



Digital patients for orthopedic surgery

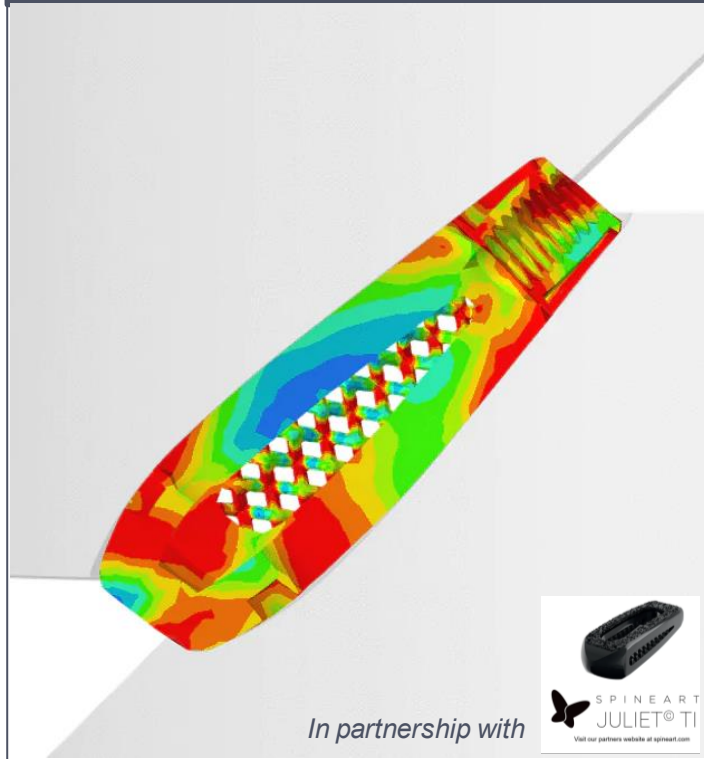
accelerate **certification** and
inform **surgical decisions**



Solutions

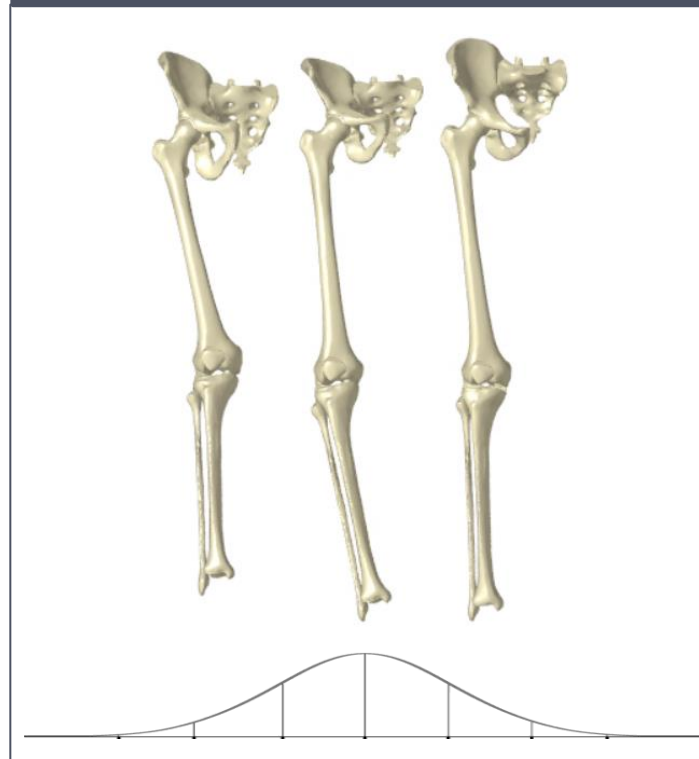
Numerical mechanical testing for **implant manufacturers** and **orthopedic practitioners**

Mechanical testing



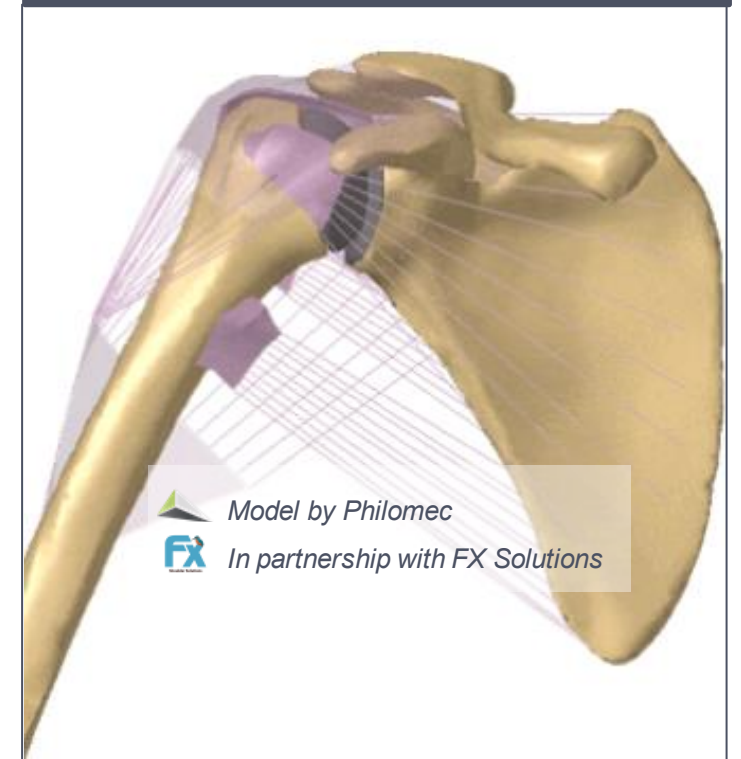
Non implanted medical device
Custom or standardized (ASTM) conditions

[Pre-] Clinical trials



Implanted medical device
Semi-personalized digital patient cohort

Surgery prediction



Implanted medical device
Patient specific digital twin

Mechanical testing for certification

Mechanical Experimental Testing

Primary objective: Measure actual mechanical performance

Evidence type: Empirical



<https://www.instron.com/>

Yes

High

Difficult and often localised

Slow

High

Moderate-high

Expensive and limited

Very high

Direct measurement

Mechanical realism

Internal stress/strain information

Design iteration speed

Cost per design iteration

Experimental variability

Identification of worst-case scenarios

Regulatory acceptance

Digital Mechanical Testing

Primary objective: Predict mechanical performance

Evidence type: Predictive

No

Depends on model fidelity

Excellent throughout the model

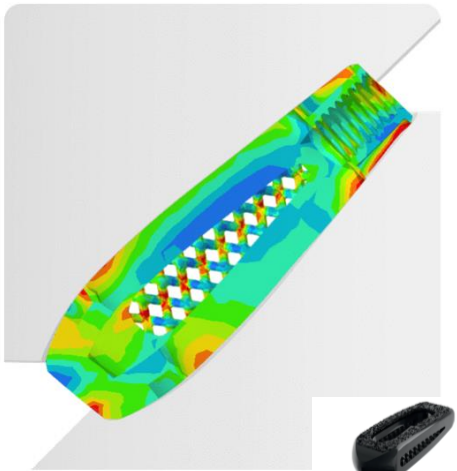
Fast

Low

Minimal

Easy

Increasing but requires validation



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Pre-clinical & Clinical trials

Traditional

Primary objective: Demonstrate safety and effectiveness

Evidence type: Empirical ; real patients



Yes

Yes

Yes

Yes

Limited to patient recruitment capabilities

Moderate to high

Months to years

High to very high

Limited

Established gold standard

Observation of real biological response

Observation of real clinical outcomes

Ability to assess healing and remodeling

Ability to assess adverse events

Population size

Ethical burden

Study duration

Study cost

Control of variables (patient variability, rare-event investigation, subgroup analyses)

Regulatory maturity

In Silico

Primary objective: Predict safety and effectiveness

Evidence type: Predictive ; virtual populations

Simulated

Predicted

Limited to modeled mechanisms

Predicted only

Limited by computational capabilities

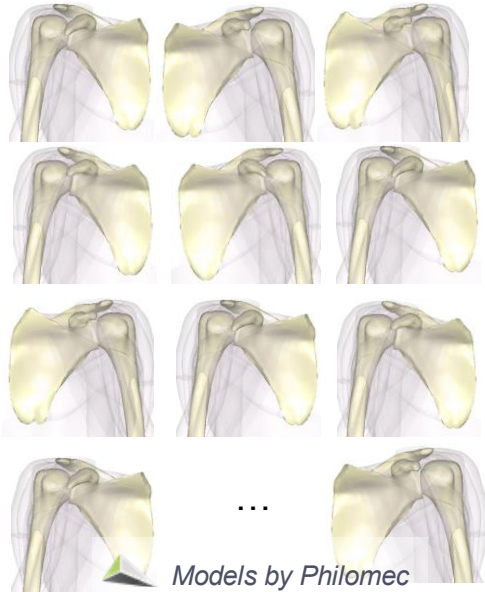
Minimal

Days to weeks

Low to moderate

Excellent

Emerging

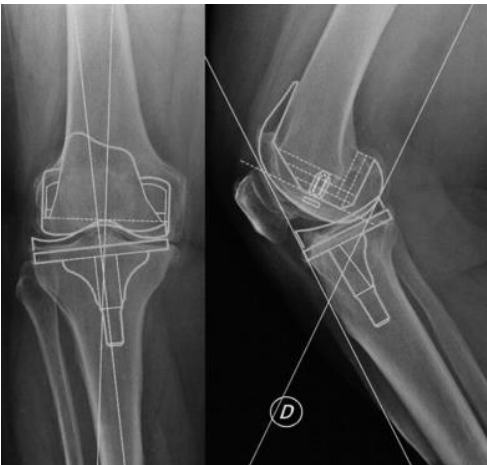


Surgery prediction

Current surgical planners

Primary objective: Predict bony interferences

Evidence type: Predictive, Anatomical, Medical imaging



<https://doi.org/10.1533/9781782420385.2.95>

Static
Based on bone geometry
Limited
Limited
No
Included in planners
Immediate
Established gold standard

Type of analysis
Range of motion
Fracture risk
Implant integration & survival
Bone remodelling
Immediate cost
Delay
Regulatory & Clinical maturity

Future surgical predictors

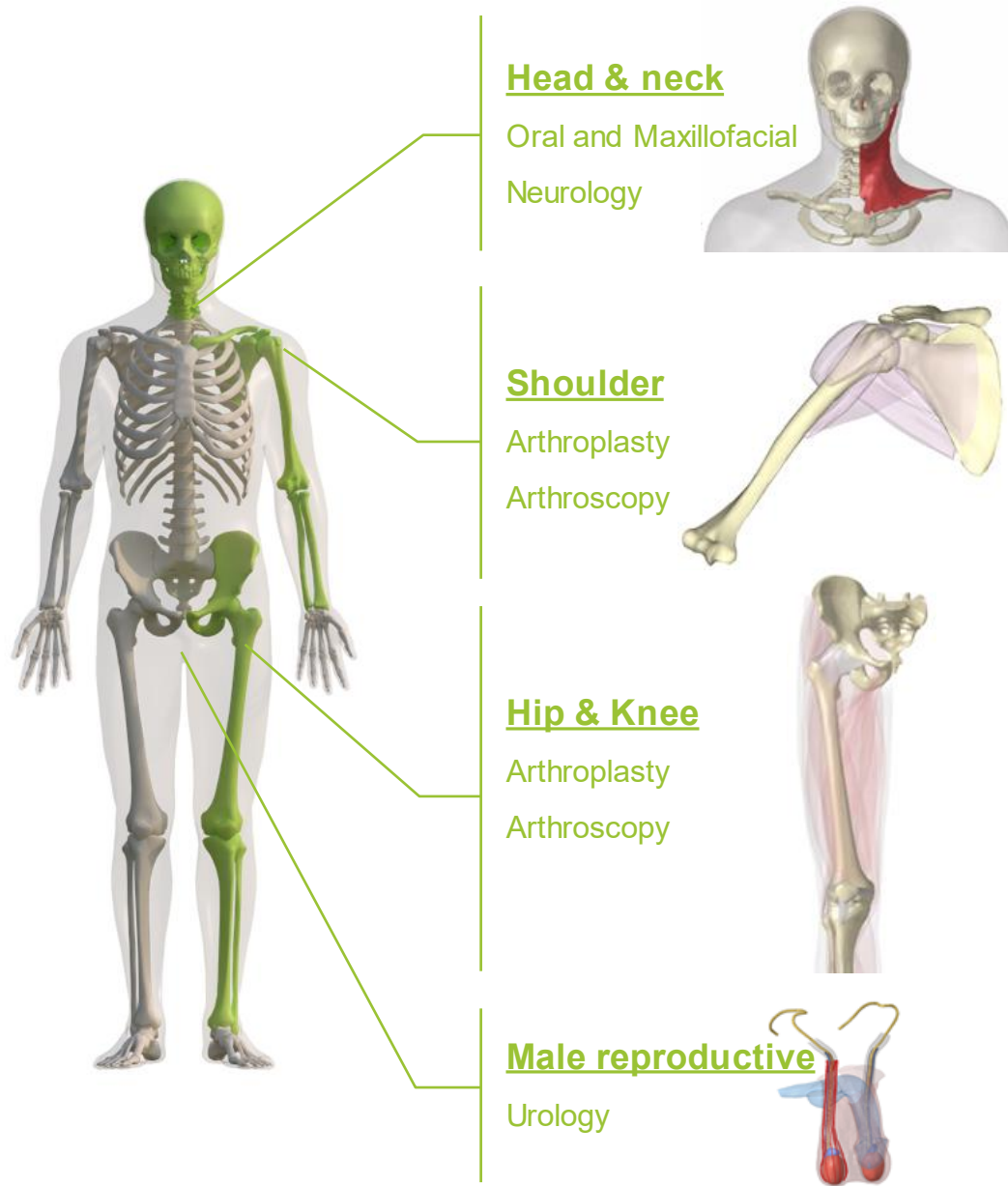
Primary objective: Predict post-operative biomechanics

Evidence type: Predictive, Biomechanical, Digital twin

Functional & dynamic
Bone + soft tissue
Yes
Yes
Yes
Added cost
Requires computing time
To be proven



Our models



Philomec

Stand #102