INTRODUCTION: Facet joint osteoarthritis and disc degeneration are important causes of mechanical low back pain. Facet joint osteoarthritis may follow disc degeneration or occurs concurrently [1]. Diagnosis of facet joint pain is important for conservative treatments as well as invasive treatments, such as artificial disc replacement. Narrowing of the facet joint space width is one of important parameters of facet joint osteoarthritis and coexists with or follows intervertebral disc degeneration. We hypothesized that the narrowing facet joint space width was correlated with decreasing disc height in disc and facet degenerative changes, and facet joint osteoarthritis is related with decreasing disc height and narrowing facet joint space width and causes low back pain. The purpose of the current study was to investigate three dimensional (3D) disc height and the facet joint space width in age-matched asymptomatic subjects and subjects with chronic low back pain using a custom subject-based 3D CT model.

METHODS: Forty subjects (20 asymptomatic subjects, group A, 20 symptomatic subjects with discogenic low back pain, group B: age range: 30-58 years with 19 females and 21 males) underwent CT scans (IRB approved). The model consisted of 3D geometrical data of the endplates and facet joint surface from T12L1 to L5S1 reconstructed from CT images for each subject. The disc height was defined as the least 3D distance between two endplates (Fig. 1) [2]. The facet joint space width was defined as the least distance between the inferior and superior joint surfaces (Fig. 2) [3, 4]. The disc height and facet joint space width were defined as the least 3D distance between two surfaces and measured using the custom software (disc height: (Fig. 1) [2] and facet joint space width (Fig. 2) [3,4]). The mean joint space width between left and right facet joints was calculated for the segment analysis. Differences between asymptomatic and symptomatic subjects were compared using an unpaired t-test and correlations between disc height and facet joint space width were measured with Pearson’s correlation (α=0.05).

RESULTS: 240 lumbar segments from T12L1 to L5S1 were evaluated. There were no differences between right and left facet joint space width. Therefore, averaged values between right and left facet joint space width at each level were used for the following analyses. Disc height (at L3L4, L4L5, and L5S1 levels) and facet joint space width (at all levels) were lower in group B as compared to group A (Table 1). There was a significant positive correlation between facet joint space width and disc degenerative change for group A (Rho=0.54, p<0.0001), and group B (Rho=0.50, p<0.0001). The ratio of disc height and facet joint space width in group B was higher as compared to group A (5.11±1.29 and 4.57±0.98, respectively; p=0.0003), indicating that the rate of change in facet joint space width was more than in disc height in symptomatic subjects.

DISCUSSION: The current work is the first to investigate both disc height and facet joint space width in the same lumbar subjects in vivo. This study utilized a novel subject-based 3D CT model, which accurately measured disc height and facet joint space width [5]. Both disc height and facet joint space width were narrowed in symptomatic patients as compared to normal volunteers. This study showed that facet joint space narrowing is more sensitive change than disc height for symptoms of mechanical pain. This result implies that narrowing of the facet joint may be an important cause of low back pain in addition to disc degeneration. The etiology of low back pain may be in the morphologic changes, especially in facet joints. Although the biomechanical changes were not yet demonstrated, decreasing disc height would change the load transmission in facet joints [6,7]. Furthermore, facet degeneration may have resulted from different pathways other than disc height decrease, such as vertebral instability and aging. Further studies are needed to correlate disc or facet joint degeneration with the current results and to define the kinematics in disc and facet joints and the relationship with aging.

REFERENCES:

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