of benefit.

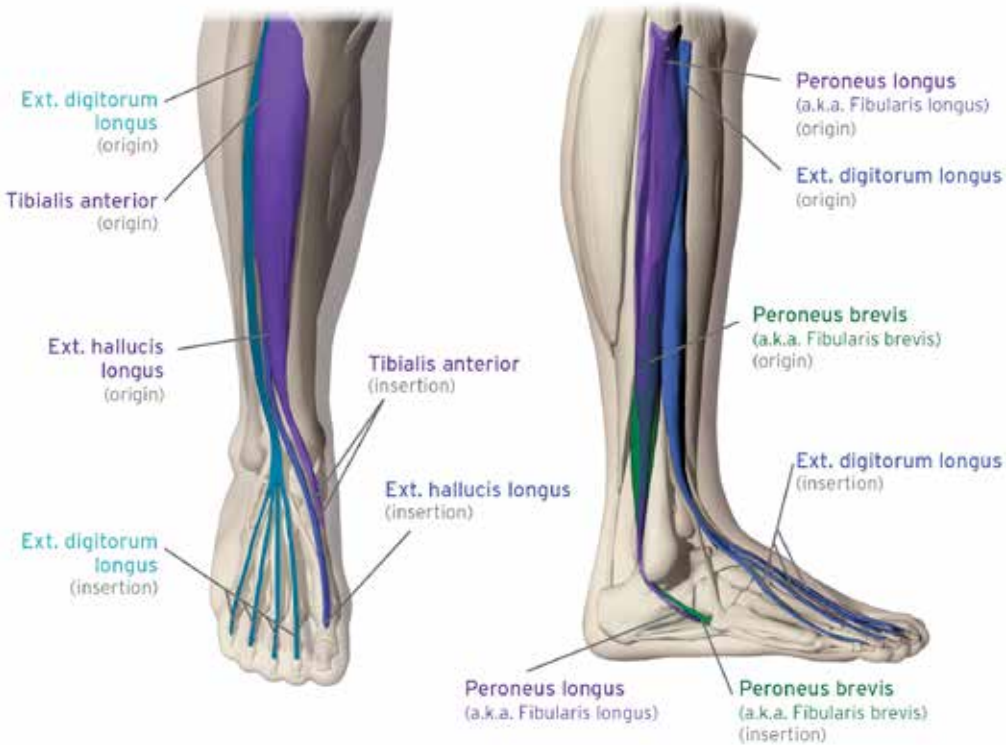


Select the most appropriate therapy.

Also recommend self-therapy concurrent with regular use of Biopods Products during gait, including heel walks and/or repetitive, full-range dorsiflexion with the heel resting on the floor.

Challenging applications requiring additional considerations

3. Neurologic loss of voluntary control of either or both tibialis anterior or peroneii muscles may offer an unpredictable outcome after implementation of Biopods Products. Success will depend on the cause (e.g., peripheral neuropathy, MS, ALS, Parkinson's).

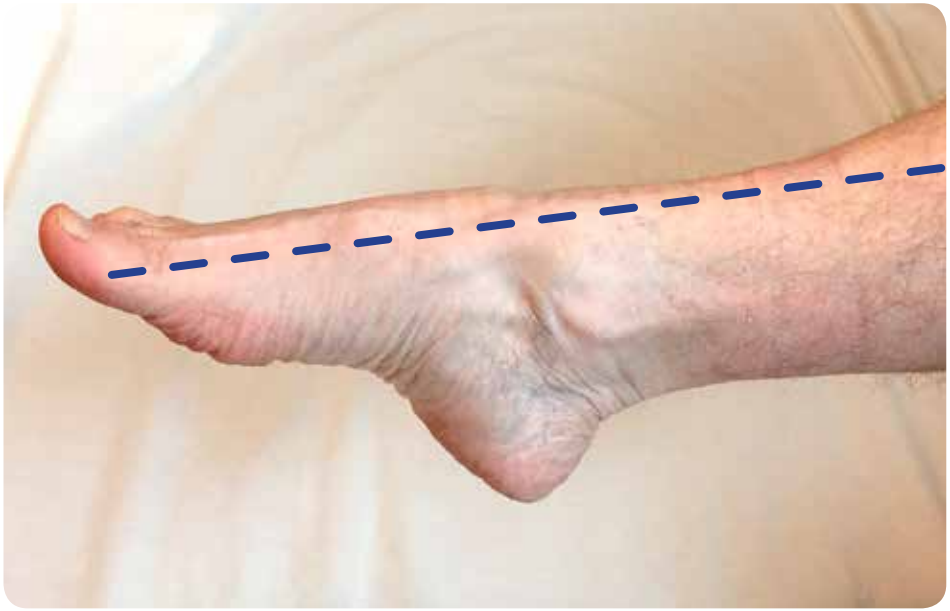


Because, in some cases, they may induce reflex activation of the tibialis anterior or peroneii, Biopods Products are a clinical trial worth pursuing.

You may need to have your patient test various stimulus intensity levels.

Challenging applications requiring additional considerations

4. Ballerina ankle configuration is a condition in which there is a virtual straight line down the tibia and foot dorsum when lying supine. This may indicate weak dorsiflexors and insufficient dorsiflexion at the talonavicular joint.



Employ mobilization or manipulation therapies before or concurrent with implementation of Biopods Products to restore mobility to the talonavicular joint.

Also recommend self-therapy that includes heel walks and/or repetitive, active, full-range dorsiflexion with the heel resting on the floor.

If you observe a significant muscle imbalance, you may need to recommend these therapies before implementing Biopods Products.

Challenging applications requiring additional considerations

5. Notably fibrotic regions — especially at the myotendonous junction and/or insertions of the tibialis anterior and/or peroneii — may become painful as a result of the stimulus intensity of Biopods Products.

After evaluating the severity, thickness, and chronicity of the fibrotic regions, you may opt to employ one or more soft tissue mobilization therapies (e.g., therapeutic ultrasound, A.R.T., Graston Technique®, deep tissue massage) to reduce or eliminate the fibrotic tissues prior to or during implementation of Biopods Products.

Your patient may require a lower stimulus intensity level until the fibrotic tissue has been sufficiently reduced or eliminated.

Clinical Protocol – **Step 2**
Assess **foot mobility.**

When using Biopods, we are most concerned about foot mobility – the ability to easily raise the arches and toes.

Clinical Protocol – **Step 3**
Identify **arch type**

- Biopods Footwear provide 3 stimulus intensity level options to meet the requirements of different foot types and activities
- A higher-intensity stimulus level does not necessarily produce a better result
- Typically, higher arches are most comfortable with a lower stimulus level
- Always let comfort be the guide iwhen selecting the most appropriate stimulus level

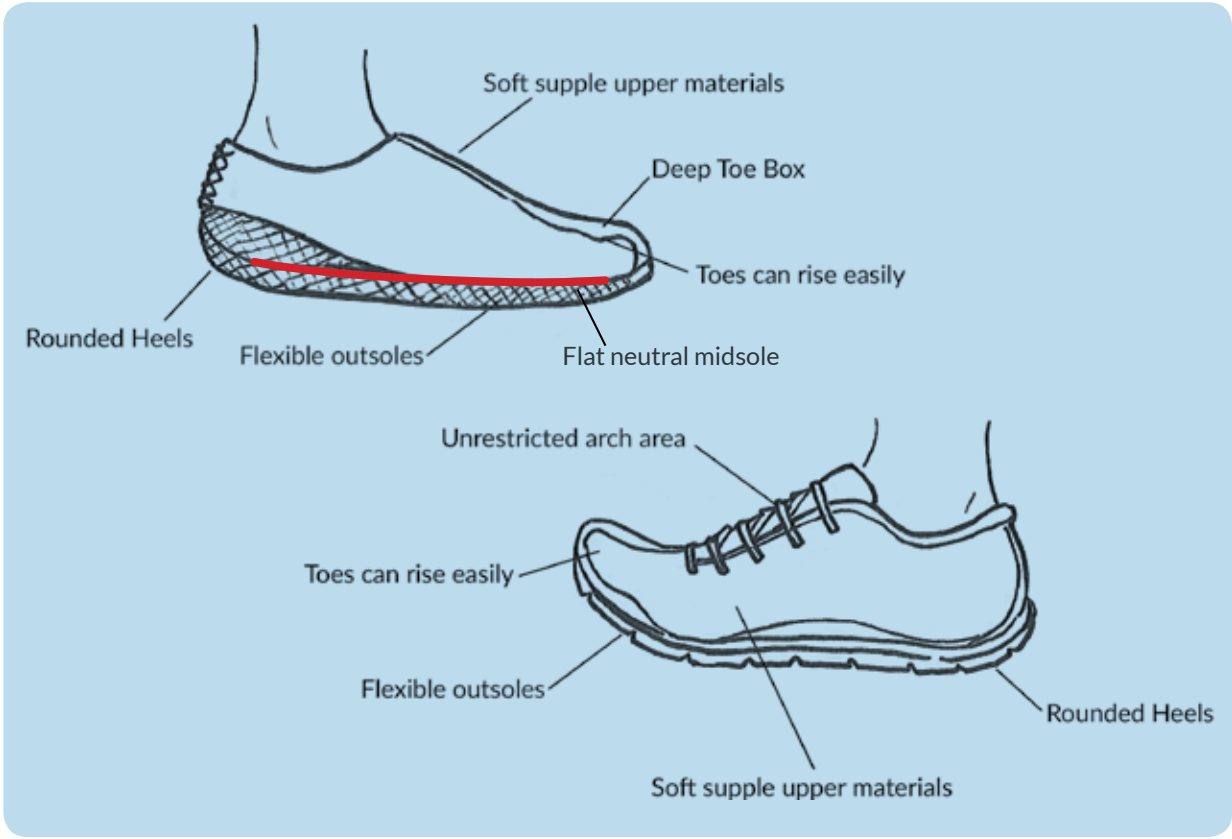
Absolute contraindication for Biopods implementation:

Hallux rigidus, or complete immobilization of the hallux of any cause – genetic, arthritic, traumatic, or surgical.

Clinical Protocol – **Step 4**

For best results with Biopods Insoles, use them in

Biopods-compatible footwear



Biopods Insoles work best:

- in soft, loosely laced, flexible footwear
- when placed on a neutral flat surface, and not in footwear with non-removable arch supports or built-in motion control features
- in footwear with low, rounded heels

Clinical Protocol – **Step 4**

Biopods and **unhealthy footwear**

Footwear designs that should be avoided or require additional consideration when using Biopods Insoles – the exceptions to the aforementioned rules

- **Stiff restrictive footwear that inhibits the natural raising of the arches and toes**

Stimsole Benefits

Comfort	Therapeutic	Performance Enhancement	Injury Prevention
Some improvement	Poor	Poor	Poor

Biopods Insole Recommendation: Not recommended

Clinical Protocol – **Step 4**

Biopods and **unhealthy footwear**

Footwear designs that should be avoided or require additional consideration when using Biopods Insoles – the exceptions to the aforementioned rules

- Footwear with built-in arch supports

Stimsole Benefits

Comfort	Therapeutic	Performance Enhancement	Injury Prevention
Some improvement	Poor	Poor	Poor

Stimsole Recommendation: **If the arch supports cannot be removed the shoes are not compatible with Biopods Insoles - Do not use**

Clinical Protocol – **Step 4**

Biopods and **unhealthy footwear**

Footwear designs that should be avoided or require additional consideration when using Biopods Insoles – the exceptions to the aforementioned rules

- Footwear with built-in motion control features

Stimsole Benefits

Comfort	Therapeutic	Performance Enhancement	Injury Prevention
Some improvement	Limited	Limited	Poor

Biopods Insoles Recommendation: Not recommended

Clinical Protocol – **Step 4**

Biopods and **unhealthy footwear**

Footwear designs that should be avoided or require additional consideration when using Biopods Insoles – the exceptions to the aforementioned rules

- **Footwear with raised heels**

Heels lower than
2 inches/6 centimeters

Heels higher than
2 inches/6 centimeters
Do not use Biopods

Stimsole Benefits

Comfort	Therapeutic	Performance Enhancement	Injury Prevention
Some improvement	Poor	Poor	Poor

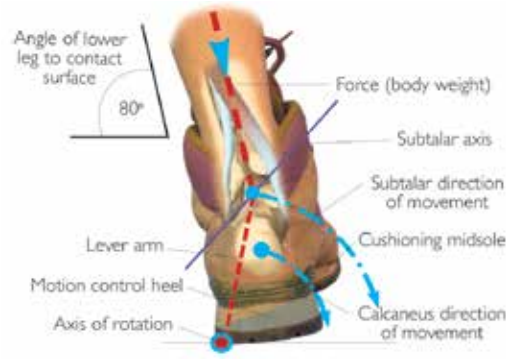
Biopods Insoles Recommendation: Lower heels are better

Clinical Protocol – **Step 4**

Biopods and **unhealthy footwear**

Footwear designs that should be avoided or require additional consideration when using Biopods Insoles – the exceptions to the aforementioned rules

- Footwear with flared heels – significantly increase ground contact stresses



Stimsole Benefits

Comfort	Therapeutic	Performance Enhancement	Injury Prevention
Some improvement	Moderate	Moderate	Poor

Biopods Insoles Recommendation: Not recommended

Clinical Protocol – **Step 4**

Biopodsa and **unhealthy footwear**

Footwear designs that should be avoided or require additional consideration when using Biopods Insoles – the exceptions to the aforementioned rules

- Footwear with concave surface areas under the forefoot

Midsole forefoot cross-section

- These features destabilize foot mechanics and cause the maladapted neuromuscular function and maladapted forefoot body geometry that contribute directly to foot-related pathologies, such as metatarsalgia and Morton's neuroma. Biopods Insoles cannot fully overcome these destabilizing effects.

Stimsole Benefits

Comfort	Therapeutic	Performance Enhancement	Injury Prevention
Poor	Poor	Poor	Poor

Biopods Insoles Recommendation: Not recommended

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Clinical Protocol – **Step 4**

Biopods and **unhealthy footwear**

Footwear designs that should be avoided or require additional consideration when using Biopods Insoles – the exceptions to the aforementioned rules

- **Footwear with contoured midsoles**

- Contoured midsoles can significantly increase the Biopods Insoles' level of stimulus.

Stimsole Benefits

Comfort	Therapeutic	Performance Enhancement	Injury Prevention
Good	Good	Good	Good

Biopods Insoles Recommendation: Use with caution

Clinical Protocol – **Step 4**

Biopods and **unhealthy footwear**

Footwear designs that should be avoided or require additional consideration when using Biopods Insoles – the exceptions to the aforementioned rules

- **Footwear with contoured midsoles or with solid rigid heels –**

with an inflexible ridge where the heel transitions into the lateral aspect of the midfoot

- When footwear with inflexible ridges are worn with Biopods Insoles, the ridges may cause a bruising or jamming of the cuboid or surrounding area. The symptoms may appear on the dorsal, lateral, or plantar aspects of the foot.
- These symptoms may manifest in a short period of time, if the ridge is more prominent; or after some time, if the ridge is less prominent. Often these ridges are virtually imperceptible unless you are looking for them. You can feel the ridges if you run your fingers over the lateral side of the shoe from the heel towards the forefoot.

Stimsole Benefits

Comfort	Therapeutic	Performance Enhancement	Injury Prevention
Painful	Poor	Poor	Poor

Biopods Insoles Recommendation: Not recommended

Clinical Protocol – **Step 4**

Biopods and **unhealthy footwear**

Footwear designs that should be avoided or require additional consideration when using Biopods Insoles – the exceptions to the aforementioned rules

- Footwear that is uncomfortable when using Biopods Insoles

- Footwear that is uncomfortable when using Biopods Insoles typically indicates that either the shoes are too tight, or they incorporate design features that conflict with the foot's optimal dynamic movement.
- Therefore, in a way, Biopods Insoles are teaching the feet what is good for them and what isn't.
- Most people with Biopods educated feet will make healthy footwear choices.

Stimsole Benefits

Comfort	Therapeutic	Performance Enhancement	Injury Prevention
Poor	Poor	Poor	Poor

Biopods Insoles Recommendation: Not recommended

Clinical Protocol – **Step 5**

How to get the most out of **BioPods Stimsoles** and proper usage.

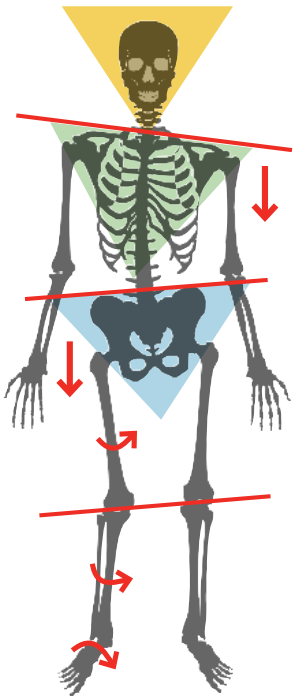
Biopods users should:

- Read instructions carefully
- Use Biopods regularly
- Avoid using orthotics in some shoes and biopods in others
- Anticipate the possibility of aches and pains as the body readjusts
- Consult Healthcare professional if pain increases

When first using Biopods, preexisting non-symtomatic fibrotic tissue may become symptomatic over time – this is beneficial because these areas can then be easily treated and optimal functional elasticity can be regained.

Clinical Protocol – Using Biopods as a **diagnostic tool**

Biopods Products can help identify patients with fibrotic tissue resulting from previous injuries that have since been forgotten.



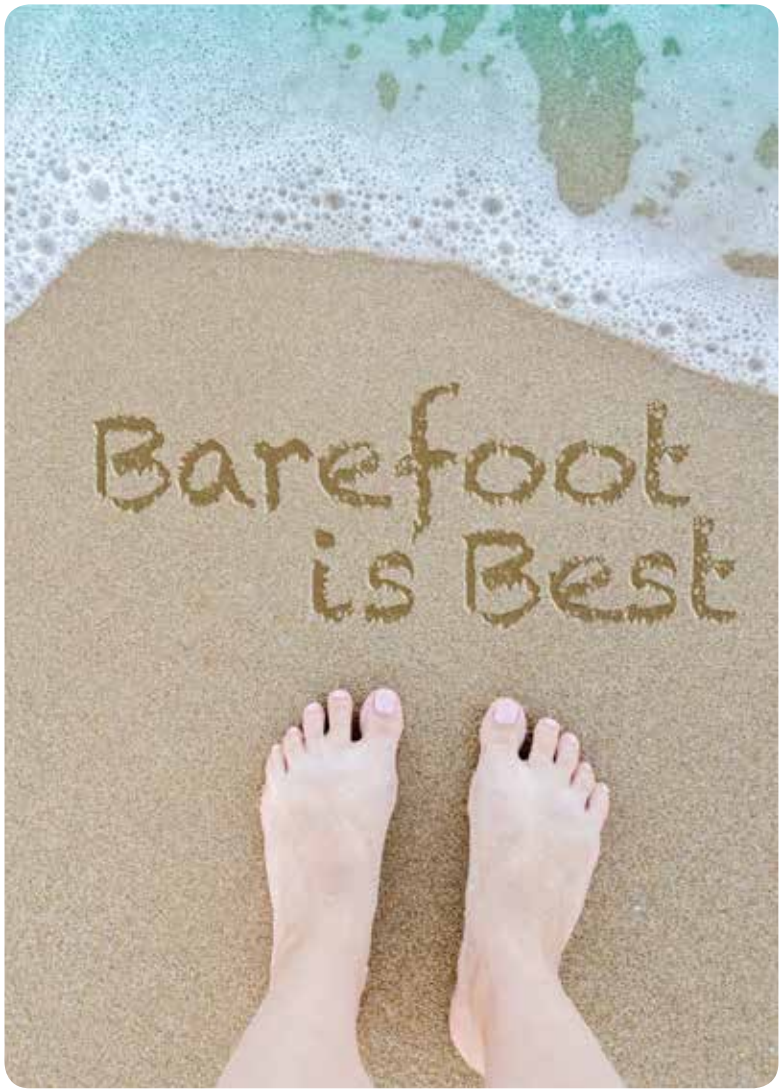
Poor functional alignment due to non-presenting fibrotic tissue, before Biopods use

With Biopods use, restrictive fibrotic tissue becomes symptomatic

With Biopods use and soft tissue mobilization therapies

Biopods Insoles can be a diagnostic tool:

- With regular use of Biopods, preexisting non-presenting inelastic fibrotic tissue can become symptomatic as the body's neuromuscular system adjusts towards healthier function.
- Once identified, the symptomatic fibrotic tissue can be easily treated using a wide variety of soft tissue mobilization therapies.



Regular barefoot activity promotes optimal neuromuscular protective reflex function throughout the feet, legs, hips, and back. This optimal function effectively eliminates the underlying cause of most foot-related pathologies.

Biopods are the next best thing to being barefoot.