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Contralateral Foraminal Area Increases Significantly After MIS Transforaminal Lumbar Interbody Fusion Using Biplanar Expandable Cage

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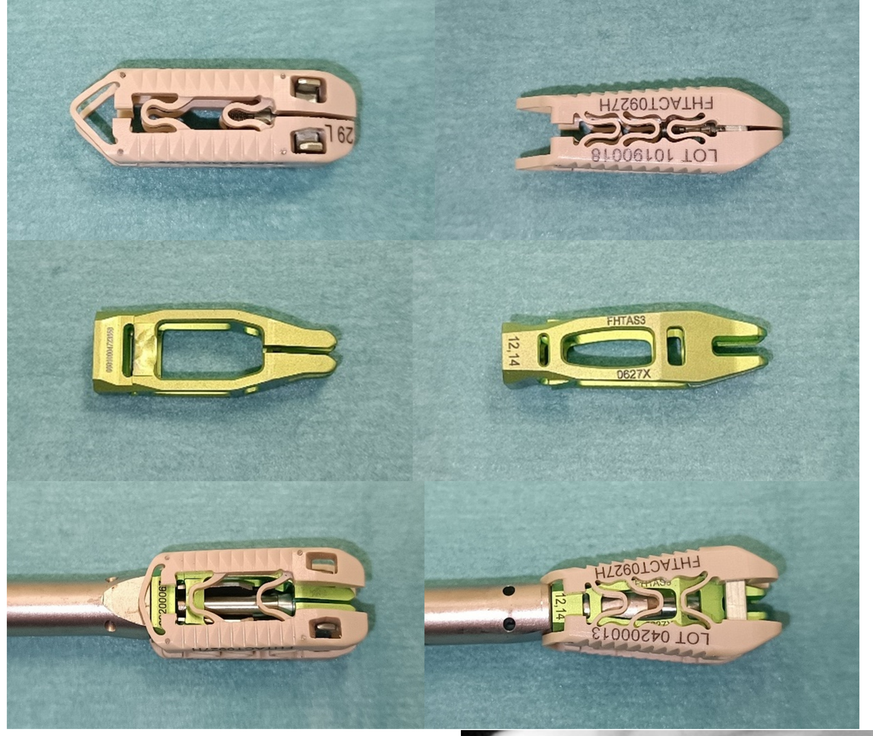
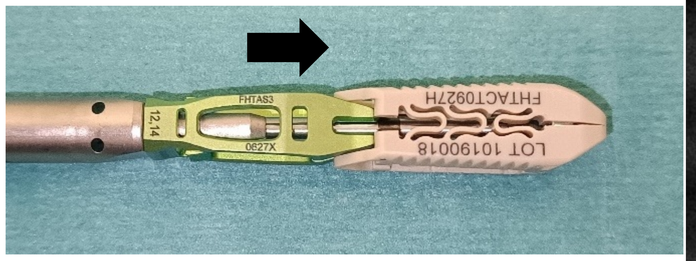
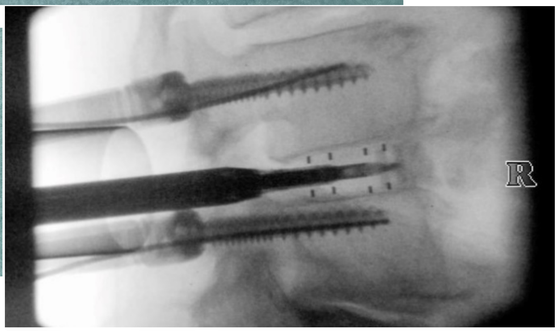
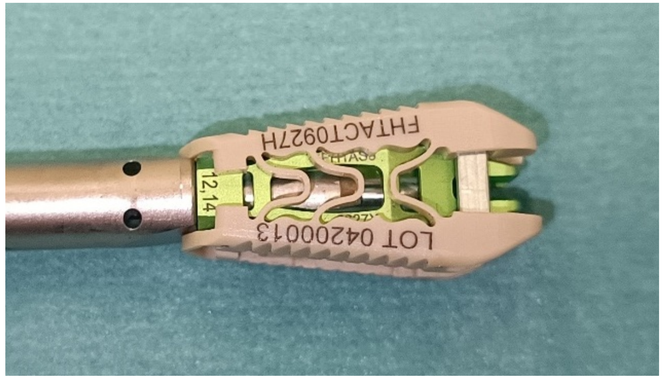
Introduction

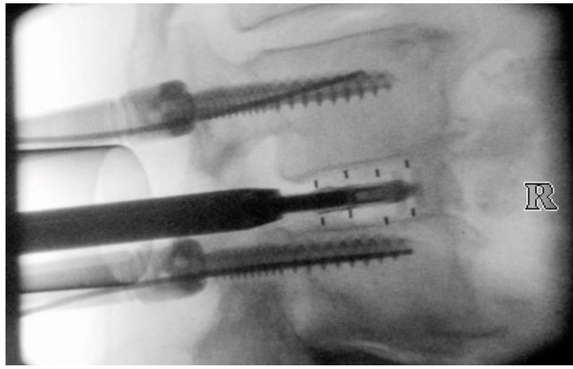
- Biplanar expandable (BE) cages recently designed for use in transforaminal lumbar interbody fusion (TLIF)
- 2-piece device consisting of a polyetheretherketone (PEEK) shell that expands bidirectionally with the insertion of a titanium shim
- Open-architecture design which allows backfilling of bone graft and conforms to patient's endplate configuration
- Limitations of current designs:
  - Static cages – small surgical window
  - Uniplanar expandable cage – small contact area risks endplate violation and cage subsidence
- Advantage of BE cages – expansion in width and height
  - Improved restoration of disc height and segmental lordosis
  - Decreased theoretical risk of subsidence due to greater implant-endplate contact surface area











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Introduction

- MIS-TLIF performed through unilateral laminectomy and facetectomy on more symptomatic side
- Management of contralateral neuroforaminal foraminal stenosis depends on indirect decompression resulting from restoration of disc height and listhesis correction.
- BE cages have been shown to improve early to mid-term clinical outcomes and radiographic parameters
- However radiographic parameters were only measured with plain radiographs and unable to measure foraminal parameters

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2. Coric D, Roybal RR, Grubb M, et al. Bidirectional expandable technology for transforaminal or posterior lumbar interbody fusion: a retrospective analysis of safety and performance. Int J Spine Surg. 2020;14(s3):S22–S30. doi:10.14444/7123
3. Tan LA, Rivera J, Tan XA, Le VP, Khoo LT, Berven SH. Clinical and radiographic outcomes after minimally invasive transforaminal lumbar interbody fusion-early experience using a biplanar expandable cage for lumbar spondylolisthesis. Int J Spine Surg.2020;14(s3):S39–S44. doi:10.14444/7125

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Objective/Aim

- Investigate change in radiographic parameters including neuroforaminal parameters after MIS-TLIF with biplanar expandable cages

Methods

- Retrospective study on consecutive patients who underwent MIS-TLIF utilizing biplanar expandable cages in 2023 from a single institution
- Intraoperative 3D imaging performed before and after MIS-TLIF were analyzed to calculate change in radiographic parameters
- Inclusion criteria:
  - Degenerative disc disease, spondylolisthesis or spinal stenosis
  - 1-level, 2-level and 3-level lumbar fusions
  - Minimally invasive (MIS) technique
- Exclusion criteria: Previous spinal fusion, infection or malignancy
- Radiographic parameters assessed:
  - Ipsilateral and contralateral foraminal area
  - Posterior and anterior disc height, listhesis, segmental lordosis,

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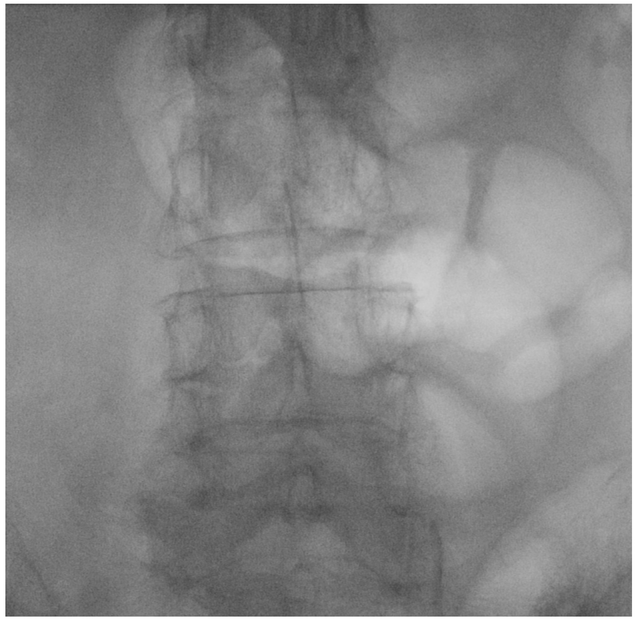
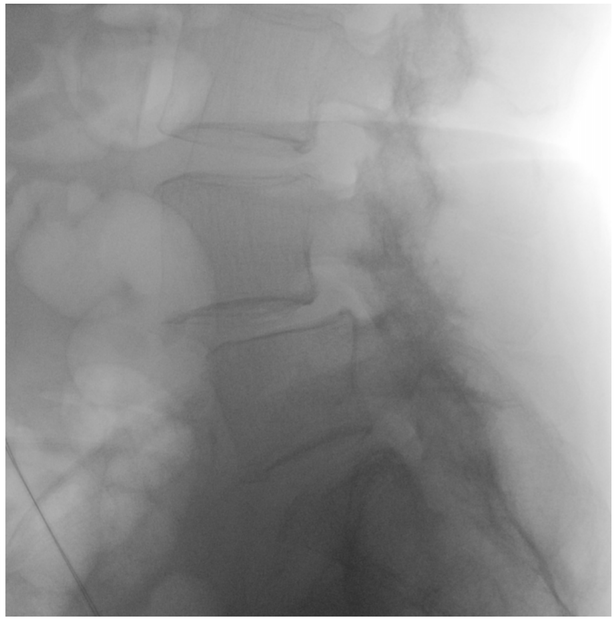
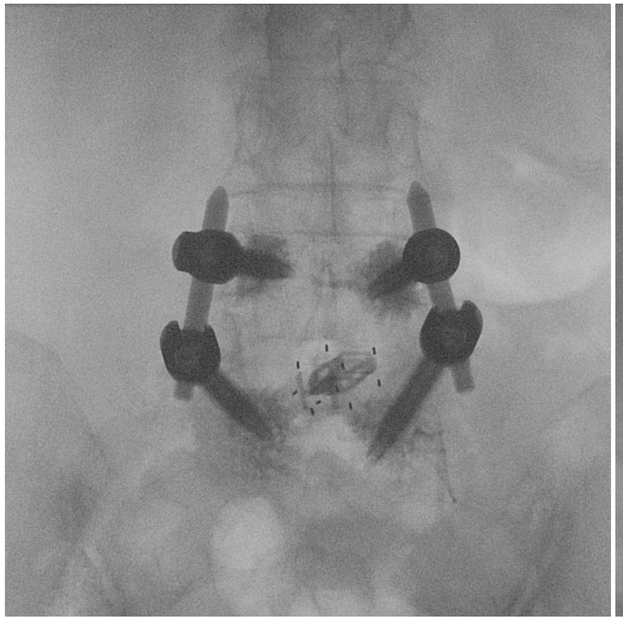
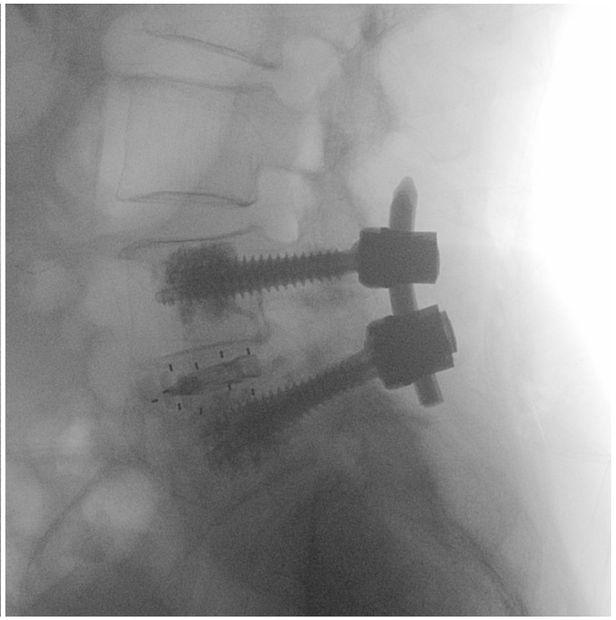

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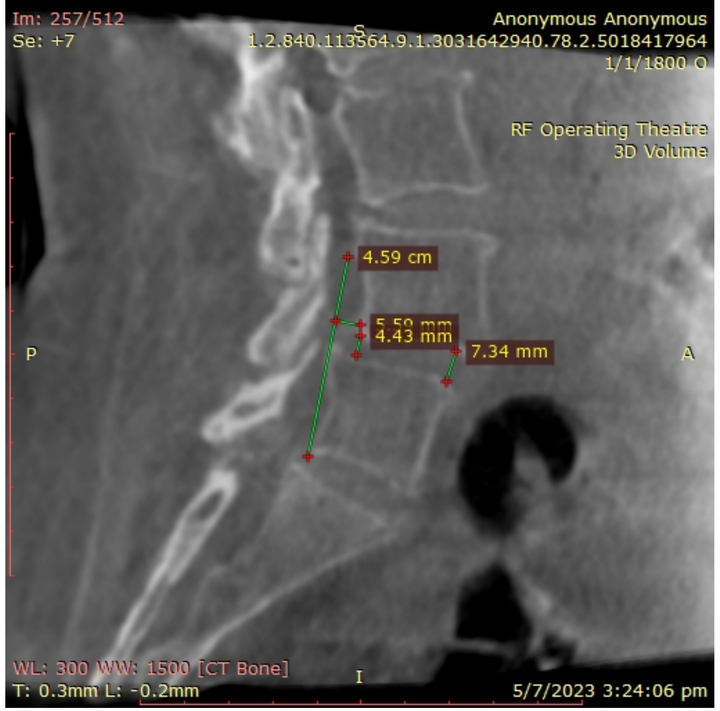

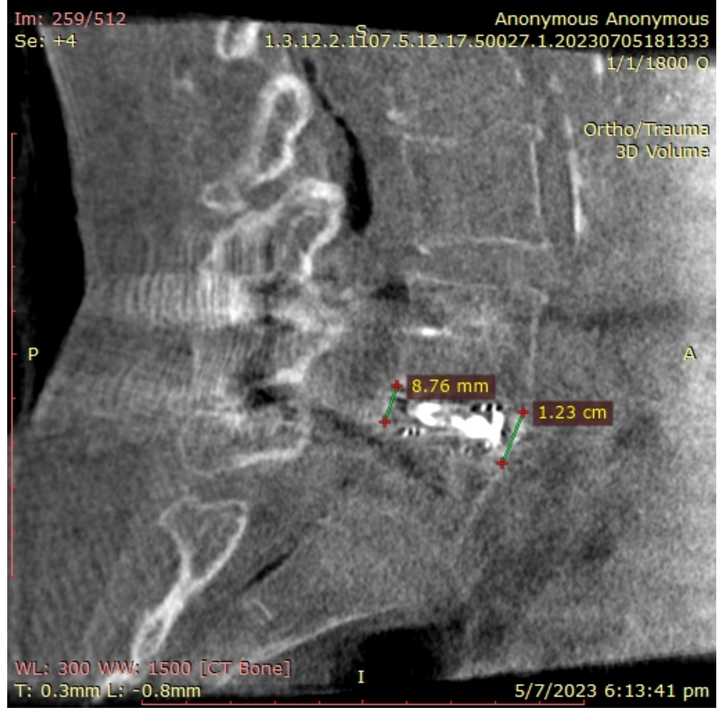

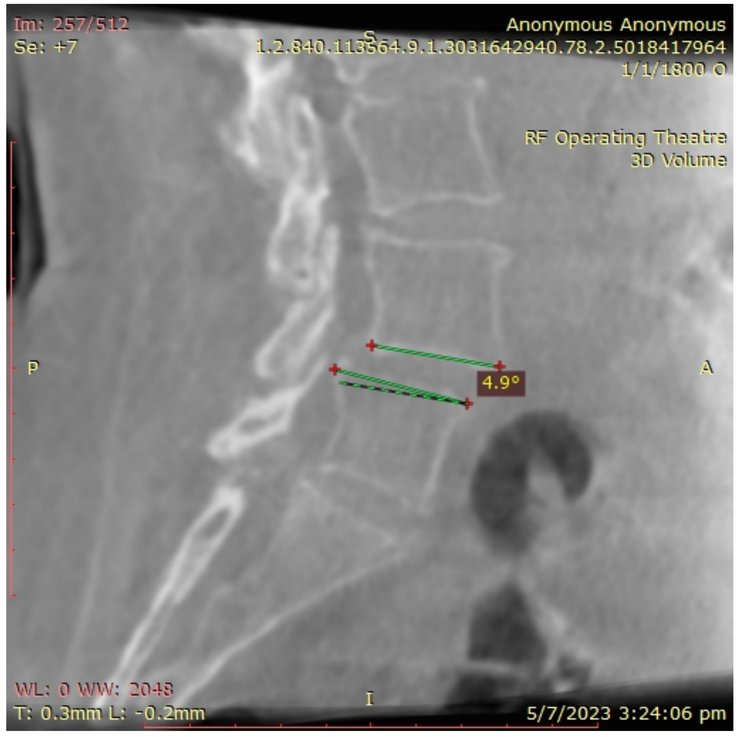

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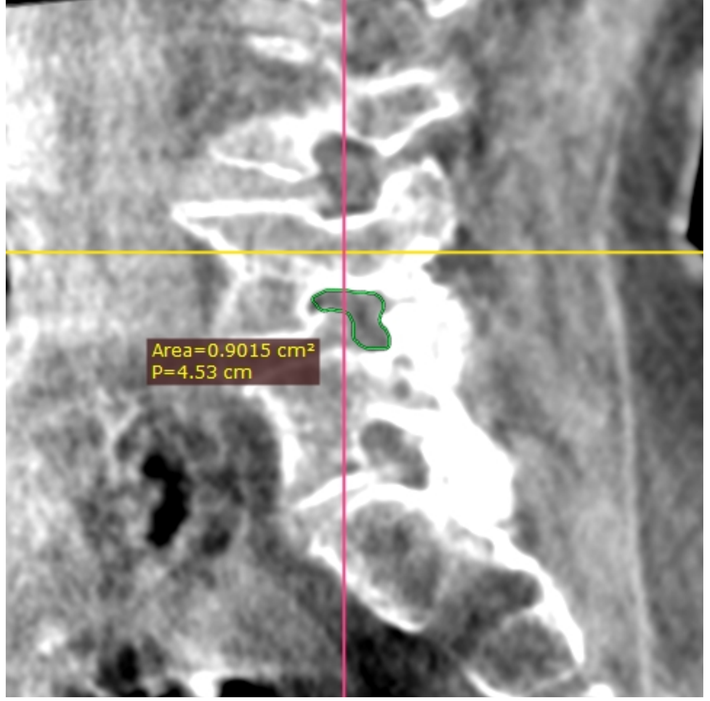

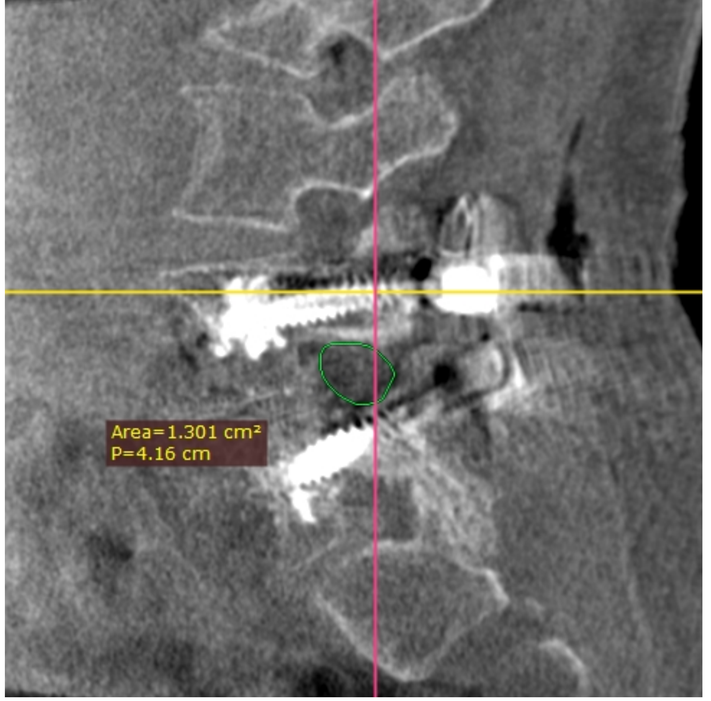

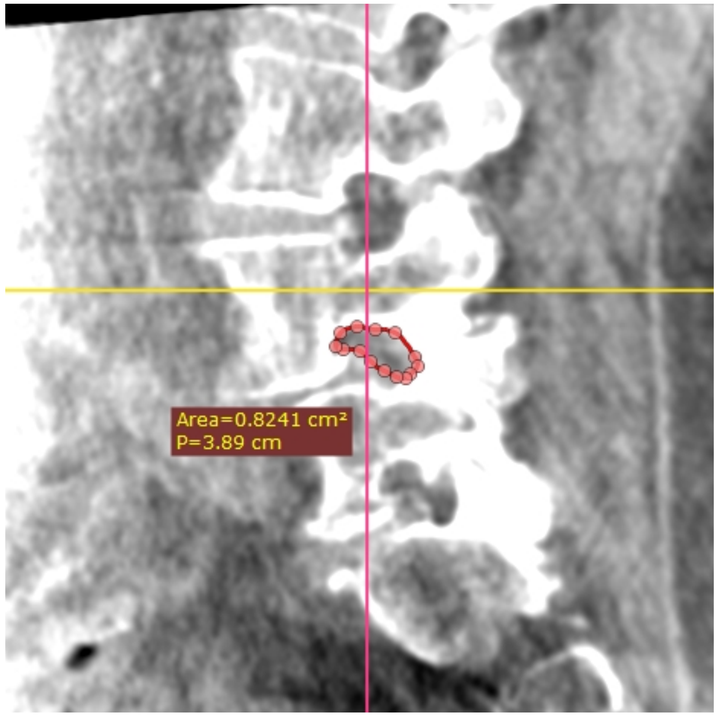

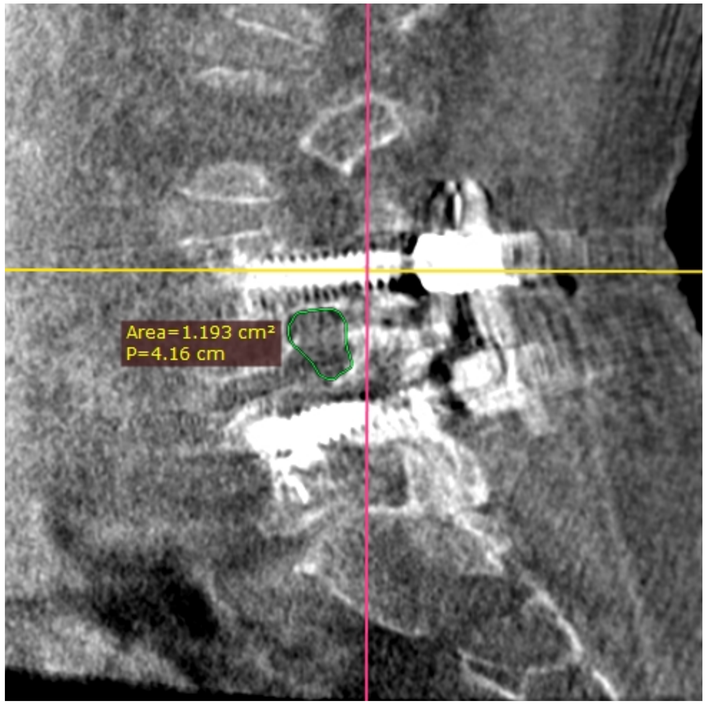

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Demographics/Patient Characteristics

Table 1. Patient Characteristics	
No. of patients	12
Age (years)	70.8 ± 5.8
BMI	26.5 ± 3.3
Gender	3 male and 9 female
Levels	5 1-level TLIF and 7 2-level TLIF
	19 spinal levels fused

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Results

- Significant improvement in posterior disc height (+2.7±1.2mm; p<0.001), anterior disc height (+2.6±3.1mm; p<0.001), listhesis, segmental lordosis (+3.2±2.6°, p<0.001)
- Significant improvement in ipsilateral (41.3+17.5cm2; p<0.001) and contralateral foraminal area (29.1+16.7cm2; p<0.001)
- Ipsilateral and contralateral foraminal area increased by 41% and 31% respectively

Table 2. Radiological Outcomes

BE cage (n=12)	Pre-op	Post-op*	Difference	p-value
Radiological Outcomes				
Segmental Lordosis(°)	6.7±4.0	10.0±3.4	3.2±2.6	<.001
Anterior Disc Height(mm)	8.4±2.1	11.0±3.1	2.6±3.1	<.001
Posterior Disc Height(mm)	4.3±1.5	7.0±1.4	2.7±1.2	<.001
Foraminal Area(cm2)				
- Ipsilateral	1.1±0.3	1.5±0.2	0.4±0.2	<.001
- Contralateral	1.0±0.2	1.3±0.2	0.3±0.2	<.001

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Conclusion

- Utilizing biplanar expandable cage in MIS-TLIF can lead to significant improvement in radiographic parameters, including increase in contralateral foraminal area