Electrotherapy 3

By
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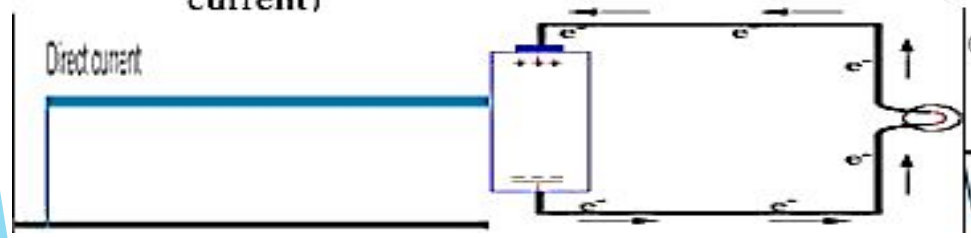
Parameters of electrical Current Parameters

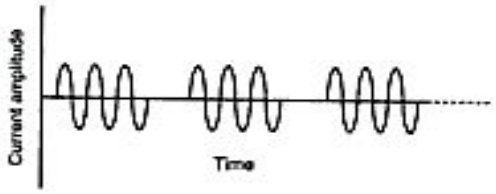
1) Types of currents: Alternating vs. direct current
2) Frequency
3) Intensity of current
4) Pulse attributes
5) Tissue impedance
6) Current density
7) Electrodes considerations

8-A-Polarity
8-B-Types and size
8-C-placement
8-D-Configurations
8-E-Orintation

1-Alternating vs. Direct Current

	DC	AC	Pulsetile
Def.	is unidirectional flow of e-'s toward (+) pole, historically known as	The e- flow in alternating directions in both sides of isoelectric line from (–) pole to (+)pole.	The e- flow in alternating directions in both sides of isoelectric line from (–)pole to (+)pole.
Shape	Monophasic	Biphasic	Polyphasic
Types	Traditional "galvanic current" Modulated Interrupted direct current or " interrupted galvanic"	The current can be symmetrical, asymmetrical TENS, Surged or Faradic Current	Groups of pulses are interrupted for short periods of time (interpulse intervals), & repeat.
Uses	Introduce medication into the body (Iontophoresis) Stimulate denervated muscle; (long duration interrupted direct current)	Used for Pain relief Neuromuscular stimulation.	





Direct Current vs. Alternating Current

Nerve doesn't know the difference between AC and DC. The biggest difference between direct and alternating current is the ability of direct current to produce chemical reaction.

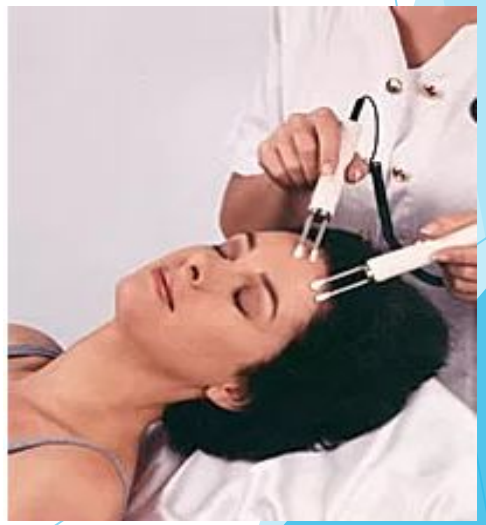
This reaction usually occurs with continuous unidirectional, long pulse duration current.

1. In low voltage direct current (LVDC) the chemical reaction may occurs.
2. In high voltage pulsed direct current (HVPC), the chemical reaction may not created due to short pulse duration.
3. In alternating current, the chemical reaction my not occur due to reversed polarity

Frequency:

Frequency of stimulus is a number of pulse generated in seconds (Hz, PPs, CPs). Amount of muscle muscles tension (contraction) and amount of recovery is function of frequency.

- Effects the mechanism of pain modulation
- Spinal pain modulation > 80Hz • Supraspinal pain modulation <20Hz
- Effects the type of muscle contraction
- Twitch response < 20 Hz
- Individual twitches become less distinguishable =20-35 Hz
- Tetanic muscles contraction >50 Hz



Intensity amplitude:

Peak current Amplitude is the maximum tip of highest point of each phase from baseline. Peak to peak amplitude: is the maximum tip of highest point of in one phase to highest point in the next phase .

Intensity should be high enough to exceed the threshold of nerve and muscles. Increase intensity will increase:

- Strength of stimulus sensory and motor (e.g. contraction).
- Depth of penetration of current to deeper tissue (nerve & muscles)
- Number of motor unit recruited. A stimulus pulse at a duration-intensity just above threshold will excite the closest and largest fibers

. Increasing the intensity will excite smaller fibers and fibers farther away.

Tissue Impedance:

Impedance is the resistance of the tissue to the passage of electrical current.

$$Z=1/2\pi FC$$

- High – impedance tissue skin, bone & fat
- Low – impedance tissue Nerve & muscle.
- Dray skin resistance (100.000-600,000Ω) , • Moist skin resistance (1000-20,000 Ω).

How to overcome resistance to passage of current?

- Decrease distance between electrodes
- Increase the size of electrodes
- Minimize air-electrode interface:
  - Use electrodes jelly or moisten the electrodes
  - Pre-warming the skin by moisten heat modalities (e.g. hot packs).

Current Density

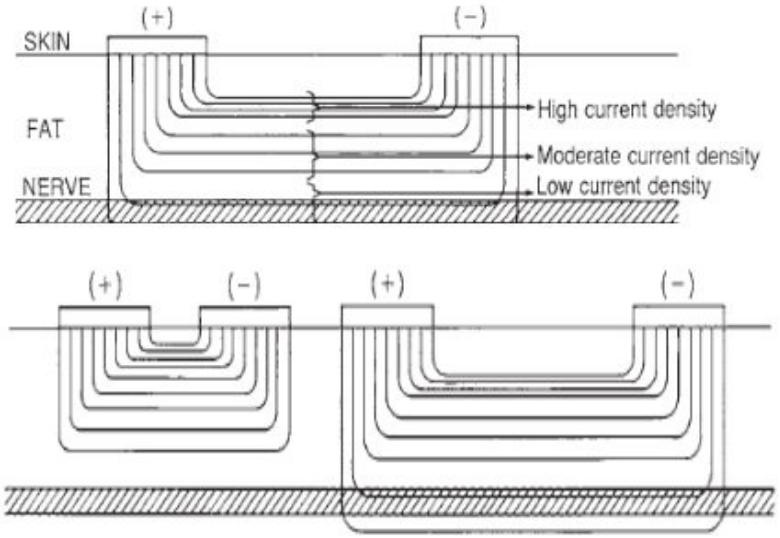
Current density (CD) is the amount of current flow per cubic volume in the tissue

CD is highest where electrodes touch skin and decreased as the electricity penetrates the deeper tissues.

Increases CD will increase perception of stimulus

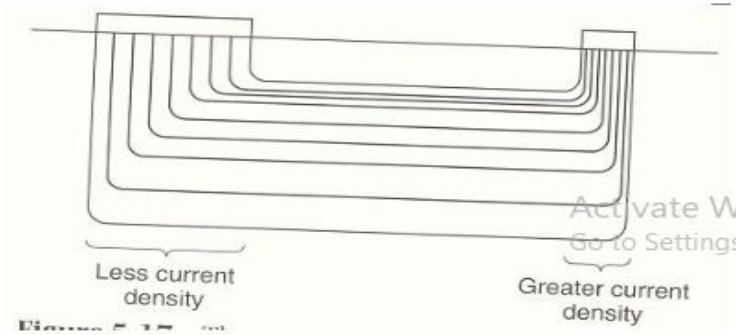
A placed closely electrodes produces high CD in superficial tissues.

A spaced apart electrodes produces high CD in the deeper tissue (nerve& muscle).



Large electrode (dispersive electrode) placed a way from the treatment area,) CD is less

Small electrode (active electrode) closed relatively to treatment area (nerve and muscle) CD is greater



Electrodes Type and Size

I-Size (same size, unequal size)

The force of muscle contraction is affected by size and alignment of electrodes .

Large electrodes size

- Distribute the current over large area
- Results in a more forceful muscle contraction
- Often used for large muscle of leg and arm
- Nearby muscle can be stimulated

Smaller electrodes size

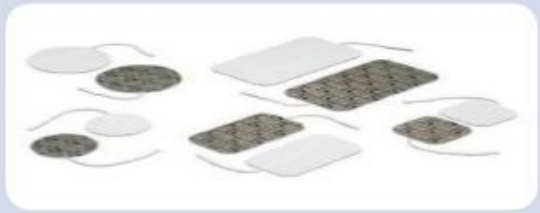
- Requires less current amplitude
- Results in a more precise muscle contraction
- Often used small muscle of hand and arm
- Nearby muscle can not be stimulated

Electrodes Type and Size

I-Size (same size, unequal size)

II-Types (carbon rubber, metal, self adhesive electrode)

Carbonised Rubber, relatively inexpensive, fairly durable, gel or water required, may cause skin irritation, Secured to skin



Self adhesive, Expensive,

Less durable, flexible,

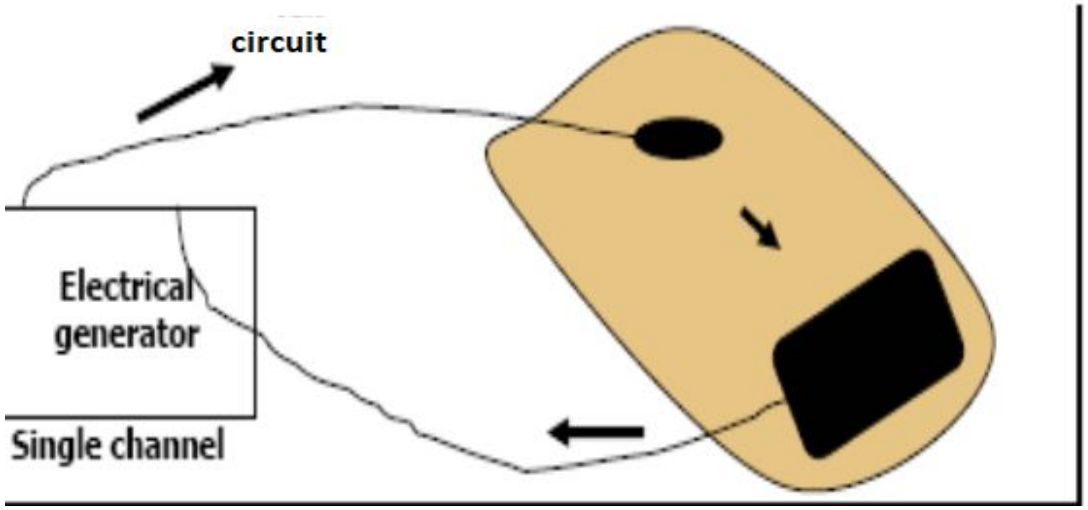
skin irritation

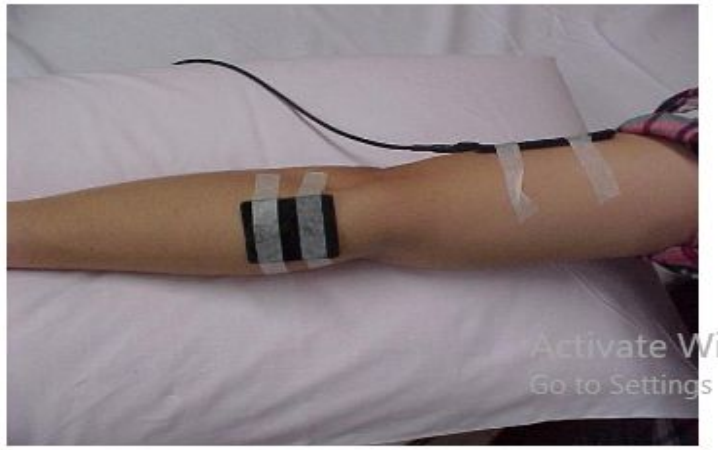
Metal electrode, durable , reusable, inexpensive, inflexible

Electrodes Configuration

Monopolar

1. **Active electrode** {smaller}: is simulating electrode and placed on the target muscle, greatest current density treatment effect.
2. **Dispersive electrode** {larger}: required to complete the circuit, low current density, little or no sensation is left from this electrode.

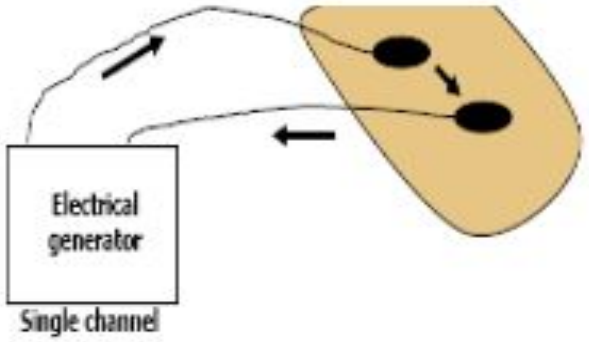


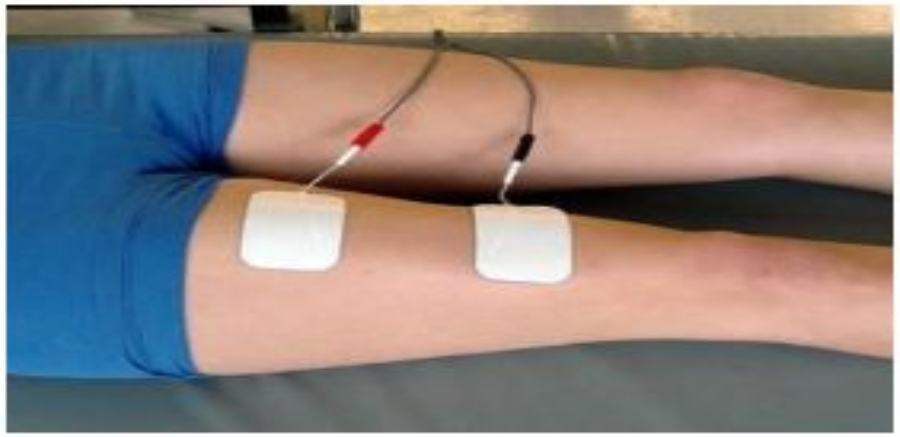


Electrodes Configuration

Bipolar Configuration

- Bipolar: two electrodes are placed on the target muscle, close to the origin and insertion.
- Electrodes are of equal (or near equal) size.
- Current density will be equal under each electrode

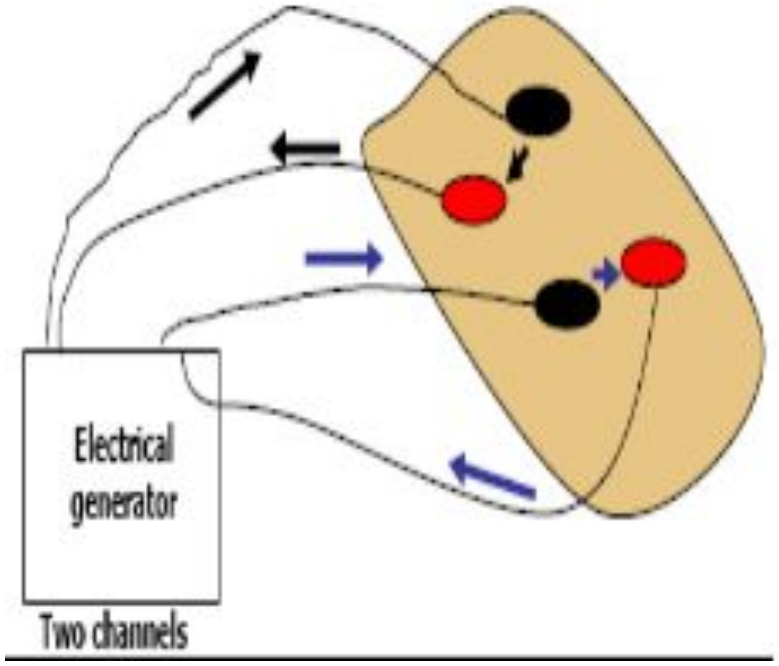


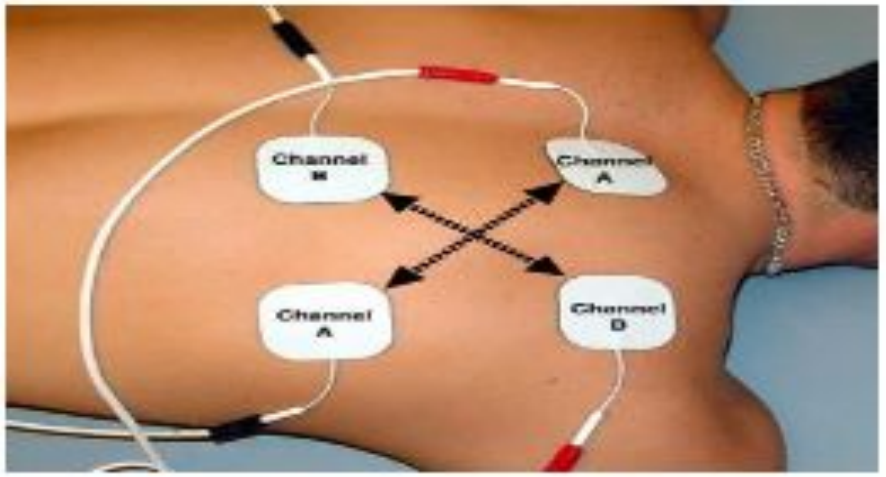


Electrodes Configuration

Quadripolar Configuration

•Quadripolar: four electrodes are placed on the target tissue Interferential.





Home Work:

Prepare a report about the types of electrotherapy, with at almost one page details about each type.