Biomechanical analysis of the MBT shoe
Functional differences between MBT and conventional shoes during walking

Praxisklinik Rennbahn AG, Basel, Switzerland

Xaver Kälin, Bernhard Segesser, Luc Hauss

Dezember 2002

Publication: Kälin, X; Segesser B: Unterschiede im Bewegungsverhalten beim Gehen mit MBT (High) gegenüber dem Gehen mit Strassenschuhen. GOTS-Kongress München 2003 und Orthopädieschuhtechnik, Ausgabe 12/ 2004.

MBT Model: High

ABSTRACT

INTRODUCTION: The MBT (Masai Barefoot Technology) is designed to promote healthier posture and walking by fostering the type of barefoot walking practiced by the Masai.

According to the MBT product brochure, this effect is achieved via a shoe whose design is radically different from that of classic shoes. MBT are made using an extremely soft sole and without a supporting element, so as to afford the foot minimal stability, thus forcing the user to exert more muscular effort to stabilise himself. A relatively hard and robust material is used in the metatarsal region, and the fiberglass and plastic plate in the forefoot exhibits a relatively high degree of flexion stiffness.

In keeping with the view of the company, MBT, that all MBT users should receive appropriate training before wearing the shoes, all MBT purchasers are trained (free of charge) to change the way they walk, as follows: to shorten the distance between the heel strike and the body's center of gravity; to realise a rolling movement on the outside of the foot; to take shorter steps; and to walk more softly by reducing the amount of vertical movement of the body's center of gravity.

The company says that this approach has been successful and that product users report that back problems, Achilles tendon problems and so on have improved as a result of wearing MBT shoes.

PUPOSE: The main goal of the present study was to document the changes in (a) movement pattern and (b) loading on the locomotor system brought about by wearing the MBT, relative to normal walking using conventional shoes.

The secondary goal of the study was to document the effect of training on our subjects movements pattern.

METHODS: 15 subjects who had no prior experience with the MBT were recruited for the study. Each subject was required, on each designated measurement day, to step with their right foot three times on a force platform and pressure measurement system in accordance with various predefined shoe related scenarios (see below). These tests involved measurement of plantar pressure distribution while the subject's foot was in contact with the floor, as well as ankle motion from the side and back. Further statistical analyses were realised on the basis of one of the three aforementioned tests.

In the interest of determining the main differences between MBT and conventional shoes, as well as the effect of training on movement pattern when MBT shoes are worn, the subjects were tested under the following shoe related conditions on three separate days:

Measurement day 1 (baseline): conventional shoes; MBT shoes without introduction; MBT shoes after introduction

Measurement day 2 (one week after): conventional shoes; MBT (MBT gait test realised on the previous day)

Measurement day 3 (six weeks after): conventional shoes; MBT (MBT gait test realised on the previous day)

RESULTS: The comparison of walking movements using conventional versus MBT shoes revealed that the MBT shoes change the following three gait parameters:

1. Maximum load in the heel and metatarsal regions:

The maximum load under the sole of the foot decreased by an average of 15 percent, while the load on the metatarsal region increased (asynchronously relative to the load on the sole of the foot) by approximately 400-500 percent. This phenomenon correlated completely with the sensations reported by each proband, including in cases where these values were measured under the sole of the shoe and were not 100 percent congruent with the measurement values obtained when an insole measurement device was used. It is therefore safe to assume that the MBT can provide substantial decompression relief for users who experience problems at the heel. However, the MBT may lead to pressure discomfort for users whose metatarsal region is sensitive, particularly in the longitudinal arch of the foot. These characteristics of the MBT are chiefly attributable to the construction of the shoe, and have little or nothing to do with the user training that is provided for the shoes.

2. Torque and movement excursion in the upper ankle joint

The pressure distribution under the sole of the MBT induces an extreme pressure shift amounting to some 40-50 mm in the initial load application point. This in turn substantially reduces the amount of torque in the upper ankle joint, thus in turn greatly reducing plantar flexion in the foot (initial flexion). In addition, the metatarsal "roll" tilts the foot relatively quickly into a pushing-off position, which requires less dorsal extension in the upper ankle joint. All of this translates into lesser movement excursions in the upper ankle joint for MBT users than for users of conventional shoes. This in turn means that the MBT is suitable for use by individuals with movement excursion problems in the upper ankle joint. These characteristics of the MBT are likewise chiefly attributable to the construction of the shoe, and have little or nothing to do with the user training that is provided for the shoes.

3. Torque and movement excursion in the lower ankle joint

Use of the MBT results in localisation of the load application point, during the deceleration phase, farther from the lower ankle joint axis, thus generating higher pronation torque and subjecting the supinators to greater strain. By preactivating the supinators in the prescribed manner, the subjects were able to increase supination prior to making contact with the floor, thus ensuring that the pronation position

returned to normal following the deceleration phase. This in turn can occasion either supinator training or supinator overloading. Further studies are needed in order to determine which of these effects occurs over the long term. However, one thing is certain: If MBT users are not taught exactly how to use the shoes, these users will inevitably experience massively elevated pronation, which will in all likelihood provoke classic pronation symptoms in the knees, Achilles tendon and elsewhere.