CHAPTER 5

Discussion

This study has investigated thickness of the lower trapezius muscle using ultrasound imaging in individuals with neck pain compared to those without neck pain. The relationships of the lower trapezius muscle thickness and neck pain characteristics (intensity of pain and neck pain and disability scores) were also determined in the study. The results of this study suggested that the thickness of the lower trapezius muscle was affected by pain. Discussion in this chapter will begin with an overview of the results according to the study hypotheses. It will then focus on implications of the change in size of the lower trapezius muscle thickness with neck pain. Limitations and direction for the future research will also be discussed.

5.1 Overview of study results

The first hypothesis of the study was that the lower trapezius muscle thickness on the ipsilateral side of pain (right side) would be less than that in the contralateral side (left side) in patients with chronic unilateral neck pain. The result demonstrated no differences in the thickness of the lower trapezius muscle between both sides in patients with chronic unilateral neck pain, which rejected the first hypothesis. The second hypothesis was that the thickness of the lower trapezius muscle would be reduced in patients with chronic unilateral neck pain compared to healthy controls. Our findings supported this hypothesis. There was a decrease in thickness of the lower trapezius muscle ipsilateral to pain (right side) in patients with chronic unilateral neck pain compared to the control group. Lastly, we hypothesized that there would be correlations between the lower trapezius muscle thickness and pain intensity (VAS), and neck pain and disability (NDI) scores. The results of the study rejected this hypothesis. No relationships between the lower trapezius muscle thickness and the VAS and NDI scores were found.

5.2 Lower trapezius muscle thickness

The results of this study demonstrated smaller thickness of the lower trapezius muscle on the right side (ipsilateral to the side of pain) in patients with neck pain compared to persons without neck pain. There was no difference in the lower trapezius muscle thickness between the contralateral side in the neck pain group and the left side in the control group. The results may suggest that neck pain have an impact on the thickness of the lower trapezius muscle. Also, the mean difference of the lower trapezius muscle thickness on the right side between the neck pain and control groups was larger than 95% of the standard error of measurement (SEM) (Appendix C2), which may indicate a true difference. Additionally, the results showed that the lower trapezius muscle thickness on the ipsilateral (right) side was similar to that on the contralateral (left) side in patients with chronic unilateral neck pain, which is in contrast to the control group. The control group had greater thickness of the lower trapezius muscle in the right (dominant) side than the left (non-dominant) side. No difference in the lower trapezius muscle thickness between the painful and non-painful sides in patients with neck pain may be surprising but is consistent with a previous study which investigated lower trapezius muscle thickness in patients with mild shoulder pain using ultrasound imaging (100). O'Sullivan et al (100) found no significant differences in trapezius muscle resting thickness between the painful and non-painful shoulder. Conversely, other studies of spinal pain have previously demonstrated side differences in muscle thickness in patients with unilateral pain (24, 102-104). For example, Rezasoltani et al (24) found the semispinalis capitis muscle thickness ipsilateral to pain side was smaller than the contralateral side in patient with unilateral posterior neck pain. Side to side differences in muscle thickness between the previous and our findings may be due to a factor of hand dominance other than other factors such as gender, age and body mass index (105-107). Yoshizaki et al (73) investigated percent integrated electromyography (% IEMG) of the shoulder muscles in healthy individuals and showed a higher % IEMG of the lower trapezius of the dominant arm than the non-dominant arm. In this study, both neck pain patients and controls were right-handed. Thus it is possible that the lower trapezius muscle thickness on the painful (right) side was reduced, allowing a consequence of similar thickness between the painful and non-painful sides in patients with unilateral neck pain. However, this may be different to

core stability muscles. Springer et al (108) investigated thickness of transversus abdominis muscle (TrA) in persons with and without low back pain and showed no influence of hand dominance but gender and body mass index on the TrA muscle thickness. Additionally, symmetry in the TrA muscle thickness was found in those without back pain whereas asymmetry in the TrA muscle thickness was found in those with low back pain.

There are several possible reasons which may explain decreased thickness of the lower trapezius muscle in patients with chronic unilateral neck pain. These include a model of pain adaptation, poor scapular muscle control and muscle disuse atrophy or inactivity. With respect to 'pain adaptation' (109), activity of the lower trapezius muscle for stabilizing and controlling scapula and scapulohumeral joint may be inhibited by pain in the cervical spine. Recently, Hodges et al (110) proposed new theory for the motor adaptation to pain, which one of key elements was that redistribution of activity within and between muscles changes mechanical behavior. There is evidence suggesting that pain in the cervical spine is associated with a change in activation of the lower trapezius muscle (10). Many patients also often complain of neck pain with overhead activities. Thus decreased thickness of the lower trapezius muscle on the painful side may be associated with redistribution of activity of the cervicoscapular muscles. Another key element proposed by Hodges et al (110) was that the motor adaptation may consequently lead to increased load, decreased movement, decreased variability or other changes. Thus, pain in the neck may lead to further problem as a result of poor scapular control and decreased thickness of the lower trapezius muscle observed on the painful side.

On the other hand, impaired function of the scapular stability muscle may induce load or compressive forces on the cervical spine (111). It is well-known that the couple force of trapezius (upper and lower parts) and serratus anterior muscles are required to upwardly rotate the scapular for maintaining the normal scapulohumeral rhythm (17, 69). Imbalance of couple forces can lead to altered scapular position which in turn causes shoulder impingement and cervical pain. Cools et al (112) investigated trapezius muscle activity between overhead athletes with impingement symptoms and non-injured athletes. The results showed increased EMG activity in upper trapezius muscle, decreased EMG activity in lower trapezius muscle and muscle imbalance on the injured

side for upper/lower trapezius during abduction in the patient group. Likewise, Wegner et al (15) investigated activity of the three portions of the trapezius muscles in patients with neck pain with poor scapular posture compared to those without neck pain during the performance of a functional typing task. They demonstrated that patients with neck pain had greater EMG activity in the middle trapezius and lesser EMG activity in the lower trapezius than the control group. Thus decreased thickness of the lower trapezius muscle observed in our patients with neck pain may be associated with dysfunction of scapular control.

Reduced thickness of the lower trapezius muscle in chronic unilateral neck pain patients may also result from muscle disuse atrophy or inactivity. Neck pain is often aggravated by arm movement including reaching overhead (113). It has been suggested that patients with neck pain had pain-related fear to neck motion (44). In Linstroem's study (114) the authors investigated fear of movement using fear-avoidance beliefs questionnaire (FABQ) contributing to maximum voluntary contraction (MVC) of neck muscles between patients with neck pain and healthy controls. The result showed that average MVC was significantly lower in patients with neck pain compared with controls. There were moderate correlations between maximum voluntary force and fear of movement and aspects of neck disability. Falla et al also found less activity of the upper trapezius activity on the right side during a functional task in patients with neck pain (115). Thus changes in motor activity associated with neck pain (116) result in changes in muscle size.

5.3 Correlation features

The results of this study showed no relationships between the thickness of the lower trapezius muscle and the NDI and VAS scores. This may suggest that the thickness of the lower trapezius muscle was not dependent on severity and intensity of neck pain. In contrast, Javanshir et al (117) investigated cross sectional area (CSA) of bilateral longus colli muscles in patients with bilateral chronic neck pain using ultrasound imaging. The results showed a negative relationship between reduced CSA and NDI scores (r = - 0.449, p = 0.046). The average NDI and VAS scores in this study was mild (9 of 50 and 4.8 of 10, respectively) whereas the average of NDI and VAS scores in Javanshir et al's study was severe (33 of 50 and 5.1 of 10, respectively). Thus,

discrepancies between Javanshir et al's and our studies may be due to features of neck pain (severity and intensity). However, it has been suggest that a sample size of 50 is required to detect correlation coefficients (96). Thus, no correlations between the thickness of the lower trapezius muscle and NDI and VAS scores in this study may be due to small sample.

5.4 Limitations of the study

Some limitations should be addressed in the study. It has been suggested that changes in scapular orientation during upper limb activities can affect function of the trapezius muscles (118). In our study, the scapular posture was screened based on clinical observation and only marked scapular abnormality was excluded. It is difficult to set scapular position and movement on the same position while performing the ultrasound imaging. As one transducer can be used, the lower trapezius muscle was only measured in the study. Severity and intensity of pain in the neck pain group was also mild. Additionally, the sample size was relatively small. The statistical power levels of the non-significant results were less than 0.8, indicating inadequate power to detect statistical significance.

5.5 Clinical implication

The results of this study provide information regarding the thickness of the lower trapezius muscle in patients with chronic unilateral neck pain. Assessment of size of the lower trapezius muscle using ultrasound imaging may be easily used to detect dysfunction of the lower trapezius muscle in both clinical and research setting. However, researchers and clinicians should be aware identical thickness of the lower trapezius muscle between sides is not an indicator of healthy controls. Additionally, hand dominance and side of pain should be considered when investigating size of the lower trapezius muscle.

5.6 Future direction research

Investigation should be undertaken to further identify size of the lower trapezius muscle during contraction in patients with chronic unilateral neck pain. Further research should also determine correlations of thickness of the lower trapezius muscle and muscle activity and force. Relationships between the lower trapezius muscle thickness and the neck disability and intensity should be investigated in a larger population with neck pain. It is well known that muscle size is affected by age (119), thus further investigation should determine influence of age on the lower trapezius muscle thickness in either healthy or neck pain populations. Additionally, further clinical trials are needed to determine the effectiveness of specific exercise training program of the lower trapezius muscle in patients with chronic neck pain. These would assist in providing a better understanding of contribution of the lower trapezius muscle dysfunction to neck pain.

5.7 Conclusion

The results of this study demonstrated smaller thickness of the lower trapezius muscle on the painful side in patients with chronic unilateral neck pain compared to the control group. The thickness of the lower trapezius muscle between the painful and non-painful sides was similar in patients with chronic unilateral neck pain. There were no relationships between the lower trapezius thickness and pain severity, and neck disability. The presence of decreased thickness of the lower trapezius muscle may be explained by a model of pain adaptation, poor muscle control and muscle disuse atrophy. From the study results, dysfunction of the lower trapezius muscle in patients with chronic unilateral neck pain can be assessed using ultrasound imaging. However, the influence of side of pain and hand dominance must be considered when investigating size of the lower trapezius muscle.