Iontophoresis

Chapter 6

History
- Developed in 1903 by LeDuc
- Originally called Ion Transfer
- Uses electrical force to drive chemicals across a membrane
- Popularity has risen and fallen over time with the circulation of different research.

Iontophoresis vs. Phonophoresis
- **Iontophoresis**
  - Uses Direct Electrical current to introduce specific ions into the target tissues.
- **Phonophoresis**
  - Uses Acoustic Energy, via Ultrasound, to drive whole molecules of a specific medication into the target tissues.

How does Iontophoresis work?
- An electrolyte solution is chosen according to therapeutic goals.
- Opposite ions attract, Like ions repel.
- Ions are introduced into the body via the active electrode which has the same charge as the solution you are using.
- Once inside the tissue, ions are picked up by the body’s own ions and are transported toward the dispersive electrode.

How does Iontophoresis Work?
- Allows for the flow of current between active and dispersive electrodes.
- Ex. Dexamethasone has a negative charge. Which will be the active electrode and which will be the dispersive electrode?

Ion Movement through Tissues
- Forces needed to move ions through tissues are determined by:
  - Strength of the electrical field (Current density)
  - Electrical Impedence
Ion Movement through Tissues

- **Current Density**
  - Difference between active and dispersive allows migration of ions
  - Can be altered by changing the size of the active electrode.
    - Increase in size will decrease current density.
    - Negative electrode should be larger than positive because accumulation of positive ions can cause an acidic reaction in the tissues.
    - Most commercially made electrodes are the same size.
  - Can be altered by increasing intensity.

- **Electrical Impedance**
  - Skin and fat: Poor conductors
  - Sweat glands: Decreases impedance
  - Saturation of ion and increase in blood flow decrease impedance

Ion Movement through Tissues

- **Ion Transfer**
  - Determined by current density, current intensity at the active electrode, duration of the current, and concentration of solution.

Current type and Generators

- **Current type**:
  - Most commonly utilizes Direct Current.
  - New research shows that Alternating current can be used to decrease burns.
  - The interrupted current of High Volt and IF are too short to provide therapeutic effects.

- **Generators**
  - Should produce direct current at a continuous rate
  - Should automatically shut down if impedance decreases to a predetermined level.
  - Current intensity control that goes between 1 and 5 mA
  - Adjustable timer
  - Clearly marked polarity terminals

Ion Transfer

- **Current Density**: Directly proportional to ion absorption.
- **Current Intensity**: can increase if the intensity is increased, but likelihood of burns goes up.

Current Flow: will increase if the length of time the current is flowing is longer, but will decrease skin impedance and the likelihood of burns will go up.

Concentration of solution: concentrations greater than 1 to 2 percent are no more effective than those that are lower.

Current Intensity

- Low amperage works best.
- Recommended amplitudes range between 3 and 5 mA
- Always increase and decrease intensity slowly
Treatment Duration
- Keep Between 10 and 20 minutes
  - 15 minutes is an average treatment time.
- Check every 3-5 minutes for visual signs of burns
- Medicated electrode can be left in place for 12-24 hours.

Dosage of Medication
- Delivered in mA-minutes
  - mA-minute = current x treatment time
- Ex. Typical treatment: 4.0 mA x 10 minutes = 40 mA-minutes.
- Can vary from 0-80 mA-minutes depending on medication used.

Electrodes
  - Active
    - Commonly made from tin, copper, lead, aluminum, or platinum.
    - Backed by rubber
    - Covered by a piece of gauze or sponge which serves as the chamber where the medication is applied
    - Each pad will tell you how many cc’s of the solution it can hold.
  - Dispersal
    - Made from a gel substance, water, or another conducting material
    - Generally close to the same size as the active electrode.

Electrode Placement
  - Monopolar Technique
    - Active electrode is placed over the injured site.
    - Dispersal electrode is placed at least the diameter of the active electrode away.
    - Some suggest at least 18 inches apart.

Ion Selection
  - Generally chosen or prescribed by physician.
  - Need working knowledge of what specific ions do.
  - Must be fat and water soluble
    - Water soluble to stay ionized in solution
    - Fat soluble to permeate through the tissues
  - Most common one used in training room is Dexamethasone.

Indications
  - Inflammation
  - Analgesia
  - Muscle Spasm
  - Ischemia
  - Edema
  - Calcium Deposits
  - Scar Tissue
  - Hyperhydrosis
  - Fungi
  - Open Skin Lesions
  - Herpes
  - Allergic Rhinitis
  - Gout
  - Burns
  - RSD
Precautions

- Since most medications are prescribed by a physician, pay close attention to notes left by the pharmacist
- Exact dosage of meds delivered to the body is unknown
- Erythema under the electrode is common after the treatment
- A treatment dose that is too strong (by amperage or duration can cause burns)
- Do not reuse electrodes due to contamination

Contraindications

- Skin sensitivity
- Aspirin Allergy (Salicylates)
- Gastritis
- Asthma
- Metal Sensitivity
- Seafood Allergy (Iodine)

Burns

- Minimization of Burns
  - Decrease Current density
    - Larger Negative electrode
    - Increase space between active and dispersal electrode
  - Proper electrode contact

- Treatment of Burns
  - Antibiotics and sterile Gauze dressing.

Why use Iontophoresis??

- Advantages
  - Transdermal delivery of medication
  - Allows localized concentration of medication
  - Bypasses metabolism via the Liver
  - Less traumatic than injected medications

- Disadvantages
  - Unreliable results
  - Unable to know how much medication is delivered to the area
  - Anxiety of stim. Units
  - Possibility of burns

Questions