Advances in surface electromyographic (EMG) signal decomposition now allow investigators to analyze firing rate data for 20-50 motor units per contraction. To simplify data interpretation, some investigators have relied on group mean analysis of the mean firing rate versus recruitment threshold relationship. It is unclear, however, whether this association is consistently linear.

**PURPOSE:** To determine whether the motor unit mean firing rate versus recruitment threshold relationship is strongest when analyzed via linear, quadratic, or cubic regression.

**METHODS:** Twenty-one men (mean ± SD age = 24 ± 4 years) participated in this study. After determining maximal voluntary contraction (MVC) force of the dominant knee extensors, participants performed threshold isometric contractions at 50% MVC by tracing a visual template displayed on a monitor directly in front of them. Participants were instructed to increase force from 0 to 50% in five seconds, maintain 50% MVC for 15 seconds, and decrease force from 50% to 0 in five seconds. Bipolar surface EMG signals were recorded from the vastus lateralis during each contraction. A surface EMG signal decomposition algorithm was used to calculate mean firing rate and recruitment threshold of each detected motor unit. Motor units with decomposition accuracy levels <90% were discarded. Polynomial regression was used to determine if each mean firing rate versus recruitment threshold relationship was best fit with a linear, quadratic, or cubic model. Data were interpreted on an individual participant basis.

**RESULTS:** Statistically significant (p < 0.05) moderate to strong (r² = 0.599-0.964) linear relationships existed for all 21 participants. Fourteen of the 21 participants demonstrated relationships that were best fit with a linear model (r² = 0.599-0.964). Of the remaining seven participants, five were best fit with a quadratic model (r² = 0.864-0.953) and two were best fit with a cubic model (r² = 0.977-0.989).

**CONCLUSION:** While moderate to strong linear relationships were found between the firing rate of motor units and their recruitment thresholds for all participants, in certain cases the strength of the association was enhanced when analyzed via a non-linear model. Our findings provide further support for the need to examine motor unit data on a participant-by-participant basis.

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**Board #73**
May 30 10:30 AM - 12:00 PM
Electromyographic Analysis of the Intensity Progression of Mat Pilates Exercises
Paula Finatto. Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil. (Sponsor: Rafael Escamilla, FACSM)
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(No responses reported)

Studies evaluating the electromyographic activation (EMG) of spine flexor muscles during Pilates exercises (PE) concluded that EMG is different among abdominal exercises, even when classified in the same intensity category.

**PURPOSE:** To compare EMG of spine extensors, flexors and rectus femoris in seven mat PE among basic (B), intermediate (I) and advanced (A) variations.

**METHODS:** The EMG of upper rectus abdomini (URA), lower rectus abdomini (LRA), external oblique (EO), internal oblique (IO), rectus femoris (RF) and multifidis were assessed for the Roll Up (RU), Single Leg Stretch (SLS), Double Leg Stretch (DLS), Hundred (HD), and Rolling Like a Ball (RLB) exercises in B, I, and A. Also evaluated in I and A were Double Straight Leg Stretch (DLS) and Single Straight Leg Stretch (SSLS). EMG results were expressed as a percentage of maximum voluntary isometric contraction. One-way ANOVA with repeated-measures was used (α = 0.05) to compare the three variations.

**RESULTS:** In HD exercise, LRA and IO EMG was significantly less (p < 0.01) in B variant (48.5% and 41.1%, respectively) than A (68.7% and 68.5%, respectively) and A (75.1% and 80.7%, respectively), and EO EMG was significantly greater (p < 0.01) in A (63.4%) compared to B (39.8%), while (51.2%) was equal to A and B. In RU exercise, URA EMG was significantly greater (p < 0.04) in A (43.8%) than B (34.9%). In DLS exercise, LRA EMG was significantly less (p < 0.01) in B variant (43.7%) than A (53.2%) and A (66.8%), EO EMG was significantly greater (p < 0.01) in A (57.7%) than B (36.1%), and IO EMG was significantly greater (p < 0.01) in A (73.5%) than B (39.7%) and I (55.3%). In SLS exercise, LRA, IO and OE EMG were significantly less (p < 0.01) in A (35.7%, 37.4% and 41.5%, respectively) than A (55%, 52.4% and 61.1%, respectively). In DLSLs exercise, EO and RF EMG were significantly greater (p < 0.04) in A (81.6%) and 29.3%, respectively) than I (71.7% and 23.29%, respectively). In SSLS and RLB exercises, no significant differences were found among B, I and A.

**CONCLUSION:** The higher URA EMG may be more related to upper limb positions while higher LRA, EO and IO EMG may be more related to lower limb positions and changes greater than 45° of raising or lowering lower or upper limbs seems to be necessary.

Supported by Capes and CNpq.

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**Board #74**
May 30 10:30 AM - 12:00 PM
Neural And Contractile Determinants Of Rate Of Force Development: A Preliminary Analysis
Mitchel A. Magrini, Ryan Colquhoun, Nathaniell Jenkins, Jason DeFreitas. Oklahoma State University, Stillwater, OK.

(No responses reported)

Neural and contractile factors have been suggested as important determinants for different phases of the rate of force development (RFD).

**PURPOSE:** To examine the influence of rate of muscle activation, motor nerve conduction velocity (CV) and motor unit number estimation (MUNE) of the vastus lateralis on early and late phase RFD.

**METHODS:** Fifteen men (age 23±3 y) completed 2 maximal (MVIC) and rapid (rMVIC) voluntary isometric contractions. Participants were instructed to kick out as hard as possible, and as fast as possible for the MVICs and rMVICs, respectively. The RFD values were calculated during the first 50 ms (rRFD50) and 100 to 150 ms (rRFD100-150) and normalized to maximal voluntary force (%MVIC/a). The rate of electromyographic signal rise (rER) was calculated during the first 50 ms of muscle excitation (rER50) and normalized to the peak-to-peak M-wave amplitude (%MPPs). MUNE was calculated as a ratio of the ensemble average of the single motor unit potential area to the compound muscle action potential area, and was corrected for alternation. Motor CV (ms) was assessed as the time (ms) from maximal stimulation of the femoral nerve to onset of muscle activity. Pearson’s correlation coefficients were used to analyze the relationships between the dependent variables. Additionally, stepwise multiple regression was used to examine the degree to which the predictor variables (rER50, MUNE, Motor CV) explained a significant proportion of the total variance in each RFD phase (rRFD50 and rRFD100-150).

**RESULTS:** rER50 (41.47±25.16 %MPPs) was significantly related to rRFD50 (0.24±0.44 N) (r²=0.640, p=0.01). rRFD100-150 was not related to any of the predictor variables. rER50 was the only significant predictor (β=0.640, p=0.015), explaining 41% of the variance in rRFD50.

**CONCLUSION:** These preliminary findings are in agreement with previous research suggesting that the early phase RFD is primarily determined by neural factors. Continued sampling will determine if additional variables significantly contribute to predicting early and late RFD performance.

**ACKNOWLEDGEMENTS:** The funding for this study was provided, in part, by the Central States American College of Sports Medicine Student Research Grant.

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**Board #75**
May 30 10:30 AM - 12:00 PM
Examining Quadriceps Muscle Excitability Throughout A Progressive Exercise Test: A Pilot Study
Emily M. Adamic, Joel T. Greenshields, Jessica A. Freemans, Koichi Kitano, David M. Koejia, Timothy Mickle鞠borough. Indiana University, Bloomington, IN.
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(No responses reported)

**PURPOSE:** A metabolic threshold occurs during progressive exercise with a non-linear increase in blood lactate. The power output at which this occurs closely corresponds to the ventilatory threshold, a non-linear increase in minute ventilation (V̇E). These factors may affect muscle excitability and thus force generating capacity. Muscle excitability has been shown to decrease after high-intensity whole-body exercise, however it has not been identified when this decrease occurs during progressive exercise. Therefore, the purpose of this study was to examine quadriceps muscle excitability throughout a progressive exercise test.

**METHODS:** Five men (age 23 ± 3.5 years) performed a step-wise cycling test, beginning at 100W and increasing 25W/min until volitional exhaustion. Minute averages of oxygen consumption (VO₂) and V̇E were collected, and heart rate (HR) and rating of perceived exertion (RPE) were recorded at the end of every minute. M-waves were induced using a stimulating electrode positioned over the femoral nerve and given at a fixed crank angle of 90° while the subject was cycling. During the exercise test, supramaximal stimulations were given every 10
seconds and averaged over the minute. Using a mixed linear model to control for within-subject variance, both absolute and relative (percent decrease) M-wave amplitudes for each minute were compared to the first minute of exercise.

RESULTS: Subjects exercised for an average of 10 (± 0.7) minutes. VO2, HR, and RPE increased significantly each minute in a linear fashion. Ventilatory threshold occurred at minute 7 (±1 minute). Compared to the first minute of exercise, absolute M-wave amplitude decreased significantly at minute 7 (2.14 ± 2.45mV versus 3.78 ± 2.58mV), whereas relative M-wave amplitude decreased significantly at minute 6 (6.20% ± 28.53%). At the time of ventilatory threshold, significant reductions were observed for both absolute and relative M-wave amplitudes, but remained reduced until exhaustion this position.

CONCLUSIONS: These data show that the M-wave may exhibit an excitability threshold corresponding to that of the ventilatory threshold. This could reflect the metabolic state of the muscle, indicating the division between sustainable and unsustainable exercise intensities. Further research should examine the neural response to progressive exercise in relation to peripheral losses of excitability.

C-33 Free Communication/Poster - Movement Disorders

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

1314 Board #76
May 30 10:30 AM - 12:00 PM
Optimizing Dance Interventions To Improve Motor Function In People With Parkinson's Disease And Older Adults
Angela L. Ridgetl, FACSM, Jin Hyun Kim, Peter Gates, Robert Melczak, Fred Discezno, Margaret Busch, Joan Meggitt. Kent State University, Kent, OH. Email: arigdel@kent.edu

(No relationships reported)

Dance comprises a broad range of techniques and styles, which have been utilized in classes specifically designed for individuals with Parkinson’s disease (PD) and healthy older adults. Previous studies have shown that a series of dance sessions can improve balance, posture, and mobility for people diagnosed with PD and healthy older adults. However, these studies have not analyze the linkage between repetitive movement types and persistent changes in motor skills. In order to begin understanding the causative factors of repetitive movement types that result in improved motor skill performance, the functional relationship between movement features and observed performance improvements needs to be examined.

PURPOSE: To identify dance movement patterns resulting in the greatest improvement in tests of gait, balance and upper extremity function using partnered and non-partnered dance to music in PD and healthy older adults. We hypothesize that scripted variation in movement will promote improvements in motor performance.

METHODS: Participants in structured group dance classes were recruited for this study. Performance measures of upper and lower extremity were collected before and after each dance class. Motion capture, video and live observations were used to examine movement patterns.

RESULTS: Individuals with PD had slower baseline performance in the 9 hole peg test (9HPT) than healthy older adults in both left (p=0.026, 33.5 s vs 24.9 s) and right hand (p=0.008, 31.2 s vs 26.5 s). There was also a significant improvement in the 9HPT for the left hand after the dance classes in the individuals with PD (p=0.055, 3.44 s). Factors that led to observed improvements in mobility and movement execution included: repetition of foundational weight shifts in a separate preparatory exercise, engagement of the spine and arms in counterbalancing movement in the legs, incorporating flexion at the knee into the dance stride, and partnering with a moderately-skilled dancer. Increased amplitude and ease of stride and greater lift in the feet in locomotion were also documented.

CONCLUSIONS: These preliminary results suggest that repetitive shifts in balance and movement during dance with music can lead to upper extremity motor performance and increased amplitude of movement in the lower extremity in individuals with PD.

1315 Board #77
May 30 10:30 AM - 12:00 PM
Effects Of A Cooling Vest On Dual-task Performance And Fatigability In Persons With Multiple Sclerosis
Samantha Everett, Chelsea Comeau, Virginia Thomas, Skantik Vallabhajosula. Elon University, Elon, NC. (Sponsor: Stephen Bailey, FACSM)

(No relationships reported)

Fatigue and heat sensitivity are commonly reported symptoms in persons with multiple sclerosis (PwMS). PwMS also often have difficulty performing concurrent cognitive and motor tasks that presents as a dual-task decrement. Heat sensitivity along with a dual-task decrement may hinder activities of daily living and quality of life for PwMS. Though using a cooling vest could help decrease heat sensitivity, it is currently unknown if it improves dual-tasking performance in PwMS.

PURPOSE: To examine the effects of a cooling vest on cognitive-motor dual-task cost (DTC) and fatigability in PwMS.

METHODS: 5 PwMS participated in two sessions that were at least 1 week apart. During one session participants wore a sham cooling vest and the other session an actual cooling vest. During each session participants completed a Timed 25-Foot Walk Test (T25FWT), 6 Minute Walk Test (6MWT), T25FWT while performing Serial 3’s, and a 6MWT while narrating a story. The type of vest and order of tests was randomized for each participant. Total times for T25FWT and total distances for 6MWT were recorded. DTC, defined as the percent change between single- and dual-task performance, was calculated. Fatigability, defined as the difference between the averages of the first two and the last two laps times of the 6MWT, was calculated. Paired samples t-tests were used to compare DTC during cooling and non-cooling sessions and fatigability during single- and dual-task conditions within each session.

RESULTS: The mean DTC during the 6MWT for cooling and non-cooling was -4.1% and -6.5%, respectively. The DTC during the T25FWT for cooling was 7.3% and 11.5% for non-cooling. The mean distance walked during 6MWT dual-task increased from 275.5m without cooling to 285.8m with cooling. There was a trend towards significant difference between single- and dual-task fatigability during 6MWT for non-cooling session (Single: 1.6±3.6m; Dual: 6.2±5.3m; p=0.05), but not for cooling session (Single: 0.7±3.8m; Dual: 12±16.4m; p=0.08).

CONCLUSION: Preliminary results with lower DTC and no significant difference between single- and dual-task fatigability when using a cooling vest suggests that a cooling vest may have a benefit for PwMS while dual-tasking during endurance activities. Further research with a larger sample size is needed to confirm these findings.

1316 Board #78
May 30 10:30 AM - 12:00 PM
Comparing Turn Performance In Parkinsonism
Sidney Baudendistel, Abigail Schmitt, Ashley Rodriguez, Chris Hass, FACSM. University of Florida, Gainesville, FL. (Sponsor: Chris J Hass, FACSM)

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(No relationships reported)

Turning while walking is one of the main tasks of daily living known to elicit falls in healthy older adults and persons with movement disorders, such as Parkinson’s disease. Essential tremor is the most common adult movement disorder; recent work has identified meaningful gait impairments in this population. However, turning performance has not been evaluated in this population.

PURPOSE: To determine differences in gait patterns between patients with Parkinson’s disease and those with Essential Tremor during a turning task and their relationship to reported falls.

METHODS: 15 persons with Essential Tremor (ET) and 15 persons with Parkinson’s disease (PD) age matched within 3 years, performed two 180 degree turns, as part of the Primary Gait Screen, on an instrumented pressure mat. Average time to complete the turn, amount of steps required to turn, and cadence (number of steps/time) of the turn were calculated. Reported falls in the last six months on a categorical scale, (0: No falls, 1: Rarely, 2: Monthly, 3: Weekly, 4: Daily), age at diagnosis, and age at first symptom were collected. Paired t-tests were used to compare measures between groups while a simultaneous multiple regression was performed to analyze potential predictors of falls.

RESULTS: No significant differences were found between the ET and PD groups (p>0.05) with the exception of cadence. Those with PD had a significantly higher cadence during the turn than those with ET (2.17 ± 0.301 steps/sec vs. 1.91 ± 0.369 steps/sec , p=0.042). Using regression to analyze possible predictors, the overall model failed to obtain significance in predicting falls (F(6)= 1.855, p=.134, R²=.336). Only age at evaluation (p=0.011) and age at diagnosis (p=0.032) were statistically significant predictors in this model, as age at evaluation increased (B=−.048 ± .030, 346

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