User Manual

Long Wave / Short-Wave

Diathermy

Model: LSW-II

Introduction

When "Radio-Frequency" electromagnetic energy of sufficient intensity is directed at biological tissue it will cause heating. This effect was recognised many years ago and has been used therapeutically. Commercial units generate "Radio-Frequency" energy with a frequency of 27.12MHz and a wavelength of 11.06m. This is an international standard and lies within the Long and Shortwave radio bands. **LSW-II** equipment is designed to emit either a constant or a pulsed output and sometimes provides both. Constant output units are used primarily to achieve deep heating of tissues. Pulsed output allows cooling between pulses, heats less strongly and enhances the non-thermal influences of "Radio-Frequency" energy. Many studies have shown a beneficial therapeutic effect with pulsed output, although the mode of action remains obscure. **LSW-II** is widely used clinically but remains poorly researched. Practical details of **LSW-II** use are not included here and the reader is referred to some of the excellent texts that are currently available. This equipment can cause serious burns if used incorrectly.

ACCESSORIES

1.Electrode plate

2.Face probe

3.Body probe

4.Power line

5.Mono-pole energy head

Conical one: for eye
Small size: for face
Middle size: for arms and legs
Large size: for body

Apparatus

The design of **LSW-II** unit will vary between the manufacturers, as does the maximum power output and range of compatible applicators. The specifications of some units used widely and readily available in the UK. Each unit consists of a signal generator and amplifier designed to deliver an output at a single frequency and with an intensity capable of producing therapeutic effects. The amplified signal is fed through a transformer to a second circuit that delivers the energy via various types of applicator to the patient. These two systems are tuned into resonance manually or automatically to allow the maximum amount of energy to be delivered. The applicators convey energy either by acting as a capacitor, in which the tissues of the patient behave as a dielectric within the electric field, by means of rigid or flexible air- or felt-spaced electrodes, or by acting as an inductor. The latter technique employs an insulated cable that is either pre-formed into a flat spiral and contained within an insulated casing, or is wound by hand to enclose or lie adjacent to the target tissue which then behaves primarily as a conductor within a magnetic field. The ability of these applicators to heat the musculature whilst retaining a low temperature in the subcutaneous fat varies considerably.

Physiological and therapeutic effects

Back Pain Therapy

In general, the tissue response to **LSW-II** compares closely with that from other methods of heating, and the common indications and contraindications are similar to those for superficial heating. Those differences which do however exist originate in the patterns of heating generated by the diathermies, which are unlike those produced by more superficial heating. Diathermy heats both the deep and superficial layers of tissue whilst the effect of superficial heating is most marked in the skin and subcutaneous tissues9. The physiological response also depends upon the magnitude of the rise in temperature, rate of rise, volume of tissue heated and the efficiency of the homoeostatic mechanisms active in dissipating heat.

Cervical Pain Therapy

Assessment Of Heating

Any assessment by the therapist of the rate of heating is necessarily qualitative because neither field strength nor real current flow can be measured easily and thus neither heat production nor dissipation can be estimated. An appropriate intensity of heating is achieved by a process more akin to an art than a science in which the therapist integrates a knowledge of anatomy, the effects of output intensity, electrode placement and the relative rates of heating of different tissues, together with verbal reports of heating from the patient. Differential heating of tissues is enhanced or reduced, according to the aims of treatment, by the choice of applicator, its subsequent alignment and proximity to the skin Therapeutic changes only occur when the temperature of the tissue rises to 40-45oC2. Below this there is little demonstrable effect. At higher temperatures the rate at which proteins denature proceeds more rapidly than repair, resulting in irreparable cell damage and acute pain.

Enzyme Activity, Metabolic Rate And Growth

Van't Hoff's Law observes that the rate of a chemical reaction increases two or three fold for each 100C rise in temperature. Thus, elevating the temperature of a tissue from the norm of 370C to 40-450C will speed cellular metabolism, oxygen consumption and energy expenditure by a factor of 1.5. Increases in metabolic rate caused by diathermy will accelerate the processes of inflammation and repair and, together with local vasodilation and improved tissue drainage, should help deeply seated lesions to resolve more rapidly

A muscle heated by **LSW-II** shows an increased capacity for muscular work. This has been demonstrated in quadriceps femoris over a two hour period post-treatment1, but others dispute this and claim that heating causes both strength and endurance to fall

Heating of the epiphysealplates in the long bones of children may affect growth, hence injudicious application of **LSW-II** to a child may lead to deformity. Collagenases implicated in the destruction of articular cartilage become increasingly active as temperature rises and the deep heating of LSW-II may exacerbate the acutely inflamed rheumatoid joint.

Tissue heated to 40-45°C exhibits a mild inflammatory reaction mediated primarily by the release of histamine and the prostaglandins. These alter directly vascular smooth muscle tone and the contractility of the endothelial cells, thus raising the hydrostatic pressure of blood within the capillaries. This in turn increases the rate at which fluid filters into the extravascular space to cause swelling. Heat reinforces acute inflammation, promoting further oedema with exacerbation of pain and loss of function. Pulsed diathermy is used more appropriately in this situation. Sub-acute or chronic conditions respond favourably to heating, **LSW-II** being reported effective in conditions such as chronic sinusitis, bicipital and supraspinatus tendinitis and epicondylitis when applied by inductance and as lessening symptoms of traumatic arthritis. Local heating clearly provokes vasodilation. Deep heating causes arterioles, capillaries and venules to dilate either by direct action or in response to decreased oxygen tension and increasing metabolite concentration in surrounding tissue. Lymph vessels also respond to heating and the rate of interstitial fluid drainage increases with temperature. Generally, blood flow to active organs rises during heating whilst that to inactive organ falls. This effect is more marked in some tissues than in others. Blood flow in skeletal muscle is primarily under metabolic regulation and is less affected by heating than skin blood flow. Blood flow in muscles heated by diathermy during cooling to 5°C of the overlying skin increased from the resting level of 2.61ml/min/IOOg to 32ml/min/100g2l. Muscles exercised whilst heated deeply show higher perfusion rates than those exercised or heated separately. Experimentally induced haematomas labelled with Cr disperse more quickly when heated to 42-45°C by diathermy. Blood flow to skin increases promptly in response to **LSW-II** heating due to the effect on the cutaneous vessels mentioned above and also the local axon reflexes served by the cutaneous thermoreceptors. Spinal reflexes produce a more complex vascular response to heating that is often remote from the treated site and may, for instance, occur in the opposite limb or in some other region. Heating the proximal segment of a limb can cause vessels lying distally to dilate. Some propose that this mechanism be harnessed to relieve the ischaemia present in peripheral vascular disease, although research has yet to confirm that the deep collateral vessels dilate to the same extent as the superficial networks.

Pain And Muscle Spasm

Pain and muscle spasm often coexist and in a variety of musculoskeletal disorders are mutually reinforcing. Empirical evidence justifies the use of heat to reduce pain although the physiological basis for this observation is poorly understood.

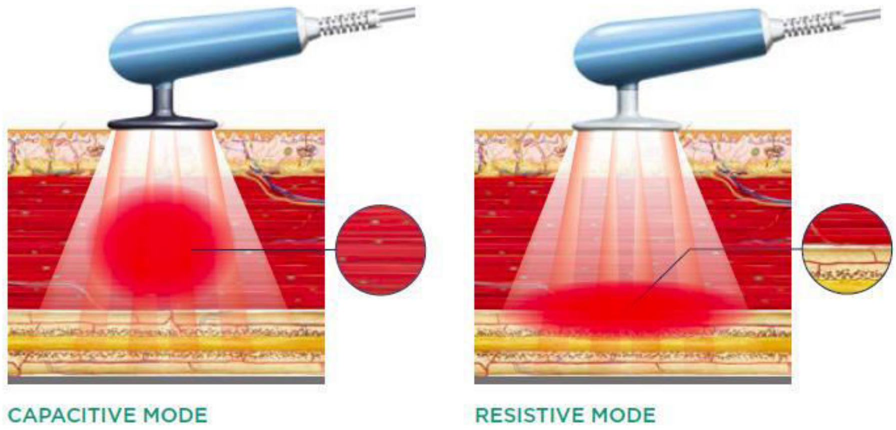
LSW-II increases pain threshold experimentally. This response is apparently mediated by a direct action of heat upon free nerve endings or on the nerve trunk that supplies the affected area. Heat may also stimulate the cutaneous thermoreceptors sufficiently to block the transmission of pain as it enters the spinal cord via the 'pain-gate' mechanism. Some suggested that heat applied at sufficient intensity to cause pain acts as a 'counter-irritant' that closes the 'pain-gate' and reduces a more severe pain elsewhere but this approach is now considered inappropriate. The increase in conduction velocity observed when peripheral nerves are heated by **LSW-II** would facilitate this mechanism. Heating also eases pain by promoting vasodilation and efflux

from the affected tissue of chemicals implicated as mediators of pain e.g. bradykinin, serotinin and the prostaglandins. Muscle spasm secondary to pain from musculoskeletal disorders is often reduced by heat and this in turn will contribute to the lessening of pain. Heat has a therapeutic effect on muscle spasm by acting directly upon the muscle spindles. These deep structures will be most effectively heated by **LSW-II.** As the temperature of the muscle spindle rises the activity of the mechanisms conveying information about static stretch to the spinal cord decreases. At the same time Golgi tendon organ output increases, helping to prevent

muscle over-stretch. The sum of these influences on the anterior horn cells in the spinal cord is inhibitory and results in the relaxation of the affected muscle. Furthermore, the output of muscle spindles is reduced and relaxation facilitated by a reduction in gamma efferent activity caused by a reflex response to skin warming.
LSW-II is often used successfully in conditions in which pain and muscle spasm are prominent including degenerative joint disease, ankylosing spondylitis, low back pain, and soft tissue injuries -such as inversion sprains of the ankle.

TECAR therapy

The term TECAR is an acronym for Capacitive and Resistive Energy Transfer. The use of TECAR technology is of major importance in rehabilitation therapies since it reduces pain, stimulates venous drainage in the lymphatic system, significantly reduces both muscular and back pain. In general, TECAR is used to treat disorders such as sprains, tendonitis, bursitis, osteoarticular distractions, chronic arthralgias, contractures, strains and muscular tears, myositis, pathologies of joint capsules, arthritic processes, lumbago and sciatica. Therapy is widely useful for treating all types of sports injuries. The TECAR method represents a technological innovation in the field of energy transfer in the diseased parts of the organism. From the other treatments that use the electromagnetic waves (ex. the ultrasound and the laser) the TECAR method is differentiated by the typology of the transmission of energy. In fact, TECAR therapy is not based on the induction of heat "from the outside", but rather on the stimulation of ionic charges naturally present in our muscular tissues through the application of particular electrodes. This involves a process of intensive stimulation of the tissues at the cellular level, which activate the blood circulation inducing an increase in temperature that accelerates a natural physiological reaction. TECAR therefore does not make use of the electric transmission from the outside, but involves the exchange of the electrolytes already present in the organism at the cellular level, with the aim of reactivating the circulation.Therefore, the process induces an increase in temperature in tissues that triggers the natural reaction of the organism, which is essential for the restoration of a considerable number of muscle and joint damage. This happens thanks to the combination of two mechanisms: increase of temperature in the deeper tissues and increase of the energy potential of cell membranes.



Thanks to the thermal effects (heating of the tissue), therapeutic therapy is often combined with manual therapy or passive stretching, where, due to local hyperthermia, a wider range of movement and faster muscle relaxation are obtained, while isometric muscle contraction stimulates the influence on the activation of individual muscle fibers. The TECAR therapy is a very pleasant treatment, since it involves an optimal feeling of heat, and which one can undergo with absolute tranquility since it does not cause collateral effects.
However, treatment is considered contraindicated for women during pregnancy, for individuals with pacemakers, as well as for neoplastic patients and for patients with a disturbed temperature detection.

Elasticity Of Connective Tissue And Joint Range

The viscoelastic properties of connective tissue vary with temperature and the concentration of a common structural component, the glycosaminoglycans, alters after treatment with **LSW-II.** As the temperature of the tissues approaches the therapeutic range, the behaviour of collagen becomes more plastic and less elastic. Thus connective tissue heated to 40- 45°C will show a greater tendency to elongate when stretched, and to retain the new length, than tissue stretched at 250C. A stretch of long duration achieved with minimal force produces the greatest elongation and maximum recovery of joint range with the minimum of tissue damage. Pain and loss of function in patients with OA knee was improved by **LSW-II** given three times a week. Such results contrast with those reporting little difference between the symptomatic improvements gained using active or disabled shortwave diathermy units**, LSW-II** or superficial heating modalities and shortwave diathermy and exercise versus interferential therapy and exercises given three times a week for two-six weeks.

Technical Parameter

Description	Long Wave / Short-Wave Diathermy
Model	**LSW-II**
General Power Supply	200-240V
Power	90W
Fuse	6 AMP
Electric Method	Capacitive Transfer Method
Frequency	300,000Hz
Voltage	1,000V ~ 1,200V
Capacity	(150W ~ 250W)
Energy Generation Principal	Biological heat generated by the electrical current
Temperature of Biological Heat	42°C ~ 45°C
Degree of heating	Deep Heat (Max. 10cm ~ 25cm)