

Frequently Asked Questions about Electrical Stimulation

Collated during Australian 'ES Train the trainer' workshops, May 2011 & April 2012

Prepared by Lannin NA, Dorsch S, Barker R, Cannell J, McCluskey A

How important is it to get consent from a person before using ES?

- Consensus was yes, it is important and should be documented
- If a person is not able to consent, family member can give consent

Do you need to do a sharp / blunt sensation test?

- Consensus was no, but APA 2001 guidelines recommend this as best practice
- People with sensory loss would be managed / treated in the same way as people without sensory loss (in fact ES is used as a treatment now in several trials to improve sensory function. May just need to check skin more often.
- If there is a routine procedure in your facility for conducting a sensation assessment or screening [eg part of OT / PT assessment] may be OK to bypass this step

If a person has a red skin mark after use, how should you manage that scenario?

- Consensus was that if the skin returns to normal colour after 30 minutes, OK to re-use; if longer, that suggests they've had a skin reaction - delay re-use
- Could switch to cloth electrodes as an alternative or have a break / shorter times

What warnings and advice do you give to people when they first use ES?

- Some therapists check skin for redness / skin irritation after removing electrodes
- Having good skin contact will reduce discomfort.
- Use micropore, shave skin / cut hairs if person is hairy, clean skin well
- Gel may help to increase skin contact instead of silicon adhesive

If a person already has an active muscle contraction, when would you use ES?

- ES may help to focus the person on partial contraction more, because the ES contraction prompts them to use the muscle / practise

Lower motor neurone (complete) lesion - would you use it to promote recovery?

- Yes, if the person has intact neural system [ie] a message will reach muscle

Would you use ES with a person who has a peripheral nerve injury?

- Yes, you can use ED with this population if damage is incomplete but no if the damage is complete

Would you still use ES if a person had a joint replacement?

- Yes, not a problem to use ES if a person has metal parts or points.

When a person has had botulinum toxin, and has had serial casting to arm / leg muscles for 2 weeks or more, how do you manage to apply ES to enable contraction of extensors?

- You can push electrodes down the cast, but the person won't be able to contract their muscle into full range inside the cast
- Often you cast over 2-3 weeks, till you have the range you want, and then focus on a motor training with ES

- Try dynamic elbow splint with an adjustable angle

When ES is used to reduce spasticity, does the ES get used applied to the spastic muscle or antagonist muscle? When using ES in conjunction with/after botulinum toxin injection, do you use ES over the injected muscle or the antagonist muscle?

- Usually used to target antagonistic or opposing muscles [eg if biceps/brachioradialis targeted with botulinum toxin, ES is used on triceps along with a high dose of practice and repetitions
- However, ES is also used in RCTs on the muscles that have been injected, with the intention of increasing the uptake of the drug. In one RCT, this was conducted for 30-90 minutes three times/ day for 3 consecutive days post injection to increase uptake of the drug

When is ES “functional” ES vs just ES?

- Many different definitions of functional ES.
- Sometimes ‘functional ES’ refers to the outcome [ie directed at achieving function such as grasp and reach during / concurrent with muscle contraction].
- Sometimes this term refers to machines that involve concurrent voluntary contraction by the person / user vs. passive contraction without the need for active patient involvement [Eg To prevent shoulder subluxation or when using cyclic ES to reduce oedema].

Is intra-muscular ES used clinically yet?

- Not as far as the presenters know; mostly used in clinical research

What are the different types of electrical currents?

- Older forms of electrical currents (faradic and galvanic) used to promote a build up of ions under the skin.
- Direct / monophasic currents: Cause the build up of ions.
- Alternating current: Aims to prevent the build up of ions

Contra-indication: What if the manual accompanying your device states not to use ES during pregnancy? The APA 2001 guidelines state ‘don’t use ES over the uterus’. What guideline do you follow?

- Some guidelines are not research informed; based on consensus / previous guidelines.
- There is a tendency for therapists / department to be risk averse rather than promote the use of ES interventions which could benefit clients.
- Useful reference: Physiotherapy Canada [2009], Vol 62 Issue 5 Page 38 - literature review on precautions and contra-indications of using electrical stimulation.

What are the recommended default stimulation parameters?

Asymmetrical waveform

- Pulse width 200 – 250 or lower if uncomfortable
- Frequency Hz 35 – 50 to minimise fatigue
- On / off times 4 sec on 8 sec off

Are there brands of ES machines that are recommended / preferred?

Suggestions from presenters and participants:

- Medtron EMS which is about \$100 to buy, easily purchased through pharmacies (can be ordered in), isn’t as expensive if it gets lost as other models. Disadvantage: will only stay on a program for 60 mins and needs to be re-programmed every hour

- Recommend that you buy a machine such as NeuroTrac Rehab which has a 'remote' hand-held switch allows the user to manually trigger stimulation to contract a muscle. This allows the patient to start/stop the device and practice contractions in between



What does 'frequency' mean?

- The frequency is the period of time the current flow (pulse) is active.
- Generally nerve tissue responds to high frequencies over short durations, and sensory nerves respond to 100-150 Hz (cycles per second). Muscle tissue responds to a lower frequency, therefore longer duration stimuli are used. Motor nerves respond to 25 Hz (cycles per second).
- The higher the stimulation frequency, the faster the muscle fatigues.
- The abbreviation for frequency is 'Hz'

What frequency (Hz – pulses per second) should you generally use?

- Recommendation: 30 - 100
- To get a muscle contraction, 30 Hz or higher to avoid twitching
- Higher frequencies (100+) can produce greater use of type II muscle fibres in normals
- The higher you set Hz, the quicker you will expect muscle fatigue

When would you use a high vs. low ramp time?

- Some machines only have a 'ramp on' option (at start of contraction)
- If you want a quick muscle response – no ramp time at beginning of contraction
- If you want a gradual / slow end of contraction - increase the 'off ramp' time (if machine has that option)

What is 'pulse width' vs 'pulse duration' ?

- Width: The length of time that the current is flowing.
- Duration: How long (period of time) that the pulse is flowing.
- Frequency: The period of time the current flow is active or flowing
- Therefore, they are the same thing

What pulse duration μ s (microseconds) to use in general?

- Smaller muscles may use lower pulse duration (200)
- Larger muscles (eg quads) – often need higher pulse duration (450)
- The larger the muscle belly the higher you may need to increase pulse duration

What is the difference between 'waveform' and 'wavelength'?

- Different 'waveforms' produce different contraction intensities and different levels of fatigue). Waveforms have different shapes that we can see on the screen. The waveform can be square or wavy, saw tooth or triangular.
- Waveform – 'types' of wave
- Wave length – 'duration' of wave

What does intensity mean/ refer to?

- Intensity refers to amplitude or milliamps (abbreviated to 'mA')
- A comfortable intensity is between 10 mA and 30 mA
- How high would you increase the intensity (milliamps) if a person had a known sensory impairment in their arm?
- Check Hz used in published RCTs aimed at improving sensory function, as several trials have used ES to IMPROVE sensation.

What proportion on/off – work/rest time is generally recommended?

- 4 sec work / 8 sec rest will produce less fatigue [than 8 sec work / 8 sec rest or 8 sec work / 4 sec rest]

How much does an ES machine cost in Australia?

- AUS\$150 upwards
- In some parts of Australia the public health system will provide an ES machine, and Dept of Veterans Affairs will supply them.

Where do you get funding to buy ES machines for a department and ongoing costs [eg batteries / electrodes]?

- COAG funding has been used to fund 10 machines at Prince of Wales Hospital Sydney. Several departments have written proposals / business case which present the evidence and NSF guidelines supporting the use. John Cannell (Launceston General Hospital), Karl Schurr and Simone Dorsch (Bankstown Lidcombe Hospital) and Bianca Kinnear (Prince of Wales /Greenwich Hospital, Sydney)
- Ongoing cost of batteries is met in one hospital by nursing department with units purchased by OT department

Can ES be used by therapy or allied health assistants? Are they ‘allowed’ to use ES?

- Yes; so they probably should be invited to attend your workshops.
- Yes; can be (and is) taught in Cert IV course for TAs and training is provided by physiotherapists and occupational therapists during that course, and in practice.
- Family/assistants are also often being trained in clinical settings, so that they can perform/use ES under direction and guidance of someone who is knowledgeable.
- Assistants who are delivering ES help to increase numbers of sessions / enable implementation of evidence.
- Assistants may only be allowed to use ES for some sessions [eg shoulder subluxation] in some facilities

Which disciplines use ES in departments?

- One presenter (PT) initially taught PT and OT staff. PT staff mainly implemented ES, trained new staff, students and assistant. Now OT use ES/ teach others. Assistants complete most shoulder ES once commenced. PTs/OTs progress the time periods.

What is the best method of visually illustrating muscles? What is legally allowed when copying pictures from books to use in slide presentations?

- Good App for Iphones: Muscle Pro 3D - app for iphone
- Can buy a licence from USA to use anatomy pictures for teaching for about \$200

Do you have suggestions for workshops where you have fewer patients than planned?

- Splitting group into 2 groups
- General consensus was that you should involve patients

How do you manage therapists during workshops with different skill levels?

- Work in pairs or mixed groups of 3 (small groups)
- Divide into less vs. more experienced people
- Have tutors involved in practical component
- People might attend the lectures but not practical component

How do you get reluctant therapists involved in the practical sessions?

- Give people a timeline by when they have to start the actual ES on self/patient
- Give people a 'coach' badge – indicates which therapist is responsible for instructing patient
- Give specific roles to group members (eg observer, stimulator, recorder of reps).

How much time should be allocated for teaching ES at in service sessions or workshops?

- Depends on the time available, and if you plan to deliver theory and practical
- If possible, plan a 2-3 week break between sessions to allow participants to practice then return with questions
- If a department or manager wants to be sure their staff are 'competent' to use ES, then will need to allow enough time to practice then evaluate specific competencies

Do you recommend that departments check all staff for 'competency' before allowing ES to be used with patients?

- Consensus was 'no' because then ES is being treated separately as a 'special' skill while other important practice areas (such as home visiting) do not typically have to be 'tested' for competency before an OT is allowed to take a patient on a home visit

How long should adhesive electrodes last? And how can you extend the life of electrodes?

- Will vary depending on frequency of use
- At one hospital, electrodes are replaced every 6 weeks
- Storage and cleaning can extend the life – wash after use to remove dead skin/oil. Wash in water. Store on plastic card, then put in sealed bag or container. Put patient's name on each electrode
- May increase stick/life of electrodes by storing electrodes/ packets in the fridge

How does ES work physiologically with denervated muscles (eg after a spinal cord injury)?

- You will see changes at the muscle level
- Strengthens the muscle peripherally.
- Leads to better recruitment of motor units, and improved blood supply to the muscle

Do any ES machines have more than two channels?

- One machine from UK 'Odstock' has several channels
- Most clinicians use two machines which each have two channels if wishing to target 4 muscles at the same time

What distance is recommended between electrodes? And why should they not touch/be too close together?

- If too close, there is no circuit so you will not see a contraction.
- Too far apart, especially in children, you may get unwanted contraction and overflow to deeper muscles

Would you still use ES with a child who has communication difficulties?

- Yes – no different is child is young or older – children under age of 1 year will not talk anyway so you learn to communicate using different voice modulations and via the child's mother.
- Good idea to trial the ES on mother