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NAVIGATIONAL ASSISTANCE IN INTERBODY DEVICE POSITIONING OPTIMIZES PERI- AND POST-OPERATIVE OUTCOMES IN MINIMALLY-INVASIVE SPINE SURGERY

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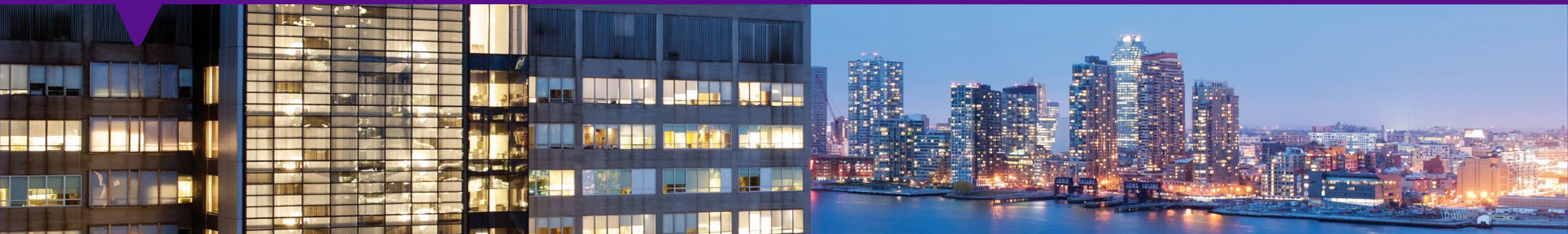
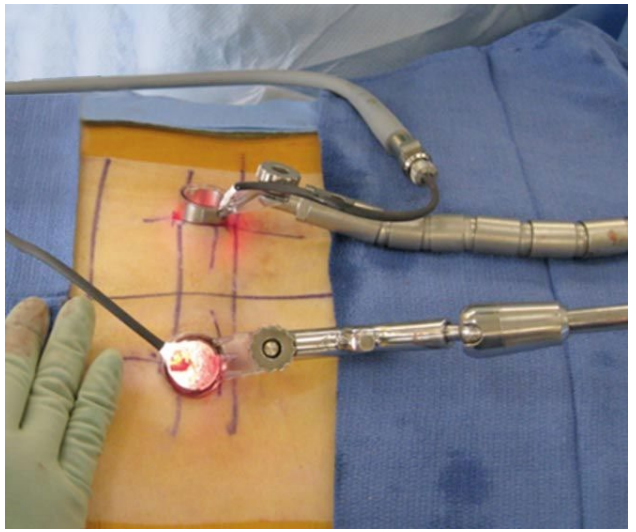


Background

- The use of minimally invasive surgical (MIS) techniques continues to be on the rise since its introduction in the early 2000s, particularly as pressures increase to drive down post-operative complications and healthcare costs.



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https://orthoinfo.aaos.org/en/treatment/minimally-invasive-spine-surgery/

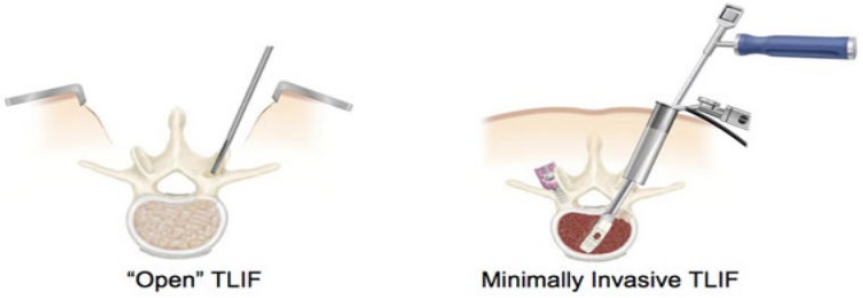
Global Spine J. 2019 Sep;9(6):624-629. doi: 10.1177/2192568218822320. Epub 2019 Feb 26.

Minimally Invasive Versus Open Transforaminal Lumbar Interbody Fusion Surgery: An Analysis of Opioids, Nonopioid Analgesics, and Perioperative Characteristics

Aaron Hockley [1], David Ge [1], Dennis Vasquez-Montes [1], Mohamed A Moawad [1], Peter Gust Passias [2], Thomas J Errico [1], Aaron J Buckland [1], Themistocles S Protopsaltis [1], Charla R Fischer [1]

- Studies have demonstrated various benefits of MIS versus open procedures, such as reduced blood loss, use of opiates, and length of hospital stay.

Khan et al., 2015; Hu et al., 2016; Hockley et al., 2019



https://www.pauljeffordsmd.com/minimally-invasive-surgical-mis-tlif

Objective

To investigate if minimally-invasive surgery utilizing navigational guidance for interbody device placement will demonstrate optimized outcomes, reduced post-operative complications and radiographic deformity markers versus non-optimized patients by 1Y

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Materials and Methods: Study Design, Inclusion Criteria, Statistical Analysis, and Defining Optimization

- Retrospective data analysis of a single academic spine center.
- Inclusion criteria consisted of:
  - Age >18 years undergoing operative treatment of lumbar deformity via MIS technique and IBD placement
  - Availability of baseline (BL) and perioperative (1Y) radiographic, surgical, and patient reported outcome data
- Means comparison analysis assessed differences in clinical, radiographic, and patient-reported outcomes at BL and 1Y post-op.

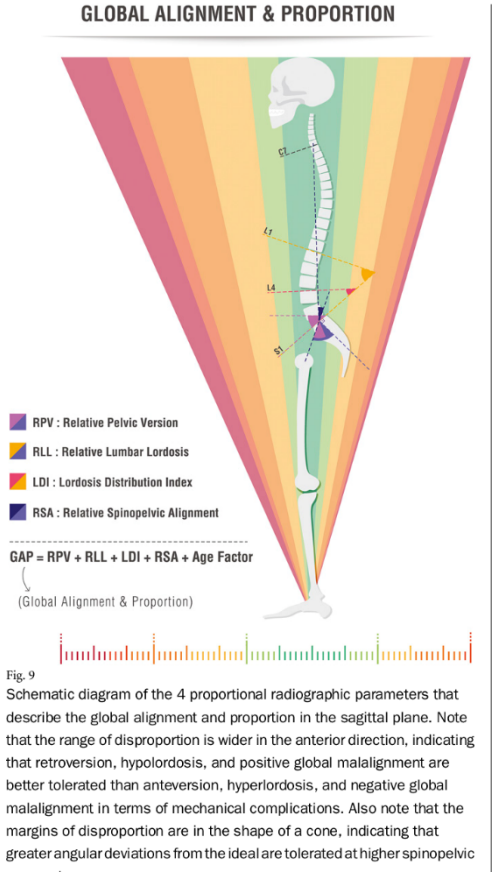

Fig. 9
Schematic diagram of the 4 proportional radiographic parameters that describe the global alignment and proportion in the sagittal plane. Note that the range of disproportion is wider in the anterior direction, indicating that retroversion, hypolordosis, and positive global malalignment are better tolerated than anteversion, hyperlordosis, and negative global malalignment in terms of mechanical complications. Also note that the margins of disproportion are in the shape of a cone, indicating that greater angular deviations from the ideal are tolerated at higher spinopelvic

- At 1Y, an optimized outcome (Optimized) was defined as meeting at least 2 of the following 5 criteria:
  - 1) improving in at least 1 GAP or age-adjusted criteria at 1Y
  - 2) achieving ideal PT per SRS-Schwab at 1Y
  - 3) Achieving ideal PI-LL per SRS-Schwab at 1Y
  - 4) No adjacent segment reoperation
  - 5) No complication requiring reoperation

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Results: Patient Demographics and Surgical Overview

- **20 patients (27.8%) considered optimized**
- Demographic comparison between cohorts revealed optimized patients were significantly more likely to be female

Demographic Factors	Optimized	Non-Optimized	p-value
Age	64.0±10.3	58.4±13.8	.103
Gender	70% Female	56% Female	**.013**
BMI	27.7±5.18	29.2±5.67	.325

*Bolded p-value denotes a significant difference

Comparison of surgical factors between Optimized vs Non-Optimized patients.

Parameter	Optimized (y/n)	Mean	Std. Deviation	p-value
UIV	No	22.00	2.84	.240
	Yes	21.05	3.43	
LIV	No	24.80	0.69	**.037**
	Yes	24.50	0.95	
Levels Fused	No	2.74	3.24	.446
	Yes	3.45	4.10	
BMP (y/n)	No	1.00	0.00	**.001**
	Yes	0.45	0.52	
Op Time (min)	No	342.98	128.55	**.001**
	Yes	355.35	207.52	
EBL (mL)	No	811.47	1426.37	.846
	Yes	742.50	1094.52	
LOS (days)	No	5.32	3.41	.504
	Yes	6.05	5.59	

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Results: Surgical Details

- Optimized patients were less likely to undergo ALIF (p<.001), and more likely to undergo LLIF, XLIF, or OLIF (p <.001).

Parameter	Optimized (y/n)	Mean	Std. Deviation	p-value
ALIF	No	.250	.437	**<.001**
	Yes	.000	.000	
LLIF/XLIF/OLIF	No	.019	.139	**<.002**
	Yes	.200	.410	
TLIF	No	.750	.437	>.05
	Yes	.850	.366	
PLIF	No	.000	.000[b]	>.05
	Yes	.000	.000[b]	

- Optimized patients:
  - Were less likely to be administered BMP (p=.001),
  - Experienced significantly higher mean op time (p=.001)

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Results: Post-Operative Radiographic Outcomes

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Key Findings:

- Compared to Non-Optimized patients, Optimized patients had significantly:
  - Lower mean S1PT at 1Y (p=.038)
  - Lower L1PA at 1Y (p=.021)
  - L4PA at 1Y (p=.009)

Parameter	Optimized (y/n)	Mean	Std. Deviation	p-value
S1SS	No	33.41	5.45	
	Yes	30.07	8.33	.706
S1PT	No	34.86	4.44	
	Yes	20.31	6.01	**.038**
S1PI	No	68.27	5.54	
	Yes	50.38	8.24	.058
PI-LL	No	17.54	2.04	
	Yes	4.09	7.41	.106
L4S1	No	-32.03	6.43	
	Yes	-31.82	9.84	.983
L1L4	No	-26.75	7.15	
	Yes	-19.19	9.11	.440
L4PA	No	20.50	7.54	
	Yes	11.07	2.91	**.009**
L1PA	No	20.18	5.87	
	Yes	8.95	4.08	**.021**

*Bolded p-value denotes a significant difference

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Results: Post- Operative Complications

Parameter	Optimized (y/n)	Mean	Std. Deviation	p-value
Any IntraOp Complication	No	0.33	0.48	**<.001**
	Yes	0.10	0.32	
Any Post-Op Complication	No	0.62	0.49	.098
	Yes	0.33	0.49	
Neurological Complication	No	0.12	0.33	**.009**
	Yes	0.00	0.00	
Deep Infection	No	0.00	0.00	-
	Yes	0.00	0.00	
Return to OR Within 30 Days	No	0.04	0.21	.498
	Yes	0.00	0.00	
Return to OR Within 90 Days	No	0.04	0.21	1.498
	Yes	0.00	0.00	

*Bolded p-value denotes a significant difference

Key Findings:

- Despite increased operative time, optimized patients demonstrated significantly:
  - Lower rates of intraoperative complications (p<.001)
  - Lower rates of post-operative neurological complications (p=.009)

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Conclusions

- Robot or navigation-assisted minimally-invasive surgery (MIS) is being increasingly implemented to increase surgeon accuracy in the placement of interbody devices, and may help optimize post-operative surgical, radiographic and patient-reported outcomes

- Despite increased operative time associated with optimizing IBD placement in MIS patients, such patients demonstrated significantly improved radiographic deformity markers and reduced neurological complication rates by 1Y.

Thank you for your attention!

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