CHAPTER 5

Discussion

This study has investigated thickness of the lower trapezius muscle at rest at 0° and 120° and during contraction at 120° of shoulder abduction using ultrasound imaging in patients with neck pain compared to healthy controls. The results partially support our hypotheses. The first hypothesis of this study was that thickness of the lower trapezius at rest at 0° and 120° of shoulder abduction would be less in patients with neck pain than controls. Our findings found that the neck pain group had smaller thickness of the lower trapezius muscle than the control group on the right side at rest at 0° of shoulder abduction only. There were no differences in the thickness at rest at 120° of shoulder abduction and during contraction. The second hypothesis was that thickness of the lower trapezius during contraction at 120° of shoulder abduction would be less in patients with neck pain compared to controls. The results demonstrated no differences in thickness of the lower trapezius muscle during contraction between the neck pain and control groups. Furthermore, the results of this study found symmetry in the lower trapezius muscle thickness between the left and right sides in all conditions in patients with neck pain but bilateral asymmetry in healthy controls.

5.1 Thickness of the lower trapezius muscle

This study demonstrated decreased thickness of the lower trapezius muscle at rest (0° shoulder abduction) on the painful side in patients with neck pain compared to controls. There was no difference in the lower trapezius muscle thickness at rest and during contraction of 120° shoulder abduction between the neck pain and control groups. However, the average of the lower trapezius muscle thickness on the painful side during contraction were likely to be less in patients with neck pain, but the difference between groups did not reach a statistical significance. These results are partially supported by a previous study conducted by O'sullivan et al (16). They investigated percentage thickness change of the lower trapezius muscle during isometric

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contraction between patients with and without shoulder pain, and between painful and non-painful sides. They demonstrated no differences between sides and groups in resting and contracted muscle thickness at 0°, 90°, and 120° of shoulder abduction in patients with unilateral shoulder pain. The percentage thickness changes during contraction at 120° were higher in the painful side than the non-painful side however the difference was not statistically significant. The discrepancy between O'sullivan et al's and our results may be due to variations between individuals and tasks. Recently, Hodges and Tucker (74) have proposed a new theory to explain the motor change in pain. Responses of muscle activity are likely to vary according to muscles and tasks. There are also various options of the nervous system to achieve the protection from pain or injury. Thus decrease or increased muscle activity can be associated with pain. The decreased thickness of the lower trapezius muscle on the painful side in this study may be due to changes in muscle activity with pain (75). Alternatively, it has been suggested that impaired function of the scapular control can produce compressive force on the cervical spine (50). Thus the thickness that decreased in the painful side may be associated with poor scapular control.

On the other hand, the results of this study are consistent to previous studies which demonstrated impairment of the lower trapezius muscle using EMG in patients with neck pain (5, 6). Wegner et al (5) reported decrease in EMG activity of the lower trapezius muscle in patients with neck pain during the typing task compared to controls. Zakharova-Luneva et al (6) also found that patients with neck pain had greater EMG activity of the lower trapezius muscle at 20%, 50% and 100% maximum voluntary contraction (MVC) than controls for the abduction and external rotation conditions.

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As mentioned earlier, activity of muscle can vary between tasks. Thus this may be one reason for no difference in the lower trapezius thickness during contraction but at rest at 0° of shoulder abduction in this study. Another reason may be associated with level of muscle contraction tested in this study. Hodges et al (57) investigated thickness of several human muscles using ultrasound imaging during isometric contraction (0-100% maximum voluntary contraction) and found that only low levels of muscle activity (< 30% MVC) could be detected by ultrasound imaging. Ultrasound measure

of thickness could not differentiate between moderated to strong contraction. In this study, participant's arm was placed at abduction angle of 120° and then we asked the participant to lift his/her arm off the bed and hold for 5-10 seconds. This may exceed low level of muscle contraction. However, force and EMG muscle activity were not measured, which is a study limitation. In addition, lifting arm at abduction angle of 120° activated not only the lower part of the trapezius muscle but also the upper and middle parts (76). Thus, different patterns of muscle activation may be another possible factor. Increase in thickness during contraction may indicate muscle contraction which is useful for clinicians training lower trapezius muscle. Although there was no significant difference in thickness during contraction between groups, it was noted that the neck pain group had a reduction in muscle contraction of the lower trapezius muscle in the right side but not the left side compared to the control. This may suggest that the lower trapezius muscle contraction is influenced by pain in the neck.

Decrease in the lower trapezius thickness during contraction was observed in some cases, particularly in the control group. We have noticed on the screen during contraction that muscle in those was pulled medially. The imaging site (3 cm lateral to spinous process at T8) may be relatively far from the spinous process, accounting for a thinner portion of the thickness measured. Furthermore, only thickness was imaged in this study. Hides et al (77) previously found lateral sliding of muscle-fascia junction of transverses abdominis (TrA) muscle in healthy controls using ultrasound imaging during a drawing-in of the abdominal wall. Gildea et al (78) also reported that small degree of TrA lateral sliding in patients with low back pain compared to controls but there was no difference in TrA thickness between the two groups. Thus, sliding patterns of muscle-fascia junction may also be associated with changes in thickness of the lower trapezius muscle between the neck pain and control group. Further research in this area is still required.

In addition, the results of this study demonstrated identical thickness of the lower trapezius muscle between the right (painful) side and left (non-painful side) side in patients with neck pain whereas the control group had a greater thickness in the dominant side than the non-dominant side. These results support other (79) and our

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previous findings (unpublished data). Wannaprom et al (79) investigated thickness of the lower trapezius muscle between the dominant and non-dominant arms in healthy controls and found thickness of the dominant arm was greater than the non-dominant-arm. Likewise, Yoshizaki et al (56) reported that dominant arm had a greater percent integrated electromyography (%IEMG) of the lower trapezius than non-dominant arm in healthy controls. The lower trapezius muscle identical in size in patients with unilateral neck pain may be due to atrophy of muscle on the side ipsilateral to pain.

From the results of this study, it may indicate that ultrasound imaging can be used to detect thickness of the lower trapezius muscle at rest (0° of shoulder abduction) in patients with neck pain. To detect impairment of the lower trapezius muscle using ultrasound during isometric contraction, further research is warranted.

5.2 Clinical implications and limitations

The study confirms impairment of the lower trapezius muscle in patients with neck pain. It also provides further information about the use of ultrasound imaging to detect thickness of the lower trapezius in patients with neck pain. The results suggest atrophy of the lower trapezius muscle in patients with neck pain. However, the evidence of decreased thickness of the lower trapezius muscle was observed at rest but not during contraction. Evaluation of thickness of the lower trapezius muscle using ultrasound may assist clinicians to determine dysfunction of the lower trapezius muscle associated with neck pain in clinics. Also, clinicians should also be aware that size of muscle is not necessary to be symmetrical. It may depend on several factors such as pain side, hand dominance and functional characteristics of muscles.

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There are some limitations in this study. The sample size of this study was small. The statistical power levels of the non-significant results (at rest and during contraction at 120° conditions) were less than 0.8, indicating inadequate power to detect statistical significance. Only the lower part of the trapezius muscle was measured as one transducer could be used at one time. Simultaneous recording of muscle activity and force were also not made. Moreover, it was not possible to control scapula during contraction between individuals. There may also be different patterns of muscle

activation. Additionally, the task for muscle contraction was tested according to anatomical structure but not be part of functional activity. Muscle fatigue may also be occurred during contraction test. Patients with neck pain in this study had mild intensity and disability of pain and pain on the dominant side. Thus the results may not be directly applied to those with higher level of pain and/or having pain on the non-dominant side.

5.3 Future directions in research

The results of this study demonstrated decreased thickness of the lower trapezius muscle at 0° of shoulder abduction in patients who had unilateral neck pain on the same side as their dominant hand. Future research using different ways to detect dysfunction of the lower trapezius muscle during contraction is required. Sliding pattern of muscle should also be addressed. Investigation of simultaneous ultrasound imaging, EMG activity and force would help to provide better understanding of relationships between thickness, muscle activation and strength of the lower trapezius muscle. Testing position should also be addressed. Further research should investigate level of the cervical joint that effect on thickness of the lower trapezius muscle. Additionally, future research should investigate thickness of the lower trapezius muscle in relative to other muscles as well as during functional tasks. Moreover, a clinical trial study investigating the effectiveness of specific exercise training on the lower trapezius muscle in patients with neck pain would also assist in supporting the contribution of the lower trapezius muscle to pain in the cervical spine.

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5.4 Conclusion

The results of this study demonstrated that patients with neck pain had smaller thickness of the lower trapezius muscle at rest 0° of shoulder abduction on the painful side compared to control but not at rest and during contraction of 120° shoulder abduction. This suggests that impairment of the lower trapezius muscle at rest 0° of shoulder abduction can be detected by ultrasound imaging. However investigation of size of the lower trapezius muscle during contraction is still warranted. Future research is also required to identify pattern of the lower trapezius muscle during functional

activity in patients with neck pain. This will provide better understanding of the association of the lower trapezius muscle and neck pain.

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