

Cervicogenic Headaches

& CHIROPRACTIC



RESEARCH IN THE AREA
has made incredible progress

Highlighting
beneficial treatments &
optimal care strategies.



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Top Take Home Points

1. Chiropractic adjustments are helpful for improving pain intensity, disability, and frequency of headache symptoms in the short-term for people with cervicogenic headaches.

2. Chiropractic adjustments are known to reduce the frequency of cervicogenic headaches up to 12 months. There is no current data to support longer-term impact.

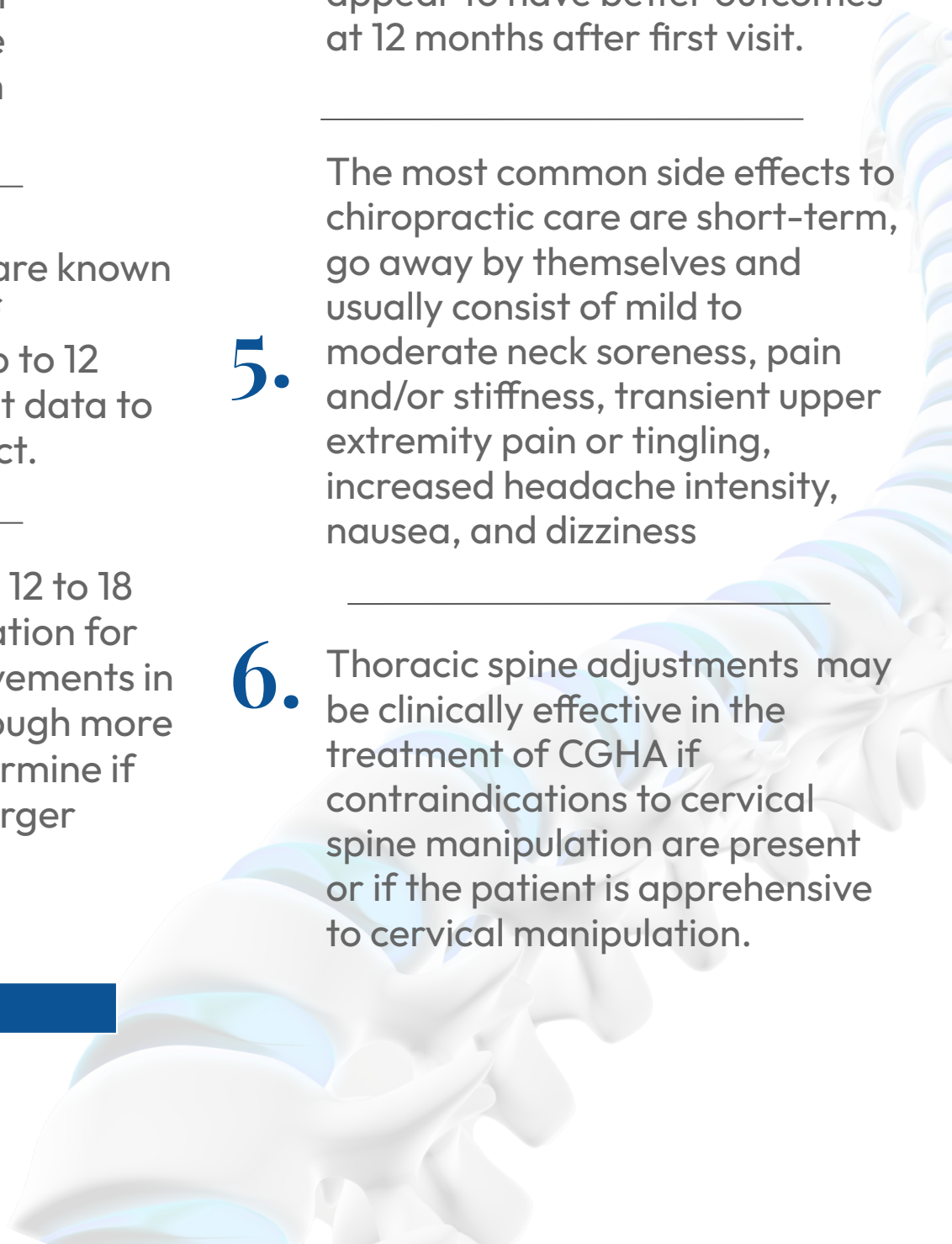
3. Current evidence supports 12 to 18 sessions of spinal manipulation for clinically significant improvements in headache frequency, although more studies are needed to determine if more treatments confer larger benefits.

4. More frequent chiropractic adjustment sessions early on appear to have better outcomes at 12 months after first visit.

The most common side effects to chiropractic care are short-term, go away by themselves and usually consist of mild to moderate neck soreness, pain and/or stiffness, transient upper extremity pain or tingling, increased headache intensity, nausea, and dizziness

5. Thoracic spine adjustments may be clinically effective in the treatment of CGHA if contraindications to cervical spine manipulation are present or if the patient is apprehensive to cervical manipulation.

- 6.



TOPIC INTRODUCTION

As a clinician, it can be difficult to keep track of new evidence as it emerges. However, this difficulty does not diminish the importance of doing so; clinicians must continue to learn and update their expertise as new information appears! This professional insight is meant as a bridge between the frontier of cutting-edge research, and its day-to-day application in clinical practice. It is a summary of recent scientific evidence as well as recommendations for care – in a non-technical format – for all readers.

Although headaches are an extremely common ailment, patient presentations can vary greatly from person to person, or even between visits. Indeed, “headache” itself is a large category that contains many smaller, distinct types. One type in particular – cervicogenic headache – accounts for as many as 20% of all headaches. Cervicogenic headaches are characterized by unilateral pain that starts in the neck, often after movement or injury.

Research in this area has made incredible progress in understanding the mechanisms behind cervicogenic headaches, as well as highlighting beneficial care options and optimal care strategies.

This professional insight is a summary of available evidence on the topic of cervicogenic headache. Though this is written to be as accessible as possible, it is meant specifically for healthcare providers and – in particular – practicing chiropractors. As part of the front-line of musculoskeletal healthcare, chiropractors see a disproportionate number of patients suffering with neck pain and headache. The knowledge in this document can help practitioners manage patient expectations, navigate care options, and create a more confident and trustworthy therapeutic relationship.

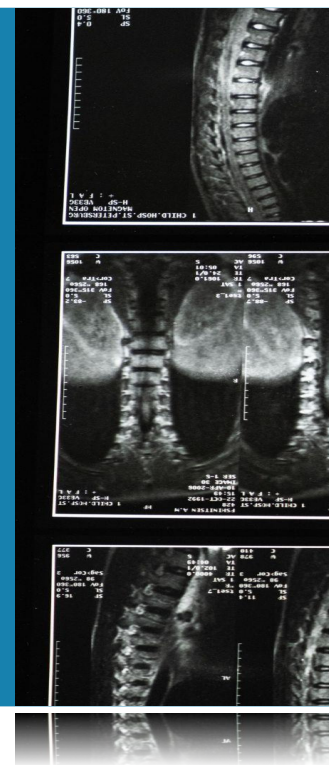
An Overview of Cervicogenic Headache

Definition

Broadly speaking, **cervicogenic headache** (CGHA) is classified as unilateral head pain that can be modified by neck or shoulder movement, as well as pressure over the neck and head (Sjaastad & Fredriksen 2000, Sjaastad et al 1998, Sjaastad et al 1990, IHS-1, IHS-2).

It is pain secondary to cervical spine dysfunction, and there is evidence that cervicogenic headache can be characterized by pain originating in the neck or occipital area, which extends or moves into the face and head (Bogduk & Govind 2009, Sjaastad & Bakketeig 2008, Zito et al 2006, Sjaastad et al 1998, Bogduk et al 1992).

Cervicogenic headache is often found concurrently with reduced cervical range of motion, poor neck and head ergonomics, as well as ipsilateral shoulder and arm pain (Sjaastad et al 1998, IHS-1,).



Symptomatology associated with other headache types, such as photophobia or nausea, are rare, and, if present, mild (Sjaastad et al 1998). However, while common symptoms and the basic mechanisms underlying cervicogenic headaches are reasonably well understood, the exact methodology for diagnosis remains divided between the use of manual examinations and fluoroscopically guided diagnostic blocks (Bogduk & Govind 2009, Grubb & Kelly 2000, Schellhas et al 1996, Dreyfuss et al 1994, Dwyer et al 1990, Feinstein et al 1954, Campbell & Parsons 1944). Similarly, the overlap between cervicogenic headache and other conditions can make clinical diagnosis difficult (Barmherzig & Kingston 2019, Fredriksen et al 2015).

Patient Experiences and Pain Patterns

Although diagnostic criteria help with diagnosis, patients will likely communicate their symptoms using terms they understand. Patients may commonly complain that their headaches become worse with neck movement, are provoked by sustained head positions, or increase with external pressure over the symptomatic side (Sjaastad et al 1998). Understanding these common descriptions is critical for clinicians to differentiate cervicogenic headaches from other headache subtypes (Leone et al 1995).

Patients may also complain of stiffness or reduced range of motion in their neck, which can be assessed clinically with both passive and active movements. It is not uncommon for patients suffering from cervicogenic headache to experience extensive range of motion deficits, often upwards of 25% or more of their individual baseline (Antonaci et al 2001).

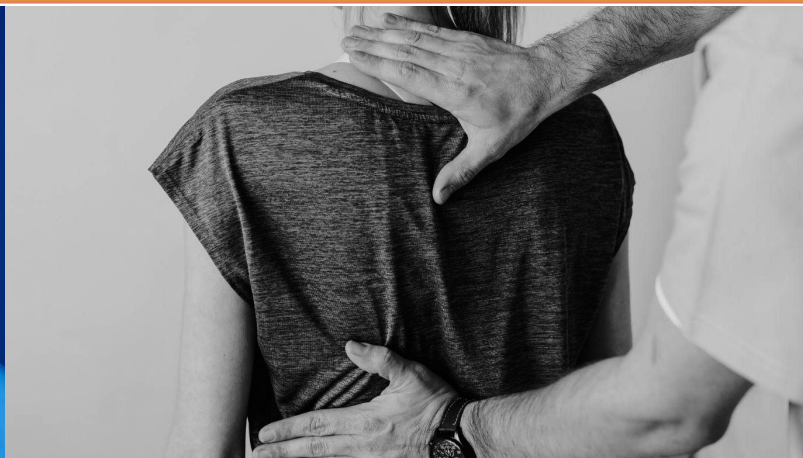


How Common are Cervicogenic Headaches



A study conducted in Norway investigating prevalence found 4.1% of the population between ages 18 and 65 were experiencing cervicogenic headache (Sjaastad & Bakketei 2001); however, other investigations have found prevalence as low as 0.4%, though accounting for as many as 15-20% of all headache complaints (Haldeman & Dagenais 2001). Females have been reported to be four times as likely to suffer cervicogenic headache than their male counterparts (Haldeman & Dagenais 2001). Though the prevalence of cervicogenic headache can vary widely, likely depending on the population examined, cervicogenic headache is a substantial global burden and significantly decreases quality of life (van Suijlekom et al 2003).

There are different classification systems regarding the etiology, diagnosis, and treatment of headache disorders. It is important for clinicians to differentiate between various headache subtypes, as several exhibit overlapping symptoms. Proper identification can greatly affect patient prognosis.



Diagnostic Criteria

There are different classification systems regarding the etiology, diagnosis, and treatment of headache disorders.

It is important for clinicians to differentiate between various headache subtypes, as several exhibit overlapping symptoms. Proper identification can greatly affect patient prognosis. The third edition of the International Classification of Headache Disorders (ICHD-3) defines cervicogenic headache as “headache caused by a disorder of the cervical spine and its component bony, disc and/or soft tissue elements, usually but not invariably accompanied by neck pain.”



Any two of the following four criteria is diagnostic for Cervicogenic Headache (ICHD-3):

- 1. Headache developed in temporal relation to the onset of the cervical disorder or lesion**
- 2. Headache significantly improved or resolved in parallel with improvement in or resolution of the cervical disorder or lesion*
- 3. Cervical range of motion is reduced, and headache is made significantly worse by provocative movements*
- 4. Headache is abolished following diagnostic blockade of a cervical structure or its nerve supply*

**Clinical and/or imaging findings may indicate a cervical spine lesion. Imaging findings are commonly found in asymptomatic patients; they are not indicative of headache causation.*

Prevalence refers to the proportion of a population who have a specific characteristic in a given time period. So, this particular study found that 4.1% of the population between the ages 18 and 65 were experiencing cervicogenic headache.

Red Flags and Referral

When a patient presents with neck pain and headache, clinicians must differentiate the associated symptoms as musculoskeletal or pathological in order to determine if conservative care is appropriate.

It is imperative that providers identify any red flags during the history and examination, and, if necessary, refer to a specialist.

Cervicogenic headache can present similarly to a vertebral artery dissection; it is of paramount importance that clinicians view headache and/or neck pain accompanied by vertigo or unilateral facial paresthesia as vital warning signs that may precede the onset of stroke by several days or even a few hours (Saaed et al 2000). These patients must be sent for emergency care immediately.

In addition to the above, there are several red flags that may arise during a history or exam as well as several notable risk factors clinicians must keep in their consideration. The following lists are adopted and modified from Cote and colleagues (2018) and Whalen and colleagues (2019).

Red flags: History

1. Known connective tissue disease
2. Osteopenia
3. Significant trauma or infection
4. Unexplained/novel neck pain especially ages <20 or >55
5. Cancer (present or previous history of)
6. Unexplained weight loss
7. Severe nocturnal pain
8. Confusion/altered consciousness or impaired level of consciousness
9. New-onset cognitive dysfunction
10. Visual or speech disturbances
11. Weakness or loss of sensation
12. New-onset neurological deficit
13. Changes in personality

It should be noted that any one or more of the above signs and symptoms in conjunction with an individual's presentation may warrant emergent referral or necessitate clinical co-management with other health care providers.

Red flags: Examination

1. Abnormal upper extremity sensory, motor, or deep tendon reflexes
2. Fever > 100°F or worsening headache with fever
3. Sudden-onset headache (e.g., thunderclap) reaching maximum intensity within 5 minutes
4. Nuchal rigidity
5. Jaw claudication or visual disturbance
6. Limited neck flexion
7. Positive Rust, Lhermitte, Hoffman or Babinski sign
8. Pain pattern unrelated to movements or activities
9. Headache triggered by exertion (e.g., cough, Valsalva maneuver (trying to breathe out with nose and mouth blocked) sneeze or exercise
10. Headache that changes with posture

Notable Risk Factors

1. Symptoms suggestive of giant cell arteritis (e.g., headaches, scalp tenderness, jaw pain and vision problems)
2. Symptoms and signs of acute narrow-angle glaucoma (e.g., severe eye pain, nausea or vomiting, blurred vision, halos or colored rings around lights, and eye redness)
3. Patients with risk factors for cerebral venous sinus thrombosis (e.g., neoplasm, pregnancy, puerperium, systemic diseases, dehydration, intracranial tumors, oral contraceptives, and coagulopathies (Saadatnia et al 2009))
4. New-onset headache in patients with a history of human immunodeficiency virus (HIV) infection
5. New-onset headache in patients with a history of cancer
6. A substantial change in the characteristics of the patient's headache
7. New onset or change in headache in patients who are aged over 40
8. Recent (typically within the past 3 months) head trauma
9. Headache that wakes the patient from sleep (migraine is the most frequent cause of morning headache)

Best Known Care Options For Cervicogenic Headache

It is known that people suffering from cervicogenic headache regularly consult providers of manual therapy as part of their headache management (Moore et al 2017). Various options have been proposed for conservative management of cervicogenic headache, including joint manipulation and mobilization, massage and endurance-based cervico-scapular exercises (Jull et al 2002; Rani et al 2019). Many of the studies in the most recent overview of systematic reviews included multiple studies with chiropractic spinal adjustments as the intervention, which were classified as manipulations by the authors (Rani et al 2019). A chiropractic spinal adjustment is a manually applied, high velocity and low amplitude (HVLA) force, directed at specific dysfunctional spinal segments to create joint movement at or beyond the normal joint end-range (Gross et al 2010; Haavik et al 2021). Neurophysiologically, this is by some seen as distinct from a manipulation, as manipulation is used to refer to HVLA thrusts applied to 'healthy' or random spinal segment (Haavik, et al 2021).

A number of contemporary systematic reviews

have shown that this kind of HVLA adjustment might be a beneficial option for reducing pain associated with cervicogenic headache (Coelho et al 2019, Voight & Frank 2016, Chaibi & Russell 2012, Garcia et al 2013). Other studies have also suggested that this kind of care can also reduce cervicogenic headache frequency, and disability (Fernandez et al 2020, Hass et al 2018, Cote et al 2010).

It is important to note, however, that relatively few rigorous studies have independently compared the efficacy of HVLA adjustments or mobilization for cervicogenic headaches compared to other non-invasive options (Coelho et al 2019). For example, in Garcia et al's 2016 systematic review, only nine studies of varying methodologies were analyzed. From these studies, the authors concluded that both mobilization HVLA adjustments are effective options for cervicogenic headache, but no more beneficial than other conservative (non-invasive) options. Furthermore, the authors stated that – in order to best manage patient expectations – shared-decision making between clinician and patient should take precedence. Their reasoning is that a combination of options may prove more effective for reducing headache disability long-term. This combination of options, however, is in contrast to work by Cote et al. (2010), which found that adding exercise to spinal adjustments or mobilization conferred no additional benefit for cervicogenic headache sufferers. Clearly, more work is needed in this area.

In conclusion, there is leading evidence that mobilization and HVLA chiropractic adjustments of the cervical spine, either alone or in combination, appears to reduce the pain intensity, frequency of, and disability stemming from cervicogenic headaches.

Research contrasting spinal mobilization and HVLA adjustments for cervicogenic headache is still in its infancy. A review by Gross et al (2010) found evidence that adjustments of the cervical spine may be a superior modality to mobilization for cervicogenic headache.

A later review by Fernandez et al (2020) appears to lend additional support to this idea. Fernandez et al (2020) combined seven studies into a meta-analysis examining several topics revolving around the use HVLA adjustments for the care of cervicogenic headache. Their data suggest that adjustments are favored over mobilization to provide short-term benefits (2 weeks – 3 months) for pain intensity, disability, and headache frequency. HVLA adjustment also decreased headache frequency over an intermediate time period, though this benefit disappeared entirely in the long term. These findings are summarized in Table 1.

Mobilization versus HVLA Adjustments

Table 1: A summary of results outlining the effects of HVLA adjustments compared to mobilization as reported by Fernandez and colleagues (2020).

	Pain Intensity	Disability	Frequency	Pain Duration
Short-term (>2 weeks but ≤ 3 months)	Positive Benefit	Positive Benefit	Positive Benefit	No Benefit
Intermediate (>3 months but < 12 months)	No Benefit	Unknown*	Positive Benefit	Unknown*
Long-term (≥ 12 months)	No Benefit	Unknown*	No Benefit	Unknown*

*Insufficient data

HVLA adjustments appears to be more beneficial than mobilization for the symptomatic relief of cervicogenic headache, though more evidence is needed. Additionally, spinal adjustments appear to provide short term improvements in pain intensity, headache frequency and disability. Headache frequency decreased over an intermediate time period as well, though there was no apparent benefit after 12 months.

Chiropractic care for Children with Headaches

Chiropractic adjustments may also benefit children with headaches (Lynge et al 2022), although more work is needed in this area. In a study of children ages 7 to 14, those receiving active chiropractic care reported 20% fewer days of headache and higher self-rated improvement when compared to sham intervention. However, the intensity or duration of persisting headaches did not appear to change (Lynge et al 2022).

It is extremely important to note that headache type was not differentiated in this study and adjustments given were not specified to a particular anatomical location (They were adjusted where the chiropractor determined it was needed). Thus, caution should be exercised in generalizing these results to any specific type of headache in children, or to adjusting any particular area of the spine.



Adverse Events Associated with HVLA adjustments



As with any medical intervention, adverse events can occur. An adverse event is any unexpected problem that happens during a health care intervention. Adverse events may be mild, moderate, or severe, and may be caused by something other than the therapy being given. However, whatever the etiology of these events, it is important to be aware of them and take them into consideration during clinical evaluation and care.

A recent study by Haas et al (2018) collected data on the prevalence of adverse events following HVLA spinal manipulation or adjustment. In this study, approximately 40% of the participants receiving spinal manipulation or adjustment experienced a transient, mild or moderate adverse effect. This stands in contrast to only 20% of participants experiencing a mild or moderate adverse effect in the light-massage control group. Though the absolute number of adverse effects in this study was almost three times higher with spinal manipulation or adjustment, it is equally important to note that all of the effects were short-term and transitory.

The mild to moderate effects most often reported included neck soreness, pain and/or stiffness, transient upper extremity pain or tingling, increased headache intensity, nausea, and dizziness.

In favor of best practice guidelines and patient-centered care, sharing possible patient experiences and adverse events when discussing spinal adjustments as part of your care plan for practice members with cervicogenic headache is imperative.



Chiropractic Care Parameters

Frequency of Care

To date, there has only been a single study specifically assessing the optimal number of spinal adjustment sessions for patients with cervicogenic headaches (Haas et al 2018). Haas et al (2018) investigated the outcomes of 0, 6, 12, and 18 sessions of spinal adjustments for cervicogenic headache over a six-week intervention period. The study found that 18 spinal adjustment sessions led to an almost 50% reduction in the frequency of cervicogenic headaches per month. Incredibly, this reduction in headache frequency was still evident one year later.

It is important to note that the study did not provide any intervention after the maximum of 18 sessions. It is possible that more sessions could provide a greater benefit (or continue to show improvement) or, indeed, that more sessions could also be detrimental. The authors did find, however, that little to no positive effect was observed with six sessions or less, and the potential for diminishing returns after 12 sessions. This is strong leading evidence, but more work is needed in this area to fully understand and support these findings.

The ideal frequency and structure of chiropractic adjustments for cervicogenic headache is, however, still unclear. Most studies appear to range from two to three sessions per week, for three to four weeks (Coelho et al 2019, Garcia et al 2016), but more work is needed to understand if this is, indeed, optimal.

With 18 sessions over six-weeks, patients reported a reduction of approximately 50% less headaches per month, surpassing the minimal clinically important improvement threshold. Further, this evidence suggests 12 to 18 sessions of spinal adjustments can lead to lasting clinically significant improvements in headache frequency. Similarly, it is unclear how to structure these sessions, though most investigations appear to offer two to three sessions per week.

Region of spinal adjustments

Though a vast majority of studies have focused exclusively on the effects of cervical adjustments to aid people with cervicogenic headache, several have also investigated the potential influence of thoracic adjustments. These studies hinge on the concept of regional interdependence. Regional interdependence states that a primary musculoskeletal complaint may be affected by distant anatomical regions or tissues (Sueki et al 2013, Sjaastad & Bakkeiteig 2008). Several studies have shown an association between thoracic spine kinematics and cervical function, citing limited thoracic mobility as a potential source of cervical impairment and neck pain (Oxland 2016). As defined earlier, cervicogenic headache is pain secondary to cervical dysfunction.

Following this logic, there is rationale to include the assessment and adjustment of the thoracic spine to help improve neck dysfunction (Joshi 2019). Also, as the contemporary model of the chiropractic vertebral subluxation suggests that local spinal dysfunction is affecting central motor control of the spine, it is logical to conclude that any region of dysfunction or subluxation may influence the brain's control and function of any other part of the spine (Haavik et al 2021).

In a recent study by McDevitt in 2022, it was found that HVLA adjustments of the thoracic spine provides meaningful improvement for reducing pain intensity and neck disability as measured by the NDI (Neck Disability Index) for those with chronic cervicogenic headache. It is important to note that the participants in this study also were given a single rehabilitation exercise focusing on thoracic spine mobility. Clinicians should consider implementing rehabilitative mobility exercises in addition to HVLA adjustments. Similarly, readers should exercise caution in interpreting these results as this is a single study, and it requires replication. It is, however, strong leading evidence that thoracic adjustments appear to exert a positive influence on the resolution of cervicogenic headache.

As of the writing of this report, there have been no investigations into the effects of lumbar or extremity-based manipulations, adjustments or mobilizations on cervicogenic headache.


These findings suggest that thoracic spine adjustments may be clinically effective in helping people who suffer with cervicogenic headache if contraindications to cervical spine adjustments are present or if the patient is apprehensive about cervical adjustments. The effects of thoracic adjustments, technique choice and frequency of care all require further evaluation.

Sensitive Outcome Measures



Investigations of cervicogenic headache have used a variety of metrics to assess changes from chiropractic care, but most revolve around quantifications of pain intensity, headache frequency, headache duration, and overall disability. The Neck Disability Index and Headache Disability Index are two common tools that appear in the literature surrounding cervicogenic headache.

The Neck Disability Index (NDI) is a measurement tool for neck pain. MacDermid (2009) found the NDI demonstrated sufficient readability, construct validity, and test-retest reliability and several recent investigations have used the NDI as a primary or secondary outcome measure for the monitoring of cervicogenic headache (McDevitt et al 2022, Dunning et al 2016). The minimal clinically important difference for the NDI tool has been approximated at eight points for patients with mechanical neck pain (Young 2009, van Suijlekom et al 2003).



The Headache Disability Index (HDI) is a questionnaire that evaluates the influence of headaches on daily life (Jacobson 1994). In a recent study by McDevitt et al, the HDI failed to show quantifiable improvement for the treatment of cervicogenic headache. It is important to note, however, that this study utilized thoracic spine manipulations; the HDI may be more sensitive to changes stemming from cervical spine manipulation. Additionally, it is unknown at this time if the HDI is better suited for symptoms relevant to primary headaches such as migraine, tension-type headaches, and cluster headaches. Further evaluation is necessary to determine if HDI is an appropriate outcome measure for secondary headaches such as cervicogenic headache (McDevitt 2022).

Given recent studies, the NDI is currently the most appropriate and sensitive outcome measure for patients suffering from cervicogenic headache.

1. Antonaci, F., Ghirmai, S., Bono, G., Sandrini, G., & Nappi, G. (2001). Cervicogenic headache: Evaluation of the original diagnostic criteria. *Cephalalgia*, 21(5), 573-583. doi:10.1046/j.0333-1024.2001.00207.x
2. Barmherzig R, Kingston W. Occipital Neuralgia and Cervicogenic Headache: Diagnosis and Management. *Curr Neurol Neurosci Rep*. 2019;19(5):20. Published 2019 Mar 19. doi:10.1007/s11910-019-0937-8
3. Barmherzig R, Kingston W. Occipital Neuralgia and Cervicogenic Headache: Diagnosis and Management. *Curr Neurol Neurosci Rep*. 2019;19(5):20. Published 2019 Mar 19. doi:10.1007/s11910-019-0937-8
4. Bartsch T, Goadsby PJ. Stimulation of the greater occipital nerve induces increased central excitability of dural afferent input. *Brain*, 125 (2002), pp. 1496-1509
5. Bartsch T, Goadsby PJ. Increased responses in trigeminocervical nociceptive neurons to cervical input after stimulation of the dura mater. *Brain*, 126 (2003), pp. 1801-1813
6. Bogduk N. The neck and headaches. *Neurol Clin N Am*, 22 (2004), pp. 151-171
7. Bogduk N, Bartsch T. Cervicogenic headache. SD Silberstein, RB Lipton, DW Dodick (Eds.), *Wolff's Headache* (8th edn.), Oxford University Press, New York (2008), pp. 551-570
8. Bogduk N. Cervicogenic headache: anatomic basis and pathophysiologic mechanisms. *Curr Pain Headache Rep*, 5 (2001), pp. 382-386
9. Bogduk N. The anatomical basis for cervicogenic headache. *J Manipulative Physiol Ther*. 1992;15(1):67-70.
10. Bogduk N, Govind J. Cervicogenic headache: an assessment of the evidence on clinical diagnosis, invasive tests, and treatment. *Lancet Neurol*. 2009;8(10):959-968. doi:10.1016/S1474-4422(09)70209-1
11. Campbell DG, Parsons CM. Referred head pain and its concomitants. *J Nerv Ment Dis*, 99 (1944), pp. 544-551
12. Chaibi A, Russell MB. Manual therapies for cervicogenic headache: a systematic review. *J Headache Pain*. 2012;13(5):351-359. doi:10.1007/s10194-012-0436-7
13. Coelho, M., Ela, N., Garvin, A., Cox, C., Sloan, W., Palaima, M., & Cleland, J. A. (2019). The effectiveness of manipulation and mobilization on pain and disability in individuals with cervicogenic and tension-type headaches: A systematic review and meta-analysis. *Physical Therapy Reviews*, 24(1-2), 29-43. doi:10.1080/10833196.2019.1572963
14. Côté, P., Yu, H., Shearer, H. M., Randhawa, K., Wong, J. J., Mior, S., . . . Lacerte, M. (2019). Non-pharmacological management of persistent headaches associated with neck pain: A clinical practice guideline from the ontario protocol for traffic injury management (OPTIMa) collaboration. *European Journal of Pain*, 23(6), 1051-1070. doi:10.1002/ejp.1374
15. Dreyfuss P, Michaelsen M, Fletcher D. Atlanto-occipital and lateral atlanto-axial joint pain patterns. *Spine*, 19 (1994), pp. 1125-1131
16. Dunning, J. R., Butts, R., Mourad, F., Young, I., Fernandez-de-Las Peñas, C., Hagins, M., . . . Cleland, J. A. (2016). Upper cervical and upper thoracic manipulation versus mobilization and exercise in patients with cervicogenic headache: A multi-center randomized clinical trial. *BMC Musculoskeletal Disorders*, 17, 64. doi:10.1186/s12891-016-0912-3
17. Dwyer A, Aprill C, Bogduk N. Cervical zygapophysial joint pain patterns I: a study in normal volunteers. *Spine*, 15 (1990), pp. 453-457
18. Feinstein B, Langton JBK, Jameson RM, Schiller F. Experiments on referred pain from deep somatic tissues. *J Bone Joint Surg*, 36A (1954), pp. 981-997
19. Fernandez, M., Moore, C., Tan, J., Lian, D., Nguyen, J., Bacon, A., . . . Bussièrès, A. (2020). Spinal manipulation for the management of cervicogenic headache: A systematic review and meta-analysis. *European Journal of Pain* (London, England), 24(9), 1687-1702. doi:10.1002/ejp.1632
20. Fredriksen TA, Antonaci F, Sjaastad O. Cervicogenic headache: too important to be left un-diagnosed. *J Headache Pain*. 2015;16:6. doi:10.1186/1129-2377-16-6
21. Garcia, J. D., Arnold, S., Tetley, K., Voight, K., & Frank, R. A. (2016). Mobilization and manipulation of the cervical spine in patients with cervicogenic headache: Any scientific evidence? *Frontiers in Neurology*, 7 doi:10.3389/fneur.2016.00040
22. Gross, A., Miller, J., D'Sylva, J., Burnie, S. J., Goldsmith, C. H., Graham, N., . . . Hoving, J. L. (2010). Manipulation or mobilisation for neck pain. *Cochrane Database of Systematic Reviews*, (1) doi:10.1002/14651858.CD004249.pub3
23. Grubb SA, Kelly CK. Cervical discography: clinical implications from 12 years of experience. *Spine*, 25 (2000), pp. 1382-1389
24. Goadsby PJ, Ratsch T. On the functional neuroanatomy of neck pain. *Cephalalgia*, 28 (suppl 1) (2008), pp. 1-7
25. Haas M, Bronfort G, Evans R, Schulz C, Vavrek D, Takaki L, Hanson L, Leininger B, Neradilek MB. Dose-response and efficacy of spinal manipulation for care of cervicogenic headache: a dual-center randomized controlled trial. *Spine J*. 2018 Oct;18(10):1741-1754. doi: 10.1016/j.spinee.2018.02.019. Epub 2018 Feb 23. PMID: 29481979; PMCID: PMC6107442.
26. Haavik, H., Kumari, N., Holt, K., Niazi, I.K., Amjad, I., Pujari, A.N., Türker, K.S. and Murphy, B., 2021. The contemporary model of vertebral column joint dysfunction and impact of high-velocity, low-amplitude controlled vertebral thrusts on neuromuscular function. *European Journal of Applied Physiology*, 121(10), pp.2675-2720. Haldeman S, Dagenais S. Cervicogenic headaches: a critical review. *Spine J*. 2001;1(1):31-46. doi:10.1016/s1529-9430(01)00024-9
27. Headache Classification Subcommittee of the International Society The international classification of headache disorders: 2nd edition. *Cephalalgia*. 2004;24(Suppl 1):9
28. Headache Classification Committee of the International Headache Society Classification and diagnostic criteria for headache disorders, cranial neuralgias and facial pain. *Headache Classification Committee of the International Headache Society*. *Cephalalgia*. 1988;8(Suppl 7):1-96.
29. Jacobson GP, Ramadan NM, Aggarwal SK, Newman CW. The Henry Ford Hospital Headache Disability Inventory (HDI). *Neurol*. 1994;44(5):837-842.
30. Joshi S, Balhilla G, Neelapala YVR. Thoracic Posture and Mobility in Mechanical Neck Pain Population: A Review of the Literature. *Asian Spine J*. 2019 Jun 3;13(5):849-860. doi: 10.31616/asj.2018.0302. PMID: 31154701; PMCID: PMC6773982.
31. Jull G, Trott P, Potter H, et al. A randomized controlled trial of exercise and manipulative therapy for cervicogenic headache. *Spine (Phila Pa 1976)*. 2002;27(17):1835-1843. doi:10.1097/00007632-200209010-00004
32. Leone, M., Moschiano, F., Farinotti, M., Filippini, G., & Bussone, G. (1995). Possible Identification of Cervicogenic Headache Among Patients With Migraine: An Analysis of 374 Headaches. *Headache: The Journal of Head and Face Pain*, 35(8), 461-464. <https://doi.org/10.1111/j.1526-4610.1995.hed3508461.x>
33. Lyngé, S., Dissing, K. B., Vach, W., Christensen, H. W., & Hestbaek, L. (2021). Effectiveness of chiropractic manipulation versus sham manipulation for recurrent headaches in children aged 7-14 years - a randomised clinical trial. *Chiropractic & Manual Therapies*, 29(1), 1. doi:10.1186/s12998-020-00360-3
34. MacDermid JC, Walton DM, Avery S, Blanchard A, Etruw E, McAlpine C, Goldsmith CH. Measurement properties of the neck disability index: a systematic review. *J Orthop Sports Phys Ther*. 2009 May;39(5):400-17. doi: 10.2519/jospt.2009.2930. PMID: 19521015.
35. McDevitt, A. W., Cleland, J. A., Rhon, D. I., Altic, R. A. K., Courtney, D. J., Glynn, P. E., & Mintken, P. E. (2022). Thoracic spine thrust manipulation for individuals with cervicogenic headache: A crossover randomized clinical trial. *Journal of Manual & Manipulative Therapy*, 30(2), 78-95. doi:10.1080/10669817.2021.1947663
36. Moore C, Adams J, Leaver A, Lauche R, Sibbritt D. The treatment of migraine patients within chiropractic: analysis of a nationally representative survey of 1869 chiropractors. *BMC Complement Altern Med*. 2017;17(1):519. Published 2017 Dec 4. doi:10.1186/s12906-017-2026-3
37. Oxland TR. Fundamental biomechanics of the spine--What we have learned in the past 25 years and future directions. *J Biomech*. 2016 Apr 11;49(6):817-832. doi: 10.1016/j.jbiomech.2015.10.035. Epub 2015 Nov 30. PMID: 26706717.

References

38. Rani M, Kulandaivelan S, Bansal A, Pawalia A. Physical therapy intervention for cervicogenic headache: an overview of systematic reviews. *European Journal of Physiotherapy*. 2019;21(4):217-23.
39. Saeed, A. B., Shuaib, A., Al-Sulaiti, G., & Emery, D. (2000). Vertebral artery dissection: Warning symptoms, clinical features and prognosis in 26 patients. *The Canadian Journal of Neurological Sciences. Le Journal Canadien Des Sciences Neurologiques*, 27(4), 292-296. doi:10.1017/s0317167100001025
40. Saadatnia M, Fatehi F, Basiri K, Mousavi SA, Mehr GK. Cerebral venous sinus thrombosis risk factors. *Int J Stroke*. 2009;4(2):111-123. doi:10.1111/j.1747-4949.2009.00260.x
41. Schellhas KP, Smith MD, Gundry CR, Pollei SR. Cervical discogenic pain: prospective correlation of magnetic resonance imaging and discography in asymptomatic subjects and pain sufferers. *Spine*, 21 (1996), pp. 300-312
42. Sjaastad O, Fredriksen TA, Pfaffenrath V. Cervicogenic headache: diagnostic criteria. *Headache*. 1990;30(11):725-726. doi: 10.1111/j.1526-4610.1990.hed3011725.x.
43. Sjaastad O, Fredriksen TA, Pfaffenrath V. Cervicogenic headache: diagnostic criteria. The Cervicogenic Headache International Study Group. *Headache*. 1998;38(6):442-445. doi: 10.1046/j.1526-4610.1998.3806442.x.
44. Sjaastad O, Bakkeiteig LS. Prevalence of cervicogenic headache: Vågå study of headache epidemiology. *Acta Neurol Scand*. 2008;117(3):173-180. doi:10.1111/j.1600-0404.2007.00962.x
45. Sjaastad O, Fredriksen TA. Cervicogenic headache: criteria, classification and epidemiology. *Clin Exp Rheumatol*. 2000;18(2 Suppl 19):S3-S6.
46. Sjaastad O, Pettersen H, Bakkeiteig LS. The Vågå study; epidemiology of headache I: the prevalence of ultrashort paroxysms. *Cephalalgia*. 2001;21(3):207-215. doi:10.1046/j.1468-2982.2001.00189.x
47. Sueki DG, Cleland JA, Wainner RS. A regional interdependence model of musculoskeletal dysfunction: research, mechanisms, and clinical implications. *J Man Manip Ther*. 2013 May;21(2):90-102. doi: 10.1179/2042618612Y.0000000027. PMID: 24421619; PMCID: PMC3649356.
48. van Suijlekom HA, Lamé I, Stomp-van den Berg SG, Kessels AG, Weber WE. Quality of life of patients with cervicogenic headache: a comparison with control subjects and patients with migraine or tension-type headache. *Headache*. 2003;43(10):1034-1041. doi:10.1046/j.1526-4610.2003.03204.x
49. Wainner RS, Whitman JM, Cleland JA, Flynn TW. Regional interdependence: a musculoskeletal examination model whose time has come. *J Orthop Sports Phys Ther*. 2007 Nov;37(11):658-60. doi: 10.2519/jospt.2007.0110. PMID: 18057674.
50. Whalen W, Farabaugh RJ, Hawk C, Minkalis AL, Lauretti W, Crivelli LS, Wyatt L, Sheppard M, Walters SA. Best-Practice Recommendations for Chiropractic Management of Patients With Neck Pain. *J Manipulative Physiol Ther*. 2019 Nov;42(9):635-650. doi: 10.1016/j.jmpt.2019.08.001. Epub 2019 Dec 20. PMID: 31870638.
51. Young BA, Walker MJ, Strunce JB, Boyles RE, Whitman JM, Childs JD. Responsiveness of the Neck Disability Index in patients with mechanical neck disorders. *Spine J*. 2009 Oct;9(10):802-8. doi: 10.1016/j.spinee.2009.06.002. Epub 2009 Jul 25. PMID: 19632904.
52. Zito G, Jull G, Story I. Clinical tests of musculoskeletal dysfunction in the diagnosis of cervicogenic headache. *Man Ther*. 2006;11(2):118-129. doi:10.1016/j.math.2005.04.00