



Patient-Specific Biomechanical Digital Twin For Superior Spine Care: from Prevention to Decision-Making Assistant

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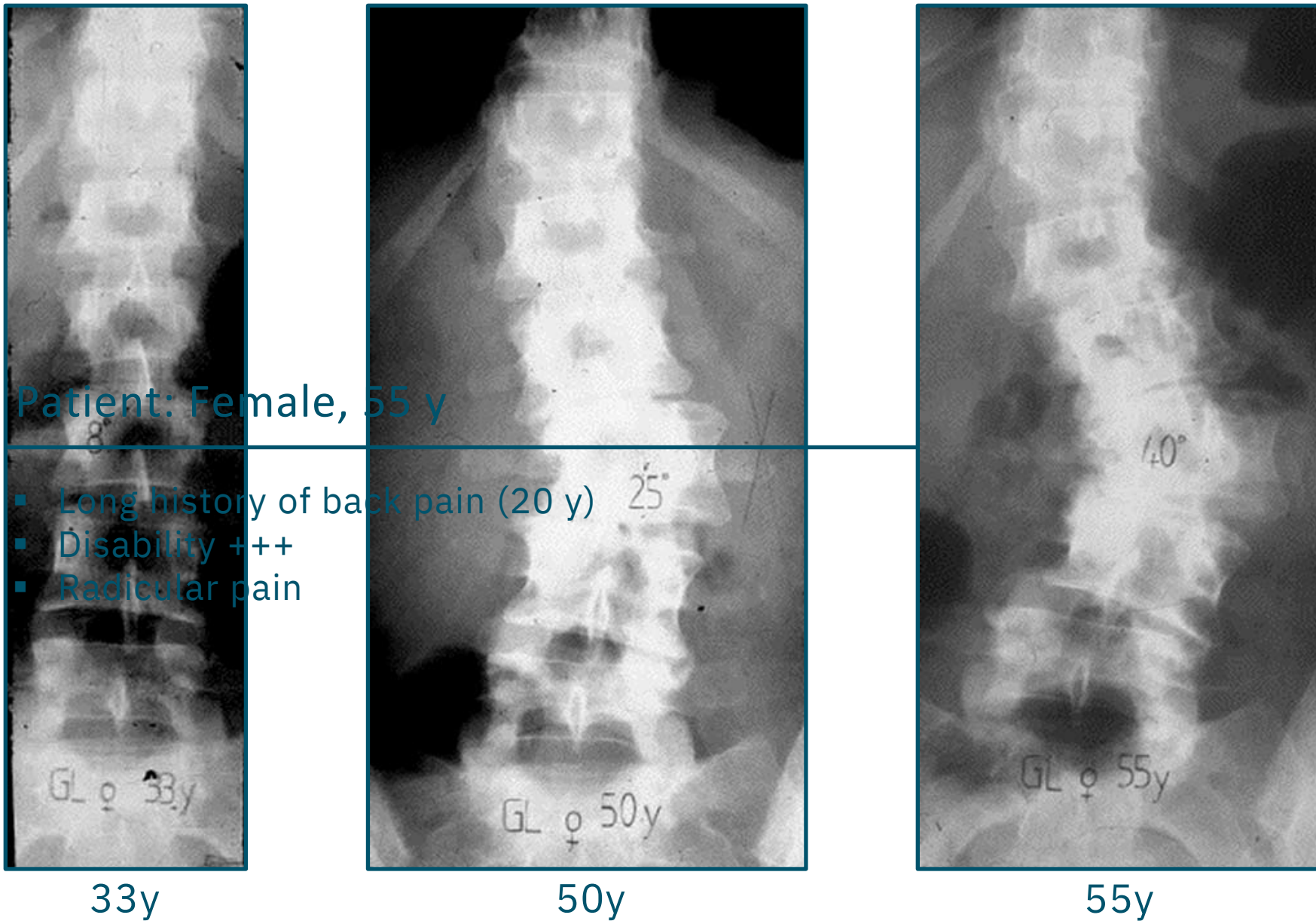
1- Presenter, R&D Engineer, 2- Head of R&D, 3- CEO

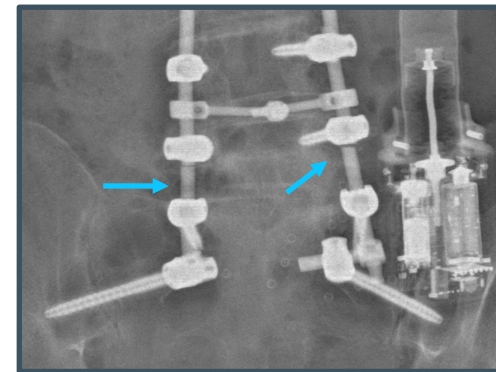
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The Clinical Need

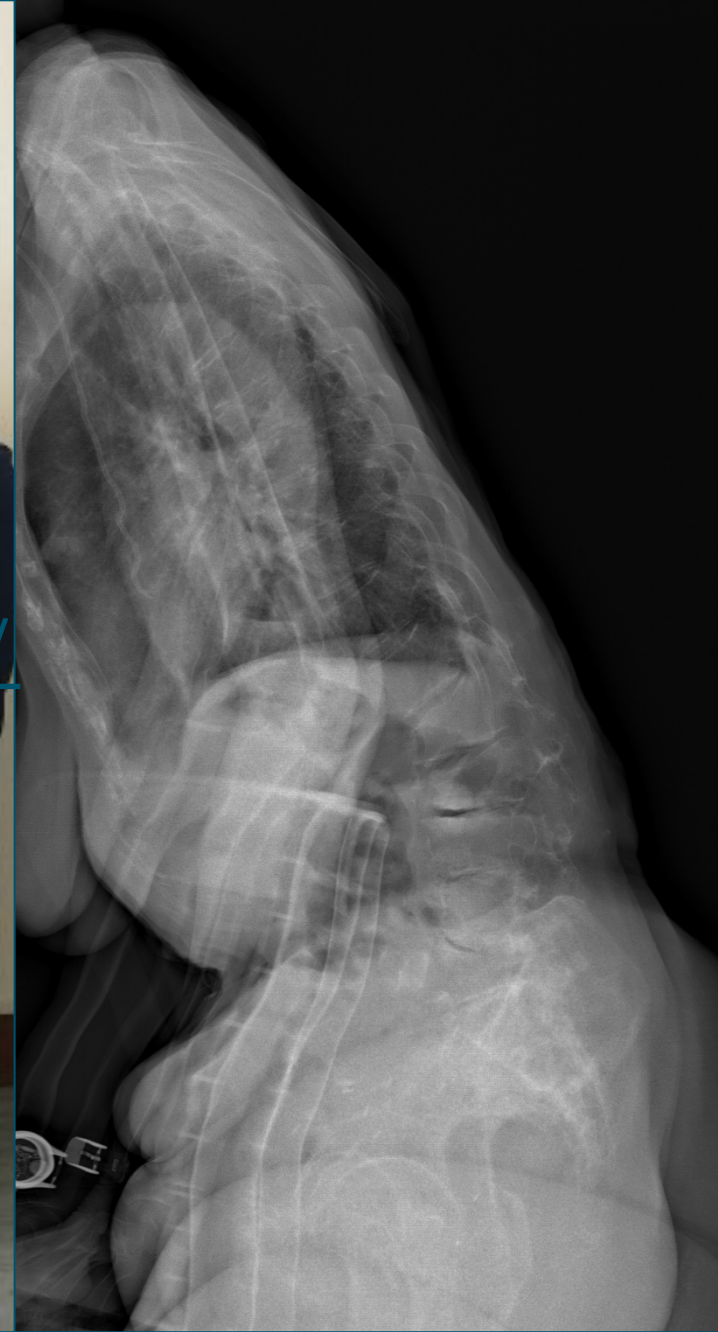
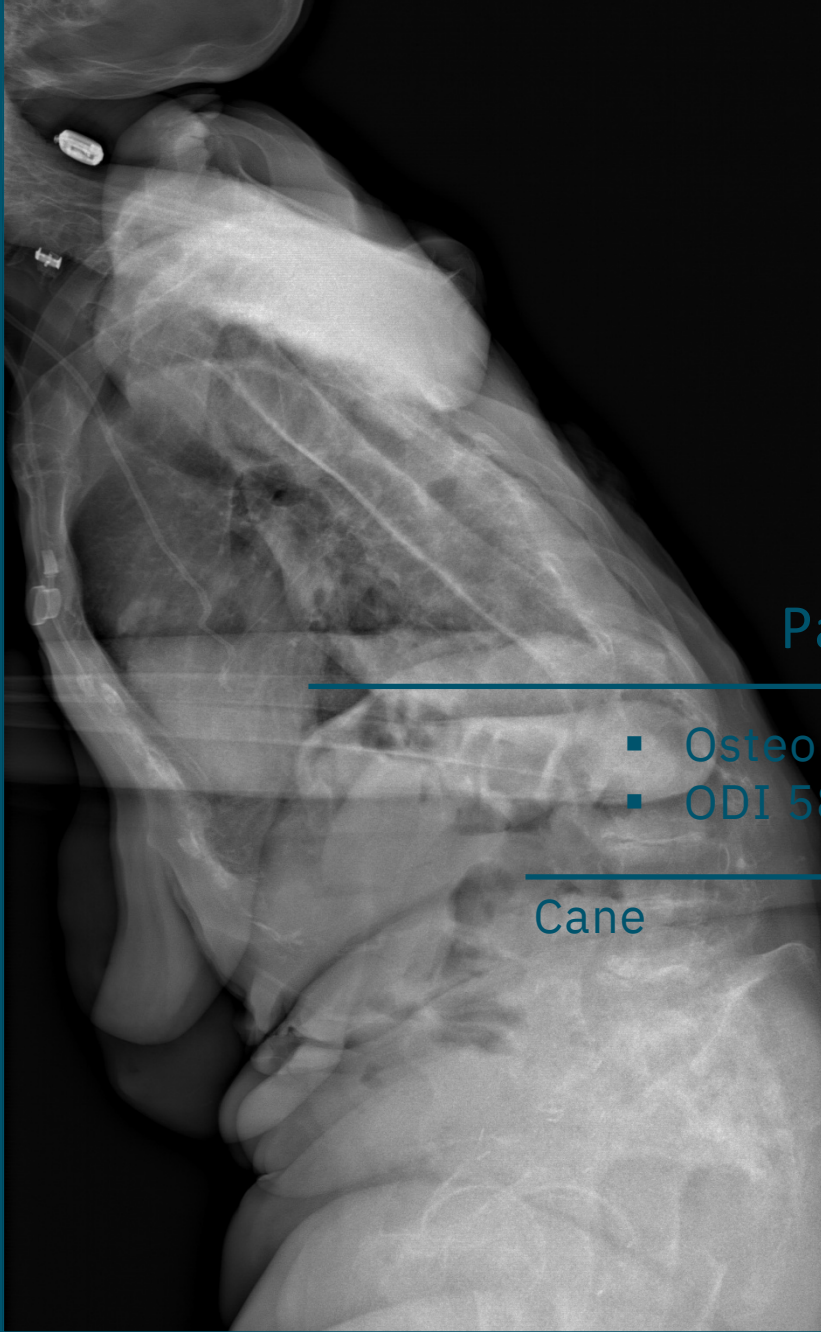
A Preventive, a Predictive and a Decision-Making Assistant





2018

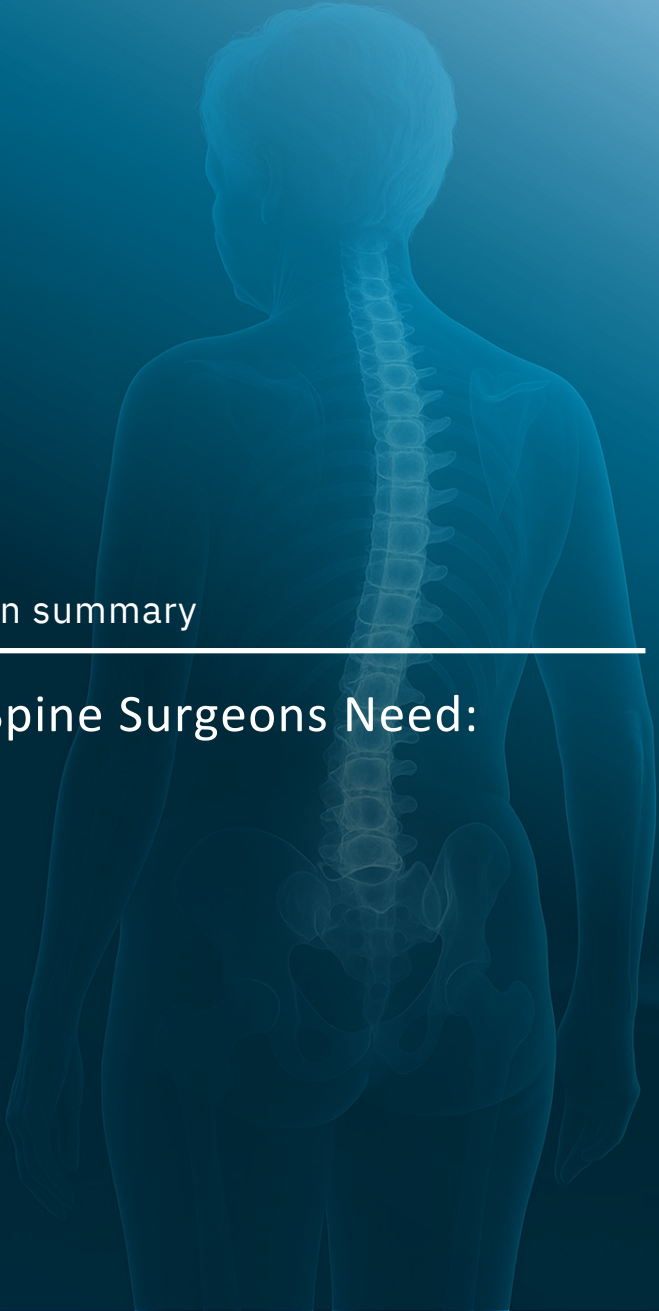
2024



Patient: Female, 80 y

- Osteoporosis
- ODI 58

Cane



In summary

Spine Surgeons Need:

■ A preventive tool

■ A Predictive tool

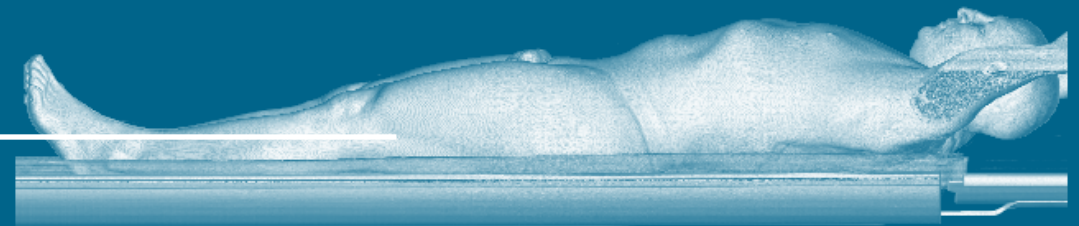
■ A Decision-Making Assistant



A Software (as Medical Device) Platform using a Biomechanical Digital Twin
for Superior Spine Care from Prevention to Treatment

Digital Twin

A Patient-Specific Biomechanical Digital Twin of the Spine



SPINEsim

Patient-Specific, Biomechanical Digital Twin

Check



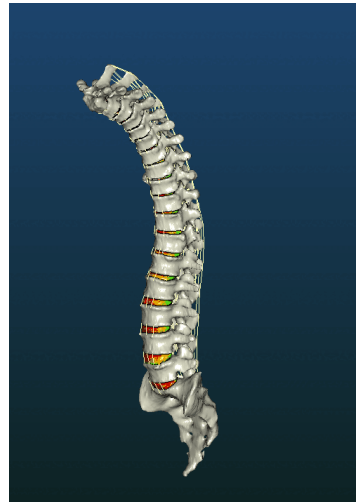
MD/Physio

Align



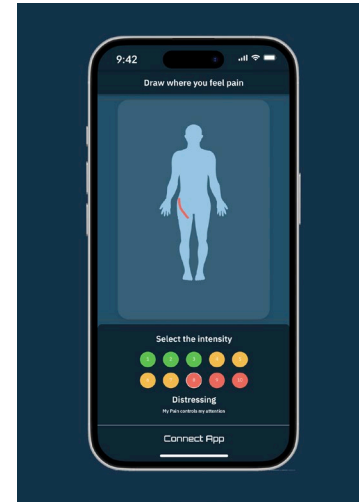
Surgeon

Balance



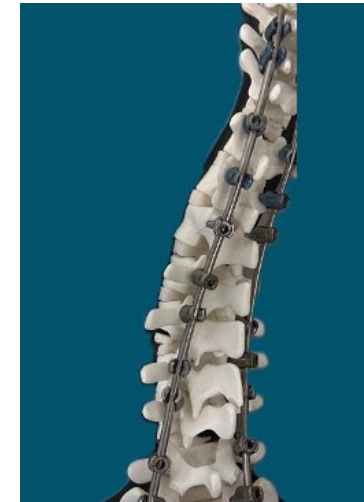
Surgeon

Connect



Patient

Design



Engineer

Educate



Students

■ IMPROVE

Improve patient outcome/life

■ SAVE COST

Save cost for payer & patient

■ SAVE TIME

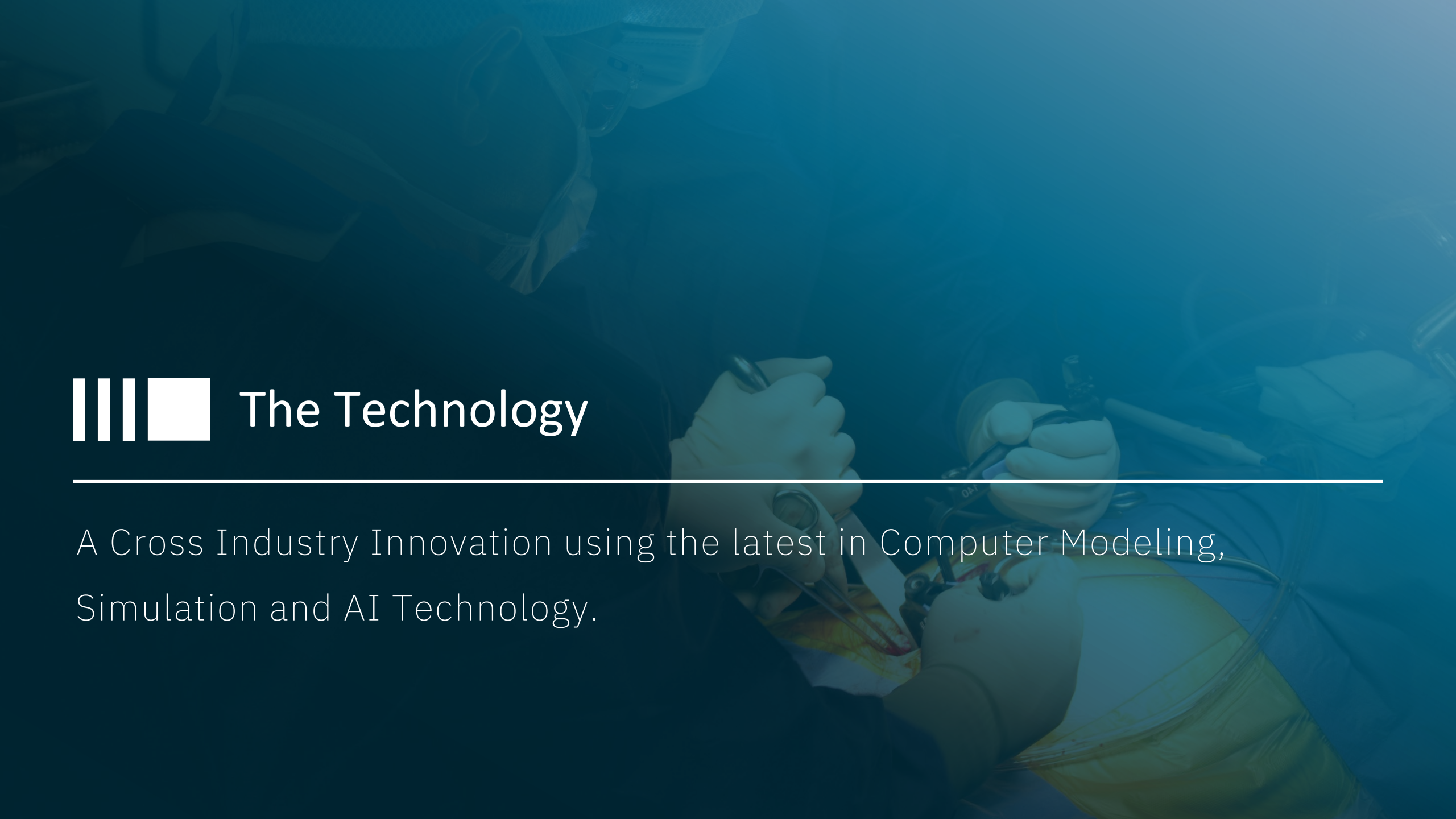
Save time for surgeon & hospital (OR)



SPINEsim offers Clinical & Socio-Economical value to all Stakeholders.

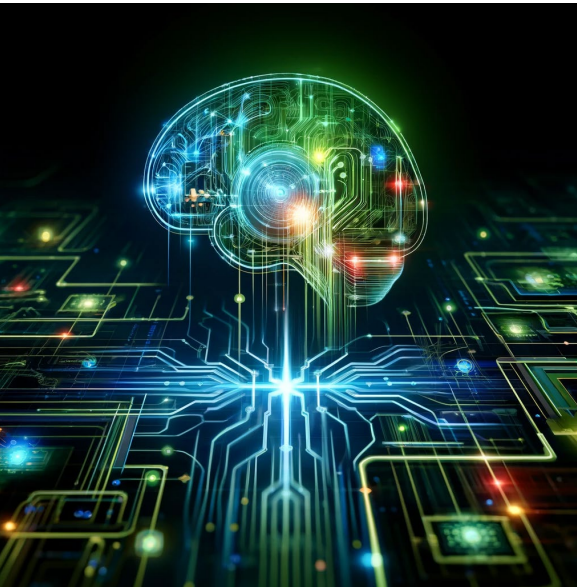
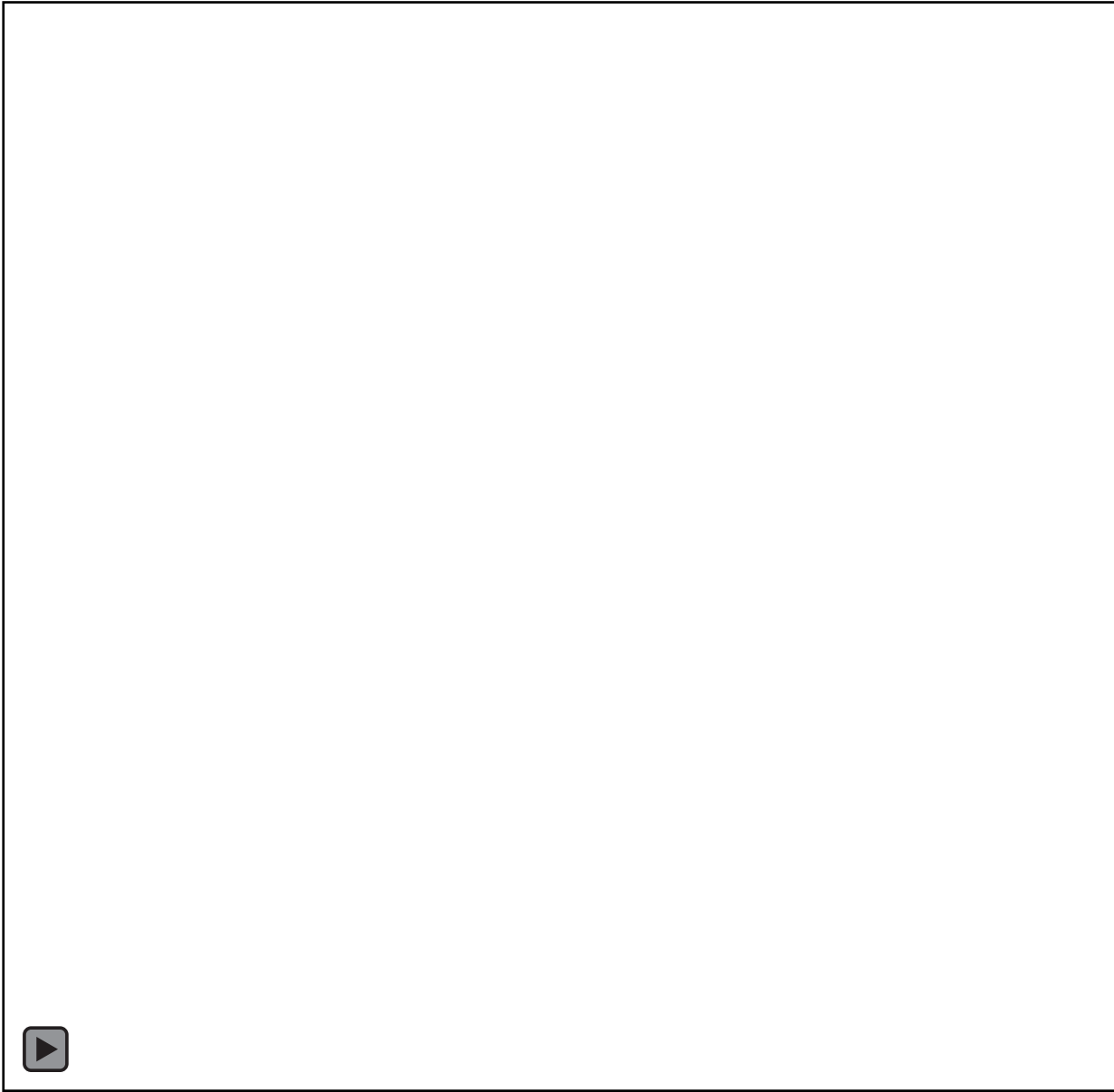
Demo:





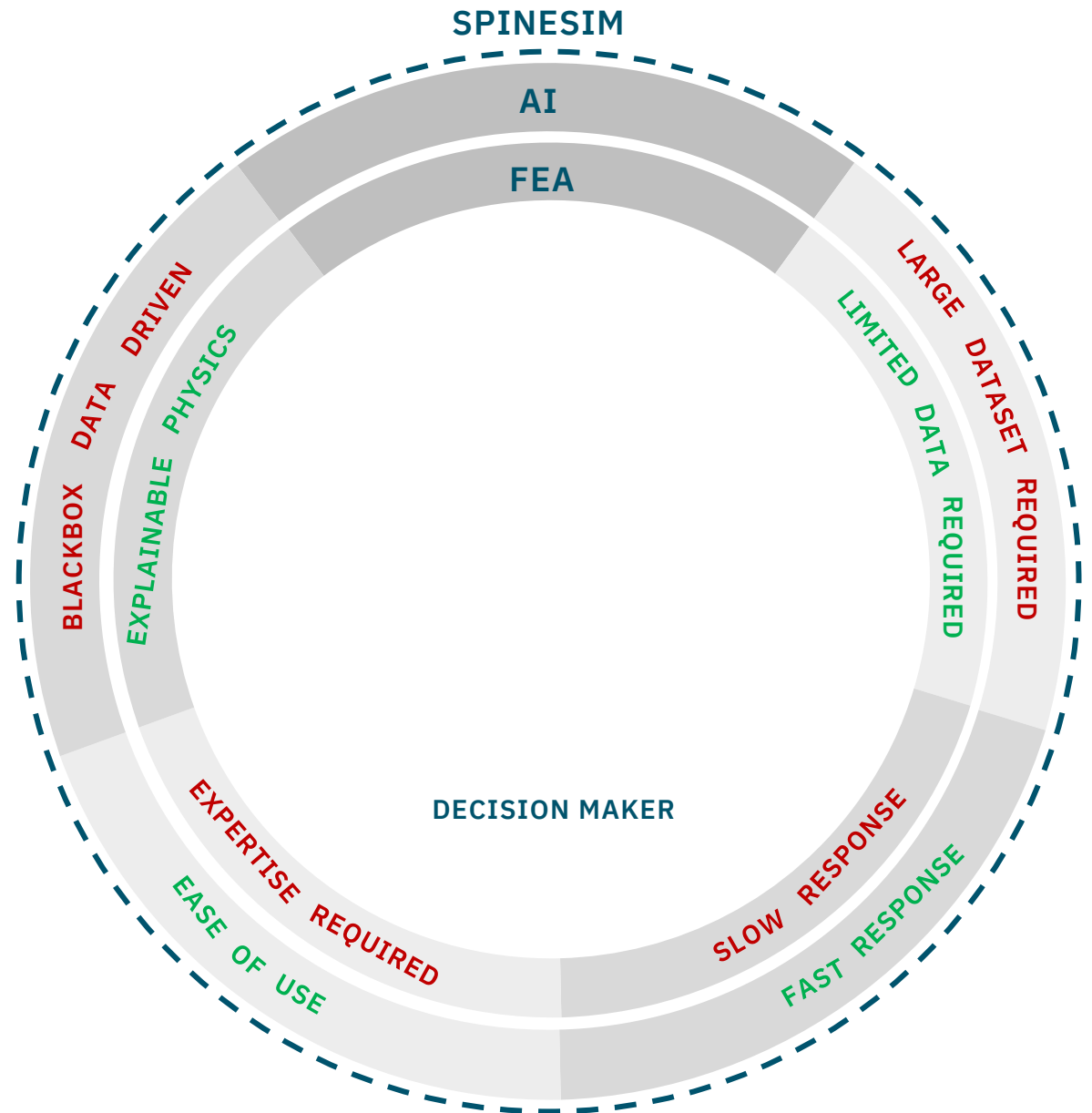
The Technology

A Cross Industry Innovation using the latest in Computer Modeling, Simulation and AI Technology.



SPINEsim

A Clinical Decision Support
with the Surgeon (& the
patient) in the Loop !





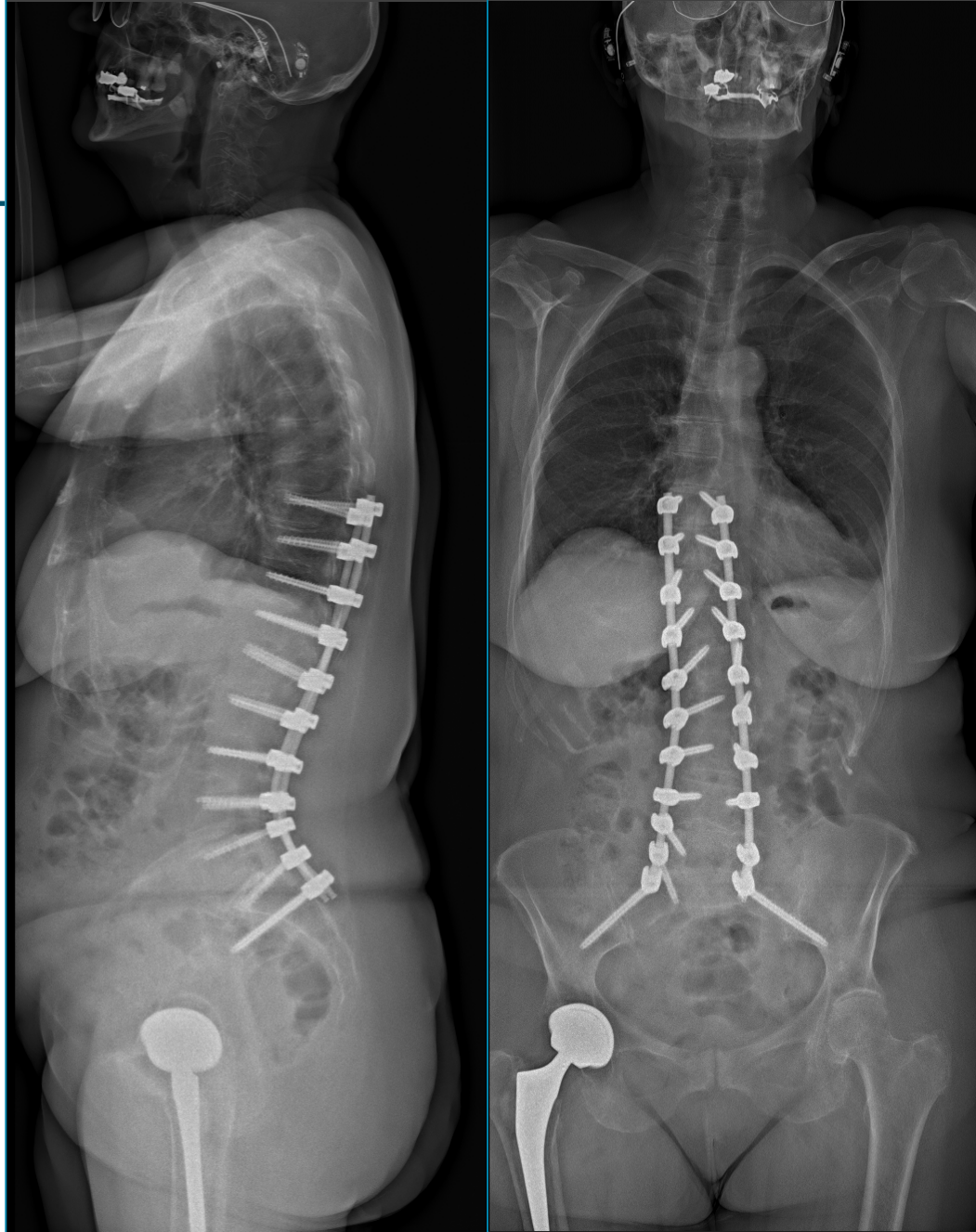
A Clinical Case - Proof of Concept

To Predict the Probability of Mechanical Failures

PreOp

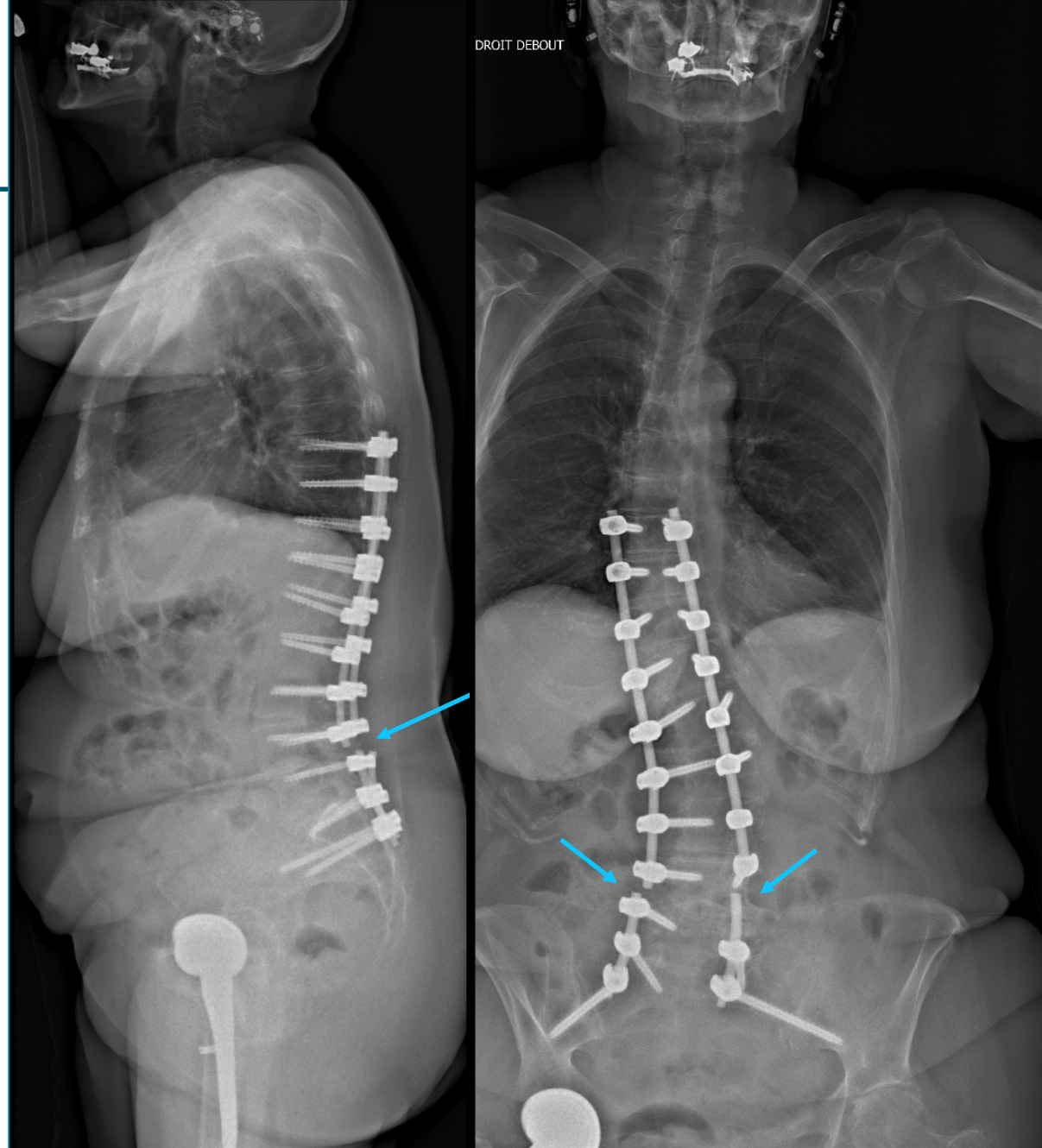


PostOp



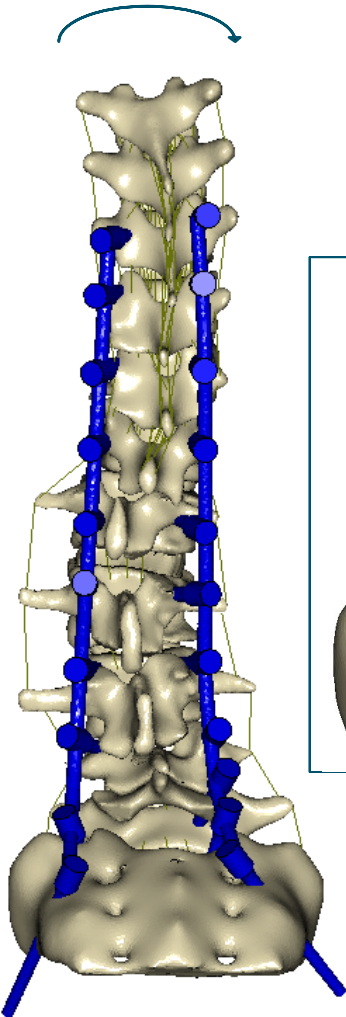
PostOp

Rod Failure After 2 Years

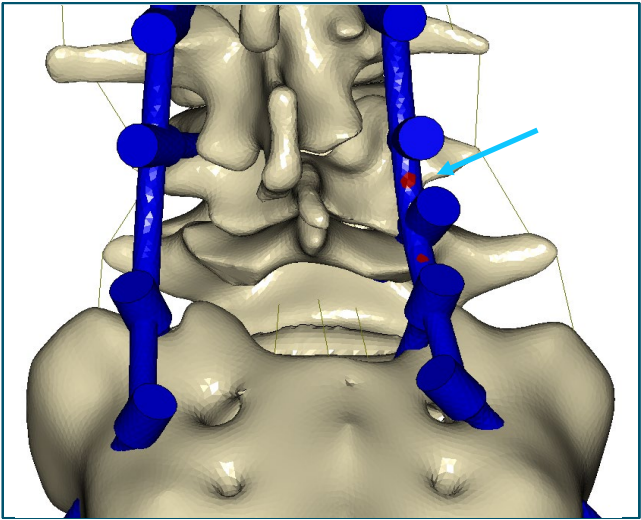


Rod Failure: Biomechanical analysis – Gravity + Lateral Bending

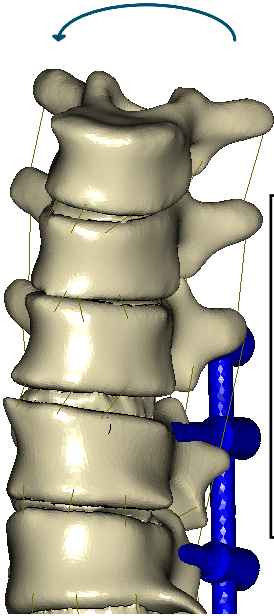
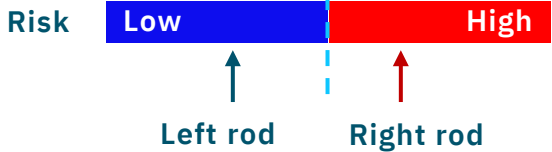
The biomechanical model could correctly predict the failure



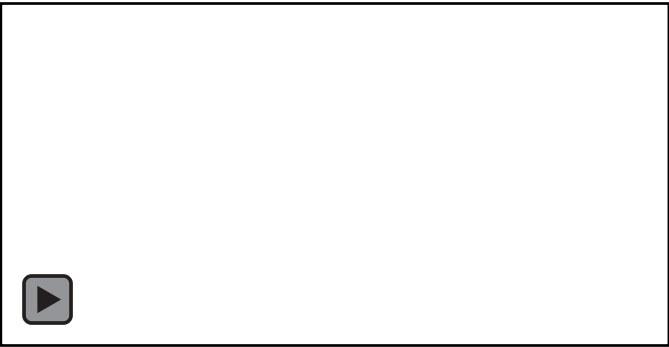
Risk of Failure (Stress)



Rod Endurance 2 years Limit



Fiber Strain IVD



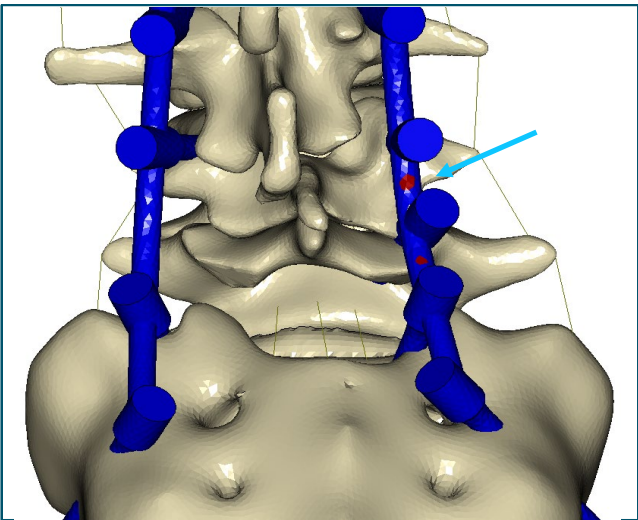
PreOp vs PostOp

Rod Failure: Biomechanical analysis with pre-stress

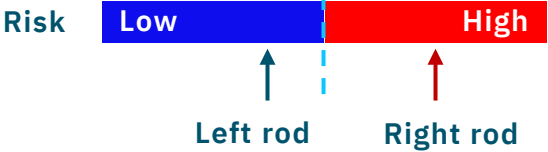
With pre-stress due to rod manual bending, the risk of failure is even higher

Risk of Failure (Stress)

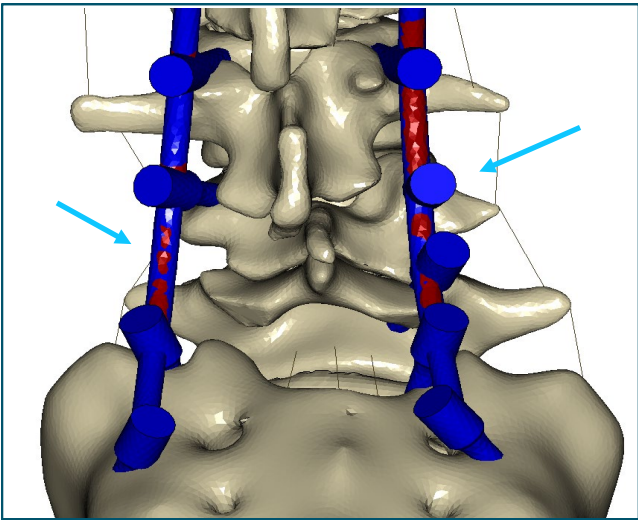
Without pre-Stress



Rod Endurance 2 years Limit



With Pre-Stress

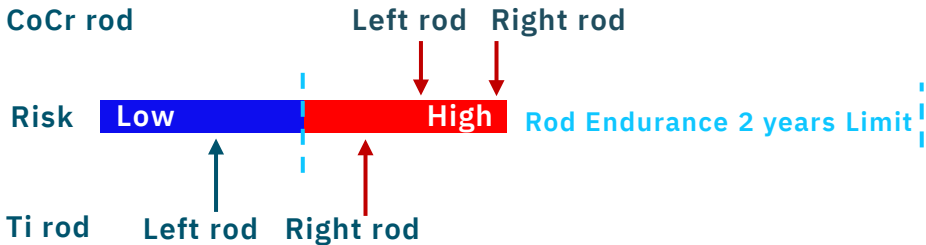
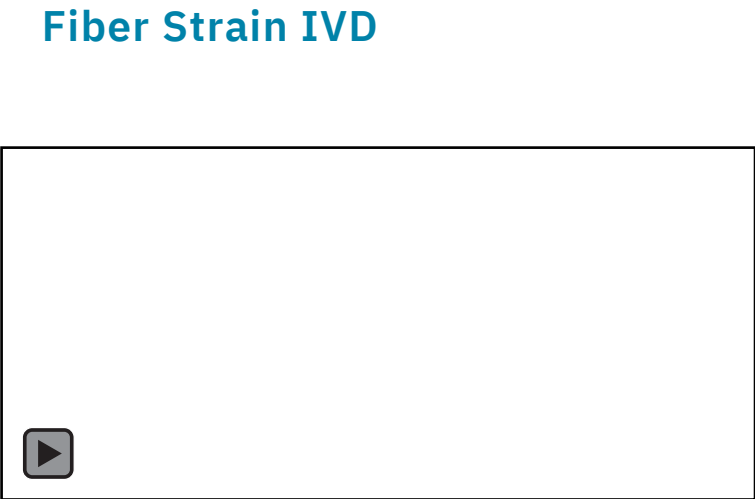
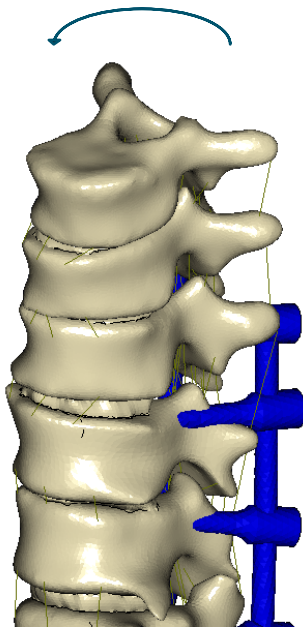
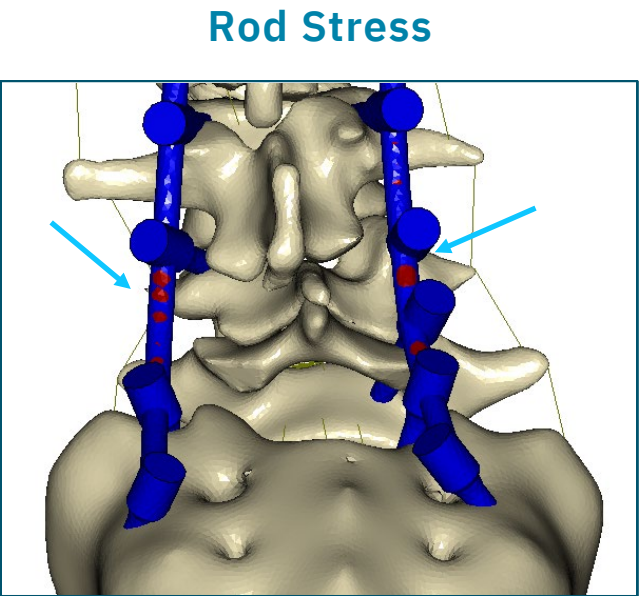
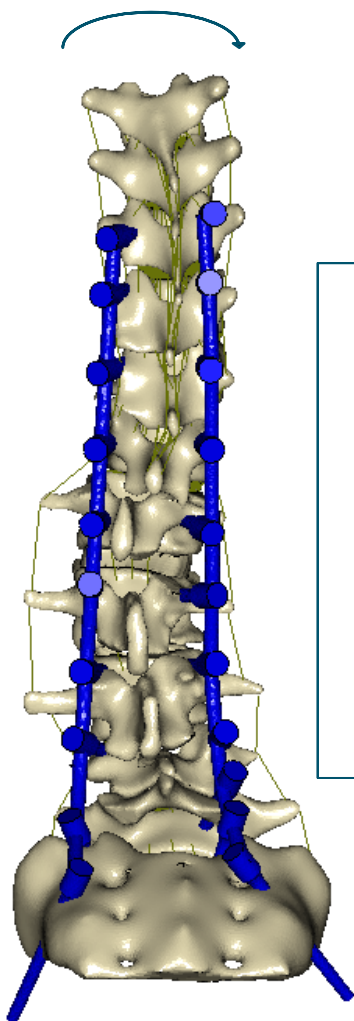


Rod Endurance 2 years Limit

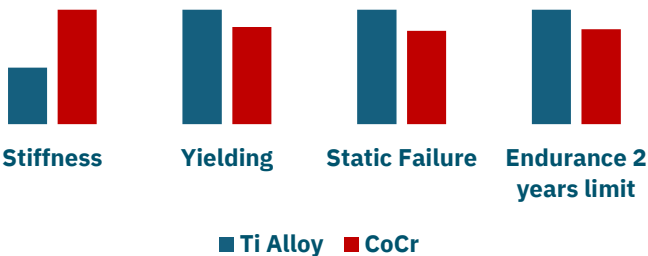


What-if 1: Cobalt-Chrome Rods vs Titanium Alloys

Higher risk of failure and PJK/PJF for both rods using CoCr rods.

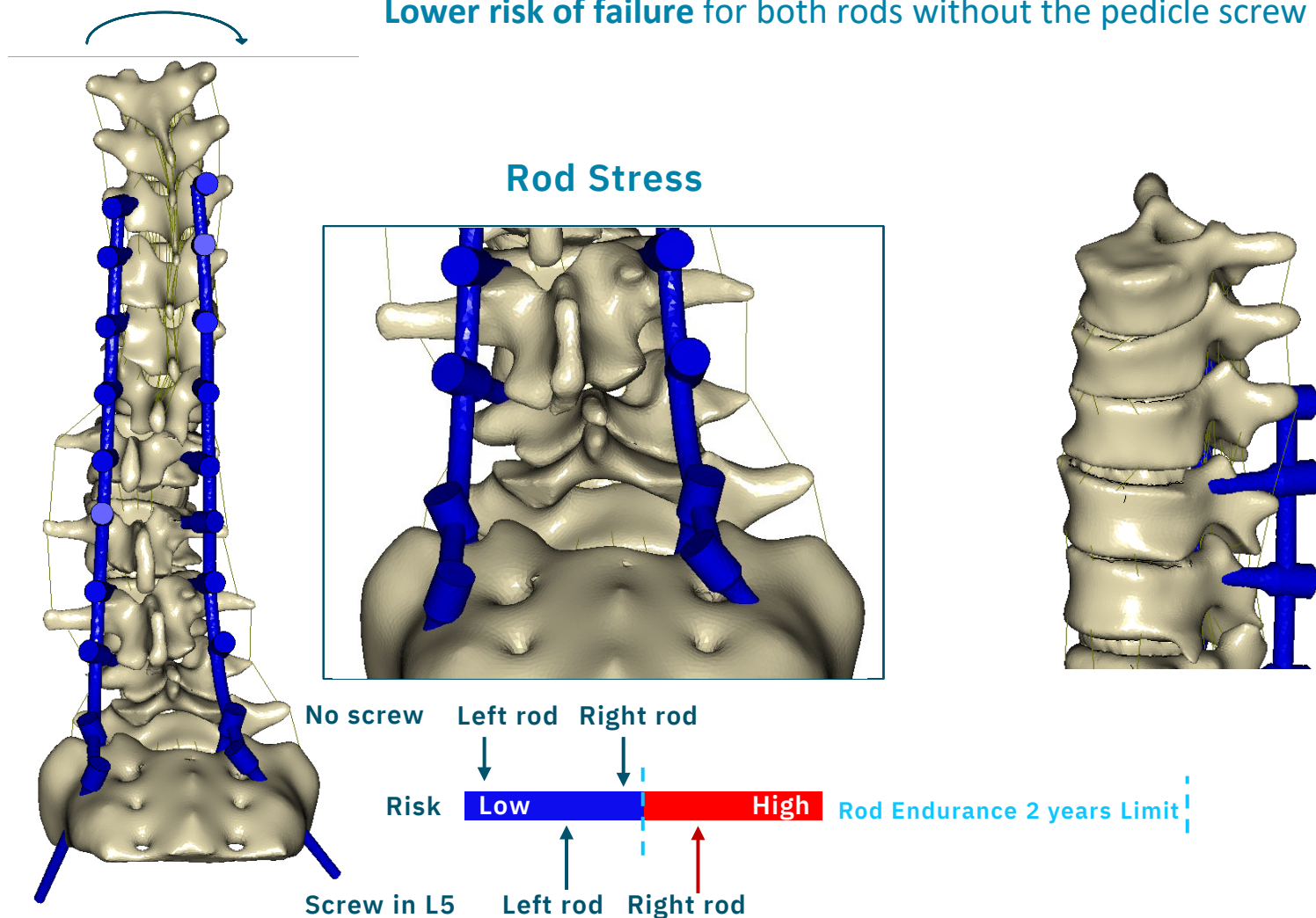


Titanium alloy vs Cobalt Chrome

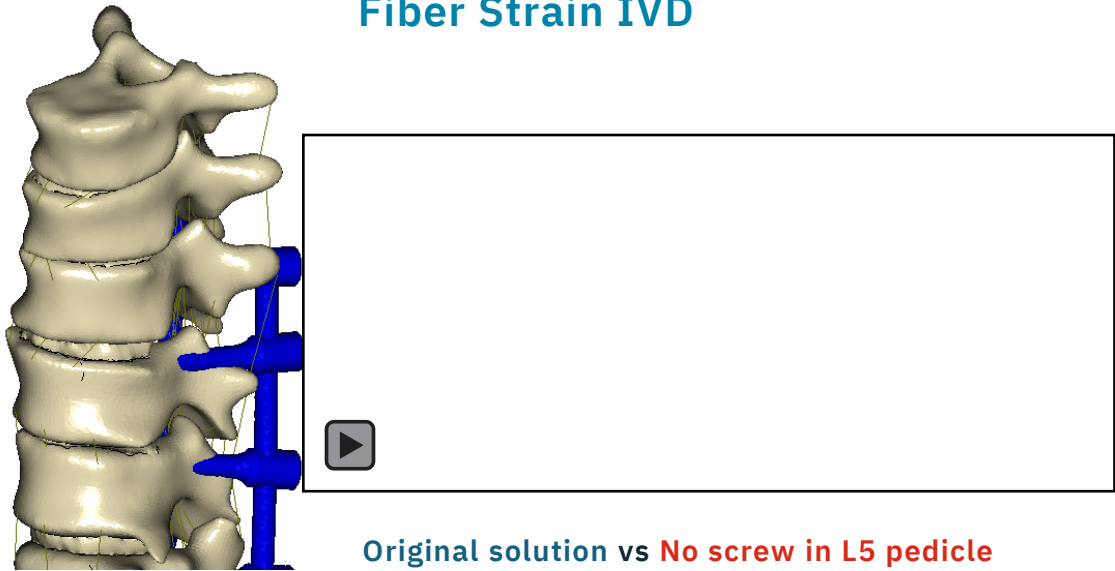


What-if 2: No Pedicle Screw in L5

Lower risk of failure for both rods without the pedicle screw in L5.

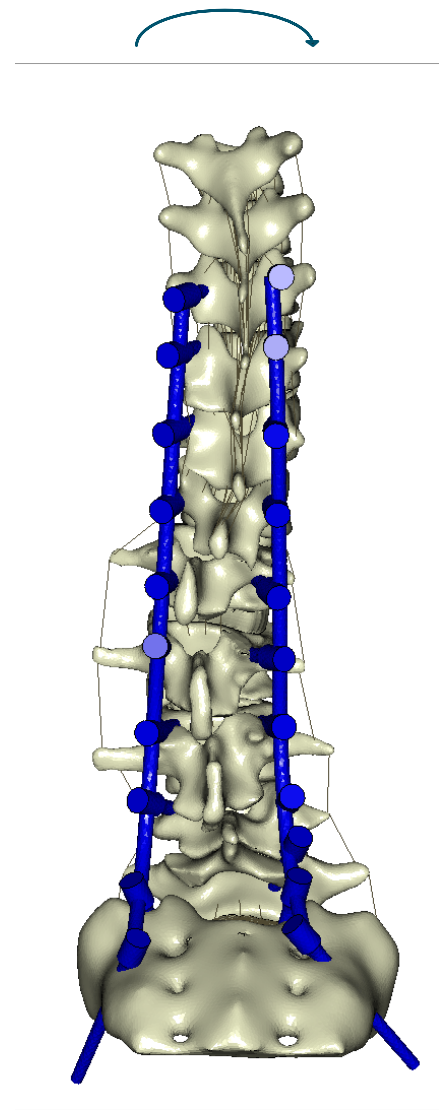


Fiber Strain IVD

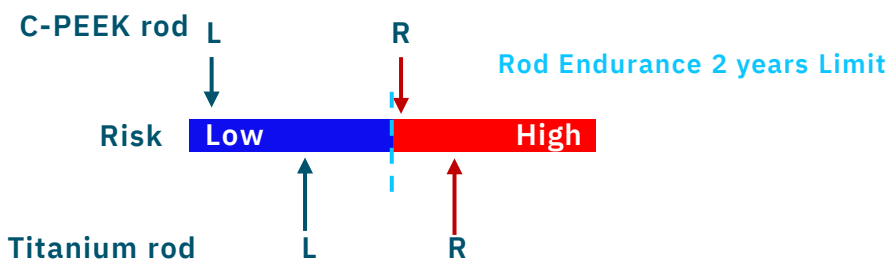
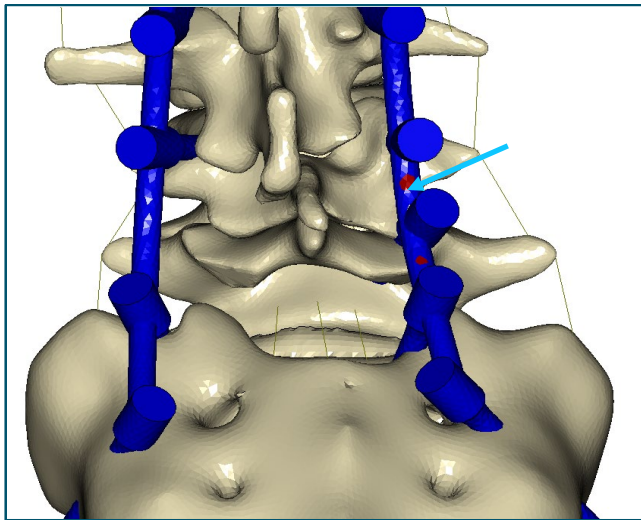


Solution 3: PEEK reinforced carbon fiber rod and screws

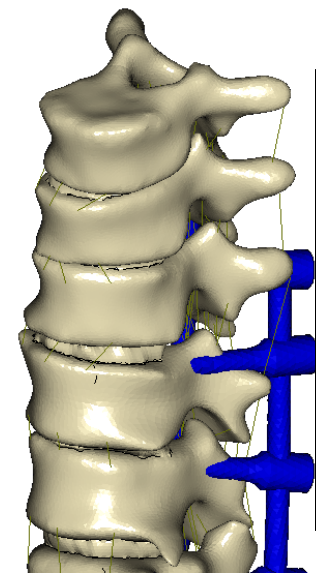
Lower risk of failure with carbon reinforced PEEK, but still high stresses.



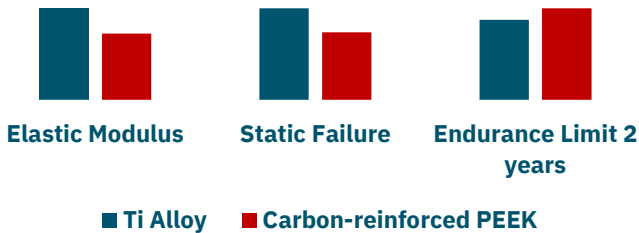
Rod Stress



Fiber Strain IVD



Titanium rod vs Carbon reinforced PEEK

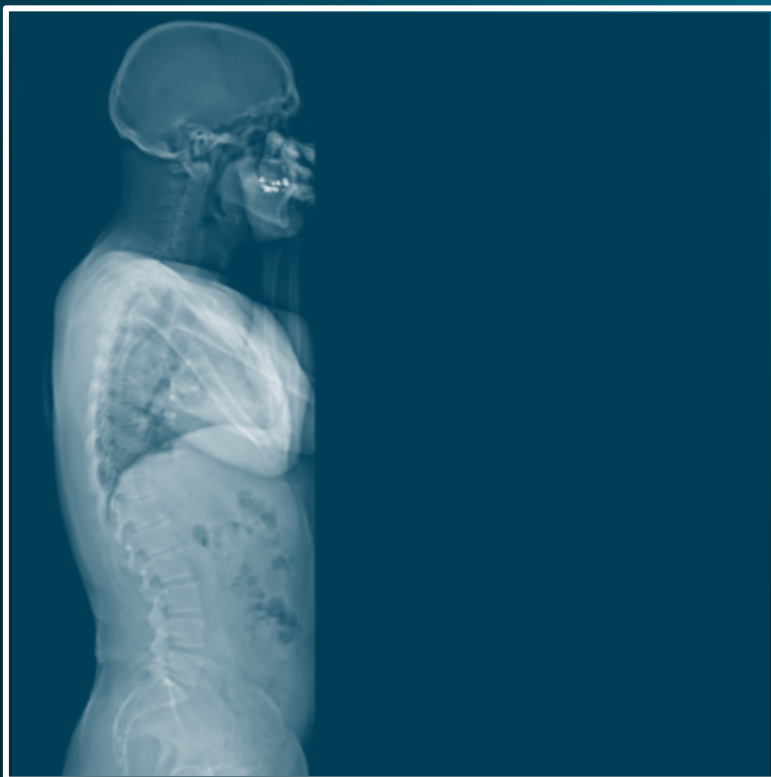


Healthcare
Mega Trends



Artificial Intelligence

SPINEsim Prime-time is NOW



Thank you

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