The Barefoot Science Foot Strengthening System™
The "First Step" in Advanced Foot Care

Overview

Numerous studies throughout the world indicate that footwear actually causes the majority of our foot, leg, and back problems. In fact, in countries where shoes are not worn, only three percent of these problems occur in comparison to shoe-wearing populations. Studies also indicate that children's feet are negatively affected by conventional footwear by the age of six. Footwear, most particularly those with cushioning features, dampens the sensory input necessary to stimulate proprioceptive muscle contractions. These muscle contractions are required to align the bones to effectively manage the forces generated relative to the activity––the more intense the activity, the higher the arch required. In addition, the restrictive environments created by conventional footwear designs prohibit optimal biomechanical function and alignment of the foot. These footwear characteristics promote (encourage) a weaker musculoskeletal structure with its associated discomfort and host of painful symptoms.

Conventional Preventative/Treatment Methodologies

Supportive/cushioning footwear and orthotics are commonly recommended in the treatment and prevention of a host of foot problems.

Many footwear companies promote designs with various supportive features in an attempt to control movement ("support"), provide comfort ("cushion"), and improve performance. Unfortunately, this creates a never-ending cycle where the foot becomes progressively weaker and more dependent on the added support and cushioning. Conventional insoles and shoe inserts (orthotics) work in much the same manner as supportive footwear; they provide additional cushioning, support, or bracing for the foot, which further contributes to a weaker structure.

However, orthotics and supportive footwear, by restricting foot movement, also prevent the natural foot dynamics required for optimal healthy musculoskeletal function. Just as a splint or a cast affects the musculoskeletal structure, supportive footwear and orthotics lead to muscle atrophy, loss of bone mass, joint stiffness, and an increase dependency on the artificial support.

It is important to note that in virtually all areas of musculoskeletal medicine long-term bracing is not the recommended treatment of choice. Yet supporting or bracing the foot continues to be the most commonly recommended preventative and treatment option for foot problems.

Conventional Foot Care Philosophy (Common Myths)

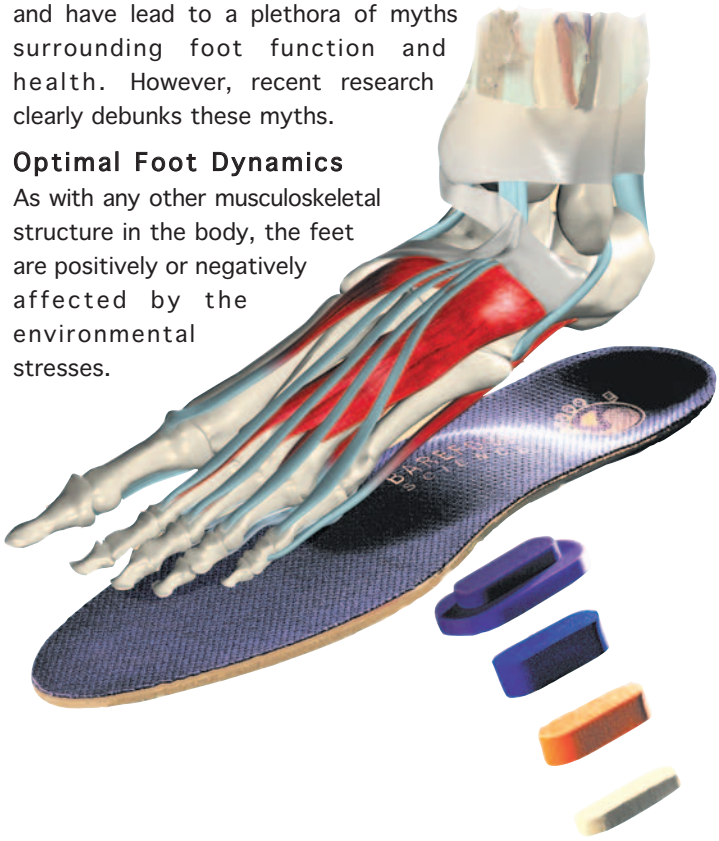
The structure of the foot and its biomechanical function have been commonly referred to in medical journals, studies, and in consumer publications as being of poor design and function, therefore, susceptible to injury. Another common statement is that most foot dysfunction and resulting pathologies are hereditary. These two myths have been perpetuated within the medical community and footwear industry by their repeated exposure in these mediums, not withstanding the fact that there are very few scientific studies to support these hypotheses—in fact, an abundance of research demonstrates otherwise.

Virtually all current foot care treatment methods and products, focused primarily on symptom relief, are based on conventional hypotheses—that the feet are inherently inefficient, weak, and unstable and, therefore, require artificial support or cushioning.

These treatment methodologies are based on theories incorporating foot function NORMS that have not changed in over 100 years, and are supported by published articles that for the most part simply rehash these outdated hypotheses. The majority of existing research is more aptly viewed as a circumvolution of thought, composed of the repetition and validation of each previous body of research (hypotheses). It is disturbing that the protocols and hypotheses were never tested for their validity, reliability, or applicability, yet these hypotheses are commonly stated as fact and have lead to a plethora of myths surrounding foot function and health. However, recent research clearly debunks these myths.

Optimal Foot Dynamics

As with any other musculoskeletal structure in the body, the feet are positively or negatively affected by the environmental stresses.



BAREFOOT SCIENCE™

Stimulates, Strengthens, and Restores Optimal Foot Health

For example, it is commonly accepted that bracing results in muscle atrophy, loss of bone mass, and joint stiffness, and that exercising through a full range of motion promotes a balance of strength and flexibility in opposing muscle groups while encouraging optimum bone density and ideal alignment at the joints.

Optimal Foot Function can be defined as an ideally aligned musculoskeletal structure capable of most efficiently managing the forces generated through three-dimensional weight-bearing bipedal activities. Optimal musculoskeletal alignment would demonstrate and promote the following:

- The bones throughout the structure are best aligned to effectively manage forces generated; forces are managed through the bone structure's center of mass, [equalized force (pressure) at (over) the joint bone-to-bone interfaces].
- The balanced use of opposing muscles (individual and groups), encouraging a balance of strength and flexibility.
- The muscles are moderately (optimally) tensioned for the most efficient performance while promoting optimal alignment of bone structure throughout the activity.

Optimal foot function is commonly seen in habitually unshod feet during barefoot gait. This is graphically demonstrated by the fact that habitually barefoot populations develop relatively few debilitating foot-related problems (The Journal of Bone and Joint Surgery), when compared 85% of North Americans who will see a medical professional for some type of foot-related pathology at some point in their lifetime (American Orthopedic Foot and Ankle Society). A recent survey by the American Orthopedic Foot and Ankle Society demonstrated that 66% of those surveyed were currently experiencing foot discomfort. While going barefoot is not an option for urban populations, by understanding the dynamics involved in barefoot gait more effective preventative and rehabilitative treatment options become apparent.

The plantar surface (sole) of the foot is highly sensitive and it is common knowledge that noxious plantar skin sensation contributes to intrinsic (reflex) foot muscular activation. Research data supports the concept that plantar feedback plays a central role in safe and effective locomotion and has demonstrated a relationship between increased arch height (foot stability) and barefoot activity; the greatest (arch height) increases were found in subjects who performed barefoot activities outdoors.

Therefore, the neurological and biomechanical requirements for optimal foot function, in order of priority of importance (related to timing of optimal musculoskeletal function), are:

1. adequate proprioceptive stimulus of the sole of the foot (mechanoreceptors)—required to trigger optimal adaptive musculoskeletal function as noted above—activating involuntary reflex response in muscle groups required to optimally align the bone structure prior to ground contact, and maintain optimal alignment throughout the activity,

Debunking the Myths

- *"Only 1% of the 322 articles reviewed displayed consistent, reputable, and scientific evidence-based information. The authors concluded that the majority of these published articles focused on generating, rather than testing, hypotheses."* Journal of the American Podiatric Medical Association 2001. This study examined the reliability of information found in articles in Podiatric medical journals.
- *"Cushioning often presents a 'comfortable' feeling initially, but it provides a false sense of security by offering benefits that are, for the most part, superficial. Cushioning products mitigate vertical shock by less than 10%, at best."* Possible Relationships Between Shoe Design and Injuries in Running. Sportverletzung-Sportschaden.
- *"Horizontal forces—rather than vertical forces—contribute most significantly to foot pathologies."* Research Institute for Sport and Exercise Sciences, Liverpool John Moores University, U.K.
- *"The consistent use of the most effective shock absorbing insert (providing medial arch support with heel cupping) did not prevent lower limb pain among healthy soldiers in basic training, and in fact, the insert may have actually caused some injuries—Thirty-eight percent of those issued inserts had lower limb pain problems compared with 29% of those not issued inserts and 38% of those who bought their own."* Prevention of Lower Limb Pain in Soldiers Using Shock-Absorbing Orthotic Inserts. Journal of the American Podiatric Medical Association.
- *"...natural gait is impossible for the shoe-wearing foot...and it is equally impossible for any orthotic to achieve "correct" foot and body balance ..."* Dr. William Rossi. "Why Shoes Make 'Normal' Gait Impossible." Podiatry Management
- *"Repeating quantitative results has proven difficult, with many researchers unable to confirm the quantitative effects of orthotics or find significant variations in effects."* Effects of Forefoot Posting on the Kinematics of the Lower Extremities During Walking. Human Performance Laboratory, University of Calgary.
- *"We should have a clear body of evidence that orthoses actually work. Unfortunately we don't."* Orthoses: Foot/Custom: The Mechanics of Foot Orthoses for Runners. Biomechanics: February 1996.
- *"Contrary to claims of correcting biomechanical alignment commonly made by those who support orthotic use, the relative change in structural alignment is minimal."* Put to the Test: Orthoses Reduce Pressure But Fall Short of Biomechanical Correction. Biomechanics: October 2000.

Optimal Foot Dynamics - Internal arch geometry through center of mass increases with the Windlass Effect

2. uninhibited dorsiflexion of the toes, which is required to form the Windlass Effect (the raising and stabilizing of the foot's arch system). This optimizes and promotes musculoskeletal efficiency and levels of performance,
3. uninhibited ability to raise the foot's arch system, which is required to form the Windlass Effect (the raising and stabilizing of the foot's arch system). This optimizes and promotes musculoskeletal efficiency and levels of performance.

Optimally aligned, the foot is capable of effectively managing multi-directional ground interface angles and the respective forces generated. This biomechanical efficiency decreases the incidence of stress and fatigue-related injuries at the muscle, tendon, and ligament junctions throughout the weight-bearing kinetic chain.

Impairments to Optimal Foot Dynamics

The foot and lower limb's optimal function—and ultimately that of the body's weight-bearing related musculoskeletal structure—is determined by the following environmental considerations:

1. In a barefoot environment, the foot:
   - is uninhibited both neurologically and biomechanically. It receives optimal stimulus and enjoys unfettered alignment.
   - is susceptible to abrasions and punctures.
   - is susceptible to extremes of heat and cold.
2. In a shod environment, the foot:
   - is inhibited both neurologically and biomechanically. Optimal stimulus is dampened, and alignmentis inhibited/restricted/prevented—not only in the foot but throughout the weight-bearing structure.
   - is required to manage greater loads and forces. Leveraged forces resulting from heel height, heel/mid-sole width, and sole/mid-sole rigidity are introduced that substantially accelerate velocities and increase loads laterally, vertically, and torsionally.
   - is, to a relative degree, protected from abrasions and punctures.
   - is protected from extremes of heat and cold.

Virtually all footwear dampens sensory stimulus to the mechanoreceptors. Without the necessary sensory feedback, the musculoskeletal structures of the feet are unable to provide the stable platform required to effectively manage the forces generated. The dampened sensory stimulus may be the result of the footwear's cushioning properties and/or rigid soles. In addition, most footwear restricts the dorsiflexion (raising) of the toes and the corresponding raising of the arch that is required to stabilize the musculoskeletal structure.

The foot's structural instability and excessive movement inside the shoe leads to the friction and pressure spots that contribute to calluses, bunions, diabetic foot ulcers, etc. Custom orthotics, and supportive (motion control) footwear are commonly recommended to prevent and treat these symptoms, however, they further contribute to the dampening of the proprioceptive stimulus and poor circulation. In addition, their rigid characteristics actually increase the multidirectional forces generated as well as their related stresses––friction, pressure spots, etc. In essence, the foot and supportive footwear fight against each other.

Optimal Foot Dynamics and Footwear Characteristics

Aside from protecting the foot, footwear should provide the sensory stimulus required to optimally align the musculoskeletal structure relative to terrain and activity levels; and it must not restrict this optimal alignment (dorsiflexion of the toes and the corresponding raising of the arch). Footwear should also be as soft and pliable as possible so that the foot and shoe work together, effectively eliminating friction and pressure spots.

The Barefoot "Science" and "NMS" Technologies

Barefoot Science™ has developed a cost effective and easy to use Neuromuscular Stimulator ("NMS") technology that is incorporated into a shoe insole, the "Foot Strengthening System." The Barefoot Science™ technology is based on a philosophy that promotes "NATURAL" foot function and treatment, and that incorporates proven scientific concepts from various specialized medical disciplines including:

- neuromuscular physiology,
- rehabilitative medicine,
- musculoskeletal mechanical physics, and
- adaptive bone remodeling.

Over 130 independent published research studies support the underlying science.

Active Stimulus vs. Passive Support/Cushioning

The Barefoot Science Foot Strengthening System™ is not an instant fix but, with consistent use, works inside the shoe like a rehabilitative exercise program to safely and naturally stimulate, strengthen, and restore healthy foot function, optimizing comfort and performance. The stabilized foot and improved muscle function facilitate optimal bone alignment, not only in the foot, but up through the body.

The net result is a stronger, stable, more efficient structure that is capable of managing greater forces with reduced stress––minimizing the risk of injury while increasing athletic performance and comfort.

The System works best in soft flexible footwear, loosely laced, with a deep toe box.

In clinical settings, Barefoot Science™ has demonstrated 97% effectiveness in treating problems in the feet, legs, knees, hips, and back. Preliminary trials with diabetic foot problem sufferers have demonstrated a complete healing of previously non-healing foot ulcers within four to five months.

Soft Tissue Adaptation Phase

During the first two months of use with the Barefoot Science Foot Strengthening System™, the body undergoes a Soft Tissue Adjustment Phase. This is the initial period when the muscles that support the foot are re-trained to function in a more natural and healthy manner. As muscle function improves, mobility at the joints increases and the bones realign to more effectively manage increased loads. Some individuals may experience "new" aches and pains in the muscles and joints as the body adjusts––this is a normal occurrence in most rehabilitation programs, most particularly when rehabilitating areas that have been braced, splinted, or casted for a period of time. These "new" aches and pains may appear in different locations and at different times during this adjustment period. Again, this is normal.

Complementary Therapies Accelerate the Rehabilitative Process

However, if these symptoms persist in any one area for longer than two weeks or if they increase in intensity, they may be the result of untreated scar tissue, which is possibly caused by foot dysfunction related to poor foot mechanics (due to footwear restrictions), or prior injury. In addition, if the person is presenting pain prior to using Barefoot Science™, it is more than likely that some soft tissue damage has occurred and that some scar tissue is present. In most instances, individuals without a history of prior injury to the affected area develop soft issue micro tears due to chronic poor foot mechanics. The micro tears progressively thicken with the repeated stress and the resulting the scar tissue inhibits optimal healthy foot function. In effect, if left untreated, the scar tissue "locks" the foot into a pattern of unhealthy mechanics and inhibits the rehabilitation process. Conventional therapies such as deep tissue massage, ultrasound, electro-stimulation, laser, and icing, etc. should be employed by a consulting medical professional to address any scar tissue, swelling, and pain.

In these instances, the user should return to a lower Level (one that is still comfortable for use) and under the supervision of a consulting medical professional (employing the therapies listed above) gradually progress with the higher insert stages as the scar tissue is broken down.

Usage Guidelines

3/4-Length: The 3/4-length version of the Barefoot Science™ System is designed for shoes without a removable insole, such as dress shoes, work shoes, boots, and some athletic footwear.

Full-Length: The full-length version of the Barefoot Science™ System is designed for shoes with a removable insole, such as athletic and casual footwear. The full-length version is not recommended for shoes without removable insoles, as the increased volume in the forefoot inhibits the System's effectiveness and optimal foot function.

Choose Shoes With Care: For optimum results with Barefoot Science™, look for soft flexible shoes that feature plenty of toe room (the higher you can raise your toes the better), that are adjustable over the arches (i.e., laces or straps), with heels lower than 3.5 cm or 1.5 inches, and that have pliable rather than rigid soles. Shoes should provide a roomy fit for adequate circulation and movement. The right shoes will allow the feet to move with less restriction so that Barefoot Science™ can provide the highest degree of immediate as well as long-term benefit. Supportive or motion control footwear is not necessary when using Barefoot Science™ and, therefore, is not recommended.

Adjust Levels According to Sport Activity

The full and 3/4-length insoles work well in most athletic footwear related to dynamic foot function, i.e., running, jumping, etc. However, static foot function found in athletic footwear such as ski boots or skates can magnify the sensation of upward pressure of the dome contour and over-stimulate the muscle firing sequences. The increased muscular activity and resulting blood flow can be inhibited by the restrictiveness of this type of footwear and can cause the foot to cramp. Therefore, wearing the insole alone or with a lower insert Level in the insole cavity will provide the highest degree of comfort and effectiveness.

"Barefoot Science philosophies are based on sound medical and scientific principles, common sense and provide a vastly superior understanding of foot function when compared to conventional views." Thomas D. McClain M.D. A.B.O.S. A.A.O.S.

BAREFOOT SCIENCE™

For more information visit our web site at
www.barefootscience.com or call us toll-free at 1-888-272-1690

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