diameter appears smaller than its pre-compression size and venous blood flow is reduced and less phasic.
Limb compression is often used to aid blood flow in the leg, e.g., deep vein thrombosis prophylaxis. However, the haemodynamic effects at the site of compression are poorly understood. The new technique allows investigation of tissue structures and blood flow directly below the cuff as the limb is compressed, leading to greater understanding of the effects of compression therapy and development of more effective compression regimes. Such information would also be invaluable for developing computer simulations of blood flow.

7381 Th, 14:30-14:45 (P44)

New method for discriminating emboli from micro-bubbles in blood flow using ultrasound Doppler velocimetry

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The purpose of this study is to develop a new method for discriminate emboli from micro-bubbles in blood flow *in vivo*. An artificial valve or a left ventricular assist device embedded generates a lot of micro-bubbles besides emboli in blood flow. The existing ultrasound method cannot discriminate emboli from micro-bubbles. We paid attention to a difference in the motion between the micro-bubble and the embolus when irradiated by ultrasound. We made a simulation experiment *in vitro* by using elasto-flexible polymeric gel particles as a model of emboli which were suspended in a model plasma solution together with air micro-bubbles. The change in the velocity of the model emboli and micro-bubbles was measured by both an ultrasound Doppler velocimeter (USD) and a laser Doppler velocimeter (LDV). As a result, it was found that air micro-bubbles were made to move by ultrasound irradiation while model emboli was not made to move. In order to confirm this phenomenon, we made several careful experiments in which ultrasound was irradiated from upstream, downstream and laterally, the motion of the two was observed and measured. We concluded that this phenomenon was because of much difference in the acoustic impedance and the mass of the model embolus and the air bubble, and that by using the difference in velocity waveform of emboli and air micro-bubble on ultrasound irradiation we can discriminate the former from the latter on blood flow *in vivo*.

5874 Th, 14:45-15:00 (P44)

Effect of training on endothelial function of cutaneous microcirculation in rats

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Objective: Exercise training is known to improve endothelium-dependent relaxation in the coronary and skeletal muscle arteries. However, the effects of exercise training on peripheral arteries, including cutaneous microcirculation, are still unclear. Therefore we investigated the effect of chronic and regular aerobic exercise on cutaneous microvascular endothelial function in rats.
Methods: We assessed the effect of physical training on skin microcirculation response to hyperaemia using Laser Doppler in 28 rats: 7 sedentary and 21 rats (Wistar Kyoto) submitted to a treadmill training protocol (15 m/min, 15% incline, 60 min/day, 8 weeks). Training rats were divided into three groups, 1 day/week (Ex 1), 3 days/week (Ex 3), or 5 days/week (Ex5).
Results: At baseline, cutaneous vascular conductance was not different between all groups (sedentary or training) at three steps of experimental protocol. After eight weeks, the hyperemic stimulus significantly increased normalized cutaneous vascular conductance only in group Ex3 after 4 weeks ($p < 0.006$) and 8 weeks ($p < 0.006$).
Conclusion: Exercise training exerts a generalized effect on the vasculature by increasing endothelial function in vessel beds different from those perfusing actively working muscle.

4967 Th, 15:00-15:15 (P44)

Wavelet analysis of the effects of static magnetic field on skin blood flowmotion: investigation using an in vivo rat model

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The effects of locally applied static magnetic field (SMF) on skin blood flowmotion within the loaded or unloaded skin in trochanter area were evaluated using wavelet analysis of skin blood flow as measured by Laser Doppler flowmetry (LDF) in anesthetized rats. SMF intensity at the trochanter area was 30 mT and the duration of exposure was 40 min. Forty-eight experimental trials were carried out on 12 Sprague-Dawley rats. Four experimental Groups were formed at random: 1) no loading treatment or SMF exposure (Group 1), 2) SMF exposure only (Group 2), 3) loaded skin without SMF exposure (Group 3), 4) loaded skin with SMF exposure (Group 4). Loaded skin was induced by locally applied external pressure of 13.3 kPa (100 mmHg) for 24 hours within 4 consecutive days to the trochanter area via specifically designed pneumatic indentors. With spectral analysis based on wavelet transform, five frequency intervals were identified (0.01−0.05 Hz, 0.05−0.15 Hz, 0.15−0.4 Hz, 0.4−2 Hz and 2−5 Hz) corresponding to endothelial related metabolic, neurogenic, myogenic, respiratory and cardiac activities respectively. The absolute amplitude of oscillations of each particular frequency interval and the relative amplitude (defined as the ratio of the absolute amplitude at a particular frequency interval to the mean amplitude of the entire spectrum) were calculated for quantitative assessments. The results showed that SMF significantly enhanced endothelial related metabolic activity (0.01−0.05 Hz) in the loaded skin ($p = 0.03$), in which the endothelial related metabolic activity was significantly lower compared with that in the unloaded skin ($p = 0.01$). However, SMF did not induce significant change in the flowmotion amplitude in the unloaded skin ($p = 0.22$). This suggests, therefore, the modulating effect of SMF on skin blood flowmotion might be related to the modified vascular tone by prolonged loading. The results also suggest that SMF might have clinical significance for pressure ulcer prevention and therapy.

5762 Th, 15:15-15:30 (P44)

Measurement of shear stress on endothelium in a flow chamber and its gene expression response

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For a fundamental investigation of the influence of fluid forces on the regulation of the activity of flow-sensitive proteins and on the modulation of gene expression [1] we built an endothelium flow chamber for *in vitro* studies. An endothelial layer of thin cells covers one channel wall that can be removed and used for culturing the cells separately. The chamber has optical access for Micro Particle Image Velocimetry (μPIV) [2] measurements. The mean shear stress on the endothelium can be set and controlled by an external pump.
In this work μPIV is used to investigate the effect of shear stress on endothelial cells in a flow chamber under known fluid mechanic conditions. Endothelial cells respond to hydrostatic pressure, tensile stresses and shear stress [3]. It is not possible to isolate the influence of shear stress on the gene expression pattern of endothelial cells *in vivo*, as along with the change in shear stress other factors will also vary [4].
μPIV measurements are performed in several planes parallel to the endothelium. Assuming the no-slip velocity condition at the surface and extrapolating the velocity profiles to zero, the surface topography as well as the shear stress distribution is determined. After the shear stress distribution is measured the shear-induced modulation of the gene expression is quantified [5]. With the set-up presented we can directly compare how different flow-induced shear stresses modulate gene expression.

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14.8.3.1 Thirty-five Years in Biofluid Mechanics – Dieter Liepsch's Retirement Session

7674 Fr, 11:00-11:30 (P52)

What role do biofluid mechanics play in health care?

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A brief introduction to the focus and methods of biofluid mechanics is planned. Biofluid mechanics can be defined as the study of the movement and forces of moving and resting biological fluids such as gas, liquids (blood), and tissue fluids within and around living organisms. Whereas classical hemodynamic studies measure pressure, flow and resistance, modern biofluid mechanics is concerned with the local, time-dependent velocity of flow in blood vessels, lungs, lymphs within the circulatory and micro-circulatory system. This field focuses on the very practical clinical applications that are of interest to clinicians, namely bypass surgery, anastomosis techniques, the placement of stents and heart valves, the development of artificial assist devices and vessels, vein and dialysis shunts and the interaction between pharmaceutical agents and interventional therapies. The goal of biofluid mechanics is to optimize procedures and provide the most economical and effective therapy, by investigating such