

New Technologies in Spinal Surgery

Andreas Loeffler



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Why?



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Why?

- Spinal surgery is complex and risky
- You see these patients before and after
- You are practical and curious
- An understanding may give reassurance

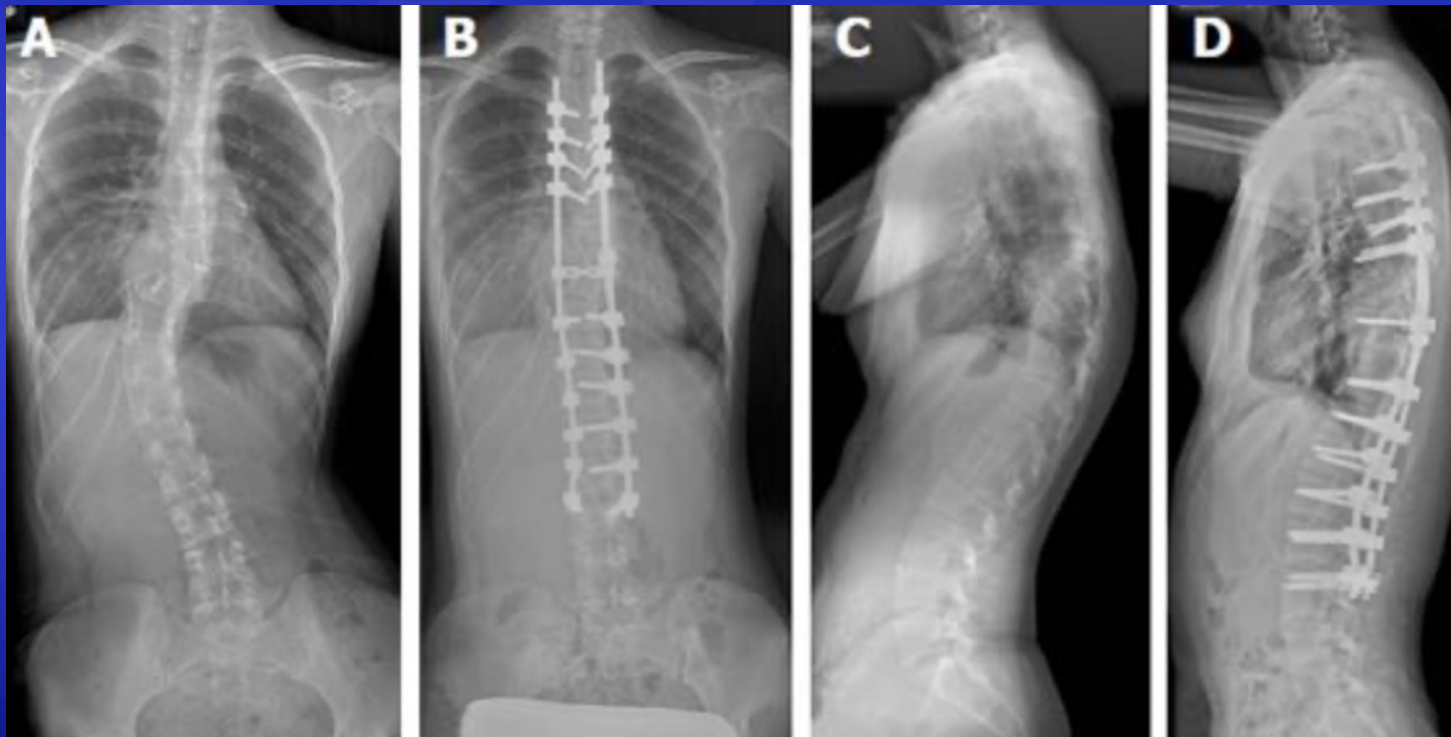


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How?



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How?

- Several consultations
- Extensive imaging
- Complex surgery
 - Team, facility, equipment, expertise
 - Allied health



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Increasing Numbers

- Total number of spinal operations
- Range of ages – very young and very old
- Complexity – Fracture, tumour, deformity
- Costs escalating
- Number of staff required



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Technologies

- Pre-operative planning
- Specialized operating theatres
- Computer navigation and robotics
- Neuromonitoring
- Custom implants



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3D Computer Planning

- Based on CT
- Virtual model
- Plan approach
- Measure size and number of implants
- Appreciate risks

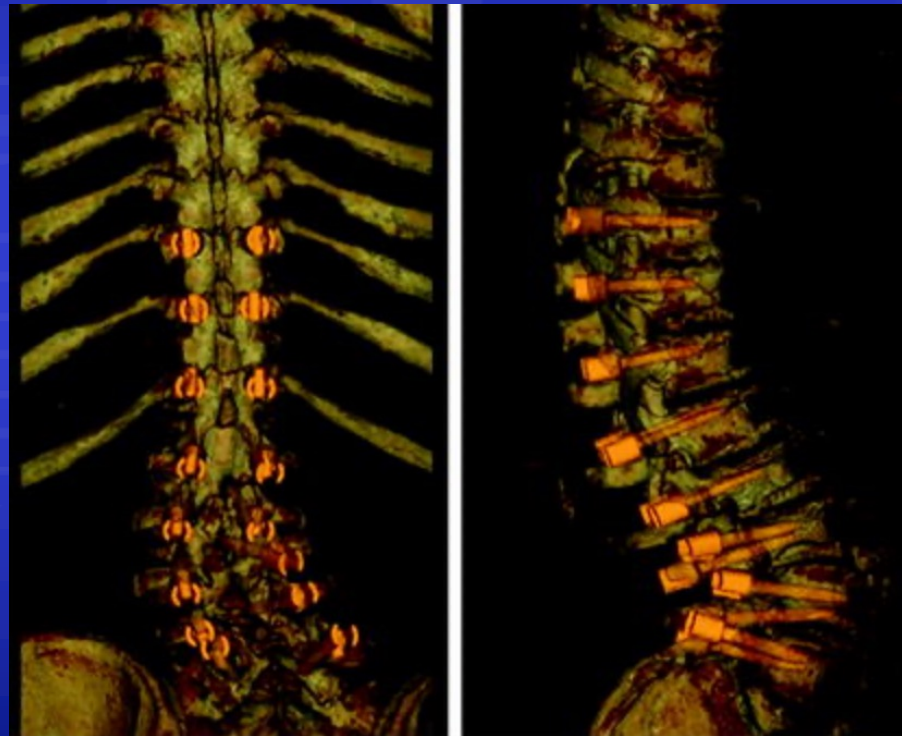


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3D Computer Planning



Extended Team

- Familiar theatre staff
- Second surgeon
- Staff for:
 - Neuromonitoring, cell saver
 - Radiographer
 - Rep for implants, navigation



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Specialized Operating Table

- Allows positioning of patient
- Traction
- Access for x-ray
- Radio-lucent
- “Rotisserie” for turning patients



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Allan Table



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"Rotisserie"



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Pedicle Screws

- Powerful hold on vertebra
 - Provide stability, correct deformity
 - Require careful placement
- Risk injury to vessels and nerves
- Risk fracture and loosening



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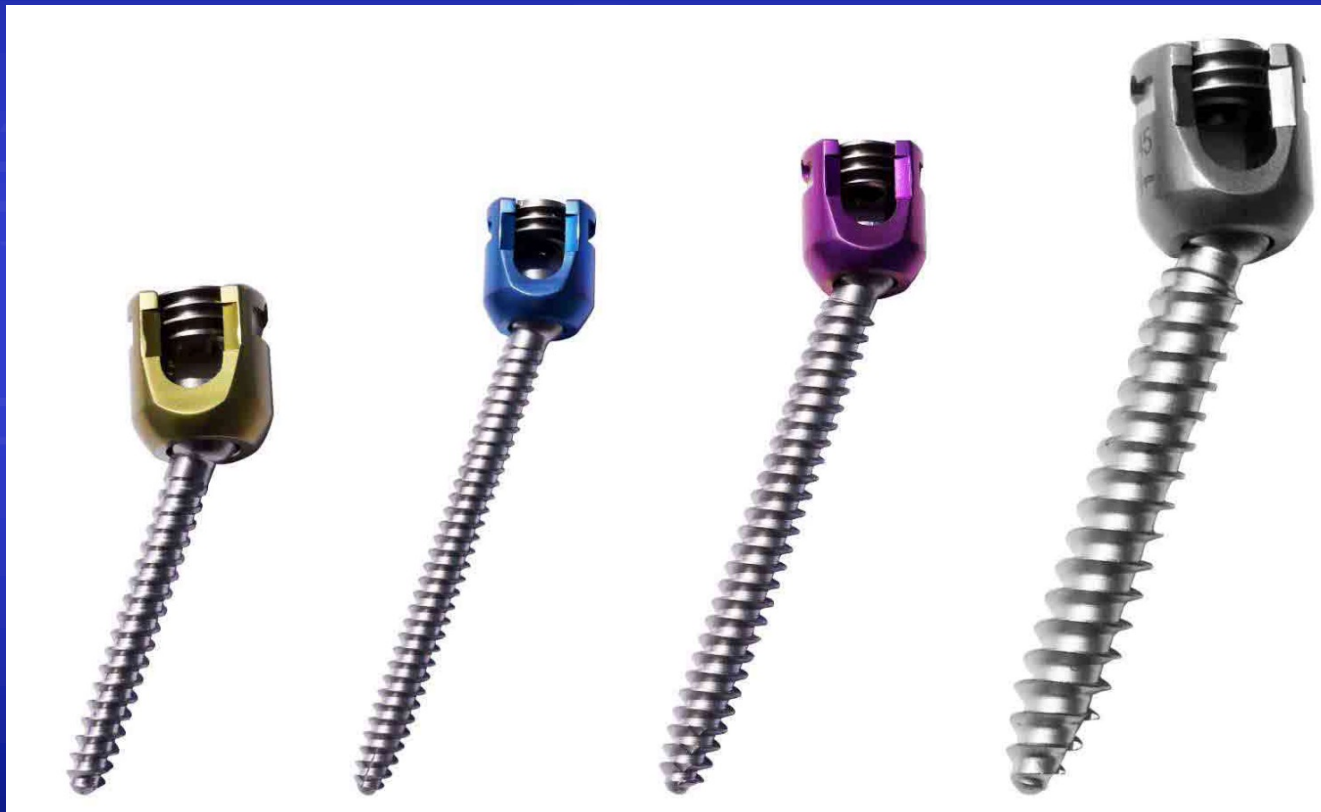
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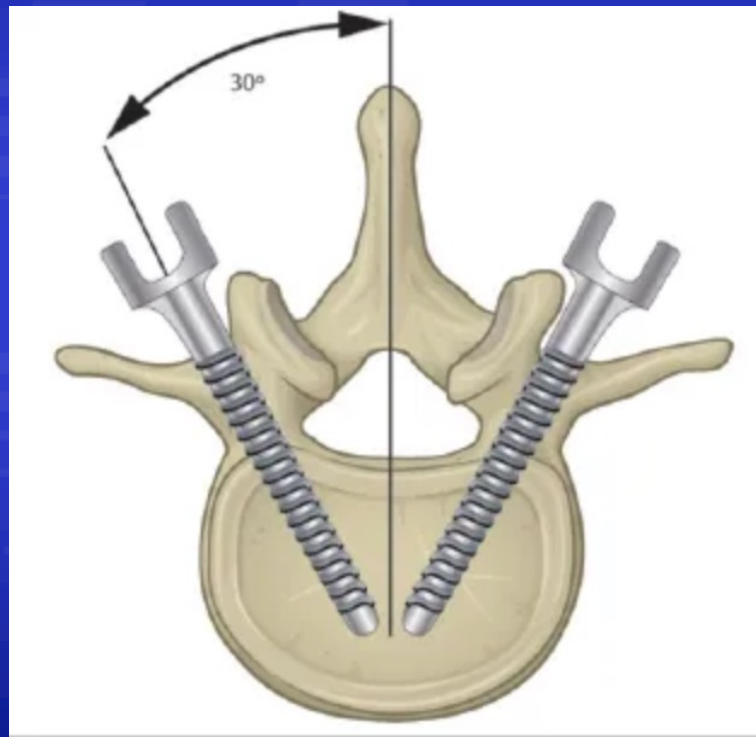
Pedicle Screws



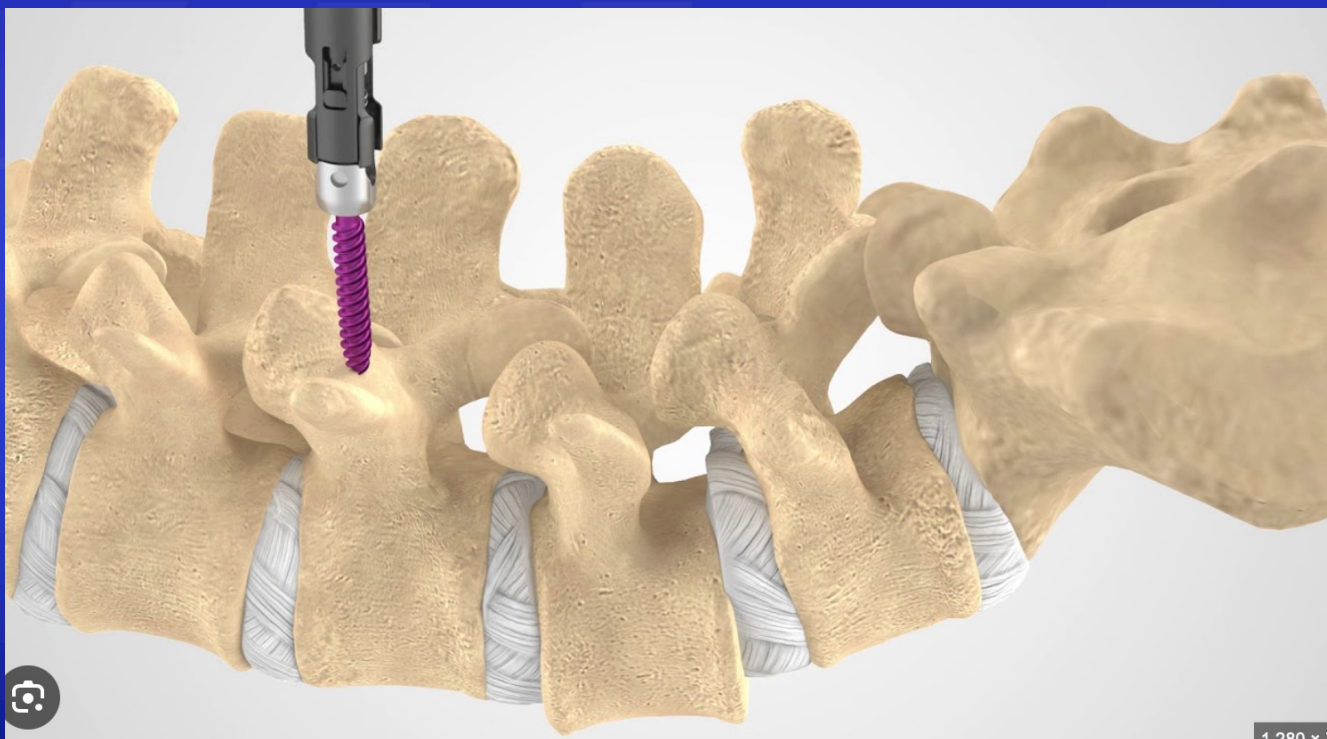
Pedicle Screws



Pedicle Screws



Pedicle Screws



Navigation

- Incorporates pre-op CT and MRI
- Matches surface image or markers
- Live 3D spatial position and trajectory
- Safe placement of pedicle screws
- Intra-op CT for verification of implants

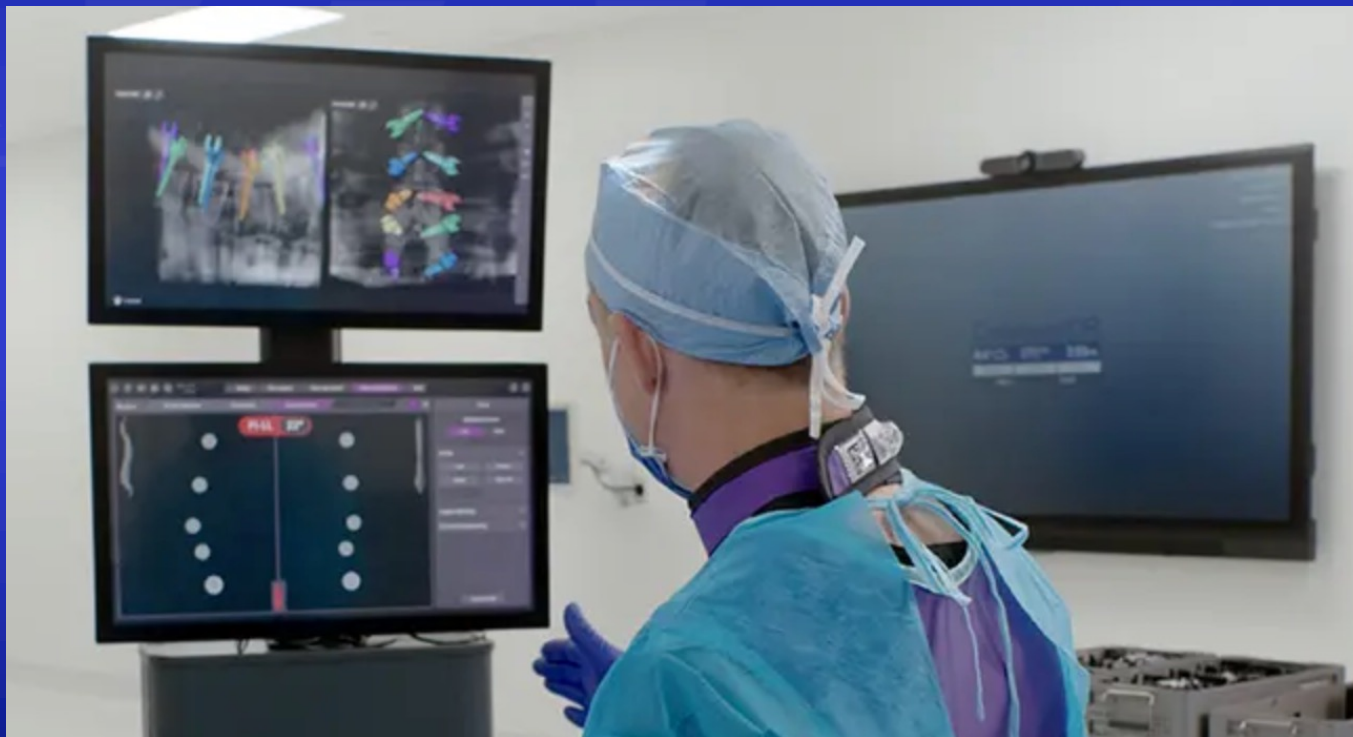


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Navigation



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Surface Registration



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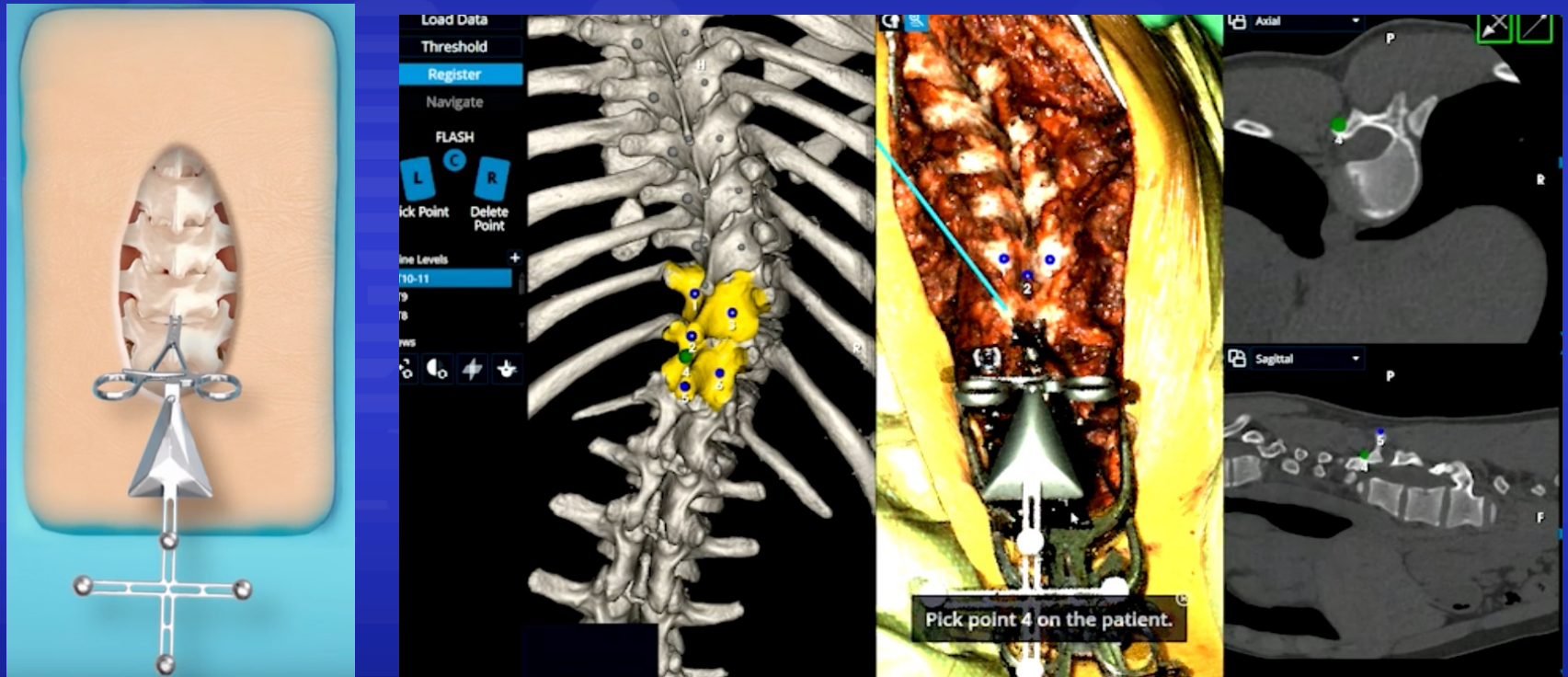
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Surface Registration



Surface Registration



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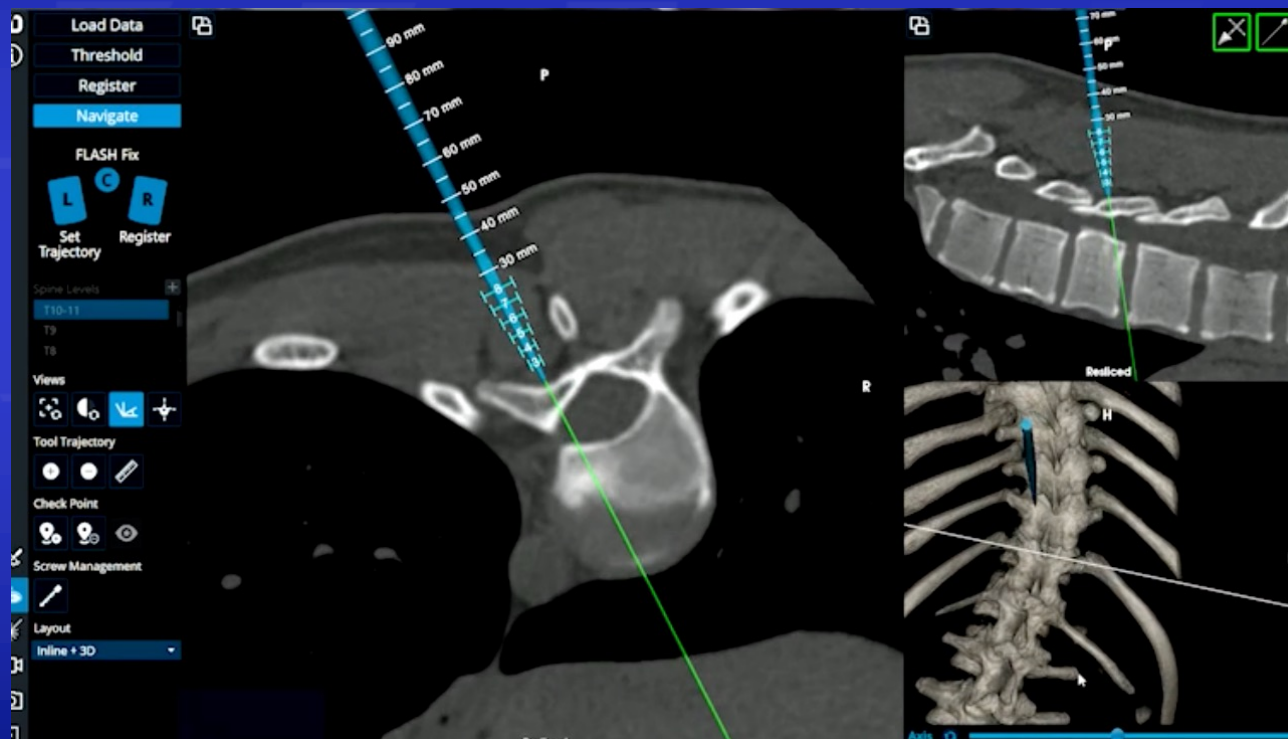
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Navigated Tools



Virtual Spine

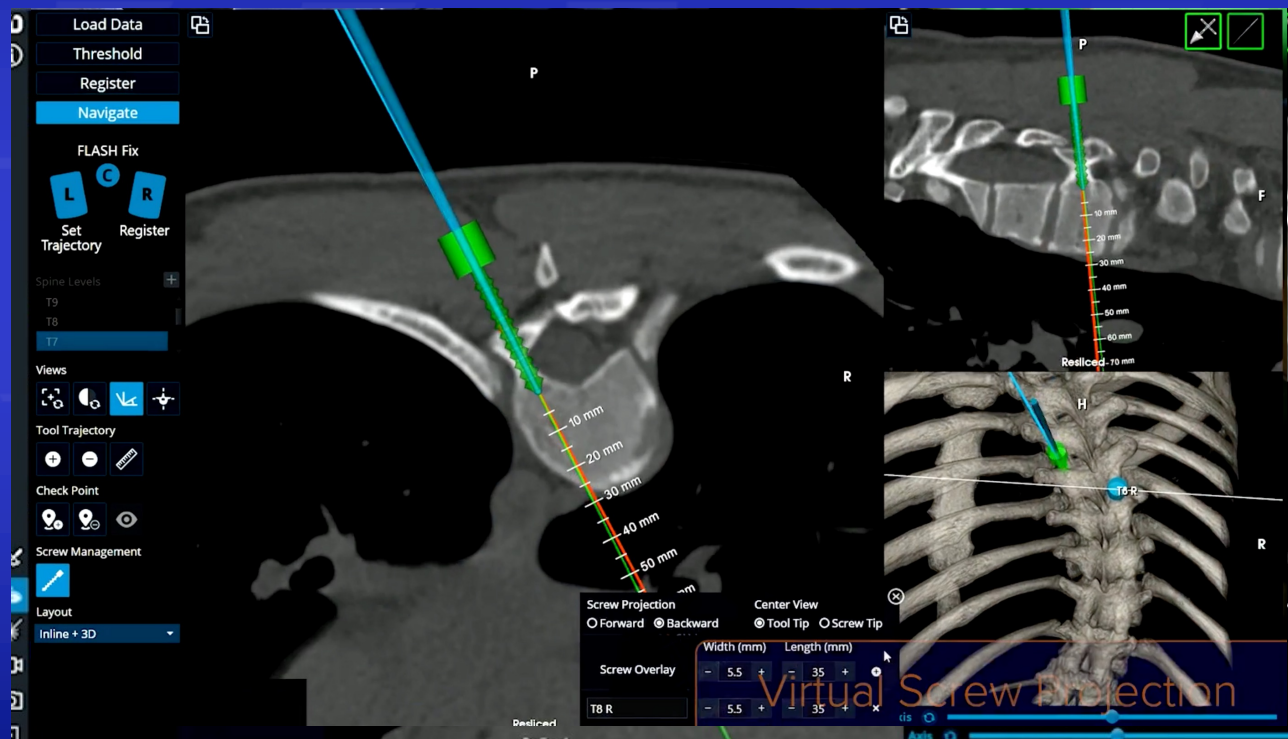


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Virtual Spine



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Navigation

- Not always perfect
 - System failure
 - User error
 - Not available
- CT verification



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Intra-operative CT



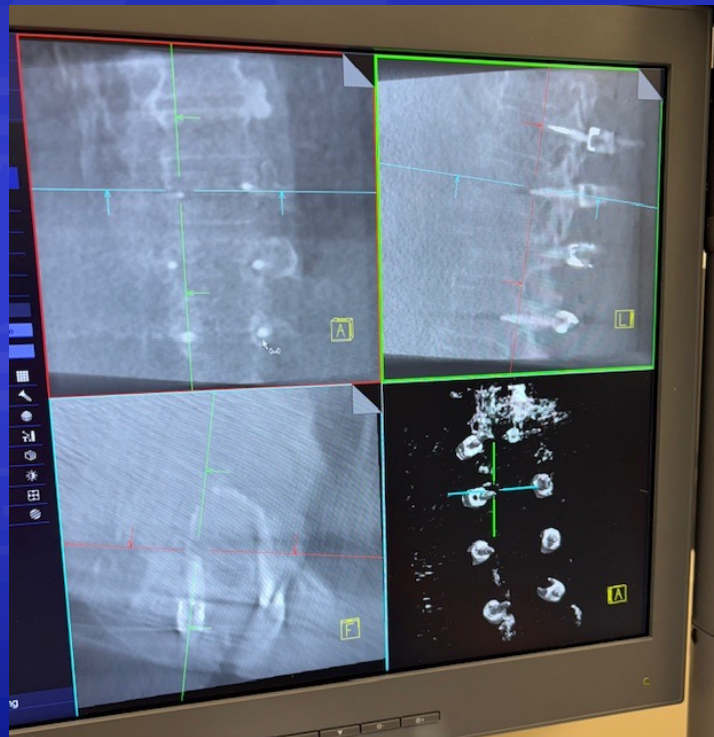
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Intra-operative CT



Intra-operative CT



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Neuromonitoring

- No longer “Wake up test”
- Real time somatosensory and motor evoked potentials
- Effects of pedicle screws or reduction manoeuvres



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Neuromonitoring

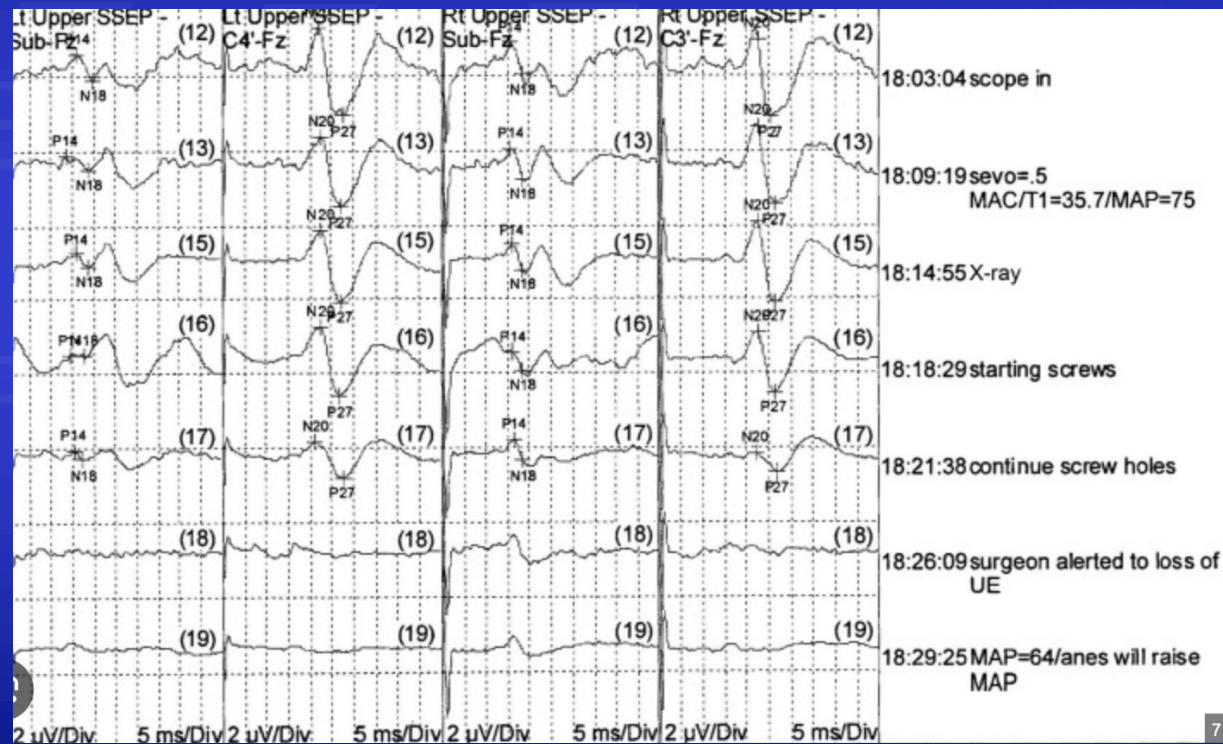


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SSEP and MEP



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Cell Saver

- Patient's blood is sucked up
- Anticoagulant is added
- Blood is washed to remove debris
- Concentrated and reinfused
- Avoids transfusion complications



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“Robotics”

- Not well defined – no autonomous machines
- Automated drill guide – not currently used
- Uncertain costs, reliability and safety
- More to come



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Mazor



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Future Robotics



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MIS

- Percutaneous placement of pedicle screws
- Endoscopic surgery
- Useful tools
- Still evolving
- Require more evaluation



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Endoscopic Surgery



Endoscopic Surgery



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Laser Surgery

- Not new
- Periods of popularity
- Shrinks tissue
 - Herniated discs and ligamentous hypertrophy
- Risk to nearby structures

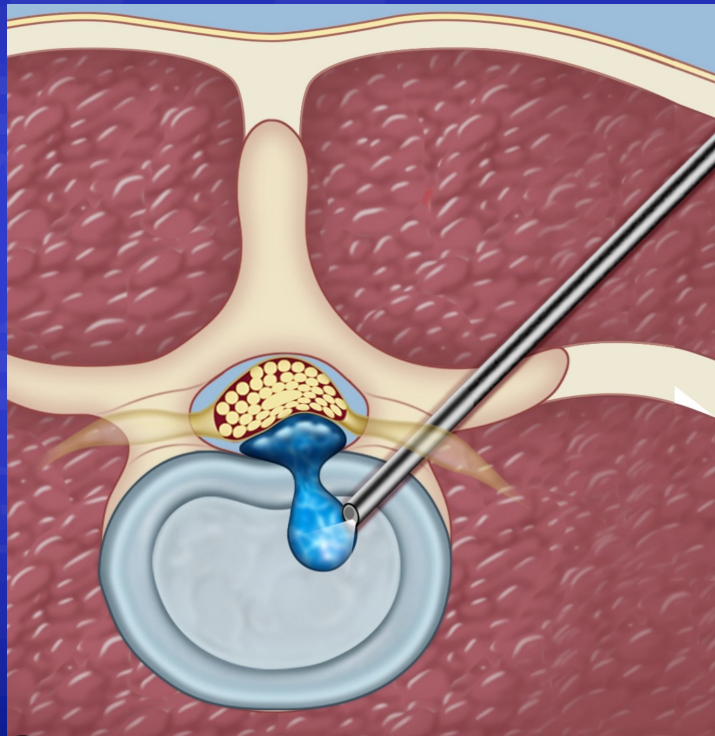


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Laser Surgery



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Custom Implants

- Especially for tumors
- Complex deformity
- CT based 3D model
- 3D printing
- Expensive, but increasingly useful

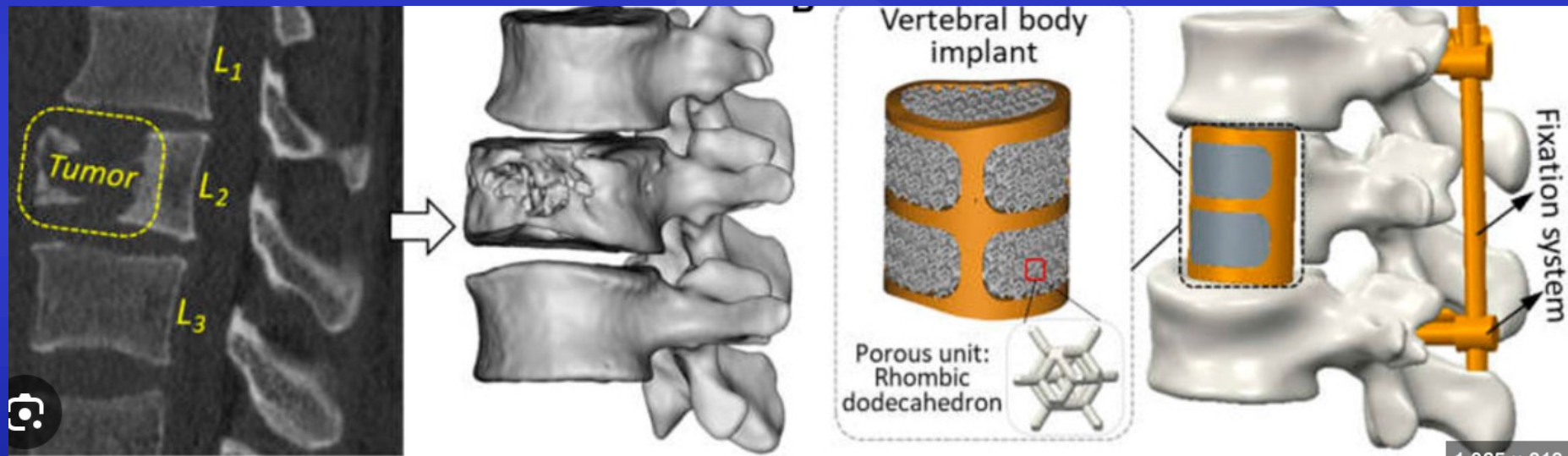


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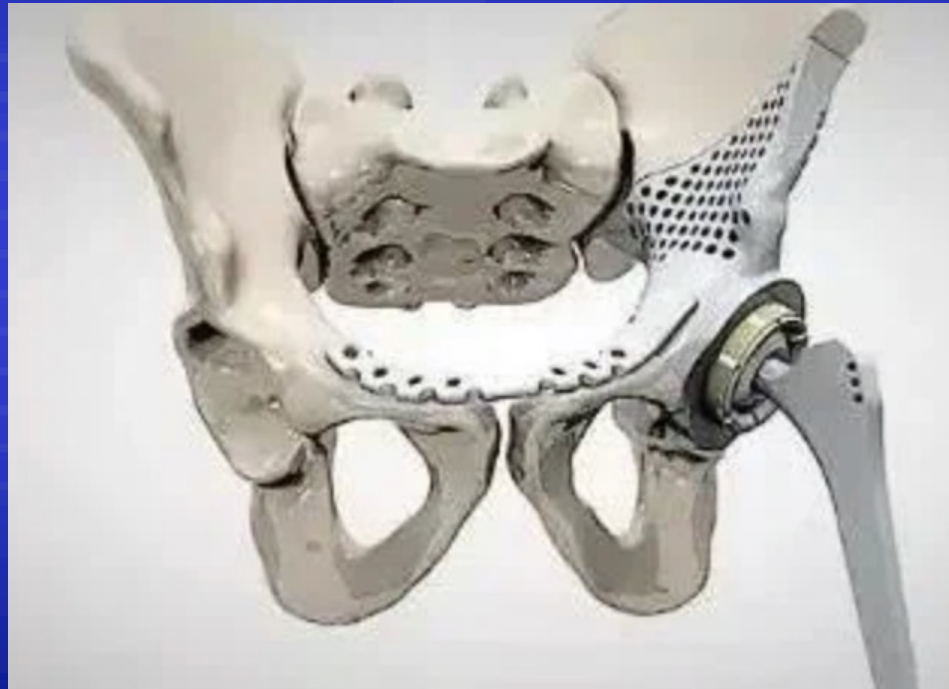
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3D Printed Vertebra



3D Printed Pelvis



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Biologics

- Helpful in achieving fusion
- Much interest – saves donor site pain
- Osteo-conductive
- Osteo-inductive
- Allograft, xenograft, synthetics



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A Brief Overview

- Complexity and cost of surgery
- Importance of teamwork
- Technological advances
- Do no Harm
- Reassure you and your patients



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Thank you



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