

## Changes of Range of Motion and Sagittal Alignment of the Cervical Spine after Laminoplasty

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### – Abstract –

**Study Design:** This is a prospective study of 85 patients

**Objectives:** We wanted to identify the changes of ROM and sagittal alignment of the cervical spine after laminoplasty, and we wanted to determine the preoperative factors affecting the ROM and sagittal alignment of the cervical spine after laminoplasty.

**Summary of the Literature Review:** Cervical laminoplasty is an effective procedure for decompressing multilevel spinal cord compression. It has been reported that the ROM of the cervical spine was decreased after laminoplasty. It is well known that preoperative lordosis of the cervical spine is prerequisite for performing laminoplasty. Maintaining the postoperative lordosis of the cervical spine is also important for decompressing the spinal cord after laminoplasty.

**Materials and Methods:** Eighty-five patients who underwent open door laminoplasty from the C3 to C7 levels were prospectively studied. The minimum follow-up was two-years. The preoperative diagnosis was cervical spondylotic myelopathy (CSM) for 52 patients, ossification of the posterior longitudinal ligament (OPLL) for 29 patients and multilevel cervical disc herniation for 4 patients. Plain cervical spine lateral radiography in the neutral, flexion and extension positions was performed preoperatively and at the two-year follow-up. The cervical lordosis or kyphosis was measured by Cobb's method. The diagnosis, degree of preoperative lordosis in the neutral position, and the degree of preoperative sagittal alignment in flexion and extension were studied as the risk factors for postoperative kyphosis.

**Results:** The preoperative ROM of the cervical spine was 29.2 degrees and the postoperative ROM was 20.3 degrees. Therefore, 30.5% of the preoperative ROM was decreased after laminoplasty. A decreased ROM of more than 50% was found in 13 patients (15.3%). Their diagnosis was CSM in 11 patients (11/52, 21.1%) and OPLL in 2 patients (2/29, 6.9%). There were no significant differences in preoperative ROM between the two groups with decreased ROM being noted in more than 50% of the patients and decreased ROM being noted in less than 50% of the patients. The preoperative lordotic angle in the neutral position was 16.2 degrees and the postoperative lordotic angle was 11.4 degrees. Kyphosis (mean: 12.2 degrees) developed in 9 patients (9/85, 10.6%) after the surgery. Their preoperative diagnosis was CSM in all patients. The preoperative lordotic angle was significantly less in the kyphotic group than in the lordotic group. The preoperative flexion was 10.2 degrees greater and the preoperative extension was 10.3 degrees less in the kyphotic group than in lordotic group. The preoperative flexion angle

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was 19.3 degree kyphosis and the extension angle was 8.7 degree lordosis in the kyphotic group.

**Conclusions:** The ROM of the cervical spine was decreased 30.5% after laminoplasty. Kyphosis developed in 10.6% of the patients. The preoperative factors affecting postoperative kyphosis were the diagnosis of CSM, a preoperative lordosis less than 10 degrees and a greater preoperative flexion angle than the extension angle. Therefore, kyphosis after laminoplasty was expected in a patient with the above three preoperative factors, so other treatment options such as instrumented fusion should be considered.

**Key Words:** Cervical spine, Kyphosis, Laminoplasty, ROM

(Fig. 1).

가

가 50%

가 50%

independent sample T-test

가 (posterior migra-

Cobb

independent sample T-test, paired sample T-test  
Mann-Whitney test

multinormal logistic regression analysis

Pearson's corre-

lation analysis

85

58 , 27

(35~80)

29 ,

Hirabayashi

door)

3, 5, 7

4

(open

suture anchor

2

56.7

1.

5.6

(P=0.005).

14.7

(P=0.000).

4.6

4.3

10.2

19.0

29.2

20.3 8.9 (30.5%) 9 (9/85, 10.6%)  
(P=0.000) (Table 1).  
가 50% 13 (15.3%)  
21.1%), 2 (2/29, 6.9%) 11 (11/52, 21%)  
가 50% 10 63 22  
31.0 , 가 50% 10 0.9 가 10  
28.8 (P=0.542). 15.8 (P=0.000).  
2. 가 10 6 (27.2%, 6/22)  
11.4 16.2 가 10 3 (4.8%, 3/63)  
4.8 (P=0.000). (Table 2).

**Table 1.** Changes of ranges of motion (ROM) after the laminoplasty

	Preoperative	2-year follow up	P-value*
Flexion (degrees)	-10.2	- 5.6	0.000
Extension (degrees)	19.0	14.7	0.000
ROM (degrees)	29.2	20.3	0.000

\*P-value by paired-sample T-test



**Fig. 1.** Sagittal alignment of the cervical spine was measured by Cobb 's method from C3 to C7.

2)	-	,	3)	,	14.3
28	.				
	(28/85)		12.2	(Mann-Whitney U=195.000,	17.1
	(57/85)		P=0.035).		9.1
	1.2		(Mann-Whitney U=14.000, P=0.000).		6.0
16.4					9.1
15.2	가	(P=0.000).	20.2		
			7.0	20.7	19.3
	13.7		8.7		
7	(25.0%, 7/28)		10.2	(Mann-Whitney U=172.000, P=0.023)	
			10.3	(Mann-Whitney U=186.500,	
	2	(3.5%, 2/57)	P=0.025).		
	(Table 3).				(Table 4).

**Table 2.** Comparison of postoperative sagittal alignment depending on preoperative sagittal alignment

	Preop lordosis<10 degrees (n=22)	Postop lordosis>10 degrees (n=63)	P-value*
Cobb 's angle at 2-year follow up (degrees)	-0.9	15.8	0.000
Incidence of kyphosis (%)	27.2 (6/22)	4.8 (3/63)	

\*P-value by independent-sample T-test

**Table 3.** Comparison of postoperative sagittal alignment depending on preoperative flexion-extension angle

	Flexion > Extension (n=28)	Extension > Flexion (n=57)	P-value*
Cobb 's angle at 2-year follow up (degrees)	1.2	16.4	0.000
Preoperative lordosis (degrees)	7.0	20.7	0.000
Incidence of kyphosis (%)	25.0 (7/28)	3.5 (2/57)	

\*P-value by independent-sample T-test

**Table 4.** Comparison of preoperative sagittal alignment between kyphotic and lordotic groups

	Kyphotic group (n=9)	Lordotic group(n=76)	P-value*
Cobb 's angle at 2-year follow up	-12.2	14.3	0.035
Preop Cobb 's angle in neutral	9.1	17.1	0.000
Preop Cobb 's angle in flexion	-19.3	- 9.1	0.023
Preop Cobb 's angle in extension	8.7	20.2	0.025

\*P-value by Mann-Whitney U test

4) 2000 71 (meta-analysis) 17~80%

가10 50%

(1) 17가 52 9 가 1-5)

Hirabayashi

17.3% 가 10 22 27.2% 30.5%가

6 28 7 25.0% 가 50% 50% 가 50%

(2) 2가 가 가 10 6.9%

12 6 50.0% 가 50% 21.1% 가 50% 가

17 7 41.2% 가 가

(3) 3가 18 6 33.3%

가 10 가

3가 6 16.2

9 3가 11.4 가 4.8

66.7% Pearson 0.902-0.965 9 , 10.6% . 2004 Wang 6) 204 가 2

0.896-0.924 . Suda 7)

Suda 가

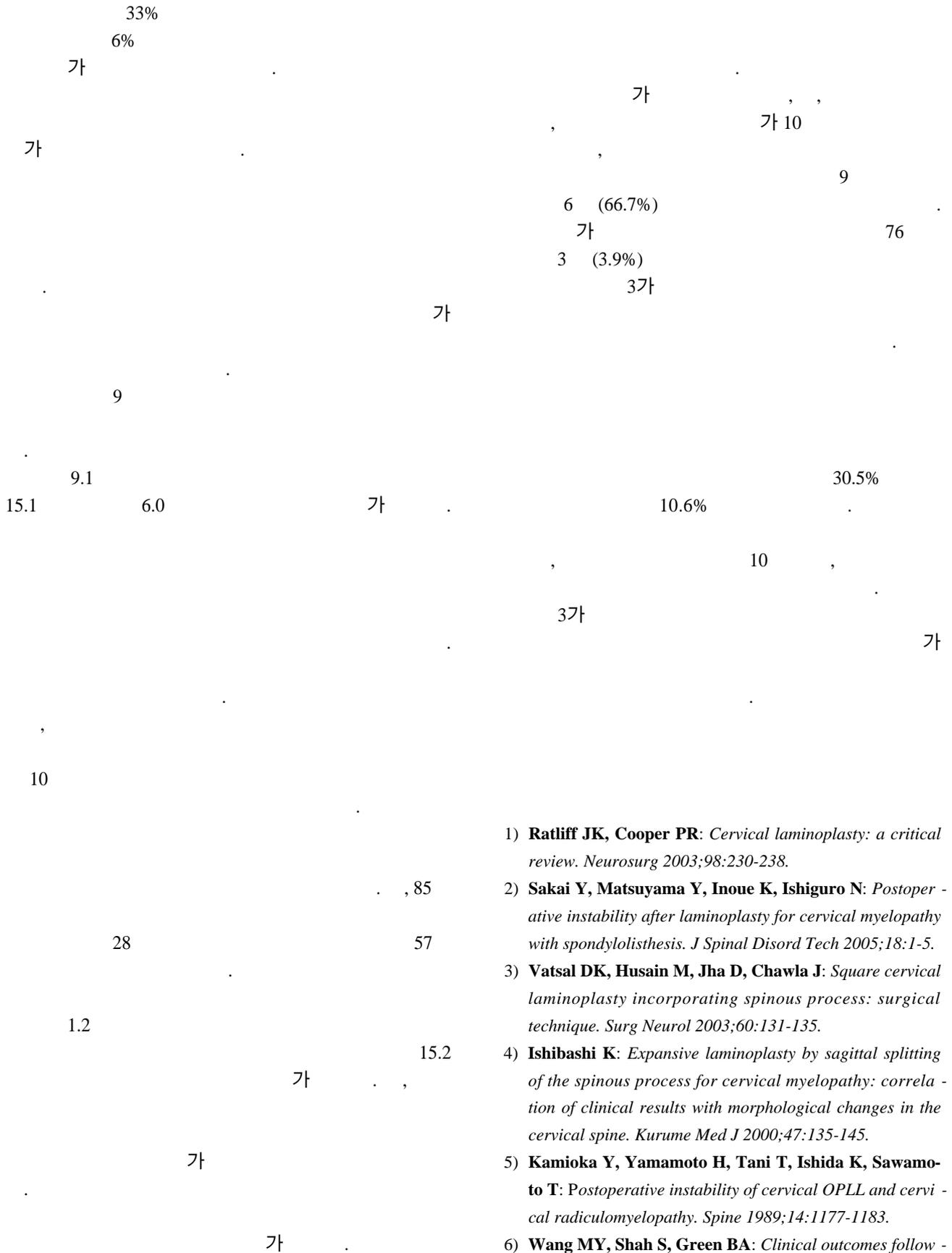
8) . Kawaguchi 9)

가 6.3% 가 . Ratiff Cooper<sup>1)</sup>

35% 10% . Iwasaki 10) 8%

. Shimamura 11) 6% . Matsumaga 12)

. 2004 Ratiff Cooper<sup>1)</sup>



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