Biomechanical experimentation to improve the biofidelity of in silico models

Commonly used acronym: *FIBEr*

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Organisation

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Department Mechanical Engineering
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Department Institute for Orthopedic Research and Training
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Partners and collaborations

Katholieke Universiteit Leuven (KUL), Katholieke Universiteit Leuven (KUL), Katholieke Universiteit Leuven (KUL), Katholieke Universiteit Leuven (KUL)

SCOPE OF THE METHOD

The Method relates to	Animal health, Human health
The Method is situated in	Basic Research, Education and training, Translational - Applied Research
Type of method	In vitro - Ex vivo
Specify the type of cells/tissues/organs	a range of biological tissues that bear mechanical load

DESCRIPTION

Method keywords

tensile testing
indentation testing
compression testing
micro-CT scanning
multi-axial loading

Scientific area keywords

mechanical testing

biomechanics
parameter fitting
finite element modeling

Method description

FIBEr (Flanders Institute for Biomechanical Experimentation) is a laboratory that investigates the mechanical properties (stiffness, strength, microstructure) of biological tissue, in casu bones, muscles, ligaments, blood vessels, etc. A quantitative characterization of the mechanical behavior of biological tissue is crucial to understand mechanics-related pathologies (aneurysm formation, osteoporosis, …) and provides us with the necessary building blocks for *in silico* testing of interacting mechanical devices and treatment methods. *In silico* testing not only reduces the need for animal testing, but also enables customized, patient-specific medical solutions. The tested material consists mainly of tissues from deceased donors, biopsies or laboratory animals (always upon ethical approval). The lab possesses several types of mechanical testing devices, each suited for testing different types of tissues and/or material properties. There is also a sample preparation room as well as a sample storage room for (cryo-)preservation. There are around 25 researchers, PhD students and master students that frequent the lab. Furthermore, projects are frequently performed for or in collaboration with biotech companies.

Lab equipment

- planar biaxial tensile testing device ;
- triaxial testing device (extensio-inflation-torsion) ;
- micro-CT scanner ;
- nano-indentor ;
- micro-indentor ;
- dynamic uniaxial tensile device ;
- sample preparation room ;
- sample storage room.

Method status

Still in development
History of use
Internally validated

PROS, CONS & FUTURE POTENTIAL

Advantages

A quantitative characterization of the mechanical behavior of biological tissue is crucial to understand mechanics-related pathologies (aneurysm formation, osteoporosis, …) and provides us with the necessary building blocks for in silico testing of interacting mechanical devices and treatment methods. *In silico* testing not only reduces the need for animal testing, but also enables customized, patient-specific medical solutions.

Challenges

Given the biological nature of the tissue, it is essential to perform the characterization in circumstances that mimic the *in vivo* conditions as closely as possible. FIBEr pays a lot of attention to applying loading conditions that are relevant for the *in vivo* loading situation, and to create a physiological testing environment (in terms of temperature, medium, etc.). Nevertheless, there will always be a discrepancy between *in vitro* and *in vivo* measured material properties.

Modifications

FIBEr is continuously striving to further optimize testing protocols and to expand its portfolio to other mechanical testing methods.

Future & Other applications

The vision of FIBEr is to become the reference center in Belgium and beyond for mechanical characterization of biological tissues and biomedical products, and to achieve worldwide recognition for the development of validated testing protocols.

REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

Links

FIBEr website

Coordinated by

sciensano

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Financed by

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verbeelding werkt

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