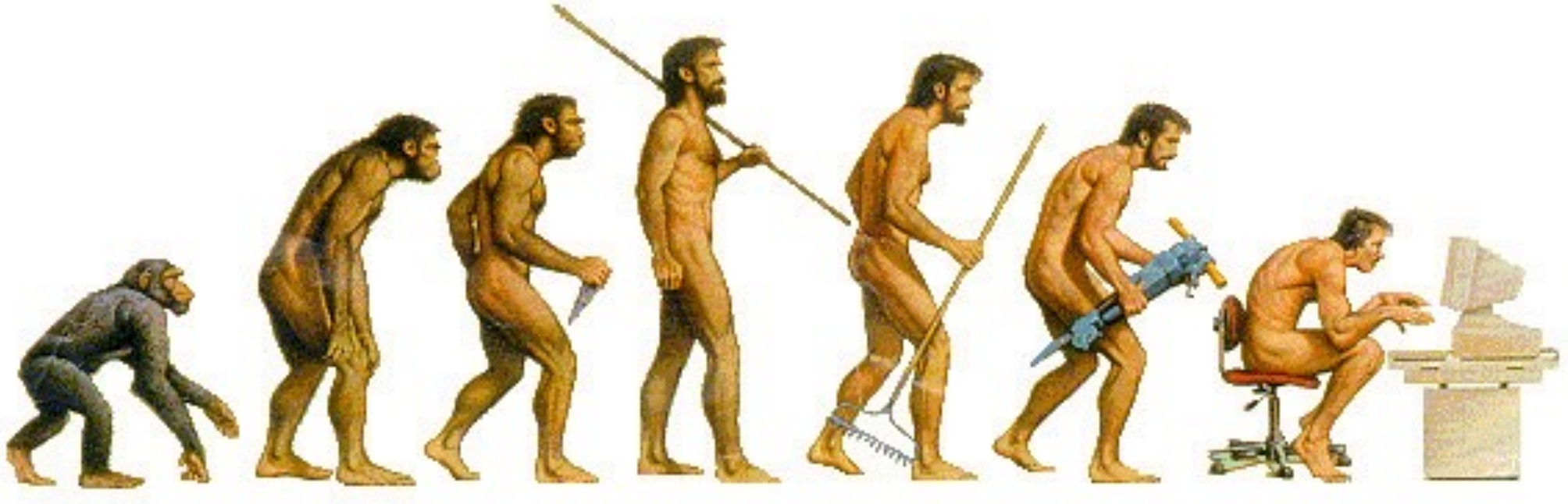

MBT
Swiss Physiological Footwear
Why MBTs keep moving

Introduction Science



For all people who want to stretch their spine smoothly

Masai **B**arefoot **T**echnology

Introduction Science

The effects of modern life can take their toll on the body. In fact, bone and joint disorders are the main reasons for long term pain and lifestyle restrictions. And, as our population ages, musculoskeletal disorders will increase considerably, which will see the cost of healthcare rise.

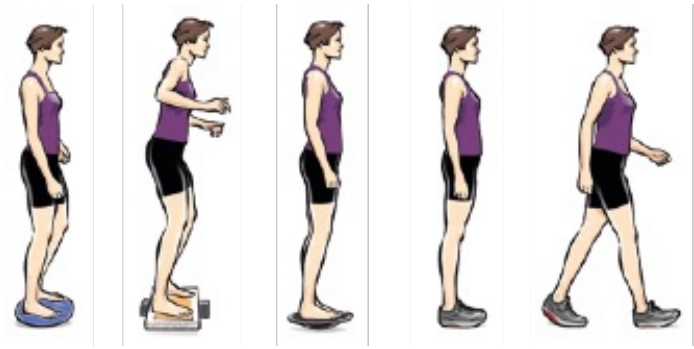
One of the reasons for this phenomenon is that we simply don't move enough. In fact, 60% of the world's population do not receive the recommended amount of activity to produce health benefits1. Our bodies are generally weaker than they should be and this can lead to physical problems, such as back pain and unnecessary stress on joints. This situation is not helped by the fact that when we do move, we do so on hard, flat surfaces, while wearing shoes that stabilize movement.

At MBT, we believed there had to be a way to break through the restrictions to body movement in modern life. So we developed a philosophy that could help increase everyone's activity level.

1. W.H.O Physical Inactivity: A Global Public Health Problem, <http://www.who.int/dietphysicalactivity/ factsheet_inactivity/en/> (accessed January 2011)

As we researched possibilities, we came upon a link between instability and movement. Instability was the code we needed. It gave us the biomechanical principle that we could apply to footwear design to help us enable people to add more movement into their life – at work, at home and throughout their day. In 1996, we introduced the world to an entirely new footwear category – physiological footwear – with our unique Masai Barefoot Technology (MBT) that can help increase movement and muscle activity through built-in instability while standing and walking.

The key to the function of MBTs is their curved sole construction. Its integrated balancing area requires an active and controlled rolling movement and can help improve balance and posture while standing and walking. Sinking into the sensor provides a comfortable heel strike and creates a natural instability that can help increase muscle activity.



The unique sole of MBTs incorporates built-in instability. This feature makes MBTs applicable as a training device for daily locomotion activities. MBTs become an integral part of the body's movement.

Science on your feet

Since its inception, MBT has valued the results of scientific research. The studies conducted with MBT footwear, including those summarized in this brochure, indicate that MBT footwear can help with certain health conditions. But there are still many areas to investigate and we shall continue to ensure the benefits our products are designed to offer are backed by sound scientific evidence and, at the same time, we will continue to collaborate with medical professionals and scientists to expand on and improve such benefits.

The MBT Academy is our central R&D facility, providing a forum for our ongoing dialog with international experts and researchers in the fields of biomechanics, clinical medicine and physiotherapy. In cooperation with numerous universities on an international basis the Academy is committed to the testing, verifying and optimizing the effects of MBT footwear on the human body.

MBT is very active in the medical and scientific communities which includes membership of the European College of Sports Science (ECSS), which is dedicated to the generation and dissemination of scientific knowledge concerning the motivation, attitudes, values, responses adaption performance and health of persons engaged in sport.

MBT contributes to the Christian Doppler Research Association (CDA) Wien, Austria.

This non-profit organization promotes development in the areas of natural science, technology and the economy. The Association enables talented scientists of renowned research centers to achieve high-quality research and knowledge sharing in line with the demands and to the advantage of the CDA member companies.

Since 1996 over 40 research projects have been undertaken with universities in Europe and North America and more than 20 different articles have been published in peer-reviewed journals about MBT footwear. Peer-reviewed studies are published and their claims approved by researchers in relevant fields, and are only recommended for publication if they meet certain expected standards of expertise.

Balance/Sensorimotor Training

The stability of human locomotion is vital for children as they learn to walk, for athletes to perform well and for the elderly to ensure mobility as long as possible. Balance disorders are common in general but widespread in the elderly population. In people under 65, falls occur once or more a year and this rate increases with age.

MBT's unstable sole can help to increase muscle activity and improve balance.

MBT footwear can be used as a sensorimotor training device. More specifically, MBT's unstable footwear can help transfer sensorimotor training into dynamic task-oriented movements and certain aspects of daily life. MBTs can also complement one's exercise program, but should not be used when participating in exercises requiring lateral or stop-and-go movement, such as running, tennis, basketball, and aerobics.

Balance/Sensorimotor training

In this study, subjects wore MBTs every day for eight weeks and were compared to a sensorimotor motor training group in order to identify the possible benefits of MBTs in sensorimotor training against conventional methods.

Functional testing of the MBT shoe compared to sensorimotor training (Korsten et al., 2008)

Institute for Sport and Sport Science, University of Freiburg, Germany

Authors: *Katrin Korsten, Guillaume Mornieux, Nils Walter, Albert Gollhofer*

Abstract

PURPOSE:

The effects of sensorimotor training (SMT) are well documented in the prevention and rehabilitation of injuries. The Masai Barefoot Technology
(MBT®) is used as a sensorimotor sports training and rehab device. Although both methods focus on comparable functions, a comparison of the effects was not investigated yet. The purpose of the study was the comparison of a MBT group, wearing the shoe for 4 h per day for 8 weeks, with the SMT group, practicing a training 3 x per week for 45 min
over 4 weeks with sensorimotor training-devices like wobbling boards; spinning tops and soft mats.

METHODS:

Parameters of postural stability, rate of force development and the maximum of isometric force were analysed by testing both groups at the beginning, as well as after 4 and 8 weeks.

RESULTS:

The results show a significant reduction of the sway path in anterior-posterior and medio-lateral direction on Posturomed® for SMT and MBT. After 4 weeks, the improvement of posturalbalance of the SMT group is considerable larger compared with the MBT group but daily wearing of MBT shoes for 4 h over 8 weeks improves postural stability as effectively as a 4-week sensorimotor training. The previously in literature described relationship between the improvement in postural balance and the rate of force development, reflecting the ability to generate high muscular strength in short time, was only shown for the SMT group. In the isolated parameters of dorsiflexion both groups show a significant improvement, whereas in plantarflexion only the MBT group improved.

CONCLUSION:

In conclusion, the results document that wearing MBT shoes lead to comparable functional adaptations as with SMT but the degree and the
dynamic of adaptation are less pronounced.

Balance/Sensorimotor training

This study featuring women over 50 years old investigates the effects of using MBTs on standing balance, reactive balance and stability limits.

Effects of an unstable shoe construction on balance in women aged over 50 years (Ramstrand et al., 2010)

Jönköping University, Sweden

Authors: *N. Ramstrand, A. H. Thuesen, D. Brandborg Nielsen, D. Rusaw*

Abstract

PURPOSE:

Shoes with an unstable sole construction are commonly used as a therapeutic tool by physiotherapists and are widely available from shoe and sporting goods retailers. The aim of this study was to investigate the effects of using an unstable shoe (Masai Barefoot Technology) on standing balance, reactive balance and stability limits.

METHODS:

Thirty-one subjects agreed to participate in the study and underwent balance tests on three different occasions. After test occasion one (baseline) 20 subjects received Masai Barefoot Technology shoes and were requested to wear them as much as possible for the remaining eight weeks of the study. Three specific balance tests were administered on each test occasion using a Pro Balance Master (NeuroCom International Inc., Oregon, USA). Tests included; a modified sensory organization test, reactive balance test and limits of stability test.

RESULTS:

Subjects in the intervention group significantly improved their performance on elements of all three tests however results on these variables were not demonstrated to be significantly better than the control group. No significant differences were observed across testing occasions in the control group.

CONCLUSION:

Results from the present study suggest that, for this group of individuals, use of unstable footwear may improve certain aspects of balance.

Posture

Sedentary lifestyles are more common now than ever before, and this is due in part to the fact that many people today sit while they work. This lack of movement can lead to weak back and stomach muscles and to muscle imbalances, which can result in a bad posture that can even lead to serious conditions like osteoarthritis. As a consequence of bad posture, the load to the spine increases and can result in sacro-iliac joint, neck and/or low back pain.

A more natural and upright posture can play a preventive role in avoiding back pain, shoulder neck tension and muscle tension of the back.

Rolling over the Balancing Area of the MBTs can help improve balance and posture while standing and walking.

Posture

Bad posture can lead to muscular and skeletal problems. But can MBT shoes help improve balance and be used for certain therapeutic applications? This study investigated the effect of wearing MBTs on posture during walking and standing.

The effects of Masai Barefoot Technology Footwear on Posture: An experimental designed study (New & Pearce, 2006)

School of Health Professions and Rehabilitation Sciences, University of Southampton, United Kingdom

Authors: *P.R. New, J.M. Pearce*

Abstract

PURPOSE:

Shoes with an unstable sole construction are commonly used as a therapeutic tool by physiotherapists and are widely available from shoe and sporting goods retailers. The aim of this study was to investigate the effects of using an unstable shoe (Masai Barefoot Technology) on standing balance, reactive balance and stability limits.

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CONCLUSION:

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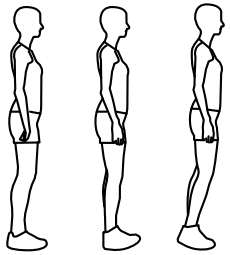
Tailored exercises

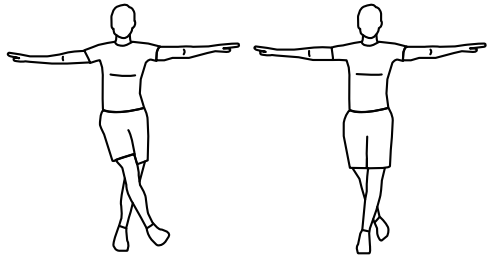
We have designed a suite of exercises for those who simply want to add more movement to theirday, as well as exercises tailored specically for therapy. You will find more exercises at mbt.com



Stabilizer muscle training

- Start position: Standing on Balancing Area
- Standing upright with both feet on the ground
- Practice rolling from heel to toe

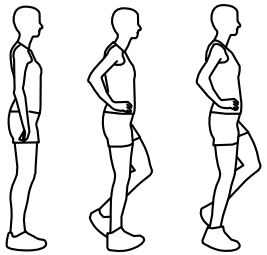
You should feel increased movement in the entire body



Cross balance

- Start position: Standing on balancing area
- Raise one leg and stabilize on Balancing Area with the other
- Cross the other leg in front and behind the supporting leg
- Repeat with other leg

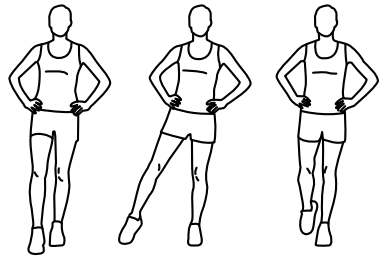
You should feel increased muscle activity in the leg and stabilizing hip muscles



Heel-toe balance training

- Start position: Standing on Balancing Area
- Stand upright on one leg
- Roll forward from heel to Balancing Area
- Repeat with other leg
- To vary this exercise, roll to the forefoot

You should feel increased muscle activity in the lower limb muscles



One leg stance

- Start position: Standing on Balancing Area
- Raise one leg and stabilize on Balancing Area with the other
- Move free leg forward, to the side and backwards
- Then move the free foot forwards and sideways
- Repeat with other leg

You should feel increased muscle activity in the leg and stabilizing hip muscles

Muscle activity

In modern life, many people experience a lack of physical activity in the workplace and in general. When we do move, we do so in environments that are very stable, with flat, hard surfaces and we wear footwear that stabilizes our movement. This combination can cause some of our muscles to weaken, which in turn can lead to problems with the musculoskeletal system.

MBT footwear can be used as a training device and creates instability that can help increase muscle activity.

Muscle activity

What are the effects of using MBT footwear on strengthening smaller muscles around the ankle joint? This six-week study involved three test groups who spent much of their workday on their feet. Findings showed MBTs can help increase muscle activity across the ankle joint.

Standing in an unstable shoe increases postural sway and muscle activity of selected smaller extrinsic foot muscles
(Landry et al., 2010)

BRI & Human Performance Laboratory, University of Calgary, Canada

Authors: *Scott C. Landry, Benno M. Nigg, Karelia E. Tecante*

Abstract

PURPOSE:

Inactivity or the under-utilization of lower limb muscles can lead to strength and functional deficits and potential injury. Traditional shoes with stability and support features can overprotect the foot and potentially contribute to the deterioration of the smaller extrinsic foot muscles.

METHODS:

Healthy subjects (n = 28) stood in an unstable MBT (Masai Barefoot Technology) shoe during their work day for a 6-week accommodation period. A two-way repeated measures ANOVA was used to determine:

A) if unstable shoe wear increased electromyographic (EMG) activity of selected extrinsic foot muscles and increased postural sway compared to standing barefoot and in a stable control shoe.

B) if postural sway and muscle activity across footwear conditions differed between a preand post-accommodation testing visit.

RESULTS:

Using an EMG circumferential linear array, it was shown that standing in the unstable shoe increased activity of the flexor digitorum longus, peroneal (PR) and anterior compartment (AC) muscles of the lower leg. No activity differences for the larger soleus (SOL) were identified between the stable and unstable shoe conditions. Postural sway was greater while standing in the unstable shoe compared to barefoot and the stable control shoe.

CONCLUSION:

These findings suggest that standing in the unstable MBT shoe effectively activates selected extrinsic foot muscles and could have implications for strengthening and conditioning these muscles. Postural sway while standing in the unstable MBT shoe also decreased over the 6-week accommodation period.

Muscle activity

In this study, 12 healthy subjects underwent 3D gait analysis when walking with regular shoes and with MBTs. While subjects walked more slowly and took shorter steps when wearing MBTs, increased muscular activity was recorded in several areas.

Changes in gait and EMG when walking with the Masai Barefoot Technique
(Romkes et al., 2006)

Laboratory for Gait Analysis Basel, Children's University Hospital Basel, Switzerland

Authors: *Jacqueline Romkes, Christian Rudmann, Reinald Brunner*

Abstract

PURPOSE:
The Masai Barefoot Technology is used as a treatment option within the field of physical therapy to treat leg, back or foot problems. No information, however, is available on how Masai Barefoot Technology changes gait or muscle activity.

METHODS:
Twelve healthy subjects underwent 3D gait analysis with simultaneously collecting surface electromyography data of the leg muscles when walking with regular shoes and with Masai Barefoot Technology-shoes. Before data collection, subjects were trained in Masai Barefoot Technology. A within-subjects study-design compared walking with regular shoes and Masai Barefoot Technology.

RESULTS:
With Masai Barefoot Technology, subjects walked slower with smaller steps. Movement pattern at the ankle showed major changes with increased dorsiflexion angle at initial contact followed by a continuous plantarflexion movement until terminal stance phase. With changed kinematics, alterations in the activity of tibialis anterior and gastrocnemius muscles could be observed. Smaller differences in movement and muscle activity were seen at knee and hip level.

CONCLUSION:
Masai Barefoot Technology has never been documented in detail concerning changes in movement pattern or muscle activity. This study showed that Masai Barefoot Technology changes movement patterns, especially at the ankle, and increases muscle activity. It may therefore be a useful training method for strengthening the muscle groups of the lower leg. Knee flexion and electromyographic characteristics around the knee joint are slightly increased and need to be considered in patients with knee problems. Our findings provide critical detailed information on changes compared to walking in regular shoes, but the clinical relevance of those changes remains to be determined.

Muscle activity

This study investigates the mechanical effects of MBTs in relation to kinematics, kinetics, muscle activity, soft tissue vibrations, and oxygen consumption compared to conventional control shoes.

Effect of an unstable shoe construction on lower extremity gait characteristics
(Nigg et al., 2006)

Human Performance Laboratory, University of Calgary, Canada

Authors: *Benno M. Nigg, Sabrina Hintzen, Reed Ferber*

Abstract

PURPOSE:

To compare kinematics, kinetics, and muscle activity during standing and walking for healthy subjects using an unstable test shoe (Masai Barefoot Technology, MBT) and a stable control shoe.

METHODS:

Eight subjects volunteered for this study. During quiet standing, center of pressure excursion and muscle activity were determined. During walking, lower extremity kinematics, kinetics, and muscle electromyographic (EMG) signals were determined. Data were collected for the two shoe conditions after a 2 week accommodation period. Statistics included repeated measures ANOVAs (a = 0.05) and post hoc tests where appropriate.

RESULTS:

During quiet standing, the center of pressure excursion was significantly and substantially greater in the unstable compared to the control shoe. The electromyographic intensity increased in the unstable test shoe for all tested muscles, but only significantly for the tibialis anterior. During locomotion, kinematics were similar in the two shoe conditions except for the initial plantar-dorsiflexion, which showed a significantly more dorsiflexed position during the first half of the stance in the unstable test shoe compared to the stable control shoe. The angular impulses did not show any significant differences between the two shoe conditions for all three joints but some trends towards a reduction for the knee and hip joints. There were no significant differences in electromyographic activities between the control and the unstable shoe. However, several muscles showed some trends.

CONCLUSION:

The unstable shoe produced changes and trends in kinematic, kinetic, and electromyographic characteristics that seemed to be advantageous for the locomotor system. Further studies should investigate muscle strength, dynamic stability, pain reduction for arthritic knees and injury prevention for high-performance athletes when using unstable shoes.

Back and neck

Chronic neck pain and non-specific low back pain (LBP) are widespread, worldwide conditions. Neck pain is a prevalent indicator for medical intervention and the number of people with chronic neck pain grows continuously. Indeed, in the case of LBP, it will affect 80% of people once in their life and its lifetime prevalence is anywhere between 60-80%. The socio-economic costs for health care systems are enormous, especially the indirect costs incurred through sick leave and early retirement, which are alarming.

The prevalence and incidence of LBP appears to be moderately increasing, with a greater increase in the functional consequences, particularly work disability. LBP will continue to prove a major concern for individuals and society.

The studies summarized in this section explore the effects of wearing MBT shoes on people suffering from both chronic neck pain and LBP.

The study summarized below compares the effect of three standardized 12-week health programs, one of which included the use of MBT footwear by subjects suffering from non-specific chronic recurrent neck pain.

Effects of selected preventive conceptions on functional health in persons with nonspecific chronic recurrent neck pain
(Henkel et al., 2009)

Institution for Physiotherapy, Friedrich-Schiller University of Jena, Germany

Authors: *J. Henkel, P. Bak, R. Otto, U. C. Smolenski*

Abstract

PURPOSE:

The number of people with chronic neck pain is growing continuously even though exact epidemiologic numbers and cost analyses for Germany do not yet exist. It has been extensively confirmed that chronic neck pain is caused by fear, agitation, anxiety and depression. The aim of this secondary preventive study was to clarify if three standardized 12-week health programs, back school, Nordic walking and Masai Barefoot Technology (MBT) shoes, show positive effects on functional health for people in the chronication phase of neck pain.

METHODS:

A clinical, randomized, prospective, interventional trial with a baseline design was established. A total of 85 participants (mean 50.7 ± 11.1) were randomized into 3 intervention groups: 27 (52.6 ± 11.6) were included in the back school, 28 (52.5 ± 11.3) participated in Nordic walking and 30 (47.4 ± 9.9) were assigned to MBT. Analyses were carried out from the assessments SF-36, EQ-5D, FFbH-R and NDI.

RESULTS:

Neck pain (NDI) and functional spine impairment (FFbH-R) were significantly alleviated in all groups. The results of health quality (SF-36) indicated that back school and Nordic walking performed better than MBT. Nordic walking had worse results in a state of health (EQ-5D).

CONCLUSION:

The study confirmed that continuous training in groups shows significant improvements in all three programs. The small numbers of participants allow no generalizations. Further studies must be carried out to clarify the situation because many other programs are on the market where the effectiveness is unexplained.

This single-blinded randomized controlled trial investigates the influence of sensory motor training (MBTs) on the iliosacral Standing Flexion Test (SFT). Results from the trial indicate treatment combining osteopathy and MBTs can help improve the long-term results for the SFT.

Sensory Motor Training for Active Completion of the osteopathic Treatment (Maetzler et al., 2007)

1) Dept. Physical Medicine & Rehabilitation, University Teaching Hospital Feldkirch, Austria

2) TORT Centre, Ninewells Hospital Medical School & Institute of Motion Analysis Research, University of Dundee, United Kingdom

Authors: *Marcel Maetzler (1,2), Thomas Bochdansky (1), Rami Aboud (2)*

Abstract

PURPOSE:

The purpose of this study was to investigate the influence of sensory motor training (realised by an unstable shoe construction) on the iliosacral Standing Flexion Test (SFT) in several investigation groups. In a pre-phase study, the functional improvement of the iliosacral suspension system in a patient group with low back pain treated by a combined osteopathic and sensory motor training approach was verified in comparison to controls.

METHODS:

A single-blinded randomised controlled trial was designed for two groups of subjects: a reference group comprising 41 subjects with no history of recent musculo-skeletal problems and a group of 46 diabetic patients with known mild to moderate polyneuropathy. Approximately half of each of the reference and control groups underwent a six week period of sensory-motor training with an unstable shoe construction. The remainder acted as controls. The SFT was carried out prior to treatment and after six weeks.

RESULTS:

The SFT results indicated that there was a positive effect of sensory motor training on iliosacral function. After a six week period of training, initially positive SFTs were negative in 50% of the reference intervention group and 62% of diabetic intervention cases. There were no SFT changes in either of the control groups.

CONCLUSION:

Sensory motor function is important in the treatment of the iliosacral suspension system. A combination of osteopathic treatment and sensory motor training with an unstable shoe construction seems to improve the long-term results for the SFT in over 30% of cases.

Knee and hip joint

Osteoarthritis is today's most common musculoskeletal disorder. It accounts for more disability among the elderly than any other disease. In people aged 55-74, osteoarthritis of the foot affects 40% of people, of the knee 10% and of the hip 3%. Prevalence increases with age and 40% of people over 70 suffer from osteoarthritis of the knee. Clinically, the disease is characterized by joint pain, limitation of movement and stiffness after immobility.

The financial burden due to osteoarthritis will significantly increase in the future. Similarly, obesity is increasing and is associated with the development and progression of osteoarthritis.

The studies summarized in this section investigated the effect of MBTs on the condition of the knee and hip joint.

Knee and hip joint

Obesity now presents an increasing problem for the Western world and induces or exacerbates many health issues. Two major risks for obese people are cardiovascular disease and joint arthritis, particularly of the knee. As ankle, knee and hip joints are often found to be more extended in obese people while walking, the study summarized below investigates whether MBTs can help improve obesity related gait and, in doing so, help reduce some associated joint loading in the lower extremities.

Effectiveness of the MBT shoe in terms of selected joint strain parameters in overweight persons while walking
(Buchecker et al., 2010)

Department of Sport Science and Kinesiology, University of Salzburg, Austria

Authors: *Michael Buchecker, Herbert Wagner, Jürgen Pfusterschmied, Thomas Stöggl, Erich Müller*

Abstract

PURPOSE:
The purpose of this study was to evaluate the effects of Masai Barefoot Technology (MBT) shoes on lower extremity joint loading in overweight males during level walking.

METHODS:
Therefore, lower extremity kinematics, kinetics, and muscle electromyographic signals of the vastus lateralis (VL), biceps femoris (BF), and gastrocnemius medialis (GM) were recorded in 10 overweight males at a self-chosen walking speed with MBT shoes and conventional shoes. Selected peak joint moments, maximal joint force loading rates, mean muscle intensities, and co-activation indices of the VL/BF, as well as of the VL/GM were analyzed and compared for the two shoe conditions using paired Student's t-tests (a50.05).

RESULTS:
Results showed that walking with MBT shoes reduced first peak knee adduction moments in overweight subjects. During midstance and terminal stance, increases in VL/GM co-activation, accompanied by increases in VL and GM (only terminal stance) intensities were found for the MBT situation. Kinetic variables analyzed to assess ankle and hip joint loading did not exhibit any statistical differences.

CONCLUSION:
These results suggest that using MBT shoes diminishes medial compartment loads at the knee without overloading hip or ankle joints in overweight males. However, the additional muscle loading should not be overlooked, and warrants further investigation.

Degenerative joint diseases such as osteoarthritis can cause considerable pain, impair mobility and affect stance and gait. The study summarized below investigated the potential of MBT footwear to be used as a therapeutic device to help reduce some pain for wearers with certain hip issues.

Effectiveness of a 10-week training intervention with the MBT in patients with hip disorders (Krauss et al., 2006)

University Hospital, Tuebingen, Department of Sports Medicine, Germany

Authors: *I. Krauss, A. Bendig, J. Mayer, D. Axmann, O. Müller, T. Horstmann*

Abstract

PURPOSE:

The aim of this study was to assess the effect of a 10-week training program with a novel training device on health-related quality of life for patients with osteoarthritis of the hip (OAH) or after total hip replacement.

METHODS:

One group (n=30) took part in a weekly exercise program and was also told to use the special training device at home. The other group (n=29) received no intervention. Before and after the training period, participants had to fill out the SF-36 Health Survey. Data were analyzed using descriptive statistics. The effect size of the intervention and a comparison to the German norm population was computed. Whereas the control group showed no differences in the ratings on the SF-36, the training group improved with regard to Vitality (ε=0.5), Bodily Pain (ε=0.4), and General Health (ε =0.4). In comparison to the German norm population, participants had lower score values in all physical ratings whereas there were almost no differences in Social Functioning, Emotional Well-Being, and Mental Health. After 10 weeks of training, the Vitality of the training group increased to levels higher than the German norm population (z=0.2).

RESULTS:

The results of the investigation show a clinically relevant improvement in health-related quality of life after a 10-week intervention with the novel training device.

CONCLUSION:

The study found no improvements with respect to strength, mobility, and walking speed; however, progress was achieved especially in the area of coordinative skills. In addition, health-related quality of life was enhanced markedly. When used purposefully, the MBT appears to be capable of supporting the therapy of patients with hip joint osteoarthritis or already implanted joint replacement.

This 12-week study investigated the effectiveness of MBTs in reducing knee joint pain in people suffering from osteoarthritis of the knee.

The effectiveness of the Masai Barefoot Technology (MBT) shoe in the reduction of pain in subjects with knee osteoarthritis
(Nigg et al., 2006)

Human Performance Laboratory/Sport Medicine Centre, Roger Jackson Centre for Health and Wellness Research, Faculty of Kinesiology, University of Calgary, Canada

Authors: *Benno M. Nigg, Carolyn Emery, Laurie Hiemstra*

Abstract

PURPOSE:
The purposes of this study were to assess A) the effectiveness of Masai Barefoot Technology (MBT) shoe in reducing knee pain in persons with knee osteoarthritis (OA) B) changes in balance, ankle and knee ROM, and ankle strength compared with a high-end walking shoe for 12 week.

METHODS:
The research design was a randomized controlled trial (123 subjects, knee OA). Subjects were randomized to a MBT (N = 57) or a control shoe (N = 66). A Western Ontario and McMaster Universities (WOMAC) OA index, BMI, balance, active ROM, and ankle torque were quantified at weeks 0, 3, 6, 9, and 12. Two-sample t-tests were done for between-group comparisons.

RESULTS:
There was no significant difference between groups in total pain score. A significant reduction over the 12-wk period was found for both shoe conditions (-42/500 or 25.6% MBT, -46.2 or 27.1% control). There was no significant group difference in pain during walking (t = -1.09, P = 0.28). Pain during walking was significantly reduced by 5.2/100 mm in the MBT and 9.7/100 mm in the control group. Total pain showed a significant reduction for the MBT -27.4/500 (-16.6%) and the control group j28.9/500 (-17.0%) between baseline and week 3. Between weeks 3 and 6, there was a significant reduction for the MBT group only (-27.2/500 or -20.0%). There was a significant increase in the static balance between baseline and 12 week in the MBT group only, although the difference between groups was not significant.

CONCLUSION:
The results indicate that special shoe interventions can reduce pain in subjects with moderate knee OA.

An increasing body of evidence suggests that how the knee is supported during walking has a great effect on the severity of joint pain in osteoarthritis. The study summarized below featured 19 healthy subjects and sought to determine if walking in MBT footwear results in a reduction of knee joint loading compared to regular, non-dynamic rolling action shoes.

Knee joint loading in walking in the MBT shoe (Blazek et al., 2008)

Stanford University, Biomotion Laboratory, Stanford California, USA

Authors: *Katherine Boyer, Katerina Blazek, Thomas Andriacchi*

Abstract

PURPOSE:

Osteoarthritis (OA) is a degenerative joint disease that is characterized by a thinning of the articular cartilage layer, osteophyte formation in the joint, stiffness, pain and decreased physical function. An increasing body of literature suggests that the mechanical environment of the knee during ambulation has a profound influence on the severity (Andriacchi et al., 2006), progression (Miyazaki et al., 2002) and treatment outcome (Prodromos et al., 1985) for osteoarthritis at the knee. Although we cannot directly measure the force within a healthy joint, the external joint moments, as calculated using an inverse dynamics approach, can be used as a surrogate measure of the joint force.

The magnitude of the load on the medial compartment of the tibia is determined by the external knee flexion and adduction moments. The MBT shoe with its unstable sole construction provides a different stimulus to the neuromotor system than a conventional shoe. Initial evidence indicates that this stimulus elicits changes in muscle activity of selected muscles, joint kinematics, and joint kinetics (Nigg et al., 2006b; Nigg et al., 2006a; Romkes et al., 2006) and thus may result in a decreased joint load. However, the reported changes in joint pain for a group OA patients was not different from a control shoe (Nigg et al., 2006a). It thus remains unclear if wearing the MBT shoe would be beneficial for a population with medial knee OA.

To determine if walking in the MBT shoe results in a reduction in the knee joint force or the joint force distribution compared to a casual shoe.

METHODS:

19 healthy volunteers were tested, all with no history of lower-limb injury or pain and who had never worn the MBT shoe before: 11 women (age: 28.9 +/- 7.3 years; BMI: 22.7 +/- 2.9) and 8 men (age: 32.6 +/- 7.5 years; BMI: 23.5 +/- 1.8). Informed consent was obtained from all subjects per Stanford University IRB guidelines. Each subject wore the shoe for a two week period prior to testing. Kinematic marker data and ground reaction forces (GRF) were collected at 120 Hz while each subject walked at a self-selected normal pace in the MBT and the subject's own casual shoe. Intersegmental joint forces and moments were calculated using inverse dynamics and a previously published link mode. Paired Student's t-tests were carried out to determine differences in the group response between the two shoe conditions.

Knee and hip joint

RESULTS:

Kinematics:

1) Slight, not significant increase of cadence with MBT
2) At heel-strike knee flexion increased ($p < 0.05$)
3) At heel strike dorsiflexion increased ($p < 0.05$)
4) At mid stance knee flexion increased ($p < 0.05$)
5) At mid stance dorsiflexion increased ($p < 0.05$)
6) At toe-off knee flexion increased ($p < 0.05$)
7) At toe-off ankle plantar flexion decreased (i.e. a more flexed ankle was maintained through out all of stance) ($p< 0.05$)
8) In the hip no statistical differences in the sagittal plane
9) The foot angle was greater in the sagittal plane (toe out angle).

Ground reaction forces:

1) The loading rate of the first peak was greater in the MBT shoe ($p < 0.05$)
2) No difference in the magnitude of the first vertical GRF peak
3) Second peak of the vertical GRF was lower in the MBT shoe
4) No significant differences in the medial lateral or anterior-posterio GRF peaks.

Kinetics:

1) The differences in the peak joint moment values were not the same for all walking speeds
2) At all walking speeds were significant differences in the peak hip extension, internal rotation moments, the peak ankle plantarflexion moments
3) No difference in the peak ankle dorsi-flexion moment ant any of the walking speeds.

OTHER RESULTS:

Decrease of knee flexion moment:

1) Decrease of no change in total knee force
2) No increase in antagonist muscle activities, lower quadriceps muscle force is needed for walking in the MBT
3) The knee adduction moment is correlated with the load distribution in the knee joint
4) Males are more likely to have a negative adaptation strategy to the shoe, based on a small population sample.
5) Subjects who increased their knee force were older, but not significantly, than those who showed a decrease ($p = 0.3$)
6) All subjects were normal weight, so it is not clear how overweight or obese subjects would respond to the shoes
7) All subjects were healthy, it is not clear how knee OA patients would respond to the shoes.

Summary:

The changes in joint kinematics for walking were small. Individual locomotion strategies for walking in the MBT shoe were identified. Three of the locomotion identified could be considered “neutral or positive” changes in terms of the medial knee joint loading. 12 of 19 subjects adopted these strategies. Three locomotion strategies identified could be considered “negative” in terms of the medial knee joint loading. 7 of 19 subjects adopted these strategies. The strategies identified were for a young healthy population. Different locomotion strategies and percentages of subjects adopting the “positive” or “negative” strategies might be expected for a pathological population.

Knee and hip joint

CONCLUSION:

The results of this study indicate that for some individuals the changes in joint kinematics, kinetics and GRF's when walking in the MBT shoe may result in a reduction in the forces of muscles crossing the knee joint and thus the knee joint load. The use of the MBT shoe as a training device to strengthen the lower leg stability muscles and intervention to reduce pain in walking may be beneficial for some medial knee OA patients. The results of this study also indicate that several different adaptation strategies exist for a healthy population, some positive and some negative in terms of the change in knee joint load.

Foot and ankle

Today’s shoes support, lead and stabilize the feet and ankles, which can lead to foot problems. Only 3% of newborns have foot deformities, but up to 80% of school age children suffer foot disorders.

In adults, painful feet and problems with ankle joints are common and conditions such as hallus valgus, flat feet, splay feet and plantar fasciitis.

If shoes stabilize the foot in such a way that the lower limb muscles around the ankle joint are neglected and the muscular stability of the ankle joint weakens, this can lead to functional deficits and potential injury.

The main objective in treating ankle instability is to strengthen surrounding muscles. This study investigates the potential for MBT footwear to be used as a therapeutic training device in cases of unstable ankle joints, compared to conventional therapy.

MBT as Therapeutic Shoe for Ankle Instabilities (Kaelin et al., 2008, 2009)

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Abstract

PURPOSE:

The top priority in the management of chronic ankle instability is the optimal strengthening of the muscles surrounding the ankle joint, initially in physiotherapy, then in daily training, so that the impaired function of the ligaments is dynamically compensated for, and the ankle joints can be functionally re-stabilised.

According to previous studies, MBT has a significant potential to train the muscles surrounding the ankle joint. Therefore, the present study aimed at investigating whether the use of MBT as a therapeutic training device in cases of chronic unstable ankle joints results in superior mid-term and long-term dynamic stability compared to conventional therapy.

METHODS:

30 subjects with diagnosed, chronic ankle instabilities were randomised in an active treatment group (therapy with MBT) and a control group (without MBT). The active treatment group received subsequently nine physiotherapy sessions – each lasting 30 minutes – in which MBT was used for the various exercises. Likewise, the control group received nine physiotherapy sessions – each of 30 minutes duration – during which all exercises were carried out in the traditional way on a soft surface, without MBT. Subsequently, the active treatment group had to wear MBT over a period of three months during daily living as frequently as possible. During the same period of time, the control group had to carry out the home training programme usually prescribed by the Praxisklinik Rennbahn every day. The two groups were biomechanically and functionally examined and quantified at the following times:

A) Immediately prior to the start of physiotherapy

B) Immediately after the end of the nine physiotherapeutic sessions and c) three months after the end of the physiotherapeutic intervention.

RESULTS:

The following biomechanical relevant parameters were measured:

1) The maximum strength during inversion/ eversion of the foot and the maximum strength during flexion/extension of the foot, using isokinetics.

2) The extent of the pronation and supination movement of the foot while walking barefoot on a soft, insecure surface (2-D kinematics).

3) The fluctuations of the centre of force in the one-legged stance, barefoot on a hard surface using a pressure measuring system (FootScan, ellipse area covering 50% of measuring points and other parameters).

4) Maximum pressure coefficient (medial/lateral) under the rearfoot and forefoot, respectively, while walking on a hard surface.

The results showed that immediately before and immediately after the physiotherapeutic intervention no significant differences between the active treatment group and the control group were measured. However, three months after the end of the physiotherapeutic intervention the active treatment group showed a significantly higher maximum strength both in the pronators (peroneal muscles) and in the calf muscles (triceps surae). Accordingly, a significantly smaller supination movement in the first half of ground contact and a significantly higher medio-lateral pressure coefficient (higher medial pressure), both under the heel and under the forefoot, were found. The pronation movements were reduced in both groups at the end of the entire study period.

CONCLUSION:

Thus, three independent measurements showed that the use of MBT over a period of three months after the end of the physiotherapeutic intervention resulted in a functionally superior stabilization of the ankle joints compared to conventional therapy. Thus MBT can be easily integrated into the physiotherapeutic management of chronic unstable ankle joints without any negative effects, although a professional introduction into the use of MBT is essential. However, the impressive benefits of wearing MBT only become apparent in the phase after the physiotherapy. At that stage, patients have the opportunity to daily wear the MBT over several hours. In this way, a maximal efficient and by far better training can be carried out compared to conventional home training programs.

The following study investigates pressure distribution in the feet of diabetic patients following sensorimotor training. Subjects were divided into three groups and electromyography of the lower leg muscles and in-shoe foot pressure were recorded simultaneously.

Abstract

PURPOSE:

The purpose of this study was to investigate changes in pressure distribution after sensorimotor training and the changes in muscle timing in normal subjects and diabetic patients. A portable four channel electromyographic system (Noraxon) has been synchronized in real time with the PEDAR® in-shoe pressure measurement system. Until now, peak pressures under the diabetic foot have generally been investigated via the application of orthopaedic insoles. To date nobody has published objective information of sensorimotor training in relationship to foot pressure distribution for the diabetic foot.

METHODS:

Three groups of subjects have been studied, a normal reference group (n=23), a randomly assigned diabetic intervention group (n=24), and a diabetic control group (n=20), by recording electromyography of the lower leg muscles and in-shoe foot pressure measurements simultaneously.

RESULTS:

After a period of 6 weeks of daily training with an unstable shoe construction (USC) peak pressure under metatarsal heads 1, 2/3, and big toe were lower but higher for metatarsal heads 4/5 in group 1. Group 2 showed a reduction in peak pressure and the pressure-time integral under the first metatarsal head and a tendential increase in peak pressure in the midfoot. Group 3 did not show any significant changes in peak pressure but a delayed peak muscle activity for the anterior tibialis muscle.

CONCLUSION:

Sensorimotor function is an important parameter in the study of foot pressure distribution under the normal and the diabetic foot which can be trained to reduce foot loading by 16%, especially in the most endangered region of the diabetic foot, the medial forefoot.

Well-being

With stress, strain, pressure and bad ergonomic environments overwhelmingly present in the workplace today, the impact on general wellbeing is considerable. Coupled with increasingly sedentary lifestyle habits these factors can decrease quality of life in general.

MBT footwear can help activate muscles and improve posture, which may contribute to improved well-being.

Well-being

In this randomized controlled trial, quality of life and effects on well-being are measured in people who spend much of their workday standing. Results of the trial indicated MBTs can have a beneficial effect on people whose work means they spend much of their time standing. The results highlight the opportunity for further and larger studies in this area and show the potential of wearing MBTs at the workplace.

Masai Barefoot Technology in an operational setting. A randomised controlled effect trial to measure quality of life and well being effects due to wearing MBT-shoes in standing activities (Bauer & Brand, 2009)

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Abstract

PURPOSE:

In view of the fact that previous studies demonstrated the clinical benefits of wearing MBT footwear (New and Pearce, 2006), the present trial investigated the extent to which the MBT shoes made available to the participating enterprise had the capacity to promote workers' sense of well-being and quality of life. This issue is taking on increasing importance against the backdrop of the aforementioned growing mental strain to which workers are subject at the workplace.

METHODS:

This randomised controlled trial designed study concerns the usage of MBT shoes in an operational setting. The shoes are provided by the selected company (S&B Systemtechnik in D-70736 Fellbach; see also Chapter 2.1) and worn as part of operational health management of staff during working hours (predominantly standing jobs). The effectiveness of the MBT shoe as a means of increasing the quality of life and general wellbeing of staff in an operational setting is examined.

RESULTS:

The results after the 7-week intervention are consistently positive. Significant intervention effects were found for 7 out of 12 examined items. The study thus demonstrates the effectiveness of the MBT shoe in increasing the quality of life and general wellbeing of staff (with predominantly standing jobs) in the operational setting.

This (psychological) effectiveness, in association with the medicinal-training knowledge already gained (cf. New & Pearce, 2006), suggests the possibility of having the MBT shoe inspected in Germany as a refundable "Participation programme for insured persons" (DRV, Form G100) and/or "Programme for participating in working life" (DRV, Appendix G130).

Well-being

CONCLUSION:

Hence the present study clearly shows that wearing MBT shoes in an corporate setting has beneficial health effects. Although significant results were not obtained for all of the measured parameters, a clear picture emerges in every domain without exception namely that MBT shoes are an extremely suitable instrument when it comes to improving employees' quality of life and sense of well being in an corporate setting. However, further larger scale studies are needed in order to substantiate the effects that were observed in the present trial.

MBT
Swiss Physiological Footwear

THANK YOU