

Technical Note & Surgical Technique

Resolution of screw radiolucency following instrumentation with a hybrid rigid to dynamic stabilization system



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ABSTRACT

Introduction: Screw loosening, a common complication of patients undergoing a semi-rigid fixation, is associated with the radiological finding of lucency within bone surrounding the implanted screw.

Case report: A clinical and radiologic review is presented of a patient who underwent rigid fixation with L4–5 interbody fusion and L3–4 posterolateral dynamic stabilization with Zimmer Dynamic-to-Optima (DTO) hybrid fusion to non-fusion system (Zimmer Spine, Minneapolis, MN) with hydroxyapatite coated pedicle screws that exhibited lucency on radiographic studies which subsequently disappeared. An L4–5 interbody fusion and L3–4 posterolateral dynamic stabilization was performed. The patient did well clinically postoperatively. At 4 months postoperatively, X-rays of the lumbar spine demonstrated the appearance of lucency around the left L3 pedicle screw, which began to resolve at 10 months, and continued to resolve on subsequent CT scan 1 year postoperatively. The patient's clinical status continued to improve, with no complications.

Conclusions: The development of radiolucent lines around pedicle screws several months postoperatively may be due to loosening of the screws or due to a stress response at the bone-screw interface. The subsequent disappearance of this finding would suggest the ongrowth of bone at the osteoconductive hydroxyapatite coating or the protection of the bone-screw interface afforded by dynamic stabilization.

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1. Introduction

The Dynesys Dynamic Stabilization System™ (Zimmer Spine, Minneapolis, MN) was developed as an alternative to rigid lumbar spine fusion for the treatment of degenerative lumbar disease [8]. This semi-rigid fixation system distributes load sharing between the anterior and posterior elements of the spine. This allows for movement in two planes while minimizing the adjacent segment stresses associated with arthrodesis [3]. Loosening of the pedicle screw is an early complication of Dynesys implants indicated by a “halo” sign on radiographical studies [11,24]. We present a case of subsequent disappearance of this halo sign on follow-up imaging, a novel finding.

2. Case report

A 43-year-old female presented with severe low back pain for 2 years. She had previously undergone L3–5 decompression and an L4–5 discectomy 6 years prior to presentation. Her comorbidities included

hypertension, obesity, urinary dysfunction, and prior smoking history. Her back pain was exacerbated by mechanical strain and included radicular pain, weakness, and sensory deficit.

Computed tomography (CT) and magnetic resonance (MR) imaging of the lumbar spine demonstrated severe disk degeneration and collapse at L4–5, with a grade 1 spondylolisthesis, and severe facet hypertrophy at L3–4 and L4–5 resulting foraminal and canal stenosis at those levels. L3–4 did not demonstrate disk degeneration or spondylolisthesis. Pars defect was noted at L3. Flexion–extension films demonstrated an absence of instability at L3–4.

An L4–5 interbody fusion and L3–4 posterolateral stabilization with the Dynesys DTO system was performed. Immediately post-operatively, patient was moving all extremities.

The immediate postoperative radiographs exhibited no lucency (Fig. 1A and B).

Radiolucent lines around the left L3 pedicle screw became apparent one month after surgery (Fig. 2), and more pronounced at four months postoperatively (Figs. 3 and 4). Ten months after the operation, repeat plain films showed resolution of this finding (Fig. 5), and CT scan one year postoperatively demonstrated complete disappearance of the halo sign (Fig. 6A and B). Overall, the patient's pain and neurological symptoms gradually improved over the course of several months postoperatively.

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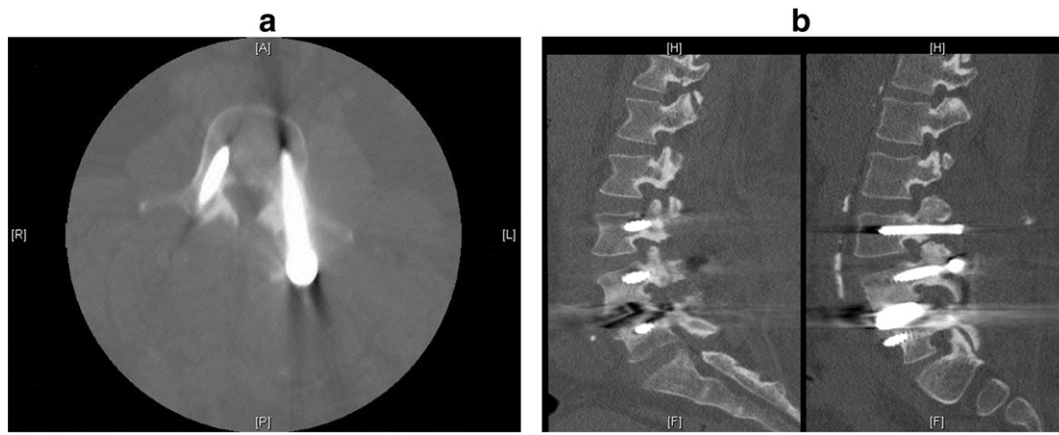


Fig. 1. A) Axial and B) sagittal computed tomography (CT) scans obtained immediately postoperatively, demonstrating intact left L3 bone-screw interface.

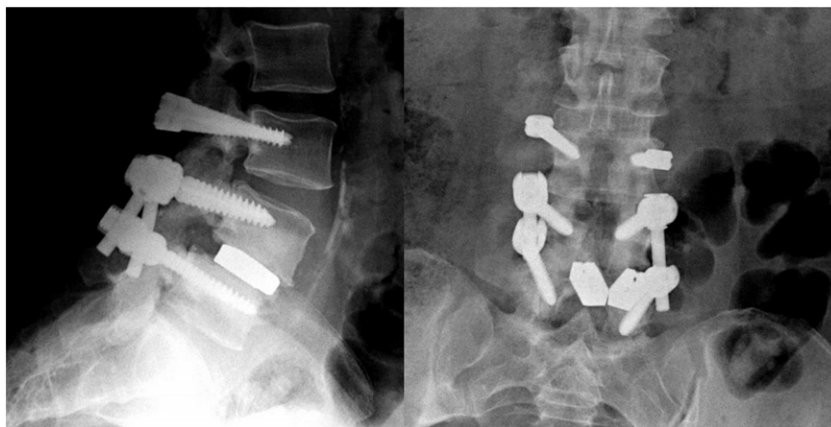


Fig. 2. Lateral and anteroposterior radiographs 1 month following surgery, demonstrating development of left L3 screw halo sign.

3. Discussion

Lumbar instrumentation has improved successful arthrodesis rates. Complications of instrumented fusion include implant failure, malposition, infection, flat-back deformity, and adjacent segment degeneration [3,10,21,23,24,27]. A poor correlation between fusion status and clinical outcomes in patients with degenerative lumbar disease was reported [16]. Furthermore, recent studies found similar postoperative clinical

outcomes in patients with pseudoarthrosis compared to patients with solid fusion [1,7,9]. This led to the hypothesis that the reduction of segmental motion is sufficient to alleviate back pain [10].

The neutral zone (NZ), an area around the neutral position in which there is minimal resistance to motion [14], is a clinically important measure of spinal stability and a more sensitive indicator of injury-induced mechanical destabilization than the range of motion [13,14]. Destabilizing injury to the spine typically increases the NZ but semi-

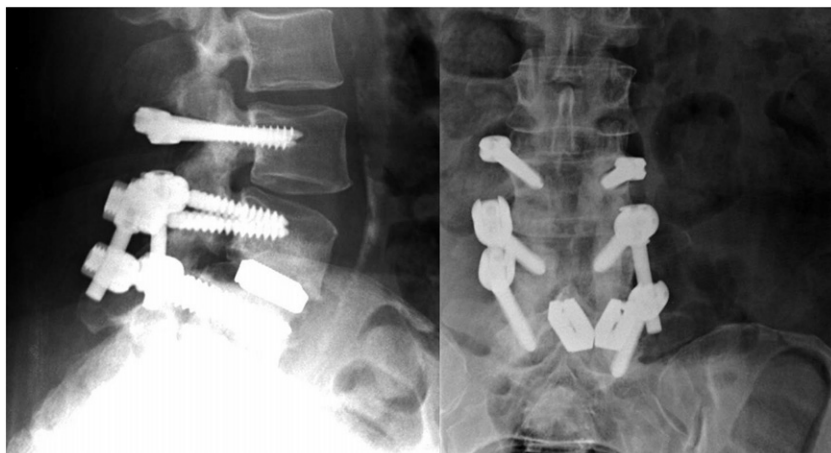


Fig. 3. Lateral and anteroposterior radiographs at 4 months postoperatively, showing more pronounced lucency and sclerotic margin surrounding the left L3 screw.

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