

# FARADIC AND GALVANIC CURRENT



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# FARADIC CURRENT

## Introduction-

- ◉ LOW FREQUENCY CURRENT
- ◉ Short duration interrupted direct current
- ◉ PULSE DURATION-0.1 to 1ms
- ◉ FREQUENCY-50-100 pulse per sec

## History-

MICHAEL FARADAY (1791-1867)- He discovered the principle of induction in 1831 and electric currents produced by these coils were called FARADIC CURRENT to honor him.

The term FARADISM was originally used to represent the type of current produced by faradic coil which is a type of induction coil.



## MODIFICATION OF FARADIC CURRENT

- ◉ Faradic current was modified to make it more useful for treatment purposes.
- ◉ These currents are surged for treatment purposes to produce a near normal tetanic like contraction and relaxation of muscle.
- ◉ The current is surged so that the intensity of successive impulses increases gradually i.e., Each impulse reaching a peak value and falls suddenly or gradually.

# WAVEFORM OF FARADIC CURRENT

## -WAVEFORM

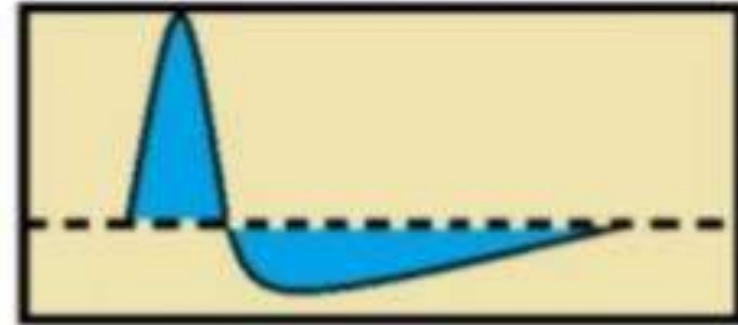
Biphasic ,Asymmetrical

## -POSITIVE PORTION

Short duration, High amplitude ,Spiked

## -NEGATIVE PORTION

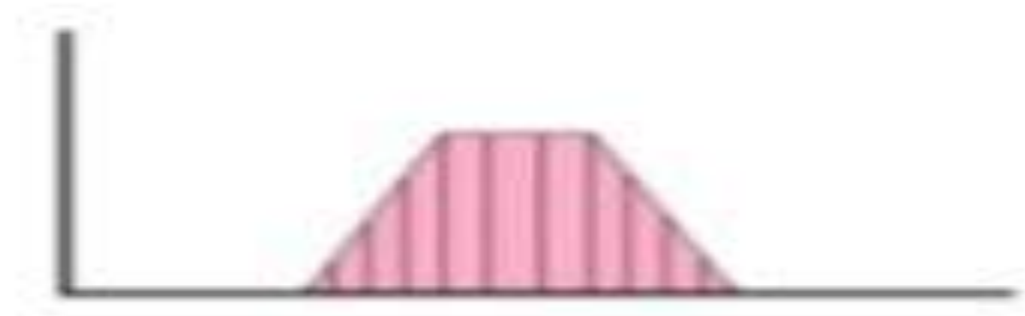
Long duration ,Low amplitude and Curved



# SURGING OF FARADIC CURRENT

## TRAPEZOIDAL SURGING

-Impulses increases slowly, maintained there for sometime and decreases gradually forming trapezoid.



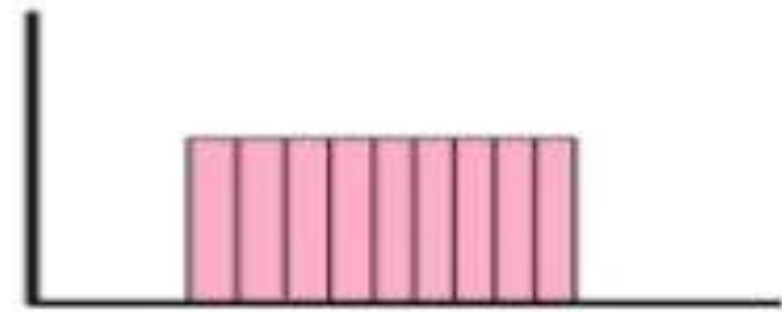
## TRIANGULAR SURGING

-Impulses increases and decreases gradually forming triangular shape



## RECTANGULAR

Impulses increases rapidly, maintained there for sometime & falls abruptly.



## SAW TOOTH

Impulses increases gradually but suddenly falls.



# ACCOMODATION

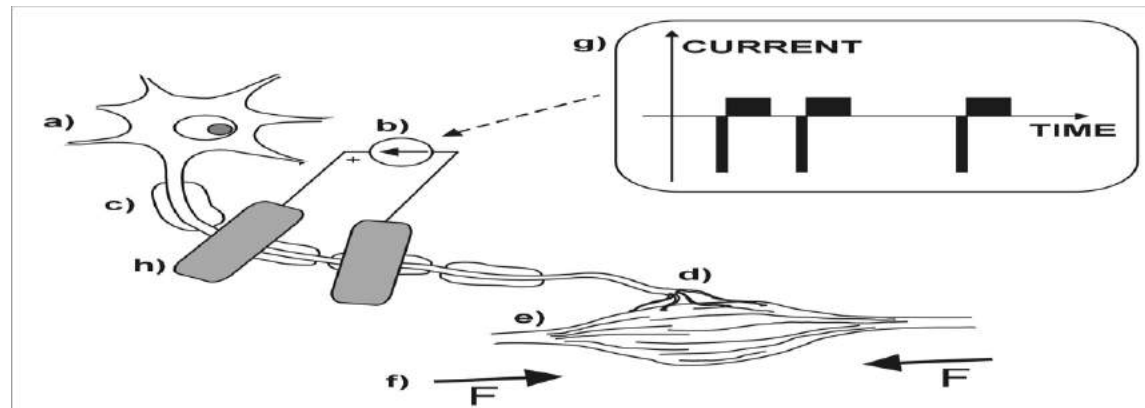
- ⊙ When a constant current flows ,the nerve adapts itself .this effect is known as ACCOMODATION or ADAPTATION.
- ⊙ When the current rises ,the impulse is initiated but a fall in current can also initiate an impulse, while the current flows at a constant level the accommodation of nerve takes place.
- ⊙ According to waveform accommodation-  
TRAPEZOIDAL > TRIANGULAR > SAW TOOTH > RECTANGULAR



## ◉ EFFECT OF NERVE STIMULATION

When a sensory nerve is stimulated, then the downward travelling impulse has no effect but the upper travelling impulse is appreciated when it reaches conscious level of Brain.

When a motor nerve is stimulated, then upper travelling impulse is unable to pass first synapse, as it is travelling downward impulse passes through the muscles supplied by the nerve causing them to contract.



## ◉ EFFECT OF FREQUENCY STIMULATION

When a single stimulus is applied, impulses pass simultaneously to a no. of motor unit so that in normal circumstances is a sudden brisk contraction followed by the immediate relaxation.

If increasing the frequency of stimuli, shortens the period of relaxation.

## ◉ STRENGTH OF CONTRACTION

Depends upon the motor units activated or recruited (which in turn depends upon intensity of current).

If the intensity of current rises suddenly then there is no time for ACCOMODATION to take place, resulting in muscle contraction.

If the current rises more slowly as trapezoidal, triangular and saw tooth impulses, there is some ACCOMODATION and greater intensity of current is needed to produce contraction.

# GALVANIC CURRENT

## INTRODUCTION-

It is also LOW FREQUENCY CURRENT.

Long Duration Interrupted Direct Current.

PULSE DURATION –more than 1ms which may be upto 300ms.

FREQUENCY-less than 50 Hz.

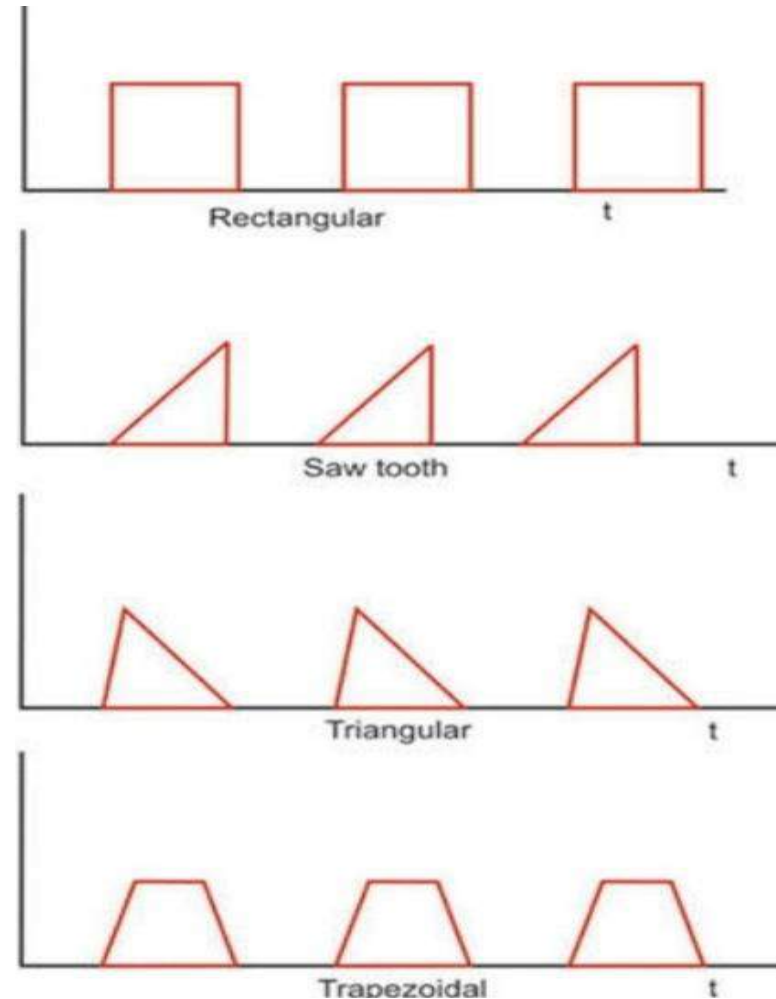
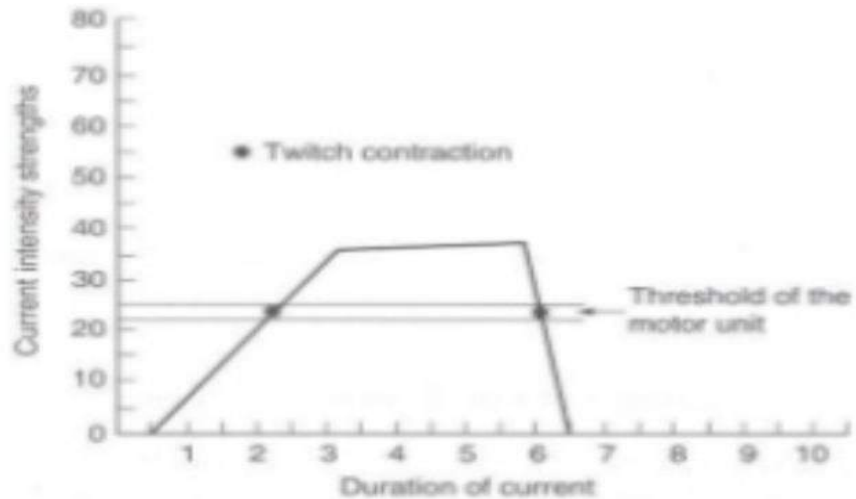


## HISTORY-

LUIGI GALVANI (1737-1798) discovered the Galvanic current in 1780s.

# WAVEFORM OF GALVANIC CURRENT

- ◉ Unidirectional waveform
- ◉ It also have surging as faradic current like Rectangular, saw-tooth, triangular & trapezoidal.



## HOW TO DIFFERENTIATE?



- ◉ Short duration pulse
- ◉ PULSE DURATION-  $< 1\text{micro sec}$
- ◉ FREQUENCY- 50-100Hz
- ◉ Used for innervated muscle

**Faradic current**



- ◉ Long duration pulse
- ◉ PULSE DURATION-  $> 1\text{micro sec}$
- ◉ FREQUENCY- less than 50Hz
- ◉ Elicits a muscle contraction from denervated muscle.

**Galvanic current**



# PHYSIOLOGICAL EFFECTS OF FARADIC AND GALVANIC CURRENT

# PHYSIOLOGICAL EFFECTS OF FARADIC CURRENT

- ◉ Stimulation of sensory nerves
- ◉ Stimulation of motor nerves
- ◉ Effect on muscle contraction
- ◉ Stimulation of denervated muscles
- ◉ Chemical effects following stimulation



## STIMULATION OF SENSORY NERVES

- ⦿ When applying faradic type current, mild prickling sensation is felt due to stimulation of sensory nerves.
- ⦿ This stimulation is not very marked because the stimuli are of fairly short-duration.
- ⦿ When sensory nerve is stimulated it produces reflex vasodilatation of superficial blood vessels.
- ⦿ So slight erythema is seen, this vasodilatation is limited up to superficial area only.



## STIMULATION OF MOTOR NERVES

- ◉ Faradic current stimulates the motor nerves and if it is of sufficient intensity, it stimulates muscle to which the nerve supplies.
- ◉ The contraction produced is thus a *tetanic contraction* because stimuli are repeated 50 times per second. This type of contraction if maintained for a longer period may result in muscle fatigue.
- ◉ So to avoid this, current is commonly *surged* to allow muscle relaxation. When the current is surged the contraction gradually increases and decreases in strength, in a manner similar to a voluntary contraction.

## EFFECT ON MUSCLE CONTRACTION

- ◉ Electrical stimulation of motor nerves causes muscle contraction and results in changes similar to those associated with voluntary contraction.
- ◉ These contractions help in regaining the *properties of muscles* as such and also helps in:
  - ◉ i. **Increasing metabolism:** The contraction and relaxation of muscles results in pumping action on the blood vessels within the muscles and around it. This pumping action provides more blood supply to the muscles and also results in increased demand and supply of oxygen and nutrition.
  - ◉ ii. **Removal of waste products:** If the muscle contraction and relaxation is sufficient enough to cause pumping effect on venous and lymphatic vessels it results in removal of waste products.



# STIMULATION OF DENERVATED MUSCLES

- ⦿ For contraction of denervated muscle the impulse more than 1 ms is required. This impulse is usually is not tolerable by the patient for treatment purposes.
- ⦿ Thus faradic type current is not used for stimulation of denervated muscle.

# CHEMICAL EFFECTS FOLLOWING STIMULATION

- ◉ Chemical effects are produced at the electrodes due to passing of direct current through the electrolyte.
- ◉ It results in formation and accumulation of chemicals at the electrode site resulting in chemical or electrolytic burn. The risk is comparatively less with an intermittent current than with a direct current.



# RESEARCH PAPER

## ◉ **Background**

- ◉ To assess the role of the surged faradic stimulation to the pelvic floor muscles as an adjunct to the conservative management in the children of idiopathic rectal prolapse

## ◉ **Methods**

- ◉ *Setting:* Pediatric Surgery Department, Pt BD Sharma, Post Graduate Institute of Medical Sciences, Rohtak.
- ◉ *Subjects:* 47 children with idiopathic rectal prolapse attending the Pediatric Surgery out patient department from July 2005 to June 2006
- ◉ *Methodology:* Surged faradic stimulation using modified intraluminal rectal probe, was given on the alternate days. The conventional conservative medical management was also continued.

## ◉ **Conclusion**

- ◉ With use of faradic stimulation, even the long-standing rectal prolapse can be fully cured. The follow up visit at 2 weeks is very important to gauge the likely success of this modality in treatment of the patients with rectal prolapse. Those showing poor response at this stage may require alternative treatment or may take a long time to get cured.



## Research article

## Open Access

## The surged faradic stimulation to the pelvic floor muscles as an adjunct to the medical management in children with rectal prolapse

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Published: 14 July 2009

Received: 24 December 2008

BMC Pediatrics 2009, 9:44 doi:10.1186/1471-2431-9-44

Accepted: 14 July 2009

This article is available from: <http://www.biomedcentral.com/1471-2431/9/44>

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### Abstract

**Background:** To assess the role of the surged faradic stimulation to the pelvic floor muscles as an adjunct to the conservative management in the children of idiopathic rectal prolapse.

**Methods:** *Study design:* Prospective

*Setting:* Pediatric Surgery Department, Pt BD Sharma, Post Graduate Institute of Medical Sciences, Rohtak

*Subjects:* 47 consecutive children with idiopathic rectal prolapse attending the Pediatric Surgery outpatient department from July 2005 to June 2006

*Methodology:* The information pertaining to duration and the extent of rectal prolapse, predisposing or associated medical conditions, results of local clinical examination were noted. Surged faradic stimulation using modified intraluminal rectal probe, was given on the alternate days. The conventional conservative medical management was also continued. The extent of relief and the number of the sittings of faradic stimulation required were noted at various stages of follow-ups

*Statistical Methods:* Mean values between those completely cured and others; poor responders and others were compared with t-test and proportions were compared with Chi square test. The p-value < 0.05 was considered statistically significant.

**Results:** The mean number of sittings in the completely cured group (n = 28(64%)) was (12.4 ± 7.8) and was comparable with very poor responder (n = 6(13%). There was higher percentage of relief (76%) at the first follow up (at 15 days) in completely cured Vs other (37%) and also the poor responders showed (20%) Vs other (68%) and was statistically significant.

**Conclusion:** With use of faradic stimulation, even the long-standing rectal prolapse can be fully cured. The follow up visit at 2 weeks is very important to gauge the likely success of this modality in treatment of the patients with rectal prolapse. Those showing poor response at this stage may require alternative treatment or take a long time to get cured

# PHYSIOLOGICAL EFFECTS OF GALVANIC CURRENT

- ◉ Stimulation of sensory nerves
- ◉ Stimulation of motor nerves
- ◉ Stimulation of denervated muscles

# STIMULATION OF SENSORY NERVES

- ⦿ *Galvanic Current* also stimulates sensory nerves and results in stabbing or burning sensation.
- ⦿ This stimulation is very marked because the stimuli are long duration impulses.
- ⦿ When sensory nerve is stimulated it produces reflex vasodilatation of superficial blood vessels.
- ⦿ So slight erythema is seen, this vasodilatation is limited up to superficial area only.



# STIMULATION OF MOTOR NERVES

- ⦿ If we stimulate motor nerve with galvanic current it also produces muscle contraction but because of frequent repeated stimuli it produces muscle twitch followed by immediate relaxation.
- ⦿ Effect of this type of current is thus less beneficial on the muscles.

# STIMULATION OF DENERVATED MUSCLES

- ◉ Galvanic current is used for stimulation of denervated muscle therapeutically, when it is of sufficient intensity and duration.
- ◉ Effective contraction is obtained only when current rises slowly rather than rising suddenly.
- ◉ An impulse of 100 ms is the shortest impulse for satisfactory treatment of denervated muscle.
- ◉ So, intensity and duration of the impulse are important factors for stimulation of denervated muscle.



# THERAPEUTIC EFFECT OF FARADIC CURRENT



- ◉ **Facilitation of muscle contraction**

When a patient is unable to produce a muscle contraction and find difficulty in doing so due to pain or injury, then electrical stimulation may be used in assisting voluntary contraction.

- ◉ **Re education of muscle**

In situation where muscle action is not readily under voluntary control without practice such as disuse atrophy or faulty posture habit such as in case of long standing flat foot due to disuse of intrinsic foot muscle or poor posture due to disuse of incorrect use of back muscle. In the circumstances , faradic type current is applied to produce movement so that the lost movement is produced to the entire range of motion, replicating the voluntary action. Total treatment time should be about 15 minutes, repeated several times daily.

- ◉ **Improved venous and lymphatic drainage**

Increase venous and lymphatic return is brought by pumping action of muscle (contraction and relaxation). This treatment is most effective when applied by the method of faradism under pressure. It is used for the treatment of edema and gravitational ulcer.

- ◉ **Spasticity reduction**

Electrical stimulation is widely used by the therapist for reduction of spasticity and to regain voluntary control.

- ◉ **Prevention of loosening of adhesion**

Where there is effusion into the tissue , adhesion are likely to be formed. Active exercise is not possible then electrical stimulation can be used for this purpose .



## ◉ Reduction of limb edema

Electrical stimulation of the muscles that generally act as the muscle pump may be continued with compresses and elevation of the limb to increase venous and lymphatic return and so relieve oedema. This technique is sometime know as faradism under pressure. The repetition rate is slow also, give time to relaxation. Treatment time 15-30 mint



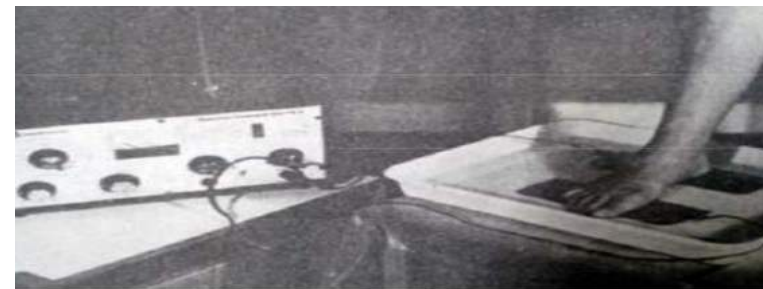
## ◉ Faradic foot bath

Electrical stimulation by faradic type current so applied in water filled baths for re-education of weaker muscle of foot. Application of faradic current to the body parts(foots) in a tube , tray or tank containing water is termed as faradic foot bath.

Pulse duration:- 150-200 micro sec, for small muscle or 200-350 micro sec, for large muscle.

On off time =1:2

Total treatment time = 15-20 mint, 2-3 times a day



# THERAPEUTIC EFFECT OF GALVANIC CURRENT

Galvanic current for treatment is to maintain the muscle in a healthy state and to retard atrophy, making muscle contract with electrical stimuli would substitute for the beneficial effect of normal muscle contraction.

When muscle is de-innervated, many structural and functional changes occur such as :-

- loss of voluntary and reflex activity .
- Atrophy, degeneration and fibrosis.
- Fibrillation (shivering-no complete contraction and relaxation)

Electrical stimulation of muscle fibers using galvanic current may slow these changes .



## ◉ Galvanic current use in facial treatment

Reduces Dullness And Makes Skin Glow.

Reduce Fine Lines And Wrinkles and tightness of face.

Improves The Elasticity Of Your Skin.

increases oxygen supply to your face.



# PROCEDURE OF TREATMENT

# 1. PROCEDURE OF TREATMENT

To giving the treatment, we used neuromuscular electrical stimulator(NMES).

The pulse duration being produced by (NMES) is- 0.01,0.03,0.1,0.3,1,3,10,30,100,300ms

While giving treatment with neuromuscular electrical stimulation to the patient.it should be kept in mind that treatment must be effective, comfortable and in a proper way. So treatment should be done under following procedure:-

1 Apparatus Preparation

2 Patient Preparation

3 Application of different techniques



## APPARATUS PREPARATION

- ◉ FOR FARADIC=Before applying to patient therapist must consider following points

Testing of apparatus=

- ◉ Attach the leads and electrodes to the terminals holding the two current in moistened hand and turning up the current until the mild prickling sensation is experienced and muscle contraction is produced.
- ◉ Describe the experience the patient will feel and make sure that patient can see the produced muscle contraction.
- ◉ Duration and frequency of the surge should be set.



- ⦿ Apparatus should be at least 2 meter far enough to prevent output disturbance by Radio frequency
- ⦿ Electrode should be dipped in tap water or in warm 1 percent saline to reduce the resistance



## QUALITIES OF AN ELECTRODE

- ⦿ Pad should be made of at least 8 layers of lint to make good contact with the tissues and electrode and to absorb the chemical if formed.
- ⦿ They should be evenly folded with no crease to prevent uneven distribution of current and consequent discomfort.
- ⦿ Electrodes should be 1cm small all around the pads to eliminate the danger of their coming in contact with skin, causing uncomfortable and possible damage to tissues from chemical action.
- ⦿ Corner of electrode should be rounded.



- ⦿ ACTIVE ELECTRODE = It should be disc electrode or a small lint sponge pad with a flat plated electrode.
- ⦿ Indifferent electrode= It should be flat plate electrode lint ,sponge pad
- ⦿ INACTIVE ELECTRODE placement(ANODE):-

For upper limb and face – C 7 or origin of muscle.

For lower limb – lumbar areas or origin of muscle.

## ELECTRODE SIZE

- Size of muscle to be stimulated for example for small muscles or localized stimulation small electrodes are used and for large muscles or a group of muscles, large electrodes are used



- ◉ FOR GALVANIC=Procedure will be same as with faradic
- ◉ Electrode padding should be proper as long duration pulses are liable to cause chemical burns
- ◉ No metal should be allowed to come in contact with patients tissue



## PATIENT PREPARATION

- ◉ Before giving treatment it should be watched
  - 1 Patient is warm so that muscle responds to stimulation
  - 2 Clothes from the area to be treated are removed
  - 3 Properly support the area to be treated to relax or shorten the muscles of the part. This position can be modified according to effect required.

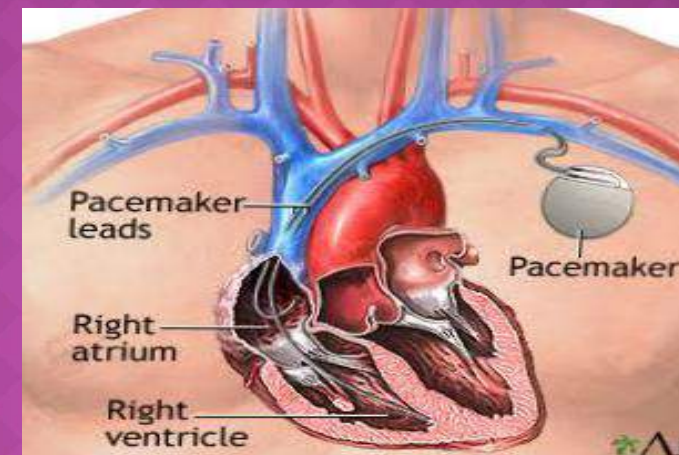


- ◉ Skin should be washed with soap to remove natural oils.
- ◉ Before applying the pad, the skin is moistened with saline water which will reduce the skin resistance as skin has high resistance due to dryness and presence of few ions.
- ◉ If skin breaks it is protected by little petroleum jelly covered with small piece of non-absorbent cotton wool to protect the Pad.
- ◉ Indifferent pad should be large to reduce the current density which is kept to minimum. It prevent excessive skin stimulation and reduce the contraction of unwanted muscle.

# CONTRAINDICATIONS

## 1. **Cardiac pacemaker and arrhythmia:**

- **Electrical stimulation may interfere with the functioning of the cardiac pacemaker and could alter the heart rate.**
- **It may interfere with the electrical activity of the heart.**
- **It may also increase the chances of unstable arrhythmia in those cases which are not treated with pacemakers.**



## 2. UNCONSCIOUS PATIENT

- ⦿ Electrical stimulation is not applied to patients who are unconscious as these patients can't report about any discomfort due to excess of chemicals formed under the electrode and the skin of such patients break easily leading to burns.
- ⦿ Unconscious patient won't be able to give feedback regarding their threshold for intensity.
- ⦿ Therefore , excess of increased intensity by the therapist can lead to burns.



### 3. RECENT RADIOTHERAPY:

Electrical stimulation is contraindicated within 6 months following radiotherapy as the tissues are de – vitalized following the same and can't bear the stress due to enhanced or increased metabolic activity brought by electrical stimulation.

### 4. CAROTID SINUS :

Care should be taken to avoid placement of electrodes in the areas of carotid sinuses. As the stimulation over those areas may cause rapid fall in blood pressure and may cause the patient to faint

### 5. PREGNANCY :

Direct stimulation of the pregnant uterus should be avoided but in cases of sacroiliac strain during pregnancy may be used if superficially placed over the sacroiliac ligament.

## 6.CANCEROUS LESION:

Electrical current may result in growth and spread of tumor.

## 7. SITE OF INFECTION:

Infection can spread from current including contaminating equipment.



## 8. UNCONTROLLED HEMORRHAGE:

Application of electrical stimulation to areas of hemorrhage to increase amount of blood loss.



PRECAUTIONS AND DANGER  
OF  
FARADIC AND GALVANIC  
CURRENT

## PRECAUTIONS:-

- ⦿ Not to be applied over eyes.
- ⦿ Not to be applied internally.
- ⦿ Not to be applied trans-cranially or upper cervical region in patient with history of seizures as it may produce seizures.
- ⦿ Transient ischemia attacks[brief episode of neurological dysfunction caused by lose of blood flow]ischemia in the brain, spinal cord or retina.
- ⦿ Cerebrovascular attacks stroke [blood flow to one part stops due to blockage or rupture of vessel]
- ⦿ Psychogenic pain - pain is induced by prolong or increase mental, behaviour or social prolong. Patient suffer from back pain, headaches etc. they are usually by social rejection, heart break etc.

# DANGERS/COMPLICATIONS

## Shock

- ◉ it is caused by:-
  - Inadequate earthing of the apparatus.
  - Wet floor with faulty earthing of the apparatus.
  - Increasing or decreasing the current quickly.



## 2. Burns

- It is caused by:-
  - Contact of the metal to the skin.
  - Over dosage or current density is high.



## Skin irritation

### Systemic effects:-

- Can cause with treating large area.
- Occur with anticholinergic drugs.
- Cause headache, abdominal pain, mild dryness of mouth
- **Increased pain**



As a rule the patient is expected to get sensation of mild tingling type , but the intensity is too high or if the electrodes are placed close to each other , the patient may feel pain.

## REFERENCES

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- ◉ JAGMOHAN SINGH (2<sup>nd</sup> Edition)
- ◉ Biomed Central (Research Paper)

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THANK YOU