

# THE EFFECTS OF LUMBOSACRAL ORTHOSES ON SPINE STABILITY: WHAT CHANGES IN EMG CAN BE EXPECTED?

Jacek Cholewicki

Biomechanics Research Laboratory, Department of Orthopaedics and Rehabilitation and Department of Biomedical Engineering,  
Yale University School of Medicine, P.O. Box 208071, New Haven, CT 06520-8071, USA

Published in *Journal of Orthopaedic Research* 22 (2004) 1150–1155

Antagonistic trunk muscle activity is normally required to stabilize the spine. A lumbosacral orthosis (LSO) might reduce the need for this antagonistic activity by providing passive stiffness to the trunk and increasing spine stability. The maximum reduction in trunk muscle EMG and in the resultant spine compression force due to the LSO was estimated using a biomechanical model. The lumbar spine stability was first quantified for the average trunk muscle EMG recorded from 11 male subjects performing various isometric trunk exertion tasks. Subsequently, the spine-stiffening effects of the LSO were implemented in the model and trunk muscle forces were reduced iteratively until the original level of spine stability without the LSO was achieved. The upper bound estimates of the reduction in trunk muscle EMG due to LSO ranged from 0.6% to 14.1% of the maximum voluntary activation depending on the task and the muscle. The resultant spine compression force averaged across all tasks decreased by only 355 N. A much larger variance of the experimental data precluded the detection of these effects at statistically significant levels. However, the small effects size does not necessarily exclude the possibility of functional benefits of slightly reducing muscle activity in patients with low back pain.

## SELECTED QUOTATIONS

### Introduction

“A certain amount of trunk antagonistic muscle co-contraction is necessary to provide structural stiffness to the lumbar spine and to maintain its stability [13, 14, 16]. ...A small amount of additional trunk stiffness provided by the LSO [QuikDraw™ by Aspen Medical Products, 6481 Oak Canyon, Irvine, CA 92618] significantly increases stability of the spine [7,10] and could in effect reduce the overall demand on antagonistic muscle co-contraction.” (Pg. 1151)

### Results

“...The smallest effect was seen in the internal oblique muscles (decrease of 1.7% MVA). On average, the overall muscle EMG was predicted to diminish by 3.8% MVA due to the trunk stiffening effects of LSO.” (Pg. 1152) In conclusion, this study reports significant results of the clinical and functional benefits to wearing a tissue belt as a complementary treatment of subacute low back pain with a significant decrease of medication consumption.” (Pg. 220)

### Discussion

“...A small reduction in trunk muscle activity afforded by the LSO may be even more functionally significant in the population of patients suffering from low back pain. These patients exhibit an increased muscle co-contraction during their activities of daily living presumably to enhance the stability of their lumbar spines [31]...the LSO may provide significant symptomatic relief to some low back pain patients by reducing the necessary static trunk muscle co-contraction and preventing muscle fatigue and pain from compounding the existing causes of the pain. (Pg. 1154)