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# Acupuncture in Primary Headache Disorders; Review of the Evidence

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## Abstract

Primary headache disorders affect large number of people worldwide. Migraine and tension type headaches constitute 95% of all headaches. Both tension type headaches and migraine impose huge socioeconomic impact on society. The role of non-pharmacological interventions in management of primary headaches is not entirely clear. Acupuncture is one of the most historical non pharmacological ways of treating migraine and tension type headaches. The evidence in support of its effectiveness however is conflicting. This review evaluates the available evidence regarding effectiveness of acupuncture for migraine and tension type headaches.

**Keywords:** Headache; Migraine; Spinal cord

## Introduction

Headache is one of the most common disorders of the nervous system with one year prevalence of 48.9% [1]. Headache disorders are associated with personal and societal burdens of pain, disability, damaged quality of life and financial cost. The World Health Organisation (WHO) considered headaches as one of the top 10 causes of disability [2].

Majority of headaches are primary i.e. not attributed to an identifiable underlying cause. Tension type headaches (TTH) and migraine constitute the vast majority of primary headaches with prevalence of 60-80% and 15% respectively [3]. Cluster headache is relatively uncommon (0.1%) [3].

Although pharmacotherapies remain the mainstay of management strategy in primary headache disorders, many patients continue to experience pain and social disruption. Adverse events to medications may also limit their use. This leads the health professionals to suggest the non-pharmacological strategies. Around 50% of chronic migraine patients and 27% of episodic migraines prefer non-pharmaco therapies for management of their migraine [4]. Acupuncture is one of the most popular non pharmacological treatment options in primary headaches disorders i.e. TTH and migraine.

National Institute for Healthcare and Clinical Excellence (NICE) in the UK recommended a course of up to 10 sessions of acupuncture over 5-8 weeks for prophylactic treatment of migraine if both topiramate and propranolol are unsuitable or ineffective [5]; the treatment however is not cost effective as long term prophylaxis. Despite a wide use of acupuncture in management of headache disorders, the available evidence to support its effectiveness remains inconsistent and inconclusive [6,7]. There are blinding issues and methodological shortcomings in many acupuncture trials.

| Study | Type of primary Headache | No of patients | Intervention | Results |
|---|---|---|---|---|
| Laitinen et al. (1975) | Migraine | 39 | Acupuncture alone | No long term benefit |
| Hesse et al. (1994) | Migraine | 77 | Acupuncture vs metoprolol | Equipotent effect in reducing frequency but metoprolol was superior in reducing severity. |
| Melchart et al. (1999)<br>Systemic review<br>22 trials | Migraine (15 trails)<br>TTH (6 trials)<br>Other headaches (1 trial) | 1042 | True acupuncture vs sham acupuncture | Some trend in favour of acupuncture but evidence was not convincing. |
| Melchart et al. (2001)<br>Systemic review<br>26 trials | Migraine (16 trials)<br>TTH (6 trials)<br>Other headaches (4 trials) | 1151 | True acupuncture vs sham acupuncture. | No straightforward conclusion could be drawn due to poor methodological quality of the clinical trials. |
| Linde et al. (2009)<br>Systemic review<br>22 trials | Migraine | 4419 | True acupuncture vs Sham acupuncture<br>Acupuncture vs other acute treatment/routine care<br>Acupuncture vs preventive pharmacotherapy | No statistically significant difference<br>Acupuncture was beneficial for short term.<br>Acupuncture found to be superior but trials quality was questionable. |

| | | | | |
|---|---|---|---|---|
| Tavola et al. (1992) | TTH | 30 | Acupuncture vs sham procedure | No difference |
| White et al. (2000) | TTH | 50 | True acupuncture vs sham acupuncture | No difference |
| Melchart et al. (2005) | TTH | 270 | Traditional or superficial acupuncture vs no treatment | Acupuncture more effective than no treatment. |
| Linde et al. (2009)<br>Systemic review<br>11 trials | TTH | 2317 | True acupuncture vs sham acupuncture<br>Acupuncture vs other treatment<br>Acupuncture vs acute treatments | Small but significant difference in favour of true acupuncture in reducing headache frequency.<br>No significant difference<br>Some benefit of acupuncture shown in two unblinded trials. |

**Table 1:** Summary of the trials.

The purpose of this review is to look through the available evidence that highlights the role of acupuncture in managing primary headache disorders i.e. migraine and TTH, identify potential factors contributing to inconclusive results and whether acupuncture could be considered as cost-effective long term prophylactic treatment especially in migraine after 2012 NICE guidelines (Table 1).

## Acupuncture in Primary Headache Disorders; The Evidence

Acupuncture is a system of complementary medicine that involves pricking of skin with fine needles to alleviate pain and to treat various physical and mental conditions. Acupuncture was originated as a part of Chinese medicine but now widely practiced in the West. According to population based survey in Germany 8.7% of adult population reported to receive acupuncture treatment in the previous 12 months [8]. A USA based survey showed 4.1% respondents reported life time use of acupuncture, 9.9% of them used for primary headache disorders [9]. Acupuncture either as monotherapy or part of complex regimen for treatment of headaches has been in practice for centuries. There are several mechanisms through which acupuncture believes to affect the neurophysiology and pain pathways. These include stimulation of nerves and muscles with subsequent release of endorphins and other neurohumoral factors affecting the pain pathways in brain and spinal cord [10,11], anti-inflammatory effects through release of immunomodulatory and vascular factors [12]; by increasing neuropeptide Y [13] or endorphin levels [14]. It is suggested that acupuncture might work through variable combination of peripheral and central mechanisms along with psychological (placebo) effects [15].

## Migraine

Migraine is the second most prevalent type of headaches with a 1-year prevalence of around 10% to 12% and a lifetime prevalence of between 15% and 20% [16]. It affects women more than men (3: 1) [17]. The WHO highlights migraine in the top 20 disabling conditions for women aged 15 to 44 [18].

Migraine is described as recurrent throbbing or pulsating headaches of moderate to severe intensity, often unilateral and lasts 4–72 hours with complete freedom between the attacks. The headaches are aggravated with physical exertion and are associated with nausea, vomiting and/or sensitivity to light, sound or smell [19]. A third of patients may experience focal neurological symptoms (aura) and many have prodromal symptoms of neck stiffness, yawning, irritability, depression, irritability with sensitivity to light, sound and smell [20]. Recurrent attacks varying in frequency from once a year to almost every day with a median frequency of 1-2 per month has been described [21]. Around 1.3-2.4% of migraine sufferers have chronic migraine (CM) defined by the IHS as headaches on 15 or more days in a month for more than 3 months of which 8 or more days per month with migrainous features [19,22]. Migraines, in particular CM are recognisable public health problem that represents immense socioeconomic burden [23,24].

## Pathophysiology of Migraine

Migraine is a complex neurobiological disorder with diverse symptomatology. The underlying mechanisms of migraine are being better understood in recent years. During most part of twentieth century vascular dysfunction was believed to be the primary cause of migraine. It was proposed that aura of migraine is driven by hypoxemia related to transient intracranial vasoconstriction with pain as a consequence of rebound vasodilation [25,26]. However this failed to explain the prodromal symptoms and other associated autonomic and cognitive symptoms seen in migraine [23,24]. Moreover, the intracranial blood flow patterns demonstrated by advanced functional neuroimaging studies in recent years were found to be inconsistent with the concepts of vascular hypothesis [27,28]. Current evidence suggests neuronal dysfunction as the primary drive leading to complex sequence of spreading depression, activation of trigeminovascular system and neuronal sensitization that accounts for prodrome, aura, headache and postdromal phase of migraine [17].

## Treatment of Migraine

The management of migraine is guided by severity and frequency of attacks. The treatment options aims to either alleviate the acute pain (abortive) or reduce the frequency of attacks (preventive). The primary objective of prophylactic treatment is to reduce the severity, frequency and duration of migraine attacks. Although pharmacological options such as propranolol, topiramate and amitriptyline remain the mainstay of prophylactic treatment [29] a significant proportion of patients struggle either due to adverse effects or lack of efficacy [30,31]. These patients often resort to non-pharmacological measures. Acupuncture is probably the most historical and extensively studied non-pharmacological treatment for migraine. In 2012 NICE recommended the use of acupuncture for up to 10 sessions over a course of 5 to 8 weeks as second-line prophylactic treatment for migraine [29].

## Acupuncture in Migraine

There are number of trials performed to evaluate the effectiveness of acupuncture comparing it to normal standard of care or sham acupuncture. The evidence for its effectiveness especially for long term prophylaxis remains inconclusive [32]. Most of the trials are faced with quality related issues in terms of blinding, methodology, sample size or choice of instruments [33]. Larger good quality clinical trials either found no difference or short term benefit over sham [34]. Its cost effectiveness beyond 11 sessions is also questioned by NICE. The cost is another relevant issue and NICE reckon acupuncture as not a cost effective treatment option if is to be used for more than 11 sessions [29].

## Earlier Trials

In 1975, Laitinen et al. evaluated the efficacy of 5 (weekly) sessions of acupuncture for migraine prophylaxis in 39 patients. After good initial response (92%), most of the patients (54%) relapsed to pre-acupuncture state after 6 months [34]. Hesse et al. in 1994 compared acupuncture with metoprolol in migraines prophylaxis through a randomised controlled trial. Patients were recruited to a 17 week regimen with sham stimulation, acupuncture, oral metoprolol or placebo. Acupuncture was found to be equipotent to metoprolol for reducing the duration and frequency of attacks but not severity of migraine attack [35]. Melchart et al. in 1999 systemically reviewed 22 randomised (or quasi randomised) controlled trials (1042 patients) of which 15 were in migraine patients. The objective was to assess the effectiveness of acupuncture in treatment of recurrent headaches. Fourteen trials compared acupuncture with sham stimulation and showed a trend in favour of acupuncture. The other eight trials compared acupuncture with other treatments was inconclusive. The evidence overall was not convincing and further large scale studies were recommended [36]. Cochrane data base systemic review evaluated 26 randomised or quasi randomised trials (1151) on primary headaches comparing acupuncture with no treatment or sham stimulation in 2001. Sixteen trials were on migraine patients, six in tension type headaches and four were in patients with various types of primary headaches. Eight of the 16 trials in migraine showed superiority of true acupuncture over sham. The review, however identified methodological and/or reporting shortcomings in majority of trials and concluded that the existing evidence although suggest some value of acupuncture in treatment of idiopathic headaches, the quality and strength of evidence were not convincing [37].

## Recent Trials

Recent Cochrane review in 2009 included 22 trials (5 multicentre) on 4419 migraine patients (mean 201 per trial; median 42) comparing acupuncture with normal standard of care or sham or other interventions (massage, biofeedback, behavioural therapy) in reducing frequency of migraine attacks [38].

## Acupuncture vs. Acute Treatment/Routine Care

Six of these 22 trials (including two large trials with 401 and 1715 patients) compared acupuncture to either acute treatment only or with routine care. The "routine care" was not particularly explained in trial protocols. Although patients treated with acupuncture showed good response with reduction in frequency and number headache days after 3-4 months; long term benefit was not assessed except by Vickers et al. (2004) who found moderate effectiveness of acupuncture at nine months [39]. Blinding was a major issue and the duration/frequency of acupuncture was not standardised.

## True Acupuncture vs. Sham Acupuncture

The true acupuncture treatment was compared with sham (placebo acupuncture) interventions in fourteen trials. Sham acupuncture mimics the true acupuncture but differs in at least one aspect i.e. either skin penetration or correction point location. . Risk of bias was low as all the trials attempted to blind the patients. However, there were significant variations in Sham techniques in terms of type of needles, their penetration depth, distance and duration and points of needling. In two trials sham interventions were used without skin penetration. Pooled data analyses failed to show a statistically significant differences between true acupuncture and sham interventions for any outcome measures including headaches frequency, number of migraine attacks, intensity, headaches scores or analgesics use. Pooled effect size, however need to be interpreted with caution due to significant variations in treatment and sham interventions.

## Acupuncture vs Pharmacotherapy

Four trials compared acupuncture to pharmaceutical treatment. Flunarazine [40], metoprolol [41,42] and some other drugs [43] were compared. Overall, the acupuncture was found to be superior in efficacy with lack of adverse events but three of the trials (Allias in 2002; Diener in 2006; Streng in 2006) were open label; bias therefore cannot be ruled out. There were technological and methodological issues in Hesse study that was conducted in 1994 such as sequence generation and concealment.

## Acupuncture vs. Other Treatments (Relaxation/ Massage)

Acupuncture was compared to other treatments like relaxation techniques [44] or a combination of relaxation and massage [45]. The findings were not reliable as both studies were small and had methodological shortfalls.

A single blind randomised multicentre study in 480 migraine patients comparing acupuncture in migraine specific sites with other sites or sham procedure showed no significant difference measured through number of migraine days during week 5-8 of treatment although the number of migraine days showed a minor improvement in the week 13-16 of treatment [6]. The study involved three groups receiving acupuncture based on traditional Chinese medicine at migraine specific sites with the control group receiving sham acupuncture. Another randomised blinded study evaluating the efficacy and safety of manual acupuncture versus sham acupuncture in 50 migraine patients showed the real acupuncture to be safe and effective although the benefit was seen in the first three months following treatment in a yearlong follow up [7].

## Cost Effectiveness

Two small studies analysed the cost effectiveness of acupuncture in chronic headaches (not migraine specific) and found the procedure to be costly compared to normal standard of care, although incorporating improvement in quality adjusted life years (QALY), the treatment was cost effective in the short term with insufficient evidence of long term benefit particularly in migraine patients [46,47]. Based on this NICE guidelines recommend short term use and do not consider

acupuncture as cost effective when more than 12 sessions of treatment is required [5].

## Summary

The benefit of acupuncture in migraine remains doubtful. The benefit in large good quality trials is small and short term. The conflicting results from other studies may well be due to blinding issues, non-standardised acupuncture techniques and lack of quality control data.

## Acupuncture in Tension Type Headaches

Tension type headache (TTH) is the most prevalent type of headache worldwide. It is estimated that 78% of the general population is affected by tension type headaches [48]. Majority have infrequent episodic TTH (once a month or less) with 24 to 37% experiencing headaches several days a month and 10% suffers once weekly. The duration of episodic TTH varies from 30 minutes to few days [49]. Chronic TTH evolves from episodic headaches and is defined as occurring on more than 15 days a month for at least three months. Chronic TTH is rare and the lifetime prevalence is estimated to be 2-3% [48,49]. TTH are defined as recurrent headaches of mild to moderate intensity, usually bilateral and pain is often described as of pressing or tightening quality. These headaches do not seem to be aggravated by physical exertion and nausea, vomiting is usually absent but photophobia or phonophobia may be present [48]. TTH is often diagnosed when there is absence of typical features of other primary and secondary headaches. Its pathophysiology is poorly understood. The most acceptable explanation is that central pain mechanism seems to take part in chronic TTH while peripheral pain mechanisms play a role in episodic TTH [50]. Most patients with episodic TTH do not consult and consume over the counter painkillers with aspirin, paracetamol and non-steroidal anti-inflammatory drugs (NSAIDS) being the mainstay of acute treatment. Those with frequent headaches may require prophylaxis with tricyclic antidepressants [51,52]. Chronic TTH are difficult to treat. They are often associated with significant comorbidities like anxiety and depression. The treatment strategy therefore should be multimodal including addressing the comorbid conditions, pharmacological and non-pharmacological interventions. Non pharmacological interventions include muscle relaxation, biofeedback, aerobic exercises, patient education and acupuncture. Acupuncture has been widely used as complimentary treatment for the management of TTH. Although recent evidence supports its role as short term treatment of TTH, but overall the results remain controversial.

## Earlier Trials

A randomised study on 30 patients with TTH comparing traditional acupuncture versus sham procedure showed no significant difference in the two groups for the intensity, frequency and duration of headache or consumption of analgesics at 4 weeks. Patients were followed up for a year [53].

In their systemic review of 22 trials (N = 1042) of which six were in TTH, Melchart et al. (1999) found a trend in favour of acupuncture although the evidence was far from convincing. Most of the trials had methodological flaws and were poorly designed [54]. A multicentre randomised controlled trial comparing real acupuncture with sham procedure in 50 patients with episodic TTH showed no significant difference in the number of headache days at 3 months [55].

Cochrane data base systemic review of 26 trials (16 in migraine, 6 in TTH and 4 trials with different types of headaches) to assess the effectiveness of acupuncture in idiopathic headaches found acupuncture to be more effective in 8 of the 16 trials among migraine and TTH; four trials showed trend in favour of true acupuncture while no differences were detected in remaining two trials. The majority of trials however were found to have methodological and/or reporting shortcomings. Studies that compared acupuncture with other treatments showed contradictory results [56]. Further large scale good quality trials were recommended in the Cochrane review.

Melchart in 2005 [57] in their study on 270 patients evaluated the effectiveness of traditional acupuncture with superficial acupuncture or no treatment in patients with TTH. Patients were randomised to receive 12 sessions of either treatment. Response was evaluated through the number of headache days 4 weeks prior to treatment with 9-12 weeks post-randomisation. Patients benefited in both acupuncture groups reporting reduction in headache days by 7.2 days (traditional) compared to 6.6 days (superficial) and 1.5 days (no treatment). The acupuncture was clearly found to be more effective than no treatment but the results could represent a strong placebo effect.

## More Recent Trials

The updated version of aforementioned Cochrane review looked at various trials evaluating the effectiveness of acupuncture as compared to sham acupuncture, normal standard of care or other interventions in TTH [58]. All trials included had minimum post randomisation follow up for 8 weeks. The main outcomes were a 50% reduction in headache frequency, analgesic consumption and pain intensity. 11 trials (2317 patients) reviewed were for TTH patients.

## True Acupuncture vs. Sham Acupuncture

Six trials compared true acupuncture with 'fake' acupuncture [59-63]. Only one trial found significant reduction in headache days in the true acupuncture in the first six months [59] although no difference was found in the headache intensity. The trial was the largest hence had a major impact on the meta-analysis. The pooled analysis of data on analgesic use [60-62] showed only a small effect of true acupuncture over sham acupuncture during first four months. Only one study with a follow up of 12 months showed reduction in headaches frequency, headaches index and analgesic consumption with time but no differences were found between acupuncture and placebo treatment (study already mentioned above as one of earlier trials) [62]. Overall, there was found to be a small but significant difference in favour of true acupuncture in terms of headache frequency during six months period.

## Acupuncture vs. Other Treatments (Physiotherapy/ Relaxation/Massage)

Acupuncture was compared to other treatments like physiotherapy, relaxation or combination of relaxation and massage in four trials [45,64-66]. Two studies found significant reduction in headache days in the non-acupuncture arm [65,66] (massage and physiotherapy) while others showed insignificant benefits or a small trend favouring acupuncture There were number of methodological uncertainties found in most of these trials that could potentially affects the reliability of results [64,45].

## Acupuncture vs. Acute Treatments

Two unblinded (potential bias) trials reported benefit of acupuncture in treating acute headaches in comparison to normal standard of care or acute pharmaceutical intervention [57,67]. A systemic review and meta-analysis of 8 randomised controlled trials comparing acupuncture and sham procedure in TTH prophylaxis showed no significant benefit in the acupuncture arm in reducing headache frequency [68,69].

## Conclusions

Primary headaches continue to be one of the major causes of disability worldwide. The role of non-pharmacological interventions is important, especially when the pharmacological treatment options become limited either due to their adverse effects or poor response. The role of acupuncture in management of primary headache disorders remains unclear. The results from Cochrane reviews suggest acupuncture could be considered as the non-pharmacological treatment option in both TTH and migraine but the quality of trials, difficulties with blinding, methodological shortfalls and lack of long term follow up makes it difficult to justify its use as cost effective long term prophylactic treatment. Moreover variations in acupuncture treatment frequency, needle retention and acupuncture stimulation mode were found to be the relevant factors contributing to conflicting results. There is need for good quality, standardised large randomised trials to find definitive answers. Based on the current evidence acupuncture may well be considered as a useful short term prophylactic treatment option in migraine patients particularly those with lack of response or adverse events to oral pharmaceutical agents.

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