Transarticular Fixation with a Bioabsorptive Screw for Cervical Spondylolisthesis

Kyongsong Kim[1], Toyohiko Isu[2], Tomoko Omura[1], Daijiro Morimoto[3], Shiro Kobayashi[1], Akira Teramoto[4]

Key words
- Bioabsorptive screw
- Cervical
- Cervical compression myelopathy
- Laminoplasty
- Posterior fixation

Abbreviations and Acronyms
LMS: Lateral mass screw
MRI: Magnetic resonance imaging
PLLA: Poly-L-lactide
TAS: Transarticular screw
uHA: Uncalcined, unsintered hydroxyapatite
VA: Vertebral artery

From the [1]Department of Neurosurgery, Chiba Hokuso Hospital, Nippon Medical School, Chiba; [2]Department of Neurosurgery, Kushiro Rosai Hospital, Hokkaido; [3]Department of Neurosurgery, Shin-Midori General Hospital, Kanagawa; and [4]Department of Neurosurgery, Nippon Medical School, Tokyo, Japan

To whom correspondence should be addressed: Kyongsong Kim, M.D. [E-mail: kyongson@nms.ac.jp]

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OBJECTIVE: **Patients with cervical instability and intramedullary signal intensity changes on preoperative magnetic resonance imaging scans may benefit from not only cervical decompression but also from fusion surgery. Transarticular screw (TAS) fixation is a useful technique for posterior fixation. We first report treating a patient with cervical spondylosis and instability by cervical laminoplasty with TAS fixation using a bioabsorptive screw.**

METHODS: **A 66-year-old woman who had undergone surgery for carcinoma of the tongue via the anterior approach experienced cervical myelopathy. Radiologic findings showed severe cervical canal stenosis with myelomalacia and spondylolisthesis at C4/C5 with instability.**

RESULTS: **We performed laminoplasty of C3 to C7 and TAS fixation of C4/C5 using a bioabsorptive poly-L-lactide screw that contained hydroxyapatite. Her postoperative course was uneventful, and at 1 year after treatment we confirmed C4/C5 fusion.**

CONCLUSIONS: **Our method has advantages over metal instrumentation. The treated area can be evaluated with the use of magnetic resonance imaging, and the space left after screw absorption is filled by newly formed bone. Because our screw contains hydroxyapatite, it is osteoconductive. This may increase the fusion rate and induce substitution with new bone. To our knowledge this is the first patient treated by cervical posterior TAS fixation via the use of a bioabsorptive screw. Our method is safe and economical and free of the complications elicited by the use of metal parts. TAS fixation with a bioabsorptive screw may be appropriate for one fixation in patients without severe instability.**

INTRODUCTION

Cervical posterior decompression is an accepted surgical treatment for cervical diseases. Segmental and kyphotic instability associated with vertebral slippage may affect surgical results (2, 20). Some patients present with cervical instability and intramedullary signal intensity changes on preoperative magnetic resonance imaging (MRI) resulting from the accumulation of minor spinal cord traumas secondary to an unstable cervical spine. To treat such patients with cervical compression myelopathy, Yagi et al. (22) recommend adding posterior fixation to cervical laminoplasty or performing anterior spinal fusion.

Transarticular screw (TAS) fixation is a useful technique for posterior fixation, and the insertion of a TAS in the middle and lower cervical spine is simple and can be performed safely with the use of lateral fluoroscopic guidance (18). This method has been used to strengthen posterior cervical spine fixation (5, 7, 11). To our knowledge, we are the first to report treating a patient with cervical spondylosis and instability by cervical laminoplasty with TAS fixation by the use of a bioabsorptive screw.

CASE REPORT

A 66-year-old woman who had undergone surgery for cervical anterior tongue carcinoma had a 1-year history of bilateral arm numbness, clumsiness with both hands, and gait disturbance. On admission to our hospital she manifested numbness of the limbs and clumsiness of both hands. She had difficulty walking as the result of bilateral lower-limb spasticity. Her deep tendon reflex of the limbs was increased, and she was positive for the bilateral Babinski reflex and lower-limb myoclonus. Standard lateral radiographs of the cervical spine revealed spondylolisthesis at C_4/C_5 and dynamic study showed increased slippage (Figure 1). Cervical MRI demonstrated canal stenosis at the level of C_4/C_5 to C_6/C_7, particularly at C_4/C_5, and intramedullary signal intensity changes on T2-weighted images at the C_4/C_5 level (Figure 2). On cervical magnetic resonance angiography, the bilateral vertebral artery (VA) was patent.

Because the patient's symptoms failed to improve under observation therapy we performed surgery. We planned posterior decompression from C_3 to C_7 and posterior fusion at the C_4/C_5 level because her previous history of surgery to address anterior tongue carcinoma complicated the anterior approach. She was placed in the prone position under systemic anesthesia.

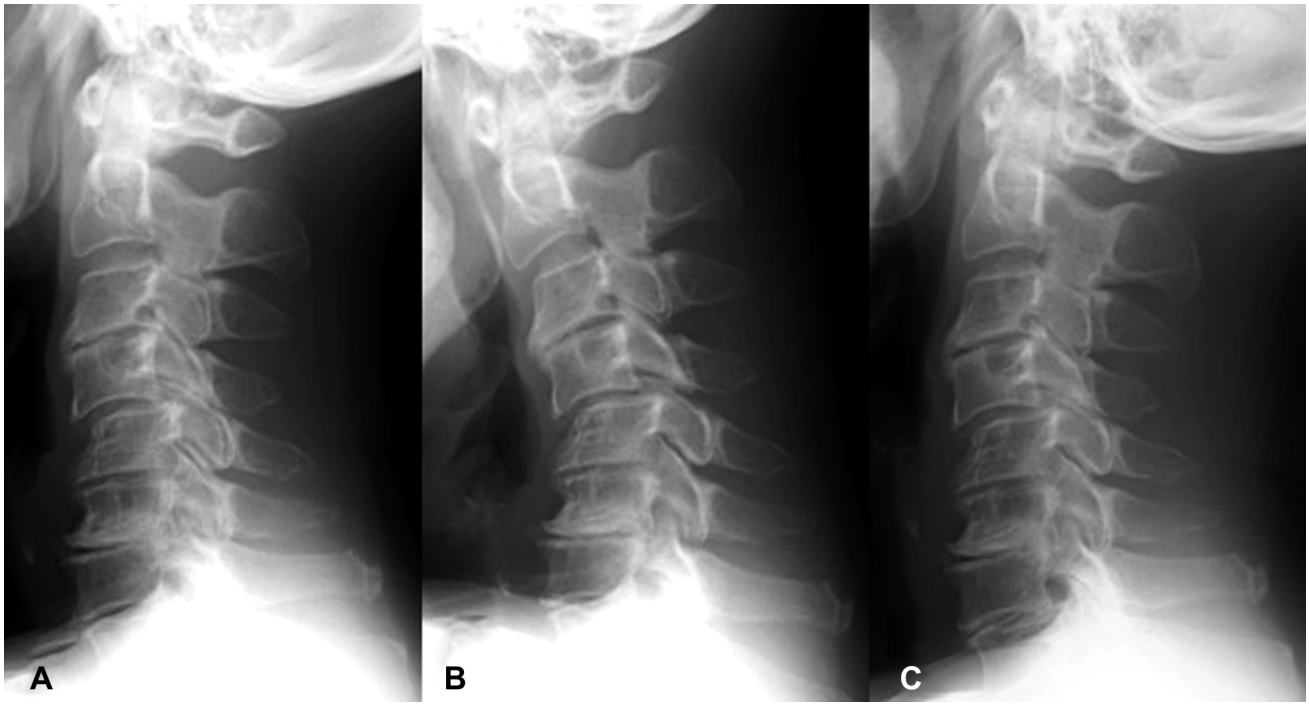

Figure 1. Preoperative radiographs of the cervical spine. Sagittal alignment is kyphosis and C4/C5 slippage is increased by flexion posture. (**A**) X-P, lateral view, neutral posture; (**B**) X-P, lateral view, flexion posture; (**C**) X-P, lateral view, extension posture.

We confirmed the cervical alignment by lateral fluoroscopy and adjusted her position to achieve maximum reduction of subluxation. After exposing the lamina of C3 to C7, we performed C4/C5 facet fixation by TAS fixation. We first curetted the articular cartilage, then drilled holes from the C4 lateral mass anterocaudally to the C4/C5 facet joint under lateral fluoroscopy, and cut a tap. We then inserted a bioabsorptive, 3.5-mm diameter uncalcined, unsintered hydroxyapatite (uHA)-poly-L-lactide (PLLA) screw (SUPER-FIXSORB; Takiron Co. Ltd., Osaka, Japan; **Figure 3**) under lateral fluoroscopy (**Figure 4**). The appropriate screw length (13 mm) was determined with a depth gauge. We then performed laminectomy of C3 and laminoplasty of C4 to C7 using ceramic spacers. In and around the bilateral C4/C5 facet, we placed autologous bone chips obtained from the lamina of C3 and the spinous process of C3 to C7; we used no artificial bone material. We encountered no complications related to screw insertion such as injury to the VA or nerve root.

Postoperatively, the patient's symptoms improved but slight bilateral arm numbness persisted. She wore a cervical collar for 8 weeks. Computed tomography and MRI studies performed 24 months after surgery confirmed adequate spinal canal decompression and fusion at the C4/C5 level without the development of a screw birdcage (**Figure 5**). Dynamic cervical radiographic performed at that time confirmed fusion at the C4/C5 level (**Figure 6**).

DISCUSSION

Some patients with cervical compression myelopathy require posterior fixation to obtain a good treatment outcome (2, 20, 22). The use of pedicle screws provides strong fixation for posterior cervical fusion; however, their placement, especially at C3 to C6 where the pedicle diameter is small, may result in catastrophic complications such as injury to the VA, spinal cord, or nerve roots (10). Although lateral mass screw (LMS) fixation is useful for cervical posterior fusion and less demanding technically, it is expensive, screw placement is dictated by the configuration of holes in the plate, and it can result in damage to the VA, nerve root, and spinal cord (5).

TAS fixation in the middle and lower cervical spine is a simple alternative method that results in immediate cervical stabilization without rods and connectors (18). It is also economical (5), and the risk for nerve root invasion is lower with TAS than LMS (8). In comparative biomechanical studies in which authors compared TAS and LMS, TAS yielded greater (7) or similar (5, 11) stability and provided satisfactory biomechanical stability for posterior cervical spine fixation. Furthermore, facet fusion with TAS is easily combined with expansive laminoplasty, whereas the use of LMS in this setting may create problems related to the trajectory of the screws (18). Thus, TAS fixation is a useful alternative in patients with cervical compression myelopathy with focal instability.

We used a bioabsorptive screw for TAS fixation. The utility of bioabsorptive products in patients undergoing cervical spine surgery and the use of bioabsorptive mesh and/or screws instead of metal instrumentation in patients treated by cervical anterior fusion has been reported (6, 13, 21). However, our search of the literature found no earlier documentation of the use of bioabsorptive screws for TAS fixation. We used uHA-PLLA screws that contain hydroxyapatite particles (30 wt%). The enduring strength of these screws during the