



INTRODUCTION TO ELECTROTHERAPY

SHSS6065
Semester 1 - Week 4

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ELECTROTHERAPY IS...

...a term which encompasses a wide range of therapies

Electrotherapy is **NOT** limited to the use of **ELECTRICITY!**

Rather, electrotherapy can be described as the application of **energy**, in a variety of forms, to bring about a **physiological change** in the target tissue.

MECHANICAL

ELECTRICAL

THERMAL



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CLINICAL REASONING

- There is a limited evidence base for electrotherapy
 - But you're used to that right?
- As clinicians we must make informed decisions based on:
 - Physiological effects
 - Therapeutic effects
 - Physical effects
 - Evidence/clinical based practice
 - Research



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You Already Use Electrotherapy!

Mechanical Energy = Mechanotransduction

- Manual Therapy
 - The use of pressure and vibration applied in the form of manual therapy brings about a physiological change

Thermal Energy

- Heat and Cold therapy
 - The molecular activity of the applied modality is different to that of the target tissue - a resultant physiological change occurs via conduction
 - Modality with ↑ molecular activity = ?
 - Modality with ↓ molecular activity = ?



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So, What's New?

Mechanical Energy

- Ultrasound – specifically TUS
 - Energy cannot be made or destroyed, it is merely *changed*
 - Electrical energy converted to mechanical energy in the form of sound waves.
 - The resulting mechanical vibration is of a frequency that is above that of audible sound (16-20,000Hz)
 - ULTRASOUND = 20,000Hz+
 - We can apply ultrasound at a frequency between 1-3MHz to [manipulate the healing process](#).
 - 1Hz = 1 cycle per second.
 - 1MHz = 1 million Hz



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Mechanical Energy

Therapeutic Ultrasound

- Dense collagenous tissue
 - Ligament, tendon, fascia, capsule, scar tissue

Pulsed Short Wave Therapy

- Wet, ionic, low resistance tissue
 - Muscle, nerve, oedema, haematoma, effusion

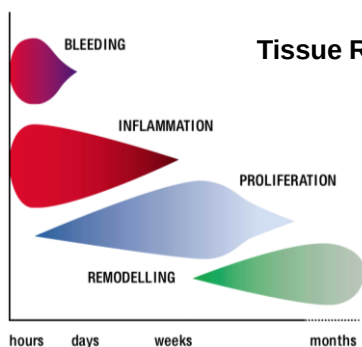
Laser

- Superficial vascular tissues
 - open wounds, nerve, muscle, tendon sheath



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Tissue Repair Model



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Electrical Energy

- Application of electrical current causes movement of ions
- We can manipulate this to have a therapeutic effect
- Vary the **intensity** and/or **duration** of a **frequency** to disturb the ionic balance across the nerve or muscle membranes



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Electrical Energy

- Low (0-200Hz) - affects sensory or motor nerves = **TENS/NMES**
- Medium (200-4000Hz) - passes through tissue without stimulation the muscle or nerve
- 2 medium frequencies create a low amplitude-modulated current which stimulates muscle and nerve = **ITF**
- High (27MHz) passes through the tissue producing heat = **SWD**

TENS – transcutaneous electrical nerve stimulation

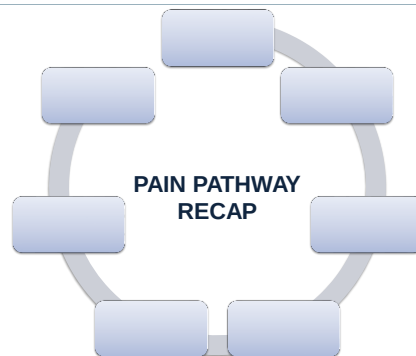
NMES – neuromuscular electrical nerve stimulation

ITF – interferential

SWD – short wave diathermy



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Electromagnetic Radiation Energy

- When the movement of electrons occurs at very high frequencies, energy is given off in the form of electro- magnetic radiation.
- These radiations enter the tissues and cause effects when they are absorbed.
- Electron movement at frequencies of thousands of millions of cycles per second (GHz) produces radiation called Microwave which lead to heat when absorbed in the tissues.
- At higher frequencies, they are called INFRA-RED and are absorbed superficially 1mm at the skin's surface causing heating.
- Higher frequencies still give INFRA-RED LASER radiation and these cause chemical changes to the tissues.



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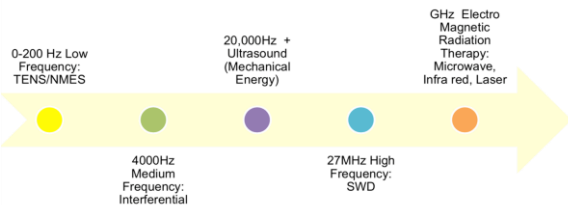
Electromagnetic Radiation Energy Pulsed Electromagnetic-field Stimulation

- Bone healing acceleration
 - stimulate calcification of the fibrocartilage in the space between the bony segments
 - Increased blood supply
 - Early formation of osteoids and calluses
 - Increasing the rate of bone formation by osteoblasts
- Non-invasive intervention
 - Capacitive coupling – no skin contact
 - Inductive coupling – electrode skin placement



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Therapeutic Application of Energy



Safety Precautions

Electric Shock

- Caused by a sudden flow, cessation or variation of an electric current through the body
- Poorly maintained or unserviced electro-medical apparatus or clinicians unsafe application

Minor → Severe → Extreme

Safety Precautions

• Electric Shock

– Minor

- Pt may be frightened and distressed but will not lose consciousness

– Severe

- Fall in BP and likely loss of consciousness

– Extreme

- Cessation of respiration
- Accompanying cardiac arrest due to VF resulting from the electrical stimulation of the heart
- Observe lack of respiratory movements, cyanosis, absence of pulse in carotid artery and fully dilated pupils

Causes of Electric Shock

- Sudden increase in current
- Low frequency current BUT intensity left high from last use
- Patient touches exposed part of the circuit (pads)
- Patient touches metal bed/chair or water pipe/radiator

Precautions

- Check for faulty parts
- Test equipment
- Adequate warm up time
- Intensity switched on last and off first
- Intensity not increased during pulse intervals
- Patient warned not to touch equipment
- Regular manufacturer service
- Water and gas pipes out of reach
- Floor is dry and insulated
- Insulated chairs and couches



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Skin Sensation Testing

Transcutaneous Electrical Nerve Stimulation TENS	Pin-Prick/Sharp-Blunt
Interferential Therapy ITF	Pin-Prick/Sharp-Blunt
Neuromuscular Electrical Nerve Stimulation - NMES	Pin-Prick/Sharp-Blunt
Ultrasound Therapy TUS	Skin-Test/Hot-Cold Test



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Pin-Prick/Sharp-Blunt Sensation Test

- A person's ability to detect a cutaneous pain sensation and to differentiate such sensations from pressure stimuli.
- Performed with a pin or needle gently applied to a skin area where it cannot be observed by the subject (point of safety pin).
- Application of the pin is alternated with the pressing of a dull object against the skin (blunt point).
- Care is taken to prevent penetration of the dermis, and the sharp object used should be sterilized or discarded after the test.
- **Under NO circumstance should you draw blood!**
- Ask Pt 'is this sharp or dull?' or 'does this feel the same as this?'
- Leave approx. 2 seconds between each stimulus to avoid summation

Mosby's Medical Dictionary, 8th edition (2009) Elsevier



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Hot-Cold Skin Test

- Two test tubes: one filled with hot water, one with cold water
- 40-45°C and Cold water 15-20°C
- Temperatures >45°C and <15°C should not be used as these ranges test pain threshold and not thermal sensation.
- Ask Pt to close eyes, then apply, in random order, the hot or cold test tubes to the area to be treated for a brief period, <1-2 secs.
- The patient is to respond 'hot' or 'cold' to each test.
- If patient is unable to reliably discriminate hot/cold over treatment area, the therapist should note this is a precaution to application of superficial heating



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