SUMMARY

Evaluation of electromyography
in patients with long-term low-back pain
and in healthy subjects

Created by Britt Elfving

Subject : Evaluation of electromyography
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Keyword : Disability, electromyography, exponential, force level, gender, healthy subjects,
tereelectrode distance, low-back pain, erector spinae, maximal voluntary contraction, muscle
fatigue, recovery, reliability, validity.

Description :
Lumbar muscle function is considered to be an important component of longterm
low-back pain. The change in the median frequency of the power spectrum of the
electromyographic (EMG) signal is commonly used to estimate muscle fatigue.
Aim: The main purpose was to evaluate a test method to estimate lumbar muscle fatigue using
frequency analysis of the electromyographic signal during isometric contraction.
Methods: In the different studies, 73 healthy subjects participated; 55 of these constituted a
reference group which was compared to 57 patients with long-term low-back pain. The
subjects performed a back extensor test in seated position: maximal voluntary contraction
(MVC) torque, 45 s isometric fatigue contraction at 80% of MVC, 5 s contractions after 1, 2,
3 and 5 min in the recovery period. Surface EMG was recorded from the lumbar muscles
bilaterally at spinal levels L1 and L5. To study reliability, this test was repeated five times by
11 of the healthy subjects and once by 20 of the patients. In a further study, 15 of the healthy
subjects performed the fatigue test at 40% and 80% of MVC with both 2 cm and 4 cm
interelectrode distances. EMG variables were initial median frequency, median frequency
slope (obtained from linear regression of the fatigue contraction) and recovery half-time
(obtained from non-linear regression of the recovery data). Activity, participation and other
health-related factors were estimated by the patients in five questionnaires.
Results: The reliability was somewhat higher for patients (ICC>0.6) than for healthy subjects.
The initial median frequency and, to a greater extent, the slope were sensitive to the exerted
torque. The patients differed from the healthy subjects by lower MVC torque, higher initial
median frequency at L5, and by flatter slope and longer recovery half-time at both lumbar
levels. Using logistic regression entering EMG initial median frequency, slope and recovery
half-time in combination with MVC, about 80% of the patients and the healthy subjects could
be correctly classified. By analyses of individual linear and non-linear regressions, it was
found that patients with not significantly negative slopes and/or not exponential-like EMG
recovery had lower self-efficacy and more activity limitations. Female patients had
significantly flatter slopes, lower physical functioning and self-efficacy than male patients.
The results indicate that the ability to fatigue the lumbar muscles in a 80% MVC contraction
might be a healthy sign
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Contact Person :
Astrid Chrisafi (mutiaraadinda@yahoo.com)

Thank You,

Astrid (astrid.chrisafi@esaunggul.ac.id)
Supervisor