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Guest Article

Soft Energy for Pain
(Clinical Application of Soft LASER - 632)

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One of the latest electrotherapeutic techniques now available for the physical medicine specialist for the treatment of pain, inflammation and oedema is "LASER".

LASER is only an acronym standing for "Light Amplification by Stimulated Emission of Radiation." The Laser beam is produced when the atoms of certain elements are excited by electromagnetic radiation. The Laser unit being discussed in this article is a low-power, athermic, soft Laser Combining Helium 85% and Neon 15%, along with infrared radiation. The infrared allows the beam to penetrate deeply into the tissues, even upto 30 mm.

The corpuscular theory of light was put forward first by Einstein in 1917. In 1960, Maiman devised the Ruby Laser for industrial purposes. In 1964, Townes, along with others, was awarded the Nobel prize in Physics for the discovery of modern Lasers. From 1968 to 1978, a lot of research was made on this subject, and in 1978, diode (gallium arsenide) Lasers were put in use. The active medium in the Laser may be solid, liquid or gas. In medical practice, the gas Lasers are often used. They are again classified as high power Laser, mid - Laser and soft Laser. The high power Laser contains Co_2, Neodyne yag or Arseno-gallium and has a thermic and destructive effect on tissues and used in surgical practice for cutting and coagulating. The soft Lasers contain gaseous mixture of Helium (85%) and Neon (15%) and athermic as the power emitted is as low as 1 milliwatt to 50 milliwatts. This soft Laser is now put to use in many parts of the world to treat various musculoskeletal disorders which produce pain, inflammation, oedema and ulceration.

To produce a Laser beam, the three essential components required are : 1) active medium, 2) pumping (external energy) and 3) optical resonator. 1) The active medium is the gaseous mixture of Helium (85%) and Neon (15%). 2) The external source of energy is the electrical current of high voltage, say 2500 volts. 3) The optical resonator is in the form of 2 concave mirrors, set apart facing each other. The beam bounces back and forth between the mirrors producing a number of lines. One of these mirrors is partially transparent to allow a certain number of photons to escape constituting the Laser beam, emitted perpendicularly to the mirror. The principle of Laser beam is thus due to the spontaneous emission phenomenon of photons, followed by stimulated emission. The mode of emission may be continuous, pulsed or modulated.

The characteristics of Laser light are :

1) Monochromaticity :

The radiation is of one selected wave length and comprises of light of one colour only. White light as emitted by bulbs or daylight is a mixture of all wave lengths and all spectral colours.

2) Coherence :

All Waves are of the same phase. Bulbs show spontaneous emission only and hence non-coherent. Laser is of the nature of stimulated emission with a maximum photon density.

3) Parallelism :

Unidirectional. All the rays are parallel and not divergent is in contrast to that in the ordinary light. This helps high directivity and concentration of projection on a selected specified area of

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body.

4) Athermic :

No heat is produced as the power is of the range of 1 milliwatt to 50 milliwatts only.

5) Luminous Emittance :

The Laser beam is highly luminous, as bright as the sun, 10,000 times more than the ordinary light. It is dangerous to look at the beam directly with naked eyes as it has damaging effect on the retina. Hence both the patient and the doctor or the therapist use the special goggles during application of the light.

Laser light has a number of biological effects on the human tissue, which are made use of in treating the various musculoskeletal disorders, such as degenerative osteoarthritis, low back pain due to strains and disc prolapse, rheumatoid arthritis, acute sports injuries with a view to reduce pain and inflammation. It also helps to reduce oedema and hasten wound repair by cell proliferation and as such used in treatment of pressure sores. Thus the Laser acts locally on the spot to bring about certain biochemical changes in the cells and tissues and not centrally on any system of the body. It is somewhat similar to the process of 'photosynthesis" in plant where solar energy is utilised to produce chlorophyll in the plant cells.

The analgesic effect of Laser, though not very well understood, is supposed to be due to the diminution of prostaglandins and increase in enkephalins and endorphins which are biochemical agents in the cells. The analgesic effect may also be due to modifications of alfa and delta nerve cells and also due to increase of serotionin increase of serotonin in blood. It is certainly not due to the "Gate control theory."

The anti-inflammatory effect is also due to the same biochemical changes mentioned above.

The wound healing effect is due to the increase in the mitochondrial, mitotic and fibroblastic activities, along with local revascularisation and increase of adreno-nucleic acid. The relief of oedema is due to the improvement of the local lymphatic drainage. All these help the cell proliferation to a great extent, thereby promoting the healing of wounds and sores.

There are very few contraindications for the use of Laser. They are 1) vascular diseases and bleeding diseases, 2) menstruation, 3) pregnancy, 4) epilepsy, 5) those with cardiac pace-makers, 6) certain endocrinal disorders, and 7) skin infections. The advantages of using Laser are 1) no overdosage any time, as the excess rays are not absorbed but scattered, 2) no side reaction or adverse effects on other systems of the body, and 3) a very few contraindications as mentioned above.

A standard Laser therapy equipment consists of a tube encased within a metal casing with a programme panel and emitting a beam of wave length of 900 nanometers. The infrared part helps the beam to penetrate to a deeper level into the tissues even upto 30 mm. In some, in addition, there is an acupuncture detector to trace out the acupuncture points in the body.

Extreme care has to be taken in installing and operating the equipment as the components are very delicate and may go out of order, if not handled properly.

The equipment is better kept in a dustfree airconditioned room, away from bright light, along with a voltage stabiliser and a spike buster to combat the fluctuations of voltage. Special goggles should invariably be worn, both by the patient and the operator. The Laser beam should be as far as possible perpendicular to the skin to optimisse absorption and penetration. Only the areas to be treated should be expoed and the other parts preferably covered with linen. The beam can be projected by (1) scanning for larger areas and (2) probe for smaller areas.

At present, there is little comparative research available to evaluate Laser as a form of treatment. A lot of study has to be done to establish its definite role in the treatment of musculoskeletal problem. It is hoped that, in the years to come, Laser will have a significant role to play in the medical management of many conditions.