

TITLE: Effects of volitional preemptive abdominal contraction on multifidus activation when performing maximal isometric barbell front and back squats.

Purpose/Hypothesis: To determine whether volitional preemptive abdominal contraction (VPAC) in various body positions, position of a squat bar, and the combination of the two, affected the thickness of the lumbar multifidus muscle (LMM) during a maximal isometric barbell squats as measured by diagnostic ultrasound. We hypothesized that both the front squat position and the use of VPAC would result in increased lumbar multifidi thickness when compared to the back squat position and no VPAC.

Materials/Methods: A total of 23 subjects were included in the study, ages 18-28 with a mean age of 22.4 (± 2.6). BMI ranged from 21.6-36.7 with a mean BMI of 27.6 ± 3.97 . No subjects were excluded. Diagnostic ultrasound of LMM was used to measure changes in thickness at L4-L5 in 10 different body positions with and without VPAC. For the VPAC conditions, subjects gently inhaled, exhaled, then stiffened their trunk as if they were about to be hit in the belly. Positions included prone with and without VPAC, standing back squat with an unweighted dowel-rod, with and without VPAC, and standing front squat with an unweighted dowel-rod, with and without VPAC. The 4 maximum isometric squats included, front squat with and without VPAC and back squat with and without VPAC. All squats were performed with knees at 60 degrees of flexion. A 2-way repeated measures ANOVA with Bonferroni correction compared each position to one another.

Results: Statistical significance (95% CI) was found when comparing maximal squats. Significant values are the mean change from baseline (relaxed prone) to maximal squat and included: front squat without VPAC greater than back squat without VPAC ($p=0.03$); front squat with VPAC greater than back squat without VPAC ($p=0.012$); and front squat with VPAC greater than back squat with VPAC ($p=0.001$).

Conclusions: The maximal isometric front squats produced greater LMM thickness than the back squat. VPAC produced greater LMM thickness during a maximal isometric front squat, than in a maximal isometric back squat. It is interesting to note, back squat with VPAC produced less multifidus thickness than back squat without VPAC. Increased weight bearing positively impacted LMM thickness in the case of front squat position.

Clinical Relevance: To maximize activation of the lumbar multifidi, physical therapists should recommend front squats as opposed to back squats in weight lifting programs as well as the inclusion of VPAC. LMM thickness has been correlated with increased stabilization of the lumbar spine. Utilization of the front squat position with VPAC may be important in the reduction mechanical stress on the lumbar spine, especially in individuals with prior history of low back pain.

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