

Range of Motion of Cervical Spine in Normal Korean People

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- Abstract -

Study design: A prospective study is to evaluate the cervical range of motion through the analysis of the plain films of the cervical spine.

Objective: To provide criteria validity for the cervical lordosis, range of motion and segmental motion of each segment using normal Korean adults, as guide lines for the radiographic diagnosis and treatment of cervical diseases.

Materials and Methods: One hundred and four healthy Korean adults were examined. Roentgenographic lateral views were taken in neutral, active flexion and extension positions. Measurement of the range of motion and segmental motion of the cervical spine, using the technique of Penning and Bakke, were independently made by two observers.

Results: The mean angle of the lordosis and the range of motion were $19.8^{\circ} \pm 8.4^{\circ}$ and $63.1^{\circ} \pm 11.2^{\circ}$, respectively, and the range of motion of each segment were $10.3^{\circ} \pm 2.9^{\circ}$; $9.2^{\circ} \pm 3.0^{\circ}$; $13.5^{\circ} \pm 7.2^{\circ}$; $15.1^{\circ} \pm 4.3^{\circ}$; $15.6^{\circ} \pm 4.4^{\circ}$ and $13.0^{\circ} \pm 5.0^{\circ}$ on C1-2, C2-3, C3-4, C4-5, C5-6 and C6-7, respectively. There were no differences in the lordotic angle between the ages and genders. The range of motion decreased with increasing age, but there was no difference between genders. The segmental motion was no different between genders, but decreased significantly with increasing age on segments C1-2, C5-6 and C6-7.

Conclusions: No significant differences were found in the range of cervical motion of each segment and the lordotic angle of the Korean population compared with those of other populations. The range of cervical motion also decreased with increasing age. These data provide guidelines in the dynamics of cervical spine and for the roentgenographic diagnosis and treatment of cervical diseases.

Key words: Cervical spine, Range of motion, Korean people

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3-6) (Table 1), Bakke

가가 , (Fig. 2B)³⁾, 7 가

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6-7 Penning⁶⁾ (Fig. 2C)

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2 2 SAS(T-test, ANOVA, Repeated measure ANOVA) p<0.05

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1. , , 가 10 104 (50 , 54) 39.1 (20 68), 45.6 (24 69) (20 , 1. 30 , 40 , 50 , 60) 30

2. 20 20.8 °± 9.7 °, 30 21.1 °± 8.4 °, 40 16.5 °± 8.2 °, 50 19.6 °± 8.0 °, 60 20.9 °± 7.4 ° , 가 20.7 °± 9.4 °, 18.9 °± 7.2 ° . 19.8 °± 8.4 °

X-ray film (p=0.39, p=0.28)(Table 2).

X-ray tube 21.9 °± 7.9 ° 20.4 °±

가 150 cm . 6.8 ° 가 , (p=0.50).

Table 1. Summary of the Normal Values Established by Different Authors(°)

| | Bakke | Buetti-Bauml | De Seze | Penning | Dvorak | Authors |
|-------|-------|--------------|---------|---------|--------|---------|
| C1-C2 | 11.7 | | | | 12 | 10.8 |
| C2-C3 | 12.6 | 11 | 13 | 12.5 | 10 | 9.9 |
| C3-C4 | 15.4 | 17 | 15.5 | 18 | 15 | 14.7 |
| C4-C5 | 15.1 | 21 | 19 | 20 | 19 | 18.4 |
| C5-C6 | 20.4 | 23 | 27.5 | 21.5 | 20 | 18.3 |
| C6-C7 | 17.0 | 19 | 17.5 | 15.5 | 19 | 15.3 |

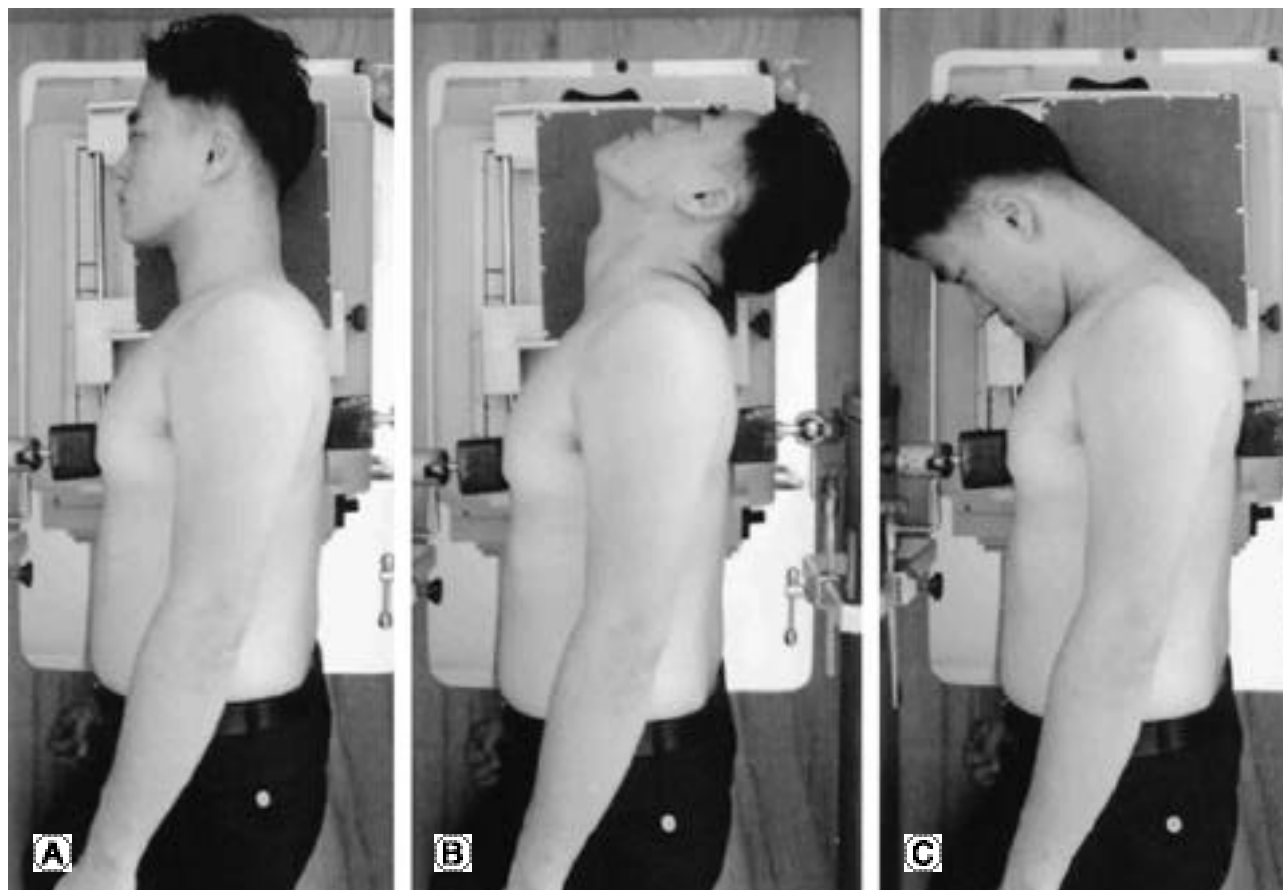


Fig. 1. (A) Neutral standing position, the thorax fixed by two pellets from ventral and dorsal; (B) Active Extension, (C) Active flexion.

(p=0.91).

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30 66.3 °± 10.8 °, 40 63.3 °± 9.7 °, 50 60.0 °± 9.0 °;
60 54.9 °± 7.3 °
63.3 °± 12.6 °
(p=0.00),
(p=0.81).
75.4 °± 8.7 °
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12.7 °± 2.4 °, 30 10.3 °± 3.6 °, 40 11.5 °± 3.8 °, 50
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10.8 °± 2.9 °
2-3 10.3 °± 2.8 °, 9.0 °±
3.7 °, 8.6 °± 3.0 °, 9.8 °± 2.6 °, 8.5 °± 2.8 °
9.2 °± 3.0 °
3-4 13.6 °± 3.2 °
13.4 °± 3.7 °, 12.1 °± 3.0 °, 13.3 °± 3.5 °, 15.1 °± 3.5 °
13.5 °± 7.2 °
4-5

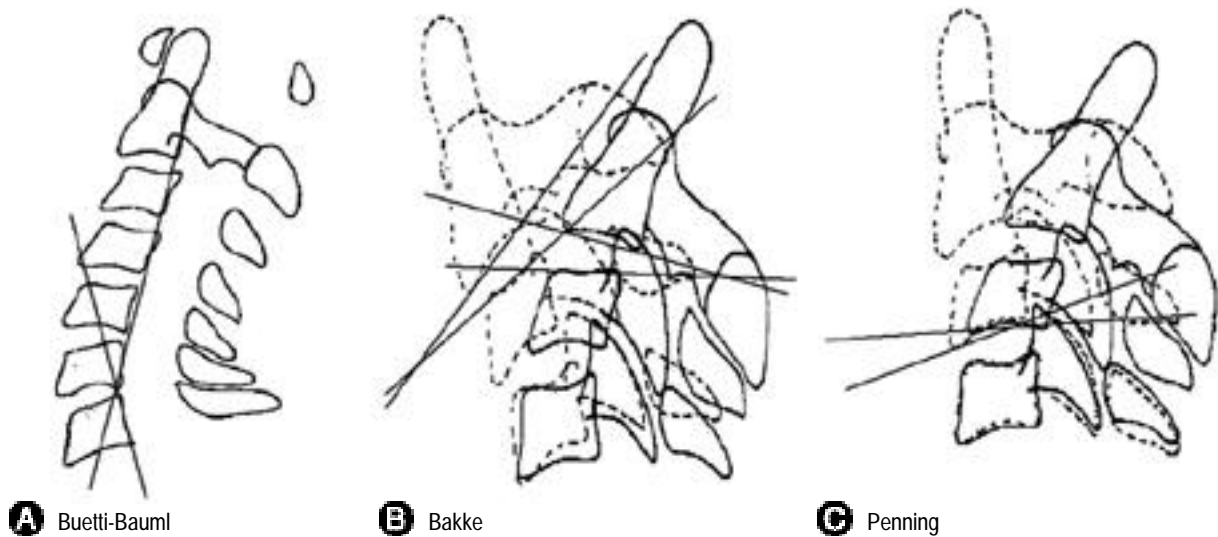


Fig. 2. Technique of measurement. (A) Buetti-Bauml technique, (B) Bakke technique, (C) Penning technique.

Table 2. Cervical Lordosis(°)

| Age | Male | Female | Mean ± SD* |
|-------|------------|------------|------------|
| 20-29 | 19.3 ± 9.9 | 22.4 ± 9.2 | 20.8 ± 9.7 |
| 30-39 | 21.4 ± 9.5 | 20.7 ± 7.6 | 21.1 ± 8.4 |
| 40-49 | 17.6 ± 9.4 | 15.4 ± 5.6 | 16.5 ± 8.2 |
| 50-59 | 19.6 ± 9.6 | 19.6 ± 7.1 | 19.6 ± 8.0 |
| 60- | 25.7 ± 6.8 | 16.0 ± 4.1 | 20.9 ± 7.4 |
| Mean | 20.7 ± 9.4 | 18.9 ± 7.2 | 19.8 ± 8.4 |

*SD: Standard deviation

16.0 °± 4.8 °, 15.6 °± 5.1 °, 15.0 °± 3.2 °, 15.3 °± 4.2 °, 13.7 °± 4.0 °, 15.1 °± 4.3 °, 5-6 18.8 °± 3.5 °, 17.4 °± 4.1 °, 16.1 °± 4.1 °, 13.0 °± 3.8 °, 13.3 °± 3.6 °, 15.6 °± 4.4 °, 6-7 15.5 °± 6.1 °, 14.4 °± 4.9 °, 13.3 °± 4.6 °, 10.8 °± 4.2 °, 60 11.5 °± 3.7 °, 13.0 °± 5.0 ° (Table 3).

1-2 11.4 °± 3.2 °, 10.6 °± 2.3 °, 2-3 8.5 °± 2.9 °, 9.9 °± 3.0 °, 3-4 14.0 °± 9.7 °, 13.0 °± 3.6 °, 4-5 14.8 °± 4.0 °, 15.4 °± 4.6 °, 5-6 15.1 °± 3.9 °, 16.1 °± 4.8 °, 6-7 13.3 °± 4.8 °, 12.7 °± 5.1 ° (Table 4).

(p=0.89), 가, 1-2, 5-6 6-7 가 (p=0.01, ml 4), p=0.00, p=0.01).

2 11.5 °± 4.3 °, 2-3 12.5 °± 2.9 °, 3-4 15.5 °± 3.0 °, 4-5 18.5 °± 4.3 °, 5-6 19.1 °± 5.5 °, 6-7 14.9 °± 3.7 °, 10.9 °± 3.2 °, 9.9 °± 2.7 °, 14.7 °± 2.4 °, 18.4 °± 4.5 °, 18.3 °± 3.7 °, 15.3 °± 4.3 ° 1-2, 2-3, 3-4, 4-5, 5-6 가 가, (p=0.78, p=0.57, p=0.43, p=0.50, p=0.71, p=0.20)(Table 5).

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5 15.1 °±4.3 °, -6 15.6 °±4.4 °, 6-7
13.0 °±5.0 °, 63.0 °±11.2 °
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