THE EFFECT OF THE SPONDYLOLISTHESIS ON THE FEMORAL HEAD LOADING

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To determine the effect of the sponsyloyisthesis on the femoral head loading analysis of the lumbar spine, 20 radiograps of healty young medical students and the 20 spondylolysthetic patients in the neutral erect positions were carefully selected. Analysis of coordinates of the each vertebra to femoral head center was done. Too little is known of the mechanical factors in the spondylolysis for a definition of the posture which put the femoral head greatest risk.

INTRODUCTION

The present study was planned to show the spondylolysthetic motion analysis of each lumbar vertebrae. The forces which tend to displace one vertebra forward on the below arise from three main sources: The effect of gravidty on the body above the level of slip; The activity of the muscles of the spine and trunk; and from movement, whether generated externally or from within the body (14). The changes in the radiogaphic coordinates of the femoral head center, as well as the instantaneous axis of rotation (IAR), were measured. This method has been used as an index for analysis of the motion pattern of the joint of the extremities (6). For this analysis, a large number of selected radiographs of healty voluntary medical students (young adults) and the spondylolisthetic patients in the neutral erect positions were used.

MATERIAL AND METHODS

Lateral radiographs of 20 medical students (13 male 7 female, ranging age from 22 to 28 years) were taken in the neutral erect postions. The radiographs satisfying the following criteria were selected for analysis: clear and very accurate picture, no anomaly or acquired deformation in the lumbasacral region, and no pain in the lower back or legs. Also, we measured the 20 spondylolysthetic patients radiography. As a result, the optimal radiographs of (23 male and 17 female, ranging in age from 22 to 68 years, with a mean age of 41 years) were selected. Frontal and lateral radiographs were taken with each subject in the stationary erect position, with the position of the soles and vertex fixed. The roentgen tube to film distance was 175 cm, and the center of the roentgenogram was set at 2 cm below the umblicus. Measurement of the Instantaneus Axis of Rotation: The IAR was measured for each of the L_4-L_5 and L_5-S1 vertebrae to femoral head on the basis of lateral film neutral erect positions. The IAR for each femroal head to vertebrae was determined according to Roluleaux's method (6). The IAR was defined by the upper anterior and upper posterior corners of each vertebra and the femoral head center. The coordinates were thus obtained for the determination of the IAR for each vertebra for femoral head (Fig 1a). The coordinate scales were adjusted to obtain an anteroposterior (AP) diamter of each vertebral body of 40 mm (average value of the AP diameters in 40 medical students), so that all the x and y values for the IAR obtained were also studied.

RESULTS

Vectorial analysis examination between center of the femoral head and spondylostisthetic vertebral segments were shown in figure 1. The angles between femoral head center and anterior inferior an inferior posterior edge of each L4-5 vertebrae, and also between upper end plates of sacrum were measured in lateral lumbosocral roentgenograms.

The angle between femoral head center and anterior and posterior edge of the upper sacrum were measured at an average of 11°. The average angle between femoral head center to inferior anterior and inferior posterior edges were 12°. The same angle which measured for L_4 were avarage 11°. The avarage angle between femoral head center and L_5 vertebra were

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measured: 12±0.3 in grade 1 spondylolisthesis, 18.0 in in grade 2 and 13.5 in grade 3 spondylolistheisis. According to this results, the angle between femoral head center and vertebral segments is more changed in L5 spondylolisthesis than L4 Spondylolisthesis. In addition to this, the angle between femoral head center and vertabrae shows an increase according to increase in slipping grade. In addition of the each vertebral spondylolysthetic vertebral segments would be put on the femoral head loading:

$W4 = W1 + W2 + W3 + \Delta W1 + \Delta W2 + \Delta W3 + \Delta P1 + \Delta P2 + \Delta P3$ and

$W4 = W + e1 \quad W1 + e2 \quad \Delta W2 + e3 \Delta W3.$

W = Weight, P= Tensile force in erector spinae, e = vertebral center displacement.

DISCUSSION

Spondylolysis and spondylolisthesis are common problems in orthopaedic surgery. There is a lot of study about biomechanical factors of spondylolysis and spodylolisthesis (1, 2, 3, 5, 6, 8, 10, 11, 12, 13, 14, 15). The relationship of the spine and trunc mucles vertebral segments and pelvis had been well demostrated in the studies (5, 14). But the distribition of forces on the femoral head in spodylolisthesis had not yet been studied well, and there is only theorical and very little knowledge about this situation. Hip pains in some spodylolisthetic patience is stimulated us to think about the force distrubution on the femoral head in spondylolisthesis. We think that the anterior displacement of the vertebra changes the forces effecting to the femoral head. In this study vectoral analysis of force distribition on the femoral head inspondylolisthesis has been studied. To measure the force which effects to the femoral head is very difficult in real manner. But it has been demonstrated that the slipped vertebra in spondylolisthesis, changes the force distribution on the femoral head. Any study about this stuation has not been found in literature. We think that this study can be a leader of the other study about this stuation.

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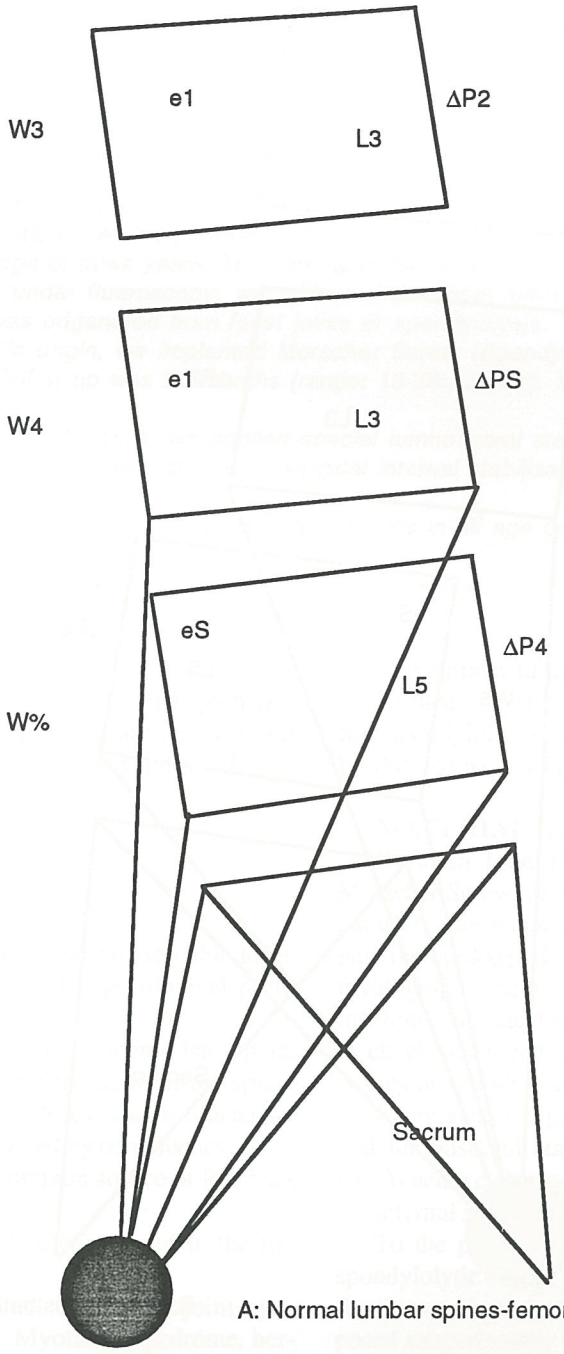
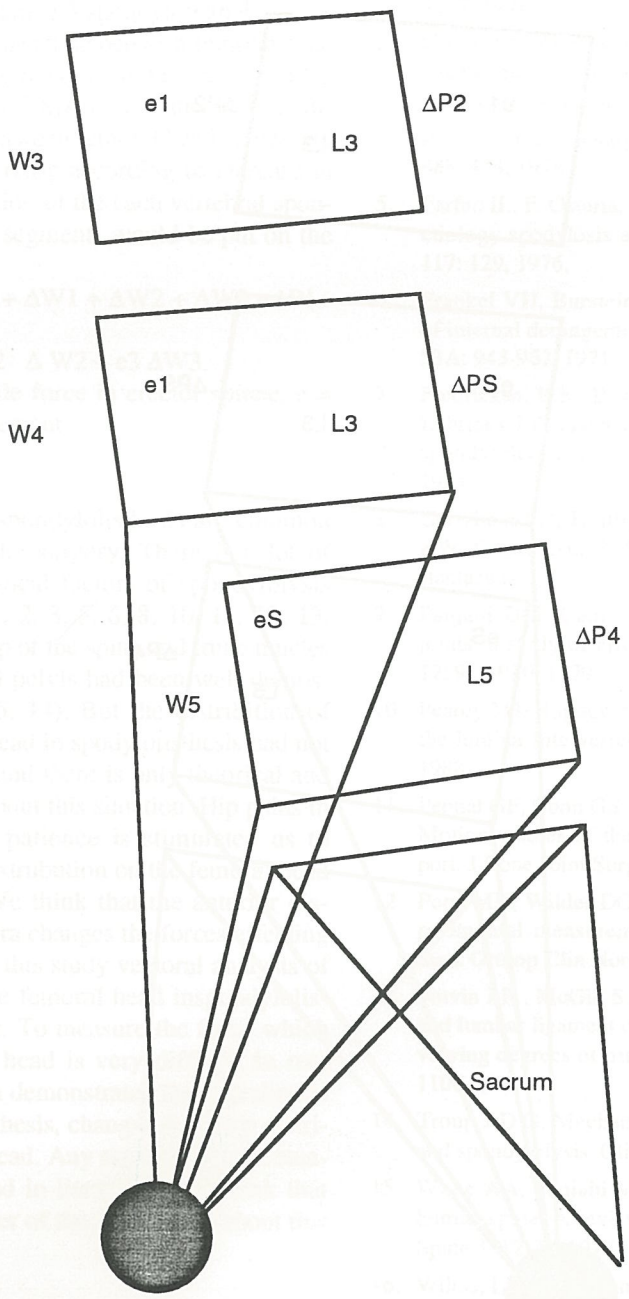


A: Normal lumbar spines-femoral head center angle



B: Spondylolisthetic spines angle.

Figure 1. Measurement of the angle of lumbar spine and femoral head cente.