MAGNITUDES OF MUSCLE ACTIVATION OF SPINE STABILIZERS IN HEALTHY ADULTS DURING PRONE ON ELBOW PLANKING EXERCISES USING A FITNESS BALL

Youdas JW, Coleman KC, Holstad EE, Long SD, Veldkamp NL, Hollman

JH Mayo School of Health Sciences Program in Physical Therapy

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BACKGROUND AND PURPOSE: Strengthening the core hip, trunk, and abdominal muscles has been shown to help with injury prevention, recovery from low back pain, and has the potential to improve athletic performance. The purpose of this study was to quantify muscle activation with surface electromyographic (EMG) analysis for four prone planking exercises, three of which used a fitness ball, requiring use of back, abdomen, shoulder, and hip muscles. The exercises included prone plank on floor (PPOF), prone plank on ball (PPOB), stir-the-pot on ball (STP), and prone plank on ball with hip extension (PPHE). Of the four exercises, we hypothesized “stir-the-pot” would generate the highest levels of EMG activity.

METHODS AND MATERIALS: 13 females (25.0 ± 3.8 years) and 13 males (25.4 ± 5.7 years) participated. EMG signals were gathered for ten right-sided muscles (iliocostalis lumborum [IL], longissimus thoracis [LT], lumbar multifidus [LM], latissimus dorsi [LD], gluteus maximus [GM], hamstring [HS], rectus abdominis [RA], external oblique [EO], internal oblique [IO], and serratus anterior [SA]) using surface electrodes at a sampling frequency of 1000 Hz. EMG signals were normalized to peak activity in maximum voluntary isometric contraction (MVIC) and expressed as a percentage. Subjects completed one 10-second repetition of each exercise in random order.

ANALYSES: Descriptive EMG data, including means and standard deviations (SDs), were calculated for EMG recruitment (%MVIC) in the aforementioned muscles. Data were compared between the four exercise conditions using a repeated measures ANOVA. Post hoc comparisons of EMG recruitment across exercises for statistically significant ANOVAs were conducted with Bonferroni corrections for multiple comparisons.

RESULTS: EO showed greater activation during STP (144% MVIC) than the three other exercises: PPOF (76% MVIC), PPOB (88% MVIC), and PPHE (109% MVIC). Additionally, during STP, LT (27% MVIC), HS (25% MVIC), and LD (30% MVIC) showed greater activation than during PPOB: LT (20% MVIC), HS (17% MVIC) and LD (20% MVIC). RA showed greater activation during STP (72% MVIC) than during PPOF (41% MVIC), GM (94% MVIC), HS (74% MVIC), and LM (62% MVIC) demonstrated greater activation during PPHE than during the three other exercises. Additionally, LD demonstrated greater activation during PPHE (27% MVIC) than during PPOB (20% MVIC).

CONCLUSIONS: During STP exercise, three muscles (RA, EO, IO) demonstrated very high (>61% MVIC) EMG activation and one muscle (SA) demonstrated high (41-60% MVIC) EMG activation. During PPHE, five muscles (GM, HS, EO, IO, LM) demonstrated very high EMG activation and two muscles (RA, SA) demonstrated high EMG activation.

IMPLICATIONS: STP and PPHE exercises are effective ways to activate RA, EO, IO, SA at levels conducive to strengthening, with STP being superior in activating EO. In addition, the PPHE is an effective way to activate GM, HS, and LM at levels conducive to strengthening.