ACPWH guidance on the safe use of transcutaneous electrical nerve stimulation (TENS) for musculoskeletal pain during pregnancy

1.0. Introduction

Transcutaneous electrical nerve stimulation (TENS) has been used by pregnant women for many years without any reported side effects for either mother or baby. In fact, it has been suggested that TENS enhances placental blood flow (Enzelsberger *et al.* 1991). More recently, there has been debate about the theoretical risk to the foetus posed by the electrical field produced by a TENS unit.

In order to clarify current thinking in this area, the Association of Chartered Physiotherapists in Women's Health (ACPWH) brought together a panel of experts who reviewed the relevant literature and used their clinical experience to develop these statements. The expert panel consisted of:

Yvonne Coldron
Teresa Cook
Elizabeth Crothers
William Notcutt
Tim Watson

(Brief resumés and contact details for the team are given in Appendix 1.)

2.0. Reasons for use

When a pregnant woman presents with low back pain (LBP) and/or pelvic girdle pain, including symphysis pubis dysfunction, a musculoskeletal assessment should be undertaken.

The first treatment options should be:

- advice on activities of daily living
- exercises to improve the muscular control of a body that is structurally and dynamically challenged
- manual therapy as appropriate

If pain persists or is a hindrance to further improvement, then TENS may be beneficial, especially when the alternative is medication that would cross the placental barrier.

3.0. Consideration of possible areas of risk

No side effects from the use of TENS during pregnancy have been reported in the literature (Walsh 1997; Dowswell *et al.* 2009), and this finding is also supported by the personal experiences of the members of the ACPWH expert panel. Resnik (2002) described the use of TENS to increase placental blood flow and reported no negative effects. Enzelsberger *et al.* (1991) suggested that the perinatal outcomes for women who had placental insufficiency were improved when TENS was used in pregnancy to increase placental blood flow.

Specific potential areas of concern are the induction of uterine contractions, the effects on foetal heart conduction and the possibility of teratogenic effects induced in the foetus. These will be dealt with individually.

3.1. Induction of uterine contractions

There is concern that uterine contractions may be stimulated and labour induced if TENS is used over specific acupuncture points.

Dunn *et al.* (1989) tried to induce labour in women who were post-term by using acupuncture. The points employed were Spleen (SP) 6 and Liver 3. Despite the methodological flaws of this paper, it was clear that, although uterine contractions were stimulated, these stopped when acupuncture stimulation ceased.

Smith & Crowther (2004) carried out a Cochrane review investigating the efficacy of acupuncture for the induction of labour and found that:

> ‘‘The limited observational studies to date suggest acupuncture for induction of labour appears safe, has no known teratogenic effects, and may be effective. The evidence regarding the clinical effectiveness of this technique is limited.’’ (Smith & Crowther 2004, p. 1)

Elden *et al.* (2005) used acupuncture over contraindicated points [in particular, Large Intestine (LI) 4] without harm to mother or foetus.

However, caution should be exercised if using a TENS unit over acupuncture points that could induce labour. If contractions are induced, stimulation should be stopped since the evidence suggests that the contractions will then also cease (see section 5.0 below).

3.2. Induction of changes to foetal development

No foetal abnormalities have been reported in the literature when TENS has been used by mothers for the treatment of musculoskeletal pain (Walsh 1997) or placental insufficiency (Enzelsberger *et al.* 1991; Say *et al.* 1996; Resnik 2002).

None of the literature on TENS reviewed by the expert panel reported any injurious effect on foetal development, and furthermore, Peng *et al.* (2010) stated that all treatment outcomes were temporary.

3.3. Effects on electrical conduction within the foetal heart

Bundsen & Ericson (1982) originally suggested the safety precautions that need to be taken when considering any direct effect from the application of TENS on the foetus 30 years ago, but there has been no further work in this area since then. The main points to consider are the current density at the skin, the estimated depth of the fat under the electrodes and the position of the baby *in utero.* The above authors stated that there are two safety precautions that should be adhered to when using electrical stimulation for pain relief during labour:

- *3.3.1.* The current density should not rise above 0.5 microamperes (μA) per square millimetre (mm^2), a figure calculated by dividing the output of the unit being used by the surface area of the electrode pad employed.
- *3.3.2.* The electrodes should not be placed suprapubically if the mother is thin, i.e. likely to have less than one inch (2.54 cm) of fat, and the foetus is occipitoposterior (OP) in presentation. This implies that that there is more room for safety if the woman is fatter and the baby is not OP. However, the placement of electrodes is more likely to be effective for spinal and pelvic girdle pain when applied posteriorly over the lumbosacral nerve roots. If large electrodes (10 × 5 cm) are used and since 20 milliamperes (mA) is the average output from any standard TENS machine, the current at the surface of the skin will be 4 μA per mm^2.

Method of calculation:

(1) Assume that the electrode is 10 × 5 cm and has a surface area of 5000 mm^2
(2) Assume that the current on the surface is typically 20 mA (this is not an unusual figure when using a TENS unit on the lumbosacral spine)
(3) 20 mA = 20,000 μA
(4) Therefore, the current density *at the skin surface* is 20,000/5000 μA per mm^2 = 4 μA per mm^2

It is most likely that the current density at the skin will be considerably less by the time that it reaches the uterus as a result of dispersal within the conducting tissues.

4.0. Balancing of potential risks against the use of strong medication

The ACPWH expert panel could not find any reports suggesting that negative effects have been produced when TENS has been used during pregnancy. However, in clinical practice, TENS is not the first treatment of choice for women presenting with musculoskeletal pain during pregnancy. The initial treatment should be aimed at correcting any joint or muscle dysfunction, and a rehabilitation programme should be devised. However, if pain remains a significant factor, then TENS is preferable to the use of strong medication that could cross the placental barrier and affect the foetus. As stated above, no negative effects have been reported following the use of this modality during

any of the stages of pregnancy, and therefore, TENS is preferable for the relief of pain.

5.0. Clinical application, cautions and precautions

Although this statement declares that TENS is of lower risk to the foetus than strong medication, careful consideration of the appropriate use of this form of treatment must be given.

When applying TENS to the pregnant woman:

- The usual contraindications and precautions should be observed.
- Extra caution should be taken if the woman has epilepsy or a very irritable uterus, or if she has a history of early miscarriage or abortion. In these situations, the patient should be fully informed, and a clinical judgement should be made in conjunction with the appropriate medical practitioner so that consent to the TENS treatment can be given or withheld.
- Current density should be kept low. If the large electrodes (10 × 5 cm) are used with a standard TENS machine, this should not be a problem.
- Caution should be taken when placing TENS electrodes over acupuncture points that are considered to be the most likely to induce labour. Grant & Ma (2003) suggested that the points that should be considered with care for use during pregnancy are LI4 (dorsal aspect of the thumb web*), and SP6, Bladder (BL) 60 and BL67 (all around the lower half of the leg and ankle*). West (2000, p. 30) also included Gall Bladder (GB) 21 (middle fibre of the trapezius*), which is very commonly used for shoulder pain. However, Ternov *et al.* (2001) observed only one potentially serious side effect in their retrospective study of 167 consecutive women who had acupuncture for low back pain in pregnancy using LI4, Stomach 36 (around the head of the fibula*), GB34 (around the head of the fibula*), BL60 (ankle*), Governor Vessel 20 (top of the head*) and other tender points on the back. In this single case, the risk of side effects from acupuncture was low compared to that associated with medication. Ternov *et al.* (2001) appear to have used a large number of contraindicated points with no serious side effects. Furthermore, even if uterine contractions should be stimulated, Dunn *et al.* (1989) established that these will stop if the TENS machine is turned off. Please note that physiotherapists should ensure that they are fully compliant with Rule 1 of the Chartered Society of Physiotherapy Rules of Professional Conduct (CSP 2002) before treating a pregnant patient with acupuncture or TENS.
- In the rare case of a patient who has an implant such as a pacemaker or defibrillator, the use of TENS should be considered and monitored by a specialist pain or cardiology clinic. It is not impossible for patients who are fitted with an implant of this type to use a TENS unit as well, but there is a substantial risk of interference and this is outside the realm of physiotherapy. There would have to be a team approach to the treatment needs of any patient with implanted stimulators. Sometimes these implants may be neurogenic stimulators and any prospective use of TENS should not be attempted until discussions with the appropriate consultant(s) have taken place. In any case in which a patient has implanted stimulators,

TENS should be tested in an acute setting where resuscitation facilities are available in the first instance.

References

Bundsen P. & Ericson K. (1982) Pain relief in labor by transcutaneous electrical nerve stimulation. Safety aspects. *Acta Obstetricia et Gynecologica Scandinavica* **61** (1), 1–5.

Chartered Society of Physiotherapy (CSP) (2002) *Rules of Professional Conduct*, 2nd edn. Chartered Society of Physiotherapy, London.

Dowswell T., Bedwell C., Lavender T. & Neilson J. P. (2009) Transcutaneous electrical nerve stimulation (TENS) for pain relief in labour. *Cochrane Database of Systematic Reviews*, Issue 2. Art. No.: CD007214. DOI: 10.1002/14651858.CD007214.pub2.

Dunn P. A., Rogers D. & Halford K. (1989) Transcutaneous electrical nerve stimulation at acupuncture points in the induction of uterine contractions. *Obstetrics and Gynecology* **73** (2), 286–290.

Elden H., Ladfors L., Olsen M. F., Ostgaard H.-C. & Hagberg H. (2005) Effects of acupuncture and stabilising exercises as adjunct to standard treatment in pregnant women with pelvic girdle pain: randomised single blind controlled trial. *BMJ* **330** (7494), 761.

Enzelsberger H., Skodler W. D. & Kubista E. (1991) [Improvement of Doppler ultrasonography findings following transcutaneous electrostimulation in women with placental insufficiency.] *Zeitschrift für Geburtshilfe und Perinatologie* **195** (4), 172–175. [In German.]

Grant A. & Ma B.-Y. (2003) The safe use of difficult and dangerous acupuncture points. *Journal of Chinese Medicine* **72** (June), 11–15.

Peng T., Li X.-T., Zhou S.-F., *et al.* (2010) Transcutaneous electrical nerve stimulation on acupoints relieves labor pain: a non-randomized controlled study. *Chinese Journal of Integrative Medicine* **16** (3), 234–238.

Resnik R. (2002) Intrauterine growth restriction. *Obstetrics and Gynecology* **99** (3), 490–496.

Say L., Gülmezoglu A. M. & Hofmeyr G. J. (1996) Transcutaneous electrostimulation for suspected placental insufficiency (diagnosed by Doppler studies). *Cochrane Database of Systematic Reviews*, Issue 1. Art. No.: CD000079. DOI: 10.1002/14651858.CD000079.

Smith C. A. & Crowther C. A. (2004) Acupuncture for induction of labour. *Cochrane Database of Systematic Reviews*, Issue 1. Art. No.: CD002962. DOI: 10.1002/14651858.CD002962.pub2.

Ternov N. K., Grennert L., Åberg A., Algotsson L. & Åkeson J. (2001) Acupuncture for lower back and pelvic pain in late pregnancy: a retrospective report on 167 consecutive cases. *Pain Medicine* **2** (3), 204–207.

Walsh D. M. (1997) *TENS: Clinical Applications and Related Theory.* Churchill Livingstone, Edinburgh.

West Z. (2000) *Acupuncture in Pregnancy and Childbirth.* Churchill Livingstone, Edinburgh.

Appendix 1

Yvonne Coldron completed a PhD in Neuromuscular Physiology in 2006 that examined abdominal and spinal muscle function in postnatal women. She has published several papers on symphysis pubis dysfunction and pelvic girdle pain. Yvonne has also taught electrotherapy to undergraduate physiotherapy students at two universities. She is currently a musculoskeletal clinical specialist physiotherapist at Mayday University Hospital, Surrey, specializing in antenatal and postnatal musculoskeletal disorders. Contact: yvonne.coldron@mayday.nhs.uk

Teresa Cook is a member of ACPWH and has worked as a women's health physiotherapist for over 20 years. Currently employed as the lead clinical lecturer on the University of Bradford ''Postgraduate Certificate: Continence for Physiotherapists'', she also works independently as a consultant and lecturer, and within healthcare regulation. Contact: tcook1@bradford.ac.uk

Dr Elizabeth Crothers completed a PhD in 1993 that examined the use of TENS for the relief of pain in labour, and she has also published a literature review of the effects of TENS on the mother and baby during pregnancy. She works in Aberdeen in the National Health Service as a consultant physiotherapist in Continence. Elizabeth also has a private practice. Contact: elizabeth.crothers@nhs.net *or* crotherseliz@hotmail.com

Dr William Notcutt qualified in 1970 and passed the Fellowship of the Royal College of Anaesthetists in 1976. He became a consultant anaesthetist specializing in pain management at the James Paget Hospital, Great Yarmouth, in 1982, and then an honorary senior lecturer at the School of Medicine, University of East Anglia, Norwich, in 2000. William is a full-time clinician in both acute and chronic pain, and anaesthesia, and he has extensive experience of the use of TENS for pain, including in pregnancy. His research includes studies of patient-controlled analgesia, pain services and the clinical use of medicinal cannabis. Contact: william.Notcutt@jpaget.nhs.uk

Professor Tim Watson qualified as a physiotherapist in 1970 and has been lecturing since the early 1980s. His main areas of interest are tissue repair and electrotherapy. He gained a BSc in Biomedical Science in 1989 and a PhD in Bioelectronics in 1994. Tim is currently Professor of Physiotherapy and Director of Research at the School of Health and Emergency Professions, University of Hertfordshire, Hatfield. In addition to university teaching and research, he runs a series of postgraduate programmes in electrotherapy and tissue repair around the UK, Europe and Asia (website: www.electrotherapy.org). Contact: t.watson@herts.ac.uk

We would like to acknowledge the valuable contributions of Jeanette Haslam, Daphne Sidney and Ros Thomas to the original document.

Footnote

*This is a general description of the point involved that is given so that those not versed in acupuncture can be aware of the areas under discussion. For more accurate descriptions of these points, consultation of an acupuncture text is recommended.