LOWER EXTREMITY EMG PATTERNS DURING CYCLING CHANGED WITH BOTH PEDALING FREQUENCY AND ADDITIONAL LOADING

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INTRODUCTION: Lower extremity muscle activity pattern changes with different pedaling frequencies. These changes were suggested partially due to the influence of the inertial properties of the lower extremities. The purpose of this study was to investigate the inertial influence of lower extremity electromyography (EMG) activity patterns during cycling.

METHODS: Sixteen male university students cycling with three different cadences: 60, 80, 100 rpm. Additional loads (0.0, 0.5, 1.0, 1.5, and 2.0 kg) were attached to the distal end of the thigh. EMG of the following muscles was recorded: gluteus maximus (GM), rectus femoris (RF), biceps femoris (BF), vastus lateralis (VL), tibialis anterior (TA), gastrocnemius (GA) and soleus (SO). Collected EMG activities were full-wave rectified. Linear envelop of the EMG were created using low pass digital filter. EMG pattern change was examined using cross correlation across the entire crank cycle (Li & Caldwell, 1999). Differences between cadence and load tested using two factor ANOVA with repeated measures (Alpha = 0.05).

RESULTS AND DISCUSSION: Significant main effects observed for both cadence and load. See Table 1 for the EMG pattern shift due to load relative to the EMG pattern at 0 kg load condition. Positive shift indicates EMG activities were detected earlier in the crank cycle. The r-values after the shift were ranging from 0.978 to 0.999. Almost all muscles showed early activity with the additional load. Most changes of EMG timing seen with the hip and knee two joint muscles RF and BF, ranging from 4 to 9 degrees compared to no load condition. Table 2 exhibits the effect of pedaling cadence in relation to pedaling at 60 rpm. Advanced muscle activities observed from all seven muscles. R-values after the shifting were ranging from 0.935 to 0.992. The most changes observed from the one and two joint hip extensors GM and BF with values from 14 to 31 degrees crank angle comparing to pedaling at 60 rpm.

Table1 EMG pattern shifted (degrees of crank angle) with different load conditions [mean (SD)]

Load	GM	RF	BF	VL	SO	GA	TA
0.5	0 (1)	6 (2)	9 (3)	2 (1)	1 (1)	0 (1)	4 (1)
1.0	4 (2)	5 (1)	6 (3)	4 (1)	2 (1)	1 (1)	4 (1)
1.5	4 (2)	7 (1)	4 (4)	4 (2)	1 (1)	1 (0)	3 (0)
2.0	3 (2)	6 (2)	5 (3)	4 (2)	0 (1)	0 (1)	2 (1)

Table2 EMG pattern shifted (degrees of crank angle) with pedaling cadences [mean (SD)]

Cadence	GM	RF	BF	VL	SO	GA	TA
80	14 (4)	2 (4)	15 (3)	5 (4)	6 (2)	3 (2)	6 (2)
100	31 (5)	3 (12)	28 (3)	12 (7)	11 (6)	11 (6)	15 (3)

CONCLUSION: Muscle activity pattern change observed with different cadences was partially resulted from the influence of the leg's inertial property in addition to the speed change.

REFERENCES:

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