MedStar Health

# E3D Imaging Integrated with Robotic Navigation—Is This the New Standard of Care? Analysis of 200 Consecutive Posterior Thoracolumbar Spinal Fusion Cases.

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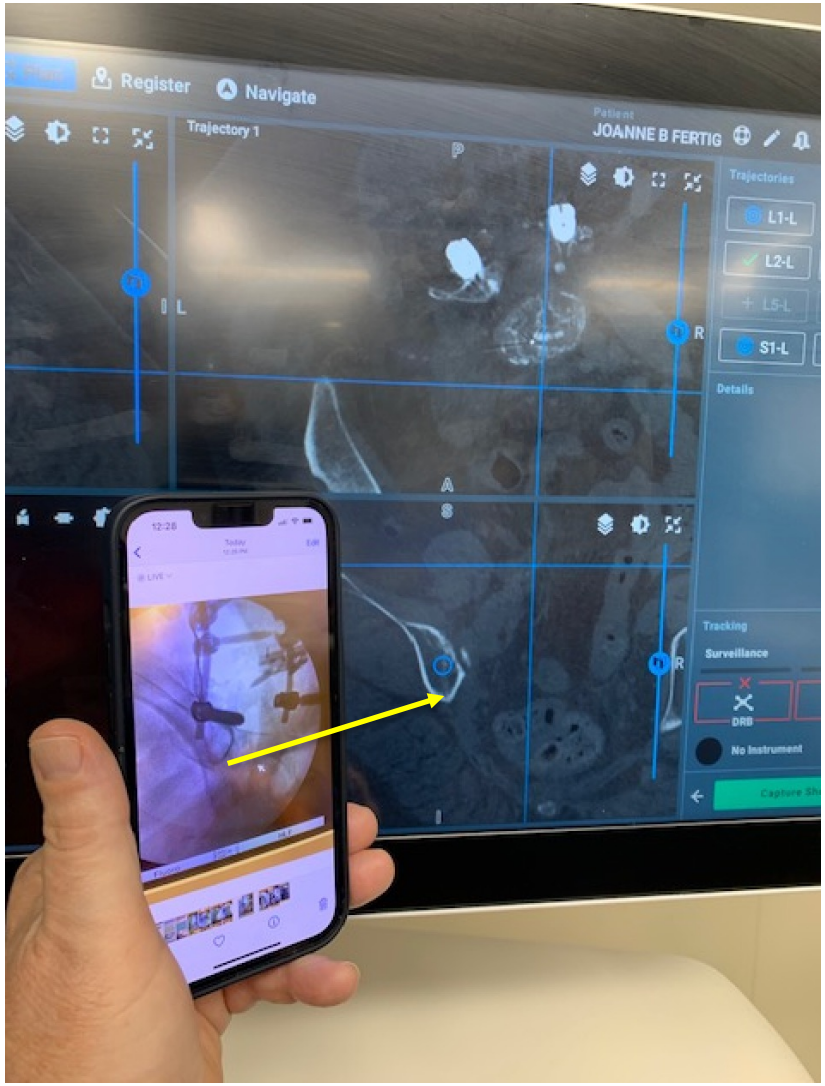
Georgetown School of Medicine

| | Robot | E3D | p-value |
|---|---|---|---|
| Patients | 80 | 80 | |
| Age | | | |
| (mean) | 65.1 ± 12.4 | 63.9 ± 12.5 | 0.612 |
| (range) | (18-86) | (19-83) | |
| Female | 42 (52.5%) | 35 (44.9%) | |
| Male | 38 (47.5%) | 43 (55.1%) | |

| | Robot Only | E3D | p-value |
|---|---|---|---|
| BMI | 31.16 ± 6.48 | 29.59 ± 6.13 | 0.320 |
| ASA Classification | 2.75 ± 0.52 | 2.56 ± 0.55 | 1.000 |
| HTN | 56 (70.0%) | 52 (66.7%) | 0.652 |
| **Same 4 Surgeons** | | | |
| CAD | 15 (18.8%) | 15 (19.2%) | 0.938 |
| CHF | 6 (7.5%) | 2 (2.6%) | 0.157 |
| DVT/PE | 11 (13.8%) | 4 (5.1%) | 0.065 |
| Asthma | 16 (20.0%) | 10 (12.8%) | 0.375 |
| COPD | 12 (15.0%) | 5 (6.4%) | 0.257 |
| OSA | 26 (32.5%) | 19 (24.4%) | 0.257 |
| CVA/TIA | 6 (7.5%) | 4 (5.1%) | 0.540 |
| CKD | 4 (5.0%) | 3 (3.8%) | 0.725 |
| Type II DM | 20 (25.0%) | 26 (33.3%) | 0.249 |
| GERD | 42 (52.5%) | 36 (46.2%) | 0.425 |
| Tobacco Use | 27 (33.8%) | 28 (35.9%) | 0.777 |
| **Interbodies/OSTEOTOMIES** | **52(.65+/-.73)** | **45(.58+/-.63)** | **1.000** |
| Osteoporosis | 2 (2.5%) | 1 (1.3%) | 0.575 |
| | | | |

| | Robot Only (n=80) | E3D (n=80) | p-value |
|---|---|---|---|
| | | | |
| **FDA Criteria for Return to OR** | | | |
| Revision | | | |
| Removal | | | |
| Require Posterior Supp Instr | | | |
| Require additional Neuro Decompression | | | |
| | | | |
| | | | |
| | | | |
| Number of Interbodies/Osteotomies | | | |
| Total | 52 | 45 | |
| Mean | 0.65 ± 0.73 | 0.58 ± 0.63 | 1.0000 |
| **Mean Fluoro Time (seconds)** | **51 ± 26** | **36 ± 20** | **0.0001** |
| **Mean Length of Surgery (minutes)** | **306 ± 73** | **257 ± 60** | **0.0001** |
| **Mean EBL (ml's)** | **474 ± 397** | **345 ± 225** | **0.0130** |
| **FDA Criteria-- Complications** | **11 (13.8%)** | **3 (3.8%)** | **0.0285** |
| Instrumentation Related | 8 | 1 | |
| Infection | 2 | 0 | |
| Other | 1 | 2 | |
| **Length of Stay** | **5.16 ± 3.40** | **3.77 ± 1.86** | **0.0236** |


Verify
Image
Register
Navigate
JOANNE B FE
Trajectory 1
Implant Placed
Implant Placed
Implant Placed
Perfect Position on
Robot Based on Preop CT!!!



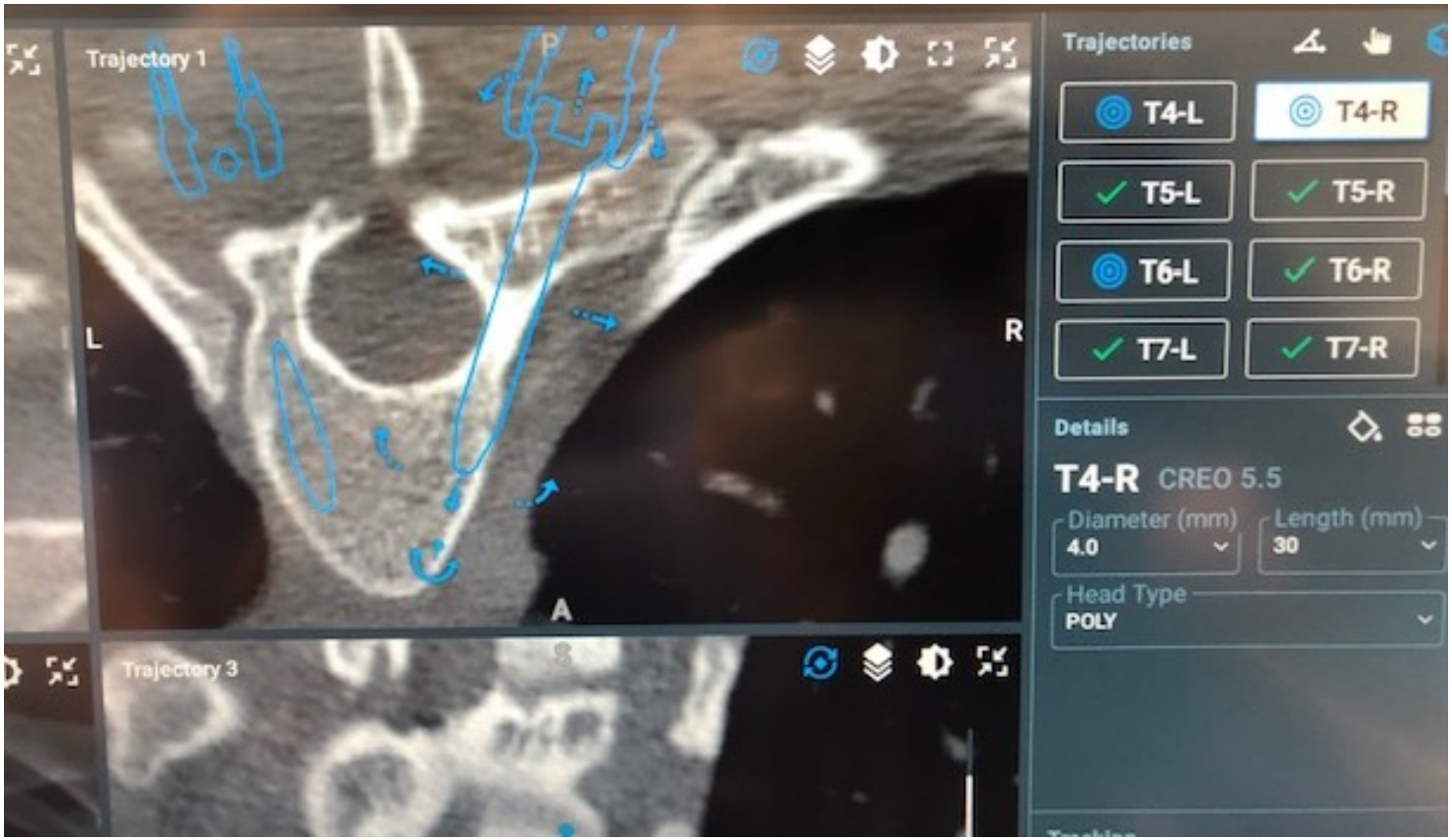

Dissociation between
Virtual Navigational Robotic Image
And Reality

Misleading Information without
E3D

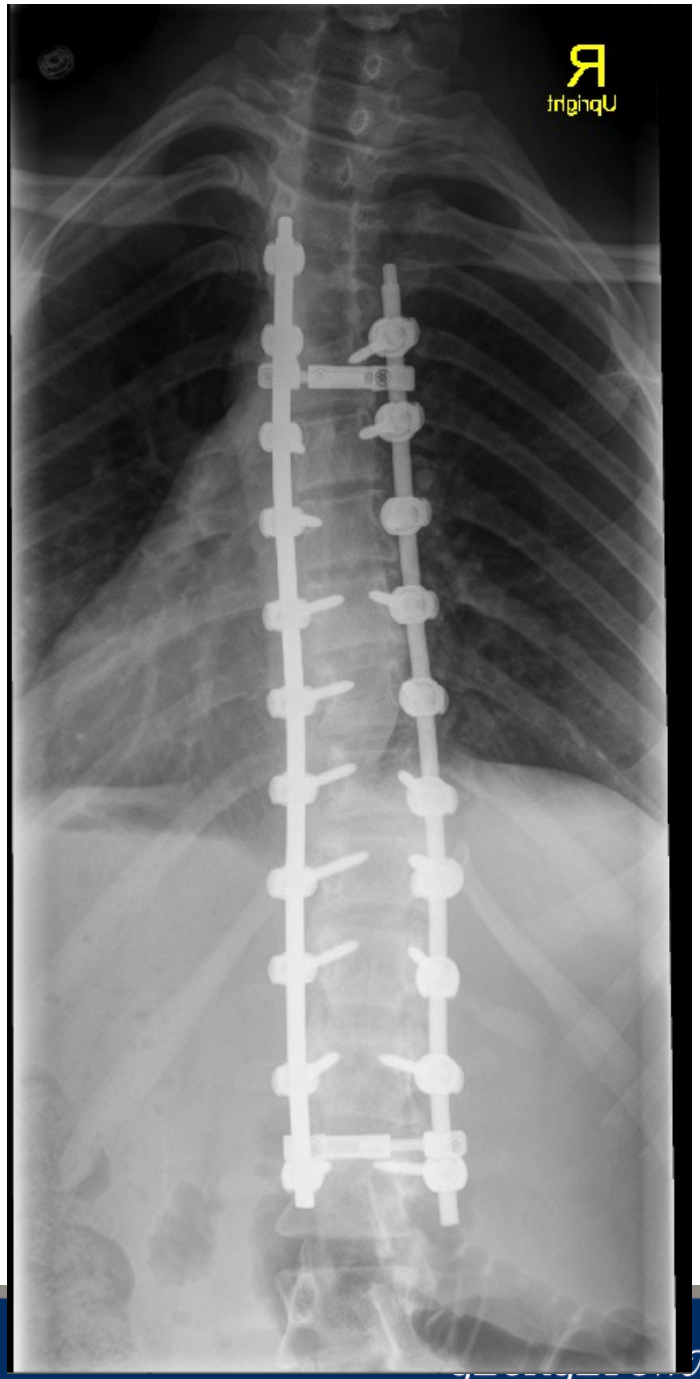
# 10 Scenarios of Indecision

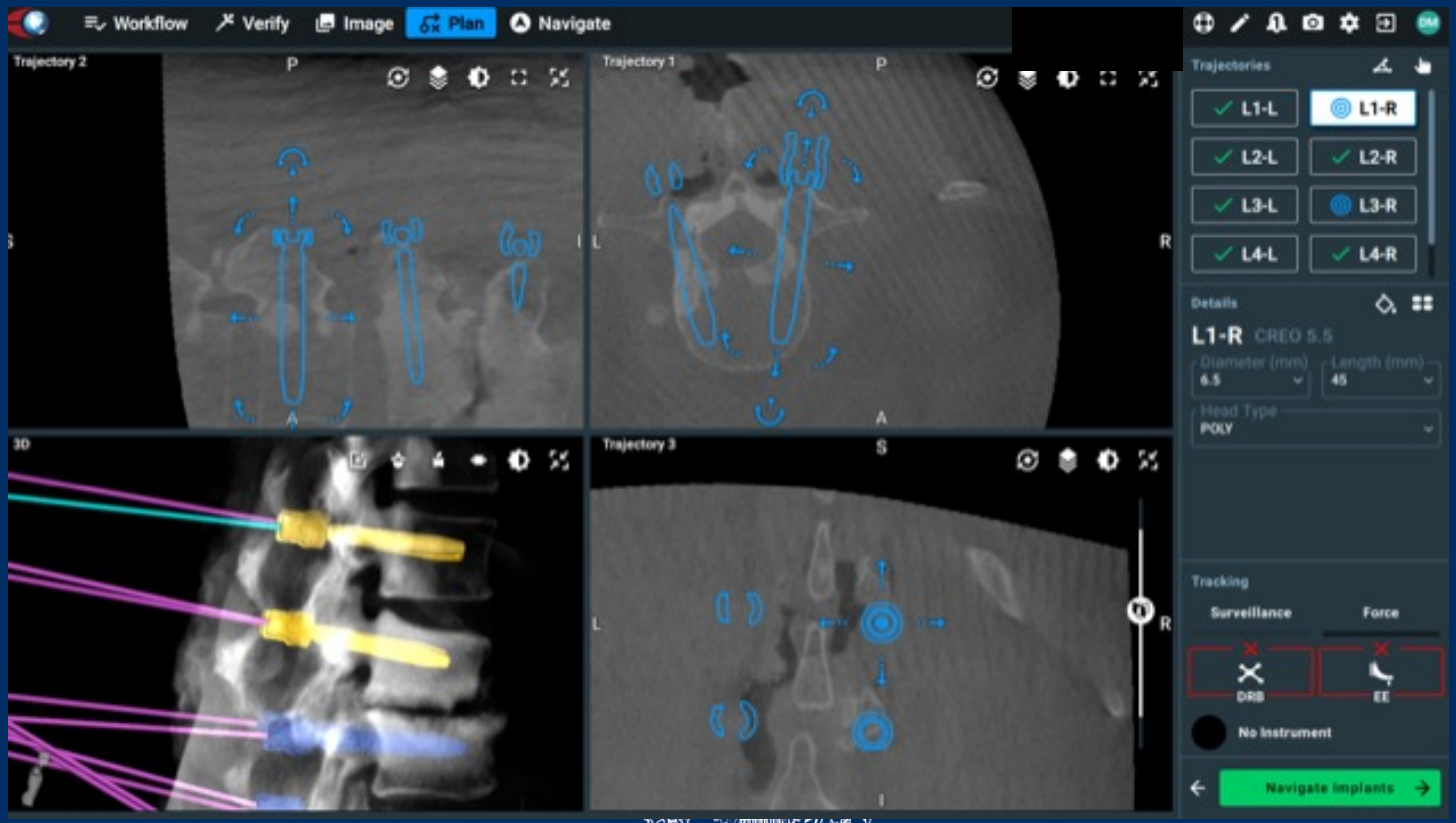
- Abnormal screw stimulation– low threshold
- Poor bone stock in Pelvis for S2AI multiple screw Fixation
- Different Trajectory for Thoracic screw-- too medial?
- Dysplastic pedicle lumbar spine lateral recess
- Dysplastic pedicle upper thoracic spine convex T1 to T6
- Change in resistance while drilling a pedicle screw
- Did you skive laterally off of vertebral body?
- CSF coming out of Pedicle screw or 10mm lateral mass screw (C3)– too deep?
- Did assistant retract too much on paraspinal muscles?
- Inadequate C-arm Fluoro view of Pelvic Tear Drop.

# Dysplastic Upper T4 Thoracic Pedicle Convexity– hold respirations?




L


R
Upright

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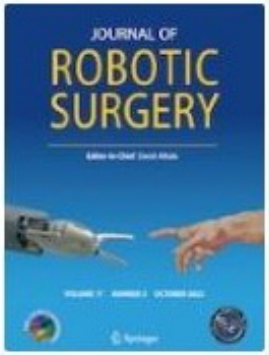
# Did Assist Retract the Paraspinal Muscles ?

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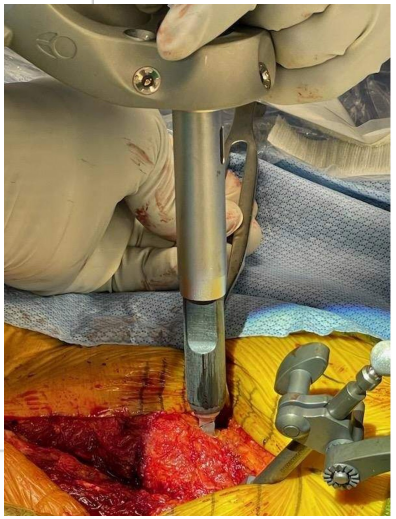


## Latest articles

100 Complex posterior spinal fusion cases performed with robotic instrumentation

Brian McCormick, Paul L. Asdourian ... Paul C. McAfee

Research | Published: 14 September 2023

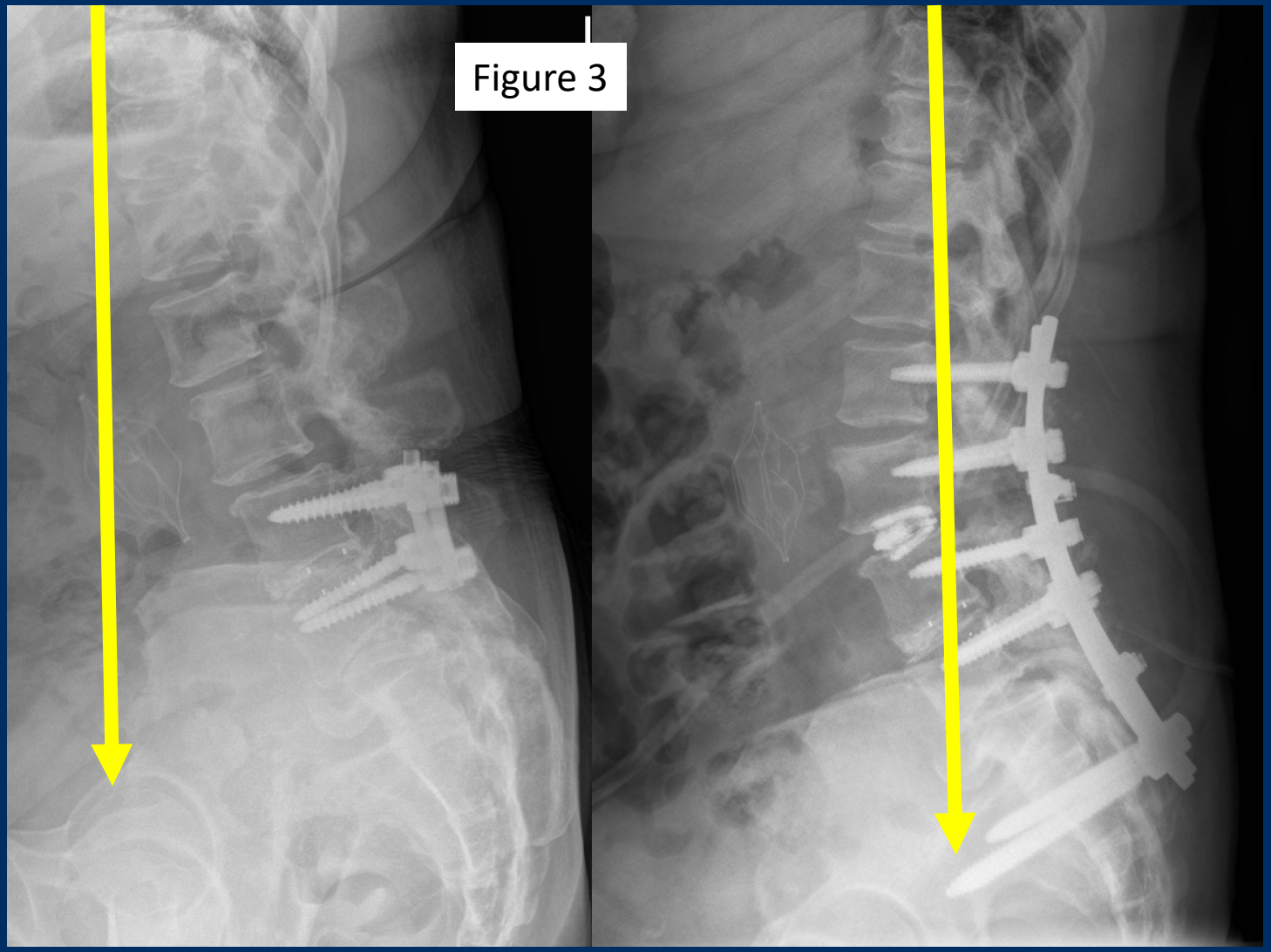
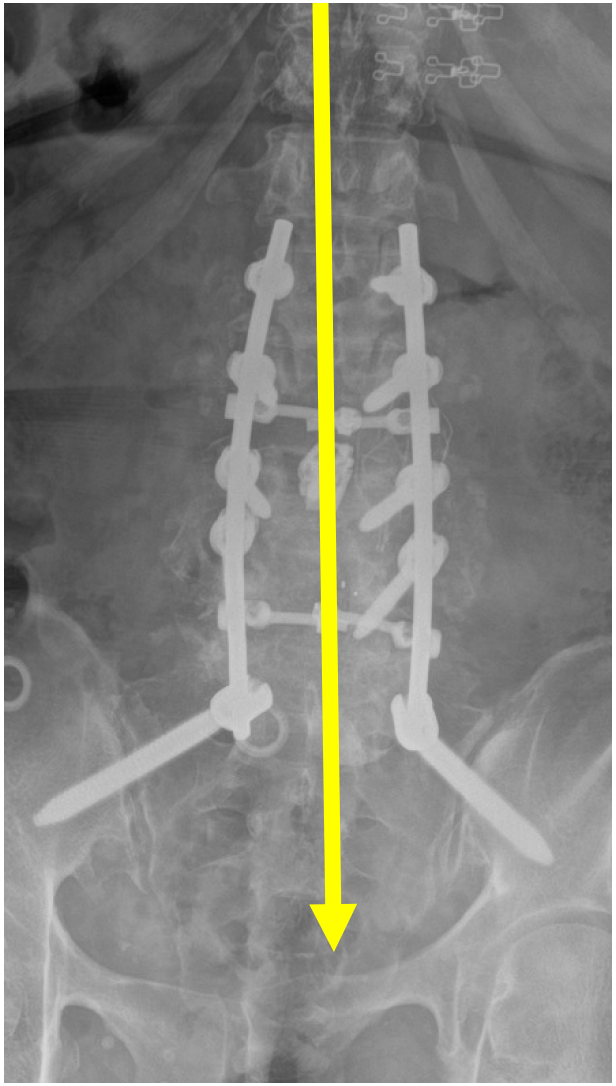
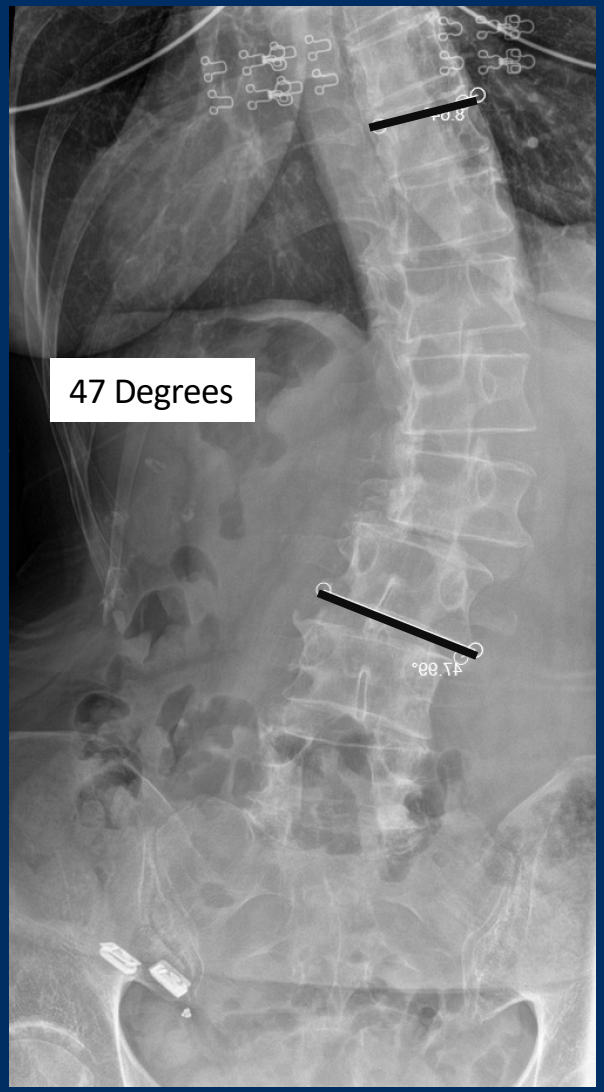


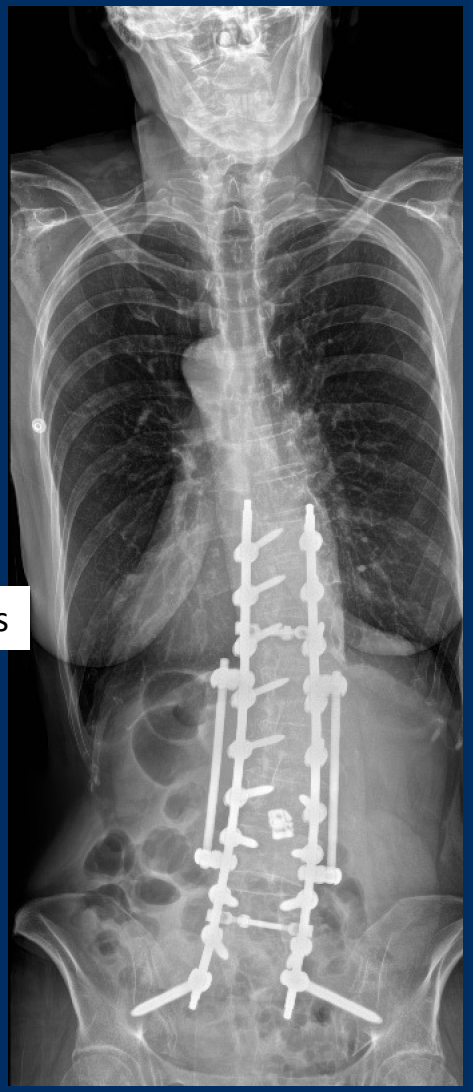
Figure 3





47 Degrees

12 Degrees



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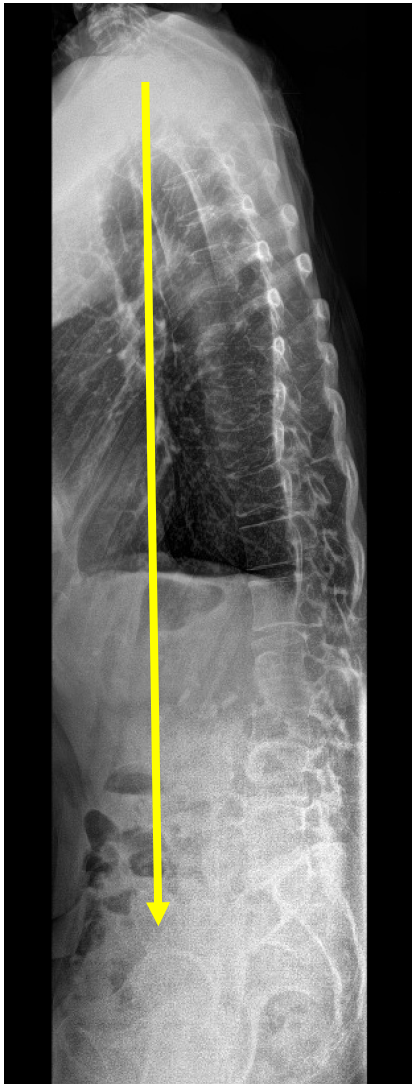

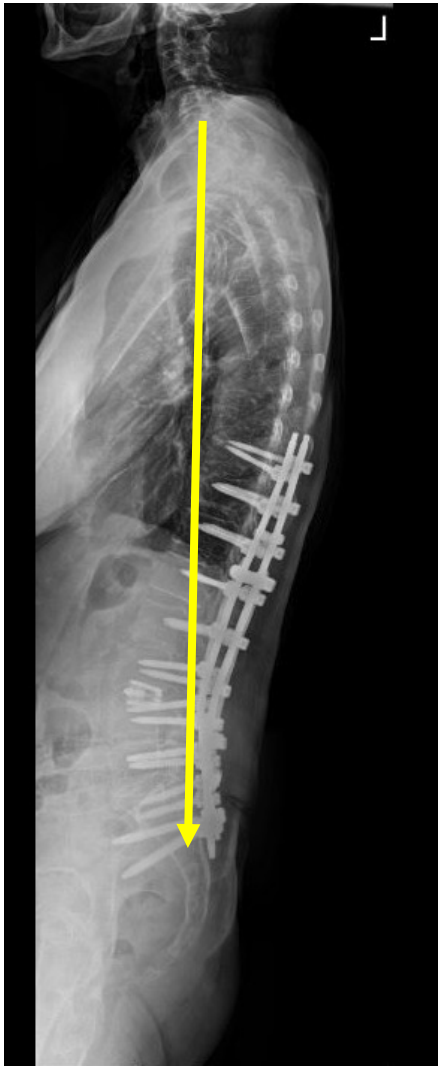

# L4 Intraoperative E3D

1789

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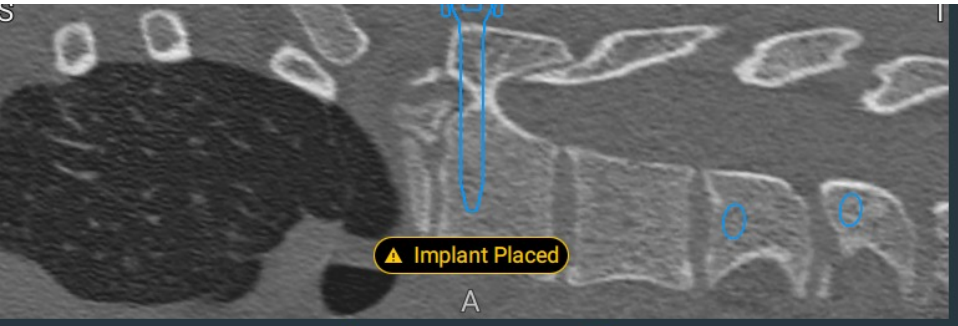
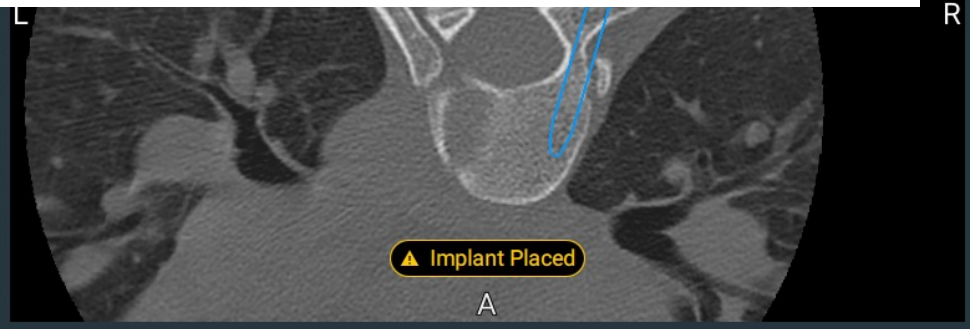
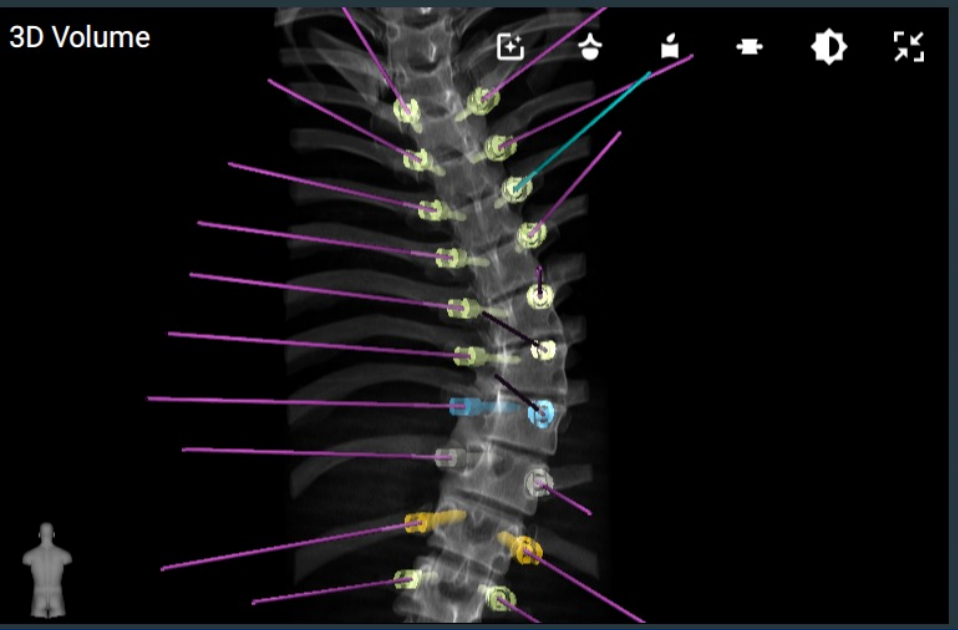
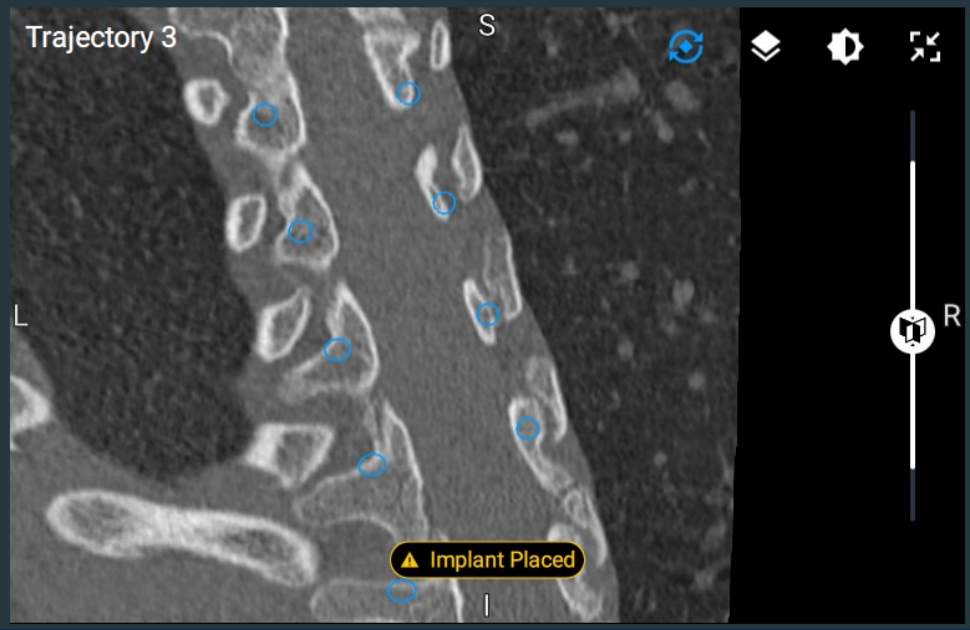
Unlike Human where each successive screw insertion adds new information—
Amount of rotation and trajectory
Robot doesn't really use AI or "Learn" with each successive screw inserted.
Each successive screw is a "New" experience. Should be a way to use AI and place a DRB (reference array) on each successive screw so the added information can be merged into the navigational computer algorithm.



# Diffusion of Innovation by Everett Rogers (1962)



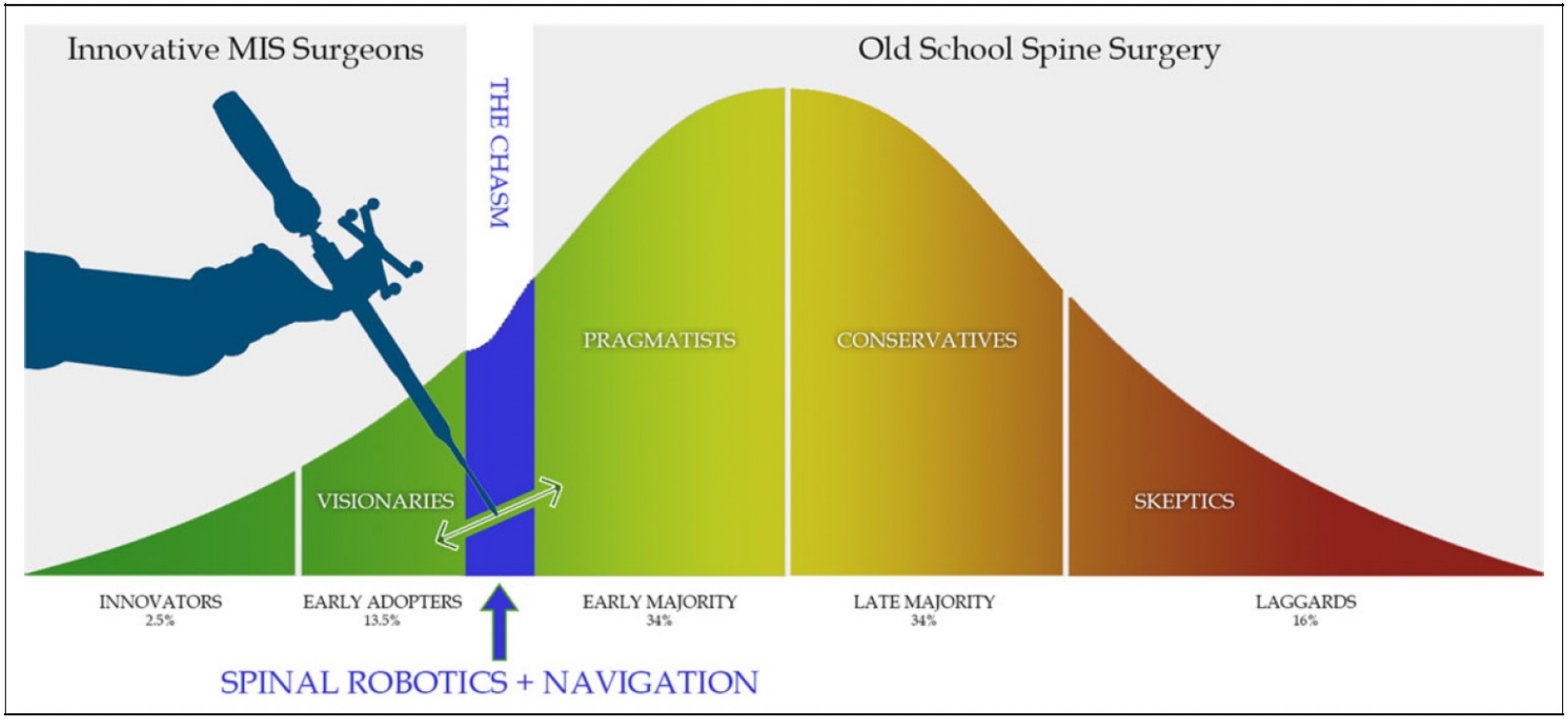
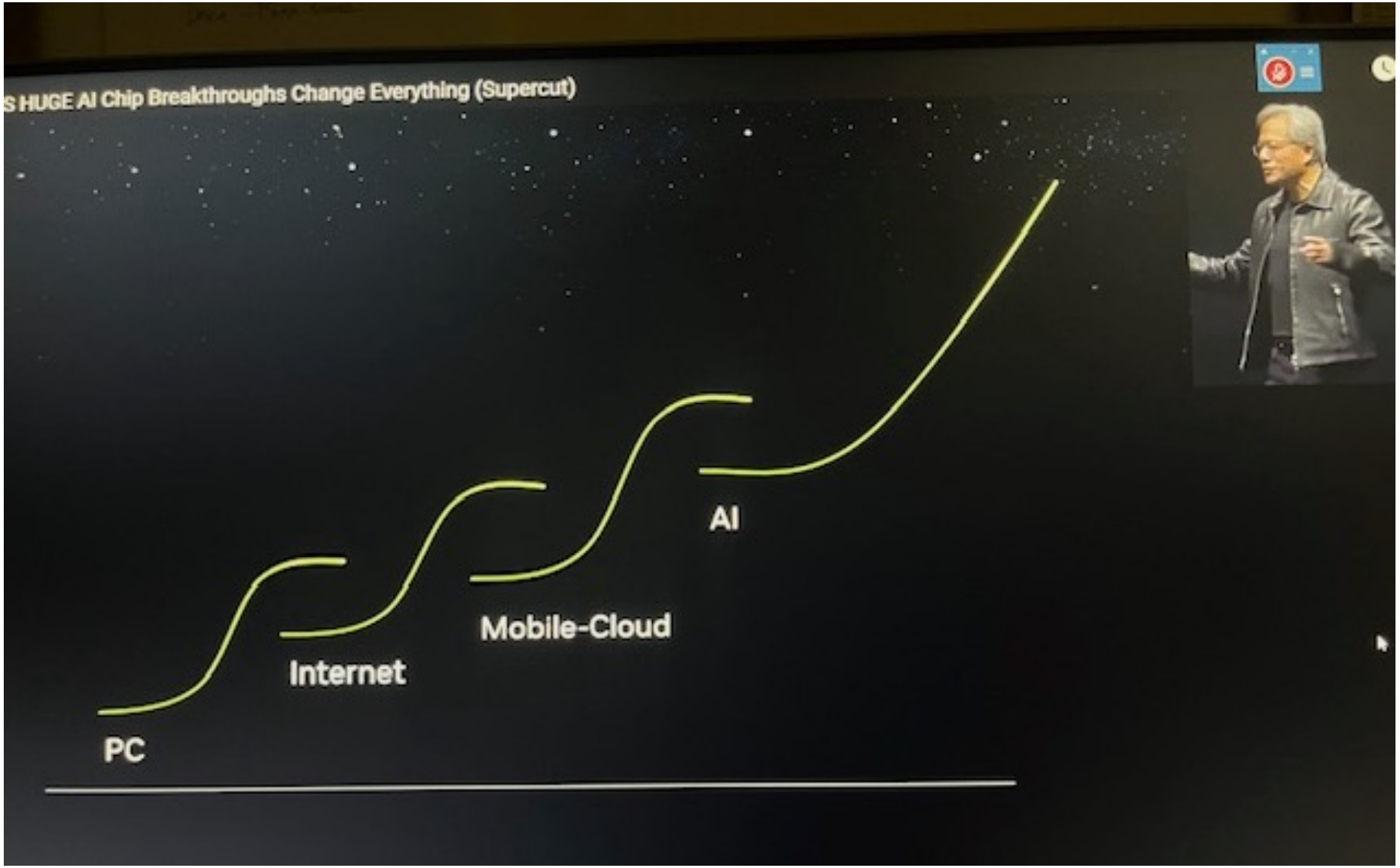
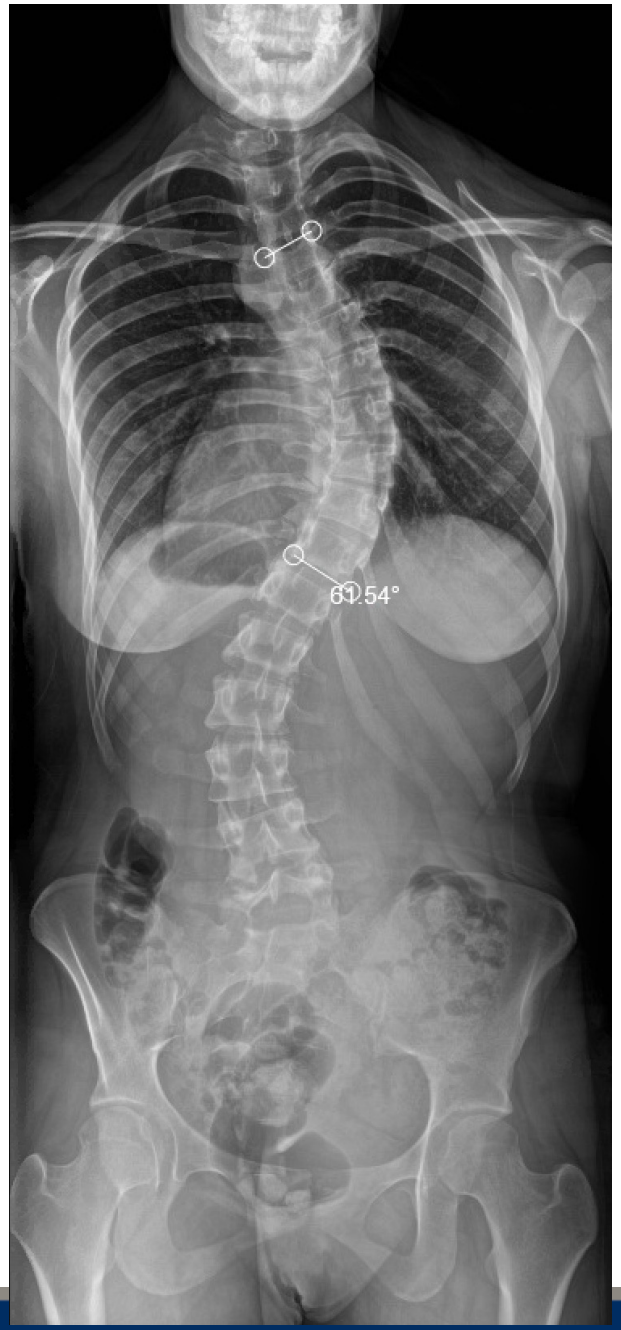
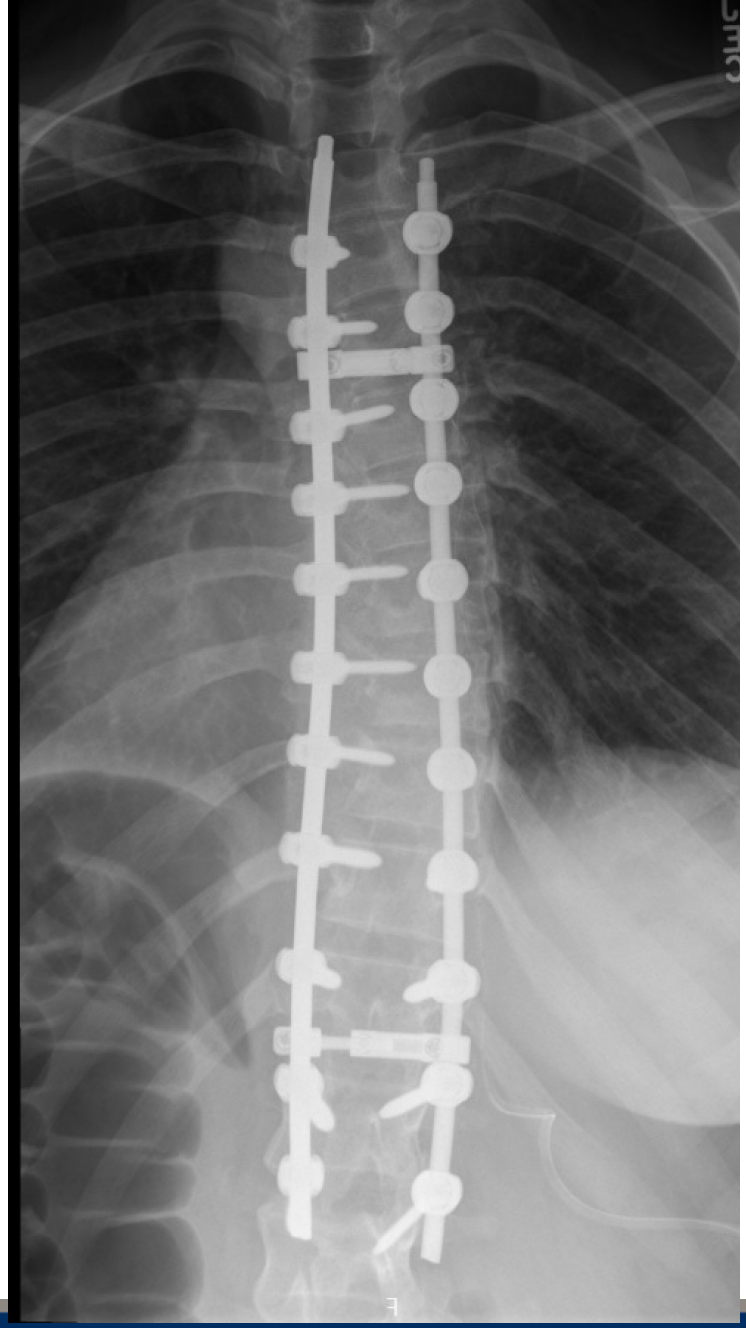



**Figure 1.** The technology and precision of Spinal Robotics and Navigation are currently at the inflection point along the Innovation Diffusion Curve. The articles in this issue are compelling enough to help Minimally Invasive Surgical (MIS) techniques to Cross the Chasm from the early adopters to the early majority of evidence-based spinal surgeons.


S HUGE AI Chip Breakthroughs Change Everything (Supercut)
PC
Internet
Mobile-Cloud
AI


61.54°



# PearlDiver– Age-matched Controls
# Return to OR in one year lower if Navigation + CT Capabilities

14,137 cases with intraoperative CT scan the day of original surgery.
(E3D, O-Arm, Aero CT)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1-year Surgery-related Complications | | | | | | | |
| | Navigated | | Control | | | | |
| | n = 14137 | | n = 14137 | | OR | 95% CI | P |
| Revision with instrumentation removal | 217 | 1.53% | 350 | 2.48% | 0.61 | 0.52 - 0.73 | <0.0001 |
| Post-laminectomy Syndrome | 1409 | 9.97% | 1914 | 13.54% | 0.71 | 0.66 - 0.76 | <0.0001 |
| Wound Disruption | 987 | 6.98% | 907 | 6.42% | 1.09 | 0.99 - 1.20 | 0.0571 |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