



Outcomes of Operative and Nonoperative Treatment for Adult Spinal Deformity (ASD): A Prospective, Multi-Center Matched and Unmatched Cohort Assessment with Minimum 2-Year Follow-Up

Justin S. Smith MD PhD; Virginie Lafage PhD; Christopher I. Shaffrey MD, FACS; Frank Schwab MD, PhD; Richard A. Hostin MD; Oheneba Boachie-Adjei MD; Justin K Scheer BS; Behrooz A. Akbarnia MD; Eric Klineberg MD; Munish Gupta MD; Vedat Deviren MD; Robert Hart MD; Douglas C. Burton MD; Shay Bess MD; Christopher P. Ames MD



Introduction

Adults with spinal deformity present with pain and disability. Our objective was to compare outcomes for op and nonop treatment for ASD.

Methods

Multicenter, prospective analysis of consecutive ASD patients. Inclusion criteria: age>18 yr and ASD. Propensity scores were used to match op and nonop patients based on baseline (BL) ODI, SRS22, maximum thoracolumbar/lumbar Cobb angle, pelvic incidence to lumbar lordosis mismatch (PI-LL), and leg pain numeric rating scale (NRS) score.

Results

689 patients met criteria, including 286 op and 403 nonop, with mean ages of 53 and 55yrs, minimum 2-yr follow-up rates of 86% and 55%, and mean follow-up of 24.7 and 24.8 months, respectively. At BL, compared with nonop, op patients had significantly worse HRQL based on ODI, SRS22, SF36, and leg and back pain NRS ($p<0.001$) (**Fig 1**) and had worse deformity based on pelvic tilt, PI-LL, and C7SVA ($p<0.002$) (**Fig 2**).

Figure 1: Summary of Patient Population (n=469): Baseline Demographic and Clinical Parameters

	Nonoperative (n=223)	Operative (n=246)	P
Min 2-yr follow-up (%)	55 (223/403)	86 (223/286)	
Gender, % women	87	84	0.212
Mean age, yrs (SD)	52.6 (16.1)	55.4 (15.2)	0.057
Mean BMI, (SD)	25.5 (5.9)	27.1 (5.9)	0.003
Mean CCI, (SD)	0.9 (1.1)	1.4 (1.6)	<0.001
Mean ODI (SD)	22.9 (16.0)	41.5 (19.9)	<0.001
Mean SRS-22 total (SD)	3.6 (0.6)	2.8 (0.7)	<0.001
Mean SF-36 PCS (SD)	43.2 (10.0)	33.3 (10.3)	<0.001
Mean leg pain score (SD)	2.5 (2.9)	4.2 (3.3)	<0.001
Mean back pain score (SD)	4.4 (2.7)	7.1 (2.3)	<0.001

Figure 2: Summary of Patient Population (n=469): Baseline Radiographic and Surgical Parameters

	Nonoperative (n=223)	Operative (n=246)	P
Mean maximum Cobb angle, ° (SD)	44 (17)	45 (21)	1.000
Mean coronal “balance”, magnitude in mm (SD)	24 (19)	33 (31)	<0.001
Mean sagittal “balance”, % with SVA > +5cm	22	46	<0.001
Mean pelvic tilt, ° (SD)	20 (10)	23 (11)	0.002
Mean PI-LL, ° (SD)	5 (17)	13 (21)	<0.001
Surgical complications (%)			
Minor		53	
Major		40	

Before reaching min 2-yr follow-up 38 nonop patients converted to op treatment and were analyzed in the op group. At min 2-yr follow-up all HRQL measures assessed significantly improved for op patients ($p<0.001$), but none of these measures improved significantly for nonop patients ($p>0.11$) (**Fig 3**). 97

Figure 3: Op vs Nonop Treatment: Impact on Outcomes

Outcome Parameter (SD)	Treatment Group (Unmatched)	P-value (op vs nonop)
Oswestry Disability Index		
Baseline	Non-operative (n=223): 22.9 (16.0)	41.5 (19.9) <0.001
Min 2-yr follow-up	23.4 (17.9)	26.1 (20.6) 0.134
P-value (baseline vs 2-yr)	0.538	<0.001
SF-36 Physical Component Score		
Baseline	43.2 (10.0)	33.3 (10.3) <0.001
Min 2-yr follow-up	42.7 (11.4)	41.4 (11.0) 0.249
P-value (baseline vs 2-yr)	0.620	<0.001
SRS-22 total score		
Baseline	3.6 (0.6)	2.8 (0.7) <0.001
Min 2-yr follow-up	3.6 (0.7)	3.7 (0.8) 0.218
P-value (baseline vs 2-yr)	0.064	<0.001
NRS back pain score		
Baseline	4.4 (2.7)	7.1 (2.3) <0.001
Min 2-yr follow-up	4.4 (3.0)	3.5 (3.1) 0.001
P-value (baseline vs 2-yr)	0.899	<0.001
NRS leg pain score		
Baseline	2.5 (2.9)	4.2 (3.3) <0.001
Min 2-yr follow-up	2.7 (3.0)	2.5 (3.0) 0.477
P-value (baseline vs 2-yr)	0.261	<0.001

matched op-nonop pairs were identified based on propensity scores. At last follow-up the 97 matched op patients had significant improvement in all HRQL measures assessed ($p<0.001$), but the 97 matched nonop patients lacked significant improvement in any of the HRQL measures ($p>0.20$). Paired op-nonop

analysis demonstrated op patients to have significantly better HRQL scores at follow-up for all measures assessed ($p<0.001$) (**Fig 4-8**). Operative minor and major complication rates were 53% and

Figure 4: Op vs Nonop Treatment: Impact on Disability

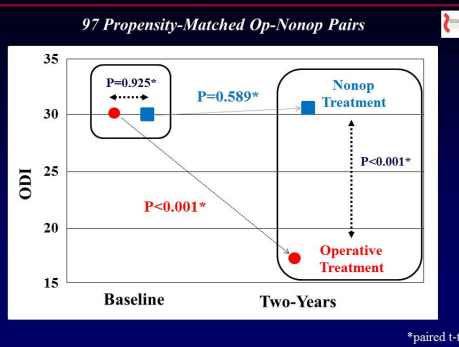


Figure 5: Op vs Nonop Treatment: Impact on SRS-22

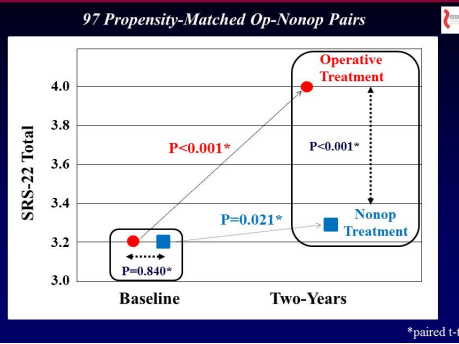
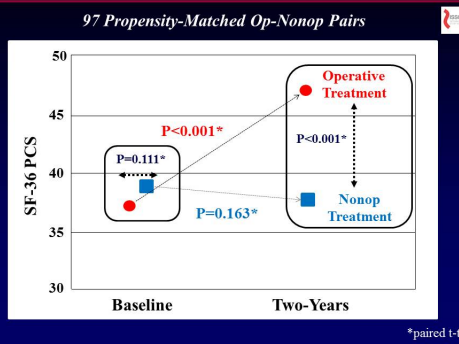


Figure 6: Op vs Nonop Treatment: Impact on SF-36 PCS



40%, respectively.

Figure 7: Op vs Nonop Treatment: Impact on Back Pain

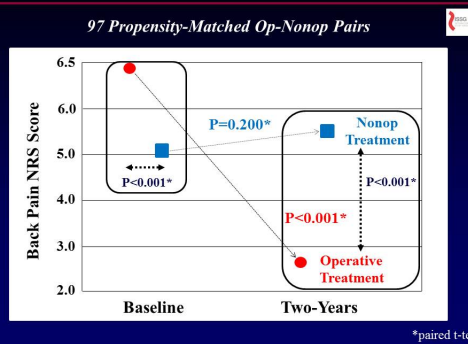
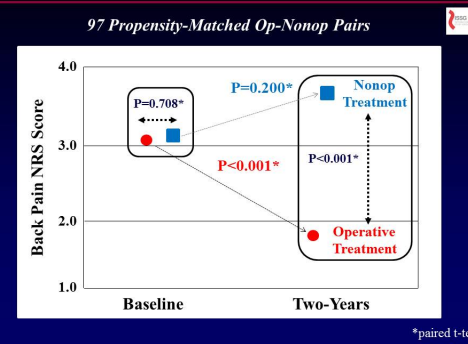


Figure 8: Op vs Nonop Treatment: Impact on Leg Pain



Conclusions

Op treatment for ASD can provide significant improvement of HRQL measures at min 2-yr follow-up. In contrast, nonop treatment appears to at best maintain presenting levels of pain and disability.

Learning Objectives

By the conclusion of this session, participants should be able to:

- 1) discuss operative management of ASD improving HRQOL over non-operative management and
- 2) understand that non-operative management of ASD maintains patients' current pain and disability.