

LIST OF PUBLICATIONS

- I Äng B and Harms-Ringdahl K. **Neck Pain and Related Disability in Helicopter Pilots: A Survey of Prevalence and Risk Factors.** *Aviation, Space, and Environmental Medicine* 2006;77:713-9.
- II Äng B, Linder J and Harms-Ringdahl K. **Neck Strength and Myoelectric Fatigue in Fighter and Helicopter Pilots with a History of Neck Pain.** *Aviation, Space, and Environmental Medicine* 2005;76:375-80.
- III Äng B. **Impaired Neck Motor Function and Pronounced Pain-Related Fear in Helicopter Pilots with Neck Pain – A Clinical Approach.** *Journal of Electromyography and Kinesiology* 2007;doi:10.1016/j.jelekin.2007.01.002.
- IV Äng B, Monnier A and Harms-Ringdahl K. **Neck/Shoulder Exercise for Neck Pain in Air Force Helicopter Pilots – A Randomized Controlled Trial.** *Submitted for publication.*

Further analyses have been added.

Paper I reprinted with kind permission from the Aerospace Medical Association, Alexandria, USA.

© 2005, by Aerospace Medical Association, Alexandria, VA

Paper II reprinted with kind permission from the Aerospace Medical Association, Alexandria, USA.

© 2006, by Aerospace Medical Association, Alexandria, VA

Paper III reprinted with kind permission from Elsevier, Oxford, England

© 2007, by Elsevier Ltd., Oxford, England

CONTENTS

1	INTRODUCTION.....	1
1.1	Perspectives and theoretical framework.....	1
1.2	Definitions of neck pain.....	3
2	BACKGROUND.....	4
2.1	Neck pain in the general population.....	4
2.2	Neck pain in air force pilots.....	5
2.3	Exposure during flight.....	6
2.3.1	Head-worn equipment.....	7
2.4	Anatomy and kinematics of the cervical neck.....	8
2.5	Measures.....	9
2.5.1	Electromyography.....	9
2.5.2	Neck muscle strength.....	10
2.5.3	Neck active range of motion.....	11
2.5.4	Active craniocervical flexion.....	11
2.5.5	Fear-avoidance beliefs about physical activity.....	12
2.6	Preventive exercise for neck pain.....	13
2.7	Rationale for the thesis.....	13
3	OVERALL AIM.....	15
3.1	Specific aims.....	15
4	METHOD.....	16
4.1	Design and ethical considerations.....	16
4.2	Study samples.....	16
4.3	Operational definition of neck pain.....	17
4.4	Instruments.....	18
4.4.1	ICF classification.....	18
4.4.2	Neck muscle strength.....	19
4.4.3	Electromyographic setup and instrumentation.....	19
4.4.4	Biofeedback unit for active craniocervical flexion.....	20
4.4.5	Cervical measuring system for active range of motion.....	20
4.4.6	Questionnaires.....	20
4.5	Neck/shoulder exercise intervention for neck pain.....	21
4.6	Experimental procedures.....	23
4.6.1	Neck muscle strength.....	23
4.6.2	Electromyographic sampling during sustained neck muscle contractions.....	23
4.6.3	Electromyographic sampling during active craniocervical flexion.....	23
4.6.4	Neck active range of motion.....	23
4.6.5	Electromyographic data analysis.....	24
4.7	Statistics.....	24
5	RESULTS.....	26
5.1	Paper I.....	26
5.1.1	Prevalence.....	26
5.1.2	Risk indicators.....	26

5.2	Paper II	27
5.2.1	Neck muscle strength	27
5.2.2	Electromyography frequency spectral variables in sitting	27
5.3	Paper III	28
5.3.1	Electromyographic frequency spectral variables in supine	28
5.3.2	Electromyographic activity during active craniocervical flexion	28
5.3.3	Neck active range of motion	29
5.3.4	Fear-avoidance beliefs about physical activity	30
5.4	Paper IV	31
5.4.1	Adaptational electromyographic activity	31
5.4.2	Adaptational fear-avoidance beliefs about physical activity	31
5.4.3	Effect of exercise intervention on number of neck pain cases	32
6	DISCUSSION	33
6.1	Findings	33
6.1.1	<i>On risk factors</i>	33
6.1.2	<i>Neck motor function</i>	34
6.1.3	<i>Exercise intervention</i>	36
6.2	Methodological considerations	37
6.2.1	External validity	37
6.2.2	Internal validity and precision	37
6.3	General discussion	40
6.3.1	Future research	41
6.3.2	Clinical implications	41
7	CONCLUSIONS	42
8	Acknowledgements	43
9	References	45