

TENS

“Transcutaneous Electrical Nerve Stimulation”



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- *Precautions and safety protocol for TENS application*

TENS

- *Introduction* –

Low –frequency modality

Non –invasive analgesic technique

Used to relieve from nociceptive, neuropathic and musculoskeletal pain.

- *Definition* –

TENS is a application of electrical stimulation to skin through surface electrodes to stimulate the nerve fibres primarily for the relief of pain.



- History background –

The development of TENS has been associated with the publication of Gate Control Theory / Pain Gate Theory by Melzack and Patrick Wall In 1965.

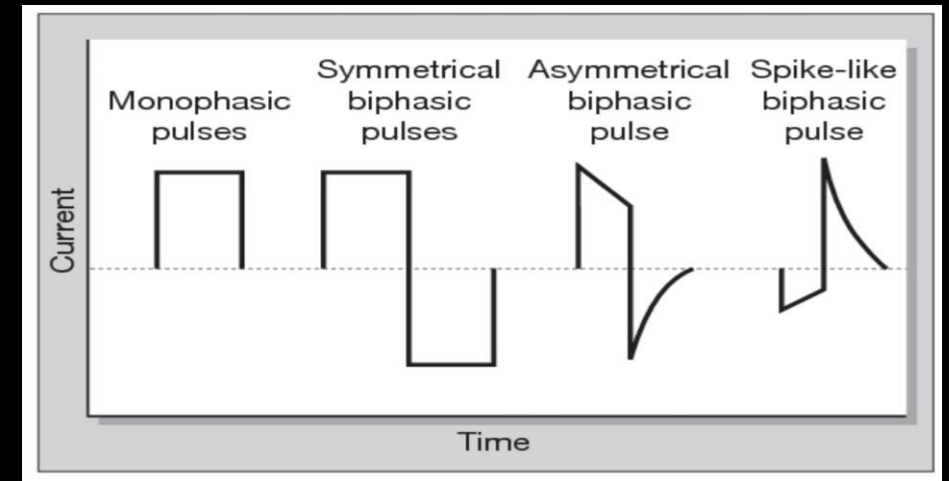
- Biophysical Principle –

TENS works on the principle of pain gate theory /gate control theory (pre-synaptic inhibition and descending pain suppression system) given by Melzack and wall in 1965.

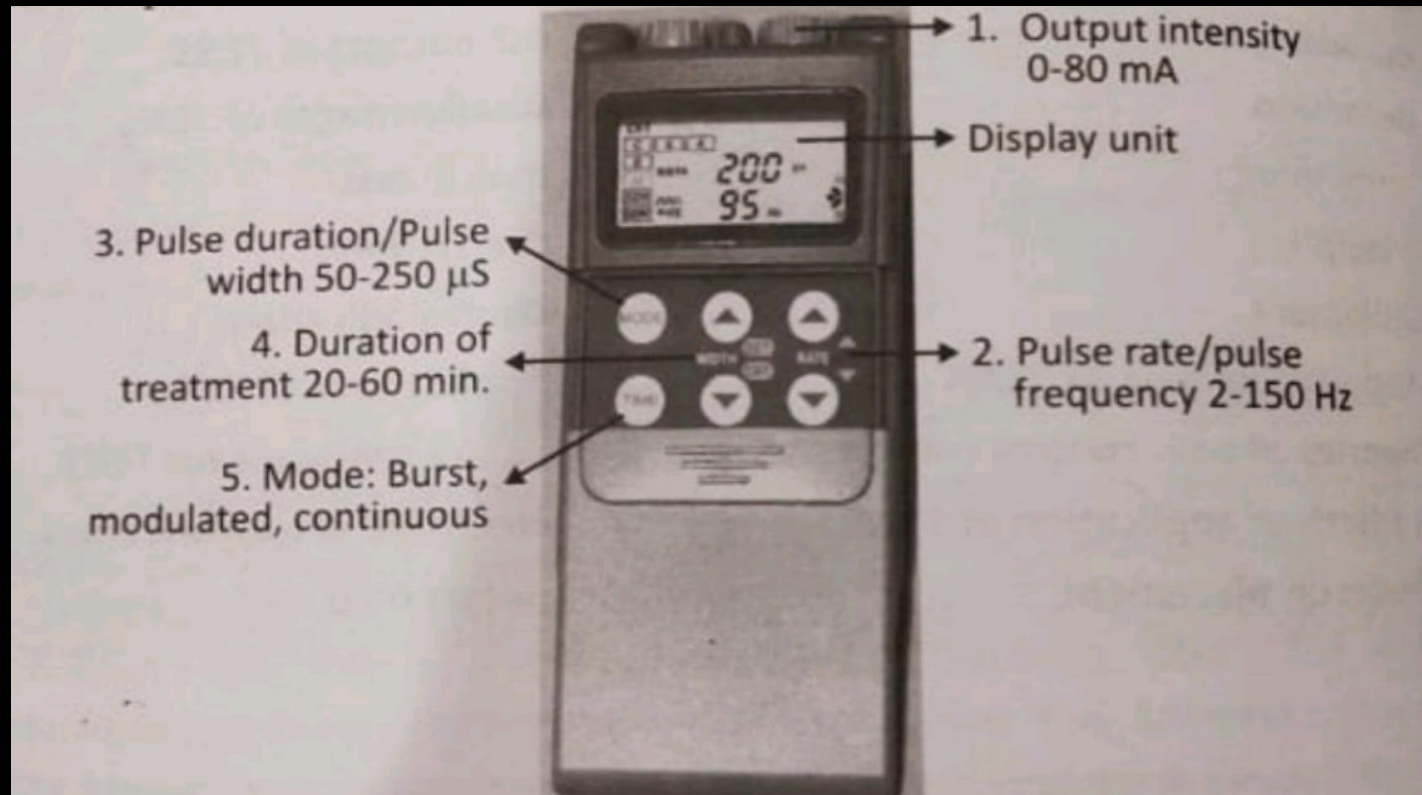
- Pulse waveforms used in TENS –

Most commonly used waveform is symmetrical

Biphasic rectangular shape.

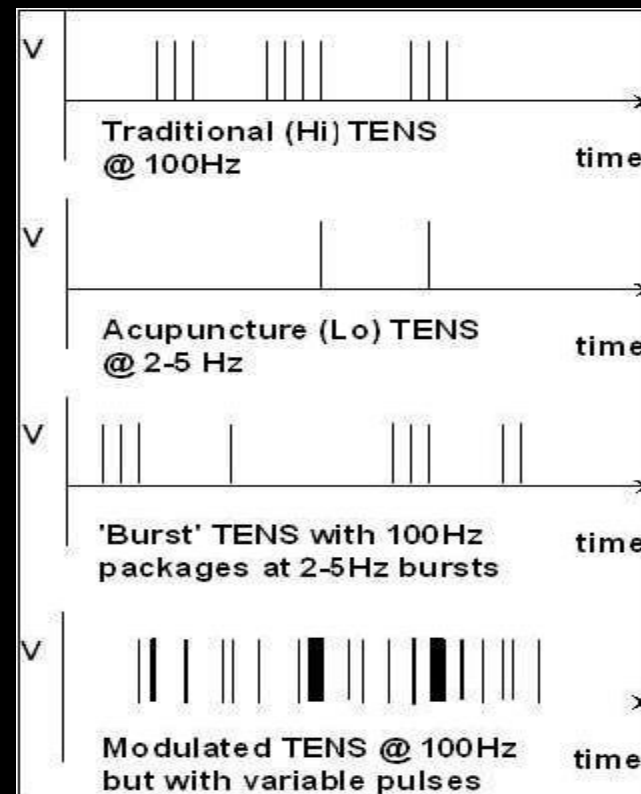


• Modern TENS unit –



MODES/TYPES OF TENS

- ***1. High TENS / Conventional TENS***
- ***2. Low TENS / Acupuncture TENS***
- ***3. Burst TENS***
- ***4. Brief TENS***
- ***5. Modulated TENS***



HIGH TENS /CONVENTIONAL TENS

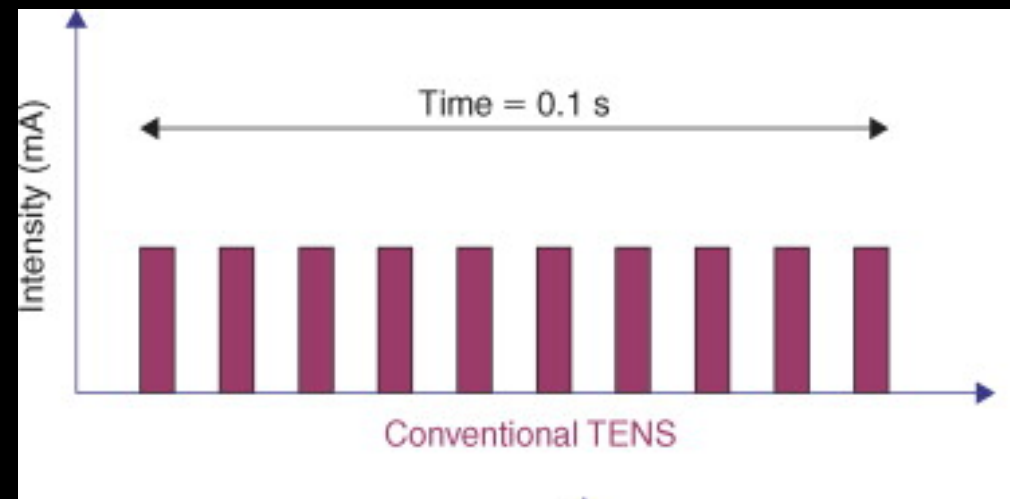
- *This mode of TENS is the most commonly used technique and it is selected as the first line of option for the most of the patient .*
- *The aim of the conventional TENS is to selectively activating large diameter (A beta) Fibres without activating (A delta) and C Fibres and muscle efferent.*

TREATMENT PARAMETERS OF HIGH TENS

- *Frequency :- 100 – 150 Hz*
- *Pulse duration:- 100 – 500 (most commonly used pulse duration is 150)*
- *Intensity : - it produces sensory stimulation (paraesthesia) prickling and tingling sensation (less than 30 mA).*

Intensity should be increased until the patient perceive a comfortable paraesthesia beneath the electrode

- Treatment time :- 20 – 30 min
- Mechanism of action :- it works at the level of presynaptic inhibition (pain gate theory) there is rapid onset of pain relief but temporary analgesia.



LOW TENS/ ACUPUNCTURE TENS

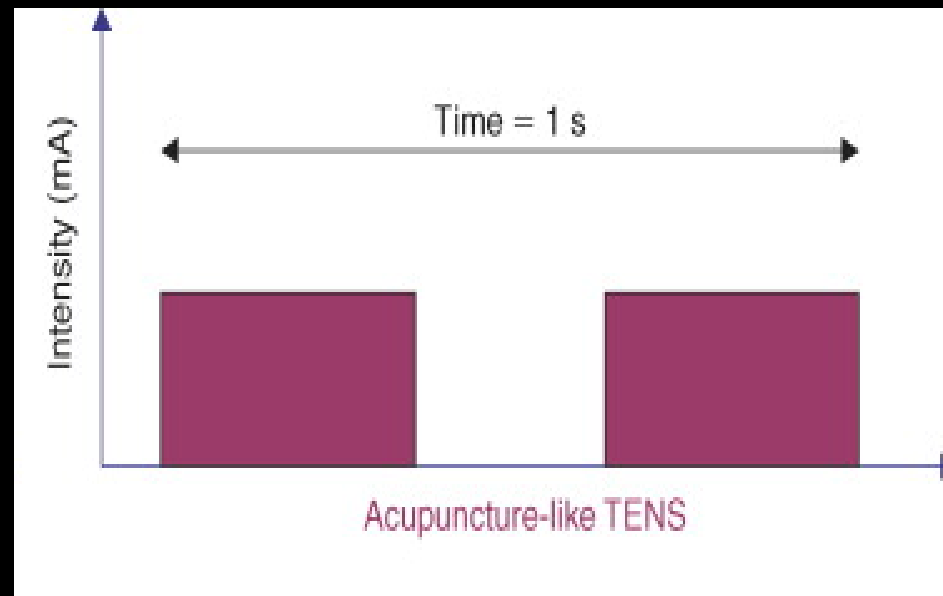
- *It is a form of hyper stimulation and it can be used if patient doesn't response to high TENS .*
- *The purpose of low TENS is to selectively activate small diameter fibres arising from the muscle (ergo receptor) by the contraction of muscle .*
- *Patient might report discomfort when low frequency pulses are used to generate muscle twitches , therefore burst of pulse should be used instead.*

TREATMENT PARAMETERS OF LOW TENS

- *Frequency :- 1-5 Hz*
- *Pulse duration :- 100 – 150*
- *Intensity :- more than 30mA intensity should be increased until the muscle twitch is produced.*
- *Treatment time :- 20 -30 min*
- *Uses :- generally used for chronic musculoskeletal pain relief.*

- Uses :- generally used for chronic musculoskeletal pain relief
- Mechanism of action :- Descending pain suppression system (pain gate theory)

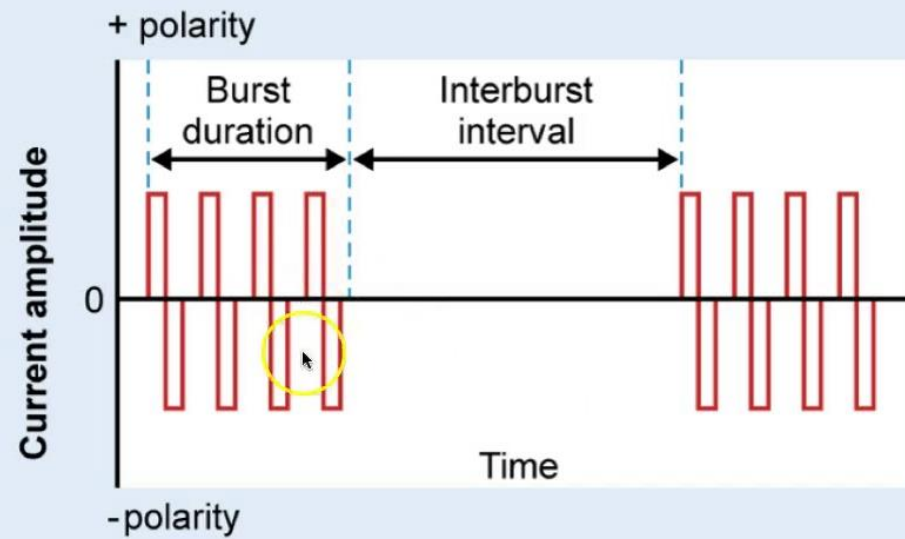
There is a slow onset of pain relief but relatively longer analgesia as comparative to conventional TENS .



BURST TENS

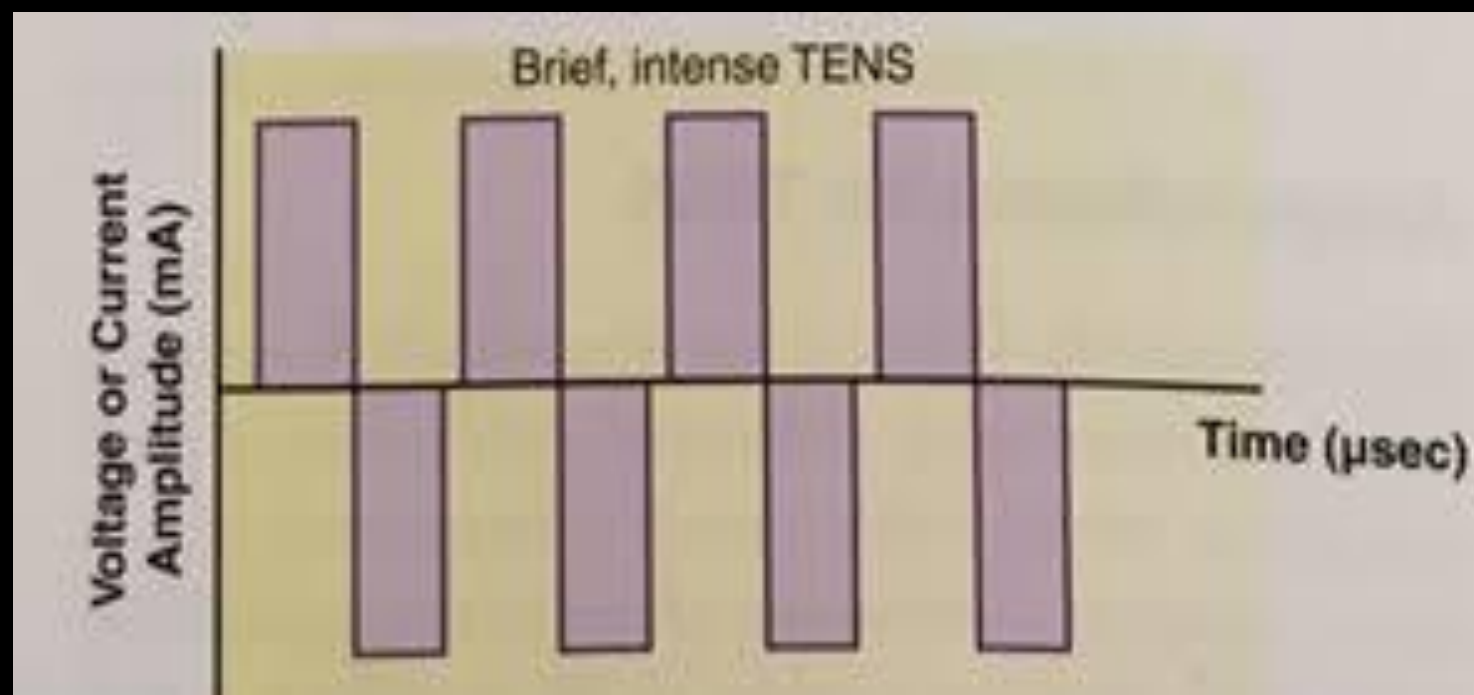
- *In Burst mode, high frequency pulses are delivered.*
- *It is the combination of conventional tens and acupuncture like tens.*
- *It comprises a base line low frequency current together with high frequency burst of pulses.*
- *The frequency of burst pulse (series) is **1-5 Hz**, delivered in packets with internal frequency of around **50-500 Hz**.*
- *This mode of tens was given by ERICKSON in 1976.*
- *This current is more tolerable than low tens as it produces a comfortable muscle contraction.*

BURST WAVEFORM



BRIEF INTENSE TENS

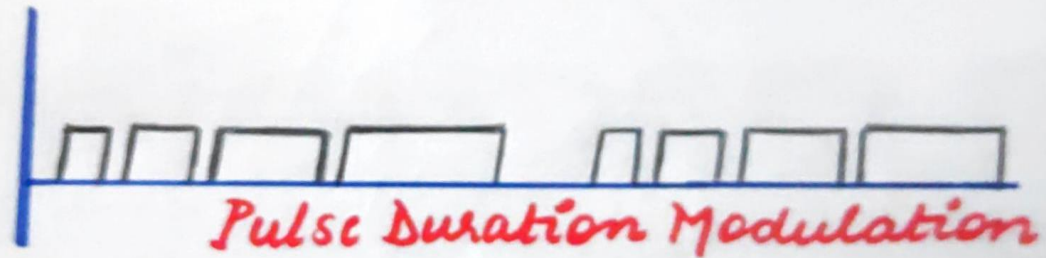
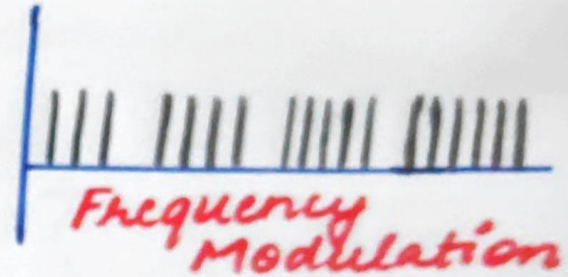
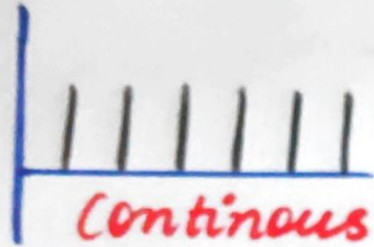
- *The brief duration of application and the stimulus intensity is higher than the other modes, producing a somewhat brief yet intense stimulation duration treatment*
- **TREATMENT PARAMETERS**
- Frequency :- 100 – 250 Hz
- Pulse duration :- 150 – 250
- Intensity :- High tolerable intensity given for a short period of time
- Treatment time :- less than 15 min
- Mechanism of action :- works on descending pain suppression system



MODULATED TENS

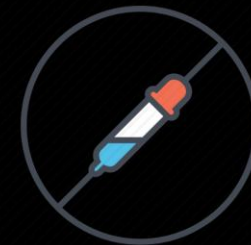
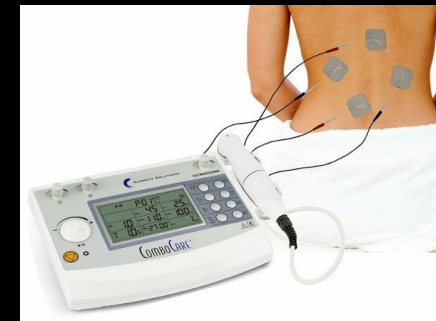
- *Modulation means there is variation in frequency, amplitude and pulse duration*
- *Sometimes some modalities have modulation in two or all the three parameters*
- *If the output is set for amplitude , a cyclic modulation is produced which increases from 0 to proset level and then back to 0 again*
- *With this we can overcome nerve accommodation and provide more comfort to the patient*
- *Mechanism of action :- both pre-order synaptic inhibition and descending pain suppression system*

MODULATION



ADVANTAGES OF TENS

- ***Non-invasive***
- ***Portable***
- ***User friendly and safe***
- ***Cheaper than regular prescriptions for analgesics(long standing pain syndrome)***
- ***Contraindications are few and side effects are minimal***
- ***Non-addictive***



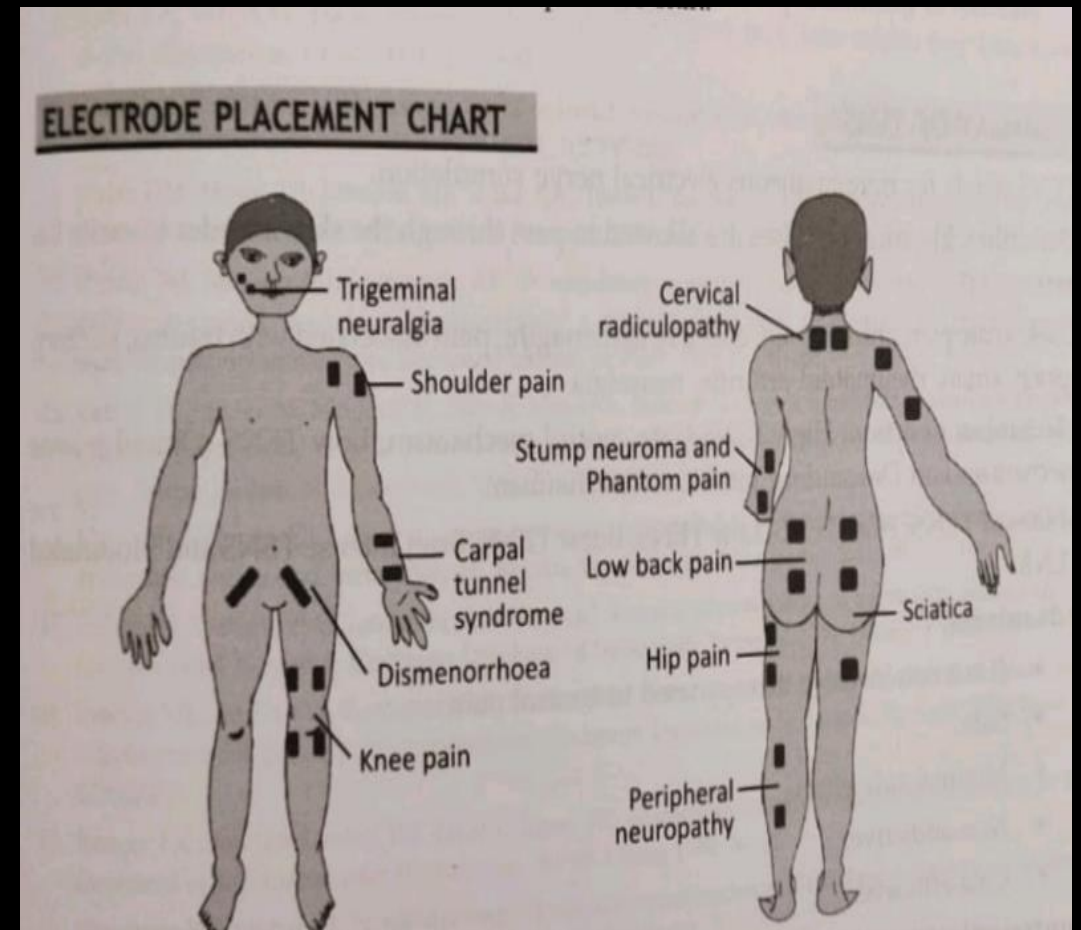
DISADVANTAGES OF TENS

- *A number of patients fail to tolerate the sensation of electrical stimulation*
- *Skin irritation*
- *Chemical burn*



ELECTRODES PLACEMENT FOR TENS

- *One of the primary factors responsible for a poor response to TENS treatment is that of ineffective electrode placement*
- *Essentially there are 4 broad categories of anatomical sites to which electrodes can be applied*
 - *Painful areas*
 - *Peripheral nerve*
 - *Spinal root*
 - *Other specific points(trigger, acupuncture, motor points)*



SELECTION OF PARAMETERS


- ***What type of pain is involved?***

Both Acute and Chronic pain can be treated with TENS , but quite often the patient's symptoms will dictate which pulse frequency to be used .

E.g.; Acute soft tissue injury of SHOULDER.



- *With a patient who has not used TENS before it is advisable to use treatment using **CONVENTIONAL TENS***

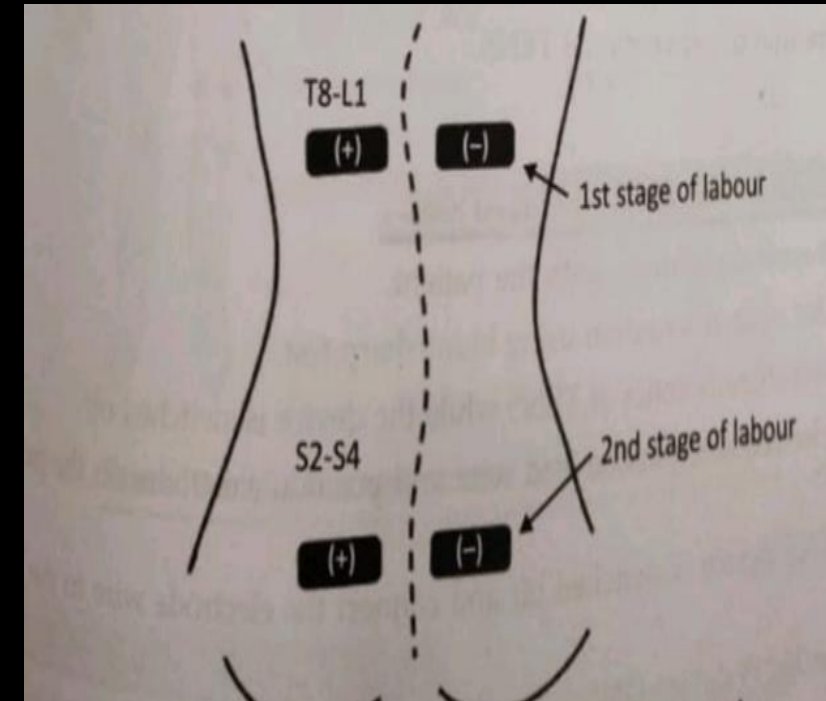
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- *If pain relief is achieved with conventional TENS, then acupuncture like TENS should also be tried for at least one treatment and any variation in the length and amount of analgesia is noted.*
 - *The intensity of TENS should be increased slowly and the patient is asked to report the onset of any sensation under the electrodes.*
 - *The intensity is increased slowly till a strong but comfortable sensation is felt.*

CLINICAL APPLICATIONS OF TENS IN LABOR PAIN

1. Obstetrical TENS: Form of analgesia during delivery of a baby.

- 1st Stage: Large size electrodes are placed on T8-L1 Para vertebral region (immediately after the onset of labor pain) with the frequency of 120Hz and pulse duration of 150 μ sec. Electrodes are positioned to target afferents active during distension of cervix and lower uterine segment.*

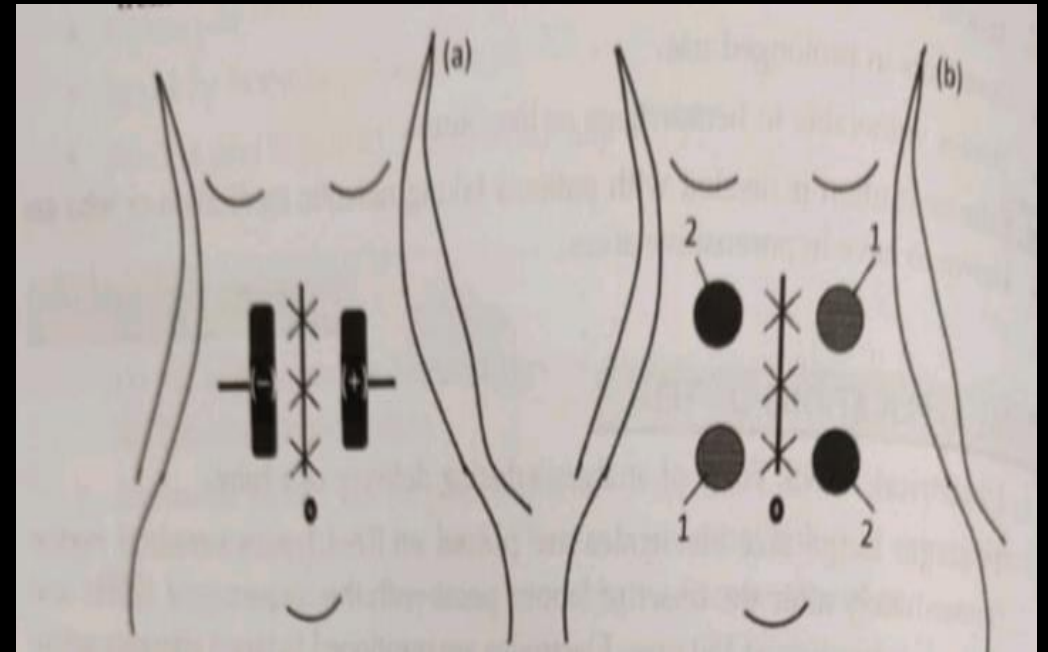
- **2nd stage:** Large size electrodes are placed on S2—S4; electrodes are positioned to target afferents active during distension of pelvis and perineum.
- **3rd stage:** Remove the distal 2 electrodes and relocate to anterior abdomen V shape-pubic triangle.
- **After the delivery:** Electrodes are positioned on proximal thoracolumbar region.



- *After the caesarean delivery: Frequency is fixed at 80-120Hz, with the comfortable stimulus intensity and the pulse duration of 150 μ sec, for hour / 4 times daily.*

2. TENS application for Post-operative Pain:

- *Electrodes placement: Large sized electrodes are placed parallel, one inch away from the incision site and crisscross pattern.*

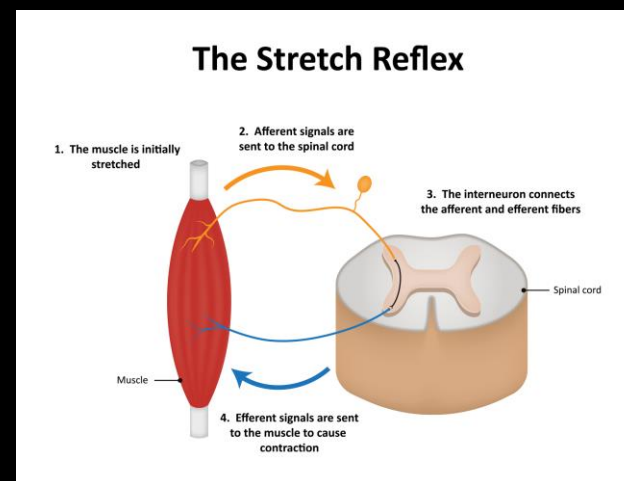


a) Parallel electrode placement to the incision site

b) Crisscross Electrode placement to the incision site

3. Effect Of TENS on Spasticity:

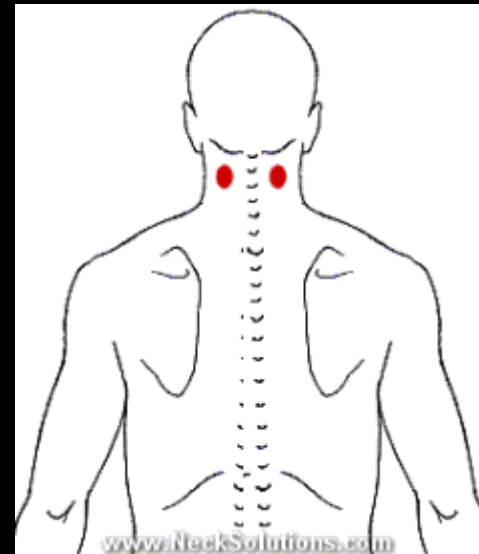
- Neurophysiology background: A normal stretch reflex is modulated , inhibited or facilitated by the higher centers of the brain; but if this connection is damage spasticity is the result. Spasticity is therefore mostly due to an excess of impulse from a-motor neurons due to a spinal cord injury or brain injury. TENS is thought to reduce spasticity by reducing/inhibiting excessive a-motor neuron activity.***



INDICATIONS OF TENS

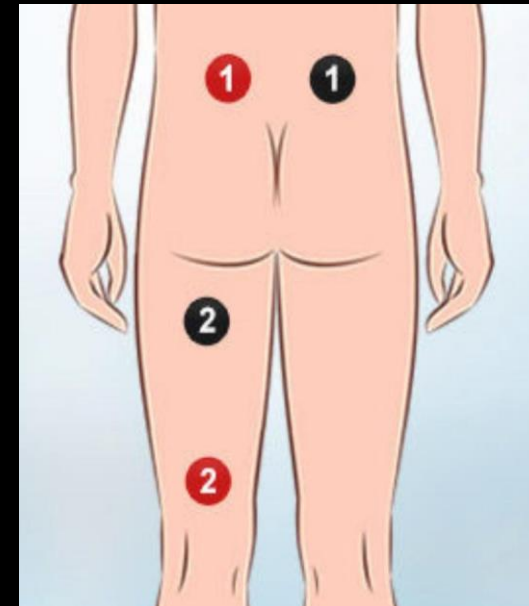
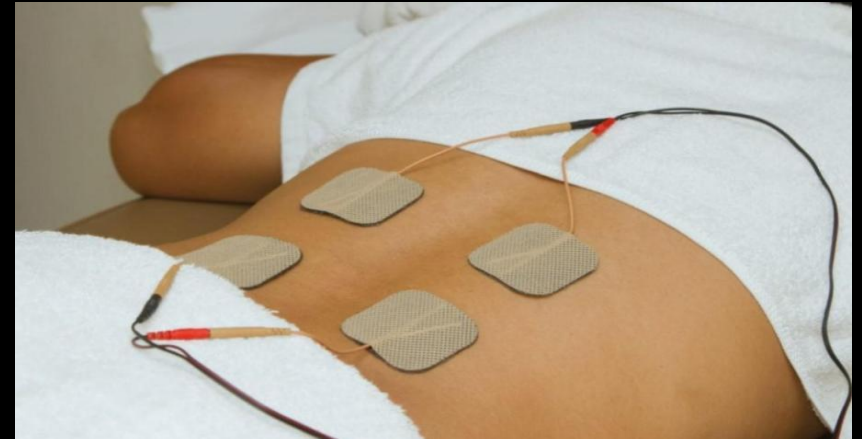
ACUTE PAIN SUCH AS :-

- 1. Musculoskeletal Pain***
- 2. Dental Pain / Orofacial Pain***
- 3. 1st and 2nd Stage Of Labor Pain***
- 4. Post Operative Incision Pain***



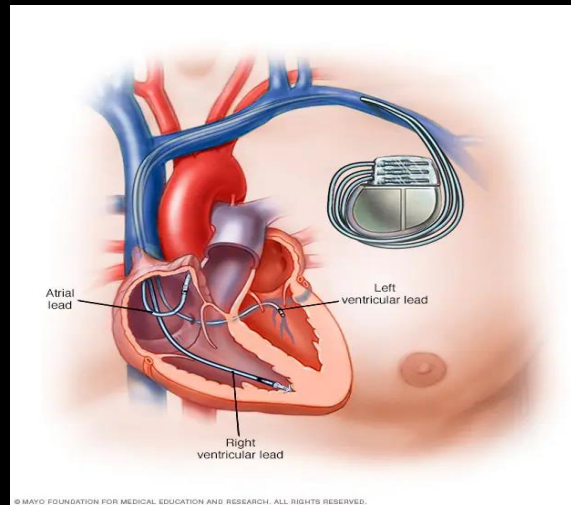
CHRONIC PAIN SUCH AS :-

- 1. Low Back Pain***
- 2. Pain Of Arthritis***
- 3. Diabetic Neuropathy***
- 4. Cancer Pain***
- 5. Phantom Limb Pain***

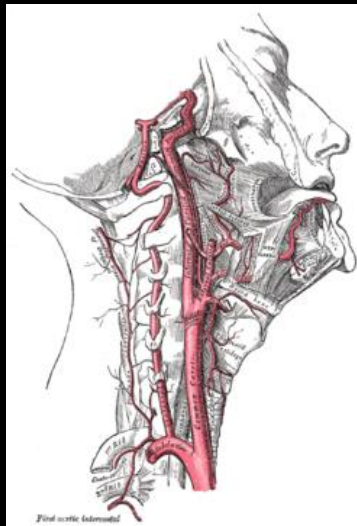


CONTRAINDICATIONS OF TENS

- **Implanted Devices** – *Implanted Devices such as Pacemaker , Neurostimulator (brain or spinal cord) , Bone growth stimulator should be avoided over or close to areas because TENS has been shown to interfere with these devices and their functions.*



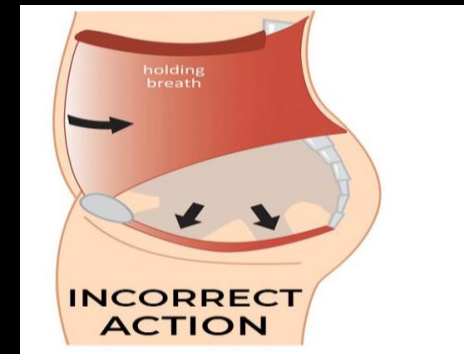
- **Carotid Sinus** – *TENS should not be applied over the carotid artery (sinus) in the antero- lateral region of the neck. Stimulation at this site might cause hypotension through a vasomotor reflex and it also cause laryngospasm due to laryngeal muscle contraction may occur.*




- *Damaged skin- TENS decreases skin impedance results in high current flow that may cause additional pain and tissues damage.*



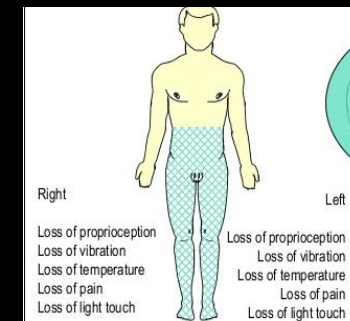
- *TENS should not be apply over abdominal , pelvic regions during pregnancy because it may under premature labor.*



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- *Electrodes should not be placed over the infected skin , it may result in the spread of infections.*
 - *The electrodes should not be placed in an area of sensory impairment (e.g, in cases of nerve lesions , neuropathies) , where the possibility of burns exist.*
 - *Electrode should not apply across the chest of a patient with cardiac disease.*
 - *TENS do not apply all the eyes or around the head.*

PRECAUTIONS


- *Never apply TENS for undiagnosed pain*
- *TENS is designed for external use only*
- *Keep out of reach of children*
- *Areas of skin irritation ,damage ,lesion*
- *For patients with diagnosed malignancies that have been diagnosed as terminal*
- *Psychogenic pain*
- *Areas of sensory loss doesn't respond well*
- *Tissues vulnerable to hemorrhage*



SAFETY PROTOCOLS

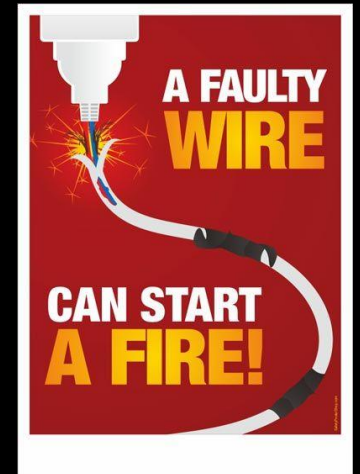
- *Check the CONTRAINDICATIONS with the patient*
- *Test skin for normal sensation using blunt/sharp test*
- *Set electrical characteristics of TENS while the device is switched off*
- *Connect electrodes to pins on lead wire and position electrodes on patient's skin.*



- 
- *Ensure TENS device is switched off and connect the electrode wire to TENS device*
 - *Switch the device on*
 - *Gradually increase the intensity further until the patient experience a strong but comfortable tingling sensation*
 - *Intensity shouldn't be painful or cause muscle contraction*

PROTOCOL FOR THE SAFE TERMINATION

- *Gradually decrease the intensity until the patient experiences no tingling sensation*
- *Switch the TENS device off*
- *Disconnect the electrode wire from TENS*
- *Disconnect electrode from pins on lead wire*
- *Remove the electrodes from patient's skin*





REFERENCES

- **Chipala P. *Essentials of Electrotherapy* , 1st Edition (2017)**
- **Clayton's *Electrotherapy* , 9th Edition**



Thank you

*“ Your mind is a powerful thing. When you fill it with positive thoughts,
Your life will start to change”*