



Case report

Effects of electroacupuncture on treatment-resistant chronic migraine with medication overuse headache: A 12-month follow-up case report

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ABSTRACT

Background: Medication overuse headache (MOH) is a secondary headache disorder that leads to pronounced disability and decreased quality of life. Available therapeutic options for MOH are limited, and many are only effective in a subset of individuals. Although the existing evidence is limited, acupuncture may be an effective treatment option for MOH.

Case presentation: A 45-year-old Chinese woman presented to the Medical Acupuncture Department of Sanming Integrated Traditional Chinese and Western Medicine Hospital on April 11, 2022. Thirty-five years ago, she had episodic migraines. The frequency increased over time, however, and for the past 10 years she has had daily headaches. These headaches were characterized by daily persistent throbbing pain on the left side of the patient's head, accompanied by photophobia, phonophobia, neck stiffness, dizziness, and fatigue. Without painkillers, the patient rated her headache intensity as 9 out of 10 on a visual analog scale (0 = no pain, 10 = intolerable pain), and reported that the headaches lasted for up to 7 days or more. With painkillers, the headaches had a reduced intensity (5 of 10), but persisted. The patient had taken 1–3.5 compound aminopyrine phenacetin tablets daily for more than 5 years. Standard conservative therapy (patient education, medication withdrawal, and behavioral intervention) for MOH had failed to improve her symptoms. Before her visit, the patient had headache and engaged in short-term medication use on 30 days per month. The total monthly headache intensity score was 90. The patient's Migraine-Specific Quality of Life Questionnaire (MSQ) score was 33 points, her Hamilton Depression Scale (HAMD) score was 24 points, and her Hamilton Anxiety Scale (HAMA) score was 20 points.

Results: After 48 acupuncture sessions over 24 weeks, the patient completely discontinued short-term analgesic use and the monthly number of headache days and headache intensity score were both reduced by 96.67 % (from 30 to 1 and 90 to 3, respectively), with no adverse effect. Compared with baseline, the MSQ, HAMD, and HAMA scores improved by 45, 17, and 16 points,

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respectively. At 12 months, the patient's condition remained stable and her MOH had not relapsed.

Conclusion: In the context of the current literature and the present case, electroacupuncture shows promise for the long-term relief of chronic migraine with MOH when other treatments fail.

1. Background

Medication overuse headache (MOH) is a secondary disorder caused by the overuse of acute headache drugs by individuals with underlying headache disorders [1]. It is characterized by regular (>10 or 15 days/month) overuse of acute or symptomatic headache medications, resulting in headaches occurring on ≥ 15 days per month and persisting for at least 3 months [2]. The prevalence of MOH in the general population ranges from 0.6% (as in China) to 7.1% [1,3]. This disorder is most common among people aged 30–50 years and predominates in females (male: female ratio, 1:3–4) [4]. It severely affects patients' quality of life and social functioning, and correlates with psychiatric disorders such as depression and anxiety [1,3]. Additionally, the overuse of analgesics due to MOH may lead to adverse events including gastritis, gastric ulceration, and liver and kidney damage [1].

The mechanisms underlying the pathophysiology of MOH have not been clarified fully, but may involve genetic factors and peripheral and central mechanisms, including those of descending pain modulation [1]. The management of MOH primarily includes discontinuation or withdrawal of the overused medication, patient education, behavioral interventions, and preventive treatment targeting MOH and underlying primary headaches [5]. However, the latter three approaches have limited effectiveness. Patient may experience anxiety about the idea of cessation [6] or have increased headache frequency or pain intensity [7]. Those with high headache frequencies and relevant mood disorders are more likely to experience pain recurrence after medication discontinuation [8]. As a result, the management of MOH remains a formidable challenge for clinicians and headache specialists, and new treatments are urgently needed.

Table 1
Symptom assessment at different timepoints.

	MOH patient (diagnostic criteria)	Baseline (April 11, 2022)	Week 4 (May 9, 2022)	Week 8 (June 6, 2022)	Week 12 (July 4, 2022)	Week 24 (October 10, 2022)	Follow-up after 12 months (October 11, 2023)	Change from baseline	
								Week 24	Follow-up after 12 months
Short-term medication use (days/ month)	>10 or 15 ^a	30 ^b	30 ^b	19 ^c	8	0 ^d	0 ^d	30	30
Headache frequency (days/ month)	$\geq 15^e$	30	30	19	8	1	1	29	29
Total monthly headache intensity score ^g	–	90	90	74	38	3	3	87	87
Headache duration	–	persistent pain ^f	persistent pain ^f	12–18 h	5–6 h	3–10 h	3–10 h	–	–
MSQ score	–	33	–	–	–	78	78	45	45
HAMD score	–	24	–	–	–	7	7	–17	–17
HAMA score	–	20	–	–	–	4	4	–16	–16
The patient's global impression of change ^h	–	–	4	4	6	7	7	–	–

Note: MSQ, Migraine-Specific Quality of Life Questionnaire; HAMD, Hamilton Depression Scale; HAMA, Hamilton Anxiety Scale.

^a Regular overuse of one or more medications for acute and/or symptomatic treatment of headache for more than 3 months: regular use of ergotamine, triptans, opioids, or compound analgesics ≥ 10 days per month, or regular use of non-opioid oral analgesics ≥ 15 days per month.

^b 1–3.5 oral compound aminopyrine phenacetin tablets/day.

^c No. of days with 1–1.5 tablets.

^d No analgesic need, overnight rest can provide relief.

^e Headaches persist for at least 3 months.

^f Last ≥ 7 days without analgesics, may be slightly relieved with analgesics, headache exacerbation time correlates with analgesic administration time.

^g Total monthly headache intensity score ranging from 0 to 90 (30 days times a daily score of 0, indicating no pain; 1, mild pain; 2, moderate pain; or 3, severe pain).

^h It consists of a single question concerning the patient's impression of the overall change in their disease status since the start of the study, with answers ranging from "very much worse" to "very much improved" on a 7-point scale.

Acupuncture is a traditional Chinese medical therapy that involves the stimulation of acupuncture points on the patient’s body, usually by the insertion of fine, disposable needles [9]. It is among the most widely used complementary treatments for chronic pain, including headaches [10]. Acupuncture has been found to effectively reduce the frequency and severity of migraine and tension headache attacks [11]. However, less is known about its effects on MOH. Here, we contribute to the existing literature by reporting the case of a patient who underwent electroacupuncture for treatment-resistant MOH, with 12 months of follow up.

2. Case presentation

A 45-year-old Chinese woman presented to the Medical Acupuncture Department of Sanming Integrated Traditional Chinese and Western Medicine Hospital on April 11, 2022. Thirty-five years ago, she had episodic migraines. The frequency increased over time, however, and for the past 10 years she has had daily headaches. Her headaches were characterized by daily persistent throbbing pain on the left side of her head, accompanied by photophobia, phonophobia, neck stiffness, dizziness, and fatigue, and that severe migraine typically endure for a duration of 7 days or more. They also caused poor sleep quality, anxiety and depression, and a poor quality of life. Medications that she had taken for this condition included painkillers (acetaminophen, acetylsalicylic acid, diclofenac sodium, ibuprofen, celecoxib, indomethacin, dihydroergotamine, zolmitriptan, and compound aminopyrine phenacetin tablets), preventive agents (topiramate and valproic acid), and anti-anxiety and depression medications (trazodone hydrochloride and mirtazapine). The compound aminopyrine phenacetin tablets slightly reduced the severity of the patient’s pain; she had required 1–3.5 tablets daily for more than 5 years. Without painkillers, she rated her headache intensity as 9 of 10 on a visual analog scale (0 = no pain, 10 = intolerable pain). With painkillers, the headaches were reduced to an intensity of 5, but persisted. At the time of the presentation, the patient’s diary confirmed that she had experienced headaches and engaged in short-term medication use on all days of the previous 30-day period, with a total monthly headache intensity score (sum of 30 daily scores; 0 = no pain, 1 = mild pain, 2 = moderate pain, 3 = severe pain) of 90. Her Migraine-Specific Quality of Life Questionnaire (MSQ) [12] score was 33 points, her Hamilton Depression Scale (HAMD) [13] score was 24 points, and her Hamilton Anxiety Scale (HAMA) [14] score was 20 points (Table 1). This patient had undergone cranial computed tomography, magnetic resonance imaging, and magnetic resonance angiography at several hospitals, and no obvious abnormality had been found. Following these procedures, she was diagnosed with chronic migraine with MOH [2]. Prior to her presentation, the patient was advised to discontinue the use of painkillers and instead prescribed oral anxiolytic and antidepressant medications, including trazodone hydrochloride, mirtazapine, and deanxit. Despite a year-long period of painkiller withdrawal, the intensity of the patient’s headaches did not improve, with the frequency of pain increasing to most days of the month (≥ 20 days). Headache attacks were alleviated by bed rest and the prescribed medications, but were still accompanied by symptoms such as dizziness, tinnitus, and fatigue. After one year, the patient experienced intolerable pain accompanied by dizziness and other discomforts, leading her to discontinue the anti-anxiety and depression medication independently, opting instead to intermittently use oral painkillers. The patient had a history of “chronic gastritis” due to long-term oral analgesic use, which had not been treated. She had no history of any other chronic disorder, such as diabetes or neurological or cardiovascular disease. Her aunts and cousins had histories of migraine, and her mother had a history of MOH.

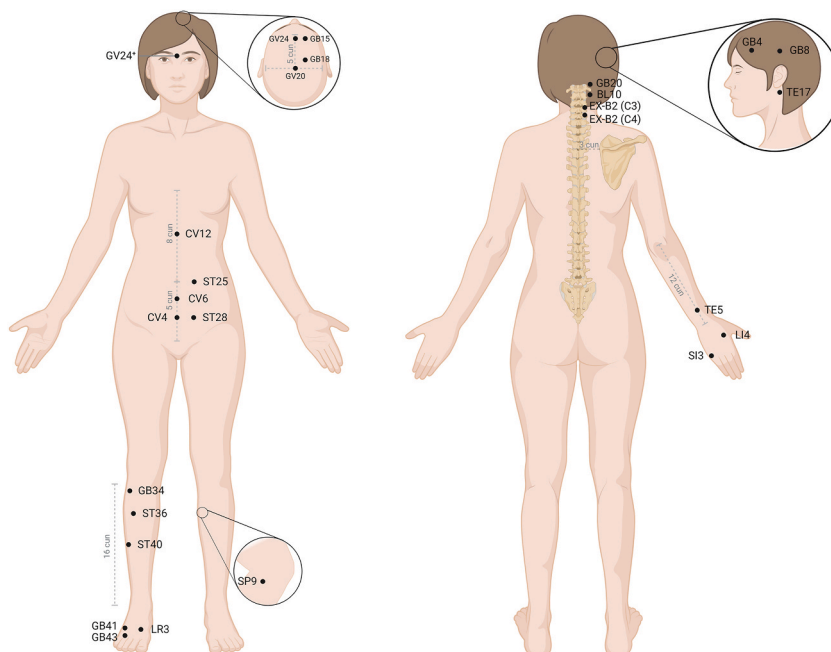


Fig. 1. Acupuncture points.

3. Acupuncture treatment

After providing informed consent, the patient underwent electroacupuncture treatment administered by a licensed acupuncturist with 10 years of clinical experience. Using the theoretical framework of traditional Chinese medicine, the acupuncturist diagnosed the patient with excessive dampness and heat in the gallbladder, liver, stomach, and spleen channels, with qi and blood stagnation. The selection of acupuncture points for the treatment was based on traditional Chinese medicine meridian theory to treat headache (incorporating both local and distal points simultaneously), existing relevant studies, and the expert opinions of the acupuncture research team. At each session, the following acupoints were stimulated: Yintang (GV24+), Shenting (GV24), Baihui (GV20), Zhongwan (CV12), Qihai (CV6), Guanyuan (CV4), and bilateral Toulinqi (GB15), Hanyan (GB4), Chengling (GB18), Shuaigu (GB8), Yifeng (TE17), Hegu (LI4), Waiguan (TE5), Houxi (SI3), Tianshu (ST25), Shuidao (ST28), Zusanli (ST36), Yanglingquan (GB34), Yinlingquan (SP9), Fenglong (ST40), Taichong (LR3), Xiaxi (GB43), Zulinqi (GB41), Fengchi (GB20), Tianzhu (BL10), and cervical Jiaji (C3–C4, EX-B2; Fig. 1, Table 2). The patient was prone for the needling of the GB20, BL10, and cervical Jiaji points and supine for the needling of the other points. Disposable needles (Hwato, 0.30 × 40 mm; Suzhou Medical Appliance Factory) were used to vertically or obliquely penetrate the skin to depths of 5–20 mm after the acupoint areas had been sterilized with 75 % medicinal alcohol.

Table 2
Acupuncture points and needling details.

Acupoint	Localization	Patient position	Insertion depth (mm)	Needling angle (°)
Yintang (GV24+)	On head, in depression between inner ends of the eyebrows	Supine	10–30	15 (horizontal)
Shenting (GV24)	On head, 0.5 cun ^a straight up from middle of front hairline	Supine	10–30	15 (horizontal)
Baihui (GV20)	On head, 5 cun straight up from middle of front hairline	Supine	10–30	15 (horizontal)
Toulinqi (GB15)	On head, 0.5 cun above front hairline, directly above pupil	Supine	10–30	15 (horizontal)
Hanyan (GB4)	On head, at intersection of upper 1/4 and lower 3/4 of curved line from Touwei (ST8) to Qubin (GB7)	Supine	10–30	15 (horizontal)
Chengling (GB18)	On head, 4 cun above front hairline, directly above pupil	Supine	10–30	15 (horizontal)
Shuaigu (GB8)	On head, 1.5 cun straight up from tip of ear into hairline	Supine	10–30	15 (horizontal)
Fengchi (GB20)	On neck, below occipital bone, in depression between upper ends of sternocleidomastoid and trapezius muscles	Prone	25–30	60 (tip toward contralateral nose tip)
Yifeng (TE17)	On neck, behind earlobe, in depression anterior to lower end of mastoid region.	Prone	10–20	90 (vertical)
Hegu (LI4)	On hand dorsum, between first and second metacarpals at about midpoint of second metacarpal radialis	Supine	10–30	90 (vertical)
Waiguan (TE5)	On the back side of the forearm, 2 cun above the transverse stripe of the dorsal distal part of the wrist, at the midpoint of the gap between the ulna and the radius.	Supine	10–20	90 (vertical)
Houxi (SI3)	On the dorsum of the hand, in the depression between the red and white flesh at the proximal end of the ulnar side of the fifth metacarpophalangeal joint.	Supine	10–15	90 (vertical)
Zhongwan (CV12)	In the upper abdomen, 4 cun above the umbilicus, on the anterior midline.	Supine	10–30	90 (vertical)
Tianshu (ST25)	In the upper abdomen, transverse to the umbilicus, 2 cun away from the anterior midline.	Supine	10–30	90 (vertical)
Qihai (CV6)	In the lower abdomen, 1.5 cun below the umbilicus, on the anterior midline.	Supine	10–30	90 (vertical)
Guanyuan (CV4)	In the lower abdomen, 3 cun below the umbilicus, on the anterior midline.	Supine	10–30	90 (vertical)
Shuidao (ST28)	In the lower abdomen, 3 cun below the umbilicus and 2 inches away from the anterior midline.	Supine	10–30	90 (vertical)
Zusanli (ST36)	Three cun below Dubi (ST35), one transverse finger (middle finger) from the anterior border of the tibia.	Supine	10–30	90 (vertical)
Yanglingquan (GB34)	On the lateral side of the calf, in the depression below the anterior aspect of the fibular head.	Supine	10–30	90 (vertical)
Yinlingquan (SP9)	On the medial side of the lower leg, in the depression formed by the lower edge of the medial tibial condyle and the medial edge of the tibia.	Supine	10–30	90 (vertical)
Fenglong (ST40)	On the lateral side of the lower leg, 8 cun above the tip of the ankle, outer edge of the tibialis anterior muscle	Supine	10–30	90 (vertical)
Taichong (LR3)	On the dorsum of the foot, between the 1st and 2nd metatarsals, in the depression anterior to the plantar union, or with palpable arterial pulsation.	Supine	10–20	90 (vertical)
Xiaxi (GB43)	Dorsum of the foot, between the toe crevices of the fourth and fifth toes, behind the edge of the webbing of the toes at the border of the red and white flesh.	Supine	10–15	45 (oblique)
Zulinqi (GB41)	The posterior aspect of the fourth metatarsophalangeal joint, in the lateral depression of the extensor tendon of the little toe.	Supine	10–15	90 (vertical)
Tianzhu (BL10)	At the back of the neck, horizontal to the superior border of the spinous process of the 2nd cervical vertebra, in the depression of the outer edge of the trapezius muscle.	Prone	10–20	90 (vertical)
C3 Jiaji (EX-B2-C3)	Both sides of the third cervical vertebra under the spinous process, 0.5 cun beside the posterior midline.	Prone	10–20	45 (tip toward spine)
C4 Jiaji (EX-B2-C4)	Both sides of the fourth cervical vertebra under the spinous process, 0.5 cun beside the posterior midline.	Prone	10–20	45 (tip toward spine)

^a One cun is equivalent to the greatest width of the participant's thumb, ~1.5 cm.

(Table 2). The acupuncturist then gently lifted and twisted the needle handles three times each to achieve “deqi” (pain, heaviness, swelling, or numbness) [15]. The paired electrodes of the electroacupuncture instrument (SDZ-V; Suzhou Medical Appliance Factory, Suzhou, China) were connected to the GV20, GV24, and bilateral GB20 acupoints, and stimulation was delivered with a 2-Hz continuous wave frequency and 1–4 mA current intensity, depending on the patient’s comfort level. The patient received a total of 48 20-min sessions (twice per week for 24 weeks).

4. Clinical outcomes

The patient’s condition was assessed at several timepoints using the numbers of days per month with headache and short-term medication use; total monthly headache intensity, MSQ, HAMD, and HAMA scores; and the patient’s global impression of change (Table 1, Fig. 2, Fig. 3) [16]. After the completion of acupuncture treatment, the patient completely discontinued short-term analgesic use, the number of headache days per month was reduced by 96.67 % (from 30 to 1), and the total monthly headache intensity score was also reduced by 96.67 % (from 90 to 3). A significant increase in the MSQ score (from 33 to 78 points; minimal clinically important difference [MCID] = 18 points [17]) and significant decreases in the HAMD (from 24 to 7 points; MCID = 4 [18]) and HAMA (from 20 to 4 points; response threshold, >50 % improvement in the total score [19]) scores were noted. The patient confirmed that she had achieved no relief from headaches in the 10 years before the acupuncture treatment, but that her headache disorder had improved dramatically and she was no longer on disability after treatment. At 12 months, the patient’s condition remained stable and her MOH had not relapsed. No unexpected or severe adverse effect was reported during the treatment or follow-up period.

5. Discussion

MOH was ranked twentieth among all causes of global years lived with disability in the 2015 Global Burden of Disease report [20], representing a significant burden in terms of disability and quality of life. Although the optimal treatment for MOH is debated, patient education, medication termination or withdrawal, and behavioral intervention are crucial elements of MOH management [1]. In this treatment-resistant chronic migraine with MOH case, 48 sessions of electroacupuncture treatment over 24 weeks resulted in the patient’s complete cessation of short-term analgesic use, the reduction of the monthly number of headache days, and improvements in the total monthly headache intensity score, anxiety and depression, and quality of life, with no acupuncture-related adverse event occurrence. At 12 months, the patient’s MOH had not recurred and her condition remained stable.

Optimal primary endpoints and follow-up duration recommendations for MOH trials have not been established [1]. In the present case, consistent with previous studies of MOH treatment [21,22], we chose to assess monthly short-term medication use and headache pain, quality of life, and anxiety and depression indicators, accompanied by the patient’s self-assessment of acupuncture efficacy. According to existing definitions of MOH and its cure [1,23], this patient was cured of MOH after receiving acupuncture treatment. Interestingly, the patient had previously undergone topiramate prophylaxis for a duration exceeding one year, a medication known for its efficacy in managing chronic migraine with medication overuse [24]. Despite this treatment, the patient continued to experience persistent headaches until seeking acupuncture. Hence, the curing of MOH in the present case appears to have been associated with the receipt of acupuncture.

The observations made in this study are in agreement with findings from one case report and one RCT. In a woman with intractable headache due to combined medication overuse and aseptic meningitis, the receipt of two 30-min acupuncture treatments was associated with a 72 % decrease in opioid demand from baseline, suggesting that acupuncture is a viable treatment option for MOH combined with headache secondary to such systemic disease [25]. In a secondary subgroup analysis of data from a randomized trial of acupuncture and topiramate use for chronic migraine [26], subjects with MOH who received 24 sessions of acupuncture showed significantly greater reductions in the number of days with acute headache medication intake and the monthly number of headache days compared with the topiramate group at 12 weeks after treatment (-8.7 ± 3.1 vs. -5.9 ± 4.6 [$P = 0.014$] and -10.3 ± 3.0 vs. -8.3 ± 3.8 [$P = 0.022$], respectively) [26]. Compared with previous studies, the alternative acupuncture approach taken in the

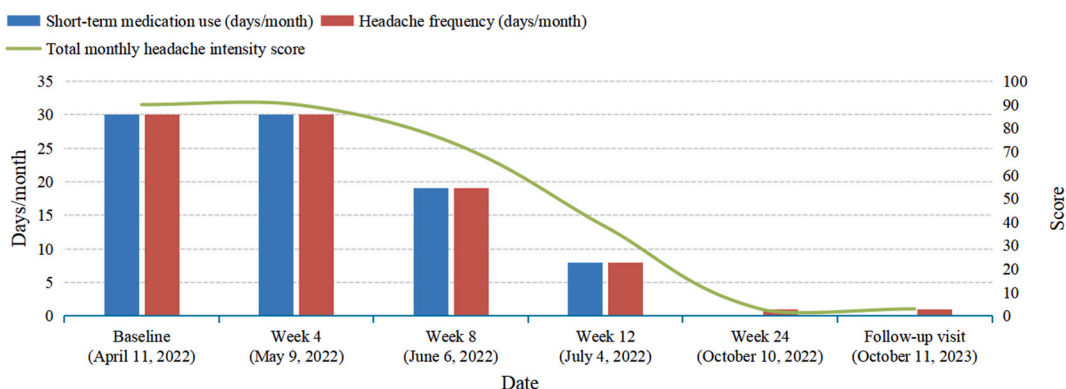


Fig. 2. Change from baseline in headache symptoms-related outcomes.

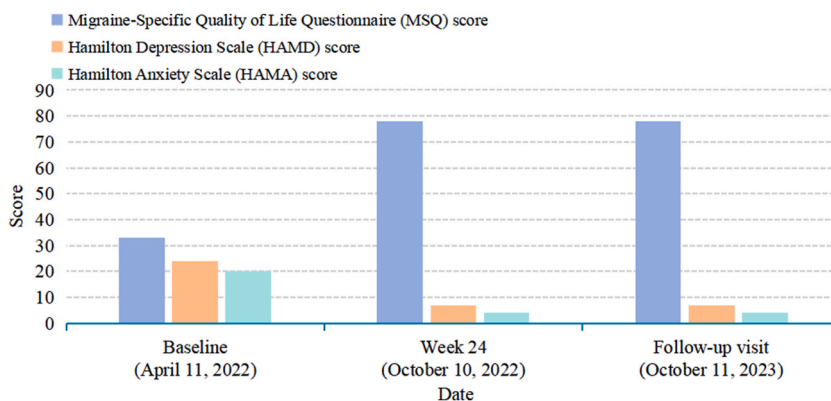


Fig. 3. Change from baseline in MSQ, HAMD, and HAMA scores.

present study involved more sessions over a longer period. Alternatively, the therapeutic impact of acupuncture on chronic migraine with MOH may manifest in its ability to transition chronic migraine to episodic migraine and alleviate medication overuse. The potential role of acupuncture in facilitating acute headache medication withdrawal was also suggested in this study [26], warranting further investigation in subsequent research endeavors.

The pathophysiology of MOH is incompletely understood. Research suggests that MOH is linked to the development of central sensitization [27,28] and the activation of peripheral trigeminal nociceptor [29]. The overuse of acute headache medication can alter the function of the central descending modulating system, resulting in increased neuronal excitability in peripheral and central nervous system structures and, in turn, headache, hyperalgesia, and/or allodynia [1]. Changes in the central descending modulating system are also associated with lower levels of serotonin and reduced density of specific opioid receptors [30]. The depletion of serotonin can trigger the expression of calcitonin gene-related peptide (CGRP) in the trigeminal ganglia, suggesting that regulating serotonin release and antagonizing CGRP could serve as a viable therapeutic approach for MOH [31,32]. The role of acupuncture in the treatment of MOH remains unknown. The inhibition of central sensitization regulated by glial plasticity has been shown to be a core mechanism of acupuncture analgesia [33]. Research has demonstrated that acupuncture can effectively alleviate migraines by increasing levels of 5-HT [34] and beta-endorphin levels [35]. Certain acupuncture points chosen in this study directly affect cervical spinal nerves. For instance, needling the GB20 point can stimulate the occipital nerve and impact the trigeminal cervicomedullary complex, leading to analgesic effects by restoring homeostasis in the trigeminal vascular nociceptive pathway [23]. Research has also demonstrated that acupuncture at GB20 can enhance migraine treatment by decreasing levels of CGRP in the trigeminal ganglion, trigeminal nucleus caudalis, and ventroposterior medial thalamic nucleus [36,37]. Collectively, acupuncture treatment for chronic migraine with MOH may exert analgesic effects through the up-regulation of serotonin and beta-endorphin expression in the central pain modulatory system, as well as the inhibition of CGRP in the caudal nucleus and dorsal horn of the trigeminal nerve [33,38].

The strength of this report is that it is the first to describe the effects of acupuncture for treatment-resistant chronic migraine with MOH, with 12 months of follow up to assess the treatment's long-term effectiveness. The current study is limited because it involved a single case and thus may not be generalizable to all patients with chronic migraine with MOH. The absence of a control group makes it difficult to draw firm conclusions about the effectiveness of electroacupuncture. There was an absence of blinding setup for outcomes evaluation and acupuncture implementation in the current study, which may have biased the results to some extent. In addition, the intensive nature of the acupuncture treatment may have increased the patient's burden. Additionally, as the MOH relapse rate is high as 42.1 % (16/38) at 3 years [39], a longer follow-up period may be needed. In the future, randomized controlled studies with larger sample sizes are needed to validate the efficacy and safety of acupuncture for chronic migraine with MOH.

6. Conclusions

Although this report describes a single case, it provides good evidence supporting acupuncture as a possible alternative therapy for chronic migraine with MOH that does not respond well to conventional therapy. Further evaluation of the efficacy and safety of acupuncture for chronic migraine with MOH is needed.

Research ethics and patient consent

The patient gave her informed agreement for her clinical data would be used for publications and research.

Data and materials availability statement

The materials supporting the evidence reported in this article are included within the article. Data included in article/supplementary material/referenced in article.

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Bullet points

- > It is the first to describe the effects of acupuncture for treatment-resistant chronic migraine with medication overuse headache (MOH).
- > We carried out 12 months follow-up to assess the long-term effectiveness of acupuncture.

CRedit authorship contribution statement

Ning Gao: Writing – original draft. **Lili Wu:** Writing – original draft. **Xinkun Liu:** Data curation. **Zhenyu Lin:** Data curation. **Zhishun Liu:** Writing – review & editing, Conceptualization. **Jun Liang:** Writing – review & editing, Conceptualization. **Weiming Wang:** Writing – review & editing, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

- [1] S. Ashina, G.M. Terwindt, T.J. Steiner, et al., Medication overuse headache, *Nat Rev Dis Primers* 9 (1) (2023) 5.
- [2] Headache classification committee of the international headache society (IHS) the international classification of headache disorders, 3rd edition, *Cephalalgia* 38 (1) (2018) 1–211.
- [3] S. Yu, R. Liu, G. Zhao, et al., The prevalence and burden of primary headaches in China: a population-based door-to-door survey, *Headache* 52 (2012) 582–591.
- [4] N. Vandenburg, D. Laterza, M. Lisicki, et al., Medication-overuse headache: a widely recognized entity amidst ongoing debate, *J. Headache Pain* 19 (1) (2018) 50.
- [5] H.C. Diener, D. Dodick, S. Evers, et al., Pathophysiology, prevention, and treatment of medication overuse headache, *Lancet Neurol.* 18 (2019) 891–902.
- [6] C. Sun-Edelstein, A.M. Rapoport, W. Rattanawong, A. Srikiatkachorn, The evolution of medication overuse headache: history, pathophysiology and clinical update, *CNS Drugs* 35 (5) (2021) 545–565.
- [7] N. Limberg, Managing migraine: medication overuse headache and treatment with eptinezumab, *Pain Ther* 12 (5) (2023) 1283–1291.
- [8] A. Raggi, A.M. Giovannetti, M. Leonardi, et al., Predictors of 12-months relapse after withdrawal treatment in hospitalized patients with chronic migraine associated with medication overuse: a longitudinal observational study, *Headache* 57 (1) (2017) 60–70.
- [9] A. Vickers, P. Wilson, J. Kleijnen, Acupuncture, *Qual. Saf. Health Care* 11 (2002) 92–97.
- [10] L. Fofi, G. Allais, P.E. Quirico, et al., Acupuncture in cluster headache: four cases and review of the literature, *Neurol. Sci.* 35 (Suppl 1) (2014) 195–198.
- [11] C. Haigh, Acupuncture reduced frequency and pain intensity of primary migraine or tension-type headaches, *Evid Based Nurs* 12 (2) (2009) 47.
- [12] B.C. Martin, D.S. Pathak, M.I. Sharfman, et al., Validity and reliability of the migraine-specific quality of life questionnaire (MSQ Version 2.1), *Headache* 40 (3) (2000 Mar) 204–215.
- [13] I.W. Miller, S. Bishop, W.H. Norman, H. Maddever, The modified Hamilton rating scale for depression: reliability and validity, *Psychiatry Res* 4 (1985) 131–142.
- [14] W. Maier, R. Buller, M. Philipp, I. Heuser, The Hamilton Anxiety Scale: reliability, validity and sensitivity to change in anxiety and depressive disorders, *J. Affect. Disord.* 14 (1988) 61–68.
- [15] K. Zhou, J. Fang, X. Wang, et al., Characterization of de qi with electroacupuncture at acupoints with different properties, *J Altern Complement Med* 17 (11) (2011) 1007–1013.
- [16] D.W. Dodick, S. Silberstein, J. Saper, et al., The impact of topiramate on health-related quality of life indicators in chronic migraine, *Headache* 47 (2007) 1398–1408.
- [17] J.C. Cole, P. Lin, M.F. Rupnow, Minimal important differences in the migraine-specific quality of life questionnaire (MSQ) version, *Cephalalgia* 29 (11) (2009) 1180–1187.
- [18] M.P. Hengartner, M. Plöderl, Estimates of the minimal important difference to evaluate the clinical significance of antidepressants in the acute treatment of moderate-to-severe depression, *BMJ Evid Based Med* 27 (2) (2022 Apr) 69–73.
- [19] B. Bandelow, Defining response and remission in anxiety disorders: toward an integrated approach, *CNS Spectr.* 11 (10 Suppl 12) (2006) 21–28.
- [20] GBD 2015 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015, *Lancet* 388 (10053) (2016) 1545–1602.
- [21] L.A. Pini, S. Guerzoni, M.M. Cainazzo, et al., Nabilone for the treatment of medication overuse headache: results of a preliminary double-blind, active-controlled, randomized trial, *J. Headache Pain* 13 (2012) 677–684.
- [22] L.N. Carlsen, S.B. Munksgaard, M. Nielsen, et al., Comparison of 3 treatment strategies for medication overuse headache: a randomized clinical trial, *JAMA Neurol.* 77 (9) (2020) 1069–1078.
- [23] S.B. Munksgaard, L. Bendtsen, R.H. Jensen, Treatment-resistant medication overuse headache can be cured, *Headache* 52 (7) (2012) 1120–1129.
- [24] H.C. Diener, P. Kropp, T. Dresler, et al., Management of medication overuse (MO) and medication overuse headache (MOH) S1 guideline, *Neurol Res Pract* 4 (1) (2022) 37.

- [25] R.T. Rudra, V. Gordin, L. Xu, Acupuncture in the management of medication overuse and drug-induced aseptic meningitis headache: a case report, *J Acupunct Meridian Stud* 13 (2) (2020) 58–60.
- [26] C.P. Yang, M.H. Chang, P.E. Liu, et al., Acupuncture versus topiramate in chronic migraine prophylaxis: a randomized clinical trial, *Cephalalgia* 31 (15) (2011) 1510–1521.
- [27] R.B. Lipton, M.E. Bigal, S. Ashina, et al., Cutaneous allodynia in the migraine population, *Ann. Neurol.* 63 (2008) 148–158.
- [28] D. Dodick, S. Silberstein, Central sensitization theory of migraine: clinical implications, *Headache* 46 (Suppl 4) (2006) S182–S191.
- [29] M. De Felice, M.H. Ossipov, F. Porreca, Update on medication-overuse headache, *Curr. Pain Headache Rep.* 15 (1) (2011 Feb) 79–83.
- [30] S. Ljubisavljevic, M. Ljubisavljevic, R. Damjanovic, S. Kalinic, A descriptive review of medication-overuse headache: from pathophysiology to the comorbidities, *Brain Sci.* 13 (10) (2023) 1408.
- [31] C. Sun-Edelstein, A.M. Rapoport, W. Rattanawong, A. Srikiatkachorn, The evolution of medication overuse headache: history, pathophysiology and clinical update, *CNS Drugs* 35 (5) (2021) 545–565.
- [32] S. Iyengar, K.W. Johnson, M.H. Ossipov, S.K. Aurora, CGRP and the trigeminal system in migraine, *Headache* 59 (5) (2019) 659–681.
- [33] Z. Lyu, Y. Guo, Y. Gong, et al., The role of neuroglial crosstalk and synaptic plasticity-mediated central sensitization in acupuncture analgesia, *Neural Plast.* 2021 (2021) 8881557.
- [34] X.X. Feng, K.Y. Huang, L. Chen, K. Zhou, Clinical efficacy of the shallow puncture and more-twirling acupuncture method in migraine treatment and its effects on serum 5-HT and β -EP levels, *Technol. Health Care* 31 (S1) (2023) 533–540.
- [35] F. Facchinetti, G. Nappi, F. Savoldi, A.R. Genazzani, Primary headaches: reduced circulating beta-lipotropin and beta-endorphin levels with impaired reactivity to acupuncture, *Cephalalgia* 1 (4) (1981) 195–201.
- [36] L.P. Zhao, L. Liu, P. Pei, Z.Y. Qu, Y.P. Zhu, L.P. Wang, Electroacupuncture at Fengchi (GB20) inhibits calcitonin gene-related peptide expression in the trigeminovascular system of a rat model of migraine, *Neural Regen Res* 12 (5) (2017) 804–811.
- [37] P. Su, X. Xie, Y. Xu, X. Luo, J. Niu, Z. Jin, Effectiveness of acupuncture in migraine rats: a systematic review, *PLoS One* 18 (1) (2023) e0280556.
- [38] C.H. Zhao, M.J. Stillman, T.D. Rozen, Traditional and evidence-based acupuncture in headache management: theory, mechanism, and practice, *Headache* 45 (6) (2005) 716–730.
- [39] L. Grazzi, F. Andrasik, D. D'Amico, et al., Behavioral and pharmacologic treatment of transformed migraine with analgesic overuse: outcome at 3 years, *Headache* 42 (6) (2002) 483–490.