THE EFFECT OF DIFFERENT FOOTWEAR ON THE MYOELECTRIC ACTIVITY OF M. TIBIALIS POSTERIOR DURING TREADMILL RUNNING

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INTRODUCTION: Overload running injuries of the lower extremity, particularly the knee, are associated with excessive pronation of the foot resulting in tibial rotation (Nigg et al., 1995). M. tibialis posterior (TP) is shown to have an active influence on pronation and the medial longitudinal arch (Kaye & Jahss, 1991). Its functional role during running and interaction with footwear is still not clearly understood (Reber et al., 1993; O'Connor & Hamill, 2004). Therefore the purpose of this study is to investigate the influence of different footwear on the muscle's EMG pattern.

METHOD: 12 volunteers were tested while walking (1.6m/s) and rearfoot running (3.0m/s) on a treadmill (video controlled; 250Hz). Intramuscular EMG of the TP and surface EMG of Mm. peroneus longus, tibialis anterior, soleus, gastrocnemius medialis and lateralis was recorded (Noraxon, 1500Hz) under four different conditions: barefoot (BARE), minimal shoe (FREE), conventional running shoe (CRS) and unstable shoe (MBT). For data analysis the EMG-signals were filtered (20Hz high pass), rectified, smoothed and amplitude normalized to barefoot maximum. To quantify the myoelectric activity of the muscles the integral (IEMG) of the processed signal was calculated for stance phase and a preinnervation time of 150ms.

RESULTS: For the first 7 analysed subjects in all shoe/barefoot conditions EMG-activity of TP showed greatest mean and IEMG values between 50-70% (walking) and 35-50% (running) of stance. In the MBT condition the IEMG of TP was statistically higher than in the BARE condition. The linear envelope of the TP EMG-signals over preinnervation and stance phase are similar to that of the other detected plantar flexors.

DISCUSSION: TP EMG-activity peaks in the same phase of running where maximum eversion of the rearfoot is reported (Nigg, 1986). This confirms the theory that TP tends to counteract the pronation. The elevated midsole of the unstable shoe attended with a greater lever arm for the horizontal forces acting upon the subtalar joint may result in higher external ankle moments in the frontal plane. It could be hypothesised that in this unstable situation higher TP EMG-activity may be needed to compensate higher ankle moments.

CONCLUSION: This study shows that footwear design has an influence on TP EMG-activity during treadmill running. Ongoing analysis of IEMG in different phases of stance and its relation to foot kinematics in the frontal plane should lead to a better understanding of the role of TP and its interaction with its antagonists in walking and running.

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