MARKERS OF STRETCH-SORTHENING CYCLE OPTIMISATION AND DETERIORATION DURING AN EXHAUSTIVE EXERCISE

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Introduction

Stretch-shortening cycle (SSC) defines natural forms of locomotion such as running and jumping (Komi, 2000). The SSC technique is a complex motor task, which is improving through learning along the repetitions so that special care should be taken when recording the so-called "pre-fatigue" SSC pattern (Regueme et al., 2005). Once fatigue develops, the SSC allows neural compensations to occur so that determination of the fatigue onset is quite difficult. This study combined electromyographic (EMG) and kinetics recordings during an exhaustive submaximal SSC rebound exercise with the aim to identify markers of (i) the "initial optimisation" of the SSC pattern and of (ii) its subsequent "deterioration with fatigue".

Methods

The exhaustive SSC exercise was performed on a sledge apparatus by 10 healthy male subjects who repeated series of 30 unilateral rebound-jumps against the sledge force plate, with inter-series rests of 3 min. The rebound height was set at 70 % of the individual maximal rebound performance. Surface EMG activity was recorded from 7 selected muscles of the exercising lower limb, simultaneously with the 3 components of the ground reaction force (GRF) and tibial acceleration (TAcc) amplitudes. Mean power frequency (MPF) of TAcc was also calculated for the braking phase. Detection of the optimized SSC series was obtained by ANOVA by comparing the mean 6 to 25th rebounds of each series. SSC deterioration was detected by comparing the mean 26 to 30th rebounds of each series to the individual optimized one.

Results

SSC optimisation was found to require 3±1 series of 30 rebounds. The initial series were characterized by significantly ($p<.05$) longer contact time CT (+18%) associated with lower vertical GRF (-0.32bw), TAcc MPF (-2.5Hz) and soleus (SOL) activation (-14%) during braking phase. SSC deterioration was reflected by decreased rebound height (-9%) with higher vertical TAcc MPF (+3.5Hz) and ML TAcc (+3g). At exhaustion, ML TAcc was positively correlated to peroneus longus (PL) activity during braking ($r=.44$, $p<.01$).

Discussion

This study confirms the CT and SOL EMG changes reported by Regueme et al. (2005) with SSC optimisation. Unlike Holmes & Andrews (2006), the vertical TAcc did not decrease during exercise. This is attributed to the very individual, but significant compensatory strategies observed among agonist muscles. The present relationship found at exhaustion between the increases in ML TAcc and PL activation could be of relevance for the understanding of injury mechanisms.

References

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