

## THE MOVEMENTS OF THE HUMAN L-SPINE WITH DEGENERATIVE CHANGE

<sup>1,2</sup> Dai-Soon Kwak, <sup>1</sup> Dong-Ho Kim, <sup>1</sup> Ho-Jung Cho, <sup>1</sup> Sang-Hyun Kim, <sup>1</sup> Deog-Im Kim

<sup>1</sup>Catholic Institute for Applied Anatomy / Department of Anatomy,  
College of Medicine, The Catholic University of Korea, Seoul, Republic of Korea

<sup>2</sup>email: daisoon@catholic.ac.kr, web: www.ciaa.re.kr

### SUMMARY

In this study, we performed the ROM (range of motion) tests of Korean L-spine by flexion/extension/lateral bending and axial rotation. Also, we tried to find the population difference in ROM and the difference with degenerative change. The results of cadaver test, the ROM of this study (Korean) was larger than previous study about other populations [1,2]. The flexion, extension and lateral bending showed decreasing range of motion with increasing degree of degeneration. On the other hand, there was no increasing or decreasing with degenerative change in axial rotation.

### INTRODUCTION

The spine is complex joint for flexibility of motion. Various in vitro studies of the lumbar spinal movements were performed. Early stage studies were about the movement of normal specimens. Some studies talked about the difference after implantation. Recently, the movement changes with degeneration were studied [1]. However, we could not find the research about the oriental populations (Asian). In this study, we performed the movement tests of Korean L-spine with flexion/extension/lateral bending and axial rotation. Also, we studied about the population difference of movement and the difference with degenerative change.

### METHODS

Forty two Korean fresh cadavers were used. The average age of the specimens was 73 (47-94) years, and the average height was 159.10±8.75cm. We took the antero-posterior and the lateral x-ray scan for grading of degenerative change. We applied Wilke et al method for grading of degeneration [3]. After x-ray scan, 82 specimens (L2/3: 40, L4/5: 42) were harvested by surgical method with the anterior/posterior longitudinal ligament, ligamenta flava, supra/inter spinous ligament.

**Table 1:** Number of specimens with grade of degeneration

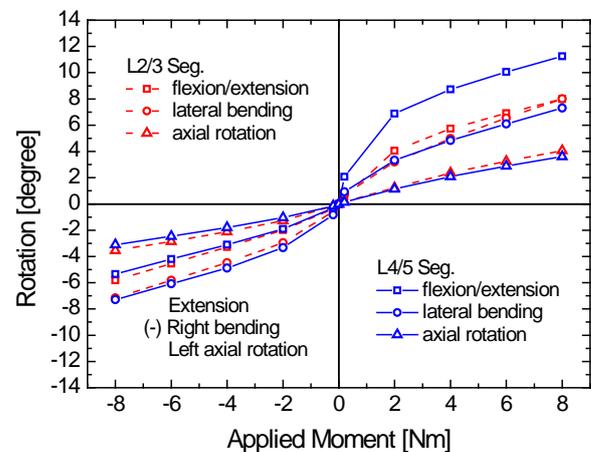
Region	Grade 0	Grade 1	Grade 2	Grade 3
L2/3	12	7	7	14
L4/5	12	13	7	10
Total	24	20	14	24

Both ends of specimens were mounted firmly by PMMA and wood screw. We used own wire-pully system for apply pure moment to specimen [4]. Universal test machine (5567,

Instron, MA), six-axes load cell (MAS-333, CASS, Korea) and inclinometer (SCA-121T, VTI, Finland) were used to perform the movement test. The flexion, extension, lateral bending and axial rotation tests were performed.

### RESULTS AND DISCUSSION

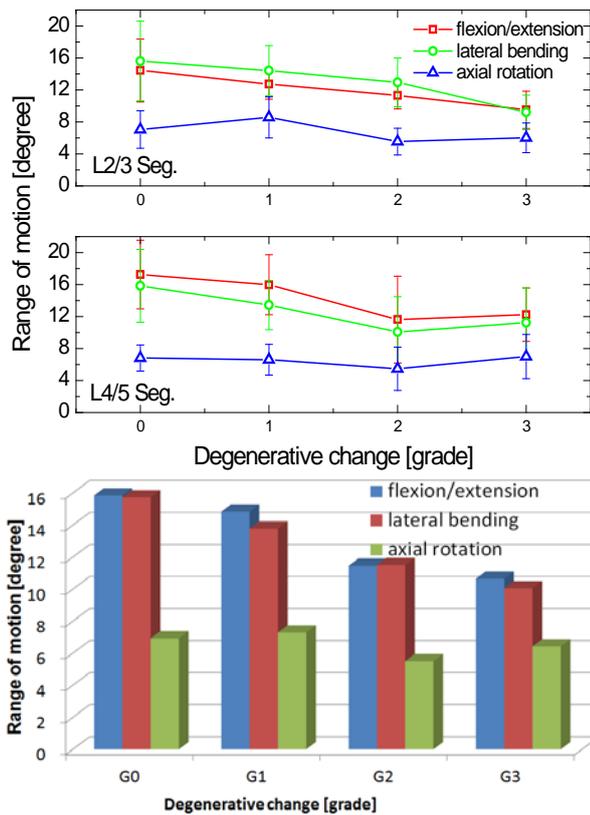
The results of 44 (L2/3:19, L4/5:25) normal specimens (grade 0, 1) showed the following range of motion at 8Nm pure moment. L2/3 segment showed  $-5.81\pm 2.38^\circ$  for extension,  $9.99\pm 1.83^\circ$  for flexion,  $7.59\pm 2.36^\circ$  for lateral bending and  $3.80\pm 1.32^\circ$  for axial rotation. L4/5 showed  $-5.34\pm 2.21^\circ$  for extension,  $11.25\pm 3.64^\circ$  for flexion,  $7.30\pm 5.23^\circ$  for lateral bending and  $3.35\pm 0.95^\circ$  for axial rotation. The range of motion of flexion was larger of L4/5 than L2/3 ( $p<0.05$ ).



**Figure 1:** The results of movement tests for normal specimens (grade 0, 1).

**Table 2:** Range of motion (unit: degree) with degeneration grade (moment -8Nm ~ +8Nm)

	G0 (N=24)	G1 (N=20)	G2 (N=14)	G3 (N=24)
Flexion/ extension	15.85 ±4.27	14.85 ±3.55	11.46 ±3.87	10.65 ±3.05
Lateral bending	15.73 ±4.66	13.78 ±3.04	11.51 ±3.94	10.05 ±3.32
Torsion	6.92 ±1.98	7.29 ±2.31	5.51 ±2.16	6.43 ±2.27



**Figure 2:** The changes of ROM with degeneration grade.

In this study, we found the changes of ROM (range of motion) caused by degeneration. Normal specimens (grade 0) showed  $15.85 \pm 4.27^\circ$  ROM for flexion/extension,  $15.73 \pm 4.66^\circ$  for lateral bending and  $6.92 \pm 1.98^\circ$  for axial rotation, respectively. But, severe degenerative changed specimens (grade 3) showed  $10.65 \pm 3.05^\circ$  for flexion/extension,  $10.05 \pm 3.32^\circ$  for lateral bending and  $6.43 \pm 2.27^\circ$  for axial rotation, respectively. There was decreasing of ROM with increasing degree of degeneration for the flexion/extension and lateral bending test. We could find the statistical difference between normal specimens and the specimens of grade 2 or 3 ( $p < 0.05$ ). But we could not find any statistical difference at axial rotational tests.

## CONCLUSIONS

The range of motion of this study (Korean) was larger than previous study about other populations [1,2]. The results flexion, extension and lateral bending showed decreasing range of motion with increasing degree of degeneration. On the other hand, there was no increasing or decreasing of ROM with degenerative change in axial rotation.

## REFERENCES

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