transform, method based on wavelet transform and method based on autoregressive modeling.

Spectral analysis is based on application of Fourier transform in order to decompose signals into sinusoidal components with fixed frequencies. The power spectrum yields the information about frequencies occurring in signals and the dominant frequency for these signals. For estimating the power spectrum we used Welch method.

Wavelet analysis allows to analyze simultaneously time and frequency contents of signals. It is achieved by fixing a function called mother wavelet (e.g. Morlet wavelet) and decomposing the signal into shifted and scaled versions of this function. It allows to precisely distinguish local characteristics of signals. Computing wavelet power spectrum one can obtain the information about occurring frequencies as well as when these frequencies occur.

In autoregressive model signal is represented as a linear combination of its prior samples with a prediction error. To calculate the power spectrum three steps are necessary: estimation of approximate model order (mostly by means of the Akaike information criterion), estimation of model coefficients and then estimation of the power spectrum.

Selected EMG signals were obtained from Physionet. EMG recordings came from three subjects: healthy, one with myopathy and one with neuropathy. EMG records were obtained using needle electrode placed in tibialis anterior muscle. Subjects dorsiflexed the foot against resistance and the needle electrode was repositioned until motor unit potentials with a rapid rise time were identified. EMG signals were recorded at 50 KHz, downsampled to 4 KHz and two analog filters were used: a 20 Hz high-pass filter and a 5 KHz low-pass filter.

Based on the obtained results we can determine that in healthy subject there are no peaks in the graph of the power spectrum and it decreases with the increase of frequency. In unhealthy subjects there are peaks present (e.g. approximately 200 Hz, 500 Hz), indicating additional structure in the signal.

Classical methods of signal analysis (e.g. methods based on Fourier transform) are still frequently used, because we can obtain basic information, but it seems that nonlinear methods are more adequate. So next step is to apply some of nonlinear methods (e.g. DFA method, Poincaré plot) to larger groups of subjects.

4. DEACTIVVATING MYOFASCIAL TRIGGER POINTS APPLYING STATIC MAGNETIC FIELD

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Myofascial pain syndrome is defined as sensory, motor and autonomic disorder caused by the occurrence of trigger points *(TrP)*. TrPs are highly irritable spots within hypertonic tissues, which under pressure manifest themselves through radiating or referred pain. Their etiology is multiple.

In literature both Polish and foreign a shortage of reports on the possibilities of deactivating TrPs through exposure to static magnetic field can be noticed. Hence the aim of current research is an attempt at answering the question whether static magnetic field can change the activity of TrPs.

The influence of static magnetic fields on living organisms results from influence of the field on uncompensated electron spins, diamagnetic molecules and moving electric charges. The most important influence is direct analgetic action to remove pain. The analgetic action lasts even after a therapy is finished. 16 volunteers in age from 20 years old up to 30 years old were tested. All of them had manually identified myofascial trigger points. The whole group was tested with use of the static magnetic fields (MagneticUnit discs). Preliminary research results proves high effectiveness of the influence of static magnetic fields on myofascial trigger points.

5. EFFECTS OF MAGNETOSTIMULATION ON HEMOREOLOGICAL PROPERTIES IN PATIENTS WITH BACKPAIN

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Magnetostimulation is one of the techniques used in physiotherapy [1]. Hemorheology deals with phenomena accompanying blood flow in vessels and analysis of the processes accompanying this flow: red cells aggregation and deformation [2, 3]. The aim of current studies was to evaluate the effect of magnetostimulation on hemorheological properties in patients with back pain. Blood samples from 5 patients

suffering from strong back pain were taken before and aftera series of 5 magnetostimulation sessions performed by means of the large applicator of the Viofor JPS instrument using the M1P2 program of intensity "2". For each blood sample the flow curve was measured in the range of shear rates γ' from 100 to 0.01 (descending order) in a 5 minute period by means of the rotary-oscillatory rheometer Contraves LS40. Apart from that oscillatory measurements were applied to obtain the complex blood viscosity η^* with its components: viscous η' and elastic η'' at constant frequency $f = 0.5$ Hz in a decreasing order of shear amplitude γ'_0. Plasma viscosity was calculated from a linear fit to its flow curve.. For each blood sample the hematocrit value was measured using the standard method. All patients donated blood twice: before the therapy and after 5 sessions of stimulations with variable magnetic field of low frequency. The rotary measurement results were analyzed by means of rheological Quemada model in order to quantify red cells aggregability and deformability [3, 4]. The following parameters were compared: hematocrit value, plasma viscosity, whole blood viscosity at four chosen shear rates, Quemada model parameters: k_0 (measure of red cells aggregability), k_∞ (measure of red cells stiffness) and γ'_c (measure of red cells tendency to aggregate), as well as the components of the complex viscosity η^*: viscous (η') and elastic (η''). As a result of magnetostimulation the following changes were found: decrease of the whole blood viscosity, decrease of plasma viscosity, decrease of red cells aggregability and improvement of red cells deformability. Evaluation of the oscillatory measurements data indicates a decrease of both elastic and viscous component of the complex blood viscosity. More accurate quantitative analysis would require a larger group of patients.

[1] Sieroń A., Zastosowanie pól magnetycznych w medycynie (red. Sieroń A.); α-medica press: Bielsko-Biała, 2002.

[2] Chmiel H. (1979) Determination of blood rheological parameters and clinical application. *Advan. In Cardiovas. Physics.* **3**:1 – 44.

[3] Lerche D., Bäumler H., Kucera W., Meier W., Paulitschke M., Flow properties of blood and hemoreological methods of quantification. W Physical Characterization of Biological cells. Basic research and clinic relevance. Red. W. Scütt, H. Klinkmann, I. Lamprecht, T. Wilson, Verlag Gesundheit GmbH Berlin 1991, 189 – 214.

[4] Quemada D. (1981) A rheological model for studying the hematocrit dependence of red cell - red cell and red cell - and red cell - protein interactions in blood, *Biorheology*. **18**:501 – 516.

6. AUTOIMMUNE ILLNESSES IN THE MORA kHz RESONANCE DIAGNOSTICS

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Autoimmune illnesses are the set of chronic illnesses that cause significant medical, economical, sociological and psychological problems. The patients suffer from the symptoms of the illness for many years. The factors initiating the illness are as a rule not known. The treatment of autoimmune illnesses is long-lasting and expensive.

The MORA-bioresonance diagnostic method was developed by Franz Morrel and Erich Rasche. They have built the commercial device MORA (Med-Tronic GmbH, EN ISO 13485, EN ISO 9001). The idea of the method is the registering of the signals in the frequency range 1 – 100kHz that are emitted by different vitamins, trace elements, toxins, pathogens or tissues by using very sensitive AD-card. These signals are characterized by the increase in the impedance of about 10% – 30% if they are transmitted through the human body and the given pathology exists in the organism. The human body can be treated as the frequency-specific filter for the applied signal. The impedance increase of the tissue is observed only up to the given amplification of the applied signal. The highest amplification of the given signal being successively damped by the body points to the amount of energy, the body is able to absorb. It makes it possible to conclude about the intensity of the given process in the body. The possible mechanism of the spectrum-specific absorption can be explained by using the Quantum Field Theory applied to the structure of the water. The very high coincidence between the frequencies of the rotation of free quasi-excited electrons in the coherent domains of the water and the frequencies being used in the MORA diagnostics is observed. These frequencies lie in the proximity of f = 7kHz i (i = 1, 3, 5, 7,…). 843 patients suffering from different symptoms were examined using MORA-bioresonance diagnostic test in years 2008 – 2013. The signal 'autoimmune illnesses' has resonated at 190 of them. 66 of them were diagnosed by academic medicine to have a given autoimmune illness. Remaining 124 patients possessed different non-specific symptoms which did not fulfill the diagnostic criteria for the given autoimmune illness.
The following conclusions were drawn based on the statistical analysis: Energy deficiency in the cell and oxidative stress are strongly involved in the autoimmune pathology. Antioxidants' deficiency (vit. E, Mn, Zn, Fe, Se, Cystein, Glutamine, Glutathione) are common in the chronic autoimmune patients. Fungosis and wheat gluten are especially involved in intestine dysbiosis generation followed by malabsorption of important nutrients. Cellular defense