



What is the Role of Interspinous Fusion Devices (IFD) in the Lumbar Spine Instability?

Alessandro Landi*, Cristina Mancarella and R'oberto Delfini

Abstract

Approximately 99% of people have experienced an episode of disabling low back pain or "back pain" at least once in a lifetime. About 14% of new outpatient visits are related to episodes of low back pain or sciatica and, of these, at least 4% undergo surgery. For this reasons the question is spontaneous: Why is back pain a phenomenon of such great deal? The explanation lies in the quality of life of every individual: normal daily activities (work, sports, habits, posture, etc.) that lead to an acceleration of the physiological age-related changes of the spine. This results in an early activation of the degenerative cascade that causes recurrence and disabling pain. The substrate of the degenerative cascade is therefore the progressive loss of competence of the metameric articular functions, which results in different forms of instability. The treatment of vertebral instability has evolved over the years with the aim of searching and developing the most effective and less invasive procedure to treat the instability. In this context, a major role was played by interspinous devices, generally used in degenerative lumbar spine disease and, more recently, by Interspinous Anchor IA. Those differ from the interspinous spacers as their aim is the fusion of the spinous processes and therefore the target is spinal stabilization by arthrodesis. The question that requires response is: are those devices able to replace arthrodesis with plates and screws in lumbar instability?

Keywords

Interspinous fusion; Interspinous anchor; Interspinous devices; lumbar spine instability; Lumbar degenerative disease

Introduction

Approximately 99% of people have experienced an episode of disabling low back pain or "back pain" at least once in a lifetime. About 14% of new outpatient visits are related to episodes of low back pain or sciatica and, of these, at least 4% undergo surgery. For this reasons the question is spontaneous: Why is back pain a phenomenon of such great deal? The explanation lies in the quality of life of every individual: normal daily activities (work, sports, habits, posture, etc.) that lead to an acceleration of the physiological age-related changes of the spine. This results in an early activation of the degenerative cascade that causes recurrence and disabling pain. The substrate of the degenerative cascade is therefore the progressive loss of competence of the metameric articular functions, which results in different forms

*Corresponding author: Alessandro Landi, Department of Neurology and Psychiatry, Division of Neurosurgery, University of Rome "Sapienza", Rome, Italy, Tel/fax: +39 06 499 79105; E-mail: dott.alessandro.landi@gmail.com

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of instability. The treatment of vertebral instability has evolved over the years with the aim of searching and developing the most effective and less invasive procedure to reduce and to neutralize dynamically the metameric hypermobility; this has led to the development of a lot of different devices, some of them used indiscriminately in recent years but with long-term results questionable. In this context, a major role was played by interspinous devices, generally used in degenerative lumbar spine disease. Recently, it has been noticed that those devices have significant problems in terms of clinical follow-up, since the action exercising on the vertebral body has an appreciable effect on the biomechanics of the lumbar spine. This is why in the last few years new devices have been introduced, called Interspinous Anchors. Those differ from the interspinous spacers as their aim is the fusion of the spinous processes on which are anchored, and therefore the target is spinal stabilization by arthrodesis and not the dynamic neutralization of the hypermovement. The question that requires response is: are those devices able to replace arthrodesis with plates and screws in lumbar instability?

Interspinous Anchors IA (Aspen, Axle etc)

Those devices have been already described in the past, their aim is the interspinous bone fusion, a surgical technique already described many years ago. The main function of the Interspinous Anchors differs from the other interspinous devices; in fact the (hypotetic) main goal of Interspinous Spacers is the motion preservation of the metamere involved by a degenerative disease; Unfortunately those devices couldn't obtain this function because they altered the physiological biomechanics of the metamere and of the entire lumbar spine, promoting and not preventing the degenerative cascade. Instead the Interspinous Anchor has a completely different basic concept: the aim is to block the hyper-motion through an interspinous bone fusion [1-15]. In this way they could stop the degeneration and immobilize the metamere. Theoretically the surgeon, with the insertion of those devices, should obtain a stabilization of the metamere with a really minimally-invasive surgical approach, without using screws and rods.

Surgical technique

These devices could be implanted by a minimally invasive approach; through a very short median skin incision (extended from the upper spinous process to the lower spinous process) of about 3-4 cm, the surgeon must expose the upper and lower lamina of one side of the metamere. Using a specific instrumentation the device must be implanted between spinous processes using a technique similar to the one used for the insertion of a classic interspinous spacers. After radiological intraoperative check, the device must be blocked in the position desired. After this, in the interspinous space, using a specific instrument, a cruentation of the bone must be performed and bone chips could be inserted. The mean time of the surgical intervention is 40 minutes and the blood loss is extremely poor. Is important to underline that a TLIF technique could be added to this devices with the aim of obtaining a 360° fusion with only a monolateral minimally invasive approach [1-9].

Discussion

Clearly these devices do not have the biomechanics stability of the plates and screws. In fact their use is not suitable for middle and

high grade of vertebral instability in which stabilization with screws and rods are recommended. Moreover, these devices have a double function, related to their possible association with TLIF interbody fusion. Firstly stand-alone – When we use this device we want to obtain a spinous process fusion of a spinal motor unit. We can obtain this in distraction or in neutral position. When IA is implanted in distraction, the axial load is altered, causing an acceleration of the degenerative process in the other metamere leading to the development of adjacent segment disease ASD. Notwithstanding, the pathological segment is stabilized. Secondly in association with TLIF interbody fusion – In my opinion this is the gold standard for using IA. It is suggested in cases of monolateral radiculopathy with foraminal stenosis due to facet hypertrophy. The surgical procedure encompasses arctrectomy to perform a TLIF, complete decompression of the foramen and of the nerve root, associated with the implant of a device in neutral position (not in distraction) . The application of an IA in association with a TLIF technique has so many advantages: 1 - TLIF make possible a monolateral decompression and the implantation of an anterior intersomatic cage. The cage, in relationship with its dimension, can restore the physiological lumbar lordosis and maintain the sagittal balance of the lumbar spine. 2 - In relation with the most anterior position of the cage and of the dimension of the cage itself its implantation in TLIF technique leads to a higher fusion rate than the one obtained in PLIF technique. 3 - Stabilization of the segment in his physiological position is allowed by the insertion of the device in neutral position. 4 - This procedure permits circumferential fusion with an exclusively posterior and monolateral approach, preserving muscular insertions and posterior tension band [12-25].

Recently the evolution of those devices has brought to the production of distraction and compression devices with cardiac instruments that allow the distraction and the compression of the segment during the surgical procedure. These new devices permit to model the orientation of the segment towards compression, increasing the pressure on the cage and assuring a better interbody fusion.

A real concrete problem for spinal surgeons is to identify clear indications for using these devices, because in the literature there is an absolute lack of clarity regarding the real function of IA and the real surgical indications. In my personal opinion, related to my experience, Interspinous anchors IA, have an extremely small range of surgical indications (while the interspinous spacers have no surgical indications at all): monolateral or bilateral foraminal stenosis without evidence of spondylolisthesis in X –Rays dynamic projections. The radiological planning is fundamental to decide when to perform a stabilization with IA or not, because the presence of a spondylolisthesis in the dynamic X-rays is a risk factor for the failing of the treatment. Their implant in my opinion has to be associated to TLIF and their insertion has to be in neutral position or in slight compression. This is very important to preserve the biomechanics of the sagittal axial load of the lumbar spine. Those devices allow the decompression of the stenotic nerve root with TLIF technique, permit a slight compression providing a contact between cage and endplates to promote a better interbody fusion, and promoting an interspinous fusion. All of these processes block the segmental degenerative process that is responsible for the pathology and for the symptoms [14-25].

Conclusion

Despite the development and the use of sophisticated and

minimally-invasive devices, the degenerative spine disease remains a specter that haunts the spine surgeons. Often the absolute lack of clarity, can lead the surgeons opt for a treatment often insufficient or even counterproductive for the patient. The IA are new devices that can be utilized but their use should be restricted to some diseases that need to be properly framed through a careful preoperative clinical and radiological analysis, but the stabilization with screws and rods nowadays have a major role in lumbar spine degeneration, especially when medium and high grade instability is associated. The spine surgeons should never understood the minimally invasive surgery as a trend that should be followed but as a chance to be undertaken only if there are all the clinical and radiological prerequisites.

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Author Affiliations

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Department of Neurology and Psychiatry, Division of Neurosurgery, University of Rome "Sapienza", Rome, Italy

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