INFLUENCES OF SPECIAL FOOTORTHOSES ON EMG AND PLANTAR PRESSURE ON PATIENTS WITH LOW BACK PAIN

Thomas Stief (1), Felix Poetzschner (1), Heiko Wagner (2), Klaus Peikenkamp (1)

1. Biomechanics Research Laboratory, University of Applied Sciences Münster, Germany
2. Department of Motion Science, WWU Münster, Germany

Introduction

Bourdiol developed an insole concept with so called Neuromuscular Operating Elements (NME). By influencing the plantar foot sensibility with NME, reflexes should activate so called muscle chain reactions and as a result of that, malposition of the whole locomotors system should be treated. New footorthoses(FO)-concepts use the NME. But they are controversially discussed, cause of the missing scientific background. In contrast to these FO, classical ones like Custom Moulded FO (CMFO) focus on lower limb problems [Collins et al]. Their effects are quiet validated [Murley et al]. So the aim of this study was to test the influences of CMFO with NME (Figure 1; total left) on muscle activation and plantar pressure distribution.

Methods

12 individuals (6 m, 6 f; 36.7±3.1yr) with Low Back Pain participated in this study. During the measurements, subjects walked on a treadmill with (mFO) or without (oFO) the CMFO (OPCT Tonic01; SIDAS) with NME (PostEva SH 50; SIDAS). SEMG (Biovision; 2 kHz) was used to obtain the activations of 24 lower limb and trunk muscles at the delivery day of the FO. An internal synchronized insole system (GeBioM; 0.2 kHz) was used to detect plantar pressure data. 40 continuing double steps were separated, time-normalized to 100 $\%_{gait\ cycle}$ and compacted to 101 data points. Paired t-Test was used to compare EMG-data at each percentage of the gait cycle. Significant changes ($p<.05$) were considered as relevant, if they are, a: in the period of activation and b: in a continuous timeframe > 10 $\%_{gait\ cycle}$. Plantar pressure parameters were statistically analyzed by paired t-Test ($p<.05$). Correlations between changes in EMG and changes in plantar pressure distribution were checked by Pearson coefficient ($p<.05$).

Results

M. glutaeus max. (glma) and Mm. multifidii lumb. (mulu) can be influenced relevantly (Figure 1; centre left). The glma activity decreases in a window of 10-25 $\%_{gait\ cycle}$ by 32 %. In the range of 84-100 $\%_{gait\ cycle}$ the mulu activation decreases by 6 %.

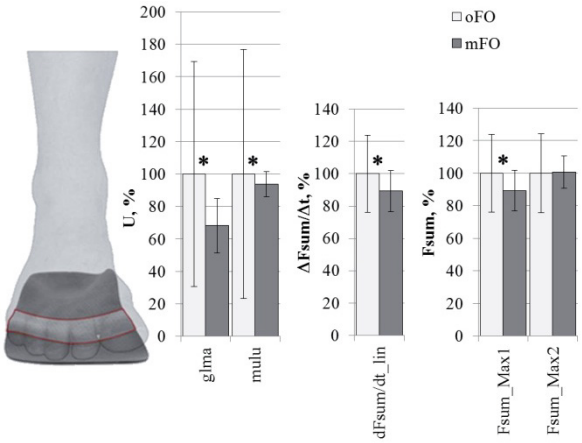

Figure 1: AP view on a CMFO with NME (total left); changes in EMG (centre left), the slope of the linear range (centre right: dFsum/dt_lin) and the maxima (total right: Fsum_Max1 and Fsum_Max2) of the sum force

The dFsum/dt_lin (Figure 1; centre right) decreases by 15 % ($p=.03$) and Fsum_Max1 (Figure 1; total right) decreases by 12 % ($p=.002$) while using the CMFO with NME. Pearson coefficient does not show any correlation between muscle activation and plantar pressure distribution.

Discussion

There are influences on muscle activation due to the used FO but muscle chain reactions cannot be confirmed, because the activation of the extensors doesn't increase like it is postulated (decrease at the mulu and glma). The effects on plantar pressure parameters are not really typically for CMFO with NME, like the decreased dFsum/dt_lin and Fsum_Max1. Identic effects are found in studies to classical FO [Murley et al]. For orthopaedic practice we can give following recommendations. The effects of the CMFO with NME should be checked individually with SEMG. Plantar pressure measurements allow no inferences to muscle activation, because there are no correlations between muscle activation and plantar pressure.

References

1. Collins et al, Foot Ankle Int, 28, 2007.
2. Murley et al, Clin. Biomech, 25, 2010.