PHYSIOTHERAPY FOR PATIENTS WITH HEAD AND NECK CANCER

Aoife Claire McGarvey, BAppSc (Physiotherapy)

A thesis submitted for the degree of PhD (Physiotherapy)

Faculty of Health

University of Newcastle

NSW, Australia

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Statement of originality

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For the facial lymphoedema study: Emma Johnson, Speech Pathologist, The Calvary Mater Newcastle Hospital, and Judy Holland, Physiotherapist-in-Charge, The Calvary Mater Newcastle Hospital provided information based on their clinical experience to assist in the development of interview questions.

For the case control and comparative electromyography studies: Clayton Reid, Physiotherapist, The Calvary Mater Newcastle Hospital, and Belinda Allen, The Calvary Mater Newcastle Hospital assisted with data collection. Carole James, PhD, University of Newcastle, provided technical assistance; and Suzanne Snodgrass, PhD, University of Newcastle, provided support with study design.

For the randomised controlled study: Head and Neck Surgeons at the Calvary Mater Newcastle Hospital, Liverpool Hospital and Westmead Hospital, and Luci Dall'Armi, Clinical Nurse Consultant, Liverpool Hospital, assisted with participant recruitment. Narelle Molloy, Physiotherapist, Calvary Mater Newcastle Hospital, Christopher Saliba, Physiotherapist, Liverpool Hospital, Katherine Maka, Physiotherapist, Westmead Hospital, Lilian Wong, Physiotherapist, Westmead Hospital, were the blinded assessors. Matthew Jennings, Physiotherapist, Liverpool Hospital, and Linda Clark, Physiotherapist, Westmead Hospital, were the treating physiotherapists at the Sydney Hospital sites. Dr Patrick McElduff, Statistician, Hunter Medical Research Institute, provided statistical support.

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Statement of Authorship

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

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The following thesis is by publication, in accordance with the Rules Governing Research Higher Degrees (Rule 53).

I hereby certify that this thesis is in the form of a series of 6 published papers of which I am a joint author. I have included as part of the thesis a written statement from each co-author, endorsed by Faculty Assistant Dean (Research Training), attesting to my contribution to the joint publications.

……...

Aoife McGarvey

Statements from co-authors

With regards to the publications:

"Lymphoedema following treatment for head and neck cancer: Impact on patients, and beliefs of health professionals"

I, Pauline E. Chiarelli, attest that Research Higher Degree candidate Aoife McGarvey contributed to the listed publication by constructing interview questions, conduction of interviews, assisting with qualitative data coding and analysis, and writing up the discussion and conclusion.

Pauline E. Chiarelli Date 3.9.14

I, Peter G. Osmotherly, attest that Research Higher Degree candidate Aoife McGarvey contributed to the listed publication by constructing interview questions, conduction of interviews, assisting with qualitative data coding and analysis, and writing up the discussion and conclusion.

Peter G. Osmotherly Date 4.9.2014

I, Gary R. Hoffman, attest that Research Higher Degree candidate Aoife McGarvey contributed to the listed publication by constructing interview questions, conduction of interviews, assisting with qualitative data coding and analysis, and writing up the discussion and conclusion.

Gary R. Hoffman Date 4.9.2014

Faculty Assistant Dean (Research Training) Date

" Physiotherapy for accessory nerve shoulder dysfunction following neck dissection surgery: A literature review"

I, Pauline E. Chiarelli, attest that Research Higher Degree candidate Aoife McGarvey contributed to the listed publication by conducting the literature review, describing the included studies, interpreting results and writing up the discussion and conclusion.

Pauline E. Chiarelli Date 3.9.14

I, Peter G. Osmotherly, attest that Research Higher Degree candidate Aoife McGarvey contributed to the listed publication by conducting the literature review, describing the included studies, interpreting results and writing up the discussion and conclusion.

Peter G. Osmotherly Date 4.9.2014

I, Gary R. Hoffman, attest that Research Higher Degree candidate Aoife McGarvey contributed to the listed publication by conducting the literature review, describing the included studies, interpreting results and writing up the discussion and conclusion.

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"Scapular muscle exercises following neck dissection surgery for head and neck cancer: A comparative electromyographic study"

I, Pauline E. Chiarelli, attest that Research Higher Degree candidate Aoife McGarvey contributed to the listed publication by assisting with study methodology, collection of data, interpreting results and writing up the discussion and conclusion.

Pauline E. Chiarelli Date 3.9.14

I, Peter G. Osmotherly, attest that Research Higher Degree candidate Aoife McGarvey contributed to the listed publication by assisting with study methodology, collection of data, interpreting results and writing up the discussion and conclusion.

Peter G. Osmotherly Date 4.9.2014

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" Impact of neck dissection on scapular muscle function: A case-controlled electromyographic study"

I, Pauline E. Chiarelli, attest that Research Higher Degree candidate Aoife McGarvey contributed to the listed publication by assisting with study methodology, collection of data, interpreting results and writing up the discussion and conclusion.

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" Maximizing shoulder function after accessory nerve injury and neck dissection surgery: A multicentre randomized controlled trial"

I, Pauline E. Chiarelli, attest that Research Higher Degree candidate Aoife McGarvey contributed to the listed publication by developing the intervention and control protocols, being an intervention group physiotherapist, assisting with selection of outcome measures, interpreting results and writing up the discussion and conclusion.

Pauline E. Chiarelli Date 3.9.14

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Gary R. Hoffman Date 4.9.2014

Faculty Assistant Dean (Research Training) Date

" Intra-operative monitoring of the spinal accessory nerve: a systematic review"

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Peer reviewed publications arising from this thesis

McGarvey, A., Osmotherly, P., Hoffman, G., Chiarelli, P. Intra-operative monitoring of the spinal accessory nerve: a systematic review. *The Journal of Laryngology and Otology* 2014; 128:746-751

McGarvey, A., Osmotherly, P., Hoffman, G., Chiarelli, P. Maximizing shoulder function after accessory nerve injury and neck dissection surgery: A multicenter randomized controlled trial. *Head and Neck*. Published online 11 July 2014 DOI 10.1002/HED

McGarvey, A., Osmotherly, P., Hoffman, G., Chiarelli, P. Facial lymphoedema following treatment for head and neck cancer: impact on patients, and beliefs of health professionals. *European Journal of Cancer Care* 2014; 23(3): 317-327

McGarvey, A., Osmotherly, P., Hoffman, G., Chiarelli, P. Impact of neck dissection on scapular muscle function: A case controlled EMG study. *Archives of Physical Medicine and Rehabilitation* 2013; 94:113-119

McGarvey, A., Osmotherly, P., Hoffman, G., Chiarelli, P. The effectiveness of scapular muscle exercises following neck dissection surgery for head and neck cancer. A case controlled EMG study. *Physical Therapy* 2013; 93(6): 786-798

McGarvey, A., Osmotherly, P., Hoffman, G., Chiarelli, P. Physiotherapy for Accessory Nerve Shoulder Dysfunction: a literature review. *Head and Neck* 2011; 33(2): 274-280

Awards

2013 – Australia and New Zealand Head and Neck Cancer Society Annual Scientific Meeting Allied Health Award

2013 – University of Newcastle School of Health Sciences, Faculty of Health and Medicine. Best Research Higher Degree Publication

Conference Abstracts arising from this thesis

1. **McGarvey, A**., Osmotherly, P., Hoffman, G., Chiarelli, P. "Maximising shoulder function after accessory nerve injury and neck dissection surgery: A multicentre randomised controlled trial". Final results presented. Australian Physiotherapy Association Conference, Melbourne. October 2013.

2. **McGarvey, A**., Osmotherly, P., Hoffman, G., Chiarelli, P. "Scapular muscle exercises following neck dissection surgery for head and neck cancer. A comparative electromyographic study". Australian Physiotherapy Association Conference, Melbourne. October 2013.

3. **McGarvey, A**., Osmotherly, P., Hoffman, G., Chiarelli, P. "Maximising shoulder function after accessory nerve injury and neck dissection surgery: A multicentre randomised controlled trial" . Final results presented. Australia and New Zealand Head and Neck Cancer Society Annual Scientific Meeting, Melbourne. August 2013.

4. **McGarvey, A. (Invited speaker):** "Physiotherapy following neck management: A clinician perspective". Australia and New Zealand Head and Neck Cancer Society Annual Scientific Meeting, Melbourne. August 2013.

5. **McGarvey, A**., Osmotherly, P., Hoffman, G., Chiarelli, P. "Impact of neck dissection on scapular muscle function". Australia and New Zealand Head and Neck Society Annual Scientific Meeting, Brisbane. October 2012.

6. **McGarvey, A**., Osmotherly, P., Hoffman, G., Chiarelli, P. "Facial lymphoedema following treatment for head and neck cancer". Poster presentation. Australia and New Zealand Head and Neck Society Annual Scientific Meeting, Brisbane. October 2012.

7. **McGarvey, A. (Invited speaker):** "Pain following head and neck surgery". Royal Australasian College of Surgeons Annual Scientific Meeting, Kuala Lumpar, Malaysia. May 2012.

8. **McGarvey, A. (Invited speaker)**, Osmotherly, P., Hoffman, G., Chiarelli, P. "Maximising shoulder function after accessory nerve injury and neck dissection surgery: A multicentre randomised controlled trial". Interim study results presented. Tri Society Head and Neck Cancer Society Annual Scientific Meeting, Singapore. September 2011.

9. **McGarvey, A**., Osmotherly, P., Hoffman, G., Chiarelli, P. "Physiotherapy for Accessory Nerve Shoulder Dysfunction: a literature review". Australia and New Zealand Head and Neck Society Annual Scientific Meeting, Sydney. September 2010.

10. **McGarvey, A**., Osmotherly, P., Hoffman, G., Chiarelli, P. "Maximising shoulder function after accessory nerve injury and neck dissection surgery: A multicenter randomised controlled trial". Aims and methodology presented. Australia and New Zealand Head and Neck Society Annual Scientific Meeting, Sydney. September 2010.

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Abstract

The management of head and neck cancer is complex and challenging. Treatment frequently results in physical morbidity, such as shoulder pain and dysfunction, and facial lymphoedema. Neck dissection surgery, involving lymph node removal, is the most common treatment for head and neck cancer. Intra-operatively, the accessory nerve can become injured, even when it remains macroscopically intact, causing reduced trapezius muscle activity and weakness. Shoulder pain and dysfunction ensues, impacting on quality of life and function. Facial lymphoedema can result from the surgical removal of cervical lymph nodes and radiation therapy.

The primary aim of this thesis was to investigate accessory nerve injury related to neck dissection surgery, and the effectiveness of a biomechanically specific physiotherapy intervention compared to a control group. The secondary aim was to explore the effects of facial lymphoedema on patients, and the understanding of and management of the condition by treating health professionals.

The qualitative facial lymphoedema study consisted of interviews of both patients with secondary facial lymphoedema as a result of treatment of head and neck cancer, and treating health professionals. The main effect of the condition experienced by patients concerned appearance and body image. The understanding of interviewed health professionals regarding the condition was found to be similar to the patient experience, however patients experiencing facial lymphoedema were generally not referred to physiotherapy. Treating health professionals need to routinely screen for any potential negative psychological and physical effects of facial lymphoedema, and affected patients referred to physiotherapy if required.

Our literature review found that little evidence exists pertaining to the effectiveness of physiotherapy on accessory nerve shoulder dysfunction after neck dissection surgery exists, with only one previous randomised controlled study published. We then undertook a case control electromyography study, to investigate any scapular muscle activity differences following neck dissection surgery in patients with clinical signs of

accessory nerve injury. The upper trapezius and middle trapezius muscles of patients' operated side were found to have significantly less muscle activity than both a healthy matched control group (p<=0.00), and their non-operated side (p =0.001). There was also significantly less electromyographic activity in the upper trapezius of the non-operated side compared with the healthy matched control group (p =0.031). A further comparative electromyography study, investigating scapular muscle activity during specific scapular strengthening exercises, found that overhead strengthening exercises were associated with higher levels of muscle activity. Scapular muscle activity findings from these innovative studies have provided crucial information to maximise the specificity of scapular muscle rehabilitation in this patient population, which then underpinned the development of a specific, graded physiotherapy intervention protocol.

The major study described in this thesis was a blinded, multicentre randomised controlled trial (RCT) to investigate the short and long term effect of progressive scapular strengthening exercises on shoulder pain and dysfunction, compared to usual care in Australia. Per-protocol analysis on 52 participants /53 shoulders demonstrated that the intervention group had statistically significantly higher active shoulder abduction at 3 months compared to the control group (+26.6°; 95% confidence interval [CI] 7.28 to 45.95; p= 0.007). No significant differences were found between groups for the questionnaires assessing shoulder pain, function and region specific quality of life. At the 6 and 12-month follow-ups, there were no statistical differences between groups. This may reflect either a plateauing of the effect of the intervention in the long term, or the number of participants lost to follow-up. The RCT provided evidence that a progressive scapular strengthening program is more effective than usual care, for patients with accessory nerve injury after neck dissection surgery, that need to rapidly improve their active shoulder abduction.

The second literature review involved the use of, and efficacy for, intra-operative accessory nerve monitoring. It found that there is minimal evidence for its effectiveness in either minimising accessory nerve injury, or as a predictor of shoulder morbidity.

The studies contained in this thesis have provided novel insights which may improve both the multidisciplinary team management, and physiotherapy management, of patients affected with accessory nerve shoulder dysfunction and facial lymphoedema following head and neck cancer treatment. Further studies are required to investigate the effects of physiotherapy intervention in the long-term for accessory nerve shoulder dysfunction, the efficacy of intra-operative accessory nerve monitoring during neck dissection, and management of facial lymphoedema.