

THE CLINICAL UTILITY OF THE TOE BRACHIAL INDEX IN OLDER ADULTS AND PEOPLE WITH DIABETES

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Statement of Originality

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution, and to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to the final version of my thesis being made available worldwide when deposited in the University's Digital Repository**, subject to the provisions of the Copyright Act 1968.

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Statement of Authorship

I hereby certify that the work embodied in this thesis contains published papers of which I am a joint author. I have included as part of this thesis a written statement, endorsed by my supervisor, attesting to my contribution to the joint publications.

Signed

Dated 18th June 2015

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Abstract

This thesis presents an investigation of the utility of the toe brachial index (TBI) in older people and those with diabetes. While recommended as a screening tool for peripheral arterial disease (PAD), there is very limited information available regarding the reliability, diagnostic accuracy and clinical utility of the TBI. This study comprised of a systematic review and a further five studies investigating the reliability of the TBI, the diagnostic accuracy of the TBI for determining the presence of PAD, and investigations of the relationship between the TBI and the risk of foot complications, diabetes-related microvascular disease and health-related quality of life.

Review and meta-analysis revealed toe blood pressures of less than 30 mmHg to be predictive of non-healing chronic foot wounds and amputation, and exposed a deficit of quality research regarding the interpretation of TBI values. As monitoring of PAD is ongoing, an investigation of the reliability of the TBI was necessary. The TBI demonstrated excellent reliability when performed by podiatrists using automated devices in an older population. However the ability of the TBI to detect PAD was still unknown. The TBI was then compared to colour duplex ultrasound for the diagnosis of stenosis affecting the lower limbs in people with and without diabetes. A value of 0.72 was determined to have the greatest accuracy for detecting stenosis and contributed to the limited evidence in support of current international guidelines for interpreting the TBI.

To further explore the utility of the TBI a cross-sectional investigation of the relationship with ulceration, amputation and the painful symptoms of PAD was undertaken. People with TBI values lower than 0.70 were 19-times more likely to have foot ulcers or amputations than those with higher values. As both PAD and microvascular dysfunction are known to contribute to the

development of foot wounds and impaired healing, the relationship between the TBI and microvascular disease was investigated. TBI values less than 0.70 were associated with a three-fold increase in the likelihood of diabetes-related microvascular disease. With correlates including foot complications and microvascular disease, the health-related quality of life associated with low TBI values warranted investigation. Modest associations between low TBI values and physical aspects of quality of life were found. The studies presented here indicate the TBI has a potential role beyond PAD diagnosis that may extend to include identifying those at risk of other vascular diseases and impaired quality of life.

Publications and Presentations

Publications

Sadler S, Hawke F, Sonter J, Chuter V. Toe brachial blood pressure measurement after 5, 10, and 15 minutes of rest. *Journal of Foot and Ankle Research* 2013; 6 (Suppl 1): 033.

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Sonter J, Ho A, Chuter V. The predictive capacity of toe blood pressure and the toe brachial index for foot wound healing and amputation: A systematic review and meta-analysis. *Wound Practice and Research* 2014; 22 (4): 208 – 220.

Sonter J, Sadler S, Chuter V. Inter-rater reliability of automated devices for measurement of toe systolic blood pressure and the toe brachial index. *Blood Pressure Monitoring* 2015; 20 (1): 47 – 51.

Sonter J, Casey S, Chuter V. Intra- and inter-tester reliability of toe pressure measurements in people with and without diabetes performed by podiatrists. *Journal of the American Podiatric Medical Association* 2015: *In Press*.

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Poster presentations

“Intra- and inter-tester reliability of toe pressure measurement and toe blood pressure in people with and without diabetes as performed by podiatrists”, Auckland, New Zealand, (2012); New Zealand Podiatry Conference.

“Blood pressure and the toe brachial index: Associations with health complications - A prospective study”, Gold Coast, Australia, (2014); Australian Wound Management Association Conference.

Awards

Best Literature Review/ Clinical Practice Review Article (2014) by the Wound Practice and Research Editorial Board. for the review: The predictive capacity of toe blood pressure and the toe brachial index for foot wound healing and amputation: A systematic review and meta-analysis.

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