The effect of electrode dislocation on lower back surface electromyography amplitude

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Introduction
Surface Electromyography (SEMG) plays an important role in the understanding of trunk muscle activity during various postures and movements. The Root Mean Square (RMS) is used to quantify the muscle activation amplitude and was shown to be a valuable parameter in research focusing on the etiology and maintenance of chronic lower back pain. However, a general finding of parameters describing EMG amplitude behaviour is their large inter- and intra-subject variability, making it difficult to compare muscle activation patterns between different subjects and in repeated trials. A major factor that may cause variations in amplitude is the electrode positioning on the muscle (Hermens and Vollenbroek-Hutten, 2004). The aim of the current study was to determine the effect of electrode dislocation on the RMS of the low back muscles.

Methods
Bipolar SEMG of the Longissimus dorsi (LoD) was simultaneously measured at the recommended electrode site (BC), determined with respect to bony landmarks, and at cranial, distal, and lateral dislocations (AB, CD and EF resp., Fig. 1) in 16 healthy subjects during five functional tasks (standing, forward flexion, re-extension, unsupported sitting and arm/leg lifting). Five trials were performed and in eight subjects the trials were repeated within two weeks, including electrode replacement. The ratio of the RMS measured at the dislocated electrode sites and electrode site BC (RMSR) was calculated to show the relative effect of electrode dislocations on the RMS. Intraclass correlation coefficients (ICCs), obtained using an analysis of variance (ANOVA) procedure, were calculated to assess the reliability of the RMS in relation to electrode dislocation (ICCDIS), the repeatability of the tasks (ICCR) and the test-retest reliability (ICCT).

Results
The mean values for RMSR are plotted in Fig. 2. On average, for EF the RMS was 18% lower (p<0.001) than for BC. No significant differences were found for AB (p=0.78) and CD (p=0.19).

Discussion
Longitudinal electrode dislocations seem to have a minor effect on the RMS of the LoD muscle. The variability caused by electrode dislocation is comparable to the variability caused by repetitions of tasks or repositioning of the electrodes. For measuring SEMG of the LoD the positioning of the electrodes at an exact height seems to be of less importance. In contrast, electrode positioning in the lateral direction can be considered as a major point of attention in experimental setups measuring SEMG of the LoD.

References