GOLF SWING MECHANICS AND MUSCLE FUNCTION USING SURFACEEMG - METHODOLOGICAL CONSIDERATIONS

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INTRODUCTION: Golf as one of the most popular recreational sports in New Zealand is gaining increasing popularity in numerous countries. The repetitive nature of the sport in combination with asymmetrical postures occurring during the swing have been associated with a large number of injuries reported in golfers. Main areas for injury are the lower back and upper extremities1. Electromyography (EMG) has been used in this context to estimate differences in muscular activation between athletes with and without lower back pain2. No effect of fatigue on muscular activations was demonstrated in previous work2. Indications for a modified timing of muscle activations, which might help stabilising the lumbar spine, have been discussed2,3. A review of the literature indicates that muscle function during the golf swing is not comprehensively understood. Recently, an optimised golf swing has been presented to enable an increased power production as well as placing less stress on the locomotor system, particularly the lumbar spine.
The purpose of this study was twofold. A cautious evaluation of limitations for surface EMG (sEMG) from various muscle groups during the golf swing was performed. Based on this evaluation recommendations for sEMG were derived. Using these recommendations two different golfing techniques were investigated regarding their muscular activation patterns.

METHODS: Five high level golfers using one out of two different swing techniques were tested in this study. Athletes were filmed with a 3D video capture system (Eva, Motion Analysis, USA; 8 cameras, 240 Hz). Forty-eight retroreflective markers were used to give a full body representation of the golfer with club and ball. Each subject performed five maximum speed trials while two force platforms simultaneously measured the ground reaction forces. EMG signals were recorded synchronously using a 16 channel EMG system (biovision, Germany) from several combinations of the following muscles: erector spinae, rectus abdominis, obliqe abdominals, biceps and triceps humeris, pectoralis major, deltoid, wrist flexors and extensors.

RESULTS: The collection of surface EMG from trunk muscles did not demonstrate serious problems with regard to movement artifacts. For the shoulder and upper arm muscles considerable movement of the respective muscle bellies against the skin were demonstrated. Therefore, a set of recommendations for electrode application was established with reference to SENIAM guidelines3. For the two golf swings compared in this study marked differences in timing and magnitude of muscular activations were demonstrated for all trunk muscles and the biceps and triceps. Results indicate an overall lower activation level of the trunk muscles for the new golf swing. Regarding the timing of muscle actions greatest differences were shown for the muscles of the upper arm. Further, a more pronounced feed forward activation was seen for subjects using the new technique4. Implications for the loading of the lumbar spine have to be discussed with reference to kinematic and kinetic results.

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