Radiographic evaluation of the instability in degenerative lumbar scoliosis

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Introduction
Degenerative lumbar scoliosis (DLS) is often seen in elderly patients. Patients suffer from low-back pain, radiating leg pain, and intermittent claudication. Choice of surgical method depends on the magnitude of curvature, spinal instability, and the patient’s symptoms. However, there are few reports about definition of segmental instability in DLS. The aim of this study is to assess the segmental instability in DLS patients compared with lumbar spinal canal stenosis (LCS) patients.

Material and methods
Patients’ demographics
Fifty one patients (21 males and 30 females) with DLS and 50 patients (21 males and 29 females) with LCS were recruited for this study. The mean age is 70.2 years in DLS group and 70.9 years in LCS group.

DLS group
Patients with a Cobb angle of >10° were defined as DLS. Curves in all patients were classified as “de novo” scoliosis.

LCS group
Patients with a Cobb’s angle of >5° were defined as LCS group. Spondylolisthesis, and spondylolysis, history of previous lumbar surgery, fracture and congenital deformity were excluded from the LCS group.

We defined wedging segment as Cobb angle of >5°, and compared several radiographic parameters between of wedging segments of DLS group, and non-wedging segments of LCS group.

Table 1. Data of objects and controls.

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<th>DLS</th>
<th>LCS</th>
<th>p-value</th>
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<td>50</td>
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<tr>
<td>age(years)</td>
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<td>70.9</td>
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<tr>
<td>sex(male : female)</td>
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<td>21:29</td>
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<tr>
<td>number of wedging segment</td>
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</tr>
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Radiographic parameters
We measured the following radiographic parameters using software (Scion Image software: Scion Co., Frederick, MD); Standing anteroposterior (AP) films (Fig 1),
1. Cobb angle
2. Segmental wedging angle
3. Lateral slip
4. Osteophyte formation using Nathan’s methods (1962, Nathan H et al. JBJS-A; Fig 2)
Bending films (Fig 3)
5. ROM
CT axial views
6. Joint space discrepancy (Fig 4)

Figure 1. X-ray AP view A) Cobb angle, B) Segmental wedging angle, C) Lateral slip

Figure 2. Degree of osteophyte formation using Nathan’s method

Figure 3. Lateral bending film. ROM = A + B

Figure 4. Spaces of Facet Joints. Joint Space Discrepancy = B - A (B > A)

Statistical analysis
All data were analyzed statistically by Student’s t-test and paired t-test was applied as necessary. For all tests, significance was defined at P<0.05. The correlation was analyzed by spearman’s correlation ratio.

Results
Average lateral slip, osteophyte formation, and joint space discrepancy in DLS group are significantly greater than those in LCS groups. There is not significant difference in averaged ROM between two groups. However, analysis of ROM in each Nathan's classification showed that ROM in DLS is significantly greater than ROM in LCS group.

Additionally, ROM toward concave side is significantly greater than ROM toward convex side in DLS group. The analysis for relation between ROM and Nathan’s grading indicated negative correlation (R²=0.5696, Fig 5).

Figure 5. The correlation between ROM and Nathan’s grading

Discussion
This study showed that the ROM of wedging segment in DLS group is significantly greater than that of non-wedging segment in LCS group. And, vertebral body moved greater toward concave side than toward convex side in DLS. Additionally, wedging segments had larger lateral slip and joint space discrepancies of the facet joint and led to lateral slip in DLS, and (2) instability is getting smaller, whenever osteophyte formation is getting larger.

Therefore, we speculated that segmental instability in DLS occurs because of asymmetric disc degeneration and leads to subluxation of the facet joint greater lateral slip, and segmental instability is braked by osteophyte formation.