B-74 Free Communication/Poster - Upper Extremity

Wednesday, May 27, 2020, 1:30 PM - 4:00 PM
Room: CC-Exhibit Hall

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Three-dimensional, Isotonic Comparison Of Dominant And Non-dominant Upper Limb Force Production

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(No relationships reported)

Athletes and coaches have traditionally relied on isokinetic devices to compare dominant and non-dominant strength ratios; the information provided is limited in its application. Recent technology permits strength and power comparisons in an isotonic, three-dimensional environment that is more compatible with the load profiles experienced during sport performance.

PURPOSE: To determine the difference in power between dominant and non-dominant arms across various loads, motions, and planes.

METHODS: 206 subjects performed 3,727 unilateral sets of 10 repetitions in upper-extremity movements on Proteus (Proteus Motion, USA). Loads were applied through magnetic resistance and ranged from 5-25 lbs; they were divided between dominant (n=1,975) and non-dominant (n=1,747) arms. The performance variables were explosiveness (peak force development rate), peak power, and braking (rate of deceleration). Descriptive statistics characterized mean performances. Linear regression models predicted the effect of arm dominance on performance parameters, holding the load and exercise constant.

RESULTS: Across all sets, explosiveness was 852.61 ± 629.46 watts/sec, peak power was 206.40 ± 112.42 watts, and braking was 1059.90 ± 766.63 watts/sec. Dominant and non-dominant arms were different in explosiveness (p=0.005), peak power (p=0.041), and braking (p=0.035). With confounding variables held constant, linear regression found use of the non-dominant arm to predict a 10-watt decrease in peak power (R^2=0.691; p<0.001), a 46-watt/sec decrease in mean explosiveness (R^2=0.553; p=0.001), and a 65-watt/sec decrease in braking (R^2=0.668; p<0.001).

CONCLUSIONS: In an athletic population, the independent use of dominant and non-dominant limbs is often critical to success. It is important to know the non-dominant performance deficit in a setting applicable to sport performance. This information can contribute to optimal training protocols and return-to-play testing batteries.

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Muscle Activity In Upper Extremity Is Modulated During Arm Cycling Exercises After Cervical Spinal Cord Injuries

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(No relationships reported)

Regaining upper extremity function following spinal cord injury (SCI) is one of the most important outcomes for quadriplegics with regards to enhancing quality of life. To facilitate locomotor recovery through increased activation of the lower limb muscles, ground reaction forces are commonly manipulated to optimal levels. Using similar mechanisms, manipulating power production during arm cycling exercises could facilitate activation of the upper limb muscles after SCI.

PURPOSE: To determine if upper limb muscles activation is modulated during arm cycling exercises after SCI.

METHODS: Five participants with chronic SCI at C4; classified as AIS A (1), B (2), C (1) and D (1) according to the American Spinal Injury Association Impairment Scale performed arm cycling exercises at four power levels (0, 5, 10, 15W) with their hands securely attached to the handles. Surface EMG signals were recorded during a series of 10 consecutive cycles from one muscle above the lesion: medial trapezius (C2-C4); and six muscles below the lesion: deltoid posterior (C5-C6), biceps brachialis (C5-C6), triceps brachialis (C6-C8), extensor digitorum (C6-C8), flexor carpi radialis (C6-C8) and extensor carpi radialis (C6-C8).

RESULTS: Arm cycling exercises were successfully performed at cadences ranging from 30 to 50 rpm. EMG signals were detected in all muscles from all participants. Modulation of EMG signals within the cycle was seen in most exercise conditions and participants, while modulation was most identifiable when participants produced larger levels of power. Increasing power production from 0 to 15 W led to an increase in the peak EMG activity of the trapezius muscle, as well as in four muscles below the lesion: deltoid, biceps and triceps brachialis, and extensor carpi radialis (P < 0.05).

CONCLUSIONS: Participants of all levels of impairment successfully performed the arm cycling exercises. Increasing power production up to 15W improved modulation of EMG signals during the cycle and increased activation of some muscles below the lesion, crossing the shoulder, elbow and wrist joints. Including arm cycling exercises in rehabilitation programs should be considered to take advantage of spinal circuitry available below the level of injury and facilitate the recovery of upper extremity function after SCI.

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An Investigation Of Bilateral Differences In Emg Responses During Submaximal Arm Ergometry

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(No relationships reported)

PURPOSE: To determine bilateral differences in neuromuscular fatigue patterns in the Biceps Brachii (BB), Triceps (Tri), and Latissimus Dorsi (LD) muscle groups during arm cranking exercise.

METHODS: A sample of 4 male and 4 female subjects (aged 22.2 ± 2.2 yrs) performed a submaximal arm cranking test for 10-minutes each @ 40% and 60% of the maximal workload attained previously, in randomized order. Oxygen consumption was determined continuously via indirect calorimetry. Mean EMG Root Mean Square (EMG_{RMS}) was calculated for 10 epochs from 15-second recordings at each minute. Slope coefficients were determined and a 2-way repeated measures ANOVA was used to analyze the differences between exercise intensity and side (left vs. right) for each of the three muscle groups.

RESULTS: Submaximal VO_2 @ 60% (1.54 $L \cdot min^{-1}$ ± 0.2) was significantly greater ($p \leq 0.01$) than the VO_2 @ 40% (1.2 $L \cdot min^{-1}$ ± 0.2) indicating an expected energy cost difference. However, there were non-significant differences in EMG_{RMS} for muscle (F=1.8, $p \geq 1.0$) and intensity (F=0.49, $p \geq 0.4$).

CONCLUSIONS: During submaximal arm ergometry at two different workloads, possible limb dominant asymmetries were not evident, indicating similar time-dependent acute neuromuscular adaptations for the three muscle groups studied.

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Quantifying Kinematic Fidelity Of Demonstrated Therapeutic Shoulder Exercises Between Therapist And Patient

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