# Experimental and clinical neck pain: effects on dynamic cervical joint motion and pressure pain sensitivity

by

Ning Qu

Neck pain is a global health issue. It significantly affects the life quality of patients and consequently causes a dramatic economic burden to society. Neck pain is a multifactorial disease influenced by many biological, psychological and psychosocial factors. Nevertheless, many researchers propose that neck pain should have a local pathoanatomical basis. However, a large portion of neck pain is classified as non-specific, since the source of neck pain is rarely identified. The assessment of dynamic cervical joint motion is supposed to reveal more impairments of neck pain at the individual cervical joint levels when compared with motion assessments on static and end-range radiographs. In addition, pressure pain sensitivity is widely investigated in patients with neck pain and applied to subgroup patients with neck pain. These two parameters also show potential diagnostic values of reflecting the sources of neck pain. Additionally, persistent motor and sensory changes may lead to the recurrence of neck pain. However, dynamic cervical joint motion patterns and pressure pain sensitivity of patients with recurrent neck pain remains unstudied. The thesis aimed to investigate the effects of pain originating from different cervical structures on dynamic cervical joint motion and pressure pain thresholds (PPTs) and to investigate dynamic cervical joint motion patterns and PPTs in patients with recurrent neck pain. Experimental deep and superficial cervical muscle pain were applied in study I and experimental inter-spinous ligament pain was applied in study II. Patients with recurrent neck pain and matched healthy controls were recruited in study III. Video-fluoroscopy was used to record cervical flexion and extension movements. Dynamic cervical joint motion parameters were extracted, which included pro-directional motion, anti-directional motion, joint motion variability, and total joint motion. PPTs were measured over bilateral C2/C3 and C5/C6 facet joints (study I-III) and the right tibialis anterior (TA) (Study III) by a pressure algometer. Results of study I showed that: 1) deep cervical muscle pain redistributed anti-directional motion between C3/C4 and C6/C7 during cervical extension while superficial cervical muscle pain decreased the overall anti-directional motion, pro-directional motion, and joint motion variability during cervical extension; 2) deep cervical muscle pain increased PPTs over bilateral C2/C3 and left C5/C6 facet joints and superficial cervical muscle pain increased PPTs over bilateral C2/C3 and C5/C6 facet joints. Results of study II showed that: 1) inter-spinous ligament pain redistributed anti-directional motion and joint motion variability between C2/C3 and C4/C5 during cervical extension; 2) inter-spinous ligament pain increased PPTs over the left C2/C3 facet joints. Results of study III showed that: 1) patients with recurrent neck pain decreased anti-directional motion at C2/C3 and C3/C4 and increased anti-directional motion at C5/C6 and C6/C7 during cervical extension and increased the overall anti-directional motion during cervical flexion; 2) no differences in PPTs over bilateral C2/C3 and C5/C6 facet joints and the right TA were found between patients with recurrent neck pain and healthy controls.

In conclusion, different effects on anti-directional motion were demonstrated when pain originated in the deep cervical muscle, superficial cervical muscle, and inter-spinous ligament. Patients with recurrent neck pain showed altered anti-directional motion patterns compared with healthy controls. However, experimental cervical muscle and ligament pain decreased the pressure pain sensitivity over different cervical facet joints and patients with recurrent neck pain showed no localized and widespread hyperalgesia. The findings in the thesis indicated that the anti-directional motion was the most sensitive to experimental and clinical neck pain and investigations of anti-directional motion may contribute to the diagnosis of neck pain when attempting to identify the pain sources.

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**PhD lecture**

**By**

**Ning Qu**

**Tuesday 07 January 2020**

DEPARTMENT OF HEALTH SCIENCE AND TECHNOLOGY
AALBORG UNIVERSITY

This thesis is based on
Ning Qu ´s research work at:

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

To fulfill the requirements for the PhD degree, Ning Qu has submitted the thesis: Experimental and clinical neck pain: effects on dynamic cervical joint motion and pressure pain sensitivity, 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 Barbara Cagnie**
**Ghent University**
**Belgium**

**Professor Alice Kongsted**
**University of Southern Denmark**
**Denmark**

**Chairman:**
**Professor Michael Voigt**
**Aalborg University**
**Denmark**

**Moderator:**
**Associate Professor Rogerio Pessoto Hirata**
**Aalborg University**
**Denmark**

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

**Tuesday 07 January 2020 at 13:00**
**Aalborg University – Room D2-106**
**Fredrik Bajers Vej 7 D2**
**9220 Aalborg East**

## Program for PhD lecture on

## Tuesday 07 January 2020

## by

## Ning Qu

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| Chairman: | Professor Michael Voigt |
| Moderator: | Associate Professor Rogerio Pessoto Hirata |
| 13.00 | Opening by the Moderator |
| 13.05 | PhD lecture by Ning Qu |
| 13.50 | Break |
| 14.00 | Questions and comments from the Committee<br>Questions and comments from the audience at the Moderator's discretion |
| 16.00 | Conclusion of the session by the Moderator |

**After the session a reception will be arranged**