Chapter 8

Shortwave & Microwave Diathermy

Objectives

- Introduce how diathermy may be best used in a clinical setting
- Discuss the physiological effects of diathermy
- Examine the difference between shortwave and microwave diathermy units
- Differentiate between capacitance and induction shortwave diathermy techniques and identify the associated electrodes
- Discuss the indications, contraindications, and precautions associated with using diathermy

Diathermy Units

- $2,000 - 4000
- $5,000 - 7000
Diathermy Units

- Use electromagnetic energy similar to broadcast radio waves but with shorter wavelength

Electromagnetic Spectrum

<table>
<thead>
<tr>
<th>Therapeutic Modalities</th>
<th>Wavelength</th>
<th>Frequency</th>
<th>Depth of penetration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical stimulating currents</td>
<td>longest</td>
<td>lowest</td>
<td>1-5 cm</td>
</tr>
<tr>
<td>Shortwave diathermy</td>
<td>27.12 MHz</td>
<td>13.56 MHz</td>
<td>1-2 cm</td>
</tr>
<tr>
<td>Microwave diathermy</td>
<td>40.68 MHz</td>
<td>2 mm</td>
<td>10-15 mm</td>
</tr>
<tr>
<td>Infrared</td>
<td>3-5 cm</td>
<td>2 mm</td>
<td>least</td>
</tr>
<tr>
<td>Cold packs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cold whirlpool</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Hot whirlpool</td>
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<td></td>
<td></td>
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<tr>
<td>Paraffin</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Hydrocollator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red (visible light – laser)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Ultraviolet</td>
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</tr>
</tbody>
</table>

Diathermy Units

- High-frequency alternating current (> 10 MHz)
  - Shortwave diathermy
    - 27.12 MHz (wavelength = 11 meters)**
    - 13.56 MHz (wavelength = 22 meters)
    - 40.68 MHz (wavelength = 7.5 meters)
  - Microwave diathermy
    - 2450 Hz
    - 915 Hz
Physiological Effects

- Thermal
  - continuous shortwave diathermy
  - microwave diathermy (not commonly used)
- Nonthermal
  - pulsed shortwave diathermy

Thermal Effects

- Heat produced by high-frequency vibration of molecules

Thermal Effects

- Ions within tissues are attracted to the pole with opposite polarity
- Ions within tissues are repelled by the pole with like polarity
- Heat produced by friction between moving ions and surrounding tissues
Thermal Effects

- Tissues with high water content are heated at depths of 2-5 cm
  - adipose tissue
  - blood
  - muscle

Thermal Effects

<table>
<thead>
<tr>
<th>Temp increase above baseline</th>
<th>Physiological effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1°C</td>
<td>reduces mild inflammation; increases metabolism</td>
</tr>
<tr>
<td>2-3°C</td>
<td>decreases pain &amp; muscle spasm</td>
</tr>
<tr>
<td>3-4°C</td>
<td>increases tissue extensibility</td>
</tr>
</tbody>
</table>

Thermal Effects

- The amount of heating is based on the total amount of power (watts) and the ratio between the “on” time and the “off” time.
- Thermal effects are obtained when total energy delivery is > 38 watts
Nonthermal Effects

- Produced by pulsed shortwave diathermy
- Total energy < 38 watts
- Theorized to occur at the cellular level
  - restores sodium pump – allowing cell to regain normal ionic balance
  - helps cells return to normal function

Shortwave Diathermy

- Produces both electrical & magnetic fields
  - Dependent on type of electrode & characteristics of the machine
  - 2 types of units
    - Capacitance (condenser)
    - Induction

Capacitance SWD

- Places the patient within the actual circuit of the machine’s energy
- Creates a stronger electrical field
- Produces more heating in the superficial tissues (adipose tissue) and bone/muscle interface
Induction SWD
- Does not place the patient directly in the unit's circuit
- Produces greater magnetic field
- Usually produces greater depth of penetration

Capacitance vs. Induction

- Types of electrodes
  - capacitor
    - air space plates
    - pad electrodes
  - induction
    - cable electrodes
    - coiled
    - pancake
    - drum electrodes
Shortwave Diathermy

- Capacitor electrodes
  - air space plates
  - pad electrodes

Shortwave Diathermy

- Induction electrodes
  - coiled cable electrodes

Shortwave Diathermy

- Induction electrodes
  - pancake cable electrodes
Shortwave Diathermy

- Induction electrodes
  - drum electrodes

Indications

- Muscle strains
- Contusions
- Ligament sprains
- Tendinitis
- Tenosynovitis
- Bursitis
- Joint contractures
- Myofascial trigger points

Contraindications

- There are probably more contraindications listed for diathermy than any other therapeutic modality
- This frightens many clinicians
Contraindications
- Acute injuries
- Areas with ischemia
- Areas with decreased sensation of pain or heat
- Metal implants
- Fluid filled areas or organs
- Joint effusion
- Synovitis
- Eyes

Contraindications (cont.)
- Moist wound dressings
- Malignancies
- Infection
- Pelvic area during menstruation
- Testes
- Pregnancy
- Epiphyseal plates in adolescents

Contraindications (cont.)
- Unshielded cardiac pacemakers
- Intrauterine devices
- Watches or jewelry
### Set-up & Application

1. Question patient thoroughly re: contraindications
2. Position patient for comfort & modesty
3. Inspect area to be treated
   a. Check for rashes, infections, or open wounds
4. Place electrode drum on treatment area

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5. Turn unit on
6. Set pulse duration
7. Set pulse frequency
8. Adjust intensity
9. Set treatment time (15-30 minutes)
10. Press start button

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5. Periodically ask patient if heating is too vigorous
6. When timer shuts off, turn all dials to zero
7. Assess treatment efficacy
   a. Inspect area
   b. Seek feedback from patient
8. Record treatment parameters
Current Research


Diathermy vs. Ultrasound

- Diathermy capable of heating a larger treatment area
- Diathermy provides more uniform heating
- Diathermy provides a longer stretching window
- Diathermy provides more clinician freedom

What questions do you have?