FENCING-SPECIFIC ELECTROMYOGRAPHIC ACTIVITY PATTERNS BEFORE AND AFTER FATIGUE

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INTRODUCTION

Fencing is a highly dynamic activity with specific and unique loading of the lower extremity. Up to now few publications dealt with psychological and medical aspects [1-4] as well as biomechanical aspects and performance-related factors in fencing [5]. The aim of the study was to investigate muscle activity patterns of fencing-specific movements and fatigue-related changes in surface EMG before and after exercise in order to gain information about the specific contribution of the muscles to lower extremity loading during different fencing movements.

METHODS

Eleven experienced fencers (5 male, 6 female) volunteered to participate in this study. Their mean age, body mass, height and BMI were 22.8±3.7 years, 70.3±11.7 kg, 175.2±8.4 cm, 22.5±2.7 kg/m^2. Surface electromyographic signals were recorded with the Myosystem hardware and software (Noraxon Inc, Scottsdale AZ, USA). EMG electrodes were placed over the following 7 leg muscles: tensor fasciae latae (TFL), adductor magnus (ADD), rectus femoris (RF), vastus lateralis (VL), biceps femoris (BF), tibialis anterior (TA) and gastrocnemius (GA) of both, the lunge (leading) leg and the supporting (trailing) leg. Fencing-specific movements, i.e. advance, retreat, and advance-lunge, were performed before and after fatiguing exercises (10 km run at self-selected speed and 15 minutes of intensive fencing footwork). Multiple trials were root-mean-squared, time-normalized and averaged to determine mean and peak EMG amplitudes. Here only the advance-lunge, i.e. the most dynamic attack movement will be considered.

For statistical analysis, intra-individual differences between lunge and support leg or before and after fatigue conditions were tested with the Wilcoxon signed-rank test ($p < 0.05$).

RESULTS AND DISCUSSION

The results for the lunge indicate preparatory muscle contraction before initiation of the fencing movements. During the advance-lunge movement, the RF and VL are more activated in the lunge leg as compared to the support leg which is due to the breaking action in the leading leg and the recovery back to the en-garde position (Tab. 1).

After fatiguing exercises, significantly reduced amplitudes were found in the TFL, ADD and TA of the lunge leg as well as in the ADD, BF and TA of the support leg (Tab. 1). These muscles are responsible for stabilizing the body in the slightly unbalanced position rather than for the propulsion of the attack movement.

CONCLUSIONS

The muscle activity measurements during fencing-specific movements may help to explain the role of specific muscle groups in fencing actions as well the changes under fatiguing loading conditions. The demonstrated findings may be used to identify those muscle groups that should be mainly considered for strengthening exercises to prevent performance loss when fatigued. Furthermore, they might help to counteract overload injuries through improved conditioning.

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Table 1: Mean EMG amplitudes (µV) of the investigated muscles during the lunge movement in both legs.

Muscle Group	**Lunge Leg** Pre-Exercise	Post-Exercise	**Pre vs. Post** p-Level	**Support Leg** Pre-Exercise	Post-Exercise	**Pre vs. Post** p-Level	**Lunge vs. Support Leg** p-Level pre	p-Level post
TFL	43.9 ± 11.0	32.5 ± 3.1	0.022	42.5 ± 10.2	43.9 ± 17.2	ns	ns	ns
ADD	27.7 ± 6.8	21.7 ± 9.2	0.022	26.6 ± 10.2	19.0 ± 13.3	0.037	ns	ns
RF	68.4 ± 20.1	56.0 ± 2.3	ns	39.4 ± 17.8	46.2 ± 1.1	ns	0.004	ns
VL	80.1 ± 31.8	88.1 ± 9.7	ns	61.4 ± 18.2	59.0 ± 2.6	ns	ns	0.037
BF	29.2 ± 10.8	28.6 ± 2.3	ns	36.4 ± 10.2	23.6 ± 6.4	0.009	ns	ns
TA	83.9 ± 22.2	54.1 ± 6.8	0.007	90.0 ± 21.1	63.7 ± 6.4	0.005	ns	ns
GA	36.9 ± 13.1	31.2 ± 3.2	ns	31.2 ± 14.4	28.0 ± 10.4	ns	ns	ns