Graz University of Technology

Institut für Biomechanik
Vorstand: Universitätsprofessor
Dipl.-Ing. Dr.techn. Gerhard A. Holzapfel

Univ.-Prof. Dipl.-Ing. Dr.techn.
Gerhard A. Holzapfel
Technische Universität Graz
Stremayrgasse 16/II
A-8010 Graz

E-mail: holzapfel@TUGraz.at
Tel.: ++43 316 873 35500
Fax: ++43 316 873 35502
URL www.biomech.tugraz.at

Invitation to a Lecture on

Mechanical Characterization of Healthy and Dissected Human Descending Thoracic Aortas

Professor Dr. **Marco Amabili**
Professor and Canada Research Chair
McGill University, Montreal, Canada

A layer-specific hyperelastic and viscoelastic characterization of human descending thoracic aortas was experimentally carried out. Healthy aortas of transplant quality from twelve donors with an average age of 49.4 years were received and axial and circumferential strips were prepared. They were dissected to separate the intimal, medial and adventitial layers. Measurements of the opening angles were used to identify the circumferential residual stresses. Uniaxial tensile tests on axial and circumferential strips, together with the Gasser-Ogden-Holzapfel material model, were used to identify the hyperelastic laws of the three aortic layers for each donor. Uniaxial harmonic excitations at different frequency, superimposed to initial stretch values, were used to characterize the viscoelastic behavior. The storage modulus and the loss factor were obtained for each layer in both directions for all the donors. The generalized Maxwell model, within the framework of nonlinear viscoelasticity with internal variables, was used to obtain the constitutive material parameters. Results show a good correlation between stiffness and donor's age for the three layers of the aorta in both axial and circumferential directions. A significant increase of the storage modulus (i.e. dynamic stiffness) is observed between the static value and loading at one Hz frequency, while a further increase in frequency slightly affected its value. The loss factor is only slightly influenced by the stretch value, which justifies the use of the viscoelastic model adopted. Also, similar values of the loss factors are found for the three aortic layers. Images for microstructural analysis taken by three different techniques (traditional histology with stained sections, NLSM-SHG and atomic force microscopy) will be also shown. The investigation was repeated for one dissected aorta and data are compared to healthy cases.

A mock circulatory loop has been developed for testing human aortas and woven Dacron aortic prostheses. The experimental activity has made use of the most advanced experimental techniques with four laser Doppler vibrometers as sensors. Experimental results will be presented for aortas under physiological pulsatile flow.

Date: Monday, December 17, 2018, 11:00 s.t.

Place: Stremayrgasse 16/I, Room BMT01038