



Reliability of Pre-operative Surgical Planning Software in Predicting Postoperative Alignment in Patients Undergoing Minimally Invasive Multilevel Anterior Column Reconstruction for Positive Sagittal Balance Deformity

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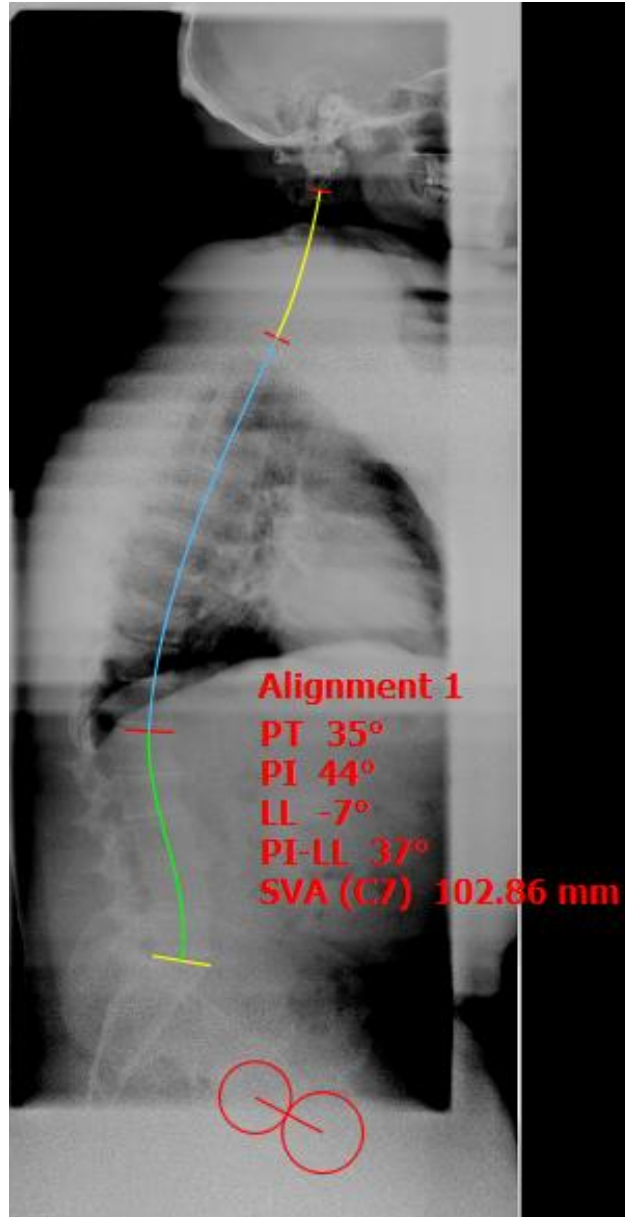
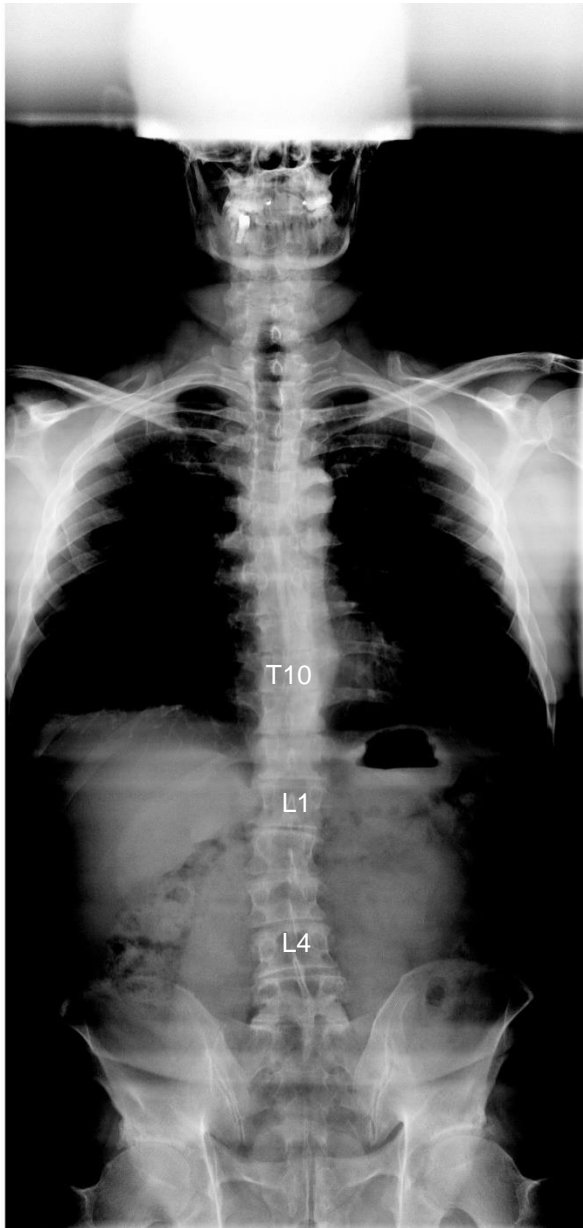


Introduction

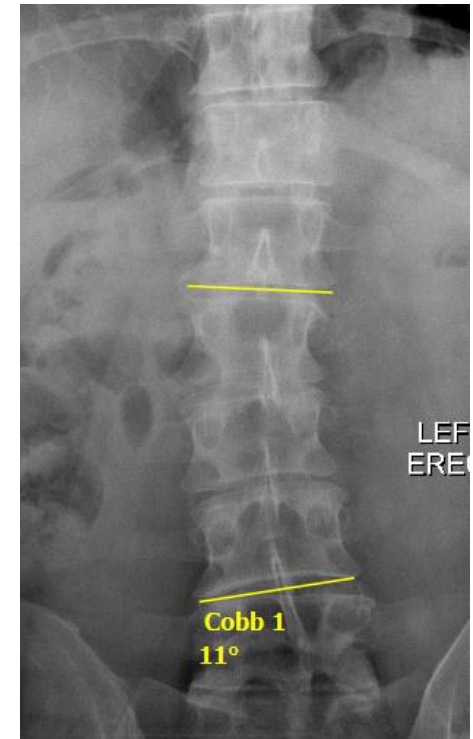
- Correction of sagittal balance is a key part of adult degenerative deformity correction
- Surgimap – measure pelvic parameters and sagittal balance
- Simulate operation and can predict outcome
- Osteotomies can be difficult to execute accurately
- Anterior column reconstruction with multiple anterior and lateral cages is a feasible way of correcting sagittal balance deformity



Case Example: Mild Degenerative Scoliosis with Loss of Sagittal Balance



	Preop
PI	44°
LL	7°
PI - LL	37°
SVA	102.86 mm
PT	35°





Surgimap showing mismatch PI and LL. True sagittal plane deformity revealed when correcting pelvic tilt to normal

	Preop	Preop (Adjusted)
PI	44°	44°
LL	7°	7°
PI - LL	37°	37°
SVA	102.86 mm	234.71 mm
PT	35°	20°

Alignment 1

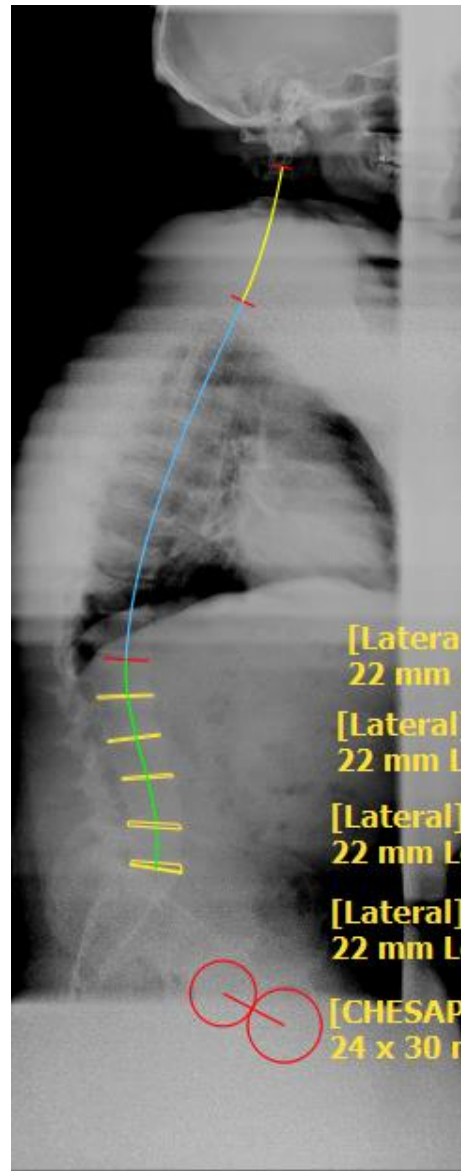
**PT 35°
PI 44°
LL -7°
PI-LL 37°
SVA (C7) 102.86 mm**

Alignment 1

**PT 20°
PI 44°
LL -7°
PI-LL 37°
SVA (C7) 234.71 mm**



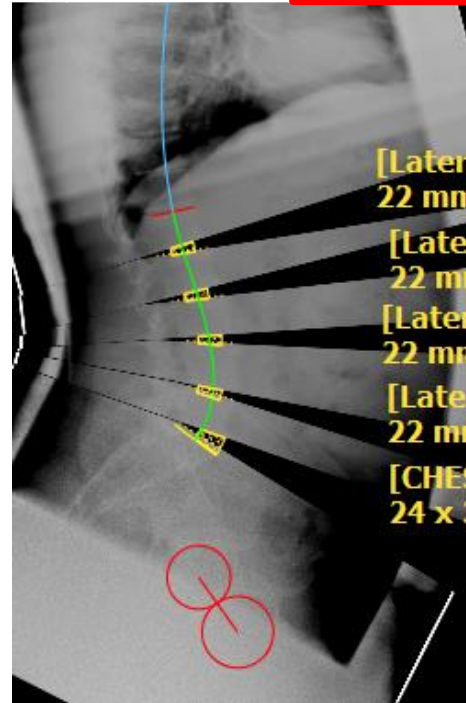
Surgimap planning



Alignment
 PT 35°
 PI 44°
 LL -7°
 PI-LL 37°
 SVA (C7) 102.86 mm

- [Lateral] 22 mm Lordotic 22 x 55 mm 10 mm
- [Lateral] 22 mm Lordotic 22 x 55 mm 10 mm
- [Lateral] 22 mm Lordotic 22 x 55 mm 10 mm
- [Lateral] 22 mm Lordotic 22 x 55 mm 10 mm
- [CHESAPEAKE Anterior-Lumbar] 24 x 30 mm 17 mm 15°

	Preop	Preop (Adjusted)	Predicted
PI	44°	49°	44°
LL	7°	16°	49°
PI - LL	37°	33°	-5°
SVA	102.86 mm	171.7 mm	15.39 mm
PT	35°	19°	8°

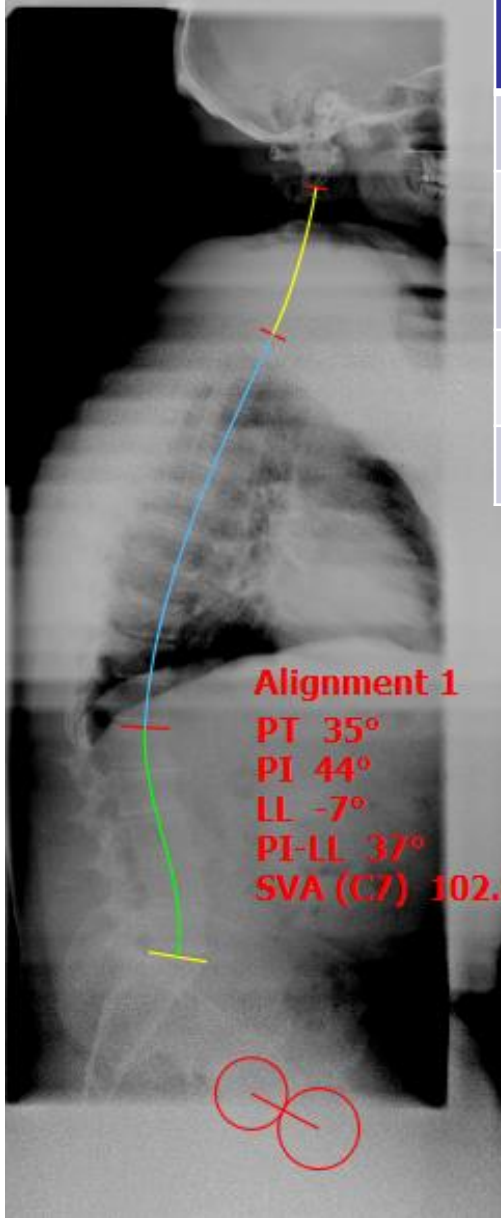


Alignment 1
 PT 8°
 PI 44°
 LL -49°
 PI-LL -5°
 SVA (C7) 15.39 mm

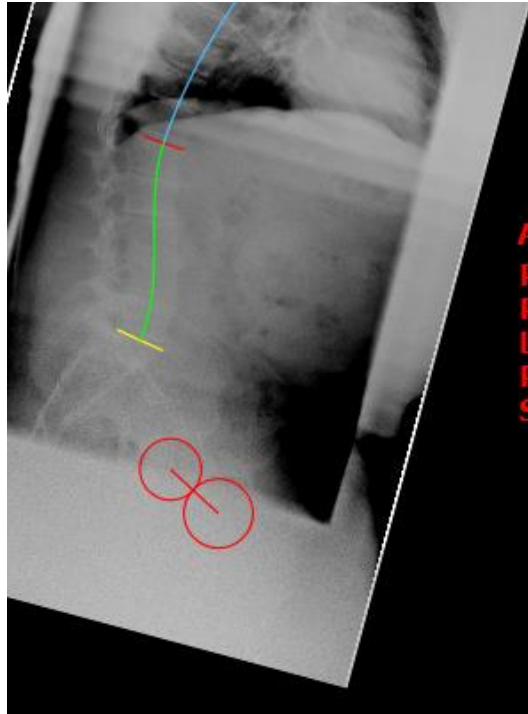
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- [CHESAPEAKE Anterior-Lumbar] 24 x 30 mm 17 mm 15°



After First Stage – L1/2 to L4/5 LLIF with L5/S1 ALIF - PI/LL now match and pelvic tilt normal



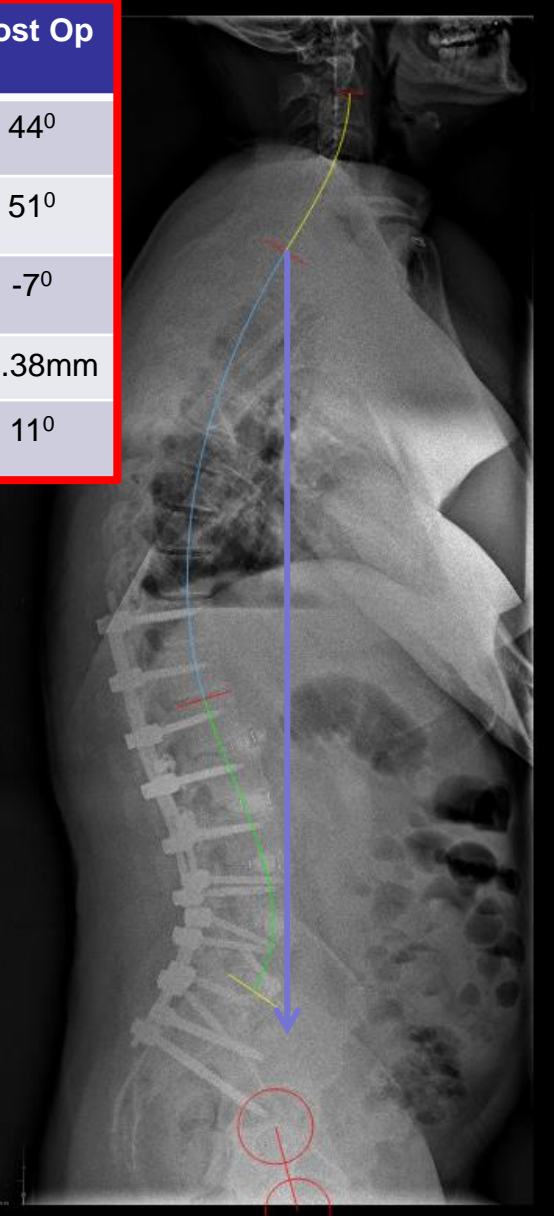
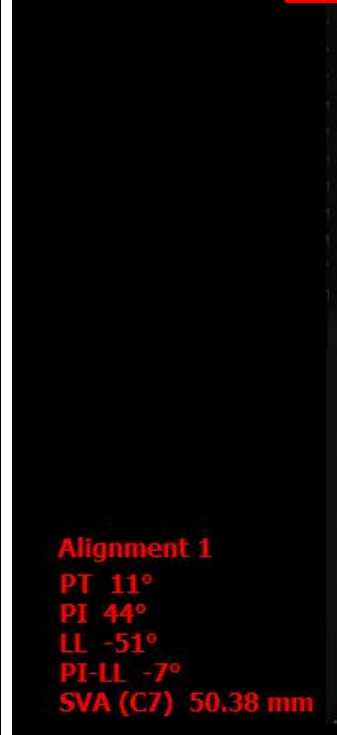
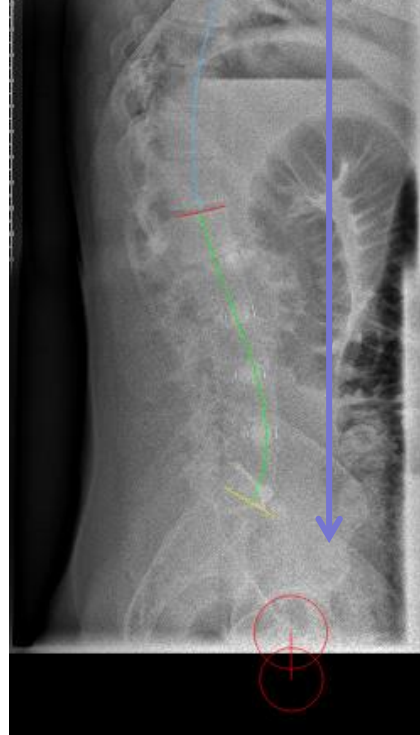
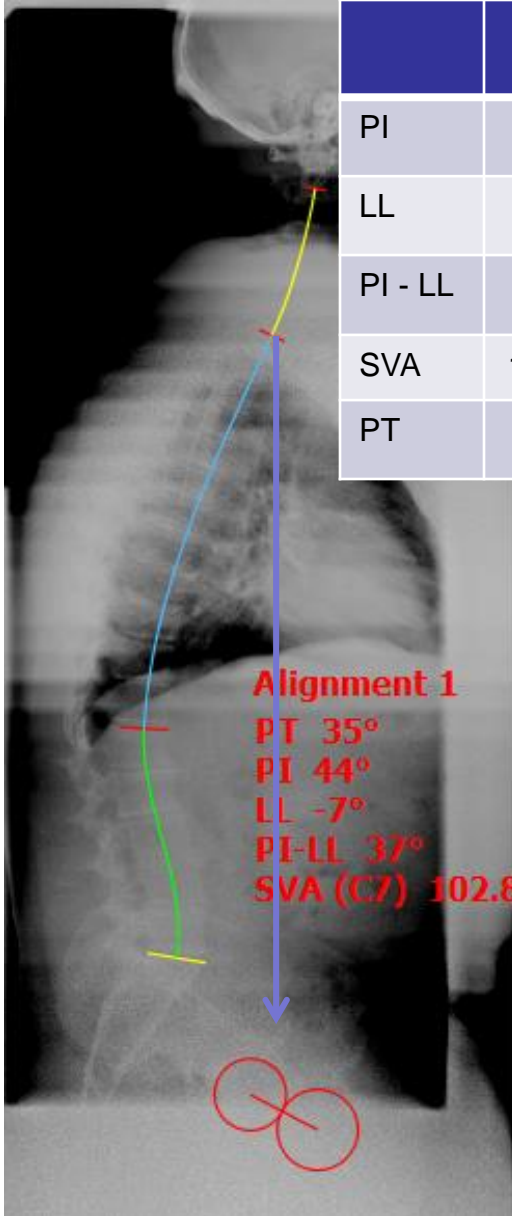
	Preop	Preop (Adjusted)	Predicted	First Stage
PI	44°	44°	44°	44°
LL	7°	16°	49°	43°
PI - LL	37°	33°	-5°	1°
SVA	102.86 mm	171.7 mm	15.39 mm	85.78mm
PT	35°	19°	8°	15°





Final Images – T11 to S2AI Fusion

	Preop	Preop (Adjusted)	Predicted	First Stage	Post Op
PI	44°	44°	44°	44°	44°
LL	7°	16°	49°	43°	51°
PI - LL	37°	33°	-5°	1°	-7°
SVA	102.86 mm	171.7 mm	15.39 mm	85.78mm	50.38mm
PT	35°	19°	8°	15°	11°





Materials and Methods

- Retrospective review of prospectively collected data of a single surgeon case series of 40 patients with positive sagittal balance (both compensated and uncompensated).
- All had erect pre-operative and post-operative whole spine x-rays
- Surgimap was then used to measure the following parameters: Lumbar lordosis (LL), Pelvic Incidence – Lumbar Lordosis mismatch (PI-LL), SVA and Pelvic Tilt (PT).



Materials and Methods

- Pelvic tilt was then adjusted to normal values for each pelvic incidence to determine the predicted SVA.
- Surgery was simulated using multilevel lateral or anterior cages.
- Predicted parameters were then compared to the final outcome.
- All patients had K2M Ravine/Lateral cages and K2M Serengeti/Everest MI



Results

- 26 degenerative scoliosis, 2 spondylolisthesis, 8 iatrogenic flat back and 12 patients with proximal level degeneration
- Surgimap planning accuracy:

	Average	Median	Range
SVA (mm)	15.13	-10.5	-50.9 – 55.4
LL (degrees)	4	4	0 - 20
PI-LL (degrees)	4	5	-20 - 11
PT (degrees)	6	4	0 - 16



Conclusions

- Surgical planning software provides a reliable way of predicting alignment outcomes in anterior column reconstruction surgery for patients with positive sagittal balance deformity.



Disclosures

- Speaker's Bureau/Honoraria: K2M, Medtronic, DePuy, Stryker
- Advisory Board: K2M, Medtronic, Signus