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Suggested citation referring to the original publication:
Journal of Foot and Ankle Research 1 (2008) O14
DOI <https://doi.org/10.1186/1757-1146-1-S1-O14>
ISSN (online) 1757-1146

Postprint archived at the Institutional Repository of the Potsdam University in:
Postprints der Universität Potsdam
Humanwissenschaftliche Reihe ; 624
ISSN 1866-8364
<http://nbn-resolving.de/urn:nbn:de:kobv:517-opus4-435525>
DOI <https://doi.org/10.25932/publishup-43552>

Oral presentation

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Therapeutic efficiency and biomechanical effects of sport insoles in female runners

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from 1st Congress of the International Foot & Ankle Biomechanics (i-FAB) community
Bologna, Italy. 4–6 September 2008

Published: 26 September 2008

Journal of Foot and Ankle Research 2008, **1**(Suppl 1):O14 doi:10.1186/1757-1146-1-S1-O14

This abstract is available from: <http://www.jfootankleres.com/content/1/S1/O14>

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Introduction

Orthopaedic insoles are used in sports medicine practice to treat overuse injuries although clinical evidence is still lacking. There are only few randomized controlled trials with male cohorts available [1]. Moreover, biomechanical effects of insoles remain unclear. Besides mechanical effects ("alignment of the skeleton"), sensorimotor effects are discussed suggesting an influence on neuromuscular control mechanisms by altering afferent input [2]. The purpose was therefore twofold: 1. To analyze the clinical efficiency of an insole intervention in female runners with overuse complaints, 2. To assess possible neuromuscular adaptation mechanisms by wearing insoles.

Methods

48 female runners with running related overuse symptoms were randomly assigned to a control group (CO: age 35 ± 10 years, height: $1,66 \pm 0,04$ m, weight: 56 ± 5 kg, training km per week: 41 ± 25 km) and an insole therapy group (IN: age: 39 ± 10 years, height: $1,66 \pm 0,06$ m, weight: 58 ± 8 kg, training km per week: 37 ± 17 km). IN received an individually accustomed insole out of special polyurethane foam (molded, longitudinal arch support, bowl-shaped heel). All insoles were accustomed by the same orthopaedic technician. CO continued their regular training regimen without therapy, while IN used the insole for every run for 8 weeks. Both groups were analyzed on a treadmill at $12 \text{ km} \cdot \text{h}^{-1}$ pre and post intervention. Surface EMG of the lower leg muscles (M. tibialis anterior, M. peroneus longus, M. gastrocnemius medialis)

was measured while subjects ran (in random order) barefoot with a reference shoe and with the individually accustomed insoles. Mean amplitude quantities (normalized to barefoot running condition) in preactivation, weight acceptance and push-off phase were extracted from EMG [3]. Functional disabilities resulting from running related injury symptoms were examined using the Pain-Disability-Index (PDI). Pain Experience Scale (SES) was used to assess current pain rating [1]. The main outcome measure (PDI sum score) was analyzed by repeated measures ANOVA ($\alpha = 0.05$). SES values as well as EMG quantities were descriptively evaluated.

Results

PDI sum score decreased in IN (-40%) compared to CO (+3%) after 8 weeks ($p < 0.001$, $Rsq = 0.81$). SES values showed a decrease in subjective pain rating in IN mainly in the first two weeks of therapy. Descriptive analysis of EMG amplitudes showed no changes in M. tibialis anterior and M. gastrocnemius medialis activity. M. peroneus longus amplitudes in preactivation phase showed an increase of about 30% after intervention in IN compared to CO.

Conclusion

Orthopedic insoles molded out of polyurethane foam with longitudinal arch supports and bowl-shaped heels are able to reduce functional disabilities resulting from running related overuse injury symptoms. Therefore insoles can be used as an efficient non-surgical treatment

option in female runners. Altered preactivation of the M. peroneus longus after therapy may result in optimized joint stability. This could possibly underline the concept of sensorimotor effects of orthopaedic insoles in sports.

Acknowledgements

This study was supported by the Federal Institute of Sports Science, Germany (VF 0407/01/49/2003–2005). Insoles were supplied by IETEC Orthopädische Einlagen GmbH & Produktions KG, Künzell, Germany.

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