DEEP AND SUPERFICIAL TRUNK MUSCLE ACTIVATION DURING WHEELCHAIR PROPULSION

Anna Bjerkefors[1], Mark G Carpenter[2], Andrew G Cresswell[3], Alf Thorstensson[1]

[1]Department of Neuroscience, Karolinska Institutet and The Swedish School of Sport and Health Sciences (GIH), Stockholm, Sweden
[2]School of Human Kinetics, University of British Columbia, Vancouver, Canada
[3]School of Human Movement Studies, University of Queensland, Brisbane, Australia

KEY WORDS: electromyography, trunk muscles, spinal cord injury, wheelchair propulsion.

INTRODUCTION: Efficient manual wheelchair propulsion is essential for persons with spinal cord injury (SCI), in their activities of daily life as well as for their participation in physical training and sports. The aim of this study in progress is to investigate the coordination of upper body muscles during wheelchair propulsion in persons with SCI at different spinal levels. Particular attention will be paid to the ability of persons with thoracic SCI, clinically classified as "complete", to activate and coordinate their abdominal muscles.

METHOD: Pilot data from two healthy habitually active men, one with a thoracic SCI, clinically classified as complete at T3 level, and one matched able-bodied person performing wheelchair propulsion on a treadmill. Electromyography was recorded unilaterally from 4 abdominal muscles using indwelling fine-wire electrodes, inserted under ultra-sound supervision, and from 5 superficial upper body muscles with surface electrodes.

RESULTS: The person with SCI was able to activate all trunk muscles during wheelchair propulsion, even those of the abdominal wall. While abdominal and back muscles showed enhanced activation with increasing speed in both subjects, the pattern of muscle responses differed. The person with SCI appeared to use a less specific coordination pattern of the trunk muscles during propulsion, with prolonged activation of the deep abdominal muscles, compared to a more distinct intermittent pattern during the push and recovery phase in the able-bodied person.

DISCUSSION: The preliminary data from this work in progress showed that the trunk muscles, including the deep abdominal muscles, are important in wheelchair propulsion (cf. Yang et al., 2006). Evidently, the SCI was not "complete", since trunk muscles could be activated. Further analysis will reveal more details about the seemingly specific coordination pattern in relation to the upper body movements, which were recorded in simultaneously.

CONCLUSION: Documenting an ability of persons with thoracic SCI to activate trunk muscles as well as their coordination with other upper body muscles has important implications for classification of impairments with SCI as well as for designing individually adapted and thus more efficient training programs for improving general proficiency, but also preparing athletes for competition in wheelchair events.

REFERENCES:

Yang et al. (2006). Surface electromyography of trunk muscles during wheelchair propulsion. *Clinical Biomechanics*, 21, 1032-41.

Acknowledgement

The authors are grateful to the Swedish Centre for Sport Research and The Swedish School of Sport and Health Sciences (GIH) for financial support. Special thanks are due to the participants in the study.