Electromyographic Analysis of Abdominal and Low Back Muscle Activity During Core Exercises Performed Conventially and Using a Portable Training Device

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The benefits associated with strength training for the abdominal and low back musculature are well established. Commercially available abdominal training devices are common features within exercise facilities, however there is considerable debate over the efficacy of such devices to elicit abdominal muscle recruitment and activation greater than conventional modalities. PURPOSE: The purpose of this study was to compare the abdominal and low back muscle activation generated ruing common abdominal exercises using an abdominal device [the AB-Inforcer, (AI) and a conventional exercise mat (MT)}. METHODS: Fifty-three adults (30 men, 23 women; 25 $\pm$ 4.7 y; 74.9 $\pm$ 13.3 kg; 172.7 $\pm$ 9.1 cm) volunteered to participate in this study. The electromyography (EMG) activity of the upper and lower regions of the rectus abdominus (URA and LRA, respectively), the external oblique (RO), and paraspinal (PS) muscle was measured during three abdominal exercises performed by each participant on the AI and MT using surface EMG. Surface electrodes were placed on the right and left sides of the trunk for each muscle group. Each participant performed one set of five repetitions for the following three exercies: 1) traditional crunch, 2) split leg scissors, and 3) bilateral heel drops from a table top position. Adequate rest time was allowed between sets to avoid fatigue and the testing order for both exercises and the exercise condition (AI vs MT) was randomized. Paired t-Tests were used to detect differences in relative mean EMG activity between the AI and MT for each exercise, and Bonferroni adjustments were made for multiple comparisons. RESULTS: All three exercises performed using the AI resulted in significantly greater mean EMG activation for the right- and left-side URA and LRA ($p < 0.001$). The split leg scissors performed on the AI resulted in significantly greater EMG activation bilaterally for the EO relative to the MT ($p< 0.001$), but was not significantly different for the crunch or heel drops ($p > 0.05$). No significant differences were observed between the AI and MT for the PS muscles during any of the three exercises ($p > 0.05$). CONCLUSIONS: Exercises using the AI resulted in significantly higher URA and LRA muscle activation. Greater EO muscle activation was observed in the AI performed exercises, but this trend was not significant for all the exercises. The AI is an abdominal training device that provides auditory and visual feedback to the user concerning body positioning and compensatory actions (such as excessive sternocleidomastoid activation). The abdominal resistance and feedback provided by the AI may have facilitated the increase in AI evoked abdominal activation observed in this study. PRACTICAL APPLICATIONS: Training of the abdominal musculature is often a fundamental component of exercise programs for athletic performance or rehabilitation, identification of appropriate and efficient training tools for abdominal muscle activation, adaptation, and strength development is consequently useful information for therapists and strength and conditioning professionals. Devices such as the AI may present an innovative and practical approach to abdominal training (within study limitations). Future research needs to examine the utility for using the AI in

individuals of different ages and clinical populations, especially those with diminished proprioception and abdominal strength or integrity.