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Research article

Selective Activation of the Rectus Abdominis Muscle During Low-Intensity and Fatiguing Tasks

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ABSTRACT

In order to understand the potential selective activation of the rectus abdominis muscle, we conducted two experiments. In the first, subjects performed two controlled isometric exercises: the curl up (supine trunk raise) and the leg raise (supine bent leg raise) at low intensity (in which only a few motor units are recruited). In the second experiment, subjects performed the same exercises, but they were required to maintain a certain force level in order to induce fatigue. We recorded the electromyographic (EMG) activities of the lower and upper portions of the rectus abdominis muscle during the exercises and used spatial-temporal and frequency analyses to describe muscle activation patterns. At low-intensity contractions, the ratio between the EMG intensities of the upper and lower portions during the curl up exercise was significantly larger than during the leg raise exercise ($p = 0.02$). A cross-correlation analysis indicated that the signals of the abdominal portions were related to each other and this relation did not differ between the tasks ($p = 0.12$). In the fatiguing condition, fatigue for the upper portion was higher than for the lower portion during the curl up exercise ($p = 0.008$). We conclude that different exercises evoked, to a certain degree, individualized activation of each part of the rectus abdominis muscle, but different portions of the rectus abdominis muscle contributed to the same task, acting like a functional unit. These results corroborate the relevance of varying exercise to modify activation patterns of the rectus abdominis muscle.

Key words: Motor control, electromyography, biomechanics, exercise

Key Points

- Selective activation of the rectus abdominis muscle is possible because this muscle has different portions (which can have different motor fibers in series) which can be innervated by different nerves as well as by a common nerve branch.
- Changes in body position and exercise intensity cre-ate different demands for the different portions of the rectus abdominis muscle.
- Exercise variation seems to be valid to modify the activation patterns of the rectus abdominis muscle.