ISSN: 2584-0355
DOI: doi.org/10.51219/MCCRJ/Christopher-Behringer/441

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Medical & Clinical Case Reports Journal

https://urfpublishers.com/journal/case-reports

Vol: 4 & Iss: 1

Case Report

Multimodal Musculoskeletal Treatment in Refractory Chronic Headache: A Case Report

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Citation: Labeeb U, Behringer C. Multimodal Musculoskeletal Treatment in Refractory Chronic Headache: A Case Report. *Medi Clin Case Rep J* 2026;4(1):1599-1598. DOI: doi.org/10.51219/MCCRJ/Christopher-Behringer/441

Received: 10 February, 2026; **Accepted:** 12 February, 2026; **Published:** 16 February, 2026

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ABSTRACT

Patients with chronic headaches frequently experience disabling symptoms that heavily impact their quality of life and ability to perform activities of daily living. Current standard treatment focuses on pharmacologic interventions and includes abortive therapies such as analgesics and migraine-targeting therapies. We report a case of a 66-year-old female with a 12-month history of a persistent, refractory secondary headache characterized by cervicogenic and occipital neuralgia features, unresponsive to multiple pharmacologic and non-pharmacologic interventions. After little progress was made with her previous treatment plan of analgesics, Rimegepant (Nurtec), physical therapy and dry needling, the patient was offered a multimodal musculoskeletal approach, including acupuncture, osteopathic manual therapy (OMT) and home exercise recommendations by a single physician provider. These therapies have been shown to provide relief in patients suffering from chronic pain. Following this multimodal approach, the patient reported significant symptom relief in their headache frequency and intensity, allowing her to have less reliance on medication, while also significantly improving her sleep quality. This case demonstrates a potential avenue for further research to hopefully develop new minimally invasive treatments of chronic headaches that can improve a patient's quality of life.

Keywords: Chronic headache; Multimodal musculoskeletal treatment; Alternative medicine

Introduction

Chronic headaches are characterized by recurrent headaches occurring on at least 15 days per month for a duration of three months or longer[1]. They represent a debilitating neurological disorder that places a considerable strain on the individual, ultimately diminishing their quality of life (QOL). Compared with episodic headaches, those who suffer from chronic headaches experience greater impairment in Health-Related Quality of Life (HRQoL), higher rates of missed activities of daily living and frequent psychiatric comorbidities such as anxiety and/or depression[1]. Acute therapies include analgesics such as nonsteroidal anti-inflammatory drugs (NSAIDs) or migraine-targeting therapeutics such as triptans or ergot derivatives. Preventive treatments remain limited, with evidence supporting

only a few agents such as onabotulinumtoxinA (BoNT-A), topiramate and CGRP-targeted monoclonal antibodies[2]. Despite the variety of pharmacological options, frequent use is discouraged due to the risk of medication adverse effects or precipitation of medication overuse headaches (MOH). This underscores the need for non-pharmacologic adjuncts, such as osteopathic manipulation treatment (OMT) and acupuncture.

Osteopathic manual therapy (OMT) is a form of manual therapy taught as part of the curriculum in American Osteopathic Medical Schools and international Osteopathy programs that emphasize the body's natural capacity for self-healing through the interplay of structure and function. In several studies, OMT has been shown to effectively treat headaches by a few mechanisms, including releasing restrictions in fascia, joints and muscles, thereby promoting a return to physiologic homeostasis[3]. In parallel, studies suggest that acupuncture is effective for a variety of chronic conditions, including headaches, as it has few adverse effects while promoting analgesia, releasing endogenous endorphins and improving psychological stability[4]. Although both OMT and acupuncture show promise in the broader management of acute and chronic pain as individual treatments, their roles when applied together in a cohesive treatment model in headache treatment remain unexplored[3-5]. This case report aims to describe a patient with refractory, chronic headache whose symptoms and QOL improved following a multimodal musculoskeletal treatment approach that incorporated OMT, acupuncture and additional therapeutic modalities.

Case Report

A 66-year-old female patient, with a past medical history significant for squamous cell carcinoma of the scalp vertex excised in February 2024, sought care for her persistent headaches that began in May 2024. She described the pain as an aching sensation that originated at the base of her left occiput and radiated anteriorly across the scalp. Her headaches occurred daily, lasted multiple hours, but were without photophobia, phonophobia or aura. Given the concern of new-onset headache, an MRI was performed, which revealed a 1-cm right caudal mass **(Figure 1)**.

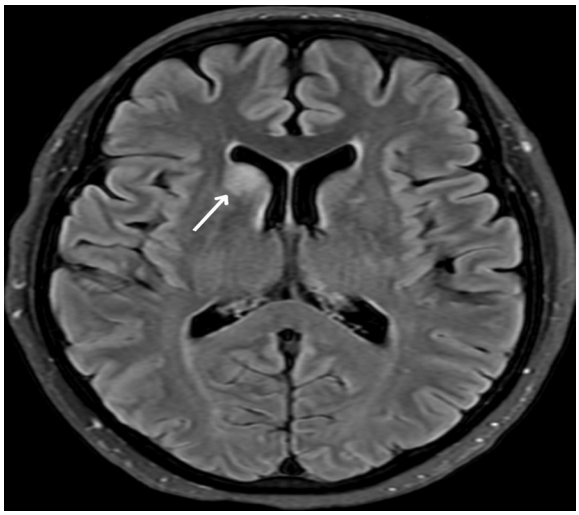

Figure 1: Axial FLAIR MRI of the brain reveals a 1-cm hyperintense lesion in the right caudal region (arrow).

She was subsequently evaluated by multiple physicians, in which there were differences in the leading differential diagnosis, including glioma, venous angioma or nonspecific white matter disease. Neurosurgical evaluation recommended non-surgical management and serial MRI monitoring, which revealed unchanging size and appearance of the intracranial lesion. Despite radiographic stability, her headaches worsened in duration and intensity, which substantially impaired her QOL. The patient's headaches were most likely multifactorial in origin, with plausible contributors being the intracranial lesion, prior vertex carcinoma excision, cervical and periscapular musculoskeletal dysfunction, postural abnormalities and/or age-related degenerative changes.

Initial management, including physical therapy, dry needling, Rimegepant (Nurtec) and NSAIDs, provided only a transient benefit. After approximately 12 months of persistent, refractory symptoms, the patient presented to our family medicine and lifestyle medicine clinic in May 2025 for further evaluation. On physical examination, there were no focal neurological deficits; however, musculoskeletal assessment revealed upper trapezius hypertonicity, weakness of the scapular depressors and tenderness to palpation at the occipital base. Based on her symptomatology and physical examination findings, her headaches demonstrated features consistent with chronic cervicogenic headache and occipital neuralgia.

A multimodal musculoskeletal approach was used for treatment, which incorporated acupuncture, OMT and a home exercise program. The treatment began with acupuncture using posterior cervical and upper thoracic acupoints that corresponded with the patient's pain distribution **(Figure 2)** with the goal of modulating nociceptive input and improving regional muscle tension.

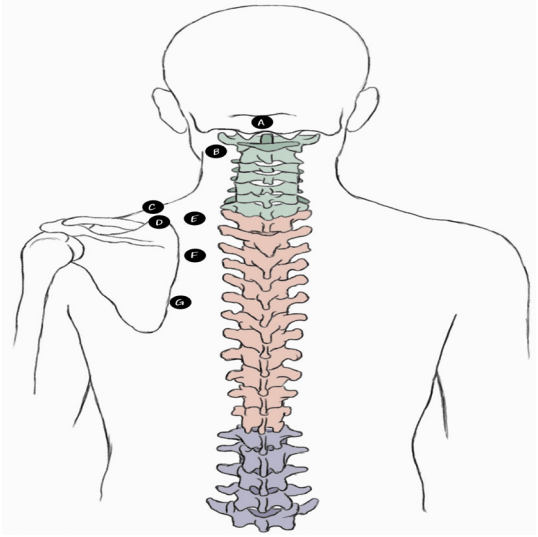

Figure 2: Acupoints used in adjunctive therapy for headaches in the reported case.

A: GV16; B: BL10; C: GB21; D: TW15; E: BL11; F: BL13; G: BL38. Although illustrated unilaterally, all points were applied bilaterally during treatment.

Following acupuncture, osteopathic manipulative techniques (OMT) were utilized to optimize musculoskeletal function by addressing relevant somatic dysfunction. Myofascial release (MFR) and then muscle energy (ME) were performed to target trapezius hypertonicity and scapular depressor weakness. The treatment sequence was then concluded with a high-amplitude, low-velocity (HVLA) thrust to the thoracic spine to improve any residual thoracic restriction, restoring thoracic mobility. Due to

exhibited weakness in scapular depression, the patient was given a daily exercise plan based on reciprocal inhibition principles to help activate her scapular depressors, thus reducing muscular tone in upper-cross muscles that may contribute to headaches[6]. These therapies were done at her weekly appointments over the next month, with progressive refinement based on symptomology. During her treatments, the patient reported no adverse effects from therapy, including worsening headache symptoms, new neurologic complaints, dizziness, syncope or functional impairment. She was eventually seen every three weeks and by six months of treatment, she reported substantial and sustained clinical improvement in headache frequency and intensity, which allowed her to have less reliance on medication and improve her sleep quality **(Table 1)**.

Table 1: Comparative assessment of patient's symptoms before and after treatments at 6 month follow up.

	Before treatment	After 6 months of treatment
Headache Frequency	Daily	1-2 per month
Headache Duration	At least 4 hours	Maximum 1-2 hours long
Awakened from sleep due to pain	1 time/week	No longer occurring
Severe headache limiting daily function	2 episodes/week	No longer occurring
NSAID dependency	Four Ibuprofen tablets daily	Required medication twice (two ibuprofen each) in the last six months

Discussion

Headaches represent one of the most common reasons for medical visits, both in emergency and primary care settings[3]. The pathophysiologic mechanism of chronic headaches is often multifactorial, including a combination of psychological stress, lifestyle triggers, musculoskeletal dysfunction and alterations in the central and peripheral pain pathways. As seen in this case, conventional therapies do not always provide sustained symptomatic relief and improvement in QOL. Since prior attempts at management provided only transient benefit, it was clear that a broader therapeutic approach was necessary and that no single modality was sufficient. With that, a multimodal musculoskeletal approach was used to engage in multiple therapeutic pathways, including biomechanical, myofascial and neuromodulator mechanisms[9]. In this patient, diagnostic evaluation could not attribute the symptoms to a single aetiology; however, physical examination did reveal cervical and periscapular dysfunction, which are known to contribute to cervicogenic headaches. In patients with headache phenotypes characterized by occipital neuralgia and cervicogenic features, such as this patient, targeted manual therapies may help alleviate symptoms by reducing cervical and suboccipital muscle tension and improving biomechanical function[7].

Chronic headaches and OMT

It is important to acknowledge that the brain itself does not have pain receptors and so the headache pain is often referred from the surrounding head, neck and upper thoracic structures. Specifically, the muscles of the suboccipital triangle, rectus capitis posterior major and obliquus capitis superior and inferior can undergo hypertrophy and/or asymmetry, resulting in possible occipital nerve compression. Dysfunctions in these musculoskeletal structures can perpetuate symptoms, which underscores the potential value of osteopathic manipulation in targeting these dysfunctions. In many cases, dysfunctions in the body can manifest as observable TART changes, also known as viscero-somatic dysfunctions. TART is an osteopathic acronym that refers to tissue texture changes, asymmetry, restricted motion and tenderness[8]. It is through these palpable changes, as well as other physical examination findings, that a somatic dysfunction can be diagnosed. OMT is not only used to diagnose somatic dysfunctions, but can also provide treatment by alleviating symptoms and subsequently reducing pain[3]. Generally, treatments can be categorized as either active or passive (based on the patient's involvement) and direct or indirect (based on the direction of treatment being away from or towards the restriction)[8]. The most common osteopathic techniques in the cervical spine are myofascial release and muscle energy[8].

In terms of the utilized treatment for this patient, myofascial release was applied in both a direct and indirect technique, with passive movements following the fascia in all directions of ease. This is intended to release the tension in the fascia and muscle fibres of the hypertonic upper-cross and cervical muscles. Both post-isometric relaxation and reciprocal inhibition of muscle energy were utilized in the patient's treatment plan. Muscle energy with post-isometric relaxation involved contracting the upper trapezius and rhomboids against an isometric force by the physician, followed by a few seconds of relaxation, which allowed for lengthening of the hypertonic muscles and increasing range of motion[9]. The treatment ended with HVLA, which was an applied, rapid force directed at the cervical facet joints, engaging the restrictive barrier and ultimately releasing the restriction[9]. Beyond in-office manual intervention, multimodal care also focuses on addressing psychosocial and lifestyle factors, including postural habits[5]. Postural habits, including forward-head posture and chronically elevated scapular positioning, can lead to inhibition and poor neuromuscular control of key scapular stabilizers. With weakened scapular stabilizers, there is compensatory overuse of upper-cross and cervical muscles and subsequently increased tension in the cervicothoracic junction[10]. Reducing hypertonic muscles like the rhomboids helps restore proper scapular motion and positioning, thereby reducing the mechanical stress that contributes to headache triggers. As seen in this case, this was ensured by providing the patient with a home exercise plan grounded in the principles of reciprocal inhibition and emphasizing posterior scapular chain activation[6]. The patient was instructed to perform an activation drill emphasizing controlled scapular retraction followed by scapular depression to preferentially activate antagonist muscles, like the lower trapezius and pectoralis minor. Activation of the stretch reflex of the muscle spindle fibres of those muscles caused the agonist muscles, such as the upper trapezius and rhomboids, to reflexively relax[9]. Additionally, this activation drill simultaneously retrained scapular control away from a chronically elevated posture towards a more dynamic motion.

Researchers hypothesize that OMT rebalances the autonomic nervous system, reduces pro-inflammatory substances, activates Golgi tendon organs and inhibits hypertonic muscles, all of which are associated with headaches[3,7]. Multiple systematic reviews and clinical trials have demonstrated that OMT significantly reduces pain intensity and improves function in patients with chronic musculoskeletal pain, such as chronic back pain. Specifically in headaches, OMT has been associated with

reductions in headache frequency, intensity and duration, as well as improvement in functional outcomes and QOL[8]. Not only do osteopathic techniques reduce pain, but studies have also indicated that combining multiple osteopathic approaches yields greater relief and headache reduction[7].

OMT has demonstrated a favourable safety profile, with reported adverse effects of discomfort, light-headedness and/or stiffness. Most of these adverse effects were reported within four hours of treatment and almost 75% had resolved symptoms within 24 hours[11]. In addition to safety, evidence suggests potential downstream benefits of manual therapies in reducing medication reliance. A large retrospective cohort study of adults with tension-type headache found that patients receiving spinal manipulative therapy had a significantly lower risk of butalbital prescription and a reduced risk of developing medication overuse headache over two years of follow-up compared with matched controls[12]. Although current evidence supports OMT as a low-risk modality, additional studies with larger sample sizes are needed to fully characterize the safety and long-term outcomes of OMT, particularly when multiple techniques are applied in a single session[11,12].

Chronic headaches and acupuncture

Recent studies, in parallel with Western medicine, have shown that acupuncture may stimulate the release of endogenous opioids, serotonin and norepinephrine that have downstream effects on nociceptors, inflammatory cytokines and physiological pain perception[13]. However, the mechanism of acupuncture is not completely known[13]. Chronic headaches involve dysfunctional pain processing and central sensitization, including altered activity within brainstem pain modulatory circuits and trigeminovascular pathways[2]. These neurological pathways may be influenced by the neuromodulator effects proposed in acupuncture therapy, providing a plausible contribution for symptom modulation in refractory headaches. Acupuncture has been studied explicitly in patients with chronic headaches, in which a Cochrane review showed that patients who received verum acupuncture had at least a 50% reduction in headache frequency when compared with usual care or sham acupuncture[13]. Additionally, another study showed that acupuncture improved the general state of health, mental health and functional capacity domains[4]. Ultimately, the authors concluded that acupuncture reduced pain and frequency of crises, minimized dependence on analgesics, improved quality of life and recommended it as an adjunctive therapy for those suffering from chronic headaches[4,13].

Regarding safety, both acupuncture and OMT are generally regarded as low-risk treatment options. Acupuncture is generally well tolerated, with minimal adverse effects, such as fatigue, local pain or micro bleeding[14]. With any procedure that involves needle introduction, there is a risk of bleeding, infection, nerve injury or trauma, such as a pneumothorax[14]. Overall, complications with acupuncture are infrequent and result in far fewer adverse effects relative to pharmacological therapies[14]. However, additional clinical studies are needed to further assess the safety of acupuncture in the treatment of headache disorders[13,14].

In addition to its safety profile, it is relatively cost-effective compared to standard care. For example, economic analyses from the United Kingdom estimated a cost of $12,080 per quality-adjusted-life-year (QALY) gained with acupuncture for patients suffering from chronic headache disorders, which falls well below commonly accepted cost-effectiveness thresholds[13]. By comparison, long-term pharmacologic management may offer limited sustained benefit, is associated with potential adverse effects and may be associated with higher long-term cost depending on medication class and duration of use[5]. Overall, available evidence supports acupuncture as a safe and cost-effective therapeutic option for the management of chronic headache disorders.

Multimodal musculoskeletal model

Acupuncture and OMT have gained increasing recognition for their effectiveness in disorders resulting in chronic pain[3,13]. Not only do both independently serve as effective treatments for pain, but when applied as a multimodal musculoskeletal treatment model, they can produce synergistic and lasting benefits[5]. Although individual therapies have been shown to reduce headache burden, studies have shown that a multimodal musculoskeletal treatment approach optimizes pain management and rehabilitation[5]. Pain is inherently complex and multifactorial. It is shaped by biological, psychological and lifestyle factors. Therefore, a more holistic approach is necessary to address all dimensions associated with pain management. Integrating multiple therapeutic modalities allows healthcare providers to address the physical, psychological and functional symptoms by leveraging the strengths of each modality. Unfortunately, current musculoskeletal care is often fragmented in practice. Patients are being referred to multiple providers for the management of a single clinical issue, which delays care and reduces follow-through. This delay causes many to rely solely on pharmacological measures[5]. This fragmentation is linked to prolonged pain, decreased function and poorer outcomes. However, a coordinated, multimodal approach can improve the level of care integration, promoting continuity of care. Providers can deliver this coordinated care either through a single practitioner skilled in multiple therapies or within a clinic where all services are accessible in the same facility in conjunction with one another[5]. This approach is particularly valuable for chronic headaches, many of which either arise from or are exacerbated by musculoskeletal dysfunction. Even in secondary headaches not caused by musculoskeletal dysfunctions, postural strain and muscle tension can still develop, further worsening symptoms. Addressing these musculoskeletal dysfunctions in an integrated way can help break the pain cycle and improve overall outcomes. In this case, the precise cause of the patient's headaches was uncertain. Despite this uncertainty, she experienced significant symptom relief and improved function. This case highlights the value of multimodal care in providing meaningful benefits for patients with chronic headaches, even when the underlying pathology is unclear.

Limitations

Certain limitations should be considered when interpreting this case. After initial imaging revealed a 1-cm caudal mass, serial MRIs were performed. However, the mass remained unchanged in terms of size and appearance and subsequently was unable to be used to monitor the patient's symptoms and/or response to treatment. Instead, treatment response was primarily measured using symptom outcomes reported by the patient, including headache frequency, intensity, duration, sleep

disruption, functional limitation and medication use. Given the potential for bias, future studies should include the use of a standardized, objective metric separate from subjective data. As this report involved a single individual, future studies should include larger sample sizes and control groups to enhance generalizability and strengthen the evidence. In this patient, there were multiple contributors that could have led to her headache, such as the stable intracranial lesion, post-surgical changes, musculoskeletal dysfunction, postural strain and age-related degenerative changes. Therefore, the observed improvement in symptoms cannot be attributed to the treatment of a single headache subtype. Additionally, further investigation is warranted to determine whether combined multimodal therapies is superior in terms of clinical benefit in comparison to individual interventions alone. All of these future studies will help further establish the efficacy of both OMT and acupuncture as individual interventions in chronic headaches, as well as when used in combination.

Conclusion

Patients with persistent, chronic headaches frequently experience debilitating physical, psychological and functional impairment, which can significantly impact a patient's quality of life. In this report, a coordinated multimodal musculoskeletal treatment approach was used in the management of a patient suffering from chronic headaches resistant to conventional care. This treatment plan integrated OMT, acupuncture and home exercises, all rendered by a single physician provider. Following this intervention, the patient reported reduced headache frequency and intensity, improved sleep quality, decreased reliance on analgesic medications and enhanced ability to perform activities of daily living. While these findings are limited by the descriptive nature of a single case, this report supports consideration of a coordinated, patient-centred, multimodal approach for chronic headaches that are refractory to conventional management. The observed clinical improvement reflects that the combination of multiple therapeutic modalities may have a synergistic effect. It has been in both the authors' clinical experience in this current case, as well as other cases, that the combination of multiple interventions at once provided improved clinical outcomes. Due to the significant global impact of headaches, further investigation, using larger cohorts and standardized outcome scales, is warranted to determine whether multimodal musculoskeletal interventions are clinically superior to individual therapies.

Acknowledgements

No additional acknowledgements to declare.

Conflicts of interests

No conflicts of interest to declare.

Funding

No funding to declare.

Ethical Approval

Consent of all participants was obtained.

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