

# High Voltage Pulsed Current (HVPC)



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# Objective

To review the core concepts and terminology used in high voltage pulsed current (HVPC)

To identify and discuss the physiological effects and therapeutic benefits of HVPC

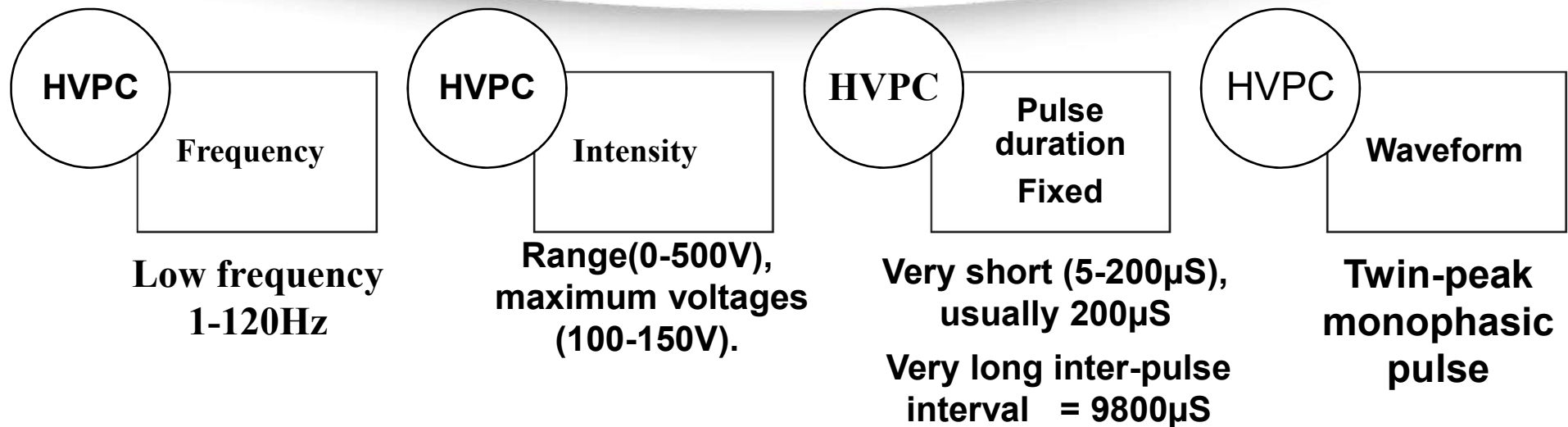
To describe HVPC formats and methods of application used in physiotherapy

To review the fundamentals of safety with respect to HVPC

# *History of HVPC*

- In 1940 this current originally developed by *Haslip* in USA, and known as *Dyna-wave*.
- In 1970s this current become popular and known as HVPC.
- The first published paper on use of this current was by *Young 1966*, on edema reduction.

# Characteristics of HVPC



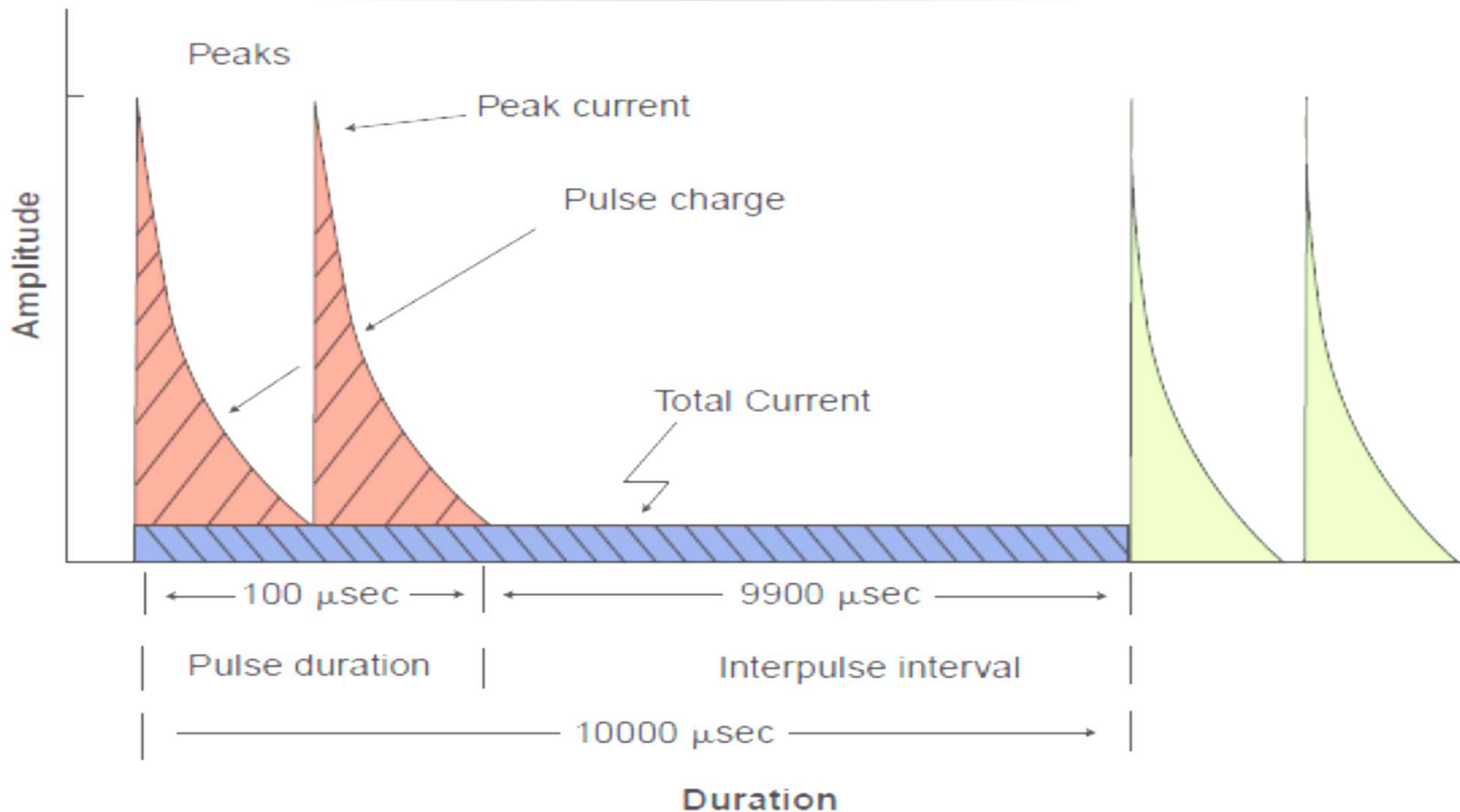
Not stimulate denervated muscles as it can not depolarized membrane .

Selectively stimulate motor rather than sensory nerves, so used for reduction of disuse atrophy

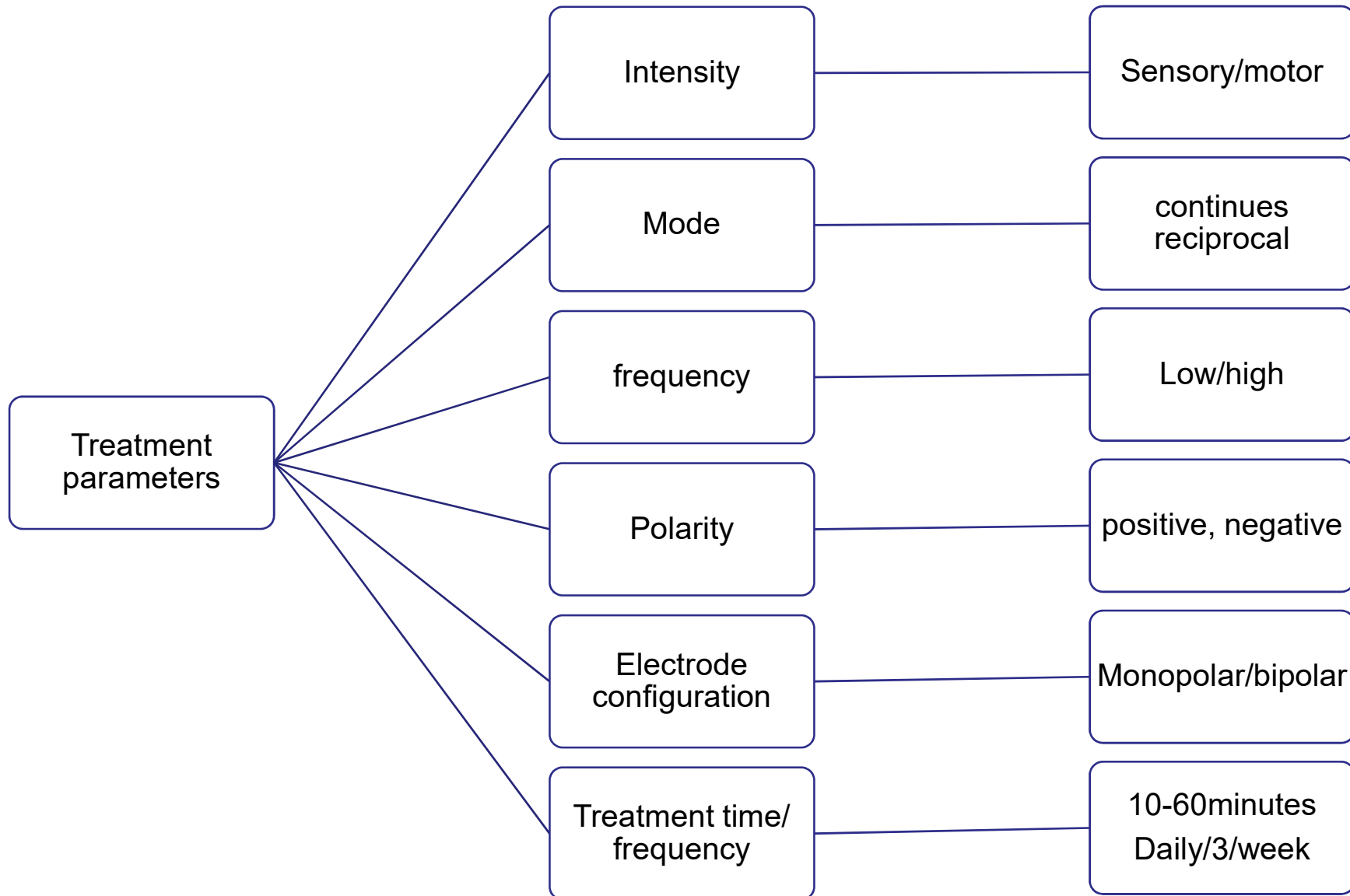
No chemical effects/ lower skin impedance

- ❖ Stimulation is safe & comfortable than Faradic current
- ❖ Maintained for longer periods of time (60minutes).

# Waveform of HVPC



# Treatment Parameter of HVPC



# 4-Main (uses) indications of HVPC

**Wound Healing**

**Edema reduction**

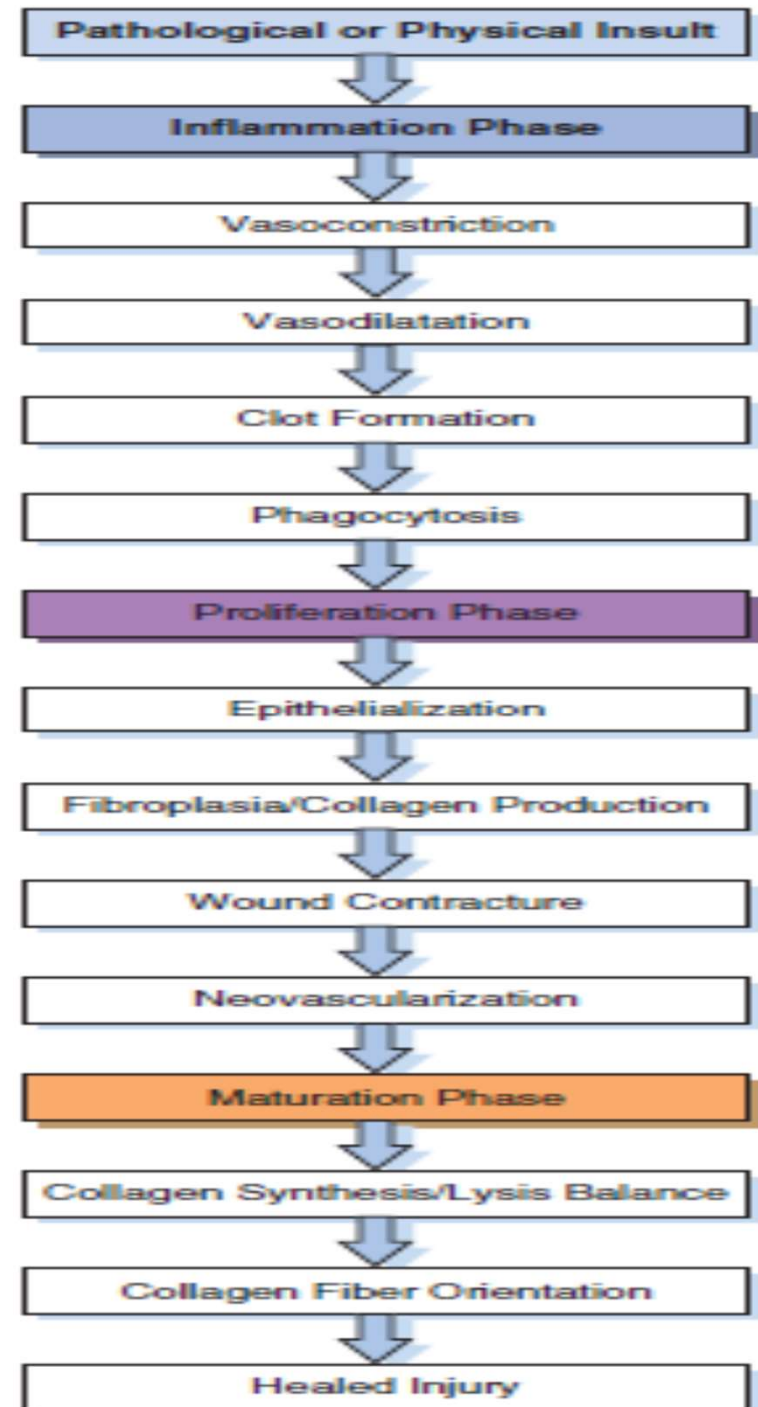
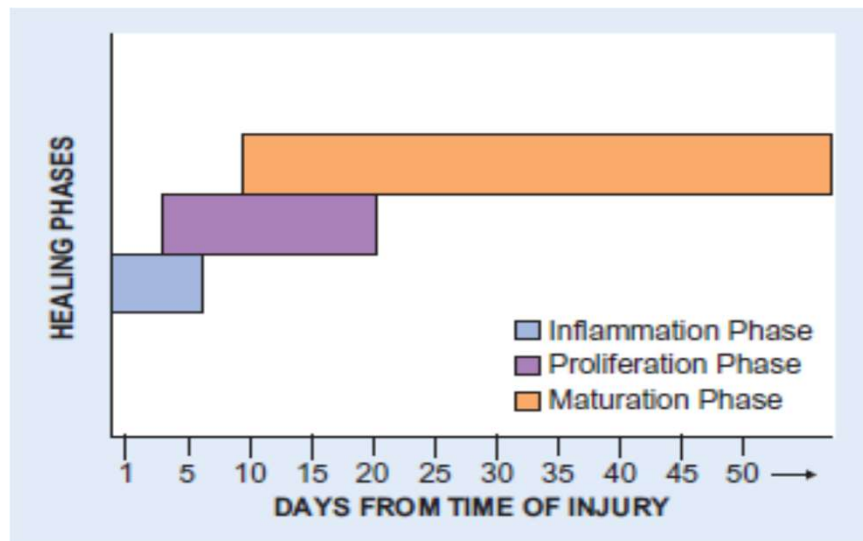
**Pain Modulation**

**Muscles stimulations**

# Inflammation and tissue repair

## Phases of Inflammation and Healing

- Inflammation Phase (1 to 6 days)
- Proliferation Phase (3 to 20days )
- Maturation Phase (Day 9 Forward)





# Inflammation and tissue repair

Inflammation Phase	Proliferation Phase	Maturation Phase
<ul style="list-style-type: none"> <li>Improves blood flow</li> <li>Promotes phagocytosis</li> <li>Enhances tissue oxygenation</li> <li>Reduces edema</li> <li>Attracts and stimulates fibroblasts and epithelial cells to the site of injury</li> <li>Stimulates DNA synthesis</li> <li>Controls infection</li> </ul>	<p>Stimulates fibroblasts and epithelial cells</p> <ul style="list-style-type: none"> <li>Stimulates protein synthesis</li> <li>Improves membrane transport</li> <li>Stimulates wound contraction</li> </ul>	<p>Stimulates epidermal cell reproduction &amp; migration</p> <p>Reduces scar tissue</p>



Attraction of macrophages, neutrophils, and epidermal cells



Increases vascularity, Attraction of macrophages, leukocytes, and neutrophils  
 Stimulation of fibroblastic growth  
 Increase collagen production  
 Increase epidermal cell migration  
 Inhibits bacterial growth

# HVPC Application for Wound Healing

Cleaned & debrided the wound before application of HVPC.  
Cover the wound with several layer of sterile gauze soaked in saline.  
Electrodes soaked in antiseptic solution

## Direct monopolar

- ❖ **Active electrodes:** Directly over the wound
- ❖ **Dispersive electrodes:** are placed proximal to active electrode

## Peri-wound technique; bipolar

- ❖ Placement of two electrodes on the intact skin on wound periphery

## Treatment time

Treat infected wound daily

Clean wound day/day



<https://www.youtube.com/watch?v=VVqg4y-yY3c>

# HVPC Application for Wound Healing



Before TTT



During TTT



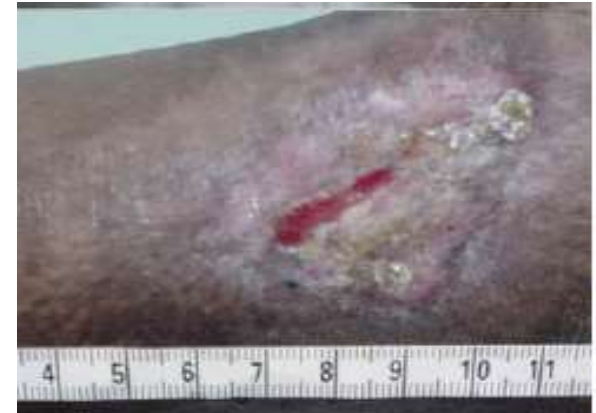
After TTT



A



B



# HVPC Application for Wound Healing

HVPC	Inflammation Phase	Proliferation Phase	Maturation Phase
Frequency	30HZ	100-120Hz	60-80Hz
Intensity	100-150V	100-150V	100-150V
Polarity	Negative (cathode)	Alternating every 3days	Alternating daily
Duration	60minutes	60minutes	60minutes
Dosage	5-7 days/weeks	5-7 times/week	3-5time/week

# Post Traumatic Edema Reduction

## Muscle pump

- Repeated rhythmic muscle (pumping) contraction (motor level stimulation) increase venous return & blood flow and help to drain fluid

## Fluid repulsion

- microvascular exchanges: Blood cells and proteins are negatively charged and are repelled by the negative electrode. This can cause a fluid shift.
- Edema Control: 5-20 Hz (muscle twitch)

## Sympathetic stimulation

- Stimulation of sympathetic neuron causing VD

# HVPC Parameter for Edema Reduction

## Technique:

### ❖ Intensity:

Sensory level (strong buzzing at 90% of visible muscle contraction)

❖ **Pulse duration:** 5 -20µsecs or 100µsecs

❖ **Frequency:** 30-100pps

❖ **Polarity:** Negative (-)

❖ **Time:** (10-20minutes) up to (30-60 minutes) for 5/ first week then 3times/week

## Technique of electrodes placement:

- One active electrodes (negative polarity) were placed over the median nerve in the antecubital fossa, while another electrodes over the ulnar nerve, at medial epicondyle
- One active electrodes (negative polarity) were placed over the median nerve in the wrist crises, another electrodes over dorsum of the hand

# Pain modulation

Gate control theory

HVPC application for Pain

supra spinal stimulation

Sensory	<b>Intensity</b>	Motor level
80-120pps	<b>Frequency</b>	2-10pps
Continuous	<b>Modes</b>	Continuous
Monopolar/bipolar Directly over painful area	<b>Electrode</b>	Monopolar/bipolar Directly over painful area
Acute –positive Chronic-negative	<b>Polarity</b>	Acute –positive Chronic-negative

# Muscles stimulation and joint mobility

Increase joint mobility

Reduction of pain and muscle spasm

Direct effect on circulation

Reduction of inflammation /edema



Muscle stimulation

Stimulate innervated muscles

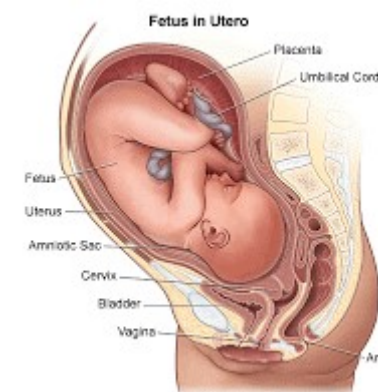
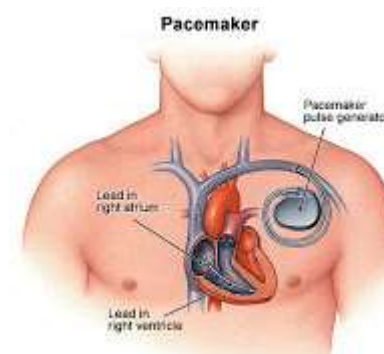
Strength & endurance

Frequency 30PPz



# Contraindications HVPC

- Over malignant tumor .
- Cardiac pacemaker
- Over area of extreme edema,
- Over hemorrhagic area.
- Over osteomyelitis
- Over anterior cervical area.
- Placement of electrodes over the carotid sinus or laryngeal musculature
  - Placement trans-cerebrally
  - Application during pregnancy



# Precautions to HVPC

## Precautions

1. Be cautious when using HVPC over an area with:
  - a. Impaired sensation
  - b. Extensive torn tissue
  - c. Hemorrhagic area
2. Patients with epilepsy should be monitored during treatment.

# Self Questioning?

- Describe the waveform characteristics of HVPC
- What are the 4 main indications for HVPC?
- Describe the parameters for targeting edema reduction
- Describe the parameter of HVPC for treating wound
- What makes HVPC more effective for edema management?
- How does the sensation of HVPC compare to TENS?
- Pulse duration for HVPC
- How is HVPC beneficial for wound healing?