**Monitoring of orthotics applications**

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There are produced a lot of types orthoses for correction, stabilization or other function on human body. Children and adolescent age is a season for effective treatment by corrective orthoses. Usually there is a problem with a discipline of using orthoses by children. All data of treatment have been given only by patients as non-provable information, sometimes as subjective or intentional. Some monitoring systems have been developed. After applications it is possible to read data of treatment season usually in 15' steps. It is accurately enough. During some years we could have more objective information of orthotics applications to compare therapeutic effect to real time of application. It will be possible to determine more optimal regimes of therapy.

**Uniaxial tensile test of perivascular adipose tissue**

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Biomechanics of elastic arteries is widely studied at present time. In contrast to the constitutive modeling of the aortic wall, little attention has been pained to mechanical properties of surrounding tissue. To fill this gap, uniaxial tensile tests with adipose tissue surrounding human abdominal aorta were conducted. Strongly nonlinear stress-strain relationship was observed. It was found that highly compliant response characterized with the initial elastic modulus about 2.16 kPa is exhibited approximately to engineering strain of 0.03. Initial linear response is followed by gradual stiffening. Tangential elastic modulus of about 500 kPa was observed at engineering strain of 0.11.

**Single cells compression testing**

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Mechanical properties of a cytoskeleton or a cell itself are considered to be a quantitative parameter for cell diversification or disease. A nanoindenter or an atomic force microscope is usually used for the assessment of the mechanical properties of a single cell. Appropriate testing probes as well as mechanical models must be chosen, in order to correctly interpret the

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mechanical loading and derive the intrinsic material characteristic of a cell. In this case, the compression tests of a single cell were performed by a Hysitron TI 950 TriboIndenter® [Hysitron, Inc., Minneapolis, USA] nanomechanical test instrument with a 100 um diamond flat end probe (90° fluid cell conical). However, a clear visualization of the living cell needs to be established in order to precisely position the probe with the X and Y coordinates of the cell. There are two microscopy regimes available for the TriboIndenter bright field and fluorescence, both top-down. Based on previous experiences, COS-1 cells [ATCC code: CRL-1650] were used due to their long viability and good adhesion properties. The cell line was derived from an African green monkey kidney; the cells grow attached to the base (adherent) and have the same morphology as fibroblasts [ATCC, USA]. The practical use of green fluorescence of EGFP modified cells exposed to a blue light applied by the TriboIndenter microscope will be discussed and compared to standard bright field microscopy also available for cell localization. Compressive load-displacement data demonstrating a critical bursting force of a cell membrane will be also presented. This research was supported by Grant Agency of the Czech Technical University in Prague, grant No. SGS13/176/OHK2/3T/12.

## An investigation of the influence of cartilaginous tissue microstructure on its local mechanical properties

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The research on mechanical properties of a cartilaginous endplate (CEP) seems to be more actual in current biomechanics of a spine. Mechanical properties of the cartilaginous endplate are presented with large range of values in the literature. Elastic moduli are given in the range from 5 MPa to 10 GPa. Which raises the following questions: What causes this large range of values? Is it an erroneously performed experiment? Is it a poorly identified endplate? Is it an inner microstructure of the endplate that causes large range of measured values? We decided to investigate mechanical properties depending on inner microstructure of CEP and thereby detect possible source of scattering of results. A fresh porcine spine was used for an experiment. The lumbar spine motion segments were immediately dissected and ten millimeter thick plates of vertebral body, CEP and annulus fibrosis were cut and polished under running water conditions. The specimen was kept in saline solution for protection from drying out during tests. Second Harmonic Generation imaging method (SHG) was used to identify CEP area and its inner structure. Nanoscale Dynamic Mechanical Analysis (nanoDMA) was used to investigate structural dependent mechanical properties afterwards. This work presents combination of a nanoindentation technique and SHG imaging to determine an influence of the cartilaginous endplate microstructure on its local mechanical