
Acupuncture and Traditional Chinese Medicine

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INTRODUCTION

Chronic pain is one of the fastest growing health problems in the United States with an estimated one third of Americans suffering from pain at an annual cost of \$80 billion to \$100 billion (Eshkevari, 2003). It is also one of the most challenging conditions clinicians face and the most common reason patients seek alternative care. Acupuncture, of all alternative therapies, has considerable potential in the treatment and management of chronic pain. Much of the evidence on acupuncture is relevant and convincing, and suggests that in some cases it may be useful on its own while in others it may be part of an integrative approach to pain management. The integrative model may offer the most potential benefit to the patient. This chapter reviews and summarizes the scientific basis and clinical evidence for acupuncture and related traditional Chinese medicine modalities in the treatment and management of chronic and acute pain. It also discusses safety and the most common therapeutic course for conditions treatable by these therapies.

ACUPUNCTURE

Acupuncture and traditional Chinese medicine (TCM), the use of Chinese herbal medicines to treat disease and promote health, are collectively referred to as Oriental medicine (OM) and sometimes as East Asian medicine. With a history of several thousand years, OM is still widely practiced in Asia and has gained acceptance in Western countries. In fact, since the 1950s acupuncture has evolved

rapidly as a modern therapy. First in China and Japan, followed by other Asian countries, Europe, and lately North America, acupuncture is gaining the respect of both the public and medical sectors. Interest in TCM followed in the mid-1980s, stimulating a surge of basic research in antiviral compounds, immunomodulating compounds for cancer, and adaptogenic compounds for neuroendocrine regulation, as well as anti-inflammatory and analgesic compounds for pain.

In the United States, acupuncture caught the public imagination in 1971 when James Reston, a reporter for the *New York Times*, published an article about his experience in China. In 1973, the U.S. Food and Drug Administration (FDA) classified acupuncture needles as experimental medical devices. Acupuncture needles were reclassified as “safe and effective” in 1995. In 1997, the National Institutes of Health published a consensus statement, the *NIH Consensus Development Conference on Acupuncture*, reporting favorable findings for the use of acupuncture in a select number of conditions. With such achievements, it is understandable that between 1992 and 1998 the demand for acupuncturists nearly doubled, climbing from 5,525 to 10,512.

At present in the United States, roughly 3,500 physicians and 12,000 licensed acupuncturists use this medical specialty for the treatment of a wide range of illnesses including chronic pain. Currently, 50 acupuncture and OM schools train nonphysicians, and about 500 to 600 physicians train yearly to American Acupuncture Medical Association standards (Erickson, 2003). Costs for acupuncture treatments vary according to locale, specialization, and

experience of practitioners with an average range from \$40 to \$75 per visit. Workers' compensation and insurance fee schedules vary from state to state, but apply for those covered. However, most patients pay for acupuncture out-of-pocket.

Although now practiced worldwide, acupuncture has its roots in Chinese cosmology and philosophy. In this model, the universe is an orderly series of ever-changing cycles and events. Human biology is looked on as a reflection of the natural environment. For example, blood vessels are like rivers and fever or inflammation is likened to fire. Animating both the human and natural worlds is the non-Western concept of *qi*, an invisible but palpable energy pervading the body that flows in specialized networks or meridian systems and that is concentrated at specific sites along the course of those meridians — the acupuncture points (acupoints). Although *qi* and the meridians have defied scientific proof of their existence, they remain the central paradigm by which acupuncture is understood and practiced.

For now, most researchers leave the question of whether *qi* is real to philosophers and newly founded specialized fields such as human bioenergy, turning their attention to investigating the underlying neurophysiology of how acupuncture works. Practitioners are equally affected by a similar quandary as researchers: are *qi* and traditional theory necessary to achieve clinical success or can acupuncture be just as effective when performed as a medical technique based on neurophysiology or other Western methodology? Some acupuncturists base their practice on traditional Chinese medical philosophy; others combine points based on protocols matched to specific diseases; and some practitioners have suggested models integrating both Eastern and Western medical paradigms. Such modernized systems only utilize traditional acupuncture theory to the extent of selection of optimal therapeutic sites for the placement of needles, electrical stimulating devices, point injections, laser, or microcurrent stimulation.

NEEDLE MECHANICS

Traditionally, needle insertion is thought to stimulate and regulate the quality and flow of *qi*, described specifically in the acupuncture literature as *de qi* or needle sensation resulting in a particular numbing response that is associated with greater therapeutic effect. Because of the extreme thinness of acupuncture needles, specialized manual skill is required to insert it without bending. In some cases, an insertion tube made of stainless or plastic is used to keep the needle from flexing during initial insertion.

Once inserted, each needle is manually manipulated or electrically stimulated to maximize the needle sensation. Concurrent with needle insertion and manipulation, patients frequently report sensations in other areas of their

body distant from the needle insertion site, which are known to correspond to meridians.

Scientific studies, on the other hand, contend that needle insertion has a wide range of neurochemical, immunological, and neurobiological effects. For example, inserting an acupuncture needle into normal tissue causes cellular disruption and corresponding immunological reactions. The multiple “mini-wounds” caused by needle insertion stimulate the release of growth factors such as platelet-derived growth factor, which induces DNA response and in turn promotes cell and tissue repair through increased protein synthesis (Filshie & White, 1998).

In the United States, acupuncturists favor pre-sterilized disposal needles in gauges between 0.12 and 0.30 mm in lengths from 15.0 to 60.0 mm. Depending on the area of the body treated and the technique employed, insertion depths range from 1 to 2 mm up to several centimeters, with an average depth of 14 mm. The number of needles used per treatment varies ranging from 2 to 12 on average.

SCIENTIFIC BASIS

Of all complementary and alternative therapies, acupuncture is the most researched, particularly for its use for pain management. Since 1976 numerous scientific studies have investigated the effects and possible mechanisms of acupuncture analgesia (AA) with a critical mass of acupuncture research accumulated between 1976 and 1988. By 2004, PubMed listings for acupuncture research included 8,916 papers of which 2,292 were related to pain. Bruce Pomeranz, a leader in acupuncture research, published more than 100 papers on AA. Other prominent researchers include Lixing Lao, Richard Hammerschlag, Jeanette Ezzo, Adrian White, Edzard Ernst, and Zang Hee Cho. In addition, research centers in China, Japan, South Korea, Hong Kong, Taiwan, and Singapore continue to contribute substantial information, as do centers in Germany and other European countries. Unfortunately, most of the results of this research is unavailable in English.

BASIC MECHANISMS

Chronic pain is thought to be the outcome of one or more causes: (1) ongoing nociception as from an unhealed fracture, a torn ligament, or chronic inflammation; (2) psychogenic factors without a known physiological basis; (3) stress-induced abnormal regulation of the hypothalamic-pituitary-adrenal axis; and (4) functional disturbances in the nervous system causing hypersensitivity without nociception as with sympathetically mediated pain. Acupuncture and related modalities, particularly electrostimulation, have the ability to regulate all four of these causes.

Acupuncture needling and electrical stimulation to acupuncture points have been shown to affect nociceptive,

proprioceptive, and autonomic nerve pathways. Both needle acupuncture and electroacupuncture (EA) increase enkephalin and dynorphin in the spine and mid-brain, and raise endorphins in the pituitary–hypothalamus complex. The flow of enkephalins in mid-brain stimulates the release of monoamines, serotonin, and norepinephrine in the spine. It is theorized that these substances are responsible for the inhibition of pain. As early as 1979, Han et al. found that serotonin turnover is increased with acupuncture, and conversely, when serotonin is depleted, the acupuncture analgesic effect is reduced (Han, Chou, Lu, Lu, Yang, & Jen, 1979). According to this hypothesis, needle stimulus acts to restore neurotransmitter chemical balance and thereby neutralizes pain initiated by a painful stimulus (Pomeranz, 2001).

Inflammatory mediators may also be involved in AA. Endorphins inhibit substance P, a short-chain polypeptide that functions as a neurotransmitter involved in pain and inflammation. Neuropeptides, such as substance P, are involved in the production of cytokines such as tumor necrosis factor- α , interleukin 1- β , interleukin 2, and interleukin 6. These cytokines along with substance P are involved in the inflammatory cascade and influence the rate of wound healing (Delgado, McManus, & Chambers, 2003). The anti-inflammatory actions of acupuncture are linked to the complex interactions between substance P and beta-endorphin, which may influence the balance between proinflammatory and anti-inflammatory activity (Zijlstra, van den Berg-de Lange, Huygen, & Klein, 2003). EA has been shown to influence substance P in the dorsal vagal complex in rat models (Liu et al., 2004).

NEWER MODELS: GENE EXPRESSION

Part of the long-term effect of acupuncture beyond opioid changes may lie in gene expression. Several studies demonstrate that levels of c-Fos, a gene that produces a protein, which functions in the control of the transcription of DNA to mRNA, increase in affected brain areas following acupuncture. Usually the amount of c-Fos in cells is low until the cell is stimulated by a stressor. c-Fos is useful as a marker for increased cellular activity and has been studied in the expression of GABAergic and serotonergic activity in the brainstem and spinal cord (Maloney, Mainville, & Jones, 2000). In animal studies, acupuncture has shown to increase c-Fos expression in the hypothalamus (Medeiros, Canteras, Suchecki, & Mello, 2003), hippocampus (Kang et al., 2003), spinal cord (Kim et al., 2003), and pituitary gland (Pan, Castro-Lopes, & Coimbra, 1996). However, in a paper by Jiang et al., EA was found to inhibit c-Fos expression during brain injury (Jiang, Zhao, Shui, & Xia, 2004). As with many research models of acupuncture, it is possible that a regulatory effect may eventually be found in which acupuncture acts as both an agonist and antagonist for c-Fos expression.

NEUROENDOCRINE MODULATION

Neuromodulators and functional changes in the neuroendocrine system may also be involved in the acupuncture response and its ability to mediate pain. In one study, researchers demonstrated that melatonin combined with EA suggested a relationship between AA with an increase in pro-opiomelanocortin (POMC) mRNA (Zhou, Yu, & Wang, 2001). POMC is a single precursor molecule for peptides such as melanocortin that effect energy homeostasis (Schwartz, Woods, Porte, Seeley, & Baskin, 2000). In another study, electrostimulation to auricular points increased plasma levels of growth hormone (Debrececi, 1991). Less is known on how the pituitary–hypothalamic complex functions than neural response; however, it is thought that acupuncture modulates hypothalamic release of β -endorphin and adrenocorticotrophic stimulating hormone by the pituitary (Masala et al., 1983). Studies suggest that both peptides continue to increase up to 80 minutes after acupuncture (Zhoy et al., 2001). Dopamine may also play a role in chronic widespread pain (Wood, 2004) and may be increased by acupuncture (Han, Yoon, Cho, Kim, & Min, 1999). Neuronal circuits that influence hormone regulation in the hypothalamus, such as POMC expression, suggest at the complexity of neuroendocrine activity in the body. These and other studies suggest how acupuncture might play a neuroendocrine regulatory role in the management of pain.

IMAGING AND BRAIN SCANNING

Historically, acupuncture research seems to have taken on the technology of the times. After endorphins, a group of 10 neurotransmitters that activate opiate receptors, were discovered by Hughes and Kosterlitz in 1975 (Kosterlitz & Hughes, 1977), for more than a decade acupuncture researchers favored opioid models. In the early 1980s, neuroendocrine models were investigated. In the early 1990s, models of gene expression were explored. As computerized scanning technology became available in the late 1990s, researchers such as Alavi and La Riccia demonstrated by single photon emission computed tomography (SPECT) scan abnormal blood flow in some brain areas of patients with chronic pain, which normalized with acupuncture (Alavi & La Riccia, 1997). In a study of five patients with chronic pain, SPECT scanning employed before and after acupuncture treatment revealed thalamic asymmetrical blood flow, which was normalized after treatment coinciding with reported pain relief from the test subjects (Alavi, La Riccia, Sadek, & Lattanand, 1996).

More recently, using functional magnetic resonance imaging, Cho investigated models for acupuncture research using neuroimaging based on molecular science and pharmacokinetics. Although far from a unifying theory of how acupuncture works, such research provides

objective and quantitative analyses in an “East meets West” approach toward understanding the mechanisms of acupuncture.

In groundbreaking work, Cho examined needling response to acupoints LI4 and ST36, both commonly used sites for amelioration of pain in the upper and lower body, respectively, in normal subjects (Cho et al., 1998; Cho, Oleson, Alimi, & Niemtow, 2002). Significant brain activity was noted in the brainstem, midbrain, and cerebral cortex. In further studies, Cho expanded acupoints to include UB67 on the foot, GB 37 on the lower lateral leg, and GB 43 on the lateral distal foot. Armed with promising results from his imaging studies, Cho formulated an acupuncture pain relief hypothesis involving higher cortical areas (Cho, 2001). In this model, the effects of acupuncture are mediated through the central nervous system affecting corresponding areas of the cerebral cortex where communication takes place, theorized principally in the hypothalamus, where further neural communication occurs resulting in pain modulation. This may also help to explain the healing effects of acupuncture on a wide range of diseases.

CLINICAL EVIDENCE

Although an overwhelming body of observational information in nonpeer-reviewed journals and books describes the effects of acupuncture and Chinese medicine, and the body of scientific research into the mechanisms of acupuncture is extensive and growing, the overall number of clinical studies remains small. The reason for this is twofold. First, initial efforts in acupuncture research have focused on amassing a sizable body of evidence evaluating the mechanisms of AA and establishing safety before conducting human trials. At the time, no one knew how acupuncture worked; therefore, animals were ethically acceptable models for investigation. Second, there are several inherent difficulties in acupuncture clinical research. These include whether single- or double-blinded studies are best, how to establish a true control group since sham acupuncture itself may have greater effect than placebo; and if placebo in fact is the standard against which acupuncture should be measured (Hammerschlag, 2003).

Blinded, placebo-controlled trials may be the gold standard for studying drugs, but obviously acupuncture is not a drug and, if anything, is more like a surgical procedure. Perhaps the only reason clinical studies for acupuncture have been compared against placebo is because of the early stance of the American Medical Association that acupuncture was no more effective than placebo or that it was similar to hypnosis. It seems strange that this debate is still going on when the first NIH grant for acupuncture headed by Ulett delivered convincing evidence in 1983 that acupuncture successfully modulated experimental pain and was not hypnosis (Ulett, 1983, 1996).

In addition, assessing the adequacy of acupuncture trials emphasizes study design but, in the West, rarely addresses whether the method used was in fact sufficiently adequate to achieve effective results (White & Ernst, 1998). The problem of effectiveness arises because of the many different techniques and styles of acupuncture used by practitioners; some methods are more effective for certain conditions than others and some practitioners are more effective than others. Compounding this is that there are no definitive studies comparing one form of acupuncture with another, such as Chinese versus Japanese acupuncture, for the treatment of a specific condition.

Systematic reviews of existing acupuncture studies also suffer from a variety of problems. These include reviewers' bias, limited number of well-designed studies, and lack of clustering of similarly designed studies. In addition, until recently there was no method of assessing the adequacy of acupuncture treatments used in the studies. To address this concern, White and Ernst devised a checklist of data required in studies using acupuncture treatments, including specifics of patient posture, number of needles used, needle size, use of international standards for acupuncture point names and locations, and depth of insertion (White & Ernst, 2003). Defining universal standards for acupuncture studies is a significant step toward establishing evidence.

In contrast to these limitations, the Cochrane Collaboration rigorously reviews methodology and outcomes and is considered the leading method for summarizing evidence (Ezzo, 2003). To date, seven Cochrane Reviews have been completed on acupuncture for rheumatoid arthritis, asthma, headache, induction of labor, lateral elbow pain, low back pain, and smoking cessation, with reviews in progress on stroke, postoperative nausea and vomiting, Bell's palsy, chronic constipation, depression, opioid dependence, and osteoarthritis. The interest in evidence-based information on acupuncture is shown by the number of reviews conducted or in progress. However, due to lack of well-designed, placebo-controlled, and randomized studies available in English, results of these reviews are equivocal.

Several important areas of study in pain management with acupuncture remain to be investigated. Because acupuncture needle therapy is time and labor intensive, it is important to learn if electrical stimulation provides equal benefit (Ceccherelli, Gagliardi, Seda, Corradin, & Giron, 1999)? If so, which type is more effective? Is auricular acupuncture, in practice much easier to administer to a patient, equal or better than whole-body needle acupuncture (Lein, Clelland, Knowles, & Jackson, 1989)? Does electrostimulation of auricular acupuncture points work better than manual auricular acupuncture? In one study comparing auricular acupuncture with electrical stimulation for the treatment of chronic cervical pain, continuous electrical stimulation of auricular acupuncture points sig-

TABLE 76.1
WHO Listed Pain Conditions

| System | Condition |
|-----------------|------------------------------------------------------------------------------------------------------|
| Dental | Toothache, post-extraction pain |
| Neurological | Headache, migraine, trigeminal neuralgia, peripheral neuropathies, intercostals neuralgia |
| Musculoskeletal | Cervicobrachial syndrome, "frozen" shoulder, "tennis elbow," sciatica, low back pain, osteoarthritis |

nificantly decreased pain, improved psychological well-being, and improved sleep (Sator-Katzenschlager et al., 2003). The challenge for researchers has been in finding a fair and objective way to evaluate the clinical evidence of acupuncture so that the foundational studies necessary are rigorously conducted (Sherman & Cherkin, 2003).

EVIDENCE BASE FOR SPECIFIC CONDITIONS

Acupuncture is used for a broad range of health conditions. Chinese acupuncture textbooks list anesthesia during surgery, infectious diseases such as the common cold and malaria, respiratory conditions such as asthma and bronchitis, cardiovascular conditions such as congestive heart failure, diabetes, hyperthyroidism, facial paralysis, headache, mastitis, and many other conditions (Bensky, 1981). However, it was not until 1979 when the World Health Organization (WHO) upon review of traditional claims for acupuncture listed more than 40 conditions that are suitable for treatment by acupuncture (Table 76.1). However, these conditions were selected without strong evidence for their efficacy. They include conditions of the upper and lower respiratory tract; eye, ear, and dental problems, gastrointestinal disorders, neurological, and musculoskeletal pain.

In 1998, almost two decades after the WHO list, the NIH Consensus Statement on Acupuncture (NIH, 1998) concluded that there was substantial evidence for the efficacy of acupuncture for postoperative, chemotherapy-induced, and pregnancy-associated nausea and vomiting, and for postoperative dental pain (Table 76.2). In addition, the panel concluded that a number of conditions are acceptably treated with acupuncture although further research is necessary. These include addiction, stroke, headache, menstrual cramps, tennis elbow, fibromyalgia, myofascial pain, osteoarthritis, low back pain, carpal tunnel syndrome, and asthma.

Recent acupuncture literature suggests that many other pain conditions respond to acupuncture and related modalities including musculoskeletal pain, sciatica, urogenital pain, labor pains, neuropathy, facial pain, neck pain, and pain associated with malignancy (Filshie & White, 1998).

TABLE 76.2
NIH Consensus Statement on Acupuncture Listed Conditions

| Conditions with substantial evidence | Acceptable conditions for treatment |
|----------------------------------------------------------------------------------------|-------------------------------------|
| Postoperative pain, chemotherapy-induced, and pregnancy-associated nausea and vomiting | Addiction |
| Postoperative dental pain | Asthma |
| | Carpal tunnel syndrome |
| | Fibromyalgia |
| | Headache |
| | Low back pain |
| | Menstrual cramps |
| | Myofascial pain |
| | Osteoarthritis |
| | Stroke |
| | Tennis elbow |

In a study of 73 patients with symptomatic osteoarthritis of the knee, acupuncture proved effective as long as 4 weeks after treatment (Singh, Berman, Hadhazy, Baretta, Lao, Zarow et al., 2001). In another study on knee osteoarthritis, psychosocial factors were measured in patients to study possible placebo effects of acupuncture. As in other arthritis studies, response to acupuncture was favorable, while no evidence of a link between psychosocial variables was found (Creamer, Singh, Hochberg, & Berman, 1999).

Acupuncture and EA have been found to ameliorate symptoms in men with chronic prostatitis and pelvic pain (Antolak, 2004) and renal colic (Antolak, 2004), dysmenorrhea (Thomas, Lundeberg, Bjork, Lundstrom-Lindstedt et al., 1995), and pelvic pain in women (Slocomb, 1984).

Chronic low back pain (cLBP) is a commonly seen condition in the pain clinic. Several studies show that acupuncture is useful in all age groups. In a 2003 randomized, controlled trial on subjects older than 60 years, Meng et al. (2003) found that acupuncture was effective and safe in older patients. In blinded, randomized, controlled studies comparing electrical stimulation with manual acupuncture, both therapies have been shown to be effective in managing cLBP (Kerr, Walsh, & Baxter, 2003). Policy setting studies are currently under way in Europe for the treatment of cLBP and osteoarthritis. To date, the largest study on cLBP is the German Acupuncture Trial for Chronic Low Back Pain study. In a multicenter, randomized, partially blinded trial 102 patients were treated. In another study 300 patients were studied for osteoarthritis under protocols developed by Acupuncture Randomized Trials, and another 300 subjects for cLBP (Brinkhaus et al., 2003). Results from these studies were due for release in 2004 but have not been published in time for inclusion here.

Studies comparing different treatments and combining modalities have also been performed. As orthopedists refer patients for physical therapy, most acupuncturists

TABLE 76.3
Comprehensive List of Pain Conditions Responsive to Acupuncture

| Conditions with substantial evidence | Conditions with reasonable evidence or consensus | Conditions potentially responsive to acupuncture based on observational studies |
|--------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------|
| Postoperative dental pain | Carpal tunnel syndrome | Malignancy-associated pain |
| Headache | Fibromyalgia | Neck pain |
| Low back pain | Intercostal neuralgia | Neurofibromatosis |
| Osteoarthritis | Menstrual cramps | Neuralgia |
| | Migraine | Post-arthroscopic pain |
| | Myofascial pain | Reflex sympathetic dystrophy |
| | Peripheral neuropathies | Rheumatoid arthritis |
| | Tennis elbow | Sciatica |
| | Trigeminal neuralgias | |

prescribe back exercises in addition to providing treatment. In one study combining EA and back exercises, 52 patients were treated with results indicating that the combination was effective in managing pain and reducing disability associated with cLBP (Yeung, Leung, & Chow, 2003). In a randomized trial with 115 patients comparing medication, spinal manipulation, and acupuncture for spinal pain, results suggest that manipulation may be better for short-term pain relief and increased mobility, but it does not provide the longer-term anti-inflammatory relief as does acupuncture or steroid medications (Giles & Muller, 2003). In a randomized, controlled trial on chronic neck pain, laser acupuncture was more effective than conventional massage therapy (Konig et al., 2003). Acupuncture is useful following musculoskeletal surgery as found in a controlled study on arthroscopic acromioplasty. Findings with 35 patients indicated lower postsurgical pain levels, less use of analgesics, increased range of motion, and a high rate of patient satisfaction (Gilbertson, Wenner, & Russell, 2003).

Malignancy-associated pain causes considerable suffering among cancer patients. In France, auricular acupuncture has been used to alleviate cancer pain for more than 30 years. In a randomized, blinded, controlled trial of 90 patients, statistically significant evidence was found for the reduction of pain intensity (Alimi, Rubino, Leandri, & Brule, 2000; Alimi et al., 2003).

Other conditions for which acupuncture has been shown to be effective include neurofibromatosis, low back pain of pregnancy, soft tissue disorders of the shoulder, rheumatoid arthritis, neuropathic pain following spinal cord injury, reflex sympathetic dystrophy, sciatica, and fibromyalgia (Table 76.3).

MERIDIAN SYSTEM AND ACUPUNCTURE POINT RESEARCH

The problem of solving or disproving the existence of *qi*, acupoints, and the meridians has been of little interest to

Western researchers. However, because these concepts are the basis of acupuncture theory and practice, and derive from Chinese culture, Asian researchers have taken the challenge more seriously. *Qi* research is largely carried on in China and Japan, where it is culturally acceptable, with international conferences annually where results of studies are presented, little of which has been taken seriously by Western scientists. Detection of acupoints has focused on electrical conductivity or resistance, with researchers theorizing that acupoints should manifest at the dermal surface as sites of lowered resistance and increased conduction.

Since the 1950s, Chinese, Japanese, French, German, and Austrian researchers have developed devices that confirm this suggesting that acupoints are anatomically real but instead are part of a non-neurological system in communication with the nervous, endocrine, and immune systems: in a sense, a homeostatic system regulating the internal physiological milieu with the outer environment.

A number of electrical point detection devices are used by acupuncturists and researchers including Electro-Acupuncture According to Voll originally developed in Germany by Reinhold Voll in 1953. This system measures galvanic skin resistance at distal acupuncture points on the fingers and toes using a 1 volt, 6 to 12 microampere current. Ryodoraku, first researched in Japan by Yoshio Nakatani in 1951 and followed by Odo and Hyodo of the pain clinic at Osaka Medical College (Hyodo, 1980), is based on autonomic nervous system function and uses a 12 volt, 200-microampere current to measure points.

Validating the existence of acupuncture meridians is equally challenging. Based on animal models, Ma et al. hypothesize that a perivascular space around blood vessels independent of lymphatic vessels constitutes an interstitial space within loose tissue through which acupuncture-induced signals are transmitted (Ma et al., 2003). Motoyama's Apparatus for Meridian Identification device is under investigation for its diagnostic capabilities in

establishing meridian and organ system disturbances and as means of monitoring effectiveness of acupuncture intervention (Borg, 2003).

SAFETY

Acupuncture safety falls into several categories: transmission of infectious diseases, infection from unsanitary needles or improper clean needle technique, direct injury to tissue or organs from needle insertion, allergic reactions, and needle breakage within the tissue. Lao, Hamilton, Fu, and Berman (2003) in a systematic review of 98 published papers between 1965 and 1999, identified 202 cases of complications associated with acupuncture. The most common complication found between 1974 and 1988 was hepatitis B with 94 cases reported. There have been no epidemiological reports of transmission of hepatitis C virus or HIV through acupuncture.

Common side effects of acupuncture include pain from needling, anxiety, and syncope. First-time patients are most susceptible; therefore, to prevent syncope the supine position is recommended over the seated position. Hematoma is another possible side effect, as are light-headedness, tiredness, drowsiness, and induction of sleep during treatment. Transient, localized skin irritation including erythema is not uncommon in patients with allergic dispositions. All of these side effects can be significantly minimized by an experienced practitioner who explains each step of treatment to new patients, and applies localized massage to acupuncture points after treatment, applies pressure when a hematoma is observed, and makes sure patients are positioned in a comfortable manner on the treatment table. Bruising may also occur in patient with a tendency for easy bruising and in elderly individuals with aged and fragile skin. Because of their blood-thinning properties, precaution should be taken with patients taking drugs such as coumadin and aspirin (Peucker, White, Ernst, Pera, & Filler, 1999).

Some patients do not react favorably to acupuncture. These nonresponders may be deficient, genetically or otherwise, in opiate receptors (Peets & Pomeranz, 1978). Non-responder results may be improved by the addition of DL-phenylalanine, an essential amino acid, at 750 to 1,000 mg daily to potentiate endorphin release (Hendler, 2001). Other factors influencing acupuncture efficacy are under investigation. In animal models, Lee et al. (2003) demonstrated that the analgesic effect of acupuncture is closely related to the amount of genetic expression of cholecystokinin-A receptors. Cholecystokinin is a peptide prehormone secreted from mucosal epithelial cells in the small intestine and produced by neurons in the enteric nervous system. It is widely distributed in the brain and may be the most abundant neuropeptide in the central nervous system.

Considering an estimated 5.4 million acupuncture visits in 1997 alone, the risks of acupuncture are small and

the incidence of side effects minimal and uncommon. According to the 2002 National Health Interview Survey, the largest and most comprehensive survey of complementary and alternative medicine use by American adults, an estimated 8.2 million U.S. adults have used acupuncture safely (Barnes et al., 2004).

ACUPUNCTURE THERAPY

Acupuncture is both a practice and a technique. The practice of acupuncture rests upon several thousand years of empirical experience and an ancient, comprehensive theory of health and disease. The technique of acupuncture consists of inserting specialized stainless steel needles into specific sites on the body, manipulating these needles manually or with electrostimulation, and then removing them. Point selection is based on the condition, location, and symptoms, and is guided by the theory of practice. The procedure is repeated at subsequent visits for a course of treatment, which on average consists of between 5 and 10 visits.

In China, it is common to perform acupuncture in a series of 10 to 30 daily treatments for two to four courses, with a rest of several days to a few weeks between each course. In the West and particularly in the HMO environment, we cannot emulate this economically, which brings up the question of cost-to-benefit ratio. But what is the most effective number of treatments for specific conditions? It is well known that repeated treatment with acupuncture or low-frequency, high-intensity electrical stimulation as with transcutaneous electric nerve stimulation (TENS) produce cumulative benefit for the patient (Pomeranz & Warma, 1988). Due to this cumulative effect, Western practitioners find that 10 to 15 treatments provided two to three times weekly produce sufficient pain-modulating effects.

Needle insertion combined with electrical stimulation, heat from moxibustion, and massage to acupoints before or after insertion are common additions to traditional acupuncture. In fact, in China acupuncture is traditionally called *zhen jiu* meaning needle and moxibustion, which is the burning of a prepared form of *Artemisia vulgaris*, a mugwort species, indirectly to an acupoint or directly to a needle inserted into a point. Other modalities include injection therapy, adaptation of microcurrent stimulation to acupoints using small probes or pads, EA without needles, retention of magnets or interdermal needles, and laser therapy.

Acupoint injection therapy uses small dosages of vitamin B₁₂, herbal extracts, homeopathic medications, biological substances such as Botox, as well as anti-inflammatory pharmaceutical agents such as cortisone and analgesics for the treatment of pain. Often referred to as “wet” acupuncture (vs. “dry” when needle only is

employed), this method has a long history in Germany but is only in the early stages of use in the United States.

Microcurrent has been shown to reduce symptoms of muscle damage following competitive sports (Lambert, Marcus, Burgess, & Noakes, 2002), neck and shoulder pain (Kim, 2001), and other pain conditions (Wieder, 1991). Devices have been adapted specifically for the acupuncture clinic using handheld probes to identify and treat problem areas such as the temporomandibular joint and other small joints.

EA devices that do not use needles but that simulate results of acupuncture are attractive for use in the pain clinic. TENS has a long history of use in the pain clinic. Grant, Bishop-Miller, Winchester, Anderson et al. (1999) demonstrated statistically significant improvement with both TENS and acupuncture, with acupuncture offering additional benefits over TENS. Home use of TENS units can complement acupuncture treatments, especially when patients can come for treatment only once or twice weekly.

Correlations among acupuncture, auricular acupuncture, EA, and vagal response have long been speculated with research conducted on heart rate (Shi, 1997; White & Ernst, 1999) and gastric secretion (Noguchi & Hayashi, 1996), as well as in the treatment of pain. In particular, auricular acupuncture according to Nogier of France has received wide acceptance (Oleson, 2002). In a study of 90 patients with cancer pain, Alimi, Rubino, Leandri, and Brule (2003) demonstrated clear benefit over placebo using auricular acupuncture.

Magnets and interdermal needles retained subcutaneously have wide use in Asia; however, there is scanty evidence in the literature for their use. Interest in using magnets applied to acupoints is increasing in the United States and may play an adjunctive role by applying magnets to affected areas in patients with pain between treatments as with TENS. In one double-blind study, Hinman, Ford, and Heye (2002) found that patients with chronic knee pain had statistically significantly less pain than the control group. In another study on osteoarthritis of the knee, Wolsko, Eisenberg, Simon, Davis et al. (2004) demonstrated statistically significant efficacy of magnetic therapy as compared to placebo after 4 hours.

Low-power lasers (LPL) have been employed in Europe since the 1970s for the treatment of pain and the promotion of tissue healing. The most frequently used types are visible red light helium–neon gas lasers, infrared gallium–aluminum–arsenide lasers, and gallium–arsenide lasers. Irradiated tissue is not heated as with surgical lasers. Trials involved LPL for pain have been conducted for trigeminal neuralgia (Walker & Akhanjee, 1985), post-herpetic neuralgia (Moore, Hira, Kumar et al., 1988), rheumatoid disease (Oyamada & Izu, 1985), and myofascial pain. LPL therapy has been adapted for stimulation of acupoints as “needleless” acupuncture. Although the mechanisms behind laser efficacy remains poorly under-

stood, there is wide acceptance among acupuncture professionals for tissue-healing, reduction in soft tissue inflammation, and in some cases, reduction of pain.

TRADITIONAL CHINESE MEDICINE

Traditionally, Chinese herbal medicine has been used in Asia for a wide range of acute and chronic pain conditions such as osteoarthritis, rheumatoid arthritis, cervicgia, low back pain, headache, fibrositis and myositis, neuritis, and other pain conditions. Herbal drugs have been shown to exert antioxidant activity, modulate cytokines and chemokines, effect gene expression, and regulate the inflammatory cascade. Modern Chinese herbal preparations include concentrated extracts, standardized dry extracts, and injectable medications. Numerous traditional Chinese herbal medicines have been shown to have analgesic and anti-inflammatory activity in the laboratory and in animal models. These include *Panax ginseng radix*, *Scutellaria radix*, *Aconiti radix*, *Stephaniae tetrandrae radix*, and others.

Ginsenosides Rb1, Rb2, Rd, Rf, Rg1, and Rg3 have antinociceptive effects on substance P–induced pain models (Choi, Han, Han, Lee, & Suh, 2003). In a study involving *Aconiti* and *Stephaniae*, analgesia was demonstrated in a rat model (Li, Zhang, & Qin, 2000). In another animal model, the flavanoid wogonin derived from *Scutellaria* inhibited inflammatory-associated enzymes such as cyclooxygenases (Chi, Lim, Park, & Kim, 2003).

However, few randomized, controlled clinical studies on large numbers of subjects have been performed. Because safety and drug–herb interactions are a controversial topic, until further investigation provides sufficient data on efficacy and safety, the practice of using Chinese herbal compounds in the integrative pain clinic should be avoided.

CONCLUSIONS

Both medical and traditional acupuncture are effective and safe methods for the treatment and management of chronic pain. Although a unifying model of the scientific mechanisms of acupuncture reconciled with TCM theory and modern human bioenergy hypotheses remains illusive, researchers continue to investigate the evidence underlying acupuncture. Further investigation is required for use of Chinese herbal preparations before they are integrated into common use in the pain clinic. It may be that bringing Western and Chinese medical paradigms into concert with each other, both in the research and clinical setting, will provide the necessary relevance needed to learn how they can benefit patients and fully integrate acupuncture and related traditional Chinese medicine therapies into the pain clinic.

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