LIST OF PUBLICATIONS

This thesis is based on the following publications, which will be referred to in the text by their Roman numerals I-V. Certain new analyses and results are also added. Contents of published material were reprinted with kind permission from the respective copyright holders.

Study I Elfving B, Németh G, Arvidsson I, Lamontagne M.
Reliability of EMG spectral parameters in repeated measurements of back muscle fatigue.

Study II Elfving B, Németh G, Arvidsson I.
Back muscle fatigue in healthy men and women studied by electromyography spectral parameters and subjective ratings.

Study III Elfving B, Liljequist D, Mattsson E, Németh G.
Influence of interelectrode distance and force level on the spectral parameters of the electromyographic signal recorded from the lumbar muscles.

Study IV Elfving B, Liljequist D, Dedering Å, Németh G.
Recovery of electromyograph median frequency after back muscle fatigue analysed using an exponential time dependence model.

Study V Elfving B, Dedering Å, Németh G.
Lumbar muscle fatigue and recovery in patients with long-term low-back trouble.
Submitted for publication.
CONTENTS

ABBREVIATIONS

1 INTRODUCTION

2 LITERATURE REVIEW
   2.1 Low-back pain
   2.2 Pain and health-related factors
   2.3 Muscular, strength, endurance and fatigue
   2.4 Recovery from muscle fatigue
   2.5 Muscle fiber composition
   2.6 Surface electromyography
      2.6.1 Recording the EMG signal
      2.6.2 Analysis of EMG signals
      2.6.3 Frequency (Fourier) analysis
      2.6.4 EMG signal during fatigue and recovery
      2.6.5 Other factors influencing the EMG signal
      2.6.6 Previous fatigue studies on back muscles using EMG
   2.7 Reliability
   2.8 Validity

3 AIMS

4 METHODS
   4.1 Study samples
      4.1.1 Healthy subjects
      4.1.2 Patients with long-term low-back pain
   4.2 Instruments
      4.2.1 Back extension device
      4.2.2 Surface EMG
      4.2.3 Borg CR-10 scale
      4.2.4 Questionnaires
   4.3 Experimental design
   4.4 Data analysis of EMG fatigue and recover
      4.4.1 Fatigue phase
      4.4.2 Recovery phase
   4.5 Statistical methods
   4.6 ICF classification
5 RESULTS

5.1 Reliability

5.2 Influence of interelectrode distance and force level

5.3 Validity

5.3.1 Patient characteristics

5.3.1.1 Low-back pain

5.3.1.2 Health-related factors

5.3.2 Differences patients – healthy subjects

5.3.2.1 Maximal voluntary contraction

5.3.2.2 EMG initial median frequency

5.3.2.3 EMG slope

5.3.2.4 EMG recovery half-time

5.3.2.5 Discrimination between patients and healthy subjects

5.3.2.6 EMG fatigue and recovery versus health-related factors in patients

5.4 Correlations

6 DISCUSSION

6.1 Subjects

6.2 MVC-based protocols

6.3 Subjective ratings

6.4 EMG

6.5 Force level

6.6 Exponential model of recovery

6.7 Reliability

6.8 Coordination of the lumbar muscles

6.9 Validity

6.9.1 Discrimination between patients and healthy subjects

6.9.2 Maximal voluntary contraction

6.9.3 EMG differences between patients and healthy subjects

6.9.4 Muscle fatigue and recovery versus health-related factors in patients

6.10 Related studies concerning slope

6.11 Further research

6.12 Clinical implications

7 CONCLUSIONS

8 ACKNOWLEDGEMENTS

9 REFERENCES