TENSIOMYOGRAPHY: ASSESSING THE IMMEDIATE EFFECTS OF KETTLEBELL SWINGS ON LUMBAR PARASPINAL MUSCLE FUNCTION

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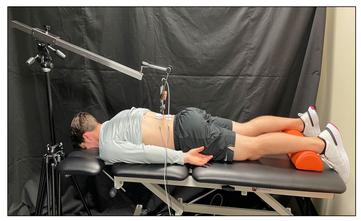
Introduction & Purpose

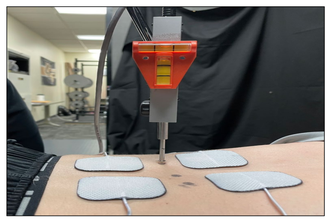
- Kettlebell swings are utilized in the rehabilitation setting to target the lumbar erector spinae and lower body musculature.
- Kettlebell swings exhibit distinct loading patterns requiring cyclical contraction of the trunk extensors and posterior chain potentially explaining its therapeutic effect.
- Tensiomyography (TMG) serves as a non-invasive technique to assess muscular fatigue.

Methods

All TMG assessments were conducted using an electrical stimulator (TMG-S1), the TMG-OK 3.0 software, and a displacement sensor (TMG-BMC, Ljubljana, Slovenia) tip with a prefixed tension of .17 $N.m^{-1}$ Markings were made 3 cm lateral to the L2 spinous process to indicate the sensor tip position. Markings were made 1.5 cm superior and inferior to the sensor position to indicate the locations of the electrodes.

Following the placement of the electrodes and sensor tip, TMG assessment began. The initial impulse was 30 mA, followed by 50 mA. Each subsequent impulse increased by 10 mA until either muscle displacement peaked or maximal output of the electrical stimulator was reached (100 mA). The time between impulses was ≳ 10 seconds. In the situation that Dm failed to increase following two consecutive impulses, assessment was terminated and the highest Dm was recorded.

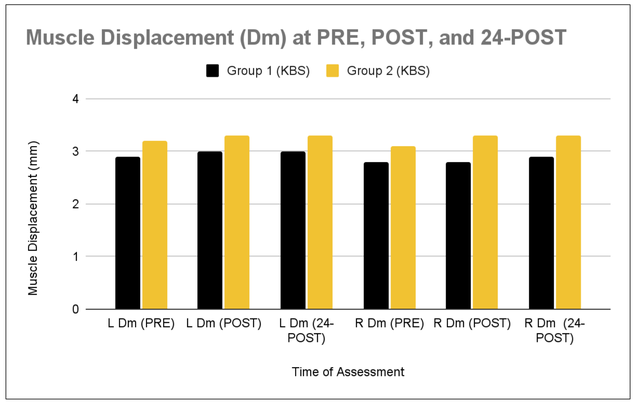




Results

- 41 healthy university students met the inclusion criteria: between ages 18-45, no recent history of low back pain or pre-existing injuries, and no positive responses on the PAR-Q.
- Participants were randomly allocated to either an interval kettlebell swing group (KBS; n=21) or a control group (CON; n = 20).
- There were no statistically significant differences between groups at baseline regarding age (p=0.765), weight (p=0.652), and height (p=0.234).
- Participants were assessed at baseline, post-intervention, and 24-hours post- intervention for bilateral erector spinae fatigue using five TMG parameters: Maximal displacement (Dm), contraction time (Tc), relaxation time (Tr), delay time (Td), and sustain time (Ts).

No significant differences were detected in the assessed TMG parameters, indicating that this interval KBS protocol failed to induce lumbar erector spinae fatigue.



	Group 1 (CON)			Group 2 (KBS)		
Variable	PRE	POST	POST-24	PRE	POST	POST-24
L Dm	2.9 (1.7)	3.0 (2.1)	3.0 (1.7)	3.2 (2.0)	3.3 (2.1)	3.3 (2.0)
R Dm	2.8 (1.4)	2.8 (1.6)	2.9 (1.6)	3.1 (2.1)	3.3 (2.1)	3.3 (2.0)
L Tc	13.0 (1.8)	15.5 (10.1)	13.5 (2.0)	13.7 (4.7)	13.1 (2.8)	13.4 (1.8)
R Tc	13.3 (2.0)	14.5 (7.0)	13.9 (2.5)	15.4 (11.3)	13.9 (3.8)	13.8 (3.3)
L Tr	7.2 (3.3)	55.5 (202.3)	8.3 (3.6)	28.2 (95.6)	10.1 (10.1)	8.9 (5.3)
R Tr	21.0 (39.1)	11.6 (10.2)	20.4 (31.3)	13.0 (28.6)	15.1 (28.3)	17.0 (41.7)
L Td	19.4 (2.7)	23.8 (17.2)	19.7 (3.1)	31.1 (55.3)	19.2 (1.7)	18.8 (1.7)
R Td	19.3 (2.5)	23.1 (18.8)	19.7 (4.4)	29.5 (46.4)	31.9 (55.5)	31.6 (56.2)
L Ts	22.3 (5.7)	91.9 (215.3)	24.3 (6.3)	65.2 (158.0)	25.5 (13.0)	24.9 (7.7)
R Ts	134.8 (284.3)	44.6 (58.1)	65.7 (107.5)	64.3 (161.0)	67.4 (155.9)	69.4 (157.8)

	Between Subjects Effect by Group		Within Subjects Effects by Group (Time*Group Variable)	
Variable	F	p	F	p
L Dm	0.299	0.587	0.016[a]	0.984[a]
R Dm	0.500	0.484	0.264[a]	0.769[a]
L Tc	0.309	0.582	1.304[a]	0.277[a]
R Tc	0.122	0.729	1.112[a]	0.334[a]
L Tr	0.214	0.646	1.423[a]	0.247[a]
R Tr	0.100	0.753	0.786[a]	0.459[a]
L Td	0.229	0.635	1.396[a]	0.254[a]
R Td	0.784	0.381	0.359[a]	0.700[a]
L Ts	0.144	0.706	2.621[a]	0.079[a]
R Ts	0.123	0.727	1.544[a]	0.220[a]

Conclusion

The interval KBS protocol failed to produce significant differences in lumbar erector spinae fatigue in comparison to a control group. The results of the study indicate that this interval KBS protocol is not sufficient to induce fatigue in the lumbar erector spinae musculature; however, further research should be conducted using higher-intensity KBS protocols.

Practical applications

Use of TMG can help clinicians determine if therapeutic exercises targeting the erector spinae induce fatigue and thus promote strength, hypertrophy, and/or endurance of the intended musculature.

References

1. Andersen V, Fimland MS, Saeterbakken A. Trunk Muscle Activity in One- and Two-Armed American Kettlebell Swing in Resistance-Trained Men. *Sports Med Int Open*. 2019;3(1):E12-E18. doi:10.1055/a-0869-7228
2. de Paula Simola RÁ, Harms N, Raeder C, et al. Assessment of Neuromuscular Function After Different Strength Training Protocols Using Tensiomyography. *J Strength Cond Res*. 2015;29(5):1339-1348. doi:10.1519/JSC.0000000000000768