# Posterior dynamic stabilisation

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**Abstract**

**Background and purpose:** The purpose of this study is to report our experience with posterior dynamic stabilization, using an interspinous distracter that avoids excessive lumbar spine instrumentation, tolerating the segmental movement without foraminal conflict and preserving the adjacent segment.

**Method:** Twenty-nine patients with ages ranging from 48 to 70 (mean 56 years) underwent surgery using this device. All patients had low back pain that radiated to the lower limb in 21 cases. The follow-up period ranged from 6 to 12 months (mean 9 months).

**Results:** Majority of patients showed outstanding results with relief of their symptoms.

**Conclusion:** Interspinous distracter insertion is a safe and reliable tissue sparing technique that restores function by stabilizing the spine and maintaining the foraminal height, the natural functional anatomy and dynamism. It offers an alternative to rigid stabilization of lumbar stenosis with mild to moderate instability. Basic knowledge of spinal motion and careful selection of the patients is indispensable prior to its use.

***Key words:*** *Interspinous stabilization, interspinous implant, interspinous process device, interspinous distracter, interspinous spacer, spinal stabilization, posterior spinal distraction and posterior dynamic stabilization. (p33-37)*

## Introduction

Neurogenic claudication was first related to lumbar stenosis with credit to Verbist.[13] Since decompressive surgery was indicated in patients who failed to respond to conservative therapy, it was followed by posterior fusion in cases where the motion segment shows instability or in cases where a secondary instability is expected to develop following surgery. However posterior fusion led to immobilization of a motion segment and resulted in the adjacent segmental syndrome.[3,6,8]

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Interspinous distracter (ISD), (Fig. 1) is designed to stabilize the motion segment after neural element decompression in lumbar stenosis, tolerating flexion and extension in this segment thus preserving the adjacent segment from deterioration

**Figure 1** - Coflex: interspinous device distracter and stabilizator.

## Material and methods

This study was conducted between September 2008 and September 2009 and included 29 patients with different lumbar spine pathologies (Table 1). All patients were treated with ISD.

**Table 1 -** Pathology of the patients at the time of presentation.

| No. of cases | Pathology | Male/ Female ratio |
|---|---|---|
| 11 | Bi-foraminal stenosis | 8/3 |
| 7 | Ligamentum flavum hypertrophy | 2/5 |
| 6 | Suspended vertebrae | 4/2 |
| 3 | Facet syndrome | All females |
| 2 | Adjacent syndrome | 1/1 |

Preoperative patient evaluation included plain lumbar x-ray, lumbar MRI and CT, and lumbar osteodensitometry.

Magnetic resonance imaging assesses the canal and foramina stenosis and the joint synovium. In the latter, weakness or absence of the intracapsular (intra-articular) white signal on T2-weighted sequence signals is characteristic of degenerative disease of the joint. Lumbar CT assesses the lumbar facets.

All patients with confirmed osteoporosis by osteodensitometry were excluded from this type of treatment.

Twenty-nine patients were included in this study; 11 of them presented with bilateral pain irradiating to the lower limb. They were all diagnosed with degenerative disc disease and subsequent bilateral foraminal stenosis (Fig. 2). Seven patients with confirmed foramino-canalar stenosis, due to ligament hypertrophy, declared symptoms consisting of bilateral lower limb disesthesias upon walking (Fig. 3).

**Figure 2a** - Preoperative CT showing bilateral foraminal stenosis and degenerative facet syndrome.

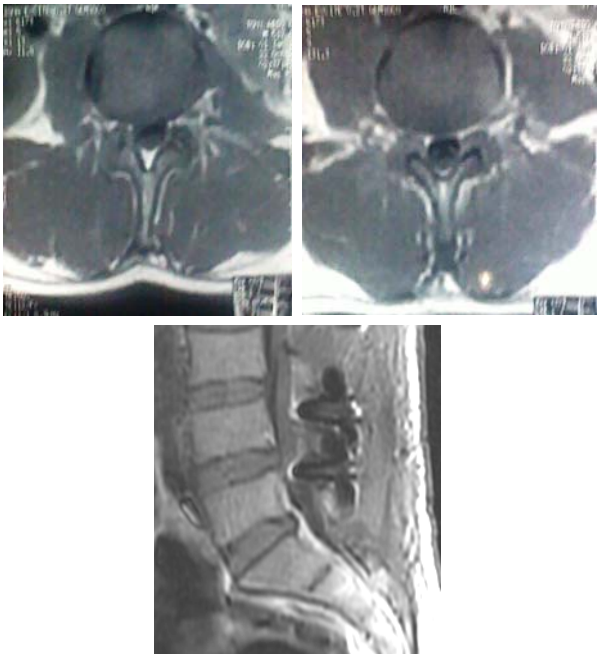

**Figure 2b -** Postoperative MRI after treatment using two interspinous distracters between L3 - L4 and L4 - L5.

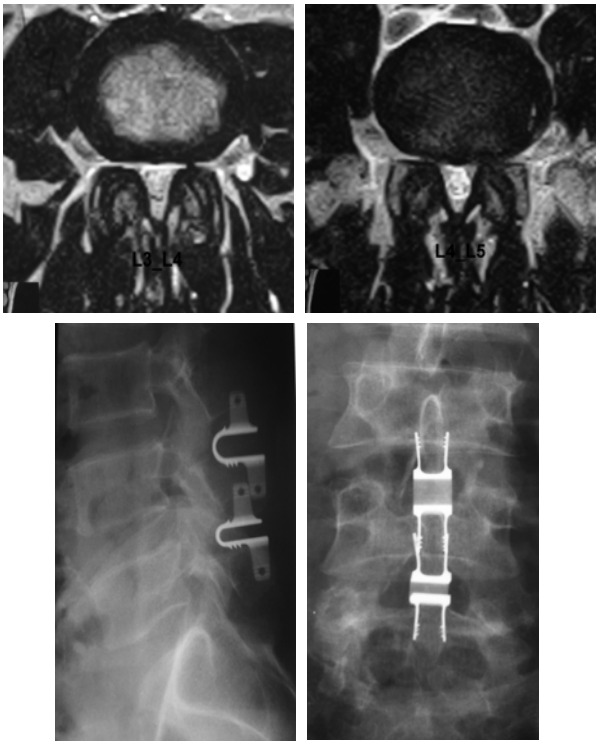


**Figure 3 -** Hypertrophied ligamentum flavum, facet, and sclerosis disc disease L3 - L4 and L4 - L5.

In 6 patients with low back pain irradiating to both lower limbs, suspended vertebra was shown mainly due to hypertrophy of ligamentum flavum, facet and foramino-canalar sclerosis (Fig. 4). Three more patients with facet syndrome were included (Fig. 5). Two patients had already undergone lumbar instrumentation with adjacent syndrome at the level above (Fig. 6).

All patients were operated in a prone position, flexed on a

Wilson surgical frame with the thoracolumbar spine segment in neutral to a slightly kyphotic position, avoiding hyperlordosis for a better interspinous distraction. Decompression of the neural elements for stenosis is made through surgical interlaminar fenestrations with flavectomy and opening of the lateral recess and not by the old-fashioned laminectomy. For the insertion of the ISD the interspinous ligament is resected with temporary disinsertion and retraction of the supraspinous ligament. Adequate preparation of the interspinous space; removal of all soft tissues and flattening of the bony walls to a straight parallel nidus were ended with an adequate insertion. Proper depth of the incorporation of ISD was determined following direct spacing of 3 - 4 mm between the deepest point of the device and the dural sac placing through that space a midsize hook. One or two interspinous spaces were treated according to the preoperative plan. Interspinous distractor was inserted with the laterally retracted supraspinous ligament always stitched to its initial location at the top of the spinous processes (Fig. 7).

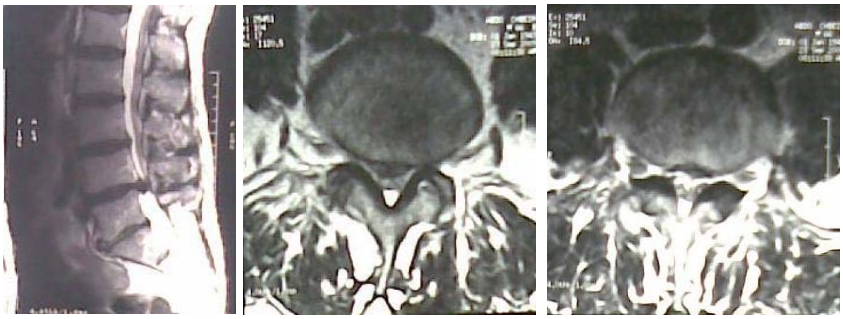

**Figure 4a** ← Segmental pan lumbar spondylosis: Suspended vertebra L3 and L4. L3 - L4; L4 - L5 facet degeneration, bilateral foraminal stenosis, lumbar stenosis and ligamentum flavum hypertrophy. MRI before surgery.

**Figure 4b** ↑ CT scan after surgery.

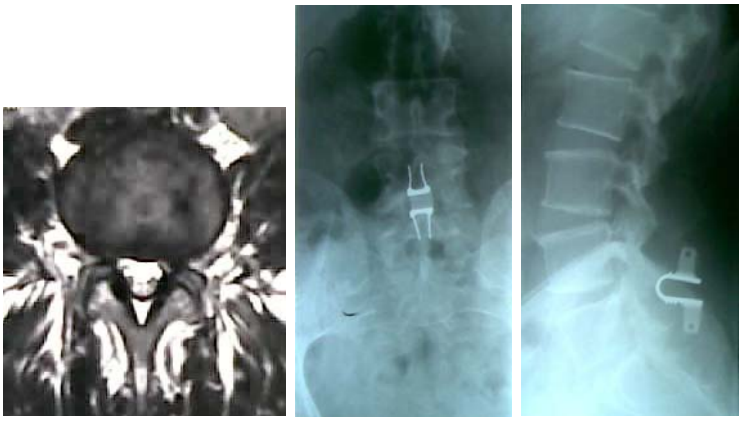

**Figure 5** ↑→ Facet syndrome - lack of synovial fluid at the level of L4 - L5 joint; a sign of degeneration.

**Figure 6** - Adjacent segment syndrome treated by interspinous distracter.

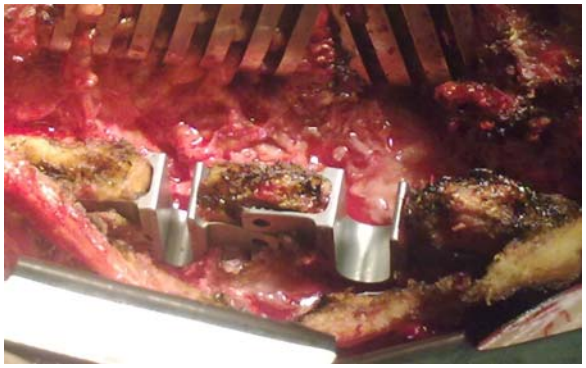

**Figure 7** - Interspinous distracter implanted between spinous processes L3 - L4 and L4 - L5. The desinserted and retracted laterally supraspinous ligament will be sutured to its initial place.

Discectomy is performed in cases where the protruded/ herniated disc is still compressing the root(s) despite ligaments resection and bone recalibrations being done. In cases where the disc is protruded/ herniated, medial dissectomy was not done (Fig. 8).

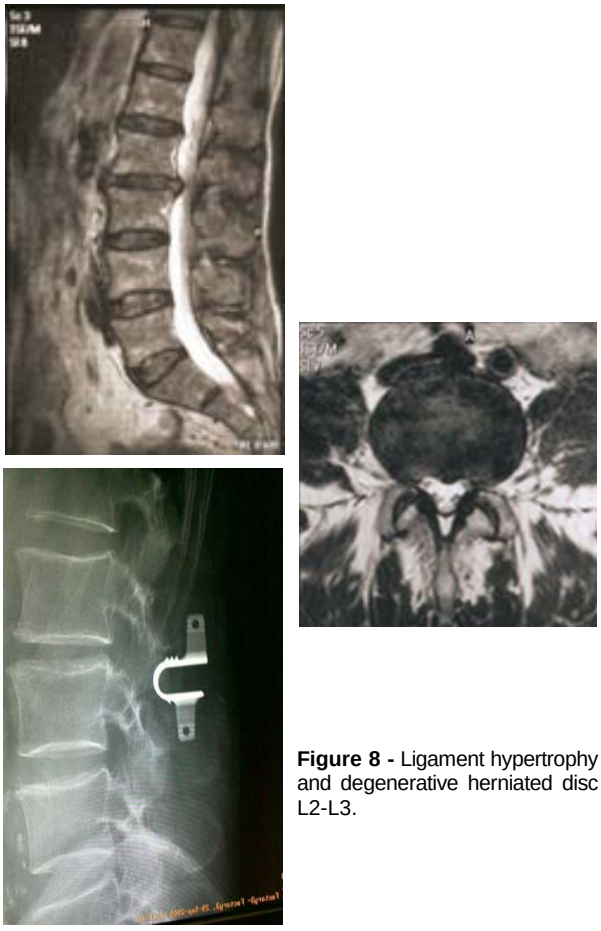

**Figure 8 -** Ligament hypertrophy and degenerative herniated disc L2-L3.

Regular closure of layers and placing of deep haemovac drain ended the surgery. The patient is out of bed the day after surgery and discharged on day 3 or even on day 2 if drain was not inserted. Control lumbo-sacral x-ray was done in two views to evaluate the created distraction. All patients were put in a lumbar brace for a period of one month during their daily activities.

## Results

Overall improvement was noted in ISD treated patients with considerable satisfaction in 75% of patients (Table 2).

Postoperative walking distance progressively increased during the next 3 months. Patients achieved maximum improvement after an average period of 6 months.

**Table 2 -** Percentage of improvement in each case.

| Cases | Improvement after treatment with ISD |
|---|---|
| Bi-foraminal stenosis | 73% |
| Ligament flavum hypertrophy | 83% |
| Suspended vertebrae | 67% |
| Facet syndrome | 66% |
| Adjacent syndrome | 100% |

No surgical complications were registered.

The prominent characteristic of this surgery is a low level of postoperative pain.

## Discussion

Traditionally, spinal fusion has been the mainstay of surgical approaches to the management of low back pain or lumbar instability. However, despite the improvement in radiographic fusion rates, there are some authors who think that there has not been a corresponding improvement in clinical outcomes. Furthermore, there is some evidence that fusion may increase the biomechanical stresses imposed on the adjacent segments leading to transitional disease, which may occur at an earlier rate in instrumented fusion cases. These issues have led to the development of the concept of posterior dynamic stabilization.[2]

Several models of ISD have proposed to stabilize the spine tolerating at the same time a certain degree of mobility of the concerned motion segment and preserving the adjacent segment from later damage. Biomechanical studies show that those devices offer a non-rigid fixation and can return a destabilized specimen back to the intact condition in terms of motion in flexion/extension and axial rotation.[2,12] It is a biomechanical alternative to a total laminectomy with pedicle screw and rod fixation.[2,3] Furthermore, the implant does not significantly change the intradiscal pressures at the adjacent levels, yet it significantly unloads the intervertebral disc at the instrumented level in the neutral and extended positions.[10] Thus, the characteristics of those devices meet the profile needed for cases where minor to moderate instability is expected in the treatment of lumbar stenosis preventing at the same time future deterioration of the adjacent motion segment. In postoperative scanning, follow-up of the patients examined showed a mineralization of the spinous process in contact with the implant, in particular at its base which appears to absorb high stresses due to lordosis.[9]

Our results are similar to those of other published series. Patients are improved in all their clinical aspects: low back pain, radicular pain and walking distance. Moderate to severe low back pain improved in 75% of patients, leg pain

and claudication were improved in 87% and walking distance improved in 74% of the patients in the series of Dieter et al, and patient satisfaction was 89%.[1] These results were achieved by one year and did not deteriorate over the long-term. In the series of Samani, the results were excellent and good in 74%, with a failure rate of 10% in cases which necessitated revision.[9] The majority of those failures resulted from insufficient decompression of central spinal canal stenosis because the bony resection was limited in order to attempt to retain enough laminar and spinous process bone to allow support of the implant. Doo-Sik et al, compared the ISD with posterior intralaminar fusion (PLIF).[3] He found that ISD is superior to PLIF in term of prevention adjacent segment immobilization and preservation of mobility of the fixed segment. In all series material were well tolerated. One case of migration was observed in the series of Dieter et al.[1] A potential complication of placement of an ISD device is fracture of the spinous processes, particularly related to osteopenic patients. There were no broken or permanently deformed implants in all series.[1,7,9]

The indications for ISD include minor segmental instability in patients requiring surgery for disc herniation and/or for spinal canal stenosis at all levels except L5 - S1, as well as patients at risk of developing secondary instability after a decompressive spinal operation. The ISD should theoretically prevent the development of the failed back surgery syndrome by restabilizing the intersegmental motion segment and by protecting the posterior spinal facet joints from overloading. Best results are obtained after using one single level mainly at L4 - L5 motion segment. However, it cannot be used as a substitute for a rigid fusion or three-column reconstruction in cases of marked instability and spinal deformity.[4,5]

## Conclusion

Interspinous distracter after surgical decompression for spinal stenosis demonstrates excellent short- and long-term results for improvement in back pain, neurogenic claudication and patient satisfaction. It offers an alternative to rigid stabilization for lumbar stenosis with mild to moderate instability.

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