

An Overview of Stimulators

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Abstract: This paper aims to bring forth the significance of stimulators, recent advancements in the field of stimulators and how electrical signals can be utilized for pain relief and to cure other diseases of human body, by using stimulators.

This paper aims to create awareness about stimulators and also focuses on their advantages as compared to the conventional medicine. Moreover, it also brings forth that how an electrical signal can be utilized for treating various human disorders and diseases.

Introduction: Stimulators are basically the electronics circuits that are used to generate the electrical signals and transmit them to the patient's body. The arrangements are made in the stimulators to change the amplitude, frequency and application time according to the patient's condition.

The electrical impulses in a stimulator are produced in a battery-powered pulse generator. The electrical impulses are applied to the effected portion of the patient's body using electrodes.

The most common application of stimulators is to relieve the patient from the pain. In this case it is analogous to taking analgesic but reduces the dependency and the danger of any reaction which an oral drug may cause.

Theory: As the name suggests stimulators are devices that provide mild stimulation of nerves using electrical signals. These signals abstract the pain signals before they can reach the brain and hence the sensation of pain is reduced. The result is like taking an analgesic.

The stimulators are basically used to treat pain, and this controlling of pain can be well explained by two theories which explain the pain control mechanism. These two theories are:

The Endorphin Release Theory, which states that the application of mild electrical impulses, stimulate the production of endorphins and enkephalins, in brain, which is analogous to the conventional drug therapy which initiates the production of these fluids in brain which reduces the sensation of pain.

Here, when we use the stimulator the advantage is that, there is no danger of side effects or of the drug dependence.

The Gate Control Theory: It is a theory, which suggests that by electrically stimulating nerve receptors, a gate mechanism is closed in nerve receptors, preventing pain-carrying messages from reaching the brain and hence blocking the perception of pain.

Types of stimulators:

Depending on the body part or the area of application, stimulators are classified as follows:

1: **Transcutaneous Electrical Nerve Stimulator (TENS):** As the name suggests, transcutaneous refers to the application of electrodes on the cutaneous or the superficial skin. These are the stimulators, which stimulate the specific portions of nerves by using pulsating electrical signals, whose amplitude, frequency and phase can be controlled, by the electronic circuitry which is present on the assembly of stimulator.

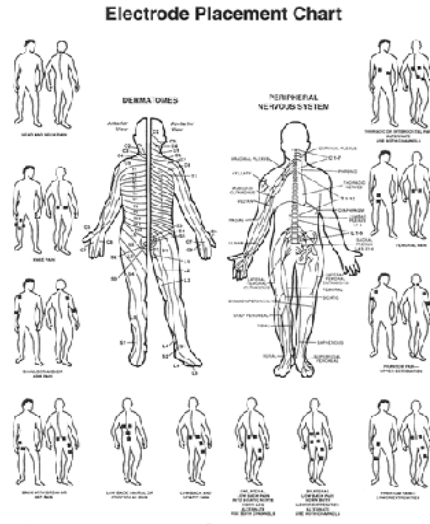
Electrodes are placed at specific sites, on the body for treatment of pain. The current, when applied in controlled quantity to the affected portion using electrodes, blocks the nerve pathways that carry the sensation of pain to the brain and hence the person feels relief from the pain.

Electrodes are used for stimulating the affected portion of body



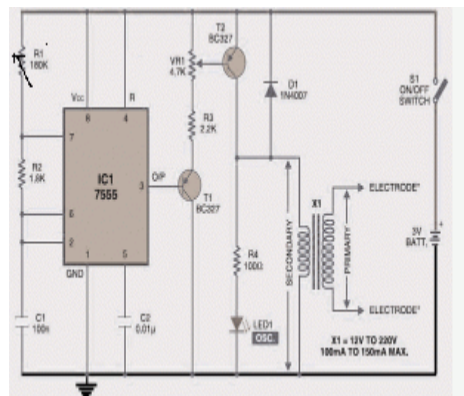
Triggering of TENS: Normally the stimulation is based around a 500 ms spike pulse, having an adjustable amplitude of 0-75 mA and adjustable frequency of 12-100 pulses per second. The other type of instrument having square waveform, have a pulse frequency range of 20-200Hz, pulse width from .1-1.0 ms and pulse amplitude of 0-120V with maximum output current of 25 mA

The electrodes of TENS are moulded from silicon rubber, loaded with carbon particles, to provide proper conductance.



2: Muscle Stimulators: These are used to mainly treat the patients suffering from full or partial paralysis. These stimulators stimulate and hence strengthen the muscle which are weak or paralysed, by applying electrical signals which create a somewhat vibration like sensation or the artificial triggering pulse for the muscle.

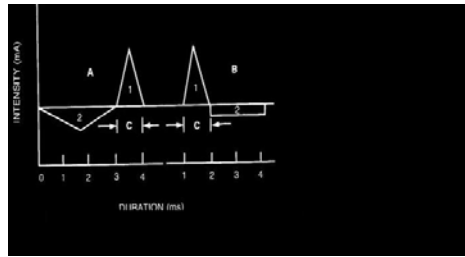
Using muscle stimulators, we try and give a sort of electrical massage and hence help the muscles to regain their strength and vitality.



Electronic muscle stimulation circuit diagram

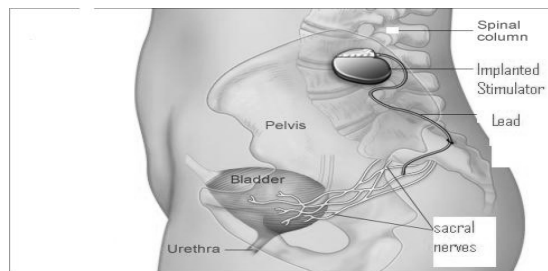
As the muscle fibres of different body parts have different strength and hardness so we use various types of electronic signals to treat various muscle anomalies. The types of currents or signals used are as follows:

- Faradic Current:** They are a series of triangular pulses with duration of about 1 ms to 20 ms. It is basically used to treat the muscle weakness.



- b) **Faradic Surging Current:** They are known as surging because their peak current intensity applied to the patient increases or decreases rhythmically at a slow rate. Such currents are mainly used for prolonged application to patient's body, like in the case of treatment of functional paralyses in spasm.
- c) **Galvanic Current:** A steady flow of direct current is passed through the skin producing a chemical effect used in treatment of paralysis and disturbance of blood flow.
- d) **Exponential progressive current:** These signals are used to treat severe paralysis. The variation of current is exponential in nature in such stimulators.

3. Bladder Stimulators: The Implanted Bladder Stimulator allows you to control your bladder using an electrical device. This system includes a stimulator that is placed under the skin of your belly that is similar to a heart pacemaker. Wires are attached to the stimulator and pass under the skin of your belly to the spine. A spinal operation called a laminectomy is performed that allows all the nerves that carry information to and from the spinal cord to the bladder to be seen. The wires from the stimulator are carefully attached to the nerves using special cuffs designed for this purpose. To allow the stimulator to get complete control over the bladder the sensory nerves from the spinal cord to the bladder are cut. This is called a rhizotomy. After the operation is complete and the wounds healed the patient uses a small hand held device similar to a television remote, to turn the bladder stimulator on and off.

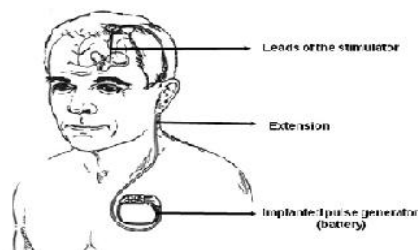


The above figure shows the implanted bladder stimulator

4. Deep brain stimulators: Here the stimulators are mainly used to treat the patient suffering from the Parkinson's disease.

This is done to stop uncontrolled shaking of patient by placing the stimulator beneath the skin, and by superimposing its rhythm on the rhythm of brain.

A diagram showing a patient of parkinson's disease with brain stimulator



Conclusion :To conclude,electronic stimulators,paved a way to the treatment which is less painful,more effective and with very less side effects as compared to the conventional treatments.

It had proved very effective ,especially for neural disorders and for treatment of pain.Moreover,it is easy to control by varying the frequency or intensity of the electronic signal given to it as an input.

However,its use is still limited and not much used worldwide,so proper awareness and reaseach needs to be done in this field.

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