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Original Research

Muscle Activation and Movement Patterns During Prone Hip Extension Exercise in Women

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Abstract

Context: The consistency of muscle activation order during prone hip extension has been debated.

Objective: To investigate whether women use a consistent and distinguishable muscle activation order when extending the hip while prone and to explore the effects of verbal cues on muscle activation and movement.

Design: Single-session, repeated-measures design.

Setting: University laboratory.

Patients or Other Participants: Eleven healthy women (age = 27.7 ± 6.2 years [range, 22–37 years]).

Intervention(s): We tested the participants under 3 conditions: no cues, cues to contract the gluteal muscles, and cues to contract the hamstrings muscles.

Main Outcome Measure(s): We measured hip and knee angle and electromyographic data from the gluteus maximus, medial hamstrings, and lateral hamstrings while participants performed prone hip extension from 30° of hip flexion to neutral.

Results: When not given cues, participants used the consistent and distinguishable muscle activation order of medial hamstrings, followed by lateral hamstrings, then gluteus maximus (195.5 ± 74.9, 100.2 ± 70.3, and 11.5 ± 81.9 milliseconds preceding start of movement, respectively). Compared with the no-cues condition, the gluteal-cues condition resulted in nearly simultaneous onset of medial hamstrings, lateral hamstrings, and gluteus maximus (131.3 ± 84.0, 38.8 ± 96.9, and 45.1 ± 93.4 milliseconds, respectively) ($P > .059$); decreased activation of the medial hamstrings ($P < .03$) and lateral hamstrings ($P < .024$) around the initiation of movement; increased activation of gluteus maximus throughout the

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movement ($P < .001$); and decreased knee flexion ($P = .002$). Compared with the no-cues condition, the hamstrings-cues condition resulted in decreased activation of the medial hamstrings just after the initiation of movement ($P = .028$) and throughout the movement ($P = .034$) and resulted in decreased knee flexion ($P = .003$).

Conclusions: Our results support the contention that the muscle activation order during prone hip extension is consistent in healthy women and demonstrates that muscle timing and activation amplitude and movement can be modified with verbal cues. This information is important for clinicians using prone hip extension as either an evaluation tool or a rehabilitation exercise.

Keywords: electromyography, motor control, verbal cues

Cara L. Lewis, PhD, PT, contributed to conception and design; acquisition and analysis and interpretation of the data; and drafting, critical revision, and final approval of the article. Shirley A. Sahrmann, PhD, PT, FAPTA, contributed to conception and design; analysis and interpretation of the data; and drafting, critical revision, and final approval of the article.

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