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The Influence Of Normalization Technique On Between-muscle Activation During A Back-squat: Methodological Considerations

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2484 Board #3 May 29 9:30 AM - 11:30 AM

The Effects Of Fatigue On Lumbo-Pelvic Coordination During The Deadlift

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Repetitive lifting with submaximal loads has gained popularity as a mean for increasing strength and endurance. Given that repetitive lifting is a known occupational risk factor for low back injury, it is important to develop an objective criterion for determination of number of lifting repetitions that maximize the benefits of lifting, while minimizing the potential risk for low back injuries.

PURPOSE: To determine whether measures of lumbo-pelvic coordination (LPC) during repetitive low-handle hexagonal bar deadlift (LHBD) get impaired before lifter exhaustion.

METHODS: Eight weight-trained males performed repetitions-to-fatigue of LHBD with a load of 68 kg. Rotations of the thorax and pelvis in the sagittal plane, measured using a motion capture system, were used to characterize LPC according to Needham, et al. 2015. Subsequently, the differences in LPC over the early portion of the lifting phase between the first and last 10% of total lifting repetitions were compared using paired to-tests.

RESULTS: Peak pelvic and trunk flexion angles and lumbar range of rotation from respective values of 53.9° ± 4.8°, 64.9° ± 6.6°, and 28.8° ± 3.2° during the first 10% of lifting cycles increased to 57.2° ± 4.1° (p = 0.02) 69.4° ± 6.7° (p = 0.05), and 32.9° ± 5.2° (p = 0.04) during the last 10%. Pelvic and trunk rotations over the early portion of the lifting phase were in-phase (anti-phase) 40.0% ± 8.8% (21.3% ± 2.8%) of the time during the first 10% of lifting cycles that increased, p=0.04, (decreased, p=0.01) to 47.9% ± 4.8% (12.4% ± 4.9%) during the last 10% of lifting cycles.

CONCLUSION: Significant changes in neuromuscular control of LPC were observed before participants stop lifting due to fatigue. Such alterations in LPC changes mechanical loads experienced in the spinal tissues, hence, affecting risk of injury. However, more research is needed to understand the impact of such impairments in LPC on spinal loads and risk of injury.

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Comparison Of Shoe Vs No Shoe On Sagittal Plane Deadlift Biomechanics

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Deadlifts are often an integral part of training programs to build posterior chain strength and power, but current research has not examined the performance outcomes when performed with and without shoes from a biomechanical perspective.

PURPOSE: To examine the differences in lower extremity sagittal plane joint kinetics and peak vertical ground reaction force (vGRF) of a conventional barbell deadlift with and without shoes.

METHODS: Ten subjects (age: 27.9 $\pm$ 3.8 years) who deadlift twice a week for the past 6 months, were free from injury, and had no history of lower extremity surgery were recruited. Subjects first performed a one repetition max (1RM) test in self-selected footwear according to NSCA guidelines. At least 72 hours later subjects returned for a 3-dimensional analysis of their deadlift at 70% of their 1RM. Subjects performed 1 set of 5 continuous reps of a conventional deadlift in both shoe and barefoot conditions in a randomized order. A 5-minute rest was given between each condition. Visual3D was used to process raw marker and force data, calculate peak sagittal joint moments of the ankle, knee, and hip and to find peak vertical ground reaction force during the concentric phase. A one-way repeated measures MANOVA was performed to statistically test differences between shoe and no shoe conditions in the dependent variables.

RESULTS: Average 1RM for males and females was 437.5 $\pm$ 83.4 lbs. and 224.2 $\pm$ 37.6 lbs., respectively. No significant differences were found in internal hip extension moments ($p=0.444$, S=2.99 Nm/kg, B=3.05 Nm/kg), knee extension moments ($p=0.151$, S=0.92 Nm/kg, B=0.81 Nm/kg), ankle plantar flexion moments ($p=0.113$, S=1.07 Nm/kg, B=1.01 Nm/kg), and peak vGRF ($p=0.295$, S=1044.9 N, B=1035.2 N) between shoe and barefoot conditions.

CONCLUSION: Anecdotal claims suggest performing a deadlift barefoot enhances stability and increases connection to the ground which would lead to improvement in deadlift performance. The lack of difference seen in sagittal plane kinetics and peak vGRF suggest that deadlift performance is unaffected by footwear choice. Future research should investigate if similar results would be attained when subjects' deadlift performance is tested at various percentages of the 1RM.

2486 Board #5 May 29 9:30 AM - 11:30 AM

The Influence Of Normalization Technique On Between-muscle Activation During A Back-squat: Methodological Considerations

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BACKGROUND/OBJECTIVE: Currently, no gold standard electromyography (EMG) normalizing technique exists when conducting between-muscle comparisons of muscle activity during isotonic resistance training exercises. The aim of this study was to assess if between-muscle activation during the back-squat differed among electromyography (EMG) normalization techniques when normalizing to: (1) 1 repetition maximum (1RM), (2) maximal voluntary isometric contraction (MVIC), and (3) the first of a set of three repetitions (Rep1%) in trained female lifters.

METHODS: Thirteen participants completed a back-squat 1RM, MVIC of the rectus-femoris (RF) and gluteus-maximus (GM), and three repetitions of the back-squat at 80% 1RM. For the 1RM and MVIC normalization techniques, the average of the peak RMS signal of both muscles during the three submaximal reps were normalized to the peak 1RM and MVIC signals. The Rep1% averaged the peak RMS signals of both muscles during the 2nd and 3rd submaximal repetitions normalized to the peak signal during the 1st repetition.

RESULTS: The RF-GM between-muscle EMG (ΔEMG) differed among normalization techniques ($p < 0.001$, $\eta_p^2 = 0.48$). *Post-hoc* pairwise comparisons indicated MVIC normalization elicited different ΔEMG with large effects compared to both 1RM ($p = 0.037$; $d = 1.2$) and Rep1% ($p = 0.004$; $d = 1.9$) techniques, but the 1RM and Rep1% did not produce different ΔEMG ($p = 0.27$; $d = 0.8$).

CONCLUSION: Our findings suggest EMG normalization technique influences the magnitude and direction of between-muscle activation during common lifting exercises, and we recommend normalizing isotonic movements to dynamic normalization methods such as a 1RM or Rep1%.

Key Words: Electromyography; Methodology; Signal processing; Lower extremity; Training; Exercise

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2487 Board #6 May 29 9:30 AM - 11:30 AM

Impact Of Vibration On Rectus Femoris During Bodyweight Squats In Female Collegiate Track Athletes

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Whole-body vibration (WBV) exposes the entire body to mechanical oscillations when one is standing on a vibrating platform. In recent years, researchers have studied the extent to which these oscillations effect the body. Previous studies have investigated muscle activity in the general population during static exercises with WBV, but there has been little research that has focused on the effects of WBV during dynamic movements in athletes.