

# Acupuncture and Acupuncture-Related Therapies Are Well-Tolerated and Can Effectively Provide Pain Relief in the Pediatric Population

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## ABSTRACT

**Introduction:** Acupuncture, a complementary and alternative medical therapy, has become a viable treatment option for patients in Western society during the last few decades.

**Objective:** The aim of this research was to analyze acupuncture and acupuncture-related therapies (ARTs) performed in a pediatric population.

**Materials and Methods:** A 3-year retrospective review was performed on all inpatient and outpatient pediatric acupuncture services.

**Results:** During the 3-year study period, 174 patients were seen 1090 times. The average patient age was 13.9 years. Patients were seen an average of 6.3 times. Of these encounters, 95.6% occurred in the clinic and 4.4% occurred in the hospital. Headache or migraine was the most common diagnosis. Acupuncture and ARTs performed included: 96% acupuncture body needling; 90% electroacupuncture; 49% laser therapy; 32% auricular acupuncture; and 27% moxibustion. Active pain was present in 72% of the patients encountered. The average pain score was 5.5 prior to intervention and 2.2 following treatment ( $P < 0.001$ ). There were no improvements in pain scores for 8% of the patients with active pain, while 40% of patients achieved complete resolution of their pain. There were no adverse events.

**Conclusions:** Acupuncture is a well-tolerated, safe, and effective resource for the pediatric population and is a viable option for pediatric pain management.

**Key Words:** Pediatric, Acupuncture, Pain, Children

## INTRODUCTION

THE USE OF complementary and alternative medicine (CAM) therapies has increased in the United States since 1990.<sup>1</sup> One particular CAM therapy is acupuncture, which has become a viable treatment option for certain patients in Western society over the last few decades. Four percent of the United States population has used acupuncture once.<sup>2</sup> However, studies show that acupuncture is used more in European countries, compared to the United States and Canada.<sup>3</sup> Historically, the use of acupuncture in children has been limited,

although 33% of surveyed pediatric pain centers in the United States offered acupuncture in 2005 and pediatricians are beginning to regard acupuncture as a valid treatment option.<sup>2,4</sup>

Acupuncture, a form of Eastern medicine originating in China more than 2000 years ago, has long been used to treat a wide variety of medical conditions and various types of pain. Acupuncture is traditionally explained as a way to alter Qi, the life energy force that flows through 20 different meridians throughout the body. Qi can be Stagnant, Depleted, Weak, or even Rebellious. Through the use of needle acupuncture and acupuncture-related

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therapies (ARTs)—including electrical stimulation, heat, and magnets—acupuncture points can be stimulated to cause an alteration in Qi within a meridian to ultimately cause a desired effect.<sup>5</sup>

Historically, children have not had access to many of the pain-treatment modalities that adults might utilize. Many pain medications have not been studied in the pediatric population. In addition, many pain-treatment methods are not appealing to children, secondary to invasiveness or potential medication side-effects. Management of chronic pain in children and adolescents continues to be a significant problem, with some studies indicating that 30% of all children and adolescents experience pain lasting longer than 3 months<sup>6</sup> and that 40% of all children experience recurrent pain at least once weekly.<sup>7</sup>

The economic cost of pain treatment in the United States is substantial. Total cost of pain treatment for adults was estimated at more than \$500 billion in 2012.<sup>8</sup> The cost of treating pain in pediatric patients is less but is still considerable, including an extrapolated economic cost of > \$19 billion annually in the United States for treating chronic pain in adolescents.<sup>9</sup> It has been suggested that additional research is required to find which therapies are best for treating pediatric chronic pain, including pharmaceuticals and integrative therapies.<sup>7</sup> CAM use in children with chronic illnesses was shown to be prevalent (42%–71%) in a 2013 study. Although CAM encompasses many alternative treatments, current acupuncture use was only 5.7%, with 10% of children having tried acupuncture.<sup>10</sup> This article presents 3 years of retrospective data on the use of Japanese-style pediatric acupuncture in a clinic setting and hospital consultative service with a planned focus on pain treatment.

## MATERIALS AND METHODS

### Study Design and Setting

This study was a 3-year retrospective review approved by the institutional review board of the University of Louisville, Louisville, KY. All patients were seen in either an outpatient clinic or at Kosair Children's Hospital, also in Louisville, KY.

### Patient Selection

A Japanese-style pediatric acupuncture service was created in November of 2010 that included an inpatient consultative service and an outpatient clinic. A retrospective analysis was performed on the charts of all patients between ages 0 and 21 who were treated with pediatric acupuncture from November 2010 through October 2013.

### Interventions

One physician performed all Japanese Kiiko Matsumoto Style acupuncture and ARTs. In general, clinic patients had

3 separate needle applications per visit, retaining the needles for 10–20 minutes with each application. Alcohol was not used prior to any type of needling. Needle depth of insertion varied depending on area needled and patient size. De Qi response was not recorded. A pain visual analogue scale (VAS) score was obtained prior to any intervention and again at the end of each treatment session. If a patient had no pain, a 0 was recorded. Various treatment methods included basic needle acupuncture, electroacupuncture (EA), moxibustion, auricular acupuncture, laser acupuncture, and electron transfer facilitated by ion cords.

Needle acupuncture was performed with DBC™ Spring Ten Acupuncture Needles. Needles were administered with a glide tube and needle length varied between 15 mm and 50 mm.

EA was performed using a HAN E600 Electro Acupuncture Unit. A combination of low- and high-frequency stimulation was used for all EA treatments. The pulse-rate frequency during EA alternated between 2 Hz and 100 Hz every 3 seconds.

Moxibustion was performed with hand-rolled cones of Ultra Pure “Gold Mountain” Moxa. Each point where moxibustion was done was first treated with Shiunko ointment prior to performing moxibustion. The patient was required to feel the moxa heat stimulation 8 times at each point where moxibustion was performed.

Efficacious ear points for auricular acupuncture were located by a needle-contact test<sup>11</sup> and/or an electrical point finder that emits an acoustic alarm when a change in electrical resistance is detected, signifying a potential active auricular acupoint. ASP® (Aiguille D'Acupuncture Semi-Permanente,® Sedatelec) gold needles were placed in efficacious ear points when auricular acupuncture was performed.

Electron transfer was performed through the use of Manaka™ Ion Pumping Cords (Fig. 1). Alligator clips were required to touch the skin on the points chosen for treatment and secured with aluminum tape. One-way transfer of electrons, from black clip to red clip, is facilitated by a germanium diode. Two Extraordinary meridian Master and Couple points were used in combination for 20 minutes for each ion-cord treatment.

Laser therapy was performed with a HY05-A Aini laser-circulation therapeutic apparatus. This device contains many laser probe sizes. The large-diameter laser probe contains 7 laser output holes, a center laser with a power of 300 mw, and a wavelength of 810 nm surrounded by 6 semiconductor laser output holes with a power of 5 mw and wavelength of 650 nm. The face of the large laser head is 4 cm in diameter and is elevated 0.5 cm from the surface of the patient (Fig. 2). In general, the large laser was used in continuous mode for a period of 20 minutes per application providing 28 J/cm<sup>2</sup> of energy. The second small laser probe emits a beam ~ 3 mm in size, and has 200 mw of power and a wavelength of 810 nm. The small laser was used for individual point stimulation and

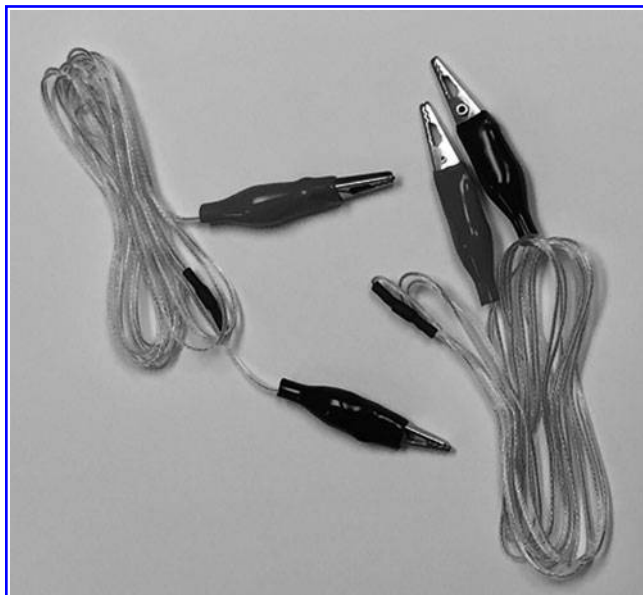


FIG. 1. Manaka™ Ion Pumping Cords.

was used for 30 seconds continuously on each point addressed, providing 85 J/cm<sup>2</sup> of energy.

Acupuncture-associated adverse events monitored for included pneumothorax, vomiting, syncope, severe worsening of existing symptoms, unacceptable pain associated with needling, cellulitis secondary to needle insertion, and needle-induced neuropathy.

**Statistics**

Patient-descriptive variables recorded included age, gender, number of patient encounters, and up to 3 diagnoses per

visit. Other recorded data included area of pain at each visit, pre- and postintervention pain scores from 0 to 10 described by a numerical self-reported pain VAS, tolerance of the procedure, and the use of ARTs including laser, EA, auricular acupuncture, moxibustion, and electron transfer through ion cords. Common descriptive statistics and percentages in addition to related-samples Wilcoxon signed rank test were used to describe the study population and pain scores. All patients that enrolled in the study were analyzed even if they withdrew from the study prior to completion (intention to treat). Analyses were performed using IBM® SPSS Statistics version 22 (Armonk, NY) and Microsoft Excel.

**RESULTS**

One hundred and seventy-four patients were seen a total of 1090 times. The average number of visits per patient was 6.23, with a median of 4 (range: 1–63). There were 124 female and 50 male patients. The average patient age of the 174 patients at each initial visit was 13.9, with a median of 14, range (0–21). In evaluating age at each of the 1090 visits, average patient age increased to 14.5 years, with a median of 15 years. The 1090 patient encounters yielded 1927 diagnoses (Table 1). The acupuncture treatment methods performed during the 1090 encounters are listed in Table 2.

One hundred and sixty-five of the 174 patients (95%) received classic needle acupuncture during at least one of their encounters. Four of the 9 patients who did not receive classic body needling received auricular acupuncture solely. One 13-year-old girl with migraines refused classic needle acupuncture, would only allow laser auricular acupuncture to be



FIG. 2. HY05-A Aini laser-circulation therapeutic apparatus.

TABLE 1. PATIENT DIAGNOSES

<i>Diagnosis</i>	<i>#</i>	<i>%</i>
Headache/migraine	520	48
Back pain	308	28
Extremity pain	159	15
Neck pain	126	12
Fibromyalgia	95	9
Abdominal pain	94	9
Complex regional pain syndrome	79	7
Obesity	76	7
Transverse myelitis	63	6
Abdominal distension	26	2
Abdominal migraine	22	2
Chest pain	18	2
Temporomandibular joint disorder	18	2
Anxiety	18	2
Thoracic outlet obstruction	16	1
Neuralgia	15	1
Trapezius spasm/pain	13	1
Scoliosis	11	1
Osteogenesis imperfecta	11	1

TABLE 2. TYPES OF ACUPUNCTURE ADMINISTERED

Acupuncture method	#	%
Classic body needling	1050	96%
Electroacupuncture	982	90%
Auricular acupuncture	343	32%
Moxibustion	294	27%
Laser therapy—large probe	530	49%
Laser therapy—small probe	21	2%
Electron transfer with iron cords	184	17%

performed, and was only seen once. The other 4 patients were: an infant with cerebral palsy and spasticity treated solely with laser acupuncture; a 12-year-old with autism treated with laser acupuncture and auricular acupuncture; a 15-year-old with a chromosome deletion and whole-body pain, who could not tolerate body needling and was only treated with electron transfer through ion cords; and a 9-year-old with sacroiliitis and hip pain, who would not assent to needle acupuncture and was treated with electron transfer through ion cords. No adverse events were reported.

Of the 1090 patient encounters, classic needle acupuncture was performed in 1050 (96%) encounters. Classic body needling was tolerated in 1045 of the 1050 (99.5%) patient encounters when classic needle acupuncture was attempted. Three patients each tolerated 2 acupuncture treatments with body needling to the front of the body but could not tolerate needle acupuncture to the back. And, as previously discussed, a 13-year-old refused body needling and a 15-year-old with a chromosome deletion could not tolerate needling. Twenty different patients comprised the subgroup of 40 patient encounters without classic needle acupuncture. Eleven patients had previous or subsequent classic body needling. The 9 other patients were described in the previous paragraph. In the 40 treatments not involving classic body needling, laser therapy was performed in 25 patient encounters, including 7 laser treatments on an infant; auricular acupuncture was utilized in 18 patient encounters; electron transfer with ion pumping cords was used in 14 patient encounters; and moxibustion was used in 2 patient encounters.

Forty-eight (4.4%) patient encounters occurred in the hospital, and 1042 (95.6%) patient encounters occurred in the

clinic setting. The most common form of acupuncture utilized in the hospital was classic body needling 40/48 (83%) followed by auricular acupuncture 31/48 (65%). The most frequent in-hospital complaint treated was head pain 24/48 (50%), with 17 of these patient encounters for migraine headache. In addition, 13/48 (27%) patient encounters were for musculoskeletal pain and 9/48 (19%) were for abdominal pain.

Of the 1090 encounters, 1087 paired pre- and post-acupuncture pain scores were available for analysis. Two excluded pain scores were from an 11-year-old patient with complex regional pain syndrome who had acupuncture following anesthesia for magnetic resonance imaging (MRI) studies. In both encounters prior to anesthesia, the patient had an initial pain VAS of 10 but a postacupuncture pain score could not be recorded, secondary to the patient being asleep. In both instances, the patient's fentanyl drip was weaned off after the patient awoke later. The second case excluded from the analysis was a 15-year-old with a chromosome deletion and whole-body pain that could be quantified on the VAS.

Of the 1087 paired pain scores available for analysis, an initial pain score of 0 was recorded in 301 patient encounters and, therefore, not included in analyses of pain response. Thus, 786 paired pain scores were analyzed. There was no improvement in 64 of the 786 (8.1%) paired pain VAS following acupuncture or ARTs. Sixty of the pain scores did not change, and 4 represented increases in pain scores following acupuncture. The average increase in pain VAS in these 4 patients was 1.25. Seven hundred and twenty-two of the 786 (91.8%) pain scores decreased following treatment. In 316/786 (40%) of patient encounters when pain was reported, the patients left with their pain completely resolved.

The average initial pain VAS of the 786 patient encounters when pain was present was 5.5. The average postacupuncture pain VAS was 2.2, showing an average improvement in pain VAS of 3.3 on a 10-point scale. A related-samples Wilcoxon signed-rank test revealed a statistically significant difference between pre- and post-acupuncture pain scores ( $P < 0.001$ ). If a patient reported pain, the area(s) of pain, including many sites, was recorded for each patient visit. A pain-score subgroup analysis of the most frequent areas of pain reported at each visit was performed; this is shown in Table 3.

TABLE 3. SUBGROUP ANALYSIS

Area of pain	# of patients	Preacupuncture average VAS	Postacupuncture average VAS	P-value
Head	285	5.1	2.1	<0.001
Head only	227	4.8	1.9	<0.001
Head (migraine) treated in hospital	17	7.0	1.7	<0.001
Back	283	5.8	2.0	<0.001
Neck	115	6.5	3.5	<0.001
Abdomen	75	6.4	2.4	<0.001

VAS, visual analogue scale.

## DISCUSSION

To the current author's knowledge, this is the largest retrospective review of pediatric acupuncture published to date. Pediatric patients were treated successfully with acupuncture and ARTs without adverse events, which is consistent with many pediatric acupuncture reviews that previously stated that acupuncture is safe in children.<sup>2,12,13</sup> This chart review supports pediatric acupuncture and ARTs, offering safe, alternative means to address pediatric disorders including treatment to address pain.

The minimal clinically significant difference in pain VAS in adults and children is reportedly 1 to 1.4.<sup>14–16</sup> Therefore, the mean 3.3-point decrease in the VAS in the 786 paired pain scores was both highly clinically and statistically significant. The average drop in pain score was similar to that seen by Lin et al. in 53 children and 112 acupuncture treatments for pediatric pain management wherein a VAS decrease of 2.9 was reported following acupuncture.<sup>17</sup>

The use of acupuncture for treating pain in children continues to be investigated as an option. Pediatric acupuncture has been supported favorably by parents of children receiving this acupuncture.<sup>18</sup> Nager et al. reported an average decrease of 1.4 in pain VAS in pediatric emergency department patients with appendicitis treated with acupuncture.<sup>19</sup> Wu et al. showed the effectiveness of acupuncture for postoperative pediatric patients who underwent spinal fusion including lower levels of narcotic usage.<sup>20</sup> Likewise, the 1 patient receiving continuous narcotics in the current chart review was weaned off the narcotic drip not just once—but twice—following acupuncture. Many successful studies support the use of pediatric acupuncture as a viable alternative for pain management.

Headache was the most common diagnosis encountered in this retrospective chart review, with 48% of patients having a diagnosis of headache or migraine. Headache is a frequent diagnosis that can be addressed successfully with acupuncture. In an Italian pediatric headache center, 11% of 124 Italian children with headaches confirmed the use of acupuncture for their headaches.<sup>21</sup> Lin et al. reported that headache comprised 15% of the pediatric acupuncture patients treated in a study that showed an overall 2.9-point decrease in VAS after acupuncture.<sup>17</sup> Pintov et al. reported effective outpatient pediatric migraine treatment with decreases in migraine frequency and intensity following 10 acupuncture treatments, compared to a control group.<sup>22</sup> Similarly, pediatric patients with headache in the current review reported clinically and statistically decreases in pain VAS following acupuncture. Of note, the 17 patients with the most severe headaches in the hospital and emergency room seemed to respond the most, with average VAS improving from 7 to 1.7 following treatment.

The acceptance of acupuncture in Western society has been slow and may be related to the lack of a defined pathophysiology explaining its effects. The exact mecha-

nism of acupuncture is still unknown. The Western world has always been skeptical of Qi movement as an explanation for the results of acupuncture. Various Western theories exist, including endogenous opioid release, alterations of brain and spinal-cord neurotransmitters, direct effects on the brain from remote points evidenced through functional MRI, a gate-control effect by overwhelming a pain stimulus with another stimulus, effects through the movement of connective tissue, and effects via the primo vascular system.<sup>5,23–31</sup> The research concepts regarding acupuncture pathophysiology can be summarized as a needle-induced multifactorial adjustment occurring in the body related to opioids, neurotransmitters, various central nervous system structures and the movement of fascia. Despite an unclear understanding of acupuncture's mechanism of action, it may be time for Western physicians to recognize the benefit that acupuncture can provide patients everywhere, including the pediatric population in need of more options for pain management.

A major limitation of the study was that it was a retrospective chart review. The effectiveness of acupuncture in the pediatric population can be strengthened by future head-to-head comparisons with conventional Western medicine regimens for pediatric disorders. In addition, although clinical and statistical pain relief was provided to the pediatric patients in this retrospective analysis, pain VAS in the analysis were reported immediately following acupuncture, thus, the total length of pain relief for each patient and the overall group could not be described.

## CONCLUSIONS

Options for pediatric pain management are relatively limited. In this retrospective chart review, acupuncture and ARTs were well-tolerated and effective for treating pain in pediatric patients. Future studies examining the cost of conventional Western medicine management, compared to acupuncture and ARTs, for treating various conditions may influence pediatric physicians further to consider nonconventional ways to address pediatric pain and other disorders.

## AUTHOR DISCLOSURE STATEMENT

No competing financial interests exist.

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