

Hoffmann L., Schwirtz A., Neubert A., Pfaff G.  
ADIDAS shoe center  
Institut Sport und Sportwissenschaft, Universität Freiburg

## ***2. Anterior knee pain and its correlation to the plantar pressure distribution***

### ***2.1 Objective:***

In running we often see overuse of the knee like chondropathia patellae or jumpers knee. The aim of this study is to find out, if there are any regularities between those troubles and the plantar pressure distribution.

### ***2.2 Methods:***

From 1996 to 1998 nearly 80 persons with anterior knee pain have been examined for their plantar pressure distribution by means of the footscan® pro system (footscan® pro mat, size 0.5 x 1.0m, 8196 sensors, this means 4 sensors/cm<sup>2</sup>, the mat is integrated in a track (12m long)). A static and dynamic measurement have been registered. For the static measurement the subject stands on the mat. For the dynamic measurements, the subjects have to perform several runs along the track hitting the mat with one try has been analysed for both feet.

For science purpose, 15 of these persons have been analysed statistically for the following reasons: these 15 persons have all realized a heel strike, they reached ground contact times of about 300 ms and they were all athletes.

For data collection and for data analysis, the scientific software (footscan® scientific 4.21) has been used. For analysing the foot structure, the system offers the possibility of point sources' pressure curves. In this study we used 2 point forces for metatarsal head 1 and 5 analysing the static pressure distribution and 5 point sources (size: 2 sensors) for the five metatarsal heads (M1-M5) analysing the dynamic pressure distribution. These point sources can be randomly positioned. The positioning has been done for all subjects by the same person. Further the lateral and medial deviation of the centre of pressure (COP) of the foot axis (axis defined by centre of heel and second toe) during the roll-off-movement have been determined.

### **2.3 Results:**

Concerning the static measurements, the pressure under metatarsal head 1 and 5 (M1-M5) are compared. It could be observed that the lateral pressure under M5 is higher than the medial under M1. Concerning the dynamic measurement, the pressure under the forefoot shows the following distribution: M1 : 27%, M2 : 22%, M3 : 20%, M4 : 16% and M5 : 15% on an average (n=15). That means that the medial foot (M1+M2) carries only 49% of the pressure while the lateral side of the foot (M3-M5) carries 51%. The maximal lateral deviation of the centre of pressure (COP) amounts on an average to 10% of the width of the foot and is reached after 25% of ground contact, the maximal medial amounts to 20% and is reached at the end of ground contact (after 91%).

### **2.4 Discussion:**

In the static as well as in the dynamic measurements high pressure on the lateral foot was observed. The authors consider this high pressure on the lateral foot as an origin of anterior knee pain. Instead the physiological force transfer (medial forefoot - talus - tibia), this lateral pressure causes an unphysiological impulse through the lateral forefoot and calcaneus, with a continued rotation of the knee and a certain change of the angle of the patellar tendon.

