

## CHAPTER 6

### Discussion and conclusion

This research aimed to provide a better understanding of the contribution of cervical musculature, sensory features and management of headache in the elderly population. A previous study has shown that alterations of the muscular and sensory systems with increasing age may result in changes in the nature of headaches in this age group. Additionally, cervical musculoskeletal impairment is a common feature in elders with headache, and may implicate their treatment options. Such changes in the cervical musculature, sensory features and effectiveness of physiotherapy in elders with headache in the study will be discussed in the following sections.

#### **Study I: Structural changes of the cervical muscles in elder women with cervicogenic headache**

Cervical musculoskeletal impairments are common features in individuals with cervicogenic headache (6). There is some suggestion that the structure (size and fat deposit) of the neck muscle may factor in or contribute to these impairments. However, little is known about the size of and magnitude of fatty deposition in the cervical muscles in older persons with cervicogenic headache. Magnetic resonance imaging (MRI) was used in this study because it is considered the gold standard for quantifying muscle atrophy and fatty infiltration (123, 166). Additionally, magnetic resonance spectroscopy (MRS) measuring can be used to some extent to measure the concentration of lipid (lipid content) within the muscle using the same MRI application (129). It has been found that if chronic neck pain patients had atrophy in the deep extensor muscles (123, 177) and increased fatty infiltration in the cervical muscles, greater changes were present in the deep muscles (165). Thus, in the first study, we examined changes in the entire cervical muscle features, including morphology, fatty infiltration and lipid content in elders with cervicogenic headache. The hypotheses of

this study were that the presence of cervical muscle atrophy and an increase in fat structure (fatty infiltration and lipid content) would be present in those elders with cervicogenic headache compared to controls. These hypotheses were partially supported. The study found that elders with cervicogenic headache demonstrated atrophy of the deep cervical extensor muscles and increased fatty infiltration in the cervical extensor muscles, but it did not find any difference in the lipid content of cervical extensor muscles between elders with and without cervicogenic headache. These findings in the present study of atrophy and increased fatty infiltration in the cervical extensor muscles in older persons with cervicogenic headache compared to controls may possibly be due to inflammatory mechanisms or avoidance to use the muscle due to pain (178). Impaired performance of the cervical flexor synergy is unique to cervicogenic headache patients (6). Surprisingly, the present study did not find any difference in cervical flexor structures in elders with cervicogenic headache. The reason for this is still unknown and requires further investigation. As for the lipid content, there failed to be a significant difference between elders with and without cervicogenic headache. Since the small area of cervical muscle is a possible explanation for this finding, the alteration in lipid content for cervical extensor muscles in cervicogenic headache is still in need of further investigation. Therefore, in conclusion, this study provides preliminary evidence towards quantifying muscle atrophy with increased fatty infiltration in the cervical muscles in older women with cervicogenic headache.

## **Study II: Localized pain hypersensitivity in older women with cervicogenic headache: A quantitative sensory testing study**

Cervicogenic headache is a pain that originates from structures innervated by the upper cervical nerve root (103, 230). The increased pain sensitivity of the peripheral nerve fibers could reflect peripheral sensitization (191). There is available evidence within the general population suggesting increases in pain sensitivity over the upper cervical nerve roots and joints in cervical headache (110, 145, 146). Thus, in the second study, we hypothesized that sensory hypersensitivity at the periphery would be found in elders with cervicogenic headache, as has been found in general populations with cervicogenic headache. This hypothesis was supported. The results demonstrated that

older persons with cervicogenic headache had decreased pain thresholds to cold stimuli at the upper cervical region, but the study did not find differences in pressure and heat pain thresholds at any sites between older persons with and without cervicogenic headache. It changes the cervical segment supporting the proposed mechanism of cervicogenic headache referral, from the cervical spine to the head. Although peripheral sensitization in cervicogenic headache may appear to be consistent among studies, reduced pain thresholds and increased responsiveness of nociceptors may be attributed to several factors, including the type of stimulus (76). Age changes in the sensory system (peripheral and central nervous system) may affect pain sensitivity (64, 65). Decreased pain thresholds to thermal stimuli in older adults with cervicogenic headache may be associated with age-related changes in the nervous system. Evidence suggests that age associated alteration of A delta nerve activity may cause disinhibition of C fiber activity, resulting in increased pain sensitivity (208). Alternatively, this study supports the previous finding that central sensitization may not be a feature of older adults with cervicogenic headache. The results did not find any difference in pain ratings to heat stimuli at any sites in older persons with cervicogenic headache compared to those without headache. Additionally, psychological factors influence pain sensitivity, however, this study showed that pain sensitivity is independent from the depression score, suggesting older persons with cervicogenic headache have learned to adapt or get used to the pain. Thus, this study demonstrated localized pain sensitivity over the upper cervical region in older adults with cervicogenic headache. However, the pain sensitivity response likely depends on the type of noxious stimuli. There were no signs of central sensitization and psychological distress in older adults with cervicogenic headache.

### **Study III: Effectiveness of physiotherapy treatment in elders with frequent intermittent headache: A randomized controlled study**

Headache in the elderly becomes less typical and more often associated with neck pain in the elderly population (1, 2). The previous study has demonstrated that cervical musculoskeletal impairments are not specific to cervicogenic origin, but other frequent headaches (i.e. migraine and tension-type headache) in the elderly population (5). This may suggest that physiotherapy treatment would have a beneficial effect for elders with

headache who have neck pain and concomitant cervical musculoskeletal dysfunction. The prior high quality study has revealed the effectiveness of spinal mobilization and therapeutic exercise for patients with neck dysfunction (15). Thus, in the third study, we investigated the effectiveness of physiotherapy treatment, specifically for elders with various types of headaches with associated neck pain and cervical musculoskeletal impairment. The hypothesis was that physiotherapy treatment would be more effective than usual care for reducing headache and neck symptoms in the elderly population. This hypothesis was supported. The results demonstrated significant reduction in headache frequency, duration and intensity, neck pain and neck disability, as well as medication for headache relief after 10 weeks of physiotherapy treatment, compared with usual care. There was also found to be an increase in cervical range of motion and treatment benefit in the physiotherapy groups compared with the usual care groups. Treatment of the neck provides benefit in older persons, regardless of headache, eligible headache associated with neck pain and CMD. This implicated CMD for playing an active role in the treatment of headache. Treatment for cervicogenic headache patients has been demonstrated to be effective for local treatment of the neck. Local treatment of the neck in the other primary headaches may benefit from treatment of the peripheral source of the nociceptive. Thus, we would recommend using physiotherapy treatment in older persons with frequent intermittent headache associated with neck pain and CMD as part of a multimodal headache intervention strategy to improve headache and neck symptoms in the elderly population who may not respond well to medication.

Reduction of pain is essential in order to evaluate the effectiveness of treatment. Evidence suggests that pain thresholds are useful for providing objective evidence of pain relief in clinical trials, as previously demonstrated in patients with chronic neck pain (231). Additionally, a recent study demonstrated that specific exercises modified the morphology of cervical muscles in patients with chronic neck pain (182). It is useful to evaluate the effectiveness of physiotherapy treatment in the aspect of morphological changes in cervical extensor muscles and also the additive objective informative of pain using pain thresholds in elders with headache. However, the current study has demonstrated the effectiveness of physiotherapy in elders with intermittent headache, but did not determine pain relief objectively using pain thresholds as well as the

morphological changes in cervical muscles after treatment. The reason for this is that all participants in the cervical musculature and sensory features study were not recruited into a randomized controlled trial study and this is the first study of investigate changes in the cervical muscles and pain sensitivity in elder populations with headache. Further research is needed to determine whether physiotherapy treatment can modify morphological changes of cervical extensor muscles and objectively evaluate the benefits of treatment for the relief of pain in elders with headache associated with neck pain and CMD.



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