

5RM tests for SBH and SBL in randomized order. Both tests were performed on a 75 cm stability ball. 10 min rest was allowed between RM tests. Repetition speed was standardized at 1 s eccentric, 1 s concentric for warm up sets and was regulated by metronome. Hand placement was normalized to the subject's shoulder width. After a 10 min recovery, participants performed three 5 s maximal voluntary isometric contractions (MVIC) for each muscle against manual resistance. A 60 s rest period between each MVIC trial was allowed. The middle three repetitions of the 5RM were analyzed and averaged. EMG was collected at 1000 Hz. Data were quantified by root mean square and normalized to MVIC activity. Paired t-tests were performed for each muscle. Alpha level was set at 0.05.

RESULTS: There was no significant ($p = 0.12$) difference in 5RM weight between exercises (SBH 228 ± 32 lbs, SBL 218 ± 32 lbs). SA activity was not significantly different ($p = 0.10$, SBH $85 \pm 51\%$, SBL $69 \pm 34\%$) but UT activity was significantly ($p = 0.03$) greater during SBH ($32 \pm 18\%$) compared to SBL ($18 \pm 15\%$). There was not a significant difference ($p = 0.27$) in UT/SA ratio (SBH $.54 \pm .43$, SBL $.33 \pm .39$).
CONCLUSION: The SBL may be a more ideal exercise for scapular stability training because of lower UT activity. However, from a logistics standpoint, the SBL is more difficult to perform and requires the feet to be secured. Since the UT/SA ratio was not significantly different, the SBH may be a more practical exercise.

2471 Board #172 May 31, 3:30 PM - 5:00 PM

Electromyographic (EMG) Analysis of the Hip Musculature During Variations Of The Glute Bridge Exercise

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(No relationships reported)

INTRODUCTION: It has been suggested that improving the function of the muscles which produce hip extension, primarily the gluteus maximus, could help improve the efficiency of human movement patterns. Clinical use of various glute bridge techniques have attempted to address this issue, however no studies have determined how various alterations in performing the glute bridge exercise may alter glute, hamstring and quadriceps activation. It is further hypothesized that increasing quadriceps activation during the bridge exercise may, through reciprocal inhibition, decrease the role of the hamstrings during hip extension and thus enhancing the glute activation.

PURPOSE: To determine the effects of various glute bridge techniques on glute to hamstring activation ratio.

METHODS: Twenty healthy recreationally trained males (age: 22.89 ± 1.91 yr, height 1.77 ± 6.50 m, mass 76.38 ± 8.75 kg.) attended a single data collection session. Maximum voluntary contraction (MVC) EMG data was collected for the gluteus maximus, rectus femoris and biceps femoris of the preferred leg. Subjects then performed three repetitions of three conditions in random order with one minute rest between trials: Normal glute bridge with feet on a force plate; Band, subject abducted the legs against a Thera-Band™ wrapped around the knees; and Shear, the subject created a shear force by pushing the toes against a stopper connected to the force plate. EMG and force plate data were collected.

RESULTS: A repeated measures ANOVA revealed no significant differences for Glute to hamstring ratio ($P > .05$) across all three conditions (Normal 1.49 ± 1.56 ; Band 3.77 ± 8.86 ; Shear 0.99 ± 0.73). There was however, significantly greater glute activation ($P < .05$) for the Band condition over both the Normal and Shear conditions.

CONCLUSION: Neither the use of a Thera-Band™ or applying a shear force altered the glute to hamstring ratio, however the Thera-Band™ did elicit greater glute activation due to its additional external rotation component. The shear condition was effective in changing the force application onto the ground however it did not result in glute to hamstring ratio alterations. **PRACTICAL APPLICATION:** Professionals working in a clinical setting can use Thera-Band™ glute bridges to increase glute activation in their patients.

F-30 Free Communication/Poster - Oxygen Uptake Kinetics

May 31, 2013, 1:00 PM - 6:00 PM
 Room: Hall C

2472 Board #173 May 31, 2:00 PM - 3:30 PM

Noninvasive Quantification of Muscle Hemodynamics and Metabolism in Women with Fibromyalgia Using Diffuse Optical Spectroscopies

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(No relationships reported)

Women with fibromyalgia (FM) have symptoms of increased muscular fatigue and reduced exercise tolerance, which may be associated with alterations in muscle microcirculation and oxygen metabolism. We have recently developed a hybrid near-

infrared diffuse optical instrument for simultaneous measurement of blood flow and oxygenation in deep muscle tissue.

PURPOSE: To characterize muscle blood flow, blood oxygenation and oxygen metabolism in post-menopausal women with and without FM.

METHODS: Fourteen women with FM and twenty-three healthy controls participated in this study. Two experimental protocols for challenging muscle function were applied to the subjects, including 6 sets of 12 isometric contractions of knee extensor muscles with steadily increased strength, followed by temporary cuff occlusion on forearm for 3 minutes. Leg or arm muscle hemodynamics, including relative blood flow (rBF), oxy- and deoxy-hemoglobin concentration ([HbO₂] and [Hb]), total hemoglobin concentration (THC) and blood oxygen saturation (StO₂), were continuously monitored throughout protocols using a custom-built hybrid diffuse optical instrument that combined a commercial near-infrared spectroscopy (NIRS) oximeter for tissue oxygenation measurements and a custom-designed diffuse correlation spectroscopy (DCS) flowmeter for tissue blood flow measurements.

Relative oxygen extraction fraction (rOEF) and oxygen consumption rate (rVO₂) were calculated from the measured blood flow and oxygenation data. Post-manipulation recovery in muscle hemodynamics was characterized by the recovery half-time, i.e., a time interval from the end of manipulation (fatiguing exercise or cuff occlusion) to the time that tissue hemodynamics reached a half-maximal value.

RESULTS: Muscle rOEF during exercise in subjects with FM was significantly lower than in healthy controls (99.7 ± 2.6 vs 107.4 ± 2.0 ; $p = 0.03$), and the half-times of [HbO₂] and [Hb] were significantly longer ($p < 0.05$) following fatiguing exercise and cuff occlusion.

CONCLUSIONS: Our results suggest an alteration of muscle oxygen utilization in the FM population. This study demonstrates the potential of using combined diffuse optical spectroscopies (i.e., NIRS/DCS) to comprehensively evaluate tissue oxygen and flow kinetics in skeletal muscle.

2473 Board #174 May 31, 2:00 PM - 3:30 PM

Near Infrared Spectroscopy (NIRS) to Assess the Onset of Increased Metabolism during Muscle Contractions

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(No relationships reported)

PURPOSE: The aims of the present study were to 1) Determine whether there is a time delay (TD) in O₂ at the onset of contractions; and 2) Explore the contribution of myoglobin versus hemoglobin to the NIRS signals during muscle contractions.

METHODS: Canine gastrocnemius (GS) muscles ($n = 6$) were isolated and pump perfused while NIRS signals were recorded continuously. The GS was electrically stimulated via the sciatic nerve (8V, 50Hz, 0.2ms pulse, 200ms duration) to elicit muscle contractions at the rate of 1 contraction/2 s. The myoglobin contribution to NIRS spectra was evaluated by comparing the NIRS signals during blood perfusion to the signals during Hb-free Krebs-Henseleit bicarbonate buffer (KHBB) perfusion. The TD was determined from the fitting of deoxy-NIRS signals (HHbMb) with a monoexponential model.

RESULTS: TD from the fitting of HHbMb was not significantly different for 1 contraction/2 s between blood perfusion (8.4 ± 1.4 s) and KHBB perfusion (8.9 ± 2.6 s). However, the TD of HHbMb during KHBB perfusion could be partially explained by dissolved O₂ and O₂ from the dynamic KHBB supply (perfusion) (sufficient for 7.3 ± 2.4 s). The Mb contribution to NIRS signals averaged $57 \pm 18\%$ but a large inter-individual variability was observed (39 - 83%).

CONCLUSIONS: A TD for HHbMb was still observed during KHBB perfusion as well as blood perfusion when assessed with a monoexponential model; this could be mostly explained by O₂ storage in the KHBB trial. Additionally, the Mb contribution to the overall NIRS signals is on the order of 50+% during muscle contractions; albeit measurement of this contribution was highly variable.

2474 Board #175 May 31, 2:00 PM - 3:30 PM

Pulmonary Oxygen Uptake Off-Kinetics and Fitness in Obese Adolescents

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In adolescents, the pulmonary oxygen (O₂) uptake off-kinetic response during recovery from exercise has received little attention in comparison to O₂ on-kinetics during the transition to steady-state exercise. Although studies have reported equivocal findings in comparing O₂ on-kinetics between obese and lean adolescents, no relationship has been shown between peak oxygen consumption (VO₂) and the O₂ on-kinetics response to moderate intensity exercise. The evaluation of pulmonary O₂ off-kinetics in adolescents has only occurred in lean subjects and training status did not have an impact on O₂ uptake during recovery.

PURPOSE: To determine the relationship between peak VO₂ and pulmonary O₂ off-