

Orientation of Lateral Screw Holes on Cervical Laminoplasty Plates Is an Independent Risk Factor for Facet Joint Violation

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INTRODUCTION: Laminoplasty is a widely-employed surgical procedure designed to treat cervical myelopathy while preserving motion in the cervical spine. Horizontal and vertical orientations of the screw holes in laminoplasty plates may affect the incidence of screw-related complications, such as facet joint violation, which may lead to postoperative issues, including altered spinal biomechanics and increased axial pain. Despite these different plate options, there is limited data comparing the outcomes based on the orientation of the screw holes in laminoplasty plates.

METHODS: This is a retrospective review of a prospective database of posterior cervical laminoplasty patients. Patients who underwent a posterior cervical laminoplasty by one of six surgeons from 2017 – 2024 were included. All patients had minimum one year radiographic and clinical follow-up. Measurements taken included preoperative, postoperative, and final C2-7 Cobb angle, T1 slope, Torg-Pavlov ratio, C2-7 SVA (sagittal vertical axis), C2-7 flexion ROM (range of motion), C2-7 extension ROM, and K-line. Plates were grouped based on the orientation of the lateral screw holes; horizontal (Figure 1) and vertical (Figure 2). Facet breach by lateral screws was assessed with postoperative neutral lateral, flexion, and extension cervical x-rays. Number of lateral screws and mechanical failure (plate migration, screw backout, fracture) were also recorded. Demographic information was recorded, and stepwise multivariate linear regression was used to determine the independent association of plate lateral screw hole orientation with the above radiographic parameters, as well as clinical outcomes (neck pain, neurologic improvement, and overall satisfaction).

RESULTS: The study included 105 patients, including 65 with horizontal plates and 40 vertical plates. The average age was 65.1 ± 10.2 years, and the mean BMI was 30.2 ± 7.1. There was no statistically significant difference in age (p=0.182), BMI (p=0.065), smoking (p=0.067), sex (p=0.146), diabetes prevalence (p=0.205), or Charlson Comorbidity Index Scores (CCI, p=0.406) (Table 1). A key finding was the significant difference in screw breach into the facet joint, occurring in 46.67% of all patients but more frequently in the vertical plate group (70%) compared to the horizontal plate group (32.31%), with a p-value of <0.001. Vertical screw hole orientation was an independent risk factor for facet breach (OR 11.7, p=0.001). Further analysis revealed that vertical, lateral screw orientation was also an independent risk factor for increased OR time, with a mean increase of 29.5 minutes (p=0.019). There were no mechanical failures in the study. Plate type and the number of lateral screws were not independently associated with initial or final postoperative kyphosis, SVA, range of motion, or clinical outcomes.

DISCUSSION AND CONCLUSION: This study highlights that a vertical orientation of lateral screw holes in laminoplasty plates is associated with significantly increased odds of facet breach and increased mean operative time compared to horizontal plates. Plate design was not independently associated with postoperative cervical parameters such as kyphosis, SVA, range of motion, or any differences in clinical outcomes. These findings indicate a possible advantage of laminoplasty plates with horizontally oriented screw holes and indicates that caution is advised if using vertical plates to avoid facet joint breach by lateral screws.

Table 1. Demographics	Horizontal holes	Vertical holes	All patients	p-value
Overall	65	40	105	
Age	66.4 ± 9.7	63.7 ± 10.6	65.1 ± 10.2	0.182
BMI	29.1 ± 6.5	31.8 ± 7.8	30.2 ± 7.1	0.065
Female sex	41.54%	27.50%	36.19%	0.146
Smoking	17.19%	5.00%	12.50%	0.067
Diabetes	36.92%	25.00%	32.38%	0.205
CCI				
0-2	13.85%	20.00%	16.19%	0.406
3-4	43.08%	52.50%	46.67%	
5+	43.08%	25.00%	36.19%	
Screw breach into facet	32.31%	70.00%	46.67%	<0.001

Figure I Horizontal Screw Hole Orientation



Figure II Vertical Screw Hole Orientation

