

Mechanical Analysis of Squat and Stoop Lifting with Known and Unknown Load Center of Mass Location/ Ayman Goda Mohammed Matar: Cairo University, Faculty of Physical Therapy, Department of Biomechanics. Supervisors: Prof. Dr. Ahmed Hassan Hussein and Prof. Dr. Ghada Mohamed El-Hafez. Thesis: Ph.D.; Biomechanics, 2010.

Abstract

Lifting an object with incorrect load knowledge may lead to low back pain and injuries. The purpose of this study was to examine the effects of different locations of load's COM and load knowledge on the erector spinae EMG and trunk kinematics during squat and stoop lifting tasks. Lumbar erector spinae EMG and trunk kinematics (ROM and velocity) were collected from 30 subjects (mean age 19.4 years \pm (1.3), mean height 175.8 cm \pm (5.1), and mean weight 72.4 kg \pm (10)). Trunk ROM and velocity were recorded through 3D Motion Analysis System, while myoelectric activity from the right and left erector spinae muscles were picked up by using surface electrode at L3 level. Each participant lifted a 6.5 kg box plus a 4 kg weight randomly placed in one of its selected five compartments (center, Rt-ant, Lt-ant, Rt-post, and Lt-ant). Four lifting series (5 lifts per series) were completed, two series of squat lifting with and without knowledge of the load's COM location and the other two series of stoop lifting also with and without knowledge of the load's COM location. The dependant variables were compared among five tested load locations using MANOVA with LSD test, while effect of the load knowledge were tested by using paired t test to compare between known and unknown conditions. Finding revealed significant differences in the tested dependant variables due to changes in COM location, with most potent effect when the COM located at left anterior location. However, considering load knowledge effect, there were non significant differences for most of the tested conditions except for trunk flexion velocity during stoop and squat lifting and erector spinae dominant side EMG during stoop lifting. Therefore, it can be concluded that lifting an object with unknown COM location put a high injury risk on the lower back especially if it is located toward non-dominant side anteriorly. In addition injury risk can be minimized if the load's COM location is located posteriorly toward dominant side either in stoop or squat lifting.

Keywords: Squat and stoop lifting, Load knowledge, COM location, Erector spinae EMG, Trunk kinematics.