

# A study of facet joint violation associated with percutaneous pedicle screw insertion -Does local kyphosis progress after implant removal?-

Takeru Akabane, Tomoto Suzuki, Hiromori Sagae, Michiaki Takagi  
Department of orthopaedic surgery, Yamagata university faculty of medicine  
Email: [banebanebane73@yahoo.co.jp](mailto:banebanebane73@yahoo.co.jp)

**Disclosures:** Takeru Akabane (N), Tomoto Suzuki (N), Hiromori Sagae (N), Michiaki Takagi (N)

**INTRODUCTION:** One method of stabilizing the spine is internal fixation with percutaneous pedicle screw (PPSF). PPSF has become widely used in the treatment of spinal injuries due to its effects such as reduced blood loss and less invasiveness to soft tissues. In addition, since PPSF is a temporary fixation without bone grafting, it is possible to reacquire the range of motion in the spine by implant removal after the fractured vertebra has healed. However, one of the complications of PPSF is facet joint violation (FJV), which has been reported to be more likely to occur with PPSF than with conventional open methods because the insertion point cannot be directly visualized. FJV carries the risk of intervertebral instability. Therefore, if FJV occurs in the intervertebral segments fixed by PPSF, there is concern about intervertebral instability after implant removal. This study aims to analyze the relationship between FJV and intervertebral instability as well as between FJV and the progression of local kyphosis following implant removal after PPSF.

**METHODS:** Of the 50 cases in which PPSF was performed for spinal injuries between January 2013 and December 2021, 15 cases with a follow-up of at least six months after implant removal were included in the study. Based on postoperative CT images, patients were divided into two groups: with and without FJV. For each patient, age, gender, BMI, the number of vertebrae for fixation, the incidence of intervertebral instability after implant removal, and the degree of local kyphosis progression in each intervertebral segment were investigated. Local kyphosis angles were examined separately for the middle thoracic (T6-T10), thoracolumbar (T11-L2), and lumbar (L3-L5) spine, with kyphosis being positive and lordosis being negative. The Mann-Whitney U test and Fisher exact test were used as statistical analysis, and  $p < 0.05$  was considered a significant difference.

**RESULTS SECTION:** A total of 132 screws were inserted, and FJV occurred in 20 joints (15.2%). Further detailed analysis revealed that FJVs were 14 of 58 (24.1%) in the thoracic spine and 6 of 74 (8.1%) in the lumbar spine. FJVs in the thoracic spine were about three times more frequent than those in the lumbar spine. There were no differences in age, gender, BMI, or the number of vertebrae for fixation between the groups with and without FJV. There were no cases of intervertebral instability in either group. There was no progression of local kyphosis at any level (FJV group: middle thoracic  $0.2^\circ \pm 1.8$ , thoracolumbar  $1.8^\circ \pm 3.4$ , lumbar  $2.0^\circ \pm 3.0$ ; without FJV group: middle thoracic  $-0.4^\circ \pm 0.6$ , thoracolumbar  $0.4^\circ \pm 2.5$ , lumbar  $-0.6^\circ \pm 3.8$ ;  $p > 0.05$  respectively).

**DISCUSSION:** The incidence of FJV in this study was 15.2%, which is comparable to previous reports of conventional methods. There was no significant difference in the degree of progression of local kyphosis after implant removal between the groups with and without FJV. In addition, the degree of progression of local kyphosis was similar in the two groups compared to previous reports. This study revealed that no difference in local kyphosis progression and intervertebral instability occurred after implant removal with or without FJV. Therefore, implant removal was considered possible to reacquire the range of motion in the spine even if FJV occurred on CT images.

**SIGNIFICANCE/CLINICAL RELEVANCE:** Even if FJV occurs in PPSF, intervertebral instability and local kyphosis progression do not occur after implant removal, so implant removal may be recommended to improve the range of motion in the spine.

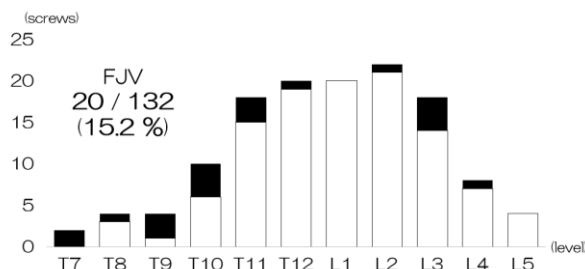
## REFERENCES:

- Ranjith B, Jong GP, Ankit IM, et al: Comparison of superior-level facet joint violations during open and percutaneous pedicle screw placement. *Neurosurgery* 71:962-70, 2012.
- Sean MJ, Mladen D, Kirk O, et al: Superior articulating facet violation: percutaneous versus open techniques. *J Neurosurg Spine* 18: 593-7, 2013.
- Marian M, Reinhold O, Teresa W, et al: Facet joint violation after open and percutaneous posterior instrumentation: a comparative study. *Eur Spine J* 32: 867-73, 2023.
- Ho SO, Hyoung YS: Percutaneous Pedicle Screw Fixation in Thoracolumbar Fractures: Comparison of Results According to Implant Removal Time. *Clin Orthop Surg* 11: 291-6, 2019.

【figure. 1】 Total number of PPS insertions, insertion level, and incidence of FJV. A total of 132 screws were inserted, and FJV occurred in 20 joints (15.2%).

【figure. 2】 Demographic data from this study are shown. The degree of local kyphosis angle and the number of patients with vertebral instability after implant removal are also presented. There were no significant differences in all parameters between the groups with and without FJV.

【figure. 1】



【figure. 2】

		FJV group (n=8)	Without FJV group (n=7)	p value
age	y.o	57.6±9.4	52.3±18.4	> 0.05
(male / female)	n	5 / 3	2 / 5	> 0.05
BMI	kg/m <sup>2</sup>	24.8±3.9	22.4±3.0	> 0.05
the number of vertebrae for fixation	n	4.0±1.8	3.0±1.3	> 0.05
the fixed range	°	0.9±3.0	2.1±2.1	> 0.05
local kyphosis within	°			
middle thoracic (T7-T10)	°	0.2±1.8	-0.4±0.6	> 0.05
thoracolumbar (T11-L2)	°	1.8±3.4	0.4±2.5	> 0.05
lumbar (L3-L5)	°	2.0±3.0	-0.6±3.8	> 0.05
The cases of intervertebral instability	n	0	0	> 0.05