

Broadcast Summary

Electrotherapy

With Professor Tim Watson First broadcast on 15th April 2015

Tim Watson

- Professor of Physiotherapy at University of Hertfordshire
- Physiotherapist by training
- Involved in teaching and research for over 30 years
- Still in practice

Electrotherapy

- Strictly it's an inaccurate term: more appropriate is electro-physical agents
- First resort of a bad practitioner?
 - Historically perhaps accurate: a method of increasing income (by treating several patients simultaneously), or as cover for not knowing what to do
 - Less likely nowadays, due to emphasis on evidence-based practice
- Used sensibly, electrotherapy can make a difference. Used unwisely, it's a waste of time like any therapy

<u>Modalities</u>

- Ultrasound mechanical therapy (sound waves). The most common modality in practice.
- Inteferential
- Electrical Muscle Stimulation
- Short wave therapy
- Magnetic therapy

Choice of Therapy

- Most of the modalities do something well, and there may be some overlap. Some do nothing at all.
- Whatever the therapy, the purpose is to push energy into the tissue, creating some sort of physiological response (eg nerve conduction, cell behaviour, tissue healing)
- Ideally, decisions are based on the patient and their problem, leading to an appropriate treatment intervention. But practitioners often only have one type of electrotherapy to offer.
- Nevertheless, the key thing is to decide which modality will get the best result, then how much of it

<u>Ultrasound</u>

- See: http://www.electrotherapy.org/modality/ultrasound-therapy (Ultrasound theory) http://www.electrotherapy.org/modality/ultrasound-dose-calculation (Dosage calculations)
- Principles:
 - Emits a sound wave (mechanical/pressure)
 - Current machines operate at either 1MHz, 3MHz or both. The frequencies were chosen for ease of engineering, not because they are the *most* effective therapeutically (they may or may not be, but they are definitely effective)
 - Pressure wave mechanically agitates the tissues, causing changes in behaviour:
 - Cell permeability and intra-cellular mechanisms alter
 - Influx of Ca ions increases
 - Causes changes in release of cytokines, fibroblastic growth factor, prostaglandins, and mediators etc
 - Leads to improved repair process
 - Direction in which treatment head is moved is irrelevant
- Placebo?
 - Placebo effect across all therapies is fairly consistent at about 30%
 - Study (about 10 years ago) found that 20% machines in survey (NHS and private physios) were broken and could not emit ultrasound.
 - Results were still good...
 - Using genuine ultrasound does improve the result from placebo level (30%) to 60/70%
 - In combination with other therapy (physio/osteo/chiropractic), results improve further still
- Checking the machine works:
 - Put treatment head in a bowl of water, pointed towards surface
 - Switch on, in continuous wave mode
 - Set to about 1W
 - Should see surface ripples
 - Where treatment head has a light this is a reliable indicator. It is part of an automatic cutout mechanism, designed to protect the treatment head
 - **Note:** putting water on the treatment head and switching on will ruin the treatment head!
- Indications
 - Works best on dense collagen tissues at any stage of injury ligament, tendon, fascia, capsule, scar tissue
 - Not good on acute muscle injury (but after 2 weeks it will work on the scar tissue)
 - Works from acute stage right through to remodelling a year later
 - Does not heat tissues significantly
 - Does not *break down* scar tissue, but improves quality of repair by applying mechanical stress, which generates a bio-electric potential
 - Post-surgery: ultrasound will not influence bone healing, but can assist with soft tissue repair
 - Note: ultrasound is **not** anti-inflammatory, therefore no good in osteochondritis type conditions
- Contraindications

- It is **not true** that metalwork (pins, plates and joint replacements) is a contraindication. There is **no** significant heat generation over these (nor anywhere else)

- Lists of contraindications provided with machines by manufacturers are unreliable and inconsistent

- Main contraindications are:
 - Pregnancy (from mid thorax to pelvis) based on animal research, can cause
 - developmental abnormalities (although very unlikely in humans)
 - Malignancy ultrasound increases rate of growth of malignant tissue. Note: a *history* of malignancy is **not** a contraindication
 - Pacemakers avoid the site itself
 - Active growth plates avoid the active sites, but OK elsewhere. Therefore ultrasound is not useful in Osgood Schlatter's. This contraindication is again based on animal evidence.
 - DVT don't use over site of thrombi (no evidence that ultrasound will dislodge clots, but it's a sensible precaution)
- Not contraindicated: barorceptors/neck (but don't use electrical muscle stimulation). No evidence against use of ultrasound around front of neck
- Using the ultrasound:
 - Must have contact with the skin (no air gaps), hence need for a gel
 - Where dealing with small, uneven surfaces (knuckles/malleoli), immerse in water works really well, but make sure machine is in date for electrical safety checks!
 - Size of treatment head is dictated by the size of treatment area, not the frequency used. If
 - buying only one, buy the larger head it's more useful.
- Choice of frequency:
 - It is not true that the different frequencies penetrate to different depths
 - But 3MHz is absorbed more quickly, so only a small proportion reaches the deep tissue
 - 3MHz energy is absorbed quickly by tissues down to about 2cm therefore more effective on superficial layers
 - 1MHz better for 2-5cm depth
 - Deeper than 5cm, don't bother with ultrasound
- Fracture diagnosis:

- Ultrasound does work: study (1983) showed that ultrasound was better at detecting fractures in first 3 weeks than plain film Xrays (93% against ~46%). MRI is better still, but more costly and harder to access.

- Theory: ultrasound vibration, at a strong dose will irritate the fracture site causing pain
- Setting: use 1MHz, 1Wcm⁻², continuous wave (ie not pulsed)
- Start away from the suspected fracture and work towards and beyond
- If fracture present, sharp pain will occur over site, then disappear as head moves away
- Fracture Healing
 - Standard ultrasound will not harm fracture healing, but doesn't help, and it hurts
 - Low Intensity Pulsed Ultrasound (LIPUS) is very good at speeding fracture recovery, including delayed and non-unions (reduces healing time by 35-40%). NICE guidelines are in favour, but LIPUS is very rarely available. Has to be done daily for 20 minutes. Best done at home, by the patient.
- Care:

- Machines should last 20-30 years (no great advantage in having a modern one other than presentational)

- Avoid knocking/dropping the treatment heads – causes the ceramic plate (the crystal) to become unglued

- Calibration has to be done by a qualified technician (usually once a year). Engineer should come to you.

- Domestic devices
 - Ultrasound is best done daily for acute injuries
 - Growing trend for domestic machines (ie rent to patient, currently dosage is pre-set, which is not ideal)
 - Advantages to patients reduced cost (as opposed to clinic treatments), increased frequency of use
 - Cost: anywhere from £500 £1000, generally

TENS (Trans-cutaneous electrical nerve stimulation)

See: http://www.electrotherapy.org/modality/transcutaneous-electrical-nerve-stimulation-tens

- Advantages:
 - Very well researched
 - Effective in 60-75% cases
 - Very simple
 - Very cheap (£13 machine can be as good as any other)
 - Designed for home use
 - Price is definitely not a good indicator of quality
 - Can be used for long periods
- But: TENS does not cure problems, it simply relieves pain
- Principle: stimulation of sensory nerves activates
 - Pain gate
 - Opioid system
- Not all TENS machines are equal:
 - No 2 patients will respond in the same way to the same settings
 - Many off-the-shelf machines have pre-set programmes, with no facility to change the settings.
 - Some will have settings purporting to be for pain in specific areas nonsense
 - Need to be able to alter intensity and frequency
- Setting the Settings:
 - Intensity needs to be strong but not unbearable
 - High frequency
 - About 80 120Hz
 - Activates the pain gate
 - Should feel relief within 5-10 minutes
 - Pain relief only when machine is switched on
 - Possibly best for acute pain
 - Low frequency
 - (2-5Hz)
 - Activates opioid mechanism
 - Pain relief after 15-20 minutes
 - Can last for several hours after machine is switched off
 - Individual has to work out the ratio of TENS stimulation to subsequent pain relief, then "top up"
 - Possibly best for chronic pain
- Placing the pads
 - Put them either side of the pain (precise orientation is unimportant)

- It doesn't matter which pad is which side (despite what some manufacturers will tell you)
- Also worth trying either side of the relevant nerve root for radicular pain
- Pads are multi-use, but single patient
- Buying a machine: simply ensure
 - It has an intensity setting (they all do no need for numbers, it all boils down to being able to feel the sensation)
 - The patient can alter the frequency between the ranges above
 - electrotherapy.org has a list of machines that meet the basic requirements (but Prof Watson does not endorse any particular type)
- Patient handling
 - Using TENS in clinic is a waste of time (more importantly, a waste of the patient's money)
 - Much better to advise patient on use at home and sell or rent the machine to them
 - Use clinic time for other interventions

Interferential

- Not effective , despite its popularity: minimal pain relief and no healing capabilities
- Similar to TENS/muscle stimulation, but does neither as well as purpose-built machine

Deep Oscillation Therapy

- Seems to have an effect
- Currently Tim's results are anecdotal
- Research on it is very limited

Laser

- Limited by penetration (5 15mm)
- Effective on superficial, vascular tissue (eg tendon sheath, carpal tunnel)

Reference:

1. www.electrotherapy.org - open access, fully referenced and unbiased