

Nonpharmacologic Treatments for Migraine and Tension-Type Headache: How to Choose and When to Use

Robert A. Nicholson, PhD^{,1,4}*

Dawn C. Buse, PhD²

Frank Andrasik, PhD³

Richard B. Lipton, MD²

Address

^{*,1}Department of Neurology & Psychiatry, Saint Louis University School of Medicine, 1402 S. Grand Blvd. Monteleone Hall, St. Louis, MO 63104, USA
Email: nicholra@slu.edu

²Department of Neurology, Albert Einstein College of Medicine, Montefiore Headache Center, Bronx, NY, USA

³Department of Psychology, University of Memphis, Memphis, TN, USA

⁴Ryan Headache Center, Mercy Health Research, St. Louis, USA

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Opinion statement

There are a variety of nonpharmacologic treatments for headache. Educating patients about headache and its management, identifying and managing triggers (via diaries), modifying lifestyles, and understanding the importance of adopting and adhering to interventions (either pharmacologic or nonpharmacologic) are relevant to all persons with headache. In addition, specific nonpharmacologic treatments can be used either alone or in conjunction with ongoing pharmacologic intervention. Strong candidates for nonpharmacologic treatment include individuals with significant headache-related disability, comorbid mood or anxiety disorders, difficulty managing stress or other triggers, medication overuse, and patients who prefer a specific treatment. Behavioral treatments (relaxation, biofeedback, and cognitive-behavioral therapy) possess the most evidence for successful headache management. They have a long history of randomized trials showing efficacy and are considered first-line preventive options. Among complementary and alternative treatments, recent positive findings from randomized trials using acupuncture provide evidence of its potential as a first-line

intervention. Other complementary and alternative techniques do not have a consistent base of research to recommend them for headache prevention, but they may be used if the patient prefers this approach or when other first-line interventions (nonpharmacologic or pharmacologic) have not provided adequate results. Among “natural” treatments, both butterbur extract and vitamin B2 have shown efficacy in more than one randomized trial and are thus potentially useful first-line preventive interventions.

Introduction

Headache is a ubiquitous symptom, arising from a broad range of primary and secondary disorders. The two most common primary headache disorders are tension-type headache (TTH), affecting about 40% of adults in the United States [1], and migraine, affecting about 18% of women and 6% of men [2]. Both TTH and migraine have episodic and chronic forms. The episodic forms are characterized by headache on fewer than 15 days per month, whereas the chronic forms are characterized by headache on at least 15 days per month for at least 3 months. Chronic TTH and chronic migraine each afflict about 2% of the general population [3]. These headache disorders create an enormous burden [4].

The individual and societal burden of TTH and migraine make both of them important targets for treatment. Treatment strategies include both nonpharmacologic and pharmacologic approaches. These treatment approaches are typically used in concert, and each intervention may enhance the other’s effectiveness [5–7]. Treatment decisions must be tailored to the patient, based on an array of factors including the headache diagnosis and severity, the comorbidity profile, response to prior treatment, and patient preference.

Pharmacologic approaches are broadly divided into acute and preventive treatments. Acute treatments are taken at the time of a headache attack to relieve pain and restore function. Virtually everyone with migraine uses acute treatments in the form of prescription drugs (which are underused), over-the-counter acute medications, or both. Preventive treatments are taken daily, whether or not headache is present, to reduce the probability of attacks. The decision to use preventive strategies is situation-specific, but in general, patients with any combination of the following may benefit: at least eight attacks per month, significant disability from headache attacks, inadequate response to acute medications, significant side effects from acute

medications, or medication overuse [8]. Preventive treatments are indicated for about one third of migraine sufferers, but they are used by only about one tenth [9].

Nonpharmacologic and pharmacologic treatments go hand in hand. The extent to which nonpharmacologic interventions will benefit an individual is based on the patient’s presentation, but certain nonpharmacologic interventions can benefit any patient. Patient education about headache and its management, trigger identification (via diaries), trigger management, lifestyle modification, and knowing how and when to take headache medication to optimize its efficacy are relevant to all persons with headache. In addition to these widely applicable interventions, specific nonpharmacologic interventions may benefit certain individuals. These include behavioral treatments, complementary and alternative medicine (CAM) treatments, “natural” medications, and surgical treatments. Patients likely to benefit include those experiencing problems with mood and/or anxiety; difficulties coping with headache, or significant headache-related disability; significant problems managing stress or other triggers; medication overuse; history of trauma; or a desire to pursue a specific treatment modality [10]. Choosing the optimal interventions requires active collaboration between the patient and clinician, focusing on the patient’s treatment needs and preferences. The clinician’s time and resources allotted to establish collaboration are often limited, but establishing a collaborative relationship can improve outcomes and increase patient and clinician satisfaction.

This review initially describes approaches that are applicable to almost all patients and then reviews the evidence for specific nonpharmacologic interventions.

Therapeutic alliance, education and adherence

Initiating the interview

Many patients approach the clinical encounter experiencing a combination of fear, embarrassment, desperation, and hope. Patients may simultaneously fear that they have a brain tumor, that the doctor will treat them dismissively, or that they have such severe headaches that nothing can be done.

We recommend beginning the encounter with a directed, open-ended question or statement such as “Tell me about your headaches and how they affect your life.” Though clinicians may be less comfortable using open-ended questions, research demonstrates that this approach improves communication and satisfaction for the patient and clinician, and in the end it saves time [11]. Patients rarely speak for more than 1 min in response to this question. In that time, they can provide a wealth of information about their priorities, personality, and the role headaches play in their lives. They usually also provide diagnostic information such as pain location, quality, duration, and associated symptoms.

Presenting the diagnosis

Most patients presenting with recurrent, disabling headaches have migraine. This diagnosis can often be made based solely on the history and examination. If the diagnosis is uncertain, remaining issues need to be addressed. If there are unusual features or “red flags,” diagnostic testing may be required [12]. Even if the diagnosis is clear to the clinician, however, the patient may have prior fears or beliefs that need to be recognized and addressed. For example, if a patient has a deep and erroneous belief that they have sinus headaches, education about migraine may be ineffective until their assumptions about sinus headache are addressed. Similarly, if a patient is unreasonably fearful about a brain tumor, reassurance is usually sufficient, but sometimes neuroimaging should be considered a nonpharmacologic treatment for the education and reassurance it provides.

Educating the patient about the disorder and its treatment

We legitimize the patient’s experience by describing migraine as a biologic disorder of the nervous system. We present migraine as a disorder of the sensitive or hyperexcitable brain, to provide a context for viewing trigger management, relaxation methods, and preventive medications as interventions that help stabilize the brain. Explaining the role of stress and of relaxation after stress is a key part of patient education (discussed more fully in the section on behavioral interventions).

We introduce treatment plans using strategies designed to optimize adherence. We begin by assessing and addressing the patient’s perception of the risks and benefits of an intervention, as described by Hahn [11] and as illustrated in Table 1. If the patient believes that the benefit is great and the risks are low (Quadrant A), adherence is likely. If the patient believes that the risks are high and the benefits are low (Quadrant D), adherence is very unlikely. For quadrants B and C, there is a balance. Adherence approaches involve modifying the patient’s perceptions of benefits so that they clearly

Table 1. Weighing the risks and benefits of adopting and adhering to a headache intervention

Risk of intervention	Benefits of intervention	
	High	Low
Low	A	B
High	C	D

outweigh the risks. This approach can help the patient decide whether to engage in and adhere to any pharmacologic or nonpharmacologic intervention.

We use other nonpharmacologic interventions to raise the patient's sense of self-efficacy and address any psychiatric comorbidities (see Buse and Andrasik [13•] and Nicholson [14•] for details).

Treatment

Diet and lifestyle

- Certain foods are anecdotally considered potential headache triggers, but many of these do not have strong evidence to fully establish them as triggers. The foods most likely to be triggers include monosodium glutamate (MSG), aspartame, nitrates, alcohol (particularly red wine), and caffeine in excess of 200 mg per day [15–18•]. Those with less evidence include tyramine and chocolate [16].
- Lifestyle factors mitigating migraine include regular sleep, meals, and exercise; stress reduction; and overall trigger management. By definition, exposure to a trigger factor increases the probability of headache onset for a clinically relevant time period, usually minutes to days. When triggers seem robust, individuals need to determine whether avoidance or management of the trigger is most likely to improve headache control. Having a patient keep a diary is one of the best ways to identify the lifestyle and trigger factors most relevant to their headaches. This helps the patient recognize potential triggers and makes them feel the headaches are less random and less out of control.
- Trigger factors have been usefully (but imperfectly) divided into three categories:
 - Triggers that are avoidable and manageable. These include alcohol, certain foods, bright lights, and loud noise. Identification and avoidance of these triggers (e.g., avoiding foods that are a trigger, wearing sunglasses to avoid bright light or glare) are beneficial.
 - Triggers difficult to avoid and manage. These include hormones, weather changes, and certain types of travel (eg, airplanes). These triggers, sometimes can be managed. For example, menstrual migraine can be treated with hormonal manipulation or preemptive treatments. The rare patient whose headaches are triggered by falling barometric pressure may move to a more stable climate. In addition, if patients recognize these triggers, they can modify other factors at times of increased risk. For

instance, some patients can drink alcohol or skip a meal at most times of the month without triggering a headache, but not during their menstrual period. At vulnerable times, it becomes even more important to practice self-management skills and ensure medication adherence.

- Triggers that are unavoidable but manageable. This includes triggers such as insomnia, stress, and skipping meals. Education and skills training are most useful for these triggers. When problems with these triggers—especially stress—are significant, the patient is likely to benefit from consulting with a psychologist or other mental health provider.
- Most studies of trigger factors conduct cross-sectional surveys of patients' beliefs about what triggers their headaches [15–18•]. This kind of research generates hypotheses but does not support strong causal inferences. Rigorous diary studies or blinded exposure in the context of clinical trials supports causal links, but few studies of this type have been published. Thus, despite evidence that reducing triggers is related to reducing headache [18•,19,20•] and the understanding and appreciation of the role triggers play in headache, evidence of the impact of managing triggers on headache is primarily anecdotal.

Behavioral interventions

- Behavioral interventions emphasize the prevention of headaches. Long-term goals of behavioral interventions include reduced frequency and severity of headaches, reduced headache-related disability and affective distress, and enhanced personal control of headaches. One key component of behavioral intervention involves educating the patient about the connection between stress and headache. We conceptualize stress at three levels: 1) the stressful event; 2) the person's reaction to, evaluation of, and adaptation to the stressful event; and 3) the physiological consequences of the event. Behavioral interventions provide the patient with tools to manage their physiological and psychological response to stressors that are an inevitable part of life. Behavioral interventions have been recommended as first-line options for headache prevention (Table 2) [10].

Relaxation training

Relaxation training involves teaching patients to gain control over their physiological response to stress by using techniques to lower sympathetic arousal [14•,21]. Patients are typically instructed to practice a graduated series of relaxation techniques for 20 to 30 min per day. Over time, the length of relaxation each day is consolidated via brief relaxation techniques, to allow patients to integrate relaxation into their daily activities. Whether training occurs primarily in or out of the office, the benefits are often proportional to the amount of practice, particularly during the first month, while the technique is being learned.

Table 2. Class of evidence for various nonpharmacologic interventions to treat migraine and tension-type headache

Intervention type	Specific procedure	Evidence class ^a	References
Behavioral interventions	Relaxation training	I	[10, 22, 23]
	Thermal biofeedback	I	[10, 22, 23, 26•]
	EMG biofeedback	I	[10, 22, 23, 26•]
	Cognitive-behavioral therapy	I	[6, 7, 10, 22, 23, 30]
CAM interventions	Acupuncture	I	[31•, 35]
	Spinal manipulation therapies	III	[28•, 36, 37]
	Physical/occupational therapy	IV	[31•, 36]
	Massage	IV	[31•]
	Yoga	II	[31•, 39, 40]
	Homeopathy	IV	[31•, 41]
	Reflexology	IV	[31•]
“Natural” treatments	Butterbur extract ^b	I	[42–44]
	Vitamin B2	I	[42, 45, 46]
	Coenzyme Q10	II	[40, 47]

^aClass I = strongest evidence; Class IV = weakest evidence
^bPetadolex (Weber & Weber USA; Orlando, FL)
CAM complementary and alternative medicine; EMG electromyography

Numerous evaluations of relaxation have been conducted and have reported that relaxation is effective for both migraine and TTH, with studies showing on average that 43% to 55% of individuals experience 50% or greater reduction in headache frequency [10,22,23]. The US Headache Consortium, Duke University’s Center for Clinical Health Policy Research reviews, and other reviews suggest that relaxation has the highest level of evidence for headache prevention [10,22,23; Class I].

Biofeedback

Biofeedback involves digital capture of physiological processes, which are converted into a medium (auditory, visual, or combined) that is displayed or “fed back” to the patient to facilitate the patient’s ability to self-regulate or “control” the physiological processes found to be most reactive during assessment [24].

The most commonly used biofeedback modalities are thermal (hand-warming) biofeedback (feedback of skin temperature from a finger) and electromyographic (EMG) feedback (feedback of electrical activity from muscles of the forehead, neck, and upper trapezius). Thermal biofeedback emphasizes the indirect self-regulation of blood flow as a means for reducing sympathetic arousal, whereas EMG biofeedback emphasizes direct self-regulation of muscle activity, to achieve a more relaxed state. Although these two modalities focus on separate physiological states, they are both focused on reducing arousal by teaching patients to monitor physiological cues that signal the onset of headaches. As with relaxation training, patients practice the self-regulation skills they are learning during biofeedback training for about 20 to 30 min per day, and as they master these skills, they are encouraged to integrate their use into their daily routine to prevent headaches. As the patient’s ability to

manipulate and control the targeted physiologic processes increases, the biofeedback device can be eliminated.

A third approach, blood volume pulse (BVP) biofeedback, is designed specifically for migraine. Patients are trained to constrict blood flow in the temporal artery. (Think of this as the nondrug counterpart to abortive medication.)

Another approach specific to migraine focuses on certain EEG parameters. Preliminary work is promising, but studies are too few in number to permit a rating [25].

Numerous evaluations of biofeedback have been conducted and have reported that biofeedback is effective for both migraine and TTH, with studies showing on average 47% to 70% of individuals experiencing 50% or greater reduction in headache frequency [10,22,23,26•]. Biofeedback can also lead to significant improvements in depression, anxiety, and self-efficacy (confidence in one's ability to manage headache), and to reductions in the use of medication [26•]. The US Headache Consortium, Duke University's Center for Clinical Health Policy Research reviews, and other reviews suggest that thermal, EMG, and BVP biofeedback have the highest level of evidence for headache prevention [10,22,23,26•;Class I].

Cognitive-behavioral therapy

Cognitive-behavioral therapy (CBT) focuses on the cognitive, affective, and behavioral precipitants and components of headache. In CBT, patients consider the role their thoughts and behavior play in generating stress (and stress-related headaches) and in increasing headache-related disability. Patients monitor the circumstances in which their headaches occur, including their thoughts and feelings prior to the onset of headaches. Once a headache-related stressful situation is recognized, the patient and therapist collaboratively identify and challenge selected cognitive targets. Cognitive targets may be stress-generating thoughts or an underlying belief or assumption that distills the common meaning or theme from many stress-generating thoughts. Difficulties with these beliefs can have a deleterious effect on headache management and disability [27•,28•,29].

Numerous evaluations of CBT have been conducted and have reported that CBT is effective for both migraine and TTH, with studies showing that 40% to 50% of individuals experience 50% or greater reduction in headache frequency [10,22,23]. The US Headache Consortium, Duke University's Center for Clinical Health Policy Research reviews, and other reviews suggest that CBT has the highest level of evidence for headache prevention [10,22,23;Class I].

Combining behavioral treatment with preventive pharmacologic treatment

In the clinical setting, it is common for an individual engaging in non-pharmacologic treatment to be using one or more pharmacologic preventive treatments as well. A handful of studies have evaluated the benefits of combining behavioral techniques with pharmacologic intervention. Those studies have shown that pharmacologic intervention is typically more effective than behavioral treatment during the first few

weeks after initiation of treatment, given that skill acquisition takes some time. Over time, however, the interventions have comparable outcomes. Typically, the biggest improvements have occurred in groups using both pharmacologic and nonpharmacologic treatment [6,7,30]. In one study, Holroyd et al. [6] reported that among individuals with chronic TTH, 64% of those treated with a combination of amitriptyline and CBT had a significant (>50%) improvement, compared with 38% of those receiving amitriptyline alone and 35% of those using CBT alone. Similar findings have occurred in other studies combining medication and CBT [7,30;Class I].

Overview of behavioral treatments

Standard dose	Varies, often ranging from 6 to 12 sessions. Reduced-contact treatments may involve 2 to 4 sessions supplemented by home training.
Contraindications	Individuals who are adamantly opposed to behavioral treatments are unlikely to benefit. Moreover, individuals who already have strong stress management skills, high internal locus of control, high self-efficacy, and no problems with mood or anxiety may not benefit from these techniques.
Complications	A very small percentage of individuals report initial discomfort as they experience deep levels of relaxation for the first time. This effect is short-lived and easily overcome.
Special points	The benefits of behavioral treatments are likely cumulative, with some research suggesting it takes months to see its full benefit [6,27•].
Cost/cost-effectiveness	Costs involve payment for individual sessions. However, the benefits of behavioral treatments can be long-lasting and reach beyond just managing headache.

Complementary and alternative medicine interventions

- CAM approaches are seen as a group of diverse medical and health care systems, practices, and products that are not generally considered part of conventional medicine [31•]. Data on the efficacy of CAM treatments is limited by small sample sizes, poor study designs, and weak results. Health care providers and patients are advised to make cautious and individualized judgments about the utility of CAM treatments for migraine. In some cases, these modalities may provide value as first-line pharmacologic and behavioral preventive treatments, but cost, time, and potential adverse effects should be weighed carefully.

Acupuncture

Data on the efficacy of acupuncture for migraine treatment and management are mixed but are mostly positive owing to the publication of results from randomized controlled trials. Reports from these trials suggest that as many as 50% of individuals experience reduced headaches after acupuncture [32–35]. In some of these trials, however, the “sham” acupuncture showed similar effects, making it possible that placebo effects play a significant role in the noted benefit. Evaluation of the mechanism behind the benefit (by comparing real vs “sham” acupuncture) has led some to

suggest that the effect in many trials has to do with needling in itself and not so much with the ideas of classic acupuncture [35]. Overall, among the physical treatments, acupuncture has the strongest evidence of efficacy for reducing headache frequency and is considered the most viable CAM option [31•,Class I].

Spinal manipulative therapies

Spinal manipulative therapies (SMT) involve chiropractic medicine and osteopathic manipulation. These approaches emanate from a belief in the benefits of manual manipulation of the cervical spine for headache. Numerous single cases, case series, and uncontrolled studies have been published, but data from controlled trials are limited, and those that have been published have small sample sizes (typically 20–30 patients). Reviews of SMT for headache report a lack of evidence to firmly establish SMT as a first-line treatment option for any kind of primary headache [28•,36,37;Class III]. Significant concerns exist about high-velocity SMT for persons at risk for stroke.

Physical and occupational therapy

A structured review of data on physical treatments for headache reported that physical therapy is more effective than massage therapy and is most effective when combined with other treatments such as biofeedback, relaxation training, and exercise [31•,36]. However, the evidence is relatively weak and thus there is no evidence that physical or occupational therapy are effective first-line treatment options for headache prevention [31•,36;Class IV].

Massage

There are few data on the efficacy of massage as a treatment for migraine. An uncontrolled trial reported that massage reduced migraine frequency and improved sleep quality [38]. The authors also observed beneficial effects on perceived stress and coping efficacy and noted that during sessions, massage induced decreases in anxiety, heart rate, and cortisol levels. However, there is not enough evidence to recommend massage as a first-line treatment for headache prevention [31•,Class IV].

Yoga

Yoga is an ancient, nonreligious practice from India that includes breathing techniques, mindfulness, meditation, and building of strength, flexibility, and stamina through physical postures and routines. Trials looking at yoga for either TTH or migraine have reported positive benefits, with one of these being a controlled trial [39,40]. More studies are needed, however, before we can advocate yoga as a first-line nondrug treatment for headache [31•,Class II].

Homeopathy

Reviews of homeopathy trials for headache conclude that homeopathy is ineffective in headache [31•,41]. There is no evidence to recommend homeopathy as a first-line treatment for headache prevention [31•,41; Class IV].

Reflexology

This therapy relies on the theoretical notion that all parts of the body (including the head) and any dysfunction in them are in some way reflected in “reflex zones” in the feet [31]•. One uncontrolled study from Denmark suggested possible headache improvement, but there have been no controlled studies and thus there is no evidence to recommend reflexology as a first-line treatment for headache prevention [31•,Class IV].

Overview of CAM treatments

Standard dose	Varies. Little systematic guidance is given for CAM treatments. Acupuncture protocols are the most directive.
Special points	Outside of acupuncture, there is limited empirical evidence supporting the efficacy of these treatments. However, certain individuals (especially those who believe these treatments will be beneficial) may consider these treatments if evidence-based treatments are ineffective. Clinicians need to provide realistic expectations and educate patients about potential risks (such as the risk of stroke from SMT) [31•] and about the likelihood of high out-of-pocket costs.
Cost/cost-effectiveness	Costs involve payment for individual sessions. There is likely to be substantial out-of-pocket cost to the patient with little empirical support for the efficacy of treatments.

“Natural” treatments

- Natural treatments have long been used in folk medicine to treat migraine and other headache disorders. Reviews of commonly used natural remedies show that some of these treatments are potentially beneficial, but most do not have enough evidence from controlled studies to recommend them as first-line interventions [42].
- Among the natural treatments, there is good evidence from clinical trials that an extract of the rhizome of the butterbur plant (Petadolex; Weber & Weber USA, Orlando, FL) is effective in reducing the frequency of migraine headaches when administered in divided doses of either 100 mg or 150 mg daily [42–44;Class I].
- There is also evidence from randomized controlled trials for vitamin B2 in doses of 200 mg twice daily for the prevention of migraine [42,45,46;Class I].
- There is also some evidence that coenzyme Q10 has benefit in the prevention of migraine, although only one randomized controlled trial has been conducted among adults with migraine [40,47;Class II].

Overview of “natural” treatments

Standard dose	Varies.
Contraindications	Each individual’s physical history and current pharmacologic profile must be reviewed prior to initiating any natural treatment.
Cost/cost-effectiveness	Costs are almost always fully out-of-pocket. Clinicians need to provide realistic expectations of benefit.

Surgical procedures

- When the burden of headache begins to feel unbearable, individuals are more likely to consider approaches that are more invasive and have greater potential for significant adverse effects. A comprehensive review of the various surgical techniques for headache and the reasons for their use is beyond the scope of this article, but there are surgical techniques that have the potential of providing significant relief to headache sufferers. Interested readers will find recent reviews that address the state of surgical techniques for headache [48•,49•].
- Most of the nonpharmacologic treatments reviewed here have few long-term adverse effects. Thus, when a patient indicates interest in one of these techniques, there is little concern about long-term negative effects beyond ensuring that the patient has realistic expectations. When a patient is considering surgery, however, potential long-term risks can arise, and the clinician must ensure that the patient is fully aware of both the potential risks and benefits before agreeing to a surgical option. Educating patients about realistic expectations for potential benefits and risks will provide them with the data needed to make an educated decision about whether to pursue these treatments.
- If a patient is experiencing psychiatric comorbidity, it is vital that a trained professional ensures that the patient is mentally and emotionally able to handle a surgical treatment option for headaches.
- Overall, the onus is on the physician to use his or her best clinical skills to collaboratively communicate with the patient about the optimal treatment choice for headache prevention.

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