

Mechanism of Pain Relief through Tai Chi and Qigong

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Abstract

The purpose of this paper is to outline the academic and medical evidence for Tai Chi and Qigong impact on pain, and describe the hypothesized mechanism that enables Tai chi and Qigong to work so well at relieving pain - often better than opioid pain medication, and with fewer side effects. This paper also describes a paradigm for research which will increase the likelihood that researchers doing projects in this field can synergize their efforts and start building a foundational body of knowledge rather than continue to do independent and disconnected studies on the phenomenon that enables Tai Chi and Qigong to work.

Keywords: Pain management; Pain mechanism; Tai Chi; Qigong; Movement; Breathe; Research guidelines; Behavioral practices; Integrative medicine

Tai Chi vs. Qigong

Decades ago there were not very many health studies on Tai chi and Qigong¹. Those that did exist were not highly controlled or validated. But slowly this has begun to change. In the last six years there have been hundreds of studies that explored the health benefits of Tai Chi and Qigong [1].

To achieve the goal of demonstrating clear evidence of the impact on the health and well being of human beings from Tai Chi and/or Qigong, first we must define what we mean by those terms. Qigong is an "integrative health exercise", and is generally comprised of a series of repetitive movements practiced in combination with proper body alignment, coordinated deep breathing and focused attention (i.e. "intention"). Staying relaxed and moving in ways that are aligned while being able to enhance strength and flexibility are very much central to the practice. The "focused attention", or "intention" is generally using either external imagery (i.e. Raising the Sun, Gazing at the Moon, Bring Heaven to Earth, etc.) or internal imagery (i.e. Imagine the light flowing down through your body, Pull in to the dantien (lower abdomen), etc. [2].¹

Tai Chi is often considered a specific type of Qigong [3]. Tai Chi is a practice that involves memorizing specific postures in sequence, known as a form, which was originally developed as a practice for self defense moves. In order to achieve advantage over their opponents, Tai Chi practitioners must remain balanced and in alignment at all times, breathing optimally, and remaining calm and clear headed. The Tai Chi practitioners must be able to "sense" or "listen" to the intention of the opponent. They must then be able to move with intention, while remaining completely relaxed, in such a way that whatever their opponent tries to do is neutralized. Movements require both strength and flexibility, and imagery is focused on the self defense of what the opponent is doing. Generally the movements of the form are practiced slowly, though they are done "at speed" in a martial or combat situation.

Current Research

Since 2004 there have been several meta analyses of studies of the health benefits of Tai Chi and Qigong [1,4-8] did an exhaustive literature search in order to compare mantra meditation, mindfulness meditation, Yoga, Tai Chi and Qigong. The initial 11,030 studies were

reduced to the 2285 studies that followed standard scientific guidelines. After applying even more meticulous scientific rigor criteria, the authors further reduced the number to 813 studies described in 803 articles. The articles that were included were primary research utilizing a control group and measureable, clearly defined health-related outcomes with a sample size greater than 10 subjects. Of these articles the authors did a "deep dive" to ascertain the characteristics and benefits of each of the meditative health practices. For example, one finding focused on the impact of the different alternative health treatments on blood pressure. Tai Chi was a highly effective at lowering systolic blood pressure (though the evidence pointed to Yoga being slightly more effective for reducing diastolic blood pressure). The resulting tables (Tables 1 and 2) shows the probability of each treatment being the best intervention.

The findings of the meta-analysis were extremely enlightening, but did not include pain relief specifically. Research that investigates the effectiveness of Tai Chi or Qigong on general pain is scarce.

Recommendations by Medical Centers

Unfortunately, until recently, few doctors learned about integrative health practices in medical school. The effects were thought to be limited to the placebo effect [9] and were, for the most part, not considered to be part of established standard of care practices.

The most influential medical schools have revised their thinking on that point, however, in face of the growing evidence to the contrary. Despite the lack of double-blind studies that provide strong scientific evidence, Qigong, Tai Chi and Yoga are all noted by many highly respected medical centers as effective pain relievers². The metabolic changes influenced by these practices are also known to prevent or slow down the onset of viruses, flus, and cancers as well as metabolic dysfunctions, autoimmune disorders and blood diseases [10,11].

Mayo Clinic doctors recommend Tai Chi [12]. As stated on their website:

Preliminary evidence suggests that tai chi may offer numerous benefits beyond stress reduction, including:

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Received December 22, 2012; **Accepted** April 15, 2013; **Published** April 17, 2013

Citation: Rhoads CJ (2013) Mechanism of Pain Relief through Tai Chi and Qigong. J Pain Relief 2: 115. doi:10.4172/2167-0846.1000115

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¹"Intention" or the "image" or "thought pattern" is an essential component of Taijiquan and Qigong practices. Further information can be found regarding this aspect at The Role of Imagery in Practice of Tai Chi Hong Kong Journal of Occupational Therapy by Chen W and Chan C [2].

Intervention	Point estimate	95% credible interval	Probability of being "best" intervention (%)
Tai Chi	-21.9	-37.9, -5.7	32.0
Yoga + BF	-20.1	-36.9, -3.1	23.8
Qi Gong	-18.4	-47.4, 10.7	27.2
CMBT	-14.9	-30.6, 0.9	8.1
Biofeedback	-13.2	.35.9, 9.4	5.1
Yoga	-13.1	-21.7, -4.4	0.6
RR	-10.8	-30.5, 8.9	0.9
Zen Buddhist meditation	-7.3	-22.1, 7.6	0.9
Rest/ Relaxation	-5.9	-22.4, 11.0	0.3
Mantra meditation (NS)	-5.6	-21.8, 10.5	1.0
TM®	-2.5	-14.0, 8.7	0.0
PMR	-2.4	-15.0, 9.6	0.0
HE	-0.5	-11.8, 10.6	0.0
WL	-0.3	-26.9, 26.3	0.0
NT	0.0	NA	0.0

BF: Biofeedback; CMBT: Contemplative meditation breathing techniques; HE: Health education; NA: Not applicable; NS: not specified; NT: no treatment; PMR: Progressive muscle relaxation; RR: Relaxation response; SBP: Systolic blood pressure; TM®: Transcendental Meditation®; WL: waiting list

Table 1: Mixed Treatment comparisons on Systolic Blood Pressure reductions compared to No Treatment [8].

Intervention	Point estimate	95% credible interval	Probability of "best" (%)
Yoga + Biofeedback	-17.1	-30.9, -3.0	34.0
Qi Gong	-15.2	-40.4, 9.3	30.6
Tai Chi	-12.1	-25.8, 1.5	12.5
Zen Buddhist meditation	-12.0	-24.4, 0.2	9.1
Yoga	-11.8	-19.1, -4.6	1.8
BF	-11.4	-32.1, 8.5	9.2
Rest/ Relaxation	-8.5	-22.0, 5.0	1.3
RR	-7.4	-24.2, 8.6	0.8
TM®	-3.4	-13.3, 5.9	0.1
WL	-3.3	-26.4, 19.3	0.0
PMR	-2.2	-12.8, 7.7	0.1
HE	-1.9	-11.8, 7.3	0.0
Mantra meditation (NS)	-1.0	-14.4, 12.4	0.6
NT	0.0	NA	0.0

BF: Biofeedback; DBP: Diastolic blood pressure; HE: Health education; NA: Not applicable; NS: not specified; NT: no treatment; PMR: Progressive muscle relaxation; RR: Relaxation response; TM®: Transcendental Meditation®; WL: waiting list

Table 2: Tables mixed treatment comparisons on Diastolic Blood Pressure reductions compared to No Treatment [8].

- Reducing anxiety and depression
- Improving balance, flexibility and muscle strength
- Reducing falls in older adults
- Improving sleep quality
- Lowering blood pressure
- Improving cardiovascular fitness in older adult
- Relieving chronic pain
- Increasing energy, endurance and agility
- Improving overall feelings of well-being

Harvard Medical School doctors also recommend Tai chi [13]. Peter M. Wayne, assistant professor of medicine at Harvard Medical

School and director of the Tai Chi and Mind-Body Research Program at Harvard Medical School's Osher Research Center has stated:

A growing body of carefully conducted research is building a compelling case for tai chi as an adjunct³ to standard medical treatment for the prevention and rehabilitation of many conditions commonly associated with age."

Harvard Women's Health Watch [14], states

This gentle form of exercise can prevent or ease many ills of aging and could be the perfect activity for the rest of your life. Tai chi is often described as "meditation in motion," but it might well be called "medication in motion."

WebMD (2011) also recommends Tai Chi. The website states:

Some people believe that tai chi improves the flow of energy through the body, leading to better wellness and a wide range of potential benefits. Those benefits include:

- Improved strength, conditioning, coordination, and flexibility
- Reduced pain and stiffness
- Better balance and lower risk of falls
- Enhanced sleep
- Greater awareness, calmness, and overall sense of well being

Difficulties of Scientific Research on Tai Chi and Qigong

The pain relieving aspects of Tai Chi and Qigong have been difficult to quantify. As shown by the meta-analysis by Ospina et al. [8], for the scientific/medical community, the real evidence is in well-designed double-blind research and practice trials. Predictably, research studies on health practices associated with Tai Chi and Qigong are rare for many reasons, the two most influential are lack of funding and difficulty in research design.

Lack of Funding

First, who would pay for such studies? Most medical research is supported by pharmaceutical companies who typically get a return on their investment for drugs when they are successful (which is profitable enough to also cover the costs of the unsuccessful trials). Getting an investment return is much more difficult within the fragmented organizations which deliver physical treatments such as Tai chi, Qigong, or other exercise therapies.

Funding is not an insignificant obstacle. Funding often determines which treatment will be more prevalent (regardless of effectiveness). Imagine that there were two equally effective treatments for pain relief. Treatment #1 would provide 12 billion dollars in revenues to a single company (the typical revenues on a blockbuster drug such as Oxycontin according to Berenson) [15]. Treatment #2 would provide

²Keep in mind that often the term Tai Chi, because it is more well-known, is used as a synonym for Qigong. Most research points to the common elements of both Tai Chi and Qigong (the magic combination of deep breathing, slow, aligned, movements and open focused thought/intention) rather than any specific form or style.

³An adjunct therapy is one that is used together with primary medical treatments, either to address a disease itself or its primary symptoms, or, more generally, to improve a patient's functioning and quality of life. Tai Chi or Qigong will not overcome the impact of an unhealthy lifestyle. In order to be effective, Tai Chi or Qigong must be combined with nutritional food, high quality sleep, and high-intensity cardiovascular exercise that lasts more than 15 minutes or so, at a relatively high heart rate (i.e. 80% of maximum heart rate). Additionally, Tai Chi and Qigong work more effectively as a preventative activity than a treatment for injury or acute disease.

several million dollars in revenue to several thousand unrelated disconnected health providers (integrative health centers and martial arts schools). Furthermore, Treatment #1 is covered by health insurance. Treatment #2 must be covered directly out of the patient's pocket. Which treatment do you think might garner research funding, and from whom? Which treatment would be prescribed more often by physicians? Which treatment would be utilized more often? Even if Treatment #2 is demonstrably more effective at a quarter of the cost without the side effects of Treatment #1, the number of people who would choose treatment #2 over treatment #1 will be very limited simply because of who is paying the bill. Funding sources, even in medical research, are not abundant without a clear path to return on investment.

Study Design Difficulties

Second, the requirements of a scientific study are often at odds with the treatment itself. How do you keep the daily practice of Tai chi or Qigong "blind"? In a drug trial you can give sugar pills that look exactly the same as the treatment so the subjects can't tell if they are getting the treatment or not. In a "double blind" study the doctors and researchers don't know which subjects are getting the treatment, either. With a daily practice treatment, it is more difficult to "hide" who's getting the treatment. People usually can tell if they are doing Tai Chi or Qigong or Yoga or just plain exercise. Bias for or against the treatment can interfere with the results.

Third, to complicate matters, as noted earlier, Tai Chi is not easily defined, and can mean different things to different people [16]. The problem of defining Tai Chi is dwarfed by the problems of defining Qigong. There are probably hundreds of thousands of different activities and behaviors that fall under the umbrella term of Qigong.

Despite progress in this area, the lack of a common definition makes finding clear and unadulterated evidence extremely difficult. One method to overcome this problem may be to avoid the terminology typically used when teaching Qigong and Tai Chi, and instead focus purely on the specific movements and behaviors. Ospina et al. [8] discussed the *Effect Modifiers*, (dose, duration, direction of attention, rhythmic pattern, and individual variables) which should be described in every research article. Even more simply, researchers could describe the movement/breath/intention sequence. Defining Tai Chi and Qigong through the sum of their parts (movement, breath, and intention) rather than the specific terms and practices commonly called Tai Chi or Qigong, it would be possible to identify the specific underlying stimulus and response of the practice. By doing so the features of the different practices can be identified as either common or distinguishing, and those features can be tested to see if there is a difference in therapeutic value for each one of them. Most studies, for example, completely ignore the imagery or martial applications in their description of the movements, yet the intention aspect of Tai Chi or Qigong may be important for these practices to work.⁴

The three components can be broken down into different aspects of their development for purposes of the research;

1. Movement: Strength development
2. Movement: Flexibility development
3. Intention: Focused attention
4. Breathing: Deep (either natural or reverse breathing)

⁴As noted earlier, the focus of attention may be an essential ingredient in why Tai Chi and Qigong work, which may be why research studies produce varied results; not all practitioners include the "mind-thought" control as part of the exercise.

5. Repetition

Using non-traditional descriptions for the movements, breath, and intention would "defrock" Tai Chi and Qigong practices from their mystical foundations without losing the essential nature of the exercise. Adopting this method of description would make it much easier to conduct research, and would enable the researchers to conduct double-blind studies that could provide stronger evidence of the efficacy and effectiveness of Tai chi and Qigong for health (or, alternatively, prove the practices immaterial in health improvement).

An example would allow us to see how this might work. The researcher might establish that Treatment 1 is movement/breath/intention sequence A plus movement/breath/intention sequence B plus (etc.). Treatment 2 would be movement/breath/intention sequence P plus movement/breath/intention sequence Q (etc.), and Treatment 3 would be movement/breath/intention sequence X, Y (etc.). In actuality, the sequences of Treatment 1 may be the same as a particular Taijiquan form, whereas the sequences of Treatment 2 might be the same as a particular Yoga style, and the sequences of Treatment 3 might be a classic Qigong. As long as the terminology is only Treatment (i.e. the subjects are not told if they are following treatment 1 or treatment 2 or treatment 3, and they are definitely not told which domain the treatments are based upon), subjects would be blind to which group they are in. Of course, another group, Treatment 4, would be required which might do nothing at all, perform movements that are unrelated to either Tai Chi or Qigong or Yoga, or perhaps just sit in a room as a control.

Additionally, when the outcomes are measured (whether it is blood pressure, immune response, pain levels, etc.) the researcher measuring the outcome should be unaware of which treatment the subject is in. This study design would result in double blind, reproducible verifiable research that would further the agenda of establishing practices based upon clear evidence.

Furthermore, the framework of movement, breathe, and intention, would enable the practices to be quantified in such a way that they could, eventually be prescribed. "Go do Tai Chi" or "Go do Yoga" is not a prescription. "Perform these specific movement sequences with accompanying intention and breathe practices three times a day for 10 minutes, seven days a week" is a prescription. If the goal is to decrease pain, being able to quantify exactly how much they need to do, with what intensity, and how often is critical. Yet this information is sadly lacking in our current state of research [8]. Only when therapeutic levels of the practice/sequence can be verified and replicated can Tai Chi and Qigong take a place among the prescriptions and medical advice coming from primary physicians.

Another step towards scientific inquiry would be to hypothesize *why* Tai Chi and Qigong work. The traditional explanations regarding chi and energy channels are insufficient in order to establish and test hypotheses. In order to find supporting evidence we need to look at a molecular, measurable, level. It is not essential to establish how Tai Chi and Qigong work in order to use it (indeed, the mechanism behind why aspirin reduces pain was only established in 1971, yet physicians have been prescribing aspirin since Felix Hoffman synthesized the compound in 1897 [17]⁵. But starting with a potential framework might help identify the most promising avenues for research. To that end, the next section will propose some potential frameworks for how and why Tai Chi and Qigong work to decrease pain.

Brain and Metabolic Mechanisms of Pain

Mechanism of pain

To understand the impact of Tai Chi and Qigong on pain, it will be helpful to first consider the feedback loop between the muscles, the nerves, the brain, and the metabolic system controlled by the brain. This feedback loop determines how much pain is “felt”. The physical manifestation of pain is when a muscle or nerve tenses or is damaged, the nerve endings send a signal up through bundles of nerves called “nerve trunks” to the Dorsal Horn. The Dorsal Horn is a bulbous bundle of nerves that serves as a switching station at the base of the spine. The Dorsal Horn sends the message up the wire-like nerve bundles that are threaded up the spinal cord to another switching station at the base of the brain. That switching station in the brain stem relays the signal to the thalamus region of the brain, just above the hypothalamus [18,19].

The amount of pain we feel is based upon the sensitivity of the Dorsal Horn, and the direction of the switch in the brain stem.

With repeated use, the Dorsal Horn becomes very sensitive, dialing up the amount of pain [20]. People who experience chronic pain have a Dorsal Horn which acts like a loaded gun with a tricky trigger finger; it is tensed up to fire pain sensation at the least provocation. The pain sensation then causes the nerves to tell the muscles to contract, which causes tension, which is felt by the Dorsal Horn (*danger, danger!*) which sends the message to the brain that there is more pain. This feedback loop keeps escalating causing an unending pain-tension-pain-tension cycle.

This cycle is enabled through the body’s method of signaling pain, which is done through neuropeptides, also known as neurotransmitters. Neurotransmitters are chemicals that move the message of pain through the nerve bundles. They cause the “Morse code of electrical discharge” that enables the pain message to travel from nerve bundle to nerve bundle and through the two switches on the way to the brain. If we paralyze the electrical activity of the short inhibitor neurons in the Dorsal Horn, we stop the pain. We “desensitize” the Dorsal Horn. Similarly, if we prevent the neurotransmitters from traveling up the spinal cord to the brain stem, we stop the pain. Sternberg [19] explains that the same channels of switches and relays that convey the pain signal in a fraction of the second up to the thalamus also include nerve pathways that travel downward through the spinal cord. Those electrical spikes are governed by the brain stem, which is in turn governed by the hypothalamus, the amygdala, and other regions of the brain which are controlled by thoughts and emotions. Sternberg [19] provides evidence that the circuitry of pain not only includes a sensory element (i.e. the “feeling” of pain), but also a psychological factor (i.e. the thought process). The psychological factor is influential through the physiological changes that occur in the brain through repeated learning and association. In other words, the brain can be conditioned to relieve pain anywhere in the body by changing the chemicals surrounding the cells receiving the pain messages.

Mechanism of pain relief

When pain is exacerbated by muscle tension, the un-ending feedback loop of pain can be broken by reducing or completely eliminating muscular tension. Deep relaxation makes the muscles so relaxed that they do not alarm the Dorsal Horn and wake the dragon

of pain. At the base level, this is one way that behavior can change pain levels.

Another natural way to relieve pain is through endogenous opiates, also known as endorphins. Nerve cells have a “protein seat” that protrudes from its surfaces. When an endorphin settles into the seat (by virtue of its shape), it trips another molecule, a protein dangling in the root of the nerve cell. That triggers a cascade of protein molecules tripping, which results in electrical activity in the cell.

Oxycontin, morphine, codeine, hydrocodone - these are opioids, drugs which mimic the effect of endorphins naturally produced in the body. They work because they have the exact same three-dimensional “shape” as the endorphins. The nerve cell doesn’t care if the molecule sitting in the protein seat is an endorphin or an opioid. It works the same.

When endorphins are plentiful in the dorsal horn, they block the electrical activity of the nerve fibers going up the spine to the brain, stopping the pain. When endorphins are plentiful in the brain, they increase the activity of the nerve bundles traveling down the spinal cord, which blocks the pain messages traveling upward. This happens because of the switch in the brain stem. The brain stem controls the direction of the pain pathway between the Dorsal Horn and the thalamus by turning each pathway “on” or “off”. When endorphins are plentiful, the “off” pathways are more plentiful and work harder, stopping the pain.

When a person is in pain, their brain is in a constant state of attention, what Fehmi and Robbins [21] calls *Narrow Focus*, which releases CRH (corticotropin-releasing hormone), causing a constant stream of stress hormones such as cortisol and adrenaline. Blood pressure and heart rate goes up. Respiration becomes shallow and the rate increases. The capillaries do contract. Over long term, these hormones begin to cause damage; inhibiting the digestive system, restricting nutritional absorption, causing muscle fatigue and increasing pain.

Open Focus attention, on the other hand, is the opposite. Open focus is a relaxed state of attention associated with enhanced critical thinking, complemented by ultra-awareness of the environment. This open focus has also been called being “in the zone” or “flow” within the realm of sports medicine [22]. Focus (either narrow or open) is measured using brain waves. Narrow focus is characterized by beta waves, whereas open focus tends toward alpha waves and gamma waves.

The existence of certain types of brainwaves has a domino effect on the body. When the brain exhibits alpha and gamma waves, neurotransmitters such as dopamine, serotonin, nor adrenaline, acetylcholine, GABA, and endorphins are released into the bloodstream. These are often called the “feel good” hormones because they cause a feeling of contentment and well-being. They do more than make people feel good, however. The increased neurotransmitters prompt the vagus nerve to activate, which lowers the heart rate and blood pressure. (The vagus nerve is one of the largest, and wanders around the body from the brain stem to the colon. It can be seen in figure 1). When the heart rate and blood pressure are lowered, that prompts the lungs to expand more fully and breathe more deeply, which activates the digestive system. A smooth-working digestive system, when combined with nutritional food, improves nutritional absorption [23].

While these changes are healthy for the body in the long term, they also have an impact in the short term; an impact that can modify pain sensations. This process indirectly causes the body to decrease

⁵Of course, since the early Greeks prescribed willow bark in 400 BC, one could say that we’ve been using aspirin for over 2000 years.

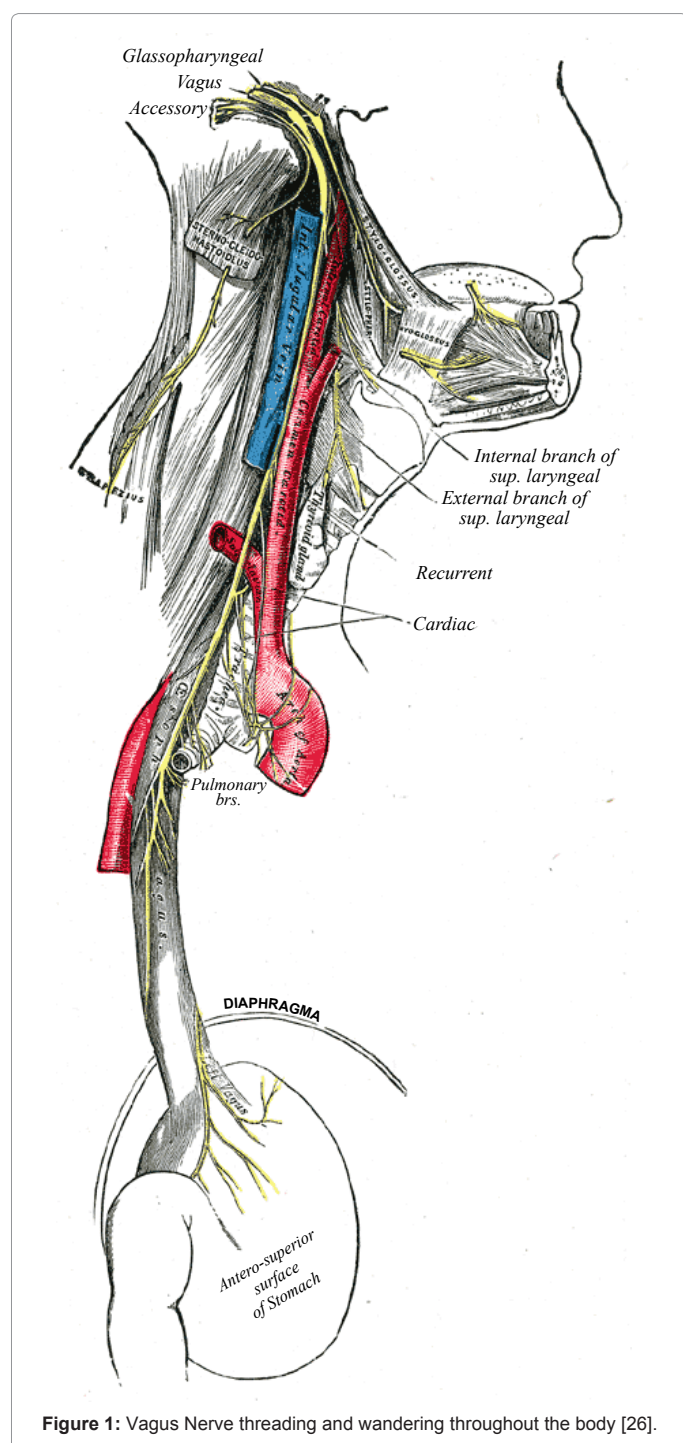


Figure 1: Vagus Nerve threading and wandering throughout the body [26].

the amount of pain felt by *over-riding* the body's response to pain. Instead of allowing the body to go into hyper drive, increasing tension and stress hormones (which actually increase the pain by getting the individual into the pain-escalating feedback loop), the response is short circuited and the brain is convinced of the reality; there is no danger, no tension, and no reason to elicit the stress response. Over time the override becomes the norm and the stress response decreases. The Doral Horn becomes less sensitive to perceived threats of pain, and the pain dissipates.

That the stress escalation process increases pain levels is well

known. What was not previously known was how to initiate the relaxation response which changes the brain waves and how to elicit the brain to manufacture more endorphins.

When drugs that mimic endorphins are introduced into the system it stops the pain in the short term. Unfortunately, the brain tends to stop manufacturing endorphins when opioids are introduced. Reliance on opioids rather than endorphins leads to drug tolerance, addiction, and a host of other side effects that eventually decrease the pain relieving effectiveness of the treatment. Eventually, the pain always returns. The natural endorphins don't have those side effects, and the body does not develop a tolerance for them. Conditioning the brain to maintain a constant level of endorphins would decrease pain and eliminate the side effects.

Manufacturing Endorphins

Research shows that meditation can shut down narrow focus and lead to open focus. *Biofeedback* is the medical treatment's name for meditation. When a person is connected to a bio-feedback machine, a visual illustration of tension appears on the computer screen. In order to "lower" the amount of tension, the person must breathe deeply, and relax their muscles. Relaxing the muscles sends a signal to the brain that there is no danger. Stress hormones such as cortisol and adrenalin are reduced or stopped. Blood pressure and heart rate go down. Respiration becomes deep and the rate decreases. Capillaries expand. Digestive systems resume normal processes, increasing nutritional absorption, increasing muscle endurance, and decreasing pain.

Research shows that Buddhist monks who are regular meditative practitioners have different brain wave patterns [24]. Because of these chemical changes, the brain switches from narrow focus to open focus quickly and easily. Tai chi and Qigong induces the same impact as meditation, causing the same chemical changes in the brain, and the same ease of switching from narrow focus to open focus.

There is some evidence that this open focus is not only good for relieving pain, but enhances the body's ability to move rapidly by changing the perception of time. Bradley [25] proposed that the pineal gland is impacted by chanting meditation and visualization techniques in martial artists to release dimethyltryptamine (DMT). DMT is a hallucinogenic compound formed by the combination of the neurotransmitter serotonin and the amino acid tryptophan. Bradley conjecture that DMT enables martial artists to change the perception of time (making time appear to slow down when defending and speed up when attacking) as well as help them deal effectively with stress, overcome spiritual blocks, or reach another level of training.⁶

Similar to the way Tai Chi and Qigong can decrease the amount of pain felt, the metabolic changes in the body can also decrease the impact of illness, especially metabolic dysfunctions such as diabetes and obesity, autoimmune disorders such as Graves disease, rheumatoid arthritis, celiac disease, multiple sclerosis, and blood disorders such as porphyria and leukemia. All of these chronic problems are exacerbated by the stress response of the body, and tempering that response can not only alleviate symptoms, but cause them to disappear entirely. The same physiological response to increased endorphins that allows pain relief also blocks inflammation and balances the immune system [19,26].

⁶Bradley also postulates that the pineal gland enables Tai Chi and Qigong practitioners to "experience chi", because it is a "vehicle to consciously experience the movement of our life-force in its most extreme manifestations" (to quote Rick Strassman, the leader medical doctor involved in DMT research).

In Summary

In summary, the medical community in the past has dismissed as anecdotal any effectiveness Tai Chi and Qigong might have as a treatment for pain relief. However, there is now growing evidence that a healthy lifestyle including regular cardiovascular exercise, good nutrition, and stress relieving activities such as Tai Chi and Qigong does work, and works very effectively for decreasing pain. It may even be that Tai Chi and Qigong work better than some medication and other treatments, with fewer negative side effects. Furthermore, the research indicates that pain relief through the natural manufacture of endorphins is a long term treatment that does not require escalating doses, but rather a lifestyle change that enables a constant therapeutic level of endorphins (as long as the activities continue to be practiced).

Further research is needed. More double-blind controlled studies are necessary. By focusing on specific sequences of movement/intention/breath we can document what works and what doesn't, and we can develop a prescription model that can provide a more specific description of integration health treatments that work.

By creating a hypothesis about how Taijiquan and Qigong work to relieve pain in terms of bio-mechanisms, we can begin to isolate the essential components. This paper introduced the concept that Tai Chi and Qigong work by affecting the metabolic processes of the body influencing the circulatory system, the digestive system, the metabolic system, and the nervous system. When practiced frequently (daily) and consistently (for months and/or years) Tai Chi and Qigong may bring about the following:

- Decreased muscle tension
- Increased lung capacity and deeper breathing
- Lowered sensitivity of the Dorsal Horn to pain
- Increased levels of neurotransmitters such as dopamine, serotonin, nor adrenaline, acetylcholine, GABA, and endorphins
- Decreased levels of stress hormones such as cortisol and adrenaline
- Smooth running digestive system
- Increased nutrition absorption
- Slower heart beat
- Increased alpha and gamma brain waves
- Decreased beta brain waves

The time for this type of research is now. Healthcare costs are skyrocketing, the population is aging, and painful chronic conditions are exploding. The lifestyle of the modern world is not necessarily the best for human bodies, and general pain syndromes reflect this. Everyone is looking for answers - and some in the medical community are now willing to look at alternative, complementary, and integrative health practices if they can be proven to work.

One way to jump start the effort would be if researchers could conduct some in-depth financial analysis and compare the treatment costs of the most common chronic pain relieving treatments using traditional drugs/surgery/rehab to the cost of treating the same chronic pain using integrative health practices. If integrative health practices become economically feasible, it would decrease the health costs for insurance companies and government agencies. That could be the source of funding for further refinements and research.

The goal must be to develop proof, using double-blind statistical studies, beyond a shadow of a doubt, of the efficacy, efficiency, and effectiveness of integrative health practices such as Tai Chi and Qigong.

References

1. Kuramoto AM (2006) Therapeutic benefits of Tai Chi exercise: research review. *WMJ* 105: 42-46.
2. Chen W, Chan C (2009) The role of imagery in practice of Tai Chi. *Hong Kong Journal of Occupational Therapy* 19: A5-A5.
3. (2011) Differences between Tai Chi and Qigong. Qigong Institute.
4. Klein PJ, Adams WD (2004) Comprehensive therapeutic benefits of Taiji: a critical review. *Am J Phys Med Rehabil* 83: 735-745.
5. Klein P, van Hooydonk K, Kutlesa M (2010) Therapeutic benefits of tai chi/qigong: an overview and critical review. January 1990 through January 2010.
6. Rogers CE, Larkey LK, Keller C (2009) A review of clinical trials of tai chi and qigong in older adults. *West J Nurs Res* 31: 245-279.
7. Verhagen AP, Immink M, van der Meulen A, Bierma-Zeinstra SM (2004) The efficacy of Tai Chi Chuan in older adults: a systematic review. *Fam Pract* 21: 107-113.
8. Ospina MB, Bond TK, Karkhaneh M, Tjosvold L, Vandermeer B, et al. (2007) Meditation practices for health: state of the research. Evidence-based Practice Center, University of Alberta, Edmonton, Canada.
9. Katz AR (2008) Reduced falls in the elderly: tai chi or placebo or Hawthorne effect? *J Am Geriatr Soc* 56: 776-777.
10. Liu X, Miller YD, Burton NW, Chang JH, Brown WJ (2011) Qi-gong mind-body therapy and diabetes control. A randomized controlled trial. *Am J Prev Med* 41: 152-158.
11. Yang Y, Verkuilen J, Rosengren KS, Mariani RA, Reed M, et al. (2007) Effects of a Taiji and Qigong intervention on the antibody response to influenza vaccine in older adults. *Am J Chin Med* 35: 597-607.
12. (2009) Tai Chi: discover the many possible health benefits. Mayo Clinic. Mayo Foundation for Medical Education and Research.
13. Brown NP (2010) Easing Ills through Tai Chi, *Harvard Magazine*.
14. (2009) The health benefits of Tai Chi. Harvard Women's Health Watch. Harvard Medical School. Harvard Health Publications.
15. Berenson A (2005) Lipitor or Generic? Billion-Dollar Battle Looms. *New York Times*.
16. Lai XS, Tong Z (2010) A study on the classification and the 'catching' of the 'arrived qi' in acupuncture. *J Tradit Chin Med* 30: 3-8.
17. Warner TD, Mitchell JA (2002) Cyclooxygenase-3 (COX-3): filling in the gaps toward a COX continuum? *Proc Natl Acad Sci U S A* 99: 13371-13373.
18. Willis WD Jr (1985) The pain system. The neural basis of nociceptive transmission in the mammalian nervous system. *Pain Headache* 8: 1-346.
19. Sternberg EM (2001) *The Balance Within: The Science Connecting Health and Emotions*. WH Freeman and Company, New York.
20. Price DD (1999) *Psychological Mechanisms of Pain and Analgesia*, (Progress in Pain Research and Management, V.15), IASP Press, Seattle.
21. Fehmi L, Robbins J (2010) *Dissolving pain: simple brain-training exercises for overcoming chronic pain*. Boston: Trumpeter.
22. Payne BR, Jackson JJ, Noh SR, Stine-Morrow EA (2011) In the zone: flow state and cognition in older adults. *Psychol Aging* 26: 738-743.
23. Healy K (2011) Knowledge of brain development and mental functioning opens up a fresh perspective on therapeutic interventions in psychotherapy. *Advances in Psychiatric Treatment* 17: 240-242.
24. Lutz A, Greischar LL, Rawlings NB, Ricard M, Davidson RJ (2004) Long-term meditators self-induce high-amplitude gamma synchrony during mental practice. *Proc Natl Acad Sci U S A* 101: 16369-16373.
25. Bradley S (2010) The Pineal Gland's Biochemical Function in the Fighting and Meditative Arts, Exemplified in Korean Sinmoo Hapkido. *Journal of Asian Martial Arts* 19: 22-33.
26. Gray H (1918) *Anatomy of the Human Body*, IX. Neurology.