Chronic pain is a physiological response to tissue damage, often associated with emotional reaction, somatic and autonomic disorders, and changes in behavior [1]. Therefore, it requires a multidisciplinary approach among which physical agents have a very important place [2, 3]. In order to apply adequate physical agents in the treatment of chronic pain, it is necessary to accurately determine pain characteristics, as well as to know the physiological mechanisms of action of the applied physical agent (Table 1) [4].

The explanation of therapeutic effects of physical agents is based on the theory of control and modulation of painful impulses at: 1) peripheral level (mechanosen-
The analgesic effects of physical therapy may be expressed on afferent or efferent segments of the consignment spinal system. In order to explain afferent analgesia, the theory most often used is the “gate control” theory of pain entrance gate control theory. The stimulation of peripheral thick fast-conducting nerve fibers activates dorsal horn neurons before signals arrive via Aδ and C fibers that cannot additionally activate them (the gate has been closed). It is considered that most physical modalities achieve their effects in this way [7, 8].

The efferent analgesic system is complex. The voluntary stimuli from the cerebral cortex (suggestion, biofeedback and other cognitive demands) increase the process of release of the matter decreasing the pain. Those are endogenous opiates (enkephalins, endorphins) of the middle brain which decrease neurotransmitter release in afferent path of pain through the downstream paths, directly or indirectly, over serotonin to distal part of the first neuron of afferent path of pain, by presynaptic inhibition over μ and partly kappa receptors. This inhibited state of the second neuron in the afferent path decreases the pain [9].

Physical therapy recognizes the term “fatigue process of the Aδ afferent fibers” through axonal blockage (repetitive, high-frequency stimuli) as well as neuropeptide transmitters release (direct and modulated current) followed by pain transfer blockage on the peripheral and spinal level. Hyperstimulation analgesia and analgesia via application of transcutaneous electrical nerve stimulation (TENS), in addition to the already mentioned mechanisms of action, also act at supraspinal level, inhibiting the pain transfer up to conscious level at the somatosensory cerebral cortex [10, 11].

**Therapeutic effects of certain physical agents**

**Kinesitherapy** is a therapy based on movement and exercise used in the management of chronic pain. Effects of this physical agent are explained by segmental blockage activation, suprasegmental blockage activation, as well as by the psycho-tonus increase with the characteristics of joy, independence, communication and feeling of security [7, 11, 12].

**Galvanic current**, named after Luigi Galvani, is a direct current where ions move constantly, with the same intensity in one direction. The analgesic effects of direct current are explained by effects of ions on C afferent nerve fibers, as well as by application of different ionic content, while neuro-modulatory effect is explained by release of neuropeptide transmitters [3, 9].

**Electrophoresis (iontophoresis)** in the chronic pain therapy is the use of galvanic current to introduce analgesic ions into the organism through non-injured skin or mucosa. Aqueous solution medicine is inserted from electrode that has the same charge as the active component of the medicine. The analgesic effect is explained by the combination effects of the galvanic current and the given medicine.

**Diadynamic currents**, or Bernard’s currents, which belong to the group of low frequency direct currents, may be semi-wave and full-wave sinusoidal currents, 50 - 100 Hz frequency. These currents are the combination of 5 differently modulated impulses by their intensity, shape and amplitude (impulse one) and galvanic component: DF (diphasic flxe), MF (monophasic flxe), CP (courte “short” period), LP (long periods), RS (rhythmic syncope). By combining diadynamic currents of different modulation, we can enhance the desired effect even more, firstly in the form of analgesia, but also in vasodilatation, sympatolytic effect or the possibility of muscle contraction [9, 10, 13].

**Transcutaneous electrical nerve stimulation** (TENS) is a basic physical therapeutic procedure for pain modulation and its effects are based on the pain entrance gate control theory and pain neuro-humoral modulation, via endogenous opiate system. TENS is the use of low-frequency currents with rectangular impulses of certain duration; analgesia is achieved with electric stimulation of neuron inhibitory system of the spinal cord last horn, via descending paths mediated by opiates (endorphins and enkephalins) [3, 9].

**Interference currents** or Nemec’s currents are produced by 2 alternating currents of middle-frequencies, but more painlessly and deeply than each would individually: deep in the tissue, low-frequency alternating current is generated. In this way, the skin resistance is avoided, as well as discomfort. Interference currents act in an analgesic way and longer than other types of currents, on local increase of tissue blood supply and edema reduction, accelerate bone healing after fracture, stimulate recovery of the injured nerves, etc. [9, 13].

**High-frequency current** is applied as short-wave and micro-wave diathermy, with the purpose to heat deep muscular tissues. It belongs to alternating currents where dipoles change their orientation, tend to be positioned in direction of circuit flow and friction between dipole molecules and viscous environment heats the tissue. The analgesic effect of diathermy is explained by thermal conditioning of mesencephalic blockage and in humoral way - via thermal/stress reaction and excretion of cortisol [9, 10].

**Cryotherapy** is the use of low temperatures for therapeutic purposes. The analgesic effect is achieved through metabolic activities, slowing down nerves conduction in the treated region, decreasing the activity of the inflammatory mediator, as well as of enzymes responsible for destructive changes in some inflammatory rheumatic diseases [3, 9].

**Heat therapy** is mostly applied in the chronic pain therapy by application of surface and deep methods of heating. Heating causes vasodilatation...
and relaxation of muscles in the treated area. In this way oxygenation is increased, as well as acceleration of cellular metabolism. The initial feeling of a mild heat may have analgesic effects and results in decrease of local soreness and muscle spasm [9].

Hydrotherapy is one of the oldest methods of physical therapy; it is the use of water, especially thermal mineral water in order to treat different diseases. The therapeutic effect is reached by the combination of physical characteristics with heat, chemical and mechanical action, and also by the combination with exercises in the water. The analgesic effect of hydrotherapy is explained by the theory of the pain entrance gate control and segmental competitive blockage through the thermal-receptor stimulation, while humoral effect can be seen through heat and cold stress, i.e. through cortisol secretion [3].

Laser therapy - low level laser therapy is the use of red and infrared laser rays, i.e. stimulated light photons on the region treated. The analgesic effect of laser therapy is explained by the mechanism of closing the entrance gate on ascendant pathway, with segmental competitive blockage through activation of peripheral axonal blockage i.e. blockage of A-α different neural fibers; the neuromodulatory effect of laser therapy is explained by inhibition of inflammatory mediators formation [9, 14].

Sonotherapy is a method of using ultrasound at frequency higher than 20 kHz, directed by applicator to the certain region of the body where sound oscillations are transmitted into mechanical vibrations. The analgesic effect is explained by the influence on the painful pulses, via activation of mesencephalic system of blockade, while humoral effect is explained by heat reaction and reduction of algogenic substances at the level of receptors [3, 9].

Ultrasoundophoresis is a treatment where active ingredients are pushed through non-injured skin by ultrasound. The analgesic effect is explained by the combination of the galvanic current and given medication effect.

Magnotherapy is the application of constant or impulse magnetic field of low or high frequency. It affects chemical and physiological processes in the organism, acting at a molecular level; it changes the activity of neural and endocrine systems that represent the main regulatory systems in the organism, influencing metabolism, microcirculation and the blood content. This way, both the analgesic and anti-edematous effect are explained [9, 10].

Acupuncture, as part of the traditional Chinese medicine and a special philosophical approach to the human body and spirit, has been successfully applied as an additional method in the chronic pain therapy. The neural thalamic network is the gate towards the cortex and, in that way, cortical projections influence the analysis of all signals going through the thalamus. Also, the existence of interaction between somatosensory regions, close to the thalamus, has been found [15].

Conclusion

Adequate pain assessment, associated with good knowledge of therapeutic effects of physical agents, and a multimodal approach to the treatment of pain, provide expected results in the management of chronic pain.

References

