High Voltage Pulsed Current (HVPC)

Mohammed Taher Ahmed

Associate professor of PT

E-Mail: momarar@ksu.edu.sa

Mobile phone : 0542115404

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

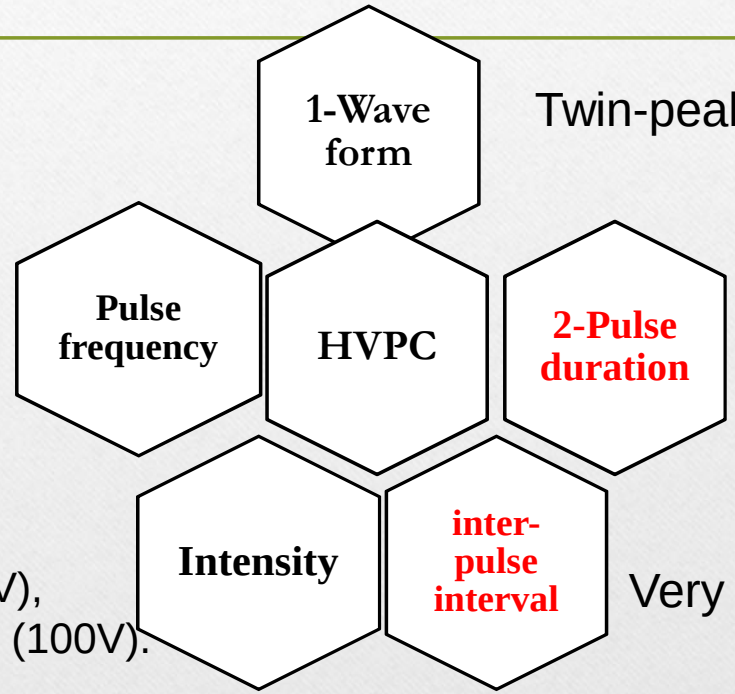
To describe HVPC formats and methods of applicat ion used in physiotherapy

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



Twin-peak monophasic pulse

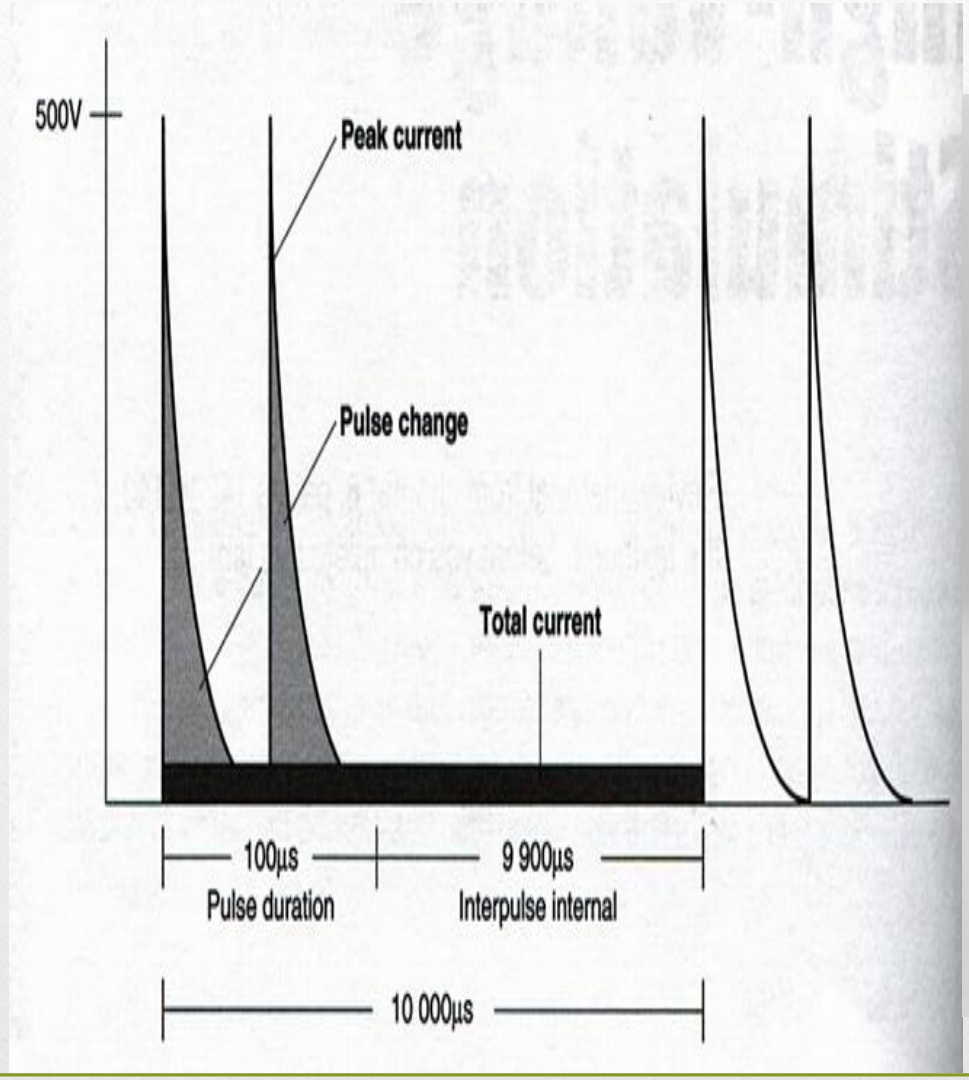
1-200Hz

very short (5-200µS), usually 200µS

Range(0-500V), maximum voltages (100V).

Very long inter-pulse interval = 9800µS

Wave form characteristics of HVPC



Potentially Advantage of HVPC

Very Short Pulse Duration (5-200 µSec)
+ long inter pulse interval

1. Not stimulate dennervated muscles as it can not depolarized membrane .

2. selectively stimulate motor rather than sensory nerves, so used for reduction of disuse atrophy.

3. No chemical effects

   Stimulation is safe & comfortable than Faradic current

   Maintained for longer periods of time (60minutes).

HVPC penetrates deeper than that of low-voltage currents.

4-Main indications (physiological)for HVPC

- **Wound Healing** — Pressure ulcer, Diabetic foot ulcer and Burn wound
- **Edema reduction** — Posttraumatic Edema e.g. Sprains & Strain
- **Pain Modulation** — Chronic low back pain Osteoarthritis,
- **Muscles stimulations** — innervated MS to increase strength endurance

1-Wound Healing

Inflammation Phase	Proliferation Phase	Remodeling Phase
• Improves blood flow • Promotes phagocytosis • Enhances tissue oxygenation • Reduces edema • Attracts and stimulates fibroblasts and epithelial cells to the site of injury • Stimulates DNA synthesis • Controls infection	Stimulates fibroblasts and epithelial cells • Stimulates protein synthesis • Improves membrane transport • Stimulates wound contraction	Stimulates epidermal cell reproduction & migration Reduces scar tissue

Increases macrophages
Promotes epithelial growth

Increases vascularity
Stimulation of fibroblastic growth
Increase collagen production
Increase epidermal cell migration
Inhibits bacterial growth

Post Traumatic Edema Reduction

What makes HVPC more effective for edema management?

Muscle pump

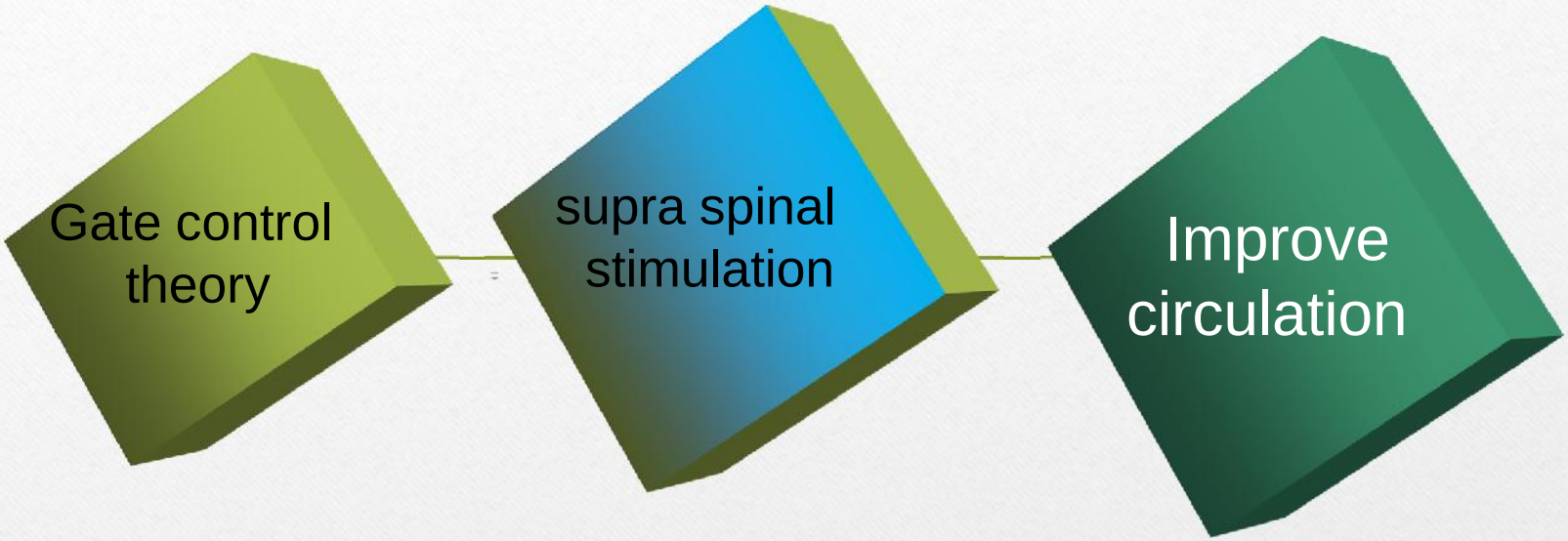
Repeated muscle (pumping) contraction (motor level stimulation) increase venous return & blood flow

Stimulation of sympathetic neuron causing VD

Fluid Repulsion Theory

Repulsion of protein rich fluid through microvascular exchanges (negative polarity).
Edema Control: 5-20 Hz (muscle twitch)

Pain modulation



High frequency
(80-120Hz)
Low intensity HVPC
C-TENS

Low frequency
(10-20Hz)
High intensity HVPC
AL-TENS

Increase blood flow
Removal of waist product
Reduction of inflammatory process,

Increase joint mobility

Reduction of pain

Direct effect on circulation

Reduction of inflammation /edema

CONTRAINDICATIONS and PRECAUTIONS

- Over malignant tumor .
- Over area of extreme edema,
- Over hemorrhagic area.
- Over osteomyelitis
- Over anterior cervical area.
- Over transcranial area.
- Over electronic implants.

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.

Treatment Parameter during HVPC Application

- Intensity (motor and / or sensory)
- Frequency (pulse rate); high or low pulse frequency.
- Modes (continuously, reciprocal).
- Polarity (positive, negative).
- Electrodes Placement (monopolar/bipolar)
- Treatment time (10-60 minutes)
- Frequency of treatment (daily /3 time per week)

HVPC Application for Wound Healing

Cleaned and debrided the wound before application of HVPC.

Cover the wound with several layer of sterile gauze soaked in saline.

Active electrodes soaked in antiseptic solution

Active electrodes will be applied either

- Directly over the wound
- Directly in the wound periphery

Dispersive electrodes are placed proximal to active electrode so that the current passes through the wound.

HVPC Application for Wound Healing

Frequency: 100pps

Pulse duration: 100 µsecs

Intensity: 150 - 200 V

Treatment duration: 30 – 60 minutes

Polarity

Negative (cathode) infected wound

Positive (anode) clean wound

Frequency of treatment

Daily infected wound

Day /day clean wound

Before TTT

During TTT

After TTT

HVPC Parameter for Edema Reduction

Technique:

- Intensity: Sensory level(strong buzzing (90% of visible muscle contraction)
- Pulse duration: 5 -20μsecs
- Frequency: 100pps
- Polarity: Negative (-)
- Time: 20-30 minutes

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, while another electrodes over dorsum of the hand

HVPC application for Pain

Technique:

Intensity:

Sensory level (acute pain)

Motor or Nociception level (chronic pain)

Frequency:

80 pps (acute pain)

1-10 pps (chronic pain)

Polarity:

Positive (+) for acute pain

Negative (-) for chronic pain

Time: 20-30 minutes

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?