

by

**Steffan Wittrup Christensen**

Neck pain is a large problem in the general population and there is a need for a better understanding of the underlying mechanisms behind clinical findings, such as increased pain sensitivity and reorganized muscle activity. One of the areas that has been proposed as a potential contributing factor to neck pain is the shoulder girdle, due to its close anatomical link to the cervical spine.

The current work explored the relationship between neck pain, pain sensitivity and axioscapular motor control, during acute and ongoing neck pain. To examine the effect of acute neck pain in healthy participants, experimental neck pain was induced by injecting hypertonic saline into the splenius capitis muscle, either unilaterally (Study I) or bilaterally (Study II). To investigate the effect of ongoing neck pain, two patient populations, insidious onset of neck pain (IONP) and whiplash associated disorder (WAD), were recruited (Study III). In all three studies, pressure pain thresholds (PPT) were used to determine pain sensitivity while electromyography recordings from both axioscapular and trunk muscles, during a standardized arm movement, was used to examine muscle activity.

In healthy participants it was shown that bilateral (II) but not unilateral pain (I) caused increased PPT in distant areas, which contrasts findings from study III. For both IONP and WAD, widespread decreased PPTs were observed when compared to healthy controls (III). Furthermore, this got progressively worse with repeated series of arm movements, although only significantly for the IONP group, while the opposite, reduced pain sensitivity, was observed for healthy controls (III). In addition, a clear link between acute neck pain and reorganized axioscapular muscles activity during arm movements was observed (I-II), where reduced activity of the ipsilateral upper trapezius muscle was a persisting finding. Moreover, for the first time, a link has been made between neck pain and altered trunk muscle activity, where bilateral neck pain caused bilateral increased muscle activity for the erector spinae muscles (II). For clinical neck pain, an increased activity was observed for the serratus anterior muscle in the WAD group as rest periods between movement series was reduced, indicating it might be a fatigue response (III).

In summary, the current work has shown that a relationship between neck pain, pain sensitivity, and axioscapular and trunk muscle activity exists, which may have great clinical importance as it underlines the importance of including both the shoulder girdle and trunk muscles when assessing and treating people suffering from neck pain.

**Ph.D. lecture**

by

**Steffan Wittrup Christensen**

**Monday 21 August 2017**



**DEPARTMENT OF HEALTH SCIENCE AND TECHNOLOGY**  
AALBORG UNIVERSITY

This thesis is based on Steffan Wittrup Christensen's research work at:



**SMI**  
**Department of Health Science and Technology**  
**Aalborg University**  
**Denmark**

To fulfill the requirements for the Ph.D. degree, Steffan Wittrup Christensen has submitted the thesis: Neck pain – Sensory and motor effects during shoulder movements, to the Faculty Council of Medicine at Aalborg University.

The Faculty Council has appointed the following adjudication committee to evaluate the thesis and the associated lecture:

**Associate Professor Birgit Juul-Kristensen  
University of Southern Denmark  
Denmark**

**Professor André Gabriel Danneels Lieven  
Ghent University  
Belgium**

**Chairman:  
Associate Professor Erika G. Spaich  
Aalborg University  
Denmark**

**Moderator:  
Professor Thomas Graven-Nielsen  
Aalborg University  
Denmark**

The Ph.D. lecture is public and will take place on:

**Monday 21 August 2017 at 13:00  
Aalborg University – Room D2-106  
Fredrik Bajers Vej 7 D2  
9220 Aalborg East**

## **Program for Ph.D. lecture on**

**Monday 21 August 2017**

**by**

**Steffan Wittrup Christensen**

Neck pain – Sensory and motor effects during shoulder movements

Chairman: Associate Professor Erika G. Spaich

Moderator: Professor Thomas Graven-Nielsen

13.00 Opening by the Moderator

13.05 PhD lecture by Steffan Wittrup Christensen

13.50 Break

14.00 Questions and comments from the Committee  
Questions and comments from the audience at the  
Moderator's discretion

16.00 (No later than)  
Conclusion of the session by the Moderator

After the session a reception will be arranged