Identification of EMG breakpoint at aerobic-anaerobic transition phase on athletes using shorts embedded with textile electrodes.

3Pekka Tolvanen 1Taija Finni, 2Min Hu, 1Pasi Kettunen, 1Toivo Vilavuo, 2Sulin Cheng,
Departments of 1Biology of Physical Activity and 2Health Sciences, University of Jyväskylä, 3Mega Electronics Ltd

BACKGROUND
The most commonly used parameters to indicate performance abilities of an athlete are based on measuring cardiovascular system characteristics e.g. HRmax, VO2max, ventilatory (VT) and lactate (LT, OBLA) thresholds. There are several reports presenting that similar parameters are available also by measurements from neuromuscular system like EMG breakpoint (EMGT) and neuromuscular fatigue threshold (NMFT), but those have only been used for scientific research purposes. Clothing equipped with textile electrodes on the thigh muscles provide a practical method to analyze the neuromuscular factors during field testing and day-to-day training activities.

PURPOSE
• To identify the EMG breakpoint of the front and rear thigh muscles using large, crosswise placed textile electrodes, and to compare its results with HRmax, VO2max, VT and LT, OBLA thresholds in treadmill test.
• To test feasibility of EMG breakpoint during field running.

METHODS
• Total of 28 male volunteers participated in the tests.
• Textile electrodes embedded into shorts (Finni et al. 2007).
• VO2 test in treadmill: Initial speed 5-11 km/h, step 1 km/h/3 min.
• Running on track with three different speeds, just below and above anaerobic threshold (AnT) and maximum.

RESULTS
Treadmill test
• Summarized EMG data shows a similar pattern to the results reported using conventional EMG measurement principle and methods.
• A breakpoint of average EMG occurs where the nonlinear increase starts which is corresponding to the EMGT2 threshold (Mäestu et al. 2006).
• The EMG breakpoint appears nearly the time of AnT defined by respiratory curves and lactate concentrations.

Field test
• Neuromuscular loading at running speed just below the AnT is stable and lower compared to the EMG breakpoint level identified at the controlled treadmill test.
• The neuromuscular loading lies around the EMG breakpoint at the speed of AnT.
• The average EMG is significantly higher than the EMG breakpoint when the running speed increased after the AnT is reached.
• The EMG rises far beyond the EMG breakpoint up to its maximum at maximal running speed.

CONCLUSIONS
• Shorts embedded with large textile electrodes placed crosswise above the thigh muscles is a feasible method to identify EMG breakpoint at aerobic-anaerobic transition phase during controlled treadmill running test.
• EMG breakpoint identified in the controlled treadmill test reflects the transition of neuromuscular loading from aerobic to anaerobic level as well as in voluntary controlled speeds field running.

RELEVANCE
Noninvasive EMG breakpoint measurement provides a practical tool for an athlete to monitor and assess the neuromuscular factors response to training.

REFERENCES
Finni et al. 2007 Physiological Measurement. In press.

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