Custom-Moulded Footorthoses (CMFO) with Neuromuscular Operating Elements (NME) have positive long-term effects for patients with Low Back Pain (LBP)

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SUMMARY

CMFO with NME are used in practice, but their effects are yet not evaluated. Therefore we were interested in long-term effects on muscular activation and pain sensation. Our results allow a deeper understanding and have influence on the individual treatment for an increased patient's benefit.

INTRODUCTION

Bourdiol developed a FO by which the human posture should be changed positively. By influencing the plantar foot sensibility with NME on flat insoles, reflexes activate so called muscle chain reactions. These elements are used in different, new FO-concepts to treat malposition of the whole locomotor system.

Classical FO, like CMFO, focus on orthopedic problems of the lower limb (1) (2). Several scientific studies validated the effects of those FO (3). But there is less proof of long-term effects (4). NME are still controversially discussed due to the missing scientific background. Research topics of a majority of studies were the influences during upright standing.

This study analyzes the effects of CMFO with NME (figure, bottom right) on both EMG activity during gait and on subjective parameters like pain sensation. So the aims of our study were to test the long-term effects of these FOs on muscle activation and to check if there is a subjective benefit for patients with LBP.

METHODS

12 individuals (6 m, 6 w; 36.7±3.1yr) with LBP participated in this longitudinal trial. The used CMFO were OPCT Tonic01 (SIDAS) and the NME PostEva; SH50 (SIDAS). Myoelectric signals of 24 muscles at the lower limb and trunk were recorded with SEMG (Biovision; 2 kHz) at the delivery date of the FO and after 8 weeks of intervention. Subjects walked on a treadmill at their favored speed.

After EMG preparation 40 continuing double steps were separated, time normalized to 100 $\%_{gait\ cycle}$ and compacted to 101 data points. Paired t-Test was used to control data at each percentage of the gait cycle. Significant changes ($p<.05$) are considered as relevant, if they are within the period of activation and last for a continuous timeframe of more than 10 $\%_{gait\ cycle}$.

Subjective parameters, like pain sensation were detected by visual analog scales and statistically analyzed by paired t-Test ($p<.05$). Pearson coefficient ($p<.05$) was used to check correlations between changes in EMG and pain sensation.

RESULTS

Subsequent only significant and relevant results are presented.

After 8 weeks of intervention with the FO the muscles of the Extension Chain (EC) can be influenced (figure, top left). The electric activation of the GM decreases by 33 % during 25-47 $\%_{gait\ cycle}$. EMG of the GMA increases in the range of 29-43 $\%_{gait\ cycle}$ by 11 %. GME is reduced by 41 % in a window of 6-18 $\%_{gait\ cycle}$ within the time of using CMFO with NME and the activation of the ML increases by 52 % during 54-71 $\%_{gait\ cycle}$.

Two muscles of the Flexion Chain (FC) show significant changes (figure, top left). The activation of the TA increases in the windows of 0-9 $\%_{gait\ cycle}$ and 93-100 $\%_{gait\ cycle}$ (interpreted as one closed area over 16 data points) by 38 %. During 81-93 $\%_{gait\ cycle}$ the EMG of the BF increases by 18 %.

And as an example for the subjective parameters, the pain sensation could be decreased from 3.5 to 1.9 (figure, center left).

Furthermore Pearson correlation shows a medium, negative correlation ($r = -0,611$) between the changes

in increased muscle activation of ML and decreased pain sensation (figure, top right).

CONCLUSIONS

Based on the contrary effects at the EC and the FC, our results do not confirm that the theory of the chain reactions is adequate to explain the effects of the CMFO with NME.

However, there is proof that the used FO influences muscle activation. At the GMA and ML we observe an increase of muscle activity during gait after an 8 week period. That can be interpreted as a mechanism for better stabilization in the lumbar region (5). Several studies had shown that LBP correlates with a pathological activity of the ML (6).

The pain sensation can be reduced significantly and that correlates with the increased ML activation. This is a strong benefit for patients with LBP (6). So we can deduce that the CMFO with NME have positive long-term effects for patients with LBP.

In practice the influences of CMFO with NME should be controlled after a few weeks and these FO have to be used for more than 2 months to get relevant effects with benefit for patients with LBP.

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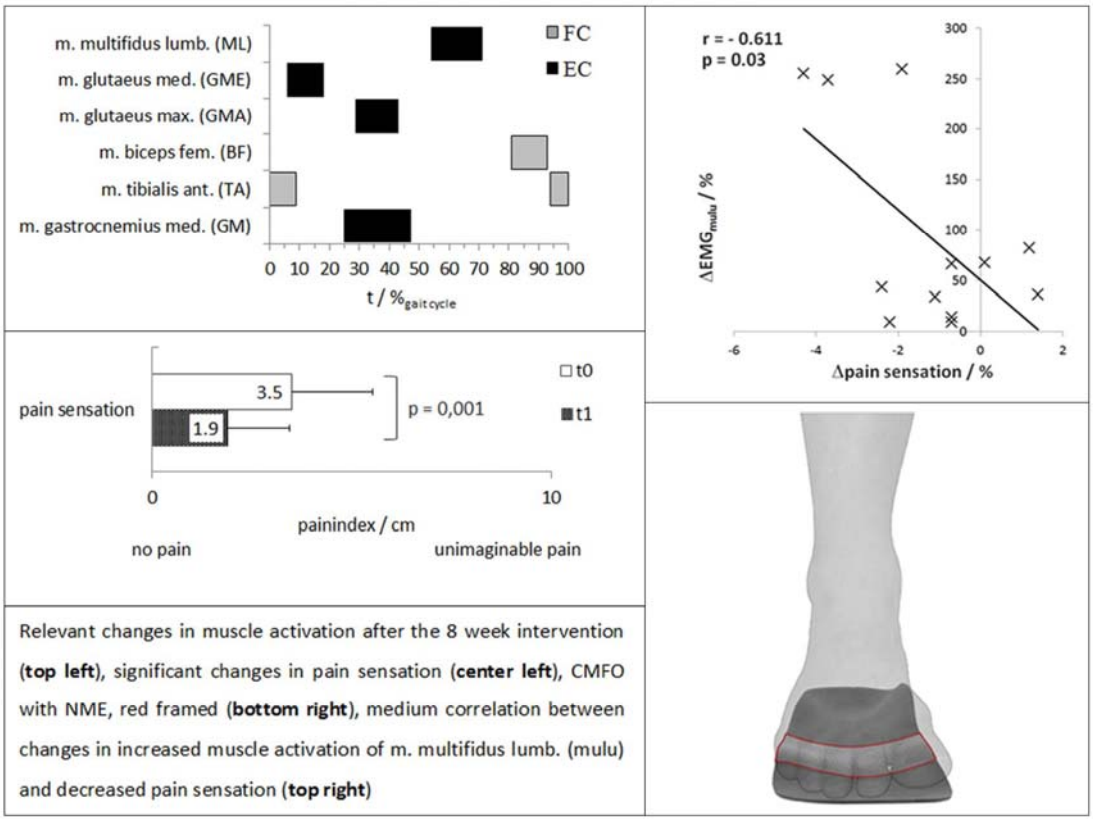

Relevant changes in muscle activation after the 8 week intervention (**top left**), significant changes in pain sensation (**center left**), CMFO with NME, red framed (**bottom right**), medium correlation between changes in increased muscle activation of m. multifidus lumb. (mulu) and decreased pain sensation (**top right**)