



# Approach Selection Multiple Anterior Lumbar Interbody Fusion to Recreate Lumbar Lordosis Versus Pedicle Subtraction Osteotomy: When, Why, How?

Andrew K. Chan, MD<sup>a,\*</sup>, Praveen V. Mummaneni, MD<sup>a</sup>,  
Christopher I. Shaffrey, MD<sup>b</sup>

## KEYWORDS

- Anterior lumbar interbody fusion • Pedicle subtraction osteotomy • Lumbar lordosis
- Sagittal imbalance

## KEY POINTS

- Multilevel ALIFs or PSO may be used to achieve restoration of lumbar lordosis and correct sagittal alignment in well-selected patients.
- Potential advantages of the multilevel ALIF technique include lower morbidity, blood loss, and decreased risk of neurologic complications at the cost of approach-specific complications including retrograde ejaculation and vascular and visceral injury.
- Potential advantages of the PSO technique include a generally greater single-level lordotic correction, the ability to correct multiplanar deformity when done asymmetrically, and avoidance of anterior scarring and adhesions in patients with a prior history of anterior spinal or abdominal surgery.
- Disadvantages of PSO include a higher complication rate, blood loss, and a more technically demanding procedure.

## INTRODUCTION

In adult spinal deformity (ASD), the loss of lumbar lordosis (LL) leads to a series of compensatory spinopelvic changes to maintain global spinal balance. Ultimately these mechanisms may fail, leading to sagittal malalignment, functional impairment, disability, and impaired quality of life.<sup>1–3</sup> There are multiple causes for the loss of LL, including lumbar degenerative disease, post-laminectomy kyphosis, post-traumatic kyphosis,

iatrogenic flat back syndrome, and ankylosing spondylitis.<sup>4–6</sup> In the case of iatrogenic flat back syndrome, inadequately restoring LL is associated with the development of adjacent segment degeneration.<sup>7,8</sup> For well-selected patients who fail conservative management strategies, spinal deformity surgery is indicated. The surgical goal of deformity surgery in the adult includes restoration of lumbar alignment in the sagittal and coronal planes.

Disclosure Statement: Dr P.V. Mummaneni is a consultant for DePuy Spine and Stryker and has direct stock ownership in Spinicity/ISD. He receives royalties from DePuy Spine, Thieme Publishers, and Springer Publishers. He has received honoraria from Globus. Dr C.I. Shaffrey has direct stock ownership in, is a consultant for, and a patent holder with NuVasive. He is a consultant and patent holder for Zimmer Biomet. He is a patent holder with Medtronic.

<sup>a</sup> Department of Neurological Surgery, University of California, San Francisco, 505 Parnassus Avenue M779, San Francisco, CA 94143, USA; <sup>b</sup> Department of Neurosurgery, University of Virginia, PO Box 800386, Charlottesville, VA 22908, USA

\* Corresponding author.

E-mail address: [Andrew.chan@ucsf.edu](mailto:Andrew.chan@ucsf.edu)

Neurosurg Clin N Am 29 (2018) 341–354

<https://doi.org/10.1016/j.nec.2018.03.004>

1042-3680/18/© 2018 Elsevier Inc. All rights reserved.

In addition to correction of sagittal vertical axis (SVA) and pelvic tilt (PT), restoration of physiologic LL is a fundamental principle of spinal deformity surgery and portends better long-term outcomes.<sup>2,3,9–12</sup> For a given pelvic incidence (PI), restoration of LL that is within 10° of PI is considered optimal.<sup>13</sup> Thus, the magnitude of correction necessary for LL is directly proportional to the magnitude of preoperative PI-LL mismatch for a given patient. Patients that are able to achieve an optimization of PI-LL mismatch have been shown to have superior outcomes following spinal deformity surgery.<sup>4,12,14</sup>

Both anterior and posterior-based approaches have been described to correct lumbar hypolordosis and each hold unique advantages and disadvantages. This article discusses the indications, techniques, and complications for an anterior-based approach (multilevel anterior lumbar interbody fusion [ALIF]) and a posterior-based approach (pedicle subtraction osteotomy [PSO]).

## MULTILEVEL ANTERIOR LUMBAR INTERBODY FUSION

The ALIF technique permits segmental realignment of the lumbar spine through the intervertebral disk. The technique is appropriate for multiple causes of lumbar degenerative deformity including degenerative scoliosis, postlaminectomy deformity, and adjacent segment degeneration. The primary prerequisite for ALIF is an intervertebral disk space through which the surgeon may gain segmental realignment of the spine. The ALIF approach permits complete release of the anterior longitudinal ligament and annulus fibrosis, facilitating lordotic correction. A primary advantage of the anterior approach lies in its avoidance of the invasiveness of the posterior approach. In the case of the multilevel ALIF, the approach altogether avoids risk to the neural structures and significant manipulation of posterior musculature, depending on the posterior instrumentation technique (eg, minimally invasive, percutaneous). The multilevel ALIF accomplishes the goal of lordotic correction without compromising the posterior tension band. Additionally, it avoids the significant morbidity and high blood loss associated with three-column osteotomies, such as PSO.

Biomechanically, the multilevel ALIF offers several advantages. The multilevel ALIF more harmoniously imitates the natural gradual segmental LL of the spine.<sup>15</sup> This is contrasted by the abrupt angular correction at the index level of PSO. Biomechanical studies suggest that ALIF may limit the destabilization of axial

rotational stability seen with lumbar PSO<sup>16</sup>; this potentially decreases the mechanical demand on posterior instrumentation and may limit rod fractures, hardware failure, and pseudarthrosis. Circumferential fusion of the lumbosacral junction is especially useful to avoid pseudarthrosis and implant failure.

A disadvantage is that the multilevel ALIF may require an additional posterior approach to facilitate spinal realignment with posterior-based mobilization of the spine, to reduce loss of correction, and to prevent pseudarthrosis or interbody cage subsidence. Posterior fixation may be accomplished by either a one-stage, two-approach procedure or a two-stage procedure, both of which may potentially lead to increased anesthesia time.

In a comparison with posterior-only surgeries for ASD, the combined ALIF and Posterior Spinal Fusion (PSF) approach has been shown to achieve largely equivalent results with significant improvements in health-related quality of life measures and radiographic outcomes, including LL.<sup>17</sup> Furthermore, in a study of 42 patients who underwent the multilevel ALIF for restoration of LL, excellent LL and PI matching was accomplished, with an average LL correction of nearly 30° at 2-year follow-up.<sup>18</sup> This is similar to the 30-degree correction associated with a PSO.

## Indications

The multilevel ALIF is appropriate for patients who have moderate-to-severe sagittal deformity who require a gradual correction in LL across several segments. The patient with a loss of lordosis on standing films with mobility on flexion/extension views, or on supine radiograph or computed tomography may be most appropriate for a multilevel anterior lumbar approach to the spine. Patients with loss of lordosis over the segments of L4 to S1 are appropriate for ALIF reconstruction to restore the appropriate alignment of the lower lumbar spine. It is less appropriate for those who require a larger angular correction at a single level in conditions including congenital kyphosis or post-traumatic deformity, for which the posterior-based PSO may be better suited. **Table 1** outlines the indications for multilevel ALIF and for PSO in the restoration of LL.

The multilevel ALIF is also advantageous in several unique clinical situations. The multilevel ALIF is generally a lower morbidity procedure than the three-column PSO in cases where a solid anterior column fusion is not present. The multilevel ALIF usually has substantially less blood loss than PSO procedures and may be preferred in more frail

Download English Version:

<https://daneshyari.com/en/article/8690299>

Download Persian Version:

<https://daneshyari.com/article/8690299>

[Daneshyari.com](https://daneshyari.com)