

MAGNITUDES OF RECRUITMENT OF SELECTED TRUNK, UPPER LIMB, HIP, AND THIGH MUSCLES DURING AN INVERTED ROW USING A PORTABLE PULL-UP DEVICE ON STABLE AND UNSTABLE SURFACES

Youdas JW, Hubble JW, Johnson PG, McCarthy MM; Yancey ML, Hollman JH

Project funding came from the Mayo School of Health Sciences Program in Physical Therapy. No funding.

The project was approved by the Mayo IRB (15006541). All subjects signed an appropriate consent form. Subject data were kept confidential.

Background and Purpose: Physical Therapists prescribe exercise procedures to train back, trunk, vertebroscapular, posterior shoulder, and arm muscles. Our purpose was to record muscle recruitment/activation of these muscles during four variations of the inverted row exercise using a commercially available portable pull-up device.

Methods and Measures: Surface electromyographic (EMG) analysis was carried out on 13 male and 13 female subjects while performing four inverted row exercises: 1) right single-leg weight-bearing (WB) with knee extended and heel contact; 2) right single-leg WB with 10% body weight (BW) added; 3) right single-leg WB on BOSU; and 4) single-leg WB on BOSU with 10% BW added. Fourteen muscles on the right side were analyzed: longissimus thoracis (LTh), lumbar multifidus (LM), latissimus dorsi (LD), middle trapezius (MT), lower trapezius (LT), posterior deltoid (PD), gluteus maximus (GMa), hamstrings (H), rectus abdominis (RA), external oblique (EO), upper trapezius (UT), biceps brachii (BB), serratus anterior (SA), and gluteus medius (GMe).

Analysis: Data from each muscle were examined separately with a repeated measures analysis of variance (ANOVA) at $\alpha = .05$. Post hoc comparisons of the magnitudes of EMG recruitment across exercises for statistically significant ANOVAs were conducted with Bonferroni corrections for multiple comparisons.

Results: There were no significant differences in muscle activation among the four exercises.

Conclusion: Seven muscles (LD, MT, PD, H, UT, BB, GMe) demonstrated very high [$>61\%$ maximum

voluntary isometric contraction (MVIC)] EMG activation during all four exercise conditions. Five muscles (LTh, LM, LT, GMa, SA) demonstrated high (41-60% MVIC) recruitment. Two muscles (RA, EO) demonstrated moderate (21-40% MVIC) recruitment.

Implications: Eleven of the muscles analyzed were recruited at greater than 50% MVIC, implying strength adaptations occur when performing any of the four inverted row exercises. The most simple of the four exercises, the single-leg WB inverted row, is sufficient to activate all 14 muscles the same amount as the other 3 exercises, so the 10% body weight and BOSU added are not necessary. Inverted row exercises can be performed on devices other than the portable pull-up device used in this study.