

Expandable Cages: Do they play a role in lumbar MIS surgery?

CON

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DISCLOSURES

- SAB; K2M, Osprey, Nanovis, Vertera, St Theresa
- Royalties; Osprey, K2M, Nanovis, Globus
- Stock ownership; Surgical Ventures, Vertera, Morphogeny, Surgifile, Paradigm, St. Theresa
(all <1%)

Goal of Fusion

- Restoration of normal anatomy
- Disc height
- Lumbar lordosis
- Foramenal decompression
- Sagittal balance

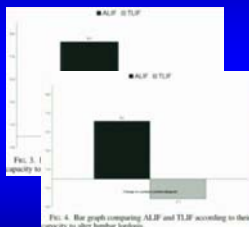
ALIF in Comparison with TLIF; Implication for the restoration of foraminal height, local disc angle, lumbar lordosis and sagittal balance
Hsieh et al, J. Neurosurgery; Spine 2007

- Reviewed radiographs of 32 pts undergoing ALIF and 25 pts TLIF
- Retrospective review of x-rays and records

ALIF vs TLIF in Sagittal Correction

Hsieh et al, J Neurosurgery, Spine Oct 2007

- ALIF ↑ the foramen height 18.5% vs 6.2% TLIF
- ALIF ↑ lordosis by 6.2 deg vs a 2.1 deg ↓ using TLIF



WHY MIS TLIF?

Why MIS TLIF?

- Workhorse operation for MIS surgeon to treat degenerative disc disease
- L4-5 Spondylolisthesis most common, may not be amenable for lateral approaches
- Achieve maximal benefit with minimal disruption of tissue

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Why MIS TLIF?

- **Pros:**
- Shorter hospital length of stay ^{1,2}
- Less intraoperative blood loss ^{1,2}
- Dramatically lower wound infection rate ³
- Preservation of stabilizing paraspinous muscles, i.e. multifidus
- *Patients want less invasive surgery!*

References:

¹ [Lima et al. Spine. 2014 Aug; 39\(16\):1763-1769. doi: 10.1097/BRS.0000000000000067. Epub 2013 Dec 19. A retrospective case-control comparing single-level minimally-invasive and open transpedicular lumbar interbody fusion.](#)

² [Gupta et al. Spine. 2014 Apr; 39\(8\):948-954. doi: 10.1097/BRS.0000000000000067. Epub 2013 Dec 19. A retrospective case-control comparing single-level minimally-invasive and open transpedicular lumbar interbody fusion.](#)

³ [Fisher et al. Spine. 2014 Apr; 39\(8\):948-954. doi: 10.1097/BRS.0000000000000067. Epub 2013 Dec 19. A retrospective case-control comparing single-level minimally-invasive and open transpedicular lumbar interbody fusion.](#)

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Why MIS TLIF?

- **Cons:**
- Steep learning curve, increased OR time initially
- Increased radiation exposure
- Potentially higher implant cost
- Burden of proof versus Open TLIF

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What is the evidence?

An Original Study

Clinical Outcomes of Minimally Invasive Versus Open TLIF: A Propensity-Matched Cohort Study

Mladen Djurasovic, MD, David P. Rouben, MD, Steven D. Glassman, MD, Michael T. Casnellie, MD, and Leah Y. Carreon, MD, MSc

www.amjorthopedics.com

March/April 2016 The American Journal of Orthopedics® E77

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Djurasovic et al

- Retrospective study at two centers from 2008 to 2012
- Inclusion:
 - One and two level TLIFs
 - Baseline, 1-year and 2-year follow-up
- Exclusion:
 - Traumatic, infectious, or oncologic etiologies

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Why MIS TLIF?

- Summary:
- Equivalent to superior long-term clinical outcomes
- Shorter hospital stay, less blood loss
- Overcome the learning curve and consider (if not already) adding to your practice

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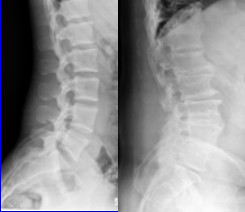
WHY EXPANDABLE CAGES?

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Why Expandable Cages?

What happens when the spine degenerates?

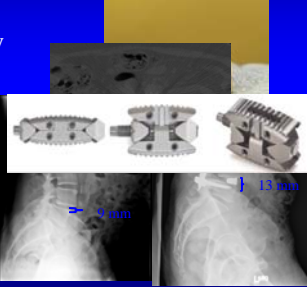
- Loss of disc height
- Preferential loss of anterior disc height
- Loss of lumbar lordosis



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Expandable Cage Advantages

- Possibly reduces risk of nerve injury on delivery (MIS)
- Ideal placement of implant
- Vary height and footprint once deployed
- Fusion?



Limit my comments to;

- Sagittal alignment
- Nerve injuries
- Bone graft
 - endplate preparation
 - device related

Literature Review

- Absence of high level data
- Case series
- Retrospective studies

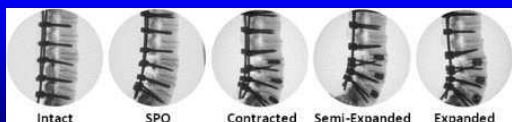
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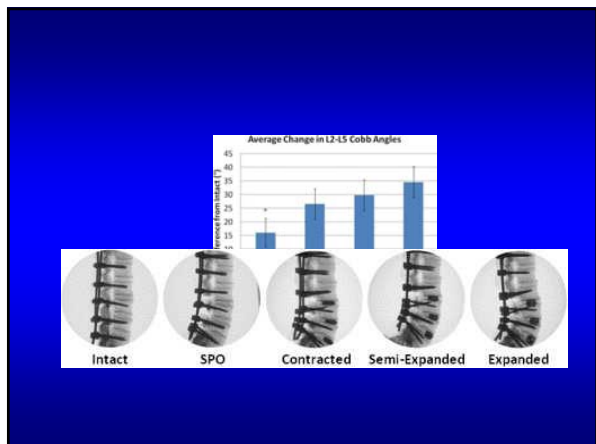


Range of Achievable Sagittal Correction
when using an expandable titanium interbody
device in lumbar SPO
Quandah et al, ORS 2014

- Examine the additional sagittal correction in multilevel SPO with the addition of an expandable cage through TLIF approach

- SPO/TLIF performed L2-L4
- Expandable cages placed at each level
 - contracted
 - semi-expanded
 - expanded

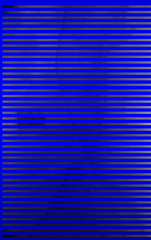




Radiographic Analysis of TLIF for the Treatment of Adult Isthmic Spondylolisthesis
 Kwon et al; J Spinal Disorders and Tech Oct 2003

- 35 consecutive adult patients
- TLIF with 1 or 2 Brantigan cages and pedicle screws
- Measured
 - anterolisthesis
 - disc space height
 - slip angle

- Anterolisthesis reduced in most cases
- Increase in disc space height
- Restoration of lordosis more closely correlated with anterior placement of interbody cage



**Expandable Technology in Minimally Invasive TLIF:
A Multicenter Clinical and Radiographic Analysis of
202 Patients with Two Year Follow Up**

Choli W. Kim, MD, PhD¹,
James Lindley, MD¹,
Todd Doerr, MD¹,
Philip St. Louis MD²,
Ingrid Luna, MPH³,
Gita Joshua, MA¹,
Ai-Min Wu, MD⁴

- 202 pts
- Retrospective analysis using expandable interbody devices MIS TLIF
- Clinical and x-ray outcomes

Results

- Durable improvement in disc height at 2 years
- Lordosis same as preop
- Asymptomatic migration or subsidence in 12 patients (5.9%)

	Preoperative	Immediately Postoperative ^a	Postoperative			P Value (Preoperative vs 24 months)
			6 months	12 months	24 months	
Disc height, mm	8.3 ± 2.7	12.4 ± 1.8	11.9 ± 2.2	11.9 ± 2.4	11.3 ± 1.9	0.80
Neuroforaminal height, mm	17.5 ± 4.6	18.2 ± 4.9	18.5 ± 4.5	18.2 ± 4.3	18.5 ± 4.5	0.30
Facet C/D angle, °	9.1 ± 5.3	10.2 ± 5.0	9.8 ± 5.6	9.7 ± 4.4	9.2 ± 4.7	0.02

^aValues are mean ± SD.
^bValues are 6-month postoperative values.

Alimi et al


Global Spine Journal, 2015

- Consecutive case series
- 49 patients
- No difference in lordosis with expandable cages

- Sagittal alignment
- Nerve injuries
- Bone graft
 - endplate preparation
 - device related

Morgenstern et al
Int J Spine Surg July 2015

- pTLIF
- Compared rigid (10) vs expandable cages(20)
- No difference in leg pain at 12 months



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Transforaminal lumbar discectomy: quantitative study in cadavers

Vialle et al. *Columna* June 2009

- Studied the efficacy of open TLIF in a cadaver model
- L3-4 TLIF allows 48% disc removal
- L4-5 TLIF allows 36 % disc removal

Disc Space Preparation in TLIF: A Comparison of MIS and Open Approaches

Rihn et al; *Clin Orth Relat Res* June 2014

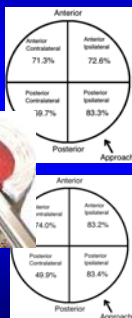
- Compare the adequacy of disc space comparing MIS and open TLIF techniques
- Variables examined
 - endplate violations
 - % disc removed
 - location of residual disc

Results

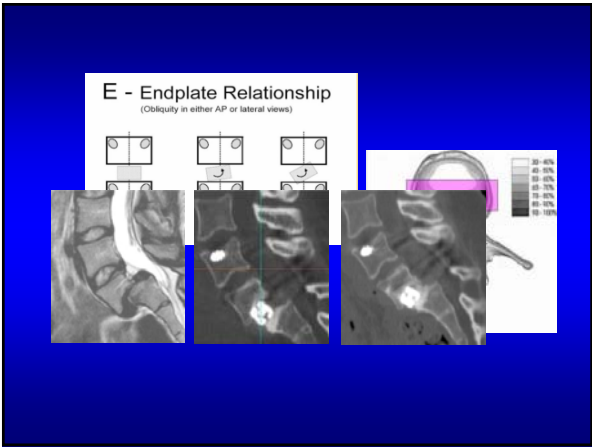
Table 1

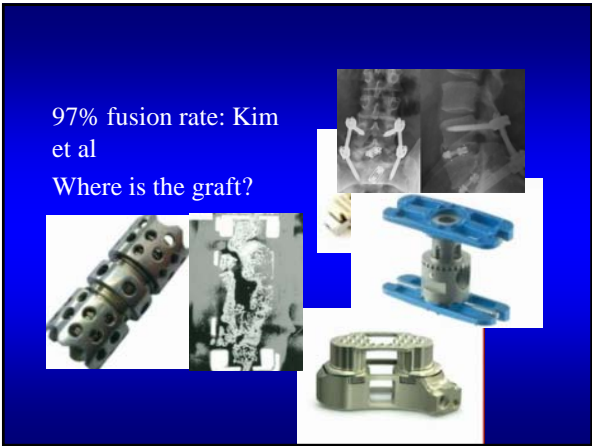
Comparison of results between MIS and open groups

Results	MIS	MIS (SD)	Open	Open (SD)	p value
Time (minutes)	12	3	9	3	0.01
Percentage disc removed by volume	77	12			
Percentage disc removed by weight	75	13			
Percentage disc removed by area	71	16			
Instrument passes	31	10			
Endplate violations	3				



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Case example

- 71 y/o male with low back pain and bilateral lower extremity pain/parasthesias
- Pain is worse in RLE
- Symptoms worse later in the day
- Symptoms exacerbated by activity
- Pain alleviated by rest
- Has had physical therapy and injections with no relief
- Disc Degeneration

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Case example



- Grade I spondylolisthesis
- Loss of disc height
- Bilateral foraminal stenosis

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Grade I L4-5 Spondylolisthesis

- Surgical goals:
 - Restore disc height
 - Reduce spondylolisthesis
- Surgical options options:
 - Lateral interbody fusion
 - MIS TLIF

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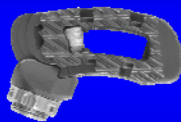
Considerations at L4-5

- Potential pitfalls for Lateral at L4-5:
- Unfavorable lumbosacral plexus anatomy
 - No safe corridor to access disc space
- Difficult access with high iliac crest
- Additional positioning for posterior stabilization

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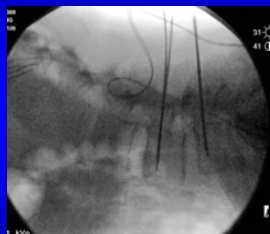
Expandable Cages

- Combines articulation and expansion into one implant
- Articulation allows for horizontal or near horizontal arrangement of implant
- Anterior and horizontal implant orientation, implant can be used as a fulcrum to introduce lordosis



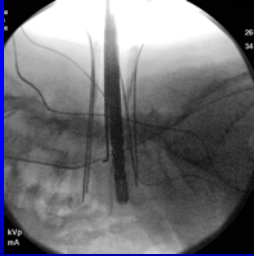
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Before TLIF exposure



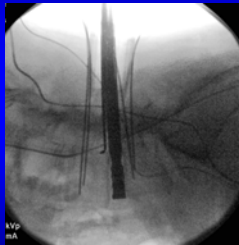
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Cage Inserted



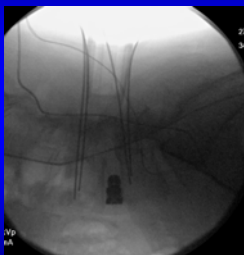
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Cage Turned



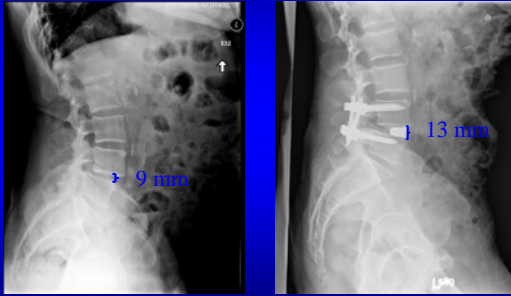
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Cage Expanded



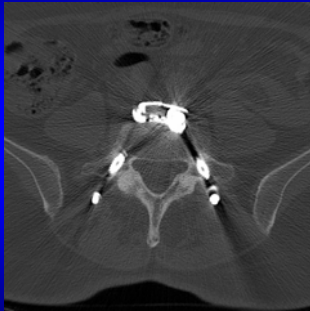
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Pre and Immediate Post-op



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Ideal Cage Placement



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Conclusion

- Sagittal alignment has more to do with cage placement than the expandable nature of the device
- Nerve injuries appear to be equivalent to static cages
- EC cages may increase risk of subsidence c/w static cages
- Endplate preparation with a TLIF is challenging

More Quality Outcome Studies



Thank You

Case example



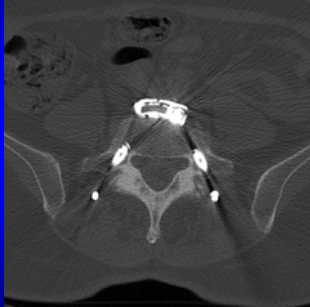
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Post-op



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Ideal Cage Placement



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