

**An examination of subject variables  
that influence pressure pain  
threshold**

**A thesis submitted for the degree of  
Doctor of Philosophy**

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**2015**

## **CERTIFICATE OF ORIGINAL AUTHORSHIP**

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of Student:

Date: 15/10/2015

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# Abstract

**Background:** Pain is a primary clinical concern for most people. Pain is the most common reason for seeking any form of health assistance be it medical, dental, physiotherapeutic or alternative disciplines. Pain threshold is defined as the lowest application of a stimulus that is perceived as pain. Experimental pain studies use a range of pain challenges including electrical, heat or cold, ischaemic and pressure. Some carry a higher potential risk of tissue injury or the sensations experienced are less acceptable to subjects. Pressure pain threshold (PPT), measured by a simple mechanical algometer is an attractive alternative well-suited for non-invasive repeated measurements on multiple sites not limited to limbs over short time intervals in a relaxed setting. Since 2000, the University of Technology Sydney had conducted eight PPT studies and collected over 47,500 baseline PPT measurements on 262 healthy subjects at 24 regional sites with three or four PPT readings for each site at each session of four to eight occasions of at least one week apart. Research Study One included seven studies with over 32,000 pre-intervention PPT measures on 235 healthy subjects at 17 sites with three PPT measures at each occasion for four consecutive occasions. These data were being analysed to develop comprehensive epidemiological profiles that assess relationships between PPT with subject variables (gender, age, BMI) and duration of temporal sessions. Research Study Two assessed the PPT at two affected and two non-affected sites of 20 patients with lateral epicondylitis. Research Study Three examined the inter-device reliability between mechanical and electronic algometers at six sites of 17 subjects.

**Aims:** Research Study One explored the temporal stability of possible relationships between subject variables of gender, age and BMI, the duration of temporal sessions with the regional PPT at each measurement site. Research Study Two assessed the regional PPT measures at LI10 and LI11 of the affected and non-affected elbows for subjects with lateral epicondylitis. Research Study Three examined the inter-device reliability of a mechanical and an electronic algometers of same measurement parameters: circular rubber plunger of 1cm<sup>2</sup> and force application rate of 1kg/s.

**Methods:** Research Study One: All studies used the same protocol including the same model algometer, tip dimensions, application rates, rest interval between measurement cycles and at least seven days between each of four data collection visits. Regional PPT measurement sites included sites on head, neck and limbs. Data analyses used GLM and the alternative non-parametric tests wherever applicable. Research Study Two: A double blind randomised controlled trial that involved PPT measurements at two affected and two non-affected acupoints LI10 and LI11. Research Study Three: PPT measurements were taken by trained examiners using electronic and mechanical algometers

alternatively at six sites on hands. Subjects were blinded with a curtain drawn across the neck to the type of algometer being applied at each site.

**Results:** Research Study One: For all 17 sites, the regional PPT for males was significantly higher than for females for each visit and each measurement cycle in general and in Intervention and Control groups. No significant differences between mean PPT and median PPT, and between the means of  $PPT_{\text{mean}}$  and  $PPT_{\text{median}}$  for each gender at all 17 measurement sites. The mean and median PPT among reading cycles within gender were generally stable for both genders independent of temporal visits. Irrespective of gender, most sites showed significant increase in means of  $PPT_{\text{mean}}$  and  $PPT_{\text{median}}$  over temporal sessions in general and in Intervention but not the case in Control. The Pearson correlation coefficients of PPT with age and BMI for both genders at all measurement sites were generally weak ( $<0.35$  in magnitude). Stepwise multiple regressions models had  $PPT_{\text{mean}}$  or  $PPT_{\text{median}}$  in Visit 1 related to solely gender in all sites except bilateral LI20 with age and gender and PC6L with BMI only. Research Study Two: Generally significant increase of mean PPT at non-affected and affected sites in Acupuncture than Sham Laser and in males than females. Research Study Three: The mean PPT of mechanical algometer did not differ with that of electronic algometer at all six measurement sites.

**Conclusions:** Research Study One: Data analysis on PPT to be completed separately by gender. Experimental design for PPT between subjects should ensure a matched gender ratio across groups. Washout period to be extended. Research Study Two: The males received higher PPT than females whilst both genders showed higher PPT from acupuncture treatment than the sham laser in lateral epicondylitis. Research Study Three: Both mechanical and electronic algometers provided valid and reliable PPT scores under similar protocols.

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# Seminars

- a. **Cheah SL** (poster and short oral presentation), Cobbin D. Temporal stability of regional pressure pain threshold between genders in healthy adults. *New Horizons* 2014: 17&19 November. (Appendix 16)
  
- b. Christine Berle, Christopher Zaslowski, Deirdre Cobbin, Peter Meier, Sean Walsh and **Seong Leang Cheah**. The effect of acupuncture treatment compared to sham laser for lateral elbow pain: a randomised controlled pilot study. World Federation of Acupuncture/Moxibustion Societies, Sydney 2-4th November 2013.
  
- c. Christine Berle, Christopher Zaslowski, Deirdre Cobbin, Peter Meier, Sean Walsh and **Seong Leang Cheah**. (5-7th October, 2012). The effect of acupuncture treatment compared to sham laser for lateral elbow pain: A randomised controlled pilot study. International Scientific Acupuncture and Meridian Symposium, iSAMS 2012.
  
- d. Zaslowski C, Berle C, Cobbin D, Meier P, Walsh S and **Cheah SL**. The effect of acupuncture on lateral elbow pain. Inaugural Chinese Medicine Academic Conference 2011 at University of Technology Sydney: August 20-21.
  
- e. Zaslowski C, Berle C, Cobbin D, Meier P, Walsh S and **Cheah SL**. The effect of acupuncture treatment compared to sham laser for lateral epicondylalgia: A randomised controlled pilot study. Australian Acupuncture and Chinese Medicine Conference 2011 in Perth May 20-22.

## Conference abstracts

- a. **Cheah SL**, Cobbin D. 2014 New Horizons, 17&19 November, Final program and abstract book: Temporal stability of regional pressure pain threshold between genders in healthy adults. 49. (Appendix 17)
- b. Christine Berle, Christopher Zaslowski, Deirdre Cobbin, Peter Meier, Sean Walsh and **Seong Leang Cheah**. 2013 Australian Journal of Acupuncture and Chinese Medicine, Selected Conference Abstracts: The effect of acupuncture treatment compared to sham laser for lateral elbow pain - A randomised controlled pilot study. 8(2):28-29. (Appendix 18)
- c. Christine Berle, Christopher Zaslowski, Deirdre Cobbin, Peter Meier, Sean Walsh and **Seong Leang Cheah**. 2012 Australian Journal of Acupuncture and Chinese Medicine, Selected Conference Abstracts: The effect of acupuncture treatment compared to sham laser for lateral epicondylalgia: results from a randomised controlled pilot study. 7(1):39. (Appendix 19)

## Publication

- d. Chenoweth L, Jeon YH, Stein-Parbury J, Forbes I, Fleming R, Cook J, **Cheah SL**, Fletcher S, Tinsley L. PerCEN trial participant perspectives on the implementation and outcomes of person-centered dementia care and environments. International Psychogeriatrics 2015 Aug 26: 1-13.

Note: Papers related to abstracts in a, b, and c will be prepared for publication. Paper (d) has no relation to this thesis but rather part of skill earned as data manager for the project.