

## Changes of Adjacent Segment in Anterior Cervical Fusion

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– Abstract –

**Study design** : A retrospective radiographic and medical record analysis of 36 patients.

**Objectives** : To describe the incidence and consequence of the distribution of sagittal plane motion, across the adjacent cervical motion segment, after cervical fusion. Furthermore, to find the cause of the progression of degenerative changes in intervertebral discs adjacent to the fused segment.

**Summary of Literature Review** : Anterior cervical fusion has been widely used in the treatment of degenerative cervical spine. An increased incidence of degenerative disease may exist at the levels immediately adjacent to a cervical fusion. However, the frequency of these complications is probably overestimated, and their effect on clinical outcome remains unknown.

**Materials and Methods** : From 1990 to 1996, 36 patients who underwent anterior cervical spine fusion for degenerative disorders were reviewed retrospectively with an average follow up of 6.9 years. Lateral views in neutral position, in flexion, and in extension of the preoperative cervical roentgenograms were analyzed in comparison with the last follow-up films in the range of motion of the neck, and in the intervertebral angular mobility and anteroposterior displacement of the vertebral bodies, and finally to quantify the incidence of the spinal instability.

**Results** : Degenerative change in adjacent intervertebral level was observed in 16 of the 36 patients (44.4%), above the fusion in 10, below the fusion in 4, and both above and below the fusion in 2 cases. In addition, degenerative change in adjacent intervertebral level was observed in 68% of cases of loss of lordosis of the fused segment, and degenerative change occurred more frequently in younger patients to a statistically significant extent.

**Conclusions** : Loss of lordosis of the fused segment and young age are two factors promoting degenerative changes in adjacent intervertebral levels after anterior cervical fusion.

**Key Word** : Cervical spine, Anterior fusion, Adjacent disc degeneration

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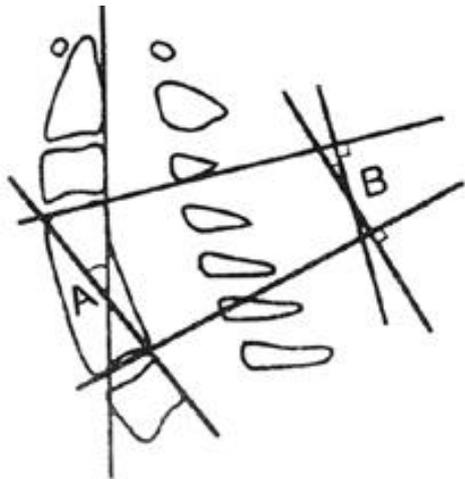
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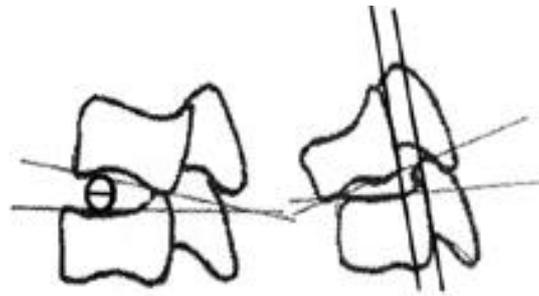
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**Fig. 1.** Measurement of the alignment of the entire cervical spine (angle A) and of the fused segment (angle B). Angle A was the angle between the line parallel to the dorsal border of the C2 and the that of the C7. Angle B was formed by the upper plane and the lower plane of the fused segment.



**Fig. 2.** Changes in the motion segment between vertebrae. Calculation of the angular displacement of the flexion/extension views.

Smith-Robinson<sup>5)</sup>

20	5	가	가	36
60	16	(	83	)
	52	.	가	

CSLP (cervical spine locking plate, Mathys, Switzerland)

	6	10	20
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2.

angle A),

(Fig. 1, angle B).

(Fig. 2).

- 1) (1 mm), 2)
- 3 mm, 3)

Dvorak<sup>11)</sup>

가

t-test Chi-Square test

1.

1990 1996

**Table 1.** Baseline Characteristics of the Study Population

	Total (n=36)	Normal adjacent level (n=20)	Degenerated adjacent level (n=16)	P value
Mean age(SD) <sup>†</sup>	50.2(9.4)	51.0(10.1)	42.4(10.9)	0.020
Gender(M/F)	20/16	11/9	9/7	NS*
Follow-up(months)	85.0(60-156)	88.4(26.2)	80.7(19.1)	NS*
Fused level(SD) <sup>†</sup>	1.75	1.9(0.6)	1.6(0.6)	NS*

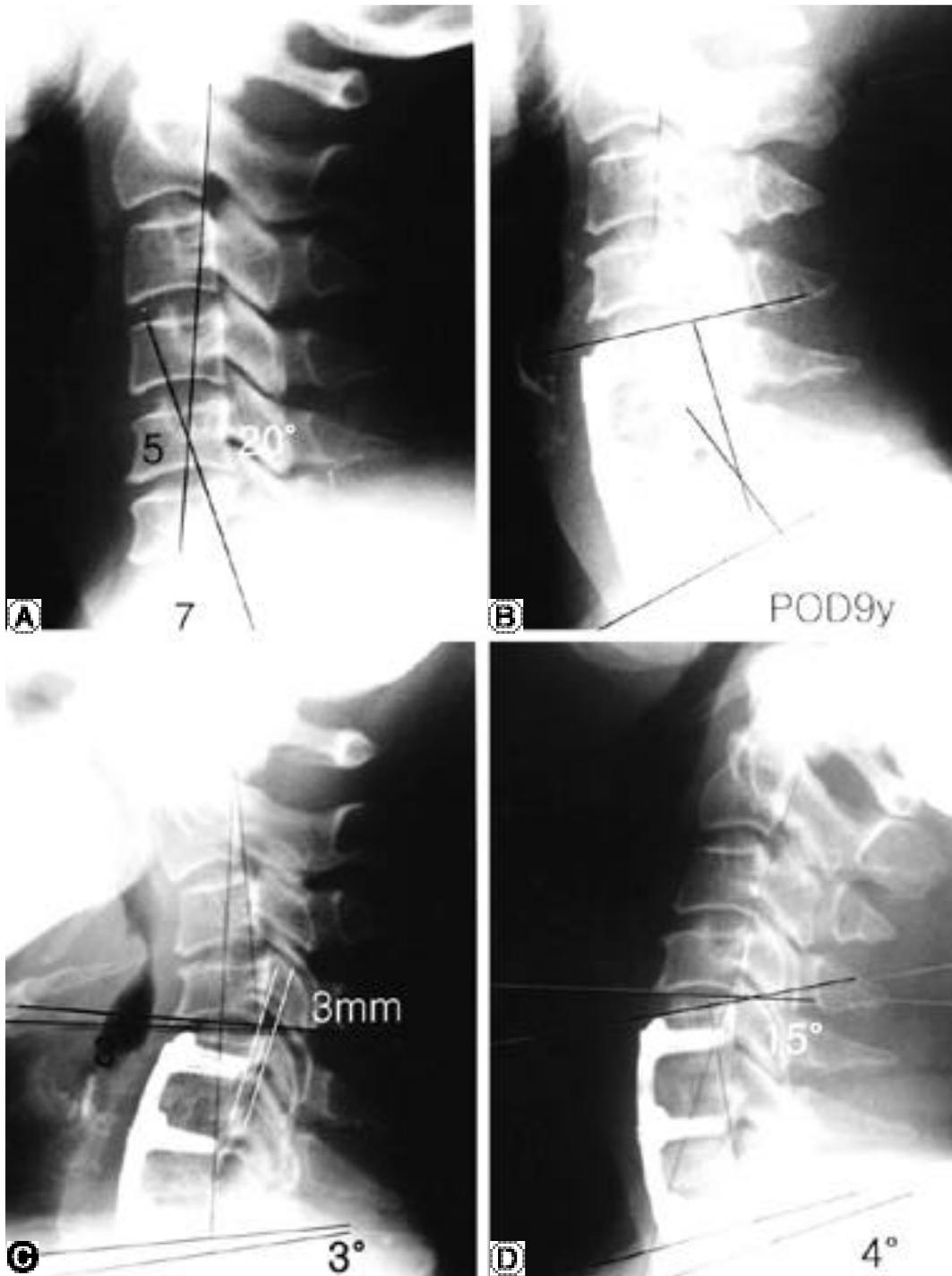
\*NS: Nonsignificant, <sup>†</sup>SD: Standard deviation

**Table 2.** Cervical Alignment in Study Group

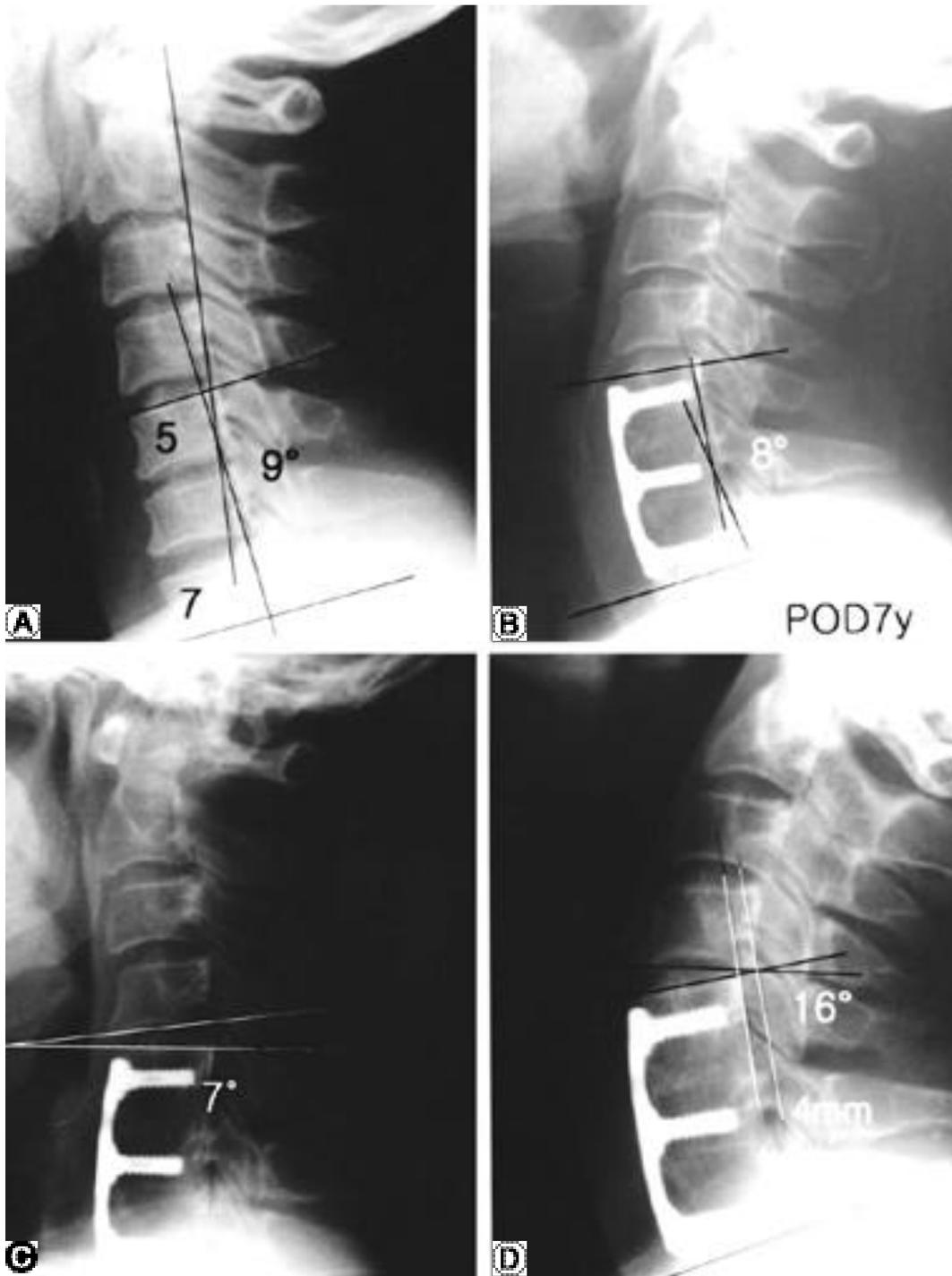
	Total (n=36)	Normal adjacent level (n=20)	Degenerated adjacent level (n=16)	P value
Preop angle A(SD) <sup>†</sup>	15.5	14.6(7.6)	16.6(7.2)	NS*
Postop angle A(SD) <sup>†</sup>	25.7	22.1(6.9)	22.9(10.2)	NS*
Preop angle B(SD) <sup>†</sup>	6.4	7.2(4.4)	5.3(3.5)	NS*
Postop angle B(SD) <sup>†</sup>	7.1	8.8(5.0)	4.8(4.3)	0.016
Curve pattern				NS*
Lordosis	31	18	13	
Straight	5	2	3	

\*NS: Nonsignificant, <sup>†</sup>SD: Standard deviation

31  
5 ,  
18 (90%),  
13 (81%) ,  
(Table 2).  
36 16  
(44.4%)  
10 , 4 , 2 3.  
, , ,  
가 ,  
(Table 1, 2).  
1 (2.8%),  
3 mm 10 (27.8%)  
(Fig. 3) Dovorak  
9 (25%) (Fig. 4).  
42.4  
, 51.0  
가 (p=0.020, Table 1).  
4.  
0.7 가 ,  
6.4 7.1  
2.  
8.8 ,  
15.5 (0~35),  
4.8  
(p=0.016, Table 2).  
25.7 (5~45) 10.2  
가 .



**Fig. 3.** A 45-year-old woman, disc herniation at C4-5-6 and treated with anterior decompression and fusion. (A) Preoperative lateral radiograph shows cervical lordosis 20 °, (B) Radiograph at postoperative 9-years follow-up shows solid union and maintained lordosis at fusion segment(17 °). (C)(D) At last follow-up, adjacent intervertebral segment shows degenerative change, angular motion is within normal limit but sagittal translation is 3 mm.



**Fig. 4.** (A) A 39-year-old man, preoperative lateral radiograph shows 9 ° of cervical lordosis. (B) At 7 years follow-up, lordosis of fused segment is 8 °. (C)(D) Lateral radiograph shows 4mm of anteroposterior translation and 23 ° of sagittal rotation.

14,15)

13)

16)

가 2

가

Katsuura <sup>16)</sup>

(slipping force) 가  
가 <sup>15)</sup>

가

가 가 가  
가 ,

가

<sup>17)</sup>

Katsuura <sup>16)</sup>

13% ,

53%

가

<sup>18,19)</sup>

23%,

39%

가

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Cineroentgenography

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가 <sup>20)</sup>  
가

가

, Panjabi<sup>21)</sup> 5-  
38%

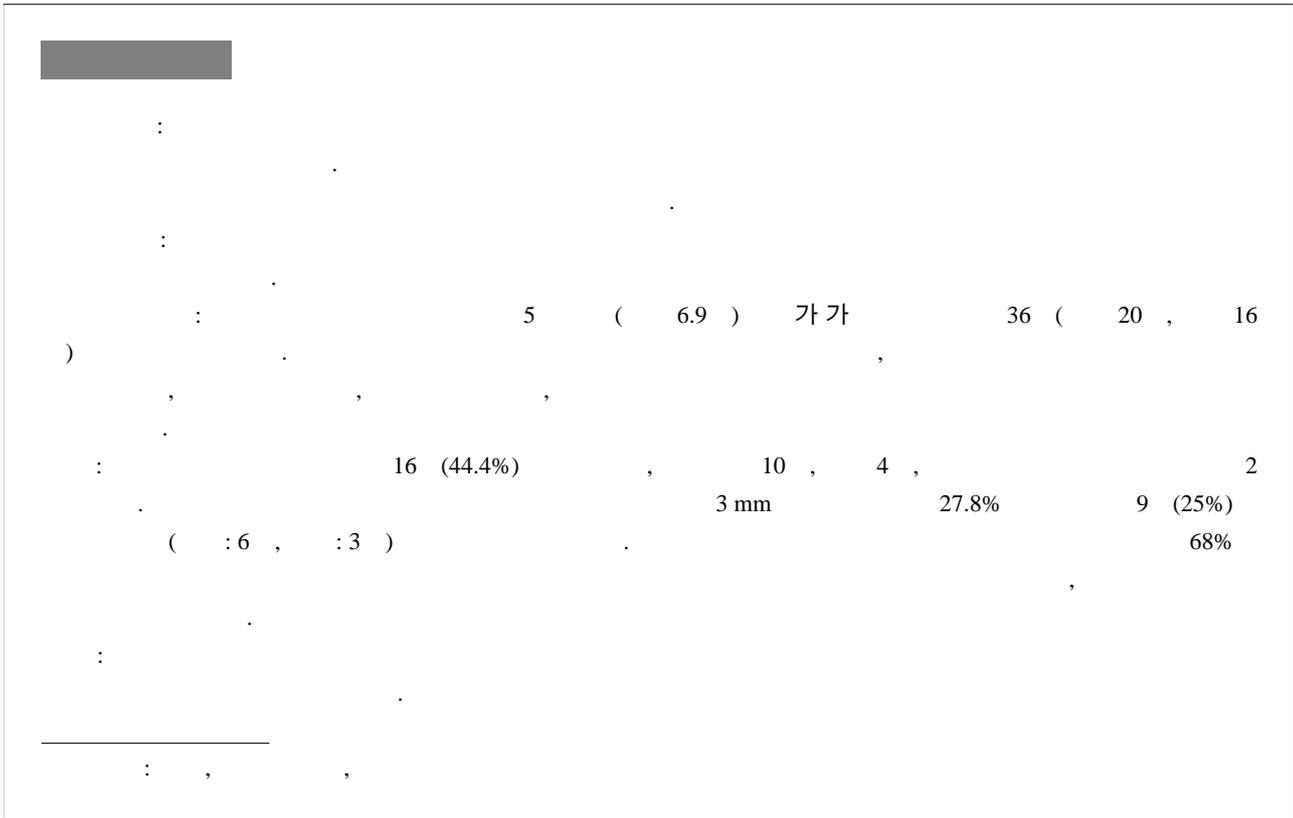
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71%

Baba <sup>22)</sup>

10 , 4 ,

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