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The Effect of Pregnancy on Torso Kinematics during Gait

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(No relationships reported)

Numerous anatomical changes occur during pregnancy that may be related to gait alterations, which in turn may be related to increased reports of lumbar and pelvis pain during pregnancy. While other researchers have reported changes in hip and ankle biomechanics, none have quantified torso kinematics related to the "waddling gait" that pregnant women are anecdotally said to exhibit**.**

PURPOSE: The purpose of this study was to examine the effects of pregnancy on torso mechanics during gait**.**

METHODS: Data were collected on 29 pregnant subjects in the mid-second and third trimesters and on 40 control women. An 8 camera motion capture system (120 Hz) was used to collect data of subjects walking at their freely chosen speed along an 8 meter laboratory runway. Subjects wore a modified Helen Hays marker set. Right foot heel strike (RHS) and left foot toe off (LTO) were determined from force plate data (1080 Hz). The 3D angles of the thorax (i.e. upper torso) and pelvis were determined at RHS. The frontal plane movement of the C7 marker and the ranges of motion of the thorax and pelvis during gait were determined between RHS and LTO. An ANOVA was performed to determine if differences existed between pregnant women in their second trimester, third trimester, and controls (α=0.05)**.**

RESULTS: There was significantly ($p<0.01$) more frontal plane motion of C7 between the third trimester (6.5 ± 2.7cm), second trimester (5.6 ± 1.9 cm), and controls (4.7 ± 1.8cm) during the stride. At RHS, the sagittal plane position of the thorax was more extended ($p<0.01$) as pregnancy advanced (third trimester: -6.6 ± 4.5°, second trimester:-3.5 ± 5.1°, Con: 1.7 ± 5.1°). No other differences in thorax and pelvis mechanics were noted**.**

CONCLUSIONS: Pregnant women demonstrated more frontal plane motion of C7 during gait, particularly in the third trimester. Because no differences in frontal plane angles of the thorax and pelvis were seen between groups, this movement of C7 is likely due to a side-to-side shifting of the body rather than a leaning. Pregnant women demonstrated a backward leaning of the thorax, which is likely to counterbalance a forward position of the center of mass due to increasing abdominal size. *Funding: NIOSH K01 008458.

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The Efficacy of "The 11" Injury Prevention Program With Regard to Knee and Trunk Motion

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The injury prevention program created by the FIFA is called "The 11." It is especially useful in the prevention of non-contact injuries. However, it is unclear how this program helps reduce injuries.

PURPOSE: To identify the effect of "The 11" on knee and trunk motion.

METHODS: Eight male collegiate soccer players were recruited for this study. The players performed "The 11" twice a week for 6 months. Before and after the intervention, knee and trunk movements were recorded using a three-dimensional motion analysis system while the subjects performed cutting tasks. Cutting tasks were performed on a force plate after running. Tasks like side step, crossover step, or forward running were randomly selected and were conducted in two situations: anticipated and unanticipated. In the anticipated situation, subjects were informed about the task in advance. In the unanticipated situation, random visual cues were presented at the moment when subjects reached about 2.5m from the force plate. Only the side step task was analyzed. In each trial, we calculated knee joint angle (flexion/extension, abduction/adduction and tibial rotation) and trunk inclination (forward and lateral) using the point cluster technique, from 100 msec before foot-contact (FC) to toe-off. Each variable at 100 msec before FC, at the time of FC, and the peak value during FC was calculated in each task. Student t-test was used to compare the difference between the conditions before and after intervention (α=0.05 was considered significant).

RESULTS: The peak knee abduction angle was significantly lower after intervention than before intervention in the unanticipated sidestep task (6.2±3.7 vs. 12.1±4.3, <0.05). The tibial external rotation angle at the time of FC after intervention was significantly lower than before intervention in the unanticipated sidestep task (5.7±6.8 vs. 10.1±8.3, $p<0.05$). Other knee variables and all trunk variables did not change.

CONCLUSIONS: "The 11" can reduce ACL injury risk as, in the anticipated situation, the knee abduction angle decreased after intervention. In this way, "The 11" can reduce sports injuries. However, trunk motion remained unchanged despite "The 11's" core stability exercise and the instructions for trunk alignment during jumping and stepping. Some training components of this program can be improved.

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Electromyographic Analysis of Trunk and Hip Muscles During Swiss Ball Bridging Exercises Performed With Two Different Ankle Positions

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(No relationships reported)

PURPOSE: Bridging exercises are commonly used in training and rehab to enhance core stability. Some trainers recommend dorsiflexing the ankles during bridging exercises to facilitate the gluteus maximus and inhibit the hamstrings. Our purpose was to compare trunk and hip muscle activity during 3 two-leg and 2 one-leg bridging exercises on a swiss ball using two different ankle positions: 1) ankle plantar flexion (PF); 2) ankle dorsiflexion (DF).

METHODS: Twenty healthy males and females between 22-27 y.o. served as subjects. Surface electrodes were positioned on the subject's right side over the upper rectus abdominis (RA), external oblique (EO), internal oblique (IO), erector spinae (ES), latissimus dorsi (LD), gluteus maximus (GMa), gluteus medius (GMe), medial hamstrings (MH), lateral hamstrings (LH), rectus femoris (RF), tensor fascia latae (TF), and adductor longus (AL). EMG data were collected from an EMG system during a 5 s isometric hold after obtaining the bridge position. EMG data were normalized by maximum voluntary muscle contractions. Differences in muscle activity were assessed by a one-way repeated measures Analysis of Variance ($p < 0.01$).

RESULTS: During the two-leg bridge with knees flexed and the ball under the upper back, activity from the RF, AL, and IO was significantly greater with DF compared to PF. During the two-leg bridge with knees extended and feet on ball, muscle activity from the RF, TF, AL, ES, and GMe was significantly greater with DF compared to PF. During the two-leg bridge with knees flexed and feet on ball, muscle activity from the LH was significantly greater with PF compared to DF. During the one-leg bridge with knees extended and right foot on ball, muscle activity from the GMa was significantly greater with DF compared to PF. During the one-leg bridge with knees flexed and right foot on ball, there was no significant difference in muscle activity between PF and DF positions.

CONCLUSIONS: Of the 5 bridging exercises assessed, GMa was greater in DF than PF in only 1 exercise, and LH was greater in PF than DF in only 1 exercise, which implies that DF does not consistently result in greater GMa activity and less hamstring activity during bridging exercises on a ball. Moreover, DF did result in overall greater hip and trunk activity compared to PF during these bridging exercises.

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Threshold for EMG Onset Detection of Trunk Muscles In Golf Swing

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(No relationships reported)

PURPOSE: The aim of this study was to compare temporal parameters of the trunk muscles EMG activation with two different threshold methods.

METHODS: Eight subjects performed ten golf swings (five with pitch, five with 4-iron). Surface EMG was recorded on both sides of trunk muscles: Rectus Abdominis (RA), External