

NIKE FREE EMEA MEDIA EVENT
ATHENS, GREECE MARCH 3RD. 2005
POWER TO THE FEET.

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"MEET YOUR FEET".

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I am delighted to have been invited here today to share with you my views on the health, strength and well being of human feet.

Most people will be amazed to know that the head weighs between 12-14 lbs or a little over 5kgs. The muscles of the shoulder girdle have the job of holding up the weight of the head.

But what holds up the weight of the full body? Amazingly the bony feet have to hold up and support the weight of the body both in standing and in locomotion.

In my case that is 190lbs or 87kgs being supported by my feet.

The foot and ankle are the focal points to which the total body weight is transmitted in ambulation.

The thick heel and toe pads perform as shock absorbers and the joints should be capable of the adjustments necessary for fine balance on a variety of terrain. But many peoples feet are redundantly weak. Before expanding on that statement I will give a short 'science lesson' on the feet.

The bones of the foot support the body and act as a lever during walking and running. There are 26 bones in each foot, 33 joints, 107 ligaments and 19 muscles. The skin on the sole of the foot (the plantar surface is much thicker than elsewhere on the body) and there are 125,000 sweat glands on each foot, more per square inch than any other part of the body. Big potential for smelly feet!

The segmented bones allow the foot to adjust to different surfaces.

A quick run through the 26 bones:

Talus, calcaneus, navicular, cuboid, medial, intermediate and lateral cuniform bones, those seven bones are termed the seven tarsal bones. Joining the tarsal bones are the metatarsal bones (5) and joining these are the toe bones (phalanges). Each of the smaller toes has three phalanges (proximal, middle and distal). The big toe

has only two phalanges (proximal and distal).

The 107 ligaments bind bone to bone and give stability. The 19 muscles allow the foot to move in the following ways.

- (1) Feet point towards body, (dorsiflexion).**
- (2) Feet point down (plantar flexion).**
- (3) Sole faces inwards (Inversion or supination).**
- (4) Sole faces outwards (eversion or pronation).**

There are three characteristic foot types:

- (1) Pes cavus (high arched)**
- (2) Pes rectus (normal foot)**
- (3) Pes planus (flat footed)**

Leonardo da Vinci described the foot "as a masterpiece of engineering and a work of art".

Certainly the feet are an amazing structure. Healthy feet allow us to live a very active lifestyle. Unhealthy feet can be very debilitating.

Feet do not work in isolation. The central nervous system originating all the way up in the head controls proprioception. Around our ankle joints are nerve endings or balance organs called Ruffini end organs, part of the peripheral nervous system. Our feet are all part of the kinetic chain. The kinetic chain describes the human locomotive system as a series of joints in the lower extremity, the foot, ankle, knee, hip, S1. Injury or a weak link in the kinetic chain has an adverse effect on the other joints and their supporting structures, ligaments, tendons, muscles, nervous system.

Balance Demo. One person from audience.

Show how tibialis anterior, tibialis posterior work to hold up the longitudinal arch. The involuntary contraction of these muscles along with the peroneals and intrinsic muscles of the foot working to maintain neutral stance.

(2) Strength Status of Human Feet. (Ger wear cervical collar)

I would like to go back to the neck. If a cervical collar is worn for a long period of time the muscles become redundant and weaken, we term this disuse atrophy. The person ends up with a bigger problem because the weight of the head does not change yet the muscles are weaker and those muscles that are functioning have a greater job in holding up the weight of the head. (Have people hold medicine ball to feel weight of head) (Hold ball close to chest, hold ball away. ? Weight)

This analogy relates directly to the feet.

The deconditioned musculature of the foot is the greatest imbalance resulting in injury that I see in my practice. Mankind by relying on footwear to control and protect the foot has allowed the foot to become weak and deconditioned.

The focus by the athletic footwear industry in the past 25 years in treating the foot as a weak link that needs to be packaged, cushioned and controlled in motion by anti-pronation devices has its limitations. It solves one problem but it presents us with another. Yes the cervical collar does a good job in holding up the head but the wearer becomes dependant on it. The muscles underneath become weak and dysfunctional. The same is true for the foot. If you don't use it you lose it. If you package it in footwear that cushion, protect, and limit normal movement we lose the natural resilience that the foot is meant to have. Weak muscles of the foot and ankle lead to a knock on effect up the kinematic chain. We see a greater incidence of injuries in the knee, hips, S1 and lumbar spine.

My interest in functional biomechanics and human performance goes back to 1975. I was fortunate when I started competitive athletics to have a coach who had great practical knowledge.

My coach advocated to me and the dozen athletes in his group to run barefoot on grass to strengthen our feet. On a regular basis we

trained barefoot, running up and down sand dunes. We did exercises to strengthen our feet which involved skipping, and bounding. I won several national Irish titles as a junior in middle distances and competed at international level in triathlon winning 7 Irish triathlon titles and competed in World triathlons and Hawaii Ironman events.

In 15 years of competitive sport I only witnessed one injury. That was in 1991 when I had a bad accident off the bike and broke my hip. I know firsthand that running barefoot and strengthening my feet protected me from overuse injury. Barefoot training and strengthening of the feet has been advocated by many coaches.

Many of you are familiar with my work as a sports injury therapist. In short I have had the opportunity to work with so many of the great stars of sport, some 43 Olympic medal winners, numerous world champions and record holders. I have worked with over 100 world class African athletes, Kenyans, Ethiopians, South African and Moroccan athletes.

Most of these athletes never wore shoes until their late teens. They have few foot defects. The range of their foot motions are remarkably great, allowing for full foot activity.

In developed countries shoes are worn from a very young age. I believe that we have become dependant on footwear to protect the foot resulting in disuse of the intrinsic muscles leading to a functionally deficient structure. It is well known that restrictive footwear, particularly ill-fitting shoes cause most of the ailments of the human foot.

I witness so many foot defects in people who have worn shoes from a young age.

Foot defects such as Hallux Valgus, Hallux rigidus, hypo-mobile subtalar joints, poor flexion - extension capabilities of the toes etc., many of these conditions have resulted due to feet being restricted in footwear.

The main sports injuries I see in people with deconditioned feet are:

- (1) Achilles tendonitis, Achilles tendinosis.**
- (2) Plantar fasciitis.**
- (3) Inversion sprains**
- (4) Stress fractures.**
- (5) Anterior tibial stress syndrome (shin splints)**
- (6) Posterior tibial stress syndrome.**

Earlier I spoke about the Ruffini end organs. These proprioceptive nerve organs responsible for keeping balance in check need to be constantly stimulated and trained.

I have witnessed so many people with deconditioned feet being prescribed orthotics to support the feet. Orthotics only hold up a weak structure. Like the cervical collar holding up the neck the orthotic device will do a good job in supporting a weak foot. Use orthotics for a period of time and the Ruffini end organs become redundant, muscles become weaker and without the extrinsic support of the orthotic the foot cannot adequately support the weight of the body in locomotion.

Feet are the contact point with the ground, they should be the strongest link. The muscles around the ankles should be strong enough to give structural support. Depending on shoes with anti pronation devices or orthotics is not the solution.

There has been a lot of focus over the years on pronation in locomotion. The athletic footwear industry designed shoes on a straight last and added anti pronation devices to control excessive pronation.

Orthotic devices reinforced this philosophy of blocking the foot and stopping pronation.

Pronation is a normal function of locomotion. The gait cycle in walking and running can be divided into stance and swing phase.

The stance phase consists of heel strike, mid stance and propulsion.

At heel strike the foot begins to pronate in order to adapt to the terrain, and to absorb shock.

Pronation continues until the early part of the midstance when the foot begins to resupinate in order to provide a rigid lever from which to propel. Pronation should be controlled by the eccentric contraction of the tibialis anterior and tibialis posterior muscles. Both the amount of pronation and the rate of pronation should be controlled by muscular activity.

The use of orthotics and anti pronation devices should only be used by people who excessively over pronate or those with leg length discrepancies or overt biomechanical needs.

Muscles if adequately strong should decelerate the rate of pronation.

Most peoples feet are so weak that they depend on a motion control shoe or orthotic to support their weak structure.

For years I have advocated the benefits of strengthening the feet. All the athletes I work with do specific strength exercises.

I am in full agreement with Dr. Muffalla's findings that the feet are the least trained part of the body.

I reinforce a few simple statements to all the sports people I work with.

(1) Structure governs function.

If structure is weak then function is compromised. Structural weaknesses or imbalances lead to structural - functional breakdown.

(2) The foot is the contact point with the ground, it should be the strongest link. Shoes do not cause injury. Weak feet cause injury.

(3) Stronger healthier feet lead to better performance in terms of ankles, knees, hips, lower back, all the way up the kinematic chain.

(4) It all starts with strong feet. The foot should have control over the shoes, rather than having the shoe control the foot.

What is the solution.

The solution is to correct the underlying problem of structurally deconditioned feet and to strengthen the weak link within the kinetic chain.

The strengthening exercises that I advocate are beneficial for recreational athletes to world class athletes.

The programme is designed to increase the following components of foot health.

- (a) flexibility**
- (b) proprioception**
- (c) strength**
- (d) dynamic strength.**
- (e) Foot Detox.**

**Flexibility Calf Soleus
Gastrocnemius**

Proprioception Improve balance, unilateral stance exercises.

Eyes closed unilateral stance hold 30 sec.

On wobble board

On foam mat

With medicine ball

Strength

- (1) Marbles pick up with toes**
- (2) Pencil pick up with toes**
- (3) Step downs**
- (4) Eccentric Heel drops - calf raises.**
- (5) Theraband, dorsiflexion, inversion, eversion.**
- (6) Use Nike Free throughout day.**

DYNAMIC EXERCISE PROGRAM.

Bunny Hop

Zig Zag bunny hops

Single leg hops

Zig Zag hops

Box jumps

Step up test.

FOOT DETOX.

Epsom Salts - Baking Soda Hot Foot Baths.

Reflexology.

Massage

Shiatsu

As an enthusiastic advocate of STRONGER FEET I have had the opportunity to be involved in the development of Nike Free. I have my athletes use Free in their training and I designed baseline training programmes to maximise the results of training with Free.

I can honestly say that in my view the Free concept is a great advance in athletic shoe innovation. Before Free, shoes were designed to cushion, protect and control the foot. The shoe was controlling the motion of a weak structure; structural weaknesses lead to injuries.

Free allows the foot to become structurally stronger. In effect the shoe allows the feet to work freely with each joint working in harmony. The end result is stronger healthier feet, reduced injury and improved performance.

In the afternoon during the practical sessions everyone will get to wear Free and go through some of the strength exercises I advocate.

Thank You.