Variability of EMG activation and kinematics of pianists during repetitive fatiguing tasks

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Résumé

Introduction. Muscle fatigue and repetitive movements are risk factors for the development of musculoskeletal disorders in pianists. A previous study showed that wrist flexor and extensor muscle fatigue development was participant dependant although they had similar expertise. The aim was to assess the effect of groups and time on the EMG and kinematics variability.
Method. Fifty professional pianists were equipped with 42 EMG electrodes arranged on the right flexor and extensor muscles of the forearm and 11 inertial measurement units to record kinematics. They played repetitive *Digital* and *Chord* piano tasks until reaching 8 out of 10 on the perceived exertion level, or were stopped after 12 minutes of continuous playing. Participants were dichotomized in two groups (*ShortDuration* vs. *LongDuration*) based on their time-to-exhaustion. A two-way ANOVA on Group (*ShortDuration* vs *LongDuration*) x Time (*Initiation* vs *Termination*) with repeated measures on Time was performed for EMG activation, and intra-participants variability of EMG activation levels, segments angles and accelerations.

Results. Results showed that intra-participants EMG activation variability increased more in the *ShortDuration* group with fatigue during the *Digital* task, and was unchanged during the *Chord* task, while it decrased for the *LongDuration* group. The intra-participants accelerations variability increased with fatigue for all segments during the *Digital* task and increased for thorax during the *Chord* task, while it decreased for the forearm and wrist. Plus, intra-participants angles variability increased with fatigue for several DoFs during the *Digital* task, while it increased with fatigue for the thorax and head, and decreased with fatigue for the wrist in the *ShortDuration* group, and increased with fatigue for the wrist *LongDuration* group during the *Chord* task.
Conclusion. Lower muscle activations and EMG activation variability, as well as higher wrist angular variability may be strategies to increase time-to-exhaustion and therefore possibly reducing the risk of injury.

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