

Acupuncture in Children Frequent or Chronic Primary Headaches

Subjects: **Pediatrics**

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Acupuncture is a spreading and promising intervention, which has proven to be very useful in the treatment and prevention of chronic pain, in particular chronic headaches, in adults. Despite the differences in tools, procedures, and application sites, acupuncture demonstrated a positive effect on both the frequency and intensity of headaches and was well tolerated.

acupuncture

chronic headache

treatment

children

adolescents

alternative medicine

1. Introduction

The use of complementary and alternative medicine (CAM) therapies has increased in the United States since 1990, and, in recent decades, has also been spreading in Europe ^{[1][2]}. Acupuncture is one of the most used CAM therapies ^{[3][4]} and, in the last few years, it has also been recognized as an important integrative medicine ^{[5][6][7]}. This ancient procedure, in recent years, has been recognized by the National Institutes of Health (NIH), the Food and Drug Administration (FDA), and the World Health Organization (WHO) for the treatment of different kinds of chronic pain ^{[8][9][10]}. With the spreading and improvement of acupuncture, over the years, acupuncture-related therapies have emerged which are alternatives to the use of needles, including those that utilize electrical stimulation, heat, and magnets ^[11].

Concerning acupuncture as a headache treatment, there are many studies that consider its utility, efficacy, and tolerability in adult patients, as both an acute and a preventive intervention ^{[8][12][13][14]}. Guidelines and systematic reviews recommend its use for headache (especially migraine) prevention, particularly in children, to avoid drug side effects ^{[15][16][17][18][19][20][21][22]}.

Treatment regimens for chronic headache patients can be expensive, requiring intravenous access and hospitalization of the patient ^{[12][23]}. In addition, studies indicate that treatment response tends to decrease in children with chronic headache disorders ^{[24][25]}, and recurrences of migraine following acute intravenous treatment are common ^{[26][27]}. Nevertheless, the use of acupuncture in children with headaches is limited, as it is so far reserved as an add-on therapy ^{[3][28]}, a third-line therapy ^[22], or a preventive therapy ^[28].

2. Acupuncture in Children Frequent or Chronic Primary Headaches

2.1. Chronic Headaches in Children and Adolescents

The average incidence of headaches in the population younger than 20 years ranges from 5.9 to 58.4%, most of which are primary headaches [\[12\]\[29\]\[30\]](#). Tension-type headache (TTH; 4.5–29%) and migraine (M; 10.1–58.0%) are the most frequent types of primary headaches for children and adolescents [\[6\]\[7\]\[31\]\[32\]\[33\]\[34\]\[35\]](#).

In many cases, headache can have a large impact on children's quality of life [\[29\]](#), can persist into adulthood (in up to 73% of children), and, in many cases, can even evolve into chronic conditions [\[29\]\[36\]\[37\]](#). Children with chronic headaches constitute the most debilitated subgroup of the headache population; therefore, these disorders require specialized management [\[38\]](#).

2.2. Acupuncture

Acupuncture is an old practice from ancient Chinese culture, the existence of which was tracked in documents dating back to 500 BC [\[8\]](#).

Nevertheless, acupuncture started to spread to Europe slowly, only many years later, with studies that confirmed the effectiveness of somatic and auricular acupuncture regarding pain control [\[14\]\[39\]\[40\]\[41\]](#). Among the first utilizations in Europe, it is notorious in the work of Paul Nogier, who established the map or homunculus of ear points [\[42\]](#).

After a workshop on its efficacy and safety, acupuncture was recognized as a “medical device” (class II) in 1996 by the NIH and the FDA [\[8\]\[9\]](#).

In 1997, a consensus meeting was conducted, where it was evidenced that acupuncture was effective for many medical conditions in adults, such as postoperative pain, chemotherapy-related nausea and vomiting, postoperative dental pain, dysmenorrhea, stroke rehabilitation, tennis elbow, headache, fibromyalgia, myofascial pain, osteoarthritis, carpal tunnel syndrome, low back pain, poststroke rehabilitation, tendonitis, and asthma [\[43\]](#).

Since then, the use of acupuncture has been reported as effective in controlled clinical trials for many other types of painful conditions, including up to a total of 28 attested conditions in 2003, according to the 2003 WHO publication [\[9\]\[10\]\[44\]\[45\]\[46\]](#).

Currently, acupuncture is one of the CAM therapies most frequently recommended by internal medicine and family doctors [\[4\]\[47\]\[48\]](#), with reported 1:10,000 to 1:100,000 incidence of serious side effects when performed by a licensed acupuncturist [\[4\]\[49\]\[50\]\[51\]](#).

Especially in children, guidelines and systematic reviews recommend the use of acupuncture for headache (in particular migraine) prophylaxis [\[15\]](#)[\[16\]](#)[\[17\]](#)[\[18\]](#)[\[19\]](#)[\[20\]](#)[\[21\]](#).

In particular, the National Institute for Health and Care Excellence advises considering a course of up to 10 sessions of acupuncture over five to eight weeks for the prophylactic treatment of CTTH, and for the third-/fourth-line treatment of CM [\[22\]](#).

How Does It Work?

Experimental measurable and repeatable acupuncture clinical effects are reported. There are several hypotheses for the mechanism of the control of pain perception [\[52\]](#)[\[53\]](#) and the anti-inflammatory effects [\[54\]](#)[\[55\]](#)[\[56\]](#)[\[57\]](#). Activation of descending inhibitory pain control systems has also been suggested, but the exact mechanism is not fully known [\[34\]](#)[\[58\]](#).

One theory explaining how acupuncture modulates pain is the neurohumoral theory. It is believed that the analgesic properties of acupuncture are mediated, in part, by a cascade of peptides such as enkephalin, endorphins, and monoamines, which are activated by stimulation of acupuncture points and create a sensation of “de qi” (a feeling of fullness, heaviness, pain) [\[9\]](#)[\[59\]](#).

The stimulation of acupuncture points leads to the stimulation of A delta fibers with the activation of the anterolateral tract of the spinal cord, midbrain periaqueductal gray, and raphe nucleus, which leads to the release of the inhibitory peptides, norepinephrine, and serotonin in the spinal cord. β -endorphins and corticotropin are released by stimulation of the hypothalamic–pituitary axis [\[9\]](#)[\[60\]](#).

Some studies have recorded quantitative changes in panopioid activity and $\beta 3$ -endorphin levels in the blood and cerebrospinal fluid (CSF) of migraine patients: one of them [\[61\]](#) showed a decrease in patients’ plasma $\beta 3$ -endorphin levels during episodes but not during periods without migraine, and two others [\[62\]](#)[\[63\]](#) demonstrated a decrease in $\beta 3$ -endorphin in the CSF. Another interesting study demonstrated higher levels of $\beta 3$ -endorphins in migraine patients as compared with control patients [\[64\]](#). In other studies, 13-endorphins were used as a marker for assessing the influence of nonpharmacologic treatment methods in patients with migraine. An increase in the level of $\beta 3$ -endorphins in plasma, as compared with pretreatment levels and those of a control group, was observed in patients with migraine who were treated with electroacupuncture [\[65\]](#)[\[66\]](#).

Pomeranz et al. supported the role of endogenous opioids by demonstrating the reversal of acupuncture analgesia after the administration of naloxone, an opioid antagonist [\[67\]](#). In support of this hypothesis, Pintov et al. found an association between a significant reduction in migraines and a β -endorphin decrease [\[66\]](#). Han et al., in addition, found that low-frequency (2–10 Hz) electrical stimulation of acupuncture points leads to increased endorphin release, while high-frequency stimulation (100 Hz) leads to increased dynorphin release [\[68\]](#).

Another hypothesized mechanism for acupuncture analgesia is that acupuncture stimulates polymodal receptors [\[69\]](#).

In some functional magnetic resonance imaging (fMRI) and positron emission tomography (PET) studies, the stimulation of specific acupuncture points on the body was related to the deactivation or activation of corresponding areas of the brain [70][71][72][73]. Some fMRI studies have shown, in addition, changes in brain blood flow following acupuncture treatment, and normalization of activity in areas of the limbic system, as well as areas of the “pain matrix” [12][40][44][46][74][75][76].

It seems that acupuncture also provokes the release of analgesic peptides like cholecystokinin octapeptide, and its antisense RNA increases the analgesic effects [77][78].

Other studies described local changes at acupuncture points in needle placement, such as connective tissue changes [79] and changes in electrical resistance [80]. Those effects were related to clinical responses in adolescent girls with pelvic pain [46]. It appears that laser–tissue interactions induce inhibition of Na⁺K⁺ATPase, affecting the resting potential of cells. In addition, laser can cause the reversible blockade of mitochondrial transport, resulting in disruption of neurotransmission in A delta and C fibers and subsequent pain relief [81].

Some other acupuncture systemic effects are reported, such as acceleration of nerve generation [82], neuroplasticity [83], changes in central and peripheral blood flow regulation [84], and alterations in immune function [85].

Concerning auricular acupuncture in the treatment or prevention of headaches, it is based on the fact that the ear receives innervation from the auricular branch of the vagus nerve, the auriculotemporal branch of the trigeminal nerve, the great auricular nerve from the second and third cervical roots, and the facial and glossopharyngeal nerves [86]. The activation of the trigeminal–vestibulocochlear reflex and the spread of neurogenic inflammation could be the causes of vestibular migraine symptoms [87][88]. Auricular acupuncture could act via the trigeminal innervation of the ear in the treatment of migraine. It is known that the ventromedial medulla oblongata, ventrolateral periaqueductal gray, locus coeruleus, and raphe magnus nucleus, structures that modulate trigeminal nociceptive input, are affected by acupuncture [12][70][89][90][91][92]. In addition, the ear is provided with neurovascular complexes, which contain capillaries, lymphatic vessels, and myelinated and unmyelinated nerve fibers [86]. The ear also has cholinergic and adrenergic fibers, which can cause neurotransmitter release [12].

Why Do Patients Choose Acupuncture Treatment?

Considering also a study with a mixed adult and child population, acupuncture is among the most widely used CAM therapies (up to 58.3%), followed by massage (46.1%) and relaxation techniques (42.4); other CAM therapies include thermotherapies, diet, music therapy, psychophonia, climatotherapy, use of high-dose megavitamins or herbal medicine, and others [3][4].

The choice to use a CAM method instead of a traditional one seems to be due to the wish to avoid chronic use of drugs with their related side effects (70% of patients), the desire for an integrated approach (52%), the reported dissatisfaction with current conventional medicine (32%), or a more suitable youth disposition (20%) [28]. However,

it is known that most patients (up to 71.1%) use CAM in addition to their conventional treatments, as integrative medicine [28].

Focusing on acupuncture, many studies reported some dropouts due to the children's or children's parents' fear of needles [1][4][12]. However, Zeltzer et al. found that no patients discontinued treatment because of fear or anxiety about the procedure and that anticipatory anxiety assessment scores were low. This might suggest that patients rated the treatment as easily tolerable and not a source of anxiety [93]. A good alternative procedure to standard acupuncture is laser acupuncture, which is nontraumatic, and could be applied to children of all ages because it is less disturbing, regardless of platelet count and coagulation status [94].

Most patients experience acupuncture as a preventive treatment (80% of patients), and a few for acute “on demand” therapy (5%), or for both (15%) [28].

Interestingly, acupuncture is often used not directly for headaches but to reduce stress, which seems to contribute to the recurrence and maintenance of migraine [28].

Predictive factors for choosing CAM use appear to be female sex, younger age, higher parental education level, and healthy lifestyle [28].

2.3. Effect of Acupuncture on Headaches

Self-reported perceived benefits regarding headache were described in 57% of the cases [28].

Considering both parents' and children's opinions about their experience with acupuncture for headaches, 67% of patients and 60% of parents reported a positive experience, while only a few patients and parents felt it had made no difference, and one parent reported that the child's pain seemed worse after the treatment [4]. There was a significant reduction in children's and parents' ratings of current pain from before to after treatment (the average rate went from 3.46 to 1.93 for children and from 3.19 to 1.81 for parents), and there was also a reduction in children's average pain ratings in the week after treatment compared with the week before (from 3.86 to 2.79 for children and from 3.33 to 2.93 for parents) [93].

Acupuncture provided by a board-certified medical acupuncturist significantly decreased, in a few minutes, headache intensity, with a mean change (up to seven points on the VAS scale [12]) [12][27].

In the Graff et al. study, 63.7% (14/19) patients had complete resolution of their migraines after auricular needle placement [12].

Changes in pain intensity scores from pre- to postintervention were not significantly affected by age, gender, years lived with headaches, headache frequency, past visits, past therapies trialed, or school days missed [27].

In the Pintov et al. study, the group undergoing the treatment had a statistically significant clinical reduction in both the frequency (9.3 ± 1.6 per month vs. 1.4 ± 0.6) and the intensity (8.7 ± 0.4 vs. 3.3 ± 1.0) of migraine headaches before and after treatment [66], while frequency (9.4 ± 1.5 vs. 9.3 ± 1.4) and intensity (7.8 ± 0.6 vs. 6.2 ± 0.4) did not change in the control group [66]. In addition, no significant change in the panopioid activity of the plasma in the control group was evident when comparing values from before and after the treatment, while a significant potentiation of panopioid activity was found in the treated group (an increase of about 50%) [66]. There was no linear correlation between the decrease in the frequency of headaches and associated changes in panopioid activity [66].

Considering the study by Zeltzer et al., child-reported depression symptoms remained unchanged from pre- to post-treatment, but it should be considered that more than 90% of patients did not have significant depression scores even before the start of treatment [93]. With regard to children's anxiety, a trend of decreasing scores from before to after treatment was observed [93]. Even negative expectations based on parents' previous acupuncture experiences did not impact treatment outcomes [93]. Along with the reduction in pain, there was a decrease in the interference of pain in the child's functioning and activities as rated by both parents and children [66][93]. In particular, the scores for appetite, sleep, anger, sadness and nervousness, children's difficulty with physical activity, activity with friends, household activities, and homework performance were lower after acupuncture treatment for both children and parents [66].

Adverse Effects

No adverse events or side effects were described in most of the studies [1][12][28][93][94], except in one case complaining of nausea [27]. Laser acupuncture has no side effects reported [94].

Nevertheless, in the literature other adverse effects in the pediatric population are reported: mild effects including crying, pain, bruising, transient hemorrhage at the puncture site, numbness at the puncture site, aggravation of preexisting symptoms, and vasovagal reactions such as dizziness or nausea/vomiting; moderate effects including severe bacterial infections at the site of needle insertion; and serious adverse effects including infections, pneumothorax, and nerve impairments [95].

3. Conclusions

In pediatric patients, it is necessary to avoid possible later disease chronicization and side effects of preventive treatments [28]. It is also necessary to find a treatment that decreases the need for hospitalization therapies, including intravenous and costly treatments, satisfying both the patients' and the parents' needs. Acupuncture may be an efficient alternative treatment for children with frequent or chronic primary headaches, due to its positive impact on headache frequency and intensity.

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