

Reflective Exercise: A Method for Helping the West to Better

Appreciate the Health-promoting Power of Tai Chi and Qigong

John Alton

Abstract

Tai Chi and Qigong are now established in the West, but their importance in terms of health promotion is poorly appreciated. This underappreciation stems from the difficulty of learning Tai Chi and Qigong relative to learning either conventional Western exercise and sports or rival Far Eastern mind-body methods such as yoga and mindfulness, which got to the Western marketplace and institutional imagination first. Reflective Exercise (RE) was developed to help overcome these obstacles. Based on Tai Chi and Qigong principles and trends that emerged in modern China in the latter half of the 20th century, RE condenses an easily-learned Tai Chi routine, followed by sensory meditation exercises in standing, sitting or reclining positions. Both Tai Chi and Qigong focus the mind on present physical conditions of the body, such as balance, weight distribution, breath, and sensations in the hands. These effects put Tai Chi and Qigong into a category of mindfulness exercise called “interoception” defined as a sense of the internal state of the body. RE tightens the interoceptive focus of Tai Chi and Qigong to a pulsatile sensation that moves along pathways that connect the lower abdomen and the head. These pathways follow not only traditional acupuncture channels, but also the anatomy of the cardiovascular system and the neuroanatomy of the sensory dimension of the autonomic nervous system. Moreover, the ability to sense these pathways imparts the ability to channel and focus the immune system on infections and injuries. Four research studies conducted at the University Virginia School of Medicine found support for RE’s claims. Two of these studies revealed that enhanced interoceptive ability through RE training can significantly reduce respiratory infections in elite college swimmers and the symptoms of traumatic brain injury (TBI) in military veterans. The other two studies showed that the interoceptive ability to sense the pulsatile sensation moving from lower abdomen to head (defined as “the Reflective Response”) correlates as a significant increase in low frequency heart rate variability (LF

HRV), a phenomenon that a large body of research associates with balanced immune system activation.

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Introduction

Reflective Exercise (RE) is a simplified Tai Chi / Qigong routine designed to help Westerners experience some of the more profound health effects of Tai Chi/Qigong in a short amount of time without traditional Chinese explanations and interpretations. It has been illustrated and discussed in both book and video formats. RE is based on western medical scientific understanding so that its primary claim to distinction can be tested and verified. RE's primary claim is that it can elicit in the practitioner the extraordinary interoceptive ability to sense and regulate blood volume and pressure shifts between the lower abdomen and the head that are being driven constantly by the autonomic cardiovascular system. This interoceptive pulsatile sensation has been defined as the "Reflective Response" (RfR) ¹. A considerable number of case studies support the claims that the RfR gives the RE practitioner some degree of control over the body's healing mechanism ². Two formal research projects conducted through the University of Virginia's School of Nursing have shown that the ability to sense the RfR correlates with a reduction in respiratory infections in collegiate swimmers and with the ability to control and eliminate headaches and other symptoms in veterans diagnosed with traumatic brain injury (TBI) ^{3, 4}. Two follow-on studies measured cardio-hemodynamic changes in RE practitioners while sensing the RfR. One study demonstrated that compared with a cohort of practitioners of various forms of mindfulness during meditation, RE practitioners showed significant increases in the low-to-high frequency heart rate variability (LF/HF HRV) ratio as well as significant increases in low frequency blood pressure variability (LF BPV) ⁵. The second study showed that the emergence of the RfR during RE training in novice collegiate swimmers correlated with significant increases in LF HRV, an effect strongly associated with wholesome immune system balance ⁶.

The RE Method and Theory

The RE method involves the sequencing and coordination of four elements: 1) a movement routine based on Tai Chi, 2) a lower abdominal maneuver coordinated with the respiration cycle, 3) sensory meditation exercises based on Qigong that are performed in standing, seated, and reclining positions, and 4) an instructional schedule that optimizes learner convenience

and elicitation of the RfR. The four elements of the RE method are detailed below.

RE Movement

RE movement consists of a four-minute sequence that resembles the slow motion of Tai Chi. RE movements take approximately one hour to learn and less than two hours to memorize. RE movement primarily differs from Tai Chi in terms of foot position. In Tai Chi, the feet often are lifted and repositioned with weight shifts, whereas in RE the feet remain in place, thus making RE a less difficult to learn than Tai Chi.

RE's upper and lower body relationship during movements resembles that of Tai Chi in that the trunk and head remain centrally aligned and follow the lower-body weight shifts, which the arms and hands also follow. But the two differ in terms of the complexity of arm and hand movement. Tai Chi often involves moving the arms in opposing directions (one ascends while the other descends) or divergent angles (one moves forward while the other moves ninety degrees upward or downward). During RE the arms and hands sweep in parallel through the space surrounding three stations—the waist, chest, and head—in a series of circular motions, thus introducing another simplification not found in Tai Chi arm movements.

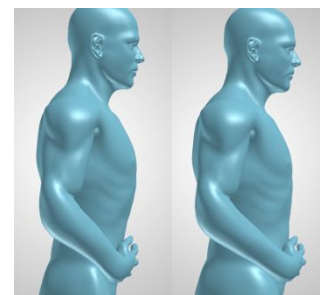
Illustration 1



RE Respiration

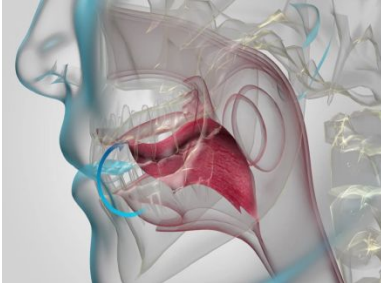
RE respiration is derived from a traditional Qigong method known as "reverse breathing" (*ni hu xi*), which coordinates gentle lower abdominal muscle maneuvers with the breathing cycle. On inhalation, the lower abdominal muscles are lightly contracted, and on exhalation, they are slowly relaxed in time with the outflow of breath. All breathing occurs through the nose.

Illustration 2



Another aspect of respiration is specific teeth and tongue positions. The molars are brought together so that they touch lightly, which causes the mastoid muscles of the jaw to tighten gently. Second, the whole tongue lifts up toward the cavity of the upper palate, and the tip curls backward and rests against the back of the gums of the upper front teeth.¹

Illustration 3



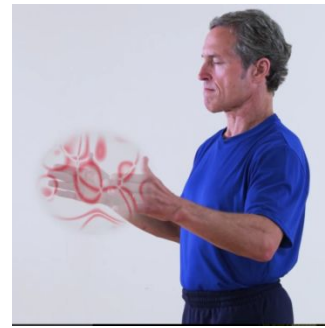
Because Westerners tend to be highly unfamiliar with RE breathing, it is treated as a separate exercise until the practitioner is able to use it at least intermittently during all phases of the RE training, including coordinating breathing with lower body weight shifts and arm and hand circular motions through the space of the three stations. Beginning practitioners often find this coordination between breathing technique and movement difficult, but tend to master the details during sitting or reclining meditation.

Sensory Meditation

After memorizing the RE movement and respiration methods, the practitioner performs a series of standing meditation exercises that involve feeling energetic-like sensations in the hands, such as heat, tingling, and invisible pressure that resembles the effect of holding in each hand a magnet with an opposing field. The hands feel these energetic-like sensations after the arms are held at the chest level for several minutes, after which the palms of the hands are aimed at each other and slowly rotated in countervailing circles.

¹ Once the practitioner begins to experience the RfR regularly, the tongue and teeth positions can be modified to enhance and gain finer control over the RfR's pathway. The RfR typically emerges as a pulsatile sensation that follows the frontal midline of the torso, neck, and head. With additional practice and modification of the teeth, tongue, and mental focus, the RfR can be directed up the spine to the top of the head on inhalation and down the front on exhalation, a classical Qigong circulatory pattern known as the "small universe" (*xiao zhou tian*). This interoceptive pattern is important because it likely constitutes the ability to use autonomic cardiovascular mechanisms to influence the flow of cerebrospinal fluid (CSF) from the spine to the brain.

Illustration 4

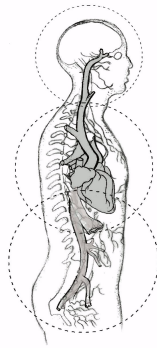


The energetic-like sensations are what traditional Tai Chi and Qigong refer to *Qi*, the existence of which is sternly opposed by Western medical scientists. This opposition has remained throughout decades of unsatisfactory debate that range from the philosophical to the experimental. This debate has diminished the possible widespread importance to human health that Chinese Tai Chi and Qigong represent.

RE avoids the debate by positing an interoceptive theory in place of what traditional Chinese medicine uses Qi and acupuncture meridians (*jing luo*) to explain. This theory lends itself to testing by scientific methods, and it allows the more profound health benefits of Tai Chi and Qigong to be examined.

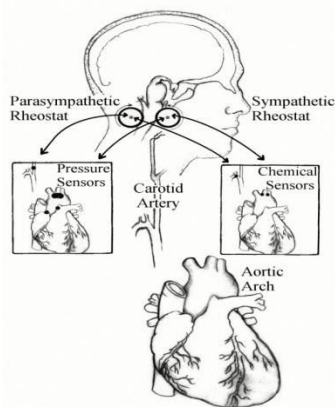
RE's interoceptive theory proposes that the energetic-like sensations in the hands represent the nervous system's tactile capacity to detect cardiovascular "reflections," changes in direction and/or magnitude of the force wave that propagates throughout the body when the heart and central aorta, located in the chest, ejects a bolus of blood into the central artery that travels up into the neck and head and down into the lower abdomen. These three areas of the central arterial pathway—the ascending, central, and descending aorta—correspond to the three stations of the head, chest, and waist that govern the location of the arms and hands during RE movement. As this blood payload shoots from the central aorta in the chest into the arteries of the neck and head, and down into the descending arteries of the lower abdomen and pelvis, it encounters changes in diameter of the arterial pipeline. The apertures of the neck and head arteries, as well as those of the lower abdomen and pelvis, are considerably smaller, so that when the force wave created by the bolus of blood arrives at those smaller apertures, part of the force reflects or bounces back in the opposite direction.

Illustration 5



This force wave and its reflections are further modulated by the elasticity of the artery itself as well as by the sensory dimension of the autonomic nervous system (ANS), embedded within the arterial pipeline and throughout the cardiovascular system, but especially in the central (thoracic) and upper (carotid) aortas. These nerves monitor blood pressure by sending feedback to the center of the ANS in the brain stem, which regulates both heart rate and aortic elasticity through the sympathetic and parasympathetic branches of the ANS. Both branches act on the cardiovascular system like modulating rheostats. The sympathetic rheostat speeds or slows heart rate and the parasympathetic rheostat manages blood pressure by changing the elasticity of the carotid and thoracic aortas .

Illustration 6

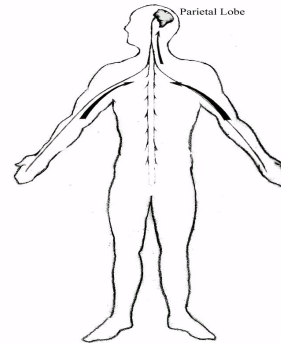


Cardiovascular measuring devices that use external sensors attached to the fingers can detect arterial reflections so accurately that they can be used to

² The expansion and contraction of the lungs during respiration also causes pressure changes in the central aorta and the pulmonary vein that sends oxygenated blood from the lungs, back into the beating heart. Moreover, the lungs also contain pressure nerves that signal autonomic centers in the brain stem that in turn produce signal outputs to the sympathetic nerves regulating heart-beat rate.

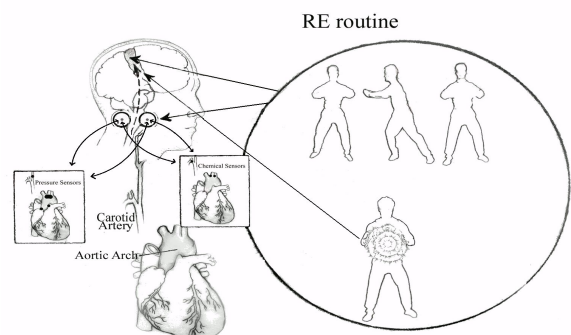
interpolate heart rate and blood pressure in real time. RE theory reasons that tactile-sensory and pressure-sensory nerves in the hands are capable of detecting the varying pressure changes in the blood vessels of the hands. These pressure-change sensations may be the source of the energetic feeling in the hands, which registers in the hand-sensory region of the parietal lobe cortex.

Illustration 7



While reflections are being sensed in the hands, the tongue and teeth positions and lower abdominal muscular maneuver coordinated with respiration are also stimulating autonomic sensory nerves that surveil and interact with their respective regions of the body. Over the course of practicing RE, these upper and lower autonomic sensory nerves transmit signals to the autonomic centers of the brain stem, where similar signals from hand-sensory-pressure nerves are being received at the same time. Given what is known about the plasticity of neural linkages in the brain and the responsiveness of that plasticity to classical conditioning, it is reasonable to suggest that RE practice may condition an association between the hand-sensory region of the parietal lobe and the deeper autonomic centers of the brain stem, which then creates the neurological means for the autonomic brain stem to transmit pressure, chemical, and other sensory signals to higher cortical areas of the brain concerned with the consciousness of touch.

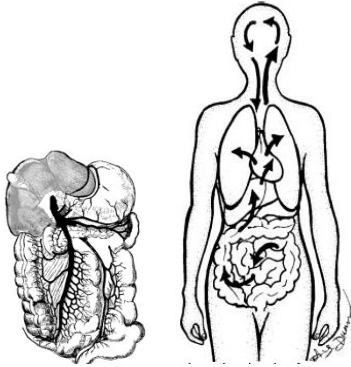
Illustration 8



One region of the cardiovascular system that likely plays a crucial role not only in sensing the RfR but also

in the immune system effects that accompany the RfR is the enteric venous system, which carries blood from the immune-rich gut to the filtration system of the liver, to the heart, to the lungs, and then to heart again, where refreshed, oxygenated blood is ejected into the aortic system.

Illustration 9



It is conceivable that the emergence of the RfR in an RE practitioner is actually the result of the transformation of unconscious autonomic sensory nerves into something closer to the conscious awareness of the sense of touch, directed inwardly, which by definition is a form of interoception. This interoceptive ability to sense and modulate cardiovascular pressure and flow also may impart the ability to sense pro- and anti-inflammatory immune activity that constantly occurs within the interconnecting vessels of the blood and lymphatic systems.

This theory has been studied once by functional MRI scan in an anecdotal test wherein increased blood flow from the abdomen to the head was observed during RfR activation, but the results were not documented. That test needs to be replicated under a variety of conditions. Yet, however untested this and other RE propositions may be, they all lie within the realm of possibility, based on medical “knowns.” This theoretical approach, combined with the simplicity of the methods, appeals to medical researchers looking for a non-invasive, holistic therapy that can achieve results beyond subjective measures, which is one of the strongest remaining criticisms that conventional medicine directs toward mind-body practices in general.

Instructional Schedule

The biggest obstacle standing in the way of learning any mind-body exercise—but especially Tai Chi/Qigong—is devoting the time, energy, and money to the task, whether the health benefit claims are backed by scientific or some other theory. Thus, an important feature of RE is that it can be learned in approximately eight one-hour-long sessions, and in most cases the RfR

emerges in the practitioner on or before the eighth hour of training. This time commitment is much shorter than that of most traditional Tai Chi or Qigong courses, which sometimes take up to several months to complete and produce no distinct interoceptive results comparable to the RfR.

The eight-hour timeline for learning RE and obtaining the RfR is an estimation based on observing over two thousand people train in RE over approximately thirty years. During this observation period, three training-schedule trends emerged as the most appealing and effective for novice learners with limited time, energy, and motivation. Highly motivated novice learners tend to do well with eight consecutive hours of intensive training, which can be accomplished over three days. People lacking such motivation tend to favor two alternative time-diffuse instructional schedules: 1. three-days-per-week of one-hour training, spread out over approximately three and a half to four weeks, or 2. two-days-per-week of one-hour training, spread out over approximately four to four and a half weeks. In both scenarios, novice learners are asked to practice by themselves one additional time on session days and twice daily on non-session days. This more time-diffuse schedule encourages training impediments, especially for low-motivated novice learners who are reluctant to practice, much less on their own.

Four experiments conducted through the University of Virginia measured the effects of RE training. One experiment involved veteran RE practitioners who over the course of their development had trained using a variety of instructional schedules. The other three experiments focused on novice RE trainees who were instructed exclusively on the basis of the two time-diffuse instructional schedules. More research needs to be done to examine the relationship between trainee motivation, instructional schedule, and outcomes.

Summary Review of Four Research Studies on RE and the RfR

The four RE studies—identified chronologically as Study One (2004), Study Two (2011), Study Three (2011), and Study Four (2014)—were conducted through the University of Virginia. The four studies were conducted over the course of a decade and increased in experimental sophistication and focus over time. Studies One and Two were limited primarily by lack of direct measurements of RfR. By the time Studies Three and Four were designed, RE and the RfR had established more credibility and the RfR was included more directly in the investigation.

The following are summaries from Studies One, Two, Three, and Four. Because Studies One and Two used subjective questionnaires to measure outcomes, no figures or statistical graphs are included here, though the publications of the studies do contain a number of detailed figures and graphics. Studies Three and Four used biometric data and statistical models to assess outcomes. A few of these are included here to illustrate these outcomes. While much more remains to be elucidated, these studies were important steps in getting Western medical scientists, who are the gatekeepers of Western public health, to have the opportunity to observe the profound health potential of Chinese Tai Chi and Qigong methods.

Study One (2003-2004): A Pilot Study of Qigong and Upper Respiratory Illness in Elite Swimmers (Wright, 2011)

Background: Upper respiratory tract infections (URIs), the most common health complaint in competitive swimmers, can diminish performance. Thus far no intervention has been shown to reduce this problem. During September 2002 and September 2003, the University of Virginia varsity swim team added to its usual training a 3-week course in qigong to improve health.

Purpose: Our primary objective was to assess the relationship between qigong practice and symptoms of URI during a time when swimmers would be at high URI risk. We also assessed the response-rate and reliability of a newly developed internet-based, self-report survey.

Design: Observational, cross-sectional, and prospective. Data on concurrent cold and flu symptoms, concurrent health problems and medication use, and qigong practice were gathered weekly for seven weeks. Retrospective health data were also collected.

Study Participants: Twenty-seven of the 55 members of the University of Virginia Swim Team.

Setting: University of Virginia Athletic Department

Main Outcome Measure: Aggregated Cold/Flu Symptom Score

Results: Survey completion was 100%; reliability of the instrument was acceptable. While cold and flu symptoms were not significantly related to reported amount of qigong practice overall, restricting analysis to swimmers practicing qigong at least once weekly revealed a strong, inverse association between practice amount and symptom scores ($R^2=0.70$, $p<0.005$). This association was not explained by differences in age, gender, supplement or medication use, baseline health problems, belief in qigong, or other potential confounders.

Conclusion: Qigong practice may be protective against URIs in collegiate swimmers. These preliminary findings warrant replication in larger, controlled studies.

Study 2 (2011): Qigong as a Novel Intervention for Military Service Members with Mild Traumatic Brain Injury (Yost and Taylor, 2013)

Background: Traumatic brain injury (TBI) has evolved into the signature injury for service members returning from the wars in Iraq and Afghanistan. Current standards for diagnosis, treatment, and rehabilitation of service members with mild TBI (mTBI) are often incomplete, leading the military medical community to seek new and innovative approaches to long-term management. One therapy that has shown potential in reducing stress and improving quality of life is qigong, an ancient Chinese healing practice that focuses internal energy towards wellness through the use of deliberate movements, diaphragmatic breathing, and meditation.

Purpose: The purpose of this study was to explore the interest in and utility of a 4-week internal qigong intervention in service members diagnosed with mTBI.

Methods: This study used a qualitative descriptive phenomenological analysis. Six service members with mTBI who were receiving outpatient neuro-rehabilitation at the Defense and Veterans Brain Injury Centers—Charlottesville Rehabilitation Center were interviewed about their experiences living with mTBI and their experiences learning and practicing qigong during a 4-week intervention. Interview data were analyzed using methods described by Giorgi.

Findings: Findings from the *baseline interviews* supported four themes with regards to their experiences living with mTBI: “burdens and barriers,” “before, after, and the future,” “the influence of military service,” and “messages for the military health care system.” New concerns were revealed including (a) the potential for war-related guilt that could influence the recovery process and (b) the potential for greater involvement of civilian resources in delivering care to those who have suffered TBI. Findings from the *week-4 interviews* revealed a dramatic change in the attitudes of the participants following the practice of qigong over the 4 weeks. Four themes emerged and included, “experiencing physical energy,” “regaining control,” “no pain, a lot of gain,” and “barriers to practice of qigong.”

Participants offered profound examples of how qigong enabled them to control their symptoms and improve their outlook on the future. Their perceptions were that qigong was conducive to the highly disciplined mindset of military service members and that the simplicity of qigong was well suited to individuals with symptoms

related to mTBI.

Study 3 (2011): Assessment of Cardiovascular Parameters with the CareTaker Device during Meditation

Introduction: We investigated cardiovascular dynamics during meditation in order to elucidate neural mechanisms underlying this salubrious practice. Several meditative methods were studied and compared including the less know method of Reflexive Exercise (RE).

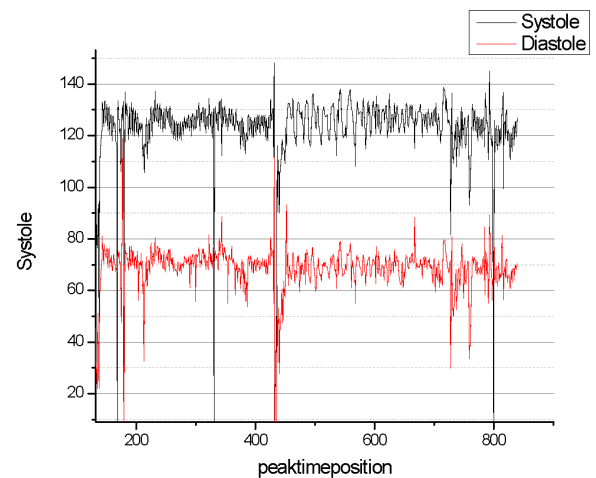
Methods: Volunteer subjects were instructed to wear a novel digital artery pressure sensor, CareTaker (CareTakerMedical.net), designed to non-invasively measure beat by beat, continuous blood pressure (cNIBP), and ECG accurate heart rate (HR), and respiration rate. Each subject underwent a rest interval of five minutes and then meditated. The meditation was accompanied with either reverse abdominal (RE) or a form of non-specific breathing technique (non-RE) for about 15 minutes. Cardiovascular parameters were compared prior to and during meditation in the same subject.

Results: The comparisons between rest and meditation in each subject generally showed increases in heart rate variability (HRV) during meditation. RE subjects also showed significant increase in blood pressure variability (BPV), while non-RE subjects showed an insignificant but measurable decrease in BPV. Spectral analysis of the HRV showed the emergence of a low frequency (LF) band with meditation and is consistent with previous observations of LF during various forms of meditation (Peng). The subjects practicing RE had a significantly larger shift in LF compared to practitioners of non-RE meditation.

Summary: In this exploratory study of experienced meditators, we observe the emergence of the LF band that has been considered to be a marker of autonomic balance in the literature. Neither of the two groups showed an increase in the high frequency (HF) HRV during meditation, which is generally accepted as a marker of parasympathetic activation associated with respiration. The type of practice of meditation, possibly related to the breathing technique used during meditation, can explain the differences in LF shift found between the RE and non-RE practitioners.

Sample Graphics

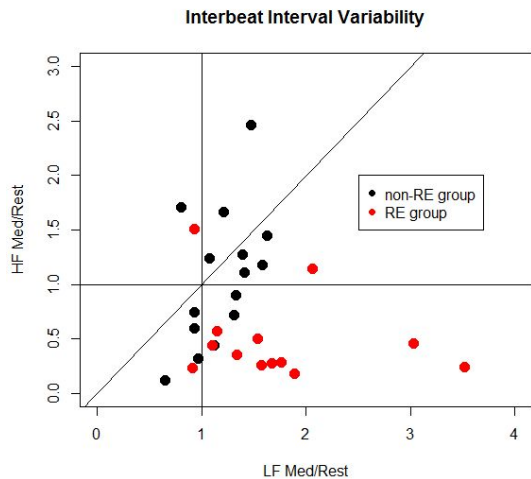
Figure 2



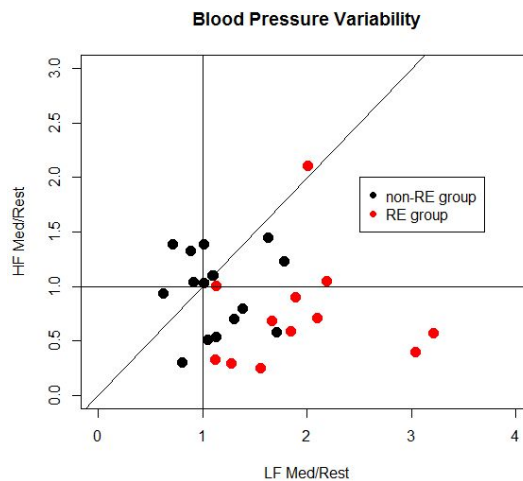
In this subject the meditation period begins after 400 (peak time position). In this subject an increase in low frequency variability is visible in the pattern immediately after meditation begins.

Figure 4. Changes in LF and HF components in

HRV and BPV



(a) RE subjects generally experience an increase in the LF/HF ratio in interbeat interval variability. This can be seen in the plot above where most RE data appear below the diagonal line.



(b) RE subjects generally experience an increase in the LF components of the blood pressure variability. This can be seen in the plot above where most RE data appear to the right of the vertical line.

Study 4 (2013-14): Assessment of Cardiovascular Parameters during Meditation with Mental Targeting in Varsity Swimmers

Introduction: Athletes who develop an immunosuppressed state because of intensive training get upper respiratory infections (URIs) and may respond to meditation. Reflective Exercise (RE), a westernized form of Qigong, combines meditation, breathing, and targeted mental attention to an internal pulsatile sensation, previously shown to protect varsity swimmers from URIs during the height of training. We report here the evaluation of cardiovascular parameters measured during meditation combined with targeted imagery (interoception) in a cohort of varsity swimmers taught RE.

Methods: Thirteen subjects were enrolled on a prospective protocol that used the CareTaker, a non-invasive cardiovascular monitor before, during and after RE training. Questionnaires regarding targeted mental imagery focusing on a pulsatile sensation were

collected. The cardiovascular parameters included heart rate, blood pressure, and Fourier spectral analysis was used to calculate low and high frequency power heart rate variability (HRV).

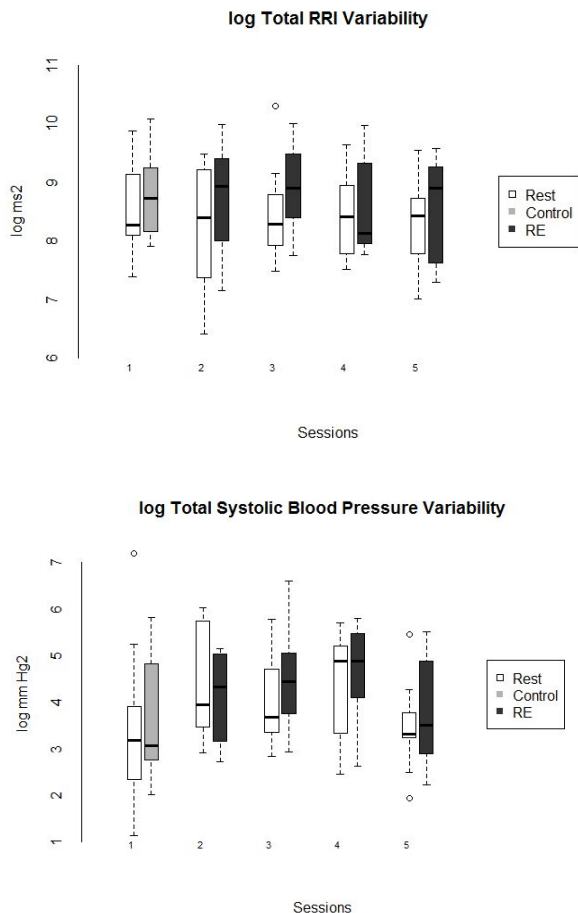
Results: Increased variance in the subjects' BP and HRV was observed over the training period of 8 weeks. In nine subjects there was an increased low frequency (LF) HRV that was significantly ($p < 0.05$) associated with the subject's awareness of the pulsatile sensation that makes up a basic part of the RE practice.

Summary: In this evaluation of varsity swimmers trained in RE that can protect from URIs, we found elevated LF HRV. These data support further evaluation of HRV measurements in subjects while meditating with mental imagery. This direction could contribute to better understanding of neurocardiac mechanisms that relate meditation to enhanced immunity.

Key Words: Meditation, Qi Gong, Reflective Exercise, Heart Rate Variability, Interoception.

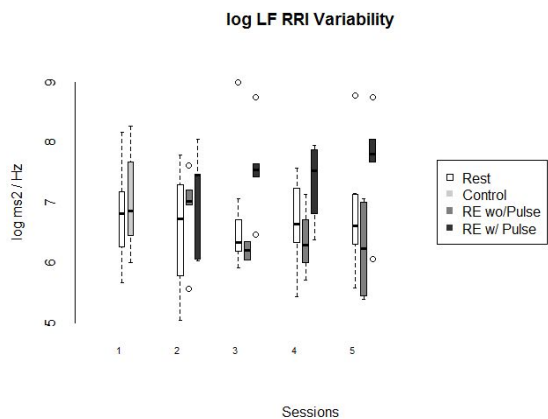
Sample Graphics

Figure 1



During session 1, subjects rested for 5 minutes followed by 15 minutes of uninstructed breathing. This 15 minute period is called the control period in the figures above. During sessions 2 through 5, subjects rested for 5 minutes and followed by 15 minutes of reflective exercises (RE).

Figure 2



During session 1, subjects rested for 5 minutes followed by 15 minutes of uninstructed breathing. This 15 minute period is called the control period in the figures above.

During sessions 2 through 5, subjects rested for 5 minutes and followed by 15 minutes of reflective exercises (RE).

Take-aways

The simplicity of the RE method and its explanation of functional benefits in terms that Western medicine understands proved to be an effective way to gain the attention of medical researchers at the University of Virginia. Moreover, the findings of RE effects exceeded those of typical investigations of Far Eastern mind-body health-promoting exercises, which in comparative research produce results similar to those of conventional Western exercise. In the case of RE, the method (Qigong or Tai Chi with a still meditation component) was shown to produce immune system effects by reducing the frequency and severity of the symptoms of upper respiratory illness. Two studies demonstrated that RE causes significant increases in cardiac periodicity, which is driven by the autonomic nervous system's continuous regulation of cardiovascular hydraulic pressure and which prior research suggests is strongly associated with balanced immune system activation. Moreover, the latter two studies confirmed that RE practitioners who can sense changes in hydraulic volume and pressure along pathways between the lower abdomen and the head simultaneously demonstrate robust increases in cardiac periodicity, signifying balanced immune system activation. Rival forms of mind-body exercise that are extremely popular at the University of Virginia and the Charlottesville community were unable to match the RE results ⁵.

Future Research

Functional MRI, ultrasound, and wearable and imbedable sensors—combined with machine learning algorithms—are providing more data than was possible just a few years ago. These technologies are starting to define and measure health and disease “pulsatility” markers within the body’s coordinated systems. As the data collecting and analytical power of these technologies become increasingly sophisticated, a serious, simple question lingers: Are all these technical breakthroughs simply rediscovering what was predicted so long ago by Laozi and the founders of Daoist medical theory? Can sickness, health, and life itself most accurately be characterized by the Taiji Tu, the great symbol of “pulsatility” that can be sensed in the body and cultivated for a longer healthier life. In my humble opinion, this should be one of the questions the International Society of Chinese Health Practices should ask and seek to answer.

Appendix

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Authors' contributions

Abbreviations

Ethics approval and consent to participate

N/A

Consent for publication

N/A

Availability of data and materials

N/A

Competing interests

N/A

Funding

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