Case Report

Resolution of Refractory Headache Symptoms Following Cervical Spinal Manipulation and Electrical Dry Needling in an Adolescent Female: A Case Report

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Abstract

Cervicogenic headache (CGH) in adolescents is poorly understood. The overlap in signs and symptoms between CGH, tension-type headaches and migraine headaches complicate the differential diagnosis. Furthermore, poor outcomes for CGH with conventional pharmacology is not uncommon. Adolescents presenting with cephalgia should be screened appropriately for cervical etiology. Evidence supports the use of upper cervical spinal manipulation and dry needling for the treatment of CGH in the adult population. However, there is a lack of evidence supporting the diagnosis and treatment of CGH in adolescents. This case report describes the clinical diagnosis and successful management of a 16-year-old female with chronic, frequent episodic CGH that was refractory to polypharmacy. The patient was able to stop taking all medication for her headaches and reported resolution of pain and disability, following 4-weeks of upper-cervical spine thrust manipulation and electrical dry needling.

Keywords

cervicogenic headache, migraine, diagnosis, manipulation, dry needling

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Introduction

Headache disorders are common in children and adolescents and may cause substantial disability, school absenteeism, and reduced participation in daily activities.[1,2] Symptoms across different headache phenotypes such as unilateral or bilateral, neck pain, photophobia, nausea, and impaired concentration may overlap, making the profiling clinically challenging.[3]

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Although migraine and tension-type headache are the most frequent headache disorders in adolescent, clinical presentations can be heterogeneous and diagnostically challenging.[3,4]

Cervicogenic headache (CGH) is classified as a secondary headache attributed to a disorder of the cervical spine.[5] Clinical features that may support a cervical contribution include reduced cervical range of motion, headache provocation with neck movement or sustained postures, reproduction of familiar symptoms during cervical external pressure, and symptoms reduction following treatment directed at the cervical region.[3,5] However, CGH remains poorly described in the pediatric/adolescent population, increasing the risk of under-recognition.[3,5,6] This diagnostic challenge is clinically relevant because adolescents with persistent or recurrent headache may receive prolonged pharmacological management before a cervical source is considered.[7,8] In cases of refractory cephalgia, particularly when headache is associated with neck pain, occipital onset, unilateral symptoms, postural aggravation, or cervical examination findings, screening for cervicogenic mechanisms should be included in the assessment.[3,9]

In adults, evidence supports several physical therapy interventions in reducing headache intensity, frequency, and duration for CGH, including cervical manipulation, exercise, and dry needling.[10-12] However, evidence regarding the diagnosis and conservative management of CGH in adolescents remains scarce. Therefore, this case report describes the clinical diagnosis and successful conservative management of a 16-year-old female with chronic, frequent episodic CGH that was refractory to previous pharmacological treatment.

Patient History

A 16-year-old female with a previous diagnosis of "atypical migraine headaches" presented to a medical pediatric clinic for follow-up and further management. Onset of headaches began at age 12, at which time the patient was referred to a pediatric neurologist. Management per the neurologist included diagnostic imaging, laboratory evaluation, and medication management. The patient had been taking propranolol titrated to 20 mg daily for prevention and intranasal zolmitriptan 2.5 mg as needed at the time of initial examination. History of failed medications for exacerbations included acetaminophen suspension, ibuprofen, rizatriptan oral dissolving tablets and sumatriptan/naproxen. Failed medications for prevention included topiramate and onabotulinumtoxinA migraine protocol (3 injections, 12-14 weeks apart) with most recent injections 7 months prior to initial presentation. The patient stated she was compliant with prophylactic propranolol despite poor therapeutic benefit and reported using intranasal rescue zolmitriptan about 1-2 times per week regularly for exacerbation, followed by hydration and rest. Propranolol was weaned from 20 mg once daily in the morning to 10 mg once daily in the morning for seven days and then discontinued as recommended by pediatric neurology. This was managed by pediatric medicine (pediatrician). Supplementation with magnesium 125 mg bid, CoQ-10-100 mg daily, folic acid 5 mg daily, and a B-complex and reported excellent compliance. She was referred to physical therapy and occupational therapy in the past for management of her headaches resulting in minimal benefit, with continued refractory headaches.

Clinical Presentation

The patient complained of cephalgia that was predominately unilateral involving the frontal, temporal, occipital, posterior cervical locations, and posterior right orbit. It was described as intense, non-lancinating, throbbing, and associated with occasional nausea, photophobia, and difficulty concentrating. The headaches were reported to be exacerbated by monthly menstrual cycles *without* other symptoms of dysmenorrhea. Headaches were also reported to be exacerbated by stress and poor sleep/posture/fatigue, and relieved by hydration with electrolytes, and zolmitriptan <50% of the time. Headache duration/temporal pattern was a minimum of two hours, and a maximum of two weeks. Patient reported frequently missing school and/or extracurricular activities secondary to symptoms of headache. School absences were reported to be one to two times per month secondary to the more severe headache symptoms. The remainder of the review of systems was significant for chronic nasal congestion exacerbated by change of seasons, and intermittent functional constipation. The patient reported depressed mood associated with functional impairment secondary to headaches without signs or symptoms of depression. The patient reported a Patient Health Questionnaire-9 score of 2, indicating low probability of adolescent depression.[13] At baseline, the patient reported a pain of 7/10, with a maximum headache severity of 10/10 on the numeric pain rating scale (NPRS).[14] Additionally, the patient reported a headache frequency 6 out of 7 days per week, and scored a 65 ("severe" disability) on the Pediatric Migraine Disability Assessment Score (PedMIDAS).[15] Medical history intake did not identify any red flags.

Clinical Findings

The patient's history seemed consistent with cephalgia of cervical origin (CGH). The neurological examination including strength, sensation, and reflex testing was normal. The physical exam was significant for limitation in cervical side bending active range-of-motion (15 degrees bilaterally) minor limitations in cervical flexion (60 degrees) and extension (60 degrees) There was notable reactive tenderness with palpation of the soft tissues (fascia, muscle, tendon, nerve) and deeper joint articulations of the right upper cervical/sub-occipital region, lower cervical region, and upper trapezius trigger points, reproducing comparable unilateral headache symptoms. Passive intervertebral movement (lateral glide testing)[16] noted hypomobility of C1-7, with a negative cervical flexion rotation test (CFRT).[17]

Clinical Impression & Intervention

Based on the history and physical exam, a primary clinical diagnosis of CGH was made. Evidence-based interventions for the primary diagnosis of CGH[10,11] including upper cervical spine manipulation and electrical dry needling were performed 2x/week for 4 weeks then 1x/week for an additional 8 weeks. Upper cervical spine thrust-manipulation primarily targeted the symptomatic side of C1-2, C0-1 at each visit. Spinal manipulative therapy was followed with electrical dry needling protocol previously described in a large trial on adult patients with CGH.[12] Detailed descriptions of these standardized procedures are provided in the Dunning et al[12,18] trials, and the dry needling protocol can be seen in Figure 1. Sterilized disposable stainless-steel acupuncture needles were used with three sizes: 0.18 mm x 15 mm, 0.25 mm x 30 mm, 0.30 mm x 40 mm. The surface of the oculofrontotemporal region, posteroinferior occiput, and posterolateral upper cervical region were cleaned with alcohol. The depth of needle insertion ranged from 10 mm to 30 mm depending on the point selected (intramuscular, periosteal, perineural) and the patient's constitution (ie, size and bone depth, muscle and/or connective tissue thickness). Following insertion, needles were manipulated bidirectionally to elicit a sensation of aching, tingling, deep pressure, heaviness or warmth. The needles were then left in situ for 20 minutes with electric stimulation (ES-160 electrostimulator ITO co.) in pairs to up to eight of the occipito-cervical and upper thoracic needles using a low frequency (2 Hz), moderate pulse duration (250 μs), biphasic continuous waveform at an intensity described by the patient as "mild to moderate".[12] Prior to initiation of cervical HVLA manipulation and dry needling, a comprehensive safety assessment was performed. The patient's history and physical examination revealed no clinical red flags or contraindications to manual therapy. A detailed neurological examination demonstrated normal cranial nerve function, upper extremity strength, sensation, deep tendon reflexes, and myotome/dermatome testing. The patient denied symptoms suggestive of cervical arterial dysfunction, including diplopia, dysarthria, dysphagia, dizziness, drop attacks, visual disturbance, facial numbness, or other focal neurological deficits. Bleeding risk was assessed through review of the medical history and medication list. The patient had no personal history of bleeding disorders, was not receiving anticoagulant or antiplatelet therapy, and had no contraindications to dry needling. Skin over the treatment region was intact without evidence of local infection or dermatologic disease. Standard infection-control procedures were followed throughout each dry needling session, including skin antisepsis, single-use sterile disposable needles, appropriate hand hygiene, and immediate sharps disposal according to institutional protocol.

Given the patient's age, risks, benefits, alternatives, and expected outcomes of cervical manipulation and dry needling were discussed with both the patient and her mother. Written informed parental consent and patient assent were obtained prior to treatment. Conservative management was selected because the patient had persistent symptoms despite multiple pharmacologic therapies, physical therapy, occupational therapy, and pediatric neurology management, and the anticipated benefits were judged to outweigh the potential risks.

Follow-Up and Outcomes

The patient reported resolution of headache pain intensity (NPRS=0/10), disability (PedMIDAS=0), headache frequency (0 out of 7 days per week), and was able to stop taking rescue medications at the 3-month follow-up. All improvements were maintained at the 9-month follow up. (Figures 2-5). No immediate or delayed adverse events were observed following any treatment session. Specifically, the patient experienced no neurological deficits, vascular events, infection, excessive bleeding, vasovagal reactions, persistent worsening of symptoms, or other complications attributable to dry needling or cervical HVLA manipulation. Mild expected post-treatment soreness resolved spontaneously without intervention. At the 12-week and 6-month follow-up evaluations, no treatment-related adverse events had been reported. Finally, written informed consent was obtained from the patient/parent for the publication of this retrospective case report and images of the dry needling protocol in a scholarly journal.

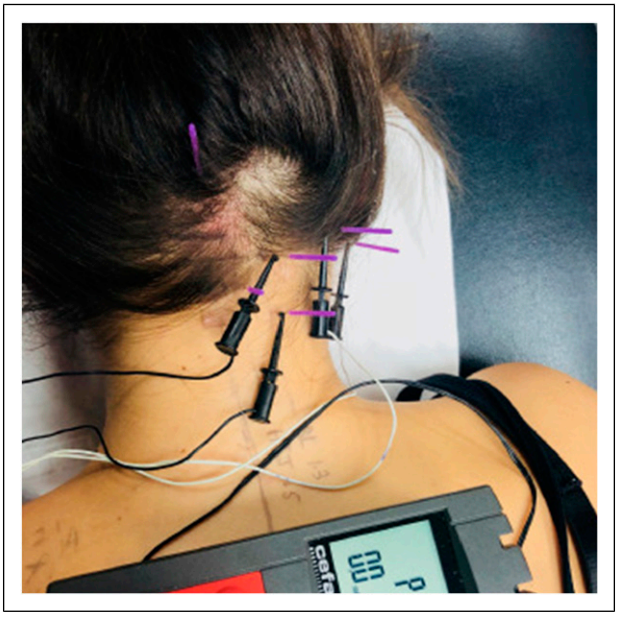

Figure 1. Electrical dry needling protocol

Discussion

This case report presents a compelling example of successful management of an adolescent with CGH using a combination of upper cervical spinal manipulation and electrical dry needling. The outcomes of this intervention may provide valuable insight into the potential benefits of this intervention for adolescent patients with chronic headaches, that are refractory to conventional pharmacological management. This case also reinforces the importance of an accurate history and physical examination in order to screen for a possible cervical contribution and support the diagnosis of CGH.

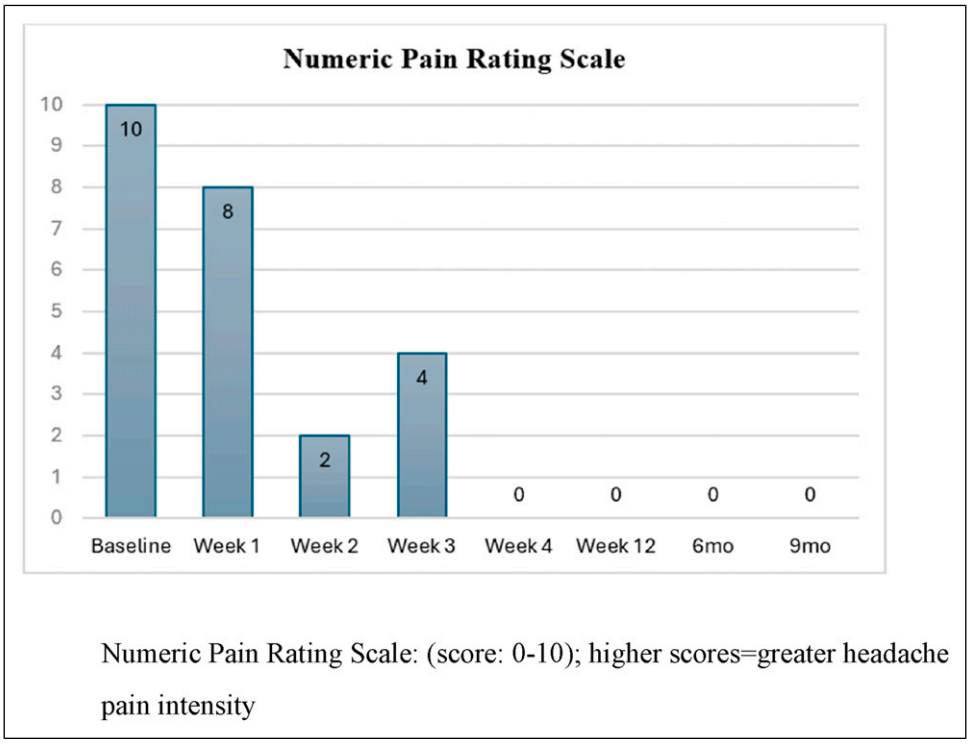

Figure 2. Headache intensity

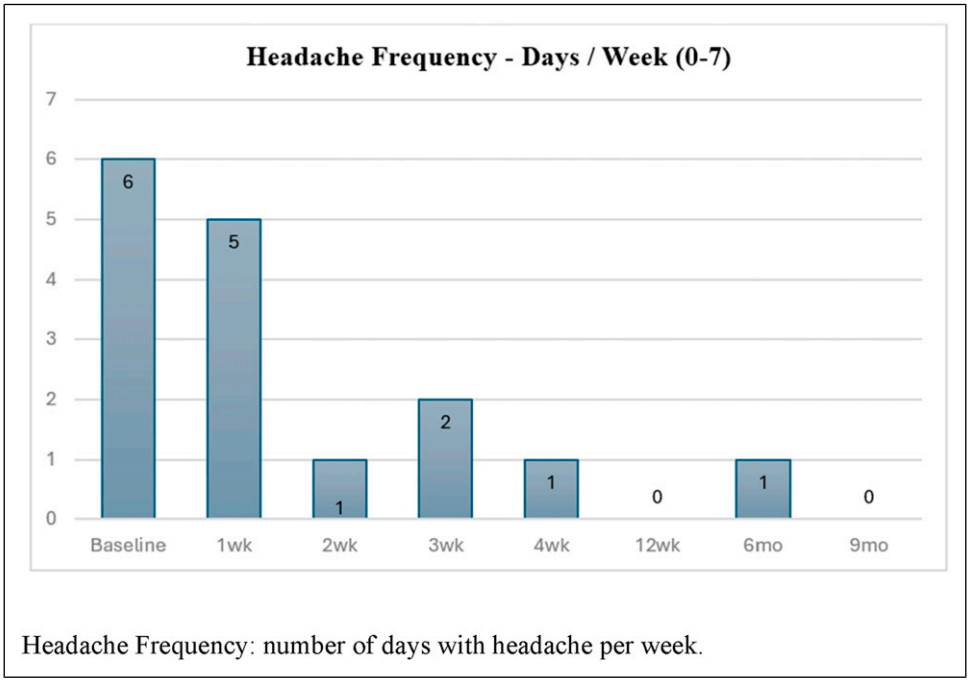

Figure 3. Headache frequency

The patient in this case report had a longstanding history of headaches with poor response to multiple classes of medication —including prophylactics and rescue agents—and associated functional disability, impacting school attendance and quality of life. The International Classification of Headache Disorders defines CGH 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".[19] A clinical diagnosis of CGH was made based on history and physical exam without the need for imaging or diagnostic anesthetic blockade. The Cervicogenic Headache International Study Group (CEHISG)[5,19] classifies CGH according to the "major criteria" (not including confirmatory evidence by diagnostic anesthetic blockades) and "head pain characteristics" consisting

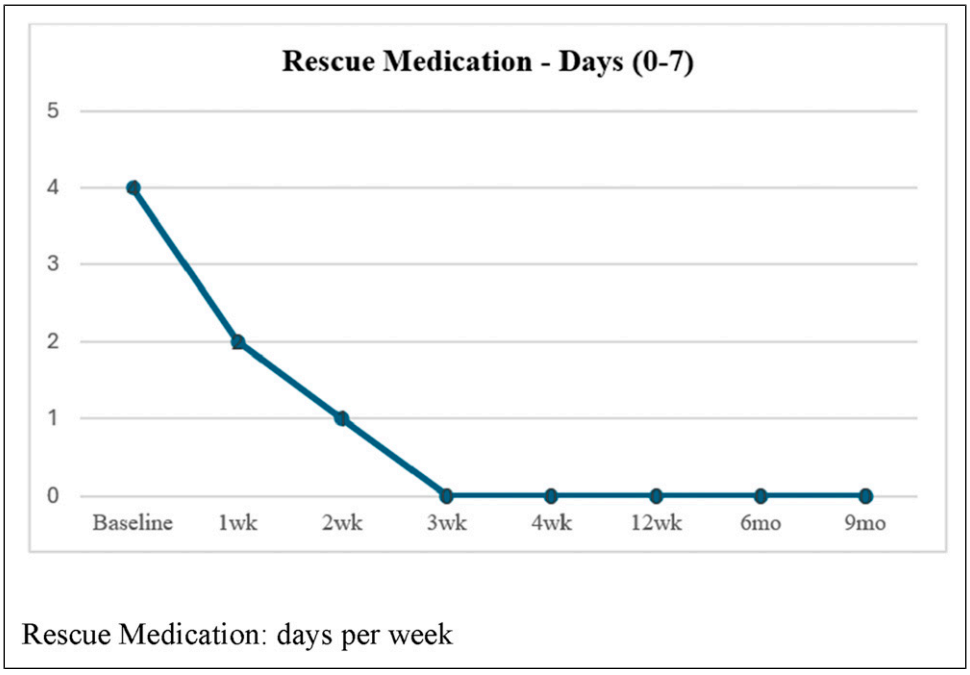

Figure 4. Use of rescue medication

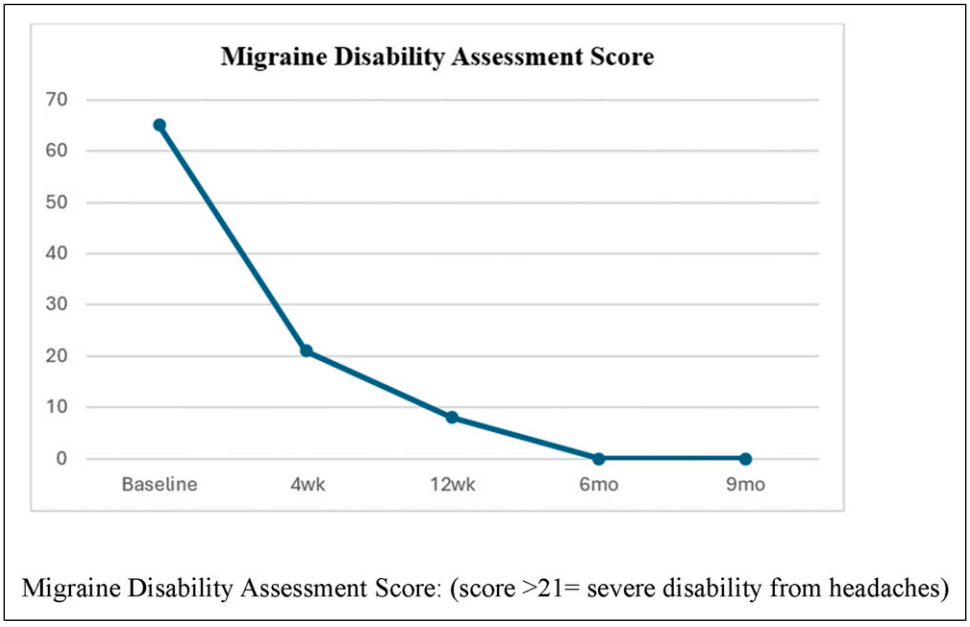

Figure 5. Migraine Disability Assessment Score

of: (1) unilaterality of the head pain without side-shift, starting in the upper posterior neck or occipital region, eventually spreading to the oculofrontotemporal area on the symptomatic side; (2) pain triggered by neck movement and/or sustained awkward positions; (3) reduced range of motion in the cervical spine; (4) pain elicited by external pressure over at least one of the upper cervical joints (C0-3); and (5) moderate to severe, non-throbbing and non-lancinating pain with a clinical pattern including unilaterality of symptoms, trigeminal distribution of pain, temporal pattern of pain, mobility limitations, and a provocative examination reproducing comparable symptoms. Although diagnostic blockade may increase diagnostic certainty, these criteria have been used to support a primary clinical diagnosis of CGH in conservative care research.[12,18] Interestingly, a secondary migrainous component to the chronic headache was considered in this case, as the patient also complained of exacerbations during her menstrual cycle, and had a negative CFRT on physical exam.[20] However, the current patient had unilateral pain without side shift, no prior relief of symptoms with multiple migraine medications, and the temporal pattern of headaches was not within the typical migraine time frame.[9,21] Therefore, rather than excluding migraine solely on the basis of cervical findings, the possibility of a mixed phenotype in which cervical nociceptive input contributed to a broader headache disorder should also be considered. This case supports the need for careful differential diagnosis when overlapping headache features are present in adolescents.

Unfortunately, the evidence is scarce outlining primary screening tools and/or conservative interventions for adolescents with CGH. However, there is robust data supporting the use of upper cervical spinal manipulative therapy and dry needling for the treatment of CGH in the adult population. Recent systematic reviews and meta-analysis have reported that manipulative therapy combined with dry needling was the highest-ranked intervention for short-term (4-12wks) reductions in intensity and frequency of CGH.[11,22] Importantly, using the CEHISG diagnostic criteria, Dunning et al[12] reported a that spinal manipulation and electrical dry needling 1-2x/week over 4 weeks resulted in greater improvements in headache intensity, disability, headache frequency, headache duration, and medication intake, than non-thrust spinal mobilization and low-load cervical exercises. Large effect sizes were noted for headache intensity, disability, headache frequency, headache duration, and medication intake. Furthermore, 66% of patients in the spinal manipulation and dry needling group completely stopped taking medication for their headaches.[12] Although these findings provide a rationale for the intervention used in the present case, direct extrapolation from adult trials to adolescents should be made cautiously.

Spinal manipulation[23] may alter afferent discharge rates by stimulating mechanoreceptors and proprioceptors, thereby changing alpha motor neuron excitability levels and subsequent muscle activity.[24,25] Manipulation might also stimulate receptors in the deep paraspinal musculature, and mobilization might be more likely to facilitate receptors in the superficial muscles.[26] Biomechanical, spinal or segmental and central descending inhibitory pain pathway models are plausible explanations for the hypoalgesic effects observed following manipulation/mobilization.[27-29] It is plausible that the results of this case are associated with a neurophysiological response involving temporal sensory summation at the dorsal horn of the spinal cord.[30] Electrical dry needling may enhance intra and extra neural microcirculation via local neovascularization and

vasodilation through autonomic reflexes and nitric oxide release.[25,31] Moreover, electroacupuncture has been found to reduce the expression of pro-inflammatory cytokines (ie, interleukin-1 β and tumor necrosis factor-α) in the synovia of joints[26] and inflamed soft-tissue,[32] and block the systemic release of inflammatory factors in the periaqueductal gray area of the brain stem.[30] This may lead to decreased inflammation of the densely innervated periarticular connective tissue of the upper cervical articulations, suboccipital muscles, and the greater occipital nerve, lesser occipital nerve, third occipital nerve, and great auricular nerve,[26,30,32] which is most frequently reported by patients as the region of the origin of symptoms before they proceed unilaterally into the posterior occiput and oculofrontotemporal region.[33-35] These mechanisms remain hypothetical in the context of a single case report, but they provide a plausible biological rationale for targeting the upper cervical region in patients with clinical features consistent with CGH.

As a single case report, these findings cannot establish treatment efficacy or determine the relative contribution of spinal manipulation, electrical dry needling, natural symptom fluctuation, patient perception, sensory processing, contextual effects, or other non-specific factors.[29,36,37] Additionally, adolescents likely differ from adults in neurodevelopment, pain processing, psychosocial context, tissue characteristics, risk perception, and clinical thresholds for invasive and manipulative procedures. This case report should not be interpreted as evidence of efficacy or safety for all pediatric patients. Careful patient selection, clinician expertise, and individualized risk-benefit assessment remain essential in pediatric populations. Nevertheless, this case highlights the potential clinical value of screening for cervical musculoskeletal contributors in adolescents with persistent or recurrent headache, particularly when symptoms are refractory to conventional pharmacological management. Further research is needed to clarify the diagnostic features, prevalence, and optimal conservative management of CGH in adolescents.

Conclusion

In adolescents with chronic headaches, appropriate screening for upper cervical spine involvement may be important prior to, and/or after failed pharmacological management. Upper cervical spinal manipulation and electrical dry needling may result in clinically meaningful improvements in pain and disability in adolescents with CGH.

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Ethical Considerations

Written informed consent was obtained prior to the evaluation and treatment.

Consent to Participate

Written informed consent was obtained from the patient prior to the evaluation and treatment.

Consent for Publication

Consent was obtained from the patient to publish this case report in a scholarly peer reviewed medical journal.

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Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data Availability Statement

All data supporting the findings of this case report will be available within the published manuscript.

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