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Upper extremity muscle activity during m-CKCUEST

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INTRODUCTION:

The Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST) was proposed to assess the upper extremity closed kinetic chain function (1). In a push-up position with hands spaced at a half arm span (m-CKCUEST, 2), the participant alternatively touches, as fast as possible, the floor outside the stance hand with the other hand (phase 1) and returns in starting position (phase 2) during three 15-s bouts. The stance limb supports about 65% of the body weight (3) and superior mediolateral peak force was reported for the nondominant limb than for the other side (4), suggesting effect of dominance on loads and muscular activation. This study aimed to assess the influence of dominance, phase and muscle on stance-limb muscle activity during m-CKCUEST.

METHODS:

Electromyography activities of lower, middle and upper trapezius, triceps brachii, posterior, lateral and anterior deltoid, and serratus anterior were recorded bilaterally for 14 male athletes (22.3±2.1 yrs, 1.66±0.06 m, 66.5±6.6 kg) performing m-CKCUEST. The effects of *dominance*, *phase* and *muscle* on the stance-limb muscle activity (% of a maximal voluntary isometric contraction) were analyzed with linear mixed model.

RESULTS:

For 26±2 touches per athlete, only a significant effect of *phase*muscle* interaction ($p<0.001$) on muscle activity was found. During phase 1, serratus anterior (31±13%), posterior deltoid (30±13%) and triceps brachii (27±14%) were more activated ($p<0.05$) than lower (18±8%), middle (17±10%) and upper trapezius (21±10%), lateral (19±6%) and anterior (19±8%) deltoid. During phase 2, the serratus anterior (33±11%), anterior deltoid (29±12%) and triceps brachii (25±11%) were more activated ($p<0.05$) than lower (15±5%), middle (15±6%) and upper (9±4%) trapezius, posterior (21±16%) and lateral (16±6%) deltoid. All muscles presented similar activity during both the phases, excepted the anterior deltoid, which was significantly more activated ($p=0.04$) during the phase 2 (29±12% vs. 19±8%).

CONCLUSION:

Our findings showed muscular activities were similar for dominant and nondominant stance limbs, and confirmed m-CKCUEST challenges the upper limb stability (3). During both the phases, serratus anterior may resist to trapezius action by rotating internally and upwardly the scapula, and triceps activated to maintain elbow in full extension. When the moving hand reached out the stance hand, posterior deltoid may counteract humeral flexion, while, when the moving hand returned to starting position, anterior deltoid may counteract humeral extension, hence limiting body anteroposterior displacement. The upper extremity muscle activities may thus be coordinated to maintain the glenohumeral joint above the stance hand during the m-CKCUEST.

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