

A preoperative planning tool for patients with EOS based on an FE model tailored to the patient

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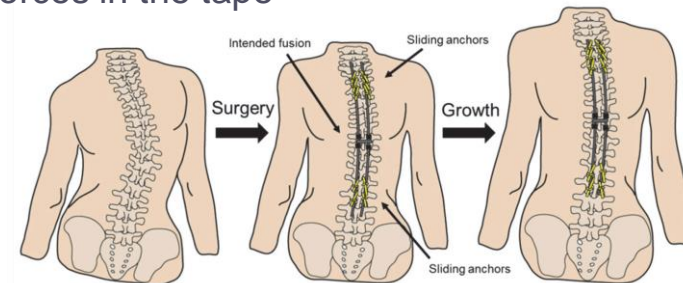
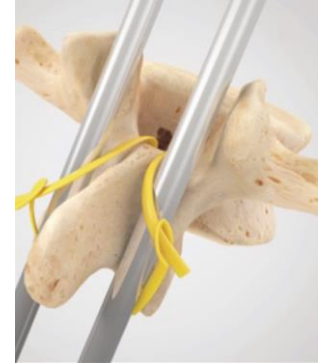
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Biomedical materials

New growth-guidance system

- ◆ Ultra-high molecular weight polyethylene (UHMWPE) sublaminar tapes for the treatment of early onset scoliosis
 - Growth friendly due to low friction coefficient
 - High fatigue strength compared to metal wires, which allows for a reduction of instrumented levels
 - More construct design possibilities due to reduction of instrumented levels
- ◆ Aims of this study
 - Create a finite element model of the spine that can be tailored to the patient's specific curvature
 - Simulate the surgical correction procedure and evaluate forces in the tape segments when instrumenting a limited number of levels



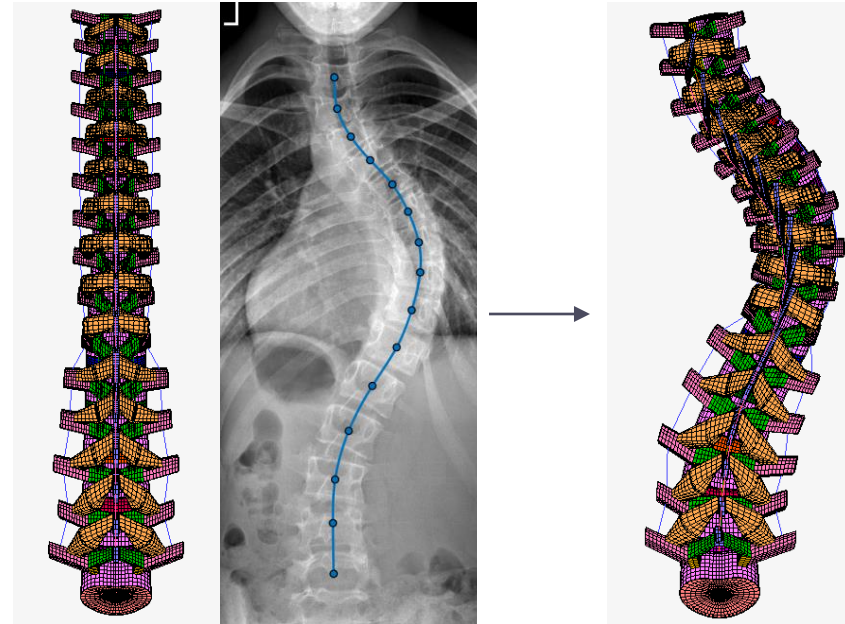
Patient-specific finite element (FE) model

Methods

- ◆ Parametrized FE model, representing a generalized healthy spine
- ◆ A computer program was developed to determine:
 - 3D spinal curvature
 - Axial rotation
- ◆ An FE problem was solved in which the model central axis is prescribed to the measured curve

Results

- ◆ The scoliotic FE model was successfully generated



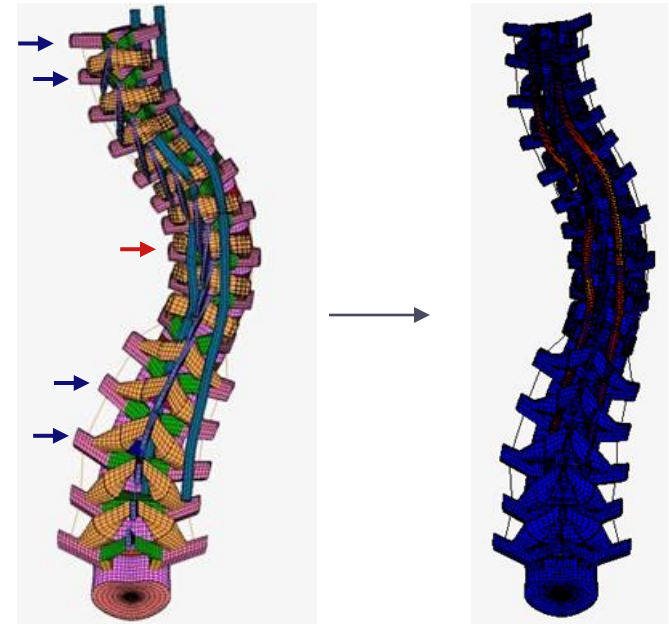
Simulation of correction procedure

Methods

- ◆ Rods, screws and sublaminar tapes were added to the curved model
- ◆ Tapes were shortened during FE simulation to simulate the correction procedure

Results

- ◆ The forces in the tapes during correction were found to be less than 220 N with the highest forces in the tapes closest to the levels fixed by screws. These forces are much less than the fatigue strength of the tapes and are not expected to harm the lamina.



- = Screws (apex)
- = Tapes

Conclusions

- ◆ The model was able to provide estimates of forces in the construct during correction depending on the patient-specific curve of the scoliosis and the treatment design
- ◆ Ultimately, it may aid the spinal surgeon in composing the ideal spinal instrumentation construct for fusionless surgery on a patient specific basis

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