


Neuromuscular changes in cervicogenic headache and implications for practice

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Headache

- Headache is a common complaint which only 10% of the population escape in their lifetimes
- The most common are the primary headaches of migraine and tension-type and the headache, secondary to cervical spine disorders, cervicogenic headache
- These headaches have great impact on public health and result in a substantial social and economic burden

Cervicogenic Headache

- Cervicogenic headache is generated by excitation of cervical nociceptors and may be associated with trauma or pathology in the cervical spine Sjaastad et al., 1983
- Most commonly pain originates from structures in the upper cervical region, however structures in the mid and lower regions of the cervical spine may also refer pain to the head Bovim et al., 1992; Biondi, 2000
- Referral of pain to the head is attributed to convergence of afferents from the upper cervical spinal roots with afferents in the descending tract of the trigeminal nerve (trigemino-cervical nucleus)

Cervicogenic Headache

- By this means, excitation of cervical nociceptors by trauma or pathology of structures such as the zygapophyseal joints, cervical muscles, or inter-vertebral disc is perceived as neck pain Bogduk, 1992; Jull et al., 1999; Jaeger, 1989; Jansen et al., 1989
- Pain can be experienced in the head and face consistent with the sensory receptive fields of the trigeminal nerve Bogduk, 2004
- Differential diagnosis of cervicogenic headache can be challenging due to symptomatic overlap with other intermittent headache types, e.g. migraine or tension-type headache

Differential Diagnosis

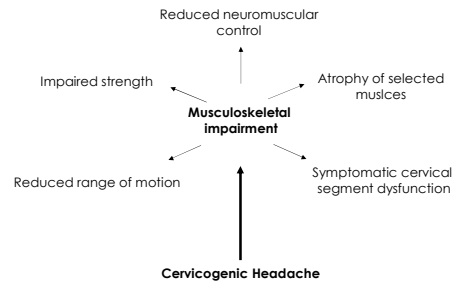
- Nevertheless, there are some distinguishing characteristics (Sjaastad et al., 1998; IHS 2004) which help to differentiate cervicogenic headache from other headache types including:
 - triggered by sustained neck postures or neck movements
 - pain spreading to the occipital region
 - tenderness in the suboccipital joint tissues
 - decreased cervical range of motion
 - unresponsiveness to typical headache medication
- A further characteristic which appears to be unique to cervicogenic headache is the presence of impaired cervical muscle function Bonnevicius & Sjaastad, 1996; Barton & Hayes, 1996; Jull et al., 1999; Dumas et al., 2001; Amiri et al., 2007; Jull et al., 2007; Zito et al., 2006.

- The notion that cervicogenic headache is associated with impaired motor function of the neck is not unexpected given that the source of nociception originates from structures in the cervical region and the knowledge of impaired neuromuscular control in people with neck pain Vernon et al., 1992; Jull, 2000; Falla et al., 2004; Jull et al., 2004; Ylinen et al., 2004; Mork & Westgaard, 2006; O'Leary et al., 2007

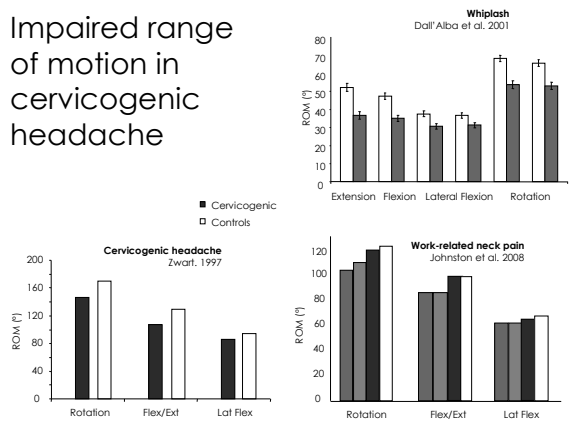
Outline

- Review evidence of impairment of function in people with cervicogenic headache
- Discuss the potential value of assessing neuro-muscular control to assist in the differential diagnosis of intermittent headaches
- Consider the value of rehabilitation of neuromuscular function for the treatment of cervicogenic headache

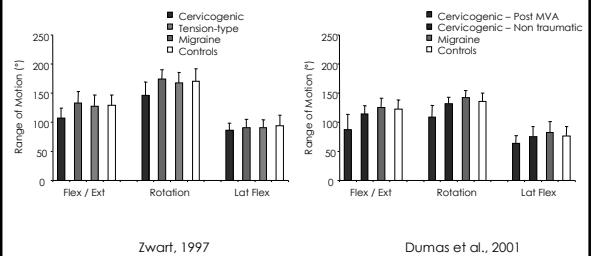
Musculoskeletal impairment in patients with cervicogenic headache



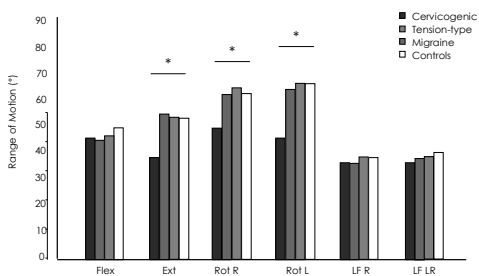
Impaired range of motion in cervicogenic headache



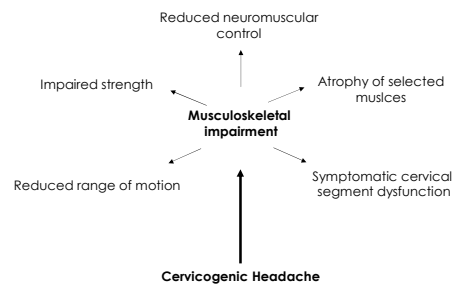
Impaired range of motion is unique to cervicogenic headache

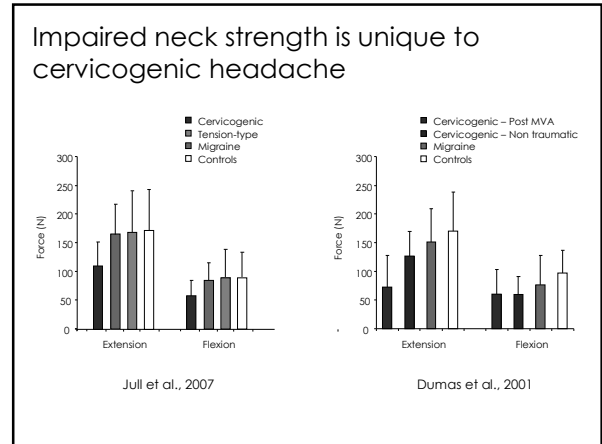
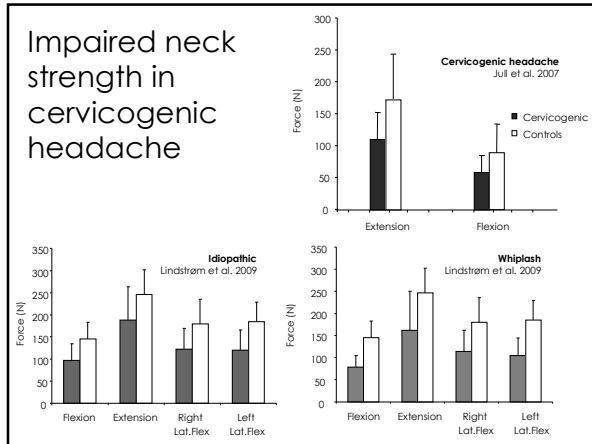


Cervical extension and rotation are most affected in cervicogenic headache

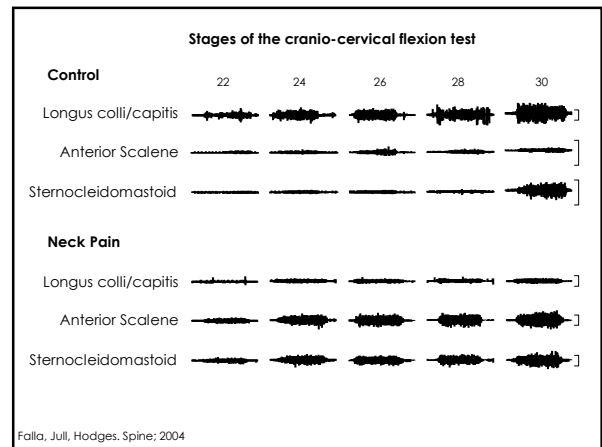
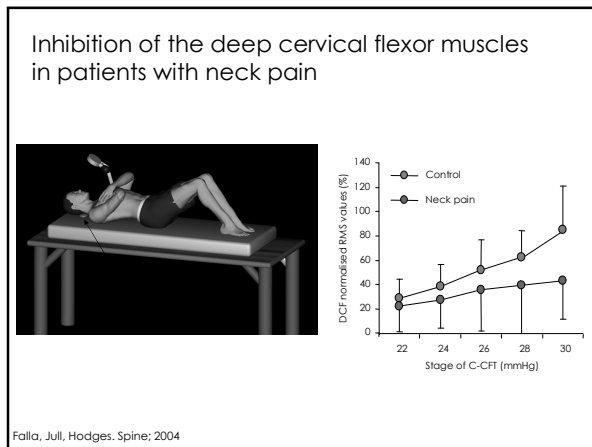
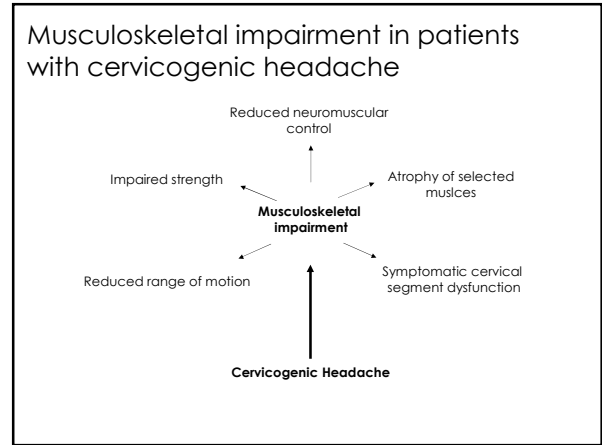


Musculoskeletal impairment in patients with cervicogenic headache

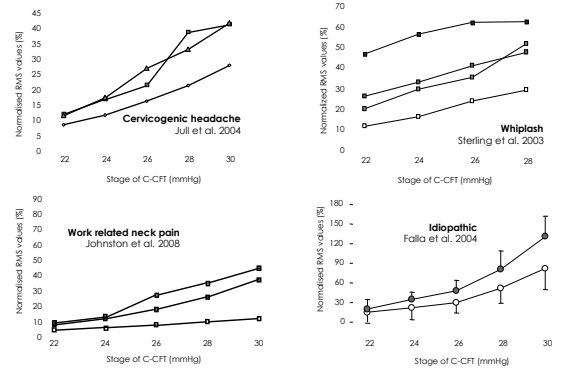




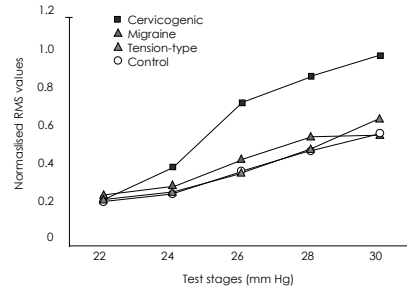
- In agreement with observations in people with neck pain, cervicogenic headache sufferers demonstrate deficits in the strength of their neck muscles (Watson & Trott, 1993; Dumas et al., 2001; Amiri et al., 2007; Jull et al., 2007)
- Some evidence suggests that neck extensor strength is more affected in cervicogenic headache originating from neck trauma following a motor vehicle accident (Dumas et al., 2001)
- The majority of studies indicate normal neck muscle strength in patients with migraine and tension-type headache (Dumas et al., 2001; Amiri et al., 2007; Jull et al., 2007; Fernandez-de-las-Penas et al., 2007)
- Additional evidence indicates that neck flexor endurance is limited in people with cervicogenic headache, a finding which was not observed in migraine or tension-type headache (Watson & Trott, 1993; Dumas et al., 2001)



Generic finding of changed neuromuscular control in neck pain patients

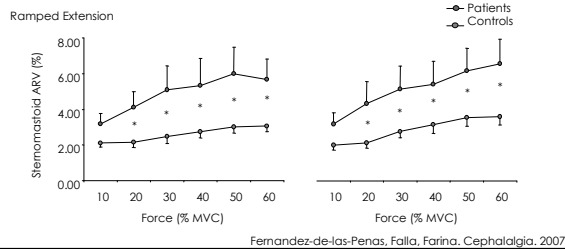


Impaired performance of the deep cervical flexors is unique to cervicogenic headache



Jull et al., 2007

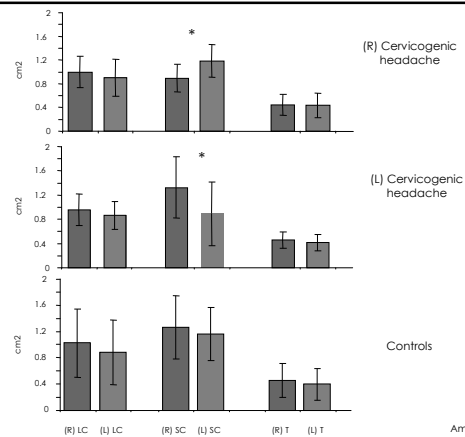
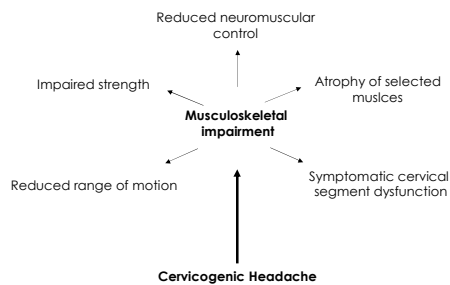
There have been some observations which suggest changed motor control in tension-type headache e.g. women with chronic tension-type headache displayed greater co-activation of cervical antagonist muscles during isometric cervical extension and flexion compared to healthy women



Fernandez-de-las-Penas, Falla, Farina, Cephalalgia, 2007

- However, increased co-activation of antagonist musculature may reflect avoidance behaviour which will affect muscle use, and may explain altered motor control in tension-type headache patients in the absence of trauma or pathology in the cervical spine Asmundson et al., 1999
- In support of this notion, elevated upper trapezius activity was found both in cervicogenic and tension-type headache patients during a stressful task suggesting that both patient groups react to a stressful situation in a similar way Bansevicus & Sjaastad, 1996; Bansevicius et al., 1999

Musculoskeletal impairment in patients with cervicogenic headache



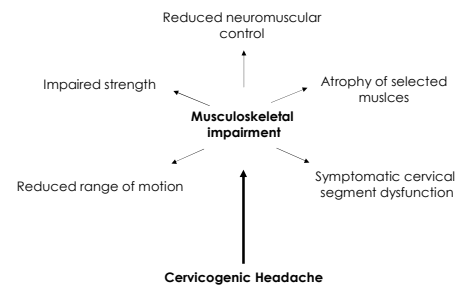
Amiri et al. 2004

- Atrophy of the semispinalis capitis muscle observed ipsilateral to the side of headache, but no evidence of atrophy for the longissimus capitis or trapezius muscles
- Selective atrophy of the semispinalis capitis was attributed to a localization of pain in the upper cervical segments and knowledge of the innervation of the semispinalis capitis, longissimus capitis and trapezius at this level
- That is, the semispinalis capitis in the upper cervical region is innervated by the dorsal rami of the upper cervical nerves Strandring, 2005
- On the contrary the upper trapezius is innervated by the accessory nerve and longissimus capitis by the dorsal rami of the lower cervical nerves Strandring, 2005

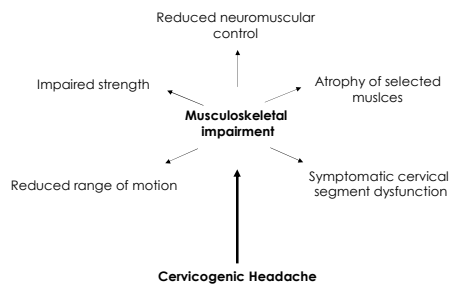
- In a recent study real-time diagnostic ultrasound imaging confirmed reduced cross sectional area of the semispinalis capitis measured at the level of the second cervical vertebrae on the symptomatic side in people with cervicogenic headache Jull et al., 2007
- No such atrophy was measured in association with migraine or tension-type headache as there were no differences in cross sectional areas between these and control subjects

- An observation in people with chronic neck pain, is atrophy and connective-tissue infiltration of the deep extensor muscles, notably, the rectus capitis minor / major and multifidus Hallgren et al., 1994; McParland et al., 1997; Elliott et al., 2006
- Future magnetic resonance imaging analyses in people with cervicogenic headache may further clarify the presence of a location-dependent muscle atrophy as the rectus capitis minor and major muscles are innervated solely by the dorsal ramus of C1 spinal nerve Strandring, 2005
- A recent study supported this hypothesis, albeit in single case of cervicogenic headache Fernandez-de-las-Penas et al., 2007

Musculoskeletal impairment in patients with cervicogenic headache



Musculoskeletal impairment in patients with cervicogenic headache



What is the value of musculoskeletal signs in differential diagnosis of headache types?

- Current clinical diagnostic criteria for CgH typically include unilateral headache without side shift, pain localized to the occipital, temporal or orbital regions, deep non throbbing pain, pain onset associated with awkward neck movement or sustained neck postures and restricted ROM Sjaastad et al., 1998; IHS, 2004
- However, there is considerable overlap in symptoms with migraine and tension-type headache - it would seem that no one clinical sign or symptom is sufficient to define patients with CgH
- Further quantitative measures which characterize CgH may assist clinicians to make a differential diagnosis avoiding the need for invasive diagnostic techniques
- The presence of impaired neuromuscular control is a feature which shows promising potential to assist in the differential diagnosis of headache

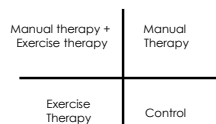
- In a recent study, various measures of muscle function were assessed in a headache cohort and control group
- Although differences were demonstrated in several measures, a discriminant function analysis revealed that the co-occurrence of reduced movement, impaired cervical muscle function (cranio-cervical flexion test) and palpable symptomatic upper cervical joint dysfunction were the strongest factors
- When these factors were used together for diagnosis, they distinguished cervicogenic headache from migraine, tension-type headaches and control subjects with 100% sensitivity and 94% specificity Jull et al., 2007

- The same features were also shown to distinguish cervicogenic headache as one of a multiple headache syndrome Amiri et al., 2007
- Appears promising for the clinical diagnosis of cervicogenic headache
- Future research is required to validate the capacity of this pattern of cervical musculoskeletal impairment, which enables a clinical diagnosis of cervicogenic headache to be made, against the current gold standard of diagnostic blockades

Is rehabilitation of neuromuscular function efficacious for the treatment of cervicogenic headache?

Trial Design

- Multicentre RCT
- 200 subjects with CgH
- Randomized into 4 groups
- Unblinded treatment
- Blinded outcome assessment
- 6 weeks of treatment
- 2 sessions per week
- Min of 8 treatments
- Max of 12 treatments
- Follow up to 12 months



Jull et al. Spine, 2002

Inclusion criteria

- CGH criteria Sjaastad et al 1998, IHS 1988
- Joint dysfunction C0-3
- Ages 18-60 years
- Headache history 2 months to 10 years

Exclusion criteria

- Headache of other causes
- Any contraindication to MT
- Litigation

Interventions

1. Manipulative therapy (Maitland et al 2000)

- Low velocity passive mobilisation
- High velocity manipulation
- Selection of treatment based on assessed joint dysfunction

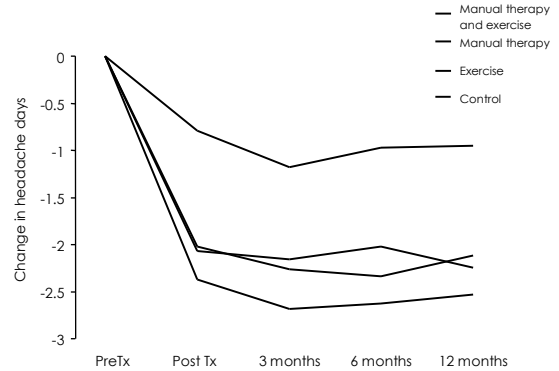


2. Specific exercise program for active stabilisation training

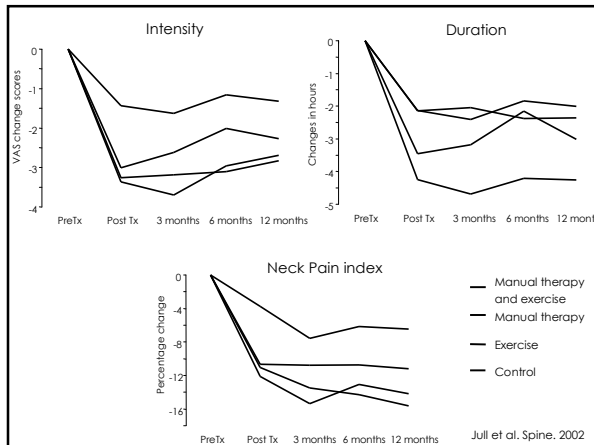
- Addressed impairment in the deep muscles
- Motor relearning program
- Restore muscle control



Headache Frequency

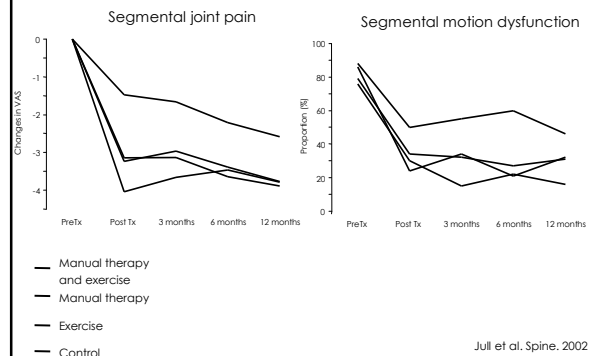


Jull et al. Spine, 2002



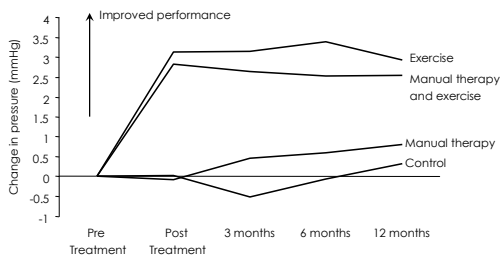
Jull et al. Spine, 2002

Manual segmental examination



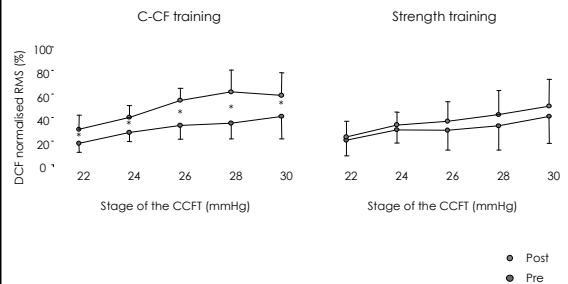
Jull et al. Spine, 2002

Performance on the craniocervical flexion test



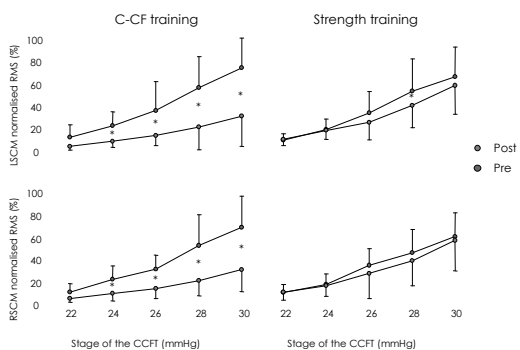
Jull et al. Spine, 2002

Activation of the deep cervical flexors during the craniocervical flexion test



Jull, Falla, Vicenzino, Hodges, 2009

Activation of the superficial cervical flexors during the craniocervical flexion test



Jull, Falla, Vicenzino, Hodges, 2009

Symptomatic relief following intervention

Treatment Group	Proportion >50% reduction	Proportion 100% reduction
Manual therapy and exercise	81	42
Manual therapy	71	33
Exercise	76	31
Control	29	4

Jull et al. Spine. 2002

Conclusion

- Cervicogenic headache constitutes approximately 14-18% of chronic headaches and thus only a proportion of headache patients will have musculoskeletal dysfunction of the cervical spine
Plaffenrath & Kaube, 1990; Nilsson, 1995
- A clinical diagnosis of cervicogenic headache is essential for clinicians to differentiate cervicogenic headache from other benign frequent intermittent headache types
- However, current classification criteria of cervicogenic headache share considerable overlap with other headache types particularly for migraine and tension-type headache

Conclusion

- Recent studies have shown that musculoskeletal impairment including altered neuromuscular control, differentiates cervicogenic headache sufferers from other headache types
- The addition of measures of neuromuscular function may strengthen the current clinical diagnostic criteria
- Furthermore, rehabilitation of neuromuscular control of the neck through a specific approach to motor learning and training has been shown to be effective for patients with cervicogenic headache
- This is especially the case when exercise is combined with manual therapy