Effects and uses of the therapeutic modalities in rehabilitation: Cold therapy, hot moist, infra red, contrast bath, wax bath therapy

Introduction

Rehabilitation is the utilization of the existing capabilities of the differently abled person, by the combined and coordinated use of medical, social, educational and vocational measures to the optimum level of functional ability.

To complete a proper rehabilitation program, certain electrotherapy modalities are employed. Electrotherapy can be defined as the treatment of patient by electrical means. By implication this means that electrical forces are applied to the body bringing about physiological changes for therapeutic purpose. However, in addition to these external forces, electrical charges are generated within the body by normal physiological process. Between these two sets of electrical forces there will be interaction. There will also be interaction between the changes that occur as a result of the body's response to injury and any applied therapeutic agent.

COLD THERAPY

Cold therapy or cryo therapy refers to the use of local or general body cooling for the therapeutic purpose

This can be classified into

1. Local effect 2. General effect

Local effect of cold therapy are

i. cutaneous blood vessels

ii. muscle blood flow

iii. metabolic rate

iv. the peripheral nervous system.

v. the motor system.

i. cutaneous blood vessels

There is immediate vasoconstriction of cutaneous blood vessels, shown by the blanching that occurs. This restricts the blood flow in the skin so that heat loss is minimized. The speed with which this vasoconstriction occurs indicates that it is a reflex in the autonomic nervous system, which is triggered by stimulation of the thermal receptor in the skin.

After some minutes the vasoconstriction may give way to a marked vasodilatation which itself may last some 15 minutes before being replaced by another episode of vasoconstriction. This alternation of constriction and dilation is called Lewis hunting reaction.(Lewis 1930). It serves to protect the tissue from damage due to prolonged cooling and ischemia.

ii. muscle blood flow

This applies to the skin only, a region involve in thermal regulation. The response of muscle flow to cooling is less dramatic. It seems likely that cooling provokes vasoconstriction in all vascular smooth muscle and the increased viscosity certainly reduces the blood flow.

iii. metabolic rate

Cooling effect the living tissue and reduce its metabolic rate due to the reduced oxygen uptake. Cold induced vasodilatation is distinguished from that of heating due to its pinkness because it contains less reduced hemoglobin. Thus cooling does not benefit the healing process.

iv. the peripheral nervous system.

Cold applied to the skin provides a strong sensory stimulation by stimulating the cold receptor. This may be used therapeutically in the suppression of pain and treatment of hypertonicity. If the cold is sufficiently intense it reduces the conduction velocity of peripheral nerve.

v. the motor system.

Muscle strength or motor skills are diminished by cooling, probably because of its effect on viscosity and metabolic rate.

General effects of cooling

Cooling applies to the skin immediately stimulates the cold receptors which are more numerous than heat receptors in any given area of skin. The hypothalamus acts as a thermostat to maintain core temperature. The posterior hypothalamus is concerned with the response to body cooling, being affected by the nervous input from the skin as well as the blood temperature. To conserve heat, it is responded by cutaneous vasoconstriction and by increasing blood flow to the skin through vasodilatation.

Therapeutic uses of cold therapy

i. Acute injuries

cold is widely used in the treatment of recent injuries, when bleeding occur on the skin surface cold serves to promote immediate vasoconstriction and makes the blood more viscid, helps to reduce bleeding.

ii. Pain

Pain can be alleviated by the application of cold in several ways;

a. By reducing oedema

b. By decreasing release of pain inducing irritant.

c. By reducing the velocity and number of impulse.

iii. Muscle spam

Application of cold would reduce muscle spam and so allow increasing range of motion.

iv. Muscle spasticity

Cooling diminishing gamma motor neuron activity and diminishing the muscle spindle discharge and so reducing spasticity.

v. Muscle strength

Cooling the skin surface can lead to increase the strength of the underlying muscle.

vi. Chronic inflammatory condition

Cold may be beneficial in chronic inflammatory condition by the virtue of its pain relieving effect.

vii. Chronic oedema and joint effusion

The application of ice and compression are used for the treatment of chronic oedema and joint effusion.

Methods of applying of cold therapy

a. Local immersion

b. Cold packs

c. Ice towels

d. Ice massage

e. Cold compression unit

f. Evaporating spray

HOT MOIST THERAPY

Hot moist therapy refers to the application of hot water to the extremity by dip and wrapping method. It can be done with hydro collateral packs.

This consists of a silica gel in a cotton fabric container. This gel will absorb large quantities of water, if it is hot, provides a considerable store of heat energy. The gel is contained in a set of separated fabric pocket, so that the whole pack is flexible and the gel confined. They are heated by being placed in a special tank of water warmed to 70-80^{0}c by an electric heater controlled by a thermostat. It takes about 2hrs to become fully heated from cold but less when reheated.

Methods of application

The hot packs are wrapped in towel about 4-6 layers before being applied to the part. This provides thermal insulation and avoids burns to the part. For the skin to reach its maximum temperature it takes about 8 minutes. As the temperature of the packs decreases, the layers of the towel can be decrease to achieve the required heat.

INFRA RED

Infra red rays are electromagnetic waves with wavelength of 750nm-1mm. Any hot bodies emits infra-red rays; the sun, gas fire, coal fire, electric fire etc.

Therapeutic infra-red lamps

There are two types of infra-red generator, Non luminous generator and luminous generator. Treatment with a luminous generator is often referred to as radiant heat, the term infra-red generally applied to the radiation from non-luminous sources.

Non-luminous generators

A simple type of element for producing infra-red consists of a coil of wire wound on a cylinder of some insulating material such as fireclay, like the element of a radiant electric fire. An electric current passed through the wire and infra-red are emitted from the hot wire, which is heated by conduction.

Luminous generator

The rays emitted from the luminous generators are produced by one or more incandescent lamps. The lamp consists of a wire filament enclosed in a glass tube, which may be evacuated or may contain an inert gas at low pressure. The filament is a coil of fine wire and is usually made of tungsten, as this material tolerates repeated heating and cooling.

Application of infra-red treatment

At the commencement of the exposure, the intensity of radiation should be low, but after 5-10 minutes, when vasodilatation has taken place and increase blood flow has become established, the strength of the radiation may be increased. This can be achieved by moving the lamp nearer to the patient or by adjusting the variable resistance.

At the end of exposure the skin should be red. Following extensive irradiation the patient should not rise suddenly from the treatment position.

Therapeutic uses of infra-red

i. Relief of pain

When the heating is mild, the relief of pain is probably due to the sedative effect on the superficial sensory nerve endings. Stronger heating stimulates the superficial sensory nerve endings and blocks the pain pathway.

ii. Muscle relaxation

Muscles relax when the tissues are warm and the relief of pain also facilitates relaxation. Infra-red irradiation is thus of value in helping to achieve muscular relaxation and for relief of muscle spasm associated with injury or inflammation.

iii. Increase blood supply

This effect is mostly marked in the superficial tissue, and it may be used in the treatment of superficial wounds and infection.

iv. Promote tissue flexibility and reduce stiffness.

v. Treat some skin condition.

Dangers with infra-red treatment

i. Burns

ii. Skin irritation

iii. Lowered blood pressure

iv. Eye damage

v. Dehydration

Contra-indication of infra-red therapy

a. Impaired cutaneous thermal sensation.

b. Defective arterial cutaneous circulation

c. Patients whose level of consciousness is markedly lowered by drugs or disease.

d. Acute skin disease e.g. Dermatitis

e. Skin damage due to deep X-ray therapy

f. Defective blood pressure regulation.

g. Acute febrile illness.

h. Tumors of the skin.

CONTRAST BATH

Contrast baths involve alternate immersion in hot and cold water producing marked hyperaemia of the skin. Such treatment will cause considerable sensory stimulation as the cutaneous hot and cold receptors are alternately activated. This stimulation is relatively vigorous because each time neural accommodation starts to occur the temperature stimulation is reverse.

Methods of application

Two suitably sized baths are filled, the hot at 40-45^{o}c and the cold at 15-20^{0}c. It is usual to start and finish with immersion in the hot water. The period of immersion in the hot water is longer 3-4min while immersion in cold water is kept to 1min. this cycle is repeated for 3-4 times so that the whole treatment lasts anything from 20-25 min.

During the treatment the hot water will cool and the cold will be warmed, partly due to the transfer of the warm/cold limb from one bath to other. It is therefore necessary to monitor the temperature with a thermometer.

Therapeutic uses of contrast bath

i. Relief pain.

ii. Helps to reduce local oedema.

<u>Wax bath therapy</u>

Paraffin wax melts at around 54^{0}c but this point can be lowered by the addition of mineral oil (liquid paraffin). Most wax bath are kept at temperatures between 42-52^{0}c, often at the higher range for hand treatment and rather lower for the feet. The wax is maintained molten in stainless steel or enameled bath, which are electrically heated. Temperature is kept constant by the thermostat.

Methods of application

The part to be treated must be clean and free from cuts, rashes or infection. Positioned the patient according to the part to be treated and instruct the patient to dip the part in and out of the bath until a thick coat of wax sets on the skin. This usually takes four to six immersions.

Wax gives off heat slowly due to its low thermal conductivity, but after removal from the bat the part cools quickly. In order to retain the heat, wrap the part in a layer of plastic sheet or a towel. Treatment is usually given for about 20minutes. After this time remove the towel and the wax.

Effects and indications of wax bath

Circulatory effect

There is stimulation of superficial capillaries and arterioles, causing local hyperaemia and reflex vasodilatation.

Effects on sensory nerves

Mild heating appears to have a sedation effect on the sensory nerve endings. As wax can be molded round the contour of the hand and feet, it is of value in treating rheumatoid arthritis or degenerative joint disease, reducing pain and muscle spasm.

Effects on the skin

The skin become moist and soft following application, which can therefore helps to soften adhesions and scars in the skin prior to mobilization and stretching procedures.

Contraindications

i. Open wound

ii. Allergic rash

iii. Acute skin condition eg. Acute dermatitis

iv. Defective arterial blood supply eg. Deep vein thrombosis and varicose vein.

v. impaired skin sensation.

CONCLUSION

From the above discussion it is well known that, electrotherapy modalities are of big help in the treatment of patients with different problems. If the modalities are well understood, there can be a wide variation in acceptable technique and treatment within the confines of safe and effective practice.