Introduction: Scoliosis influences the optimal posture and locomotion of the human body. Lumbar and thoraco-lumbar scoliosis has possibly an even greater impact due to the close relation with the pelvic region, a major determinant of gait. The effect of moderate idiopathic scoliosis on the gait cycle of young adults is of major interesting.

Discussion-Hypothesis and aims: Young adults (20-40 years old) with MIS (lumbar and thoraco-lumbar primary curves) present kinematic modifications regarding the convex (ipsilateral extremity) or concave (controlateral extremity) side of the body as well as variations compared to non-scoliosis individuals during the gait cycle. Aim of this study was to indentify these variations on the physical quantities exerted from the major joints of the lower extremities as well as the center of gravity too and examine their significance in adult patients with MIS.

Materials and methods: A cohort of twenty young adult patients (group A, 12 females- 8 males, mean age 39,7 years) having MIS with mean Cobb's angle 29^o (24^o to 34^o) and a control group (B) of fifteen (8 females, 7 males) of healthy individuals were submitted in clinical examination and 3-D gait analysis. Direct linear transformation (DLT) was used for analysis of linear displacement on the three axes (x, y and z) as well as 3D velocity and acceleration. The anatomical sites evaluated were concerning hip joint (greater trochanter), knee joint (lateral condyle) and ankle joint (lateral malleolus). Additionally, the gait cycle as well as the knee range of motion was examined. and the transition of the center of gravity (CoG).

Results: Mid leg length discrepancy (1,2cm ±0, 2, C.I 95%) was evident in scoliosis patients. Body-weight distribution between lower extremities was unevenly distributed in group A, $p<0,05$. The gait cycle in scoliosis patients showed increased duration compared to non scoliosis group patients. The ipsilateral side (to the convex side) had a mean gait cycle 1,42sec (±0,11sec) and the controlateral side (to the concave side) had a mean gait cycle 1,39sec (±0,076 sec). Group B had a mean gait cycle at 1,21 sec (±0,073), significantly faster, $p<0,05$. Regarding side to side comparison of the lower extremities in group A the following outcomes were identified: Hip and CoG were found to have greater sagittal (forward / backward) displacement on the ipsilateral side (to scoliosis curve) compared to the controlateral by 29,6% and 32,8% respectively ($p<0,05$). Knee joint linear displacement in the ipsilateral side was 25,7% (increased), regarding sagittal axis, $p<0,05$. Ankle joint linear displacement in the ipsilateral (convex) side showed 33,2 % (increased), regarding sagittal axis, $p<0,05$. When compared group A to group B the following differences found: The hip joint in the ipsilateral side demonstrated frontal displacement increased by 16,6% compared to group B, c) The hip joint in the controlateral side had frontal (medial / lateral) displacement increased by 12,6% and sagittal displacement decreased by 30,1%, compared to group B ($p<0,05$), d) The CoG in the controlateral side had mean sagittal displacement decreased by 28,6%, $p<0,05$ while in the ipsilateral side the difference was not significant. The knee joint in the ipsilateral side (group A) had mean (z) frontal displacement 19,1% (increased), $p<0,05$. The knee joint in the controlateral side had mean sagittal (x) displacement 26,5% (decreased), the mean frontal displacement and the mean vertical (y-upwards / downwards) displacement in group A were 17,5% and 40,5% (increased) respectively, $p<0,05$. The ankle joint in the ipsilateral side had mean sagittal and frontal displacement, 36,2% and 26,4%

(increased) respectively, $p<0,05$. The ankle joint in the controlateral side had 22,8% mean frontal displacement (increased), $p<0,05$. The knee range of motion in scoliosis patients was seriously reduced during gait cycle. The ipsilateral knee joint had at initial contact (heel strike) 93% lesser extension. At initial and mid swing phases 37% and 32% lesser flexion, compared to control group, $p<0,05$. The controlateral knee had 94% lesser extension at initial contact, $p<0,05$. A initial and mid swing phases 36% and 31% lesser flexion, $p<0,05$.

Conclusion: Studies showed that scoliosis patients (MIS) presented asymmetries in the gait pattern and possible gait compensation on the controlateral extremity. Produced higher sway area in all axes than normal subjects but the stance phase and stride phase are similar to normal subjects. A sagittal knee motion restriction and a step length reduction by 6 cm on average were shown. In this study of patients with MIS and mild LLD, the gait cycle had increased duration compared to healthy people. Asymmetries exerted amongst the ipsilateral and controlateral hip, knee and ankle joint as well as the CoG during the gait cycle. Also asymmetries found in comparison to healthy people suggesting some kind of deformity and stiffness due to scoliosis. Some of these asymmetries agree to other studies and while others not. Pathologies affecting the gait cycle phases like inadequate extension or flexion may be responsible for a shorter stride length in conjunction to a higher sway radius of the distal parts of the lower extremities. A compensatory walking which was relatively close to normal walking existed. These statistical significant differences might prove to be helpful in evaluating and treat the gait cycle and can create a basis for intervention as well as further studies on biomechanics and entities like athletic and occupational performance, sense fatigue and pain symptoms.

Keywords: Adult Idiopathic scoliosis, gait cycle, DLT method, lower extremities.