

# ABSTRACTS

OF THE 7<sup>TH</sup> INTERNATIONAL

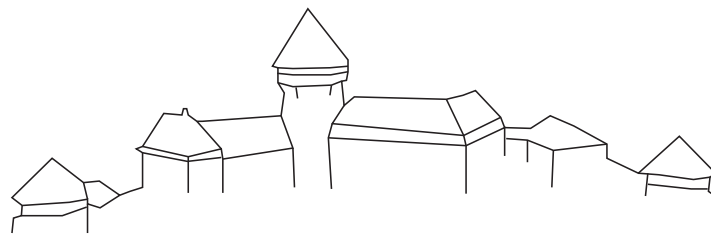
# POSTURE SYMPOSIUM

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SMOLENICE CASTLE  
SLOVAKIA  
SEPTEMBER 6 - 9, 2015

INSTITUTE OF NORMAL AND PATHOLOGICAL PHYSIOLOGY  
SLOVAK ACADEMY OF SCIENCES

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Smolenice Castle, Slovak Republic, September 6-9, 2015

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Editors: František Hlavačka  
Jana Lobotková

Reviewers: Diana Bzdúšková  
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Peter Valkovič

Publisher: Institute of Normal and Pathological Physiology  
Slovak Academy of Sciences  
Sienkiewiczova 1, 81371 Bratislava

**ISBN 978 – 80 – 971699 – 2 – 3**

Printed in Slovakia

## **ORGANIZED BY**

Institute of Normal and Pathological Physiology  
Slovak Academy of Sciences  
Bratislava, Slovakia

Faculty of Physical Education and Sports  
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Bratislava, Slovakia

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# FUNCTIONAL AND LATERAL REACH PERFORMANCE AND STANDING BALANCE DURING SENSORY CONFLICT

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## Introduction

Sensory information from different modalities should be adequately integrated for optimal standing balance. Otherwise a sensory conflict occurs which interferes with stance. Data on balance during a dynamic task in case of sensory conflict are scarce. Functional reach (FR) [1, 2] is proven to be a reliable method for falls risk assessment among elderly people. However, its modification – lateral reach (LR) [3] is less studied. Therefore we chose FR and LR as dynamic tasks to explore the influence of sensory conflict on standing balance.

## Methods

Fifteen healthy right-handed volunteers (aged  $28.47 \pm 3.94$  years, six females) performed FR and LR in four sensory conditions: eyes-open (EO), eyes-closed (EC – absence of visual information), head-extended with eyes open or closed (HE-EO or HE-EC). The last two series add conflict of vestibular origin. Subjects were instructed to reach forward, left and right as far as they could without knee flexion or foot lifting. After holding in the farthest position for 3 seconds, an instruction for going back was given. Reach was measured in mm with a ruler fixed on a wall, the third metacarpal bone was used as a marker. Center-of-pressure (COP) sway was recorded by a pedobarographic platform Tekscan. Each recording lasted 30 s. The evaluated measures were: maximal reach, COP sway path, medio-lateral (M-L) for FR and anterior-posterior (A-P) COP sway for LR. They were further evaluated for FR by two-way ANOVA with factors: vision and head position. Statistical evaluation of the measures for LR was done by three-way ANOVA with reach direction as a third factor.

## Results

During sensory conflict FR significantly shortened, especially in the case where visual and vestibular modalities were affected (HE-EC). In the FR series head extension significantly increased COP sway path but only when visual information was absent. Both COP sway path and M-L sway increased during absence of vision, no matter what the head position was. In the LR series three-way ANOVA revealed statistical significance for factors vision and head position but not for reach direction for all measures. Left and right reach significantly shortened during sensory conflict, while COP sway path and A-P sway increased. This again was most expressed when both modalities were affected. For the three tests (FR and reach to the right or left) the time spent for reach completion was about 10 s, which consists 1/3 of the recording. A tendency of overshoot when going to initial position after task completion was found for all three tests. The error was significant (verified by t-test against zero).

## Conclusions

The results of our study suggest that dynamic balance and task performance are vision- and vestibular-dependent and they deteriorate in the presence of sensory conflict affecting these modalities. Both functional and lateral reach test in the sensory conflict context can serve as their sensibilized variants for early risk of fall detection and prevention.

**Keywords:** *dynamic balance, center of pressure, posture and movement, sensory integration*

**Acknowledgements:** The study was funded by Grant TK 02/60 with the National Science Fund, Ministry of Education and Science, Republic of Bulgaria, <http://cleverstance.com/>.

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posture control changes trial signal human force action gait stance task experiment impairment person body sway amplitude muscle level condition perturbation pattern step walking model subject index vestibular vision galvanic initiation centre of foot pressure anterior posterior direction sport magnitude analysis coordinate hypothesis activation electromyography anticipatory adjustments age input balance patient somatosensory decrease brain information Parkinson disease performance reflex group study participation result instruction role improvement tremor accelerometry comparison displacement variable movement interval position surface record mode reaction pressure delay onset response central nervous system knowledge elderly leg investigation research support purpose theory joint effect kinematics measurement segment cortex swing phase eyes protocol relation platform correlation significance clinic eyes frequency parameter disturbance tilt motion stimulus velocity trunk investigation physiology contraction angle torque limb feedback peak component spectrum reduction oscillation stride prediction procedure foot contact vibration forward dynamic unstable limit of stability biofeedback reweighting supranuclear palsy backward

ISBN 978-80-971699-2-3



9 788097 169923

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