

## Characteristics and effect of physical modalities

PMT can not replace active exercise in physiotherapy, and should not make up more than 20 % of the total treatment.

Sorting of the characteristics is based on type of energy.

Changing of energy inside the human body or application of more types of energy

- Mechanotherapy
- Thermotherapy
- Phototherapy
- Electrotherapy (However there is a risk of burning when there is long application time of DD currents or TENS)
- Combined therapy (For example electrotherapy and ultrasound for diagnostics and treatment)

Direct impact: Influence of local physical and biochemical processes in tissues, primarily on cellular level. For example local increase of temperature

Indirect impact: Caused by nervous or endocrinal systems. Modern PTM should use these kinds of impacts.

Other types of impact can be placebo and postponing effect, which means that the effect occurs some days after treatment.

Effects can be increase or decrease of body temperature, analgetic, myostimulative or myorelaxative, antiinflammatory, antiedematic, hyperaemic or hypoaemic and trophic. A hyperaemic effect will lead to an increase of blood flow that optimally will lead to increased metabolism and thereby nutrition to muscles and removal of waste products.

Active hyperemia (peracute stadium) with symptoms pain, swelling, red colour, local increase of temperature

Passive congestion (acute/subacute) pain, swelling, livid colour, high or normal temperature

Consolidation (subacute/subchronic) swelling

Fibroplastic conversion (chronic)

## **The issue of thermoregulation, physical and physiological principles**

Humans normally maintain a body temperature about 37 degrees, and maintenance of this temperature is critical. Normal fluctuations occur with the circadian rhythm. Higher or lower body temperatures than lower, under 35 or over 37 degrees, are called hypothermia and hyperthermia. The proteins and enzymes required for life processes within cells begin to slow down as temperature increases towards 40 degrees. Dehydration will be both a cause and reason for hyperthermia.

Thermoregulation can be both by conduction or radiation, where conduction is far more efficient. The components of thermoregulatory mechanisms are thermoreceptors, both peripheral and central, where there are approximately 10 times more cold receptors in peripheral part. Hypothalamus, where posterior hypothalamus gives reaction to cold, while anterior hypothalamus gives reaction to heat.

Effector thermoregulatory activity (thermoregulatory response) are the body's ways of adaptation either by behavioral adaptations or neurally mediated effector thermoregulatory activity.

Adaptation to heat is among other done by vasodilatation and vasoconstriction, which regulates the blood flow. We distinguish core temperature and shell temperature in the body.

Heat, either because of weather, exercise or both, will lead to vasodilatation and sweating to cool of the body, because liquid makes the transport of heat faster by evaporation.

The body will also prioritize to send blood to central parts and vital organs when it is very cold, so frostbite on distal parts can occur if they are not sufficiently protected. Unvoluntarily muscle contractions are also made in order to generate heat by increasing blood flow. People will also more or less conscious, move more around to keep up the body temperature in cold conditions.

## **Thermoregulation and heat therapy applications in basic hydrotherapy treatments**

Heat therapy in physical therapy depends on whether we want systemic or local effect.

Thermoregulation in physiotherapy can be done by heat packs, paraffin application, hydrotherapy, ultrasound or electrotherapy.

Caution should be taken in some kinds of electrotherapy, because it can burn the skin because of ionizing effect under electrodes. TENS electrotherapy should for example not be used longer than 6 minutes before changing polarity because of its galvanic part, and it is recommended to use a contact gel to reduce the burning effect.

Medium frequency interferential current can be used to induce a heating effect deeper down in the tissue.

Hydrotherapy can be done by submerging either a body part or the whole body into water. Heat therapy applications are heat packs or hot water. There is also a special kind of electrotherapy bath, which use application of galvanic current to the whole body during general baths. Water temperature should be around body temperature.

Mechanotherapy in the form of both exercises and massage will also increase body temperature.