

Health benefits of tai chi: potential mechanisms of action

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Introduction

Optimal human movement requires continuous integration of afferent (incoming) and efferent (outgoing) nervous system impulses. Humans cannot flow through the environment safely unless they concurrently take in information with their senses (e.g. visual, auditory, somatosensory and tactile information), integrate these ascending impulses, and plan and execute the next motor action. Indeed, one does not move until one first has the inspiration (thought) to move. Tai Chi (TC) is a mind and body exercise that provides a solid foundation for all functional movement (e.g. activities of daily living, work, play and sport applications). From its roots as a martial art, TC practice fosters the development of both efficient and effective movement.¹ TC was first described in the scientific literature in 1981.² TC emphasized an alert, yet relaxed mind, and a strong, yet supple body. Traditional Chinese Medicine distinguished TC as a holistic exercise with strong preventative elements. It was considered ideal for balancing one's mind and body, creating an overall sense of peace and harmony and naturally inspiring longevity.³ The Chinese proclaimed TC as a spiritual exercise beneficial for mental health (psychological well-being) and physical health by decreasing blood pressure, providing mild aerobic exercise, improving flexibility (particularly spinal mobility) and promoting the conservation of energy (Qi) through efficient and effective (i.e. functional) movements.^{2,3}

Modern medicine describes TC is a meditative movement therapy⁴ that fosters functional movement patterns addressing the strength, endurance, mobility and balance impairments frequently seen in the aging population.¹⁻⁵ Today, the health benefits of TC are renowned and address many of the mortality and morbidity factors associated with lifestyle-related noncommunicable diseases and conditions (e.g. osteoarthritis, heart disease, cognitive impairment and dementia, chronic obstructive pulmonary disease, stroke) seen in the 21st century.⁶⁻⁹ The rising burden of chronic disease poses a challenge for the health system and requires innovative approaches to optimize aging and wellness.⁶⁻⁹ Community-based and individual practice of TC holds promise as a health promotion and wellness exercise as well as an intervention for a variety of chronic health conditions afflicting older adults.¹⁻⁹

But how exactly does TC work to achieve these many health benefits; what is its mechanism of action? A linear rise in psychoneuroimmunology (PNI) publications (N=1104 articles since 2000) reflects the growing suspicion that a disease-oriented biomedical model is insufficient in addressing the chronic health conditions facing aging adults in the 21st century.¹⁰ The field of PNI seeks to understand the mechanisms by which both drug and non-drug interventions such as TC, yoga and mindfulness-based meditation promote health.^{10,11} The intent of this paper is to evaluate Chinese mind-body principles and guidelines of TC practice in an effort to comprehend how TC is able to impact multiple dimensions of wellness within the human experience (Figure 1).

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Figure 1 Tai chi impacts dimensions of wellness within the human experience.

Chinese mind-body principles

Three Chinese mind-body principles (Table 1) and seven guidelines (Figure 2) for TC practice inform how TC is instructed and practiced. The mind-body principles (centering, effective action, TC energetics) and guidelines for TC practice are integral to all styles of TC and may explain how TC imparts its health benefits.¹² *Centering* directs us to “get in touch with our body and our surroundings.”¹² TC begins with a few moments (to minutes) of quiet, focused attention into the present moment. This stillness prepares the mind and body for the flowing movement of TC. The mindful practice of TC creates *effective action* that is rooted in the feet, powered by the legs, guided by the torso and expressed in the hands.¹² Body mechanics and spontaneous action are hallmarks of the effective action of TC. The third mind-body principle, *TC energetics*, promotes sensory awareness and balanced, relaxed flowing movement.¹²

Guidelines of TC practice

Mindfulness – strive to focus on the present moment. Mindfulness is the intentional and non-judgmental focus of one's attention on the

emotions, thoughts, sensations and actions currently taking place.¹³ A simple review of the scientific literature (*PubMed* “mindfulness benefits, systematic reviews, last 5 years”) yielded n=51 articles touting the physiological and psychological benefits of mindfulness. Meditative practices impart general health benefits as well as improvement from depression, mental illness, anxiety, pain and other psychological stressors.¹⁴ There is evidence of decreased levels of

cortisol, epinephrine and norepinephrine (stress-related hormones) with mind-body interventions like TC, yoga and meditation. Moreover, PNI-based interventions are also associated with reductions in inflammatory processes and levels of pro-inflammatory cytokines in cancer, HIV, depression, anxiety, wound healing, sleep disorder, cardiovascular diseases and fibromyalgia.¹⁵

Table I Chinese Mind-Body Principles – definition, Chinese tenet, English translation and application

Mind-Body principle	Chinese tenet	English components (Translation)
Centering Mindfulness	Be still as a mountain, move like a great river.	Bring attention into the present moment. Feel the movement in your body as you breathe. Keep body upright and naturally aligned Bring awareness into hands, fingers and feet. Notice the sounds, sights and smells around you.
Effective Action Body Mechanics	Tai chi is rooted in the feet, powered by the legs, directed by the torso and expressed in the hands.	Movement is from the ground up with proper postural alignment and body mechanics. With the body relaxed and aligned, spontaneous movements are naturally circular. Efficient and effective movement allows us to move (flow) around obstacles.
Tai Chi Energetics Sensory Awareness	Relaxed and rooted to the earth, the body moves effortlessly like a floating cloud (moving like a string of pearls).	Heavy: Knees, tailbone and elbows are relaxed, and feel heavier. Light: Head, eyes, fingers are light and uplifted fostering the flow of Qi (energy) into the hands.



Figure 2 Guidelines for TC Practice.

Postural Alignment – maintain the body in an upright posture. TC posture (Figure 3) reminds us to maintain an upright spinal posture as we move throughout our day. The flexed knee posture readies us for action while supporting the natural primary (thoracic kyphosis) and secondary (cervical and lumbar lordotic) curves of the spine. Based on engineering (tensegrity) principles, the spinal curves contribute to the structural integrity and balance of the spine, enhancing strength and protecting us from injury.^{16,17} Use of the powerful muscles of triple extension in the lower extremity (e.g. hip extensors, quadriceps and plantar flexors) along with the 3-dimensional mobility of the hip joint further protects the spine as we use our extremities to complete the many tasks of our day.

Breathe Awareness – relaxed, natural diaphragmatic breathing. At the center of all meditative movement therapies (e.g. TC, qigong, yoga) is

breath awareness. Breathing is essential to life, and to be thankful for each breath is essential to happiness. Indeed, when a baby first emerges from the womb, its first action of life is a deep and nourishing diaphragmatic breath. The stress of everyday life frequently steals away the body’s natural tendency to perform these natural cleansing breaths. TC practice reminds us to slow down and inhale deeply to *nourish* and exhale completely to *cleanse* every cell in our being. During the practice of TC, deep diaphragmatic breathing is integrated into body motions to achieve a harmonious balance between body and mind and to facilitate the flow of internal energy (Qi).⁹ Depending on style of TC (e.g. Yang, Chen, Sun, Wu or Wu-Hao) and underlying health of the participant, TC is a mild-to moderate aerobic exercise appropriate for a variety of cardiopulmonary diseases, and can likewise be used in the general community as a preventative health measure.³⁻⁹

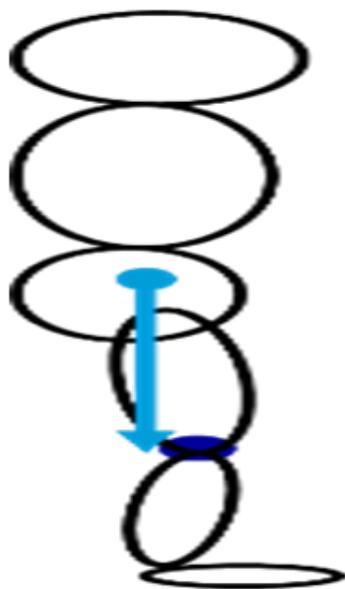


Figure 3 TC posture: Rooted in the feet, powered by the legs (quadriceps), directed by the torso and expressed in the hands.

Active Relaxation – a state of relaxed inner stillness while in motion. Long believed to be the most difficult, active relaxation is the center point of the seven guidelines for TC practice (Figure 2). While all seven guidelines are simultaneously performed in TC, it is active relaxation that reminds us to integrate inner calmness while simultaneously taking on safe and effective physical action. Motor learning and motor control theory tells us that while mental practice and physical practice alone both enhance movement, but the combination of the two (dual tasking) is most effective.¹⁸⁻²⁰

Slow Movement – builds strength and endurance.⁷⁻²¹ While slow movement is more difficult it allows the nervous system time to create optimal balance between agonistic and antagonistic muscles. It affords the brain ample time to integrate our joints, and to craft the precise action we wish to accomplish. Slow movement, when repeated, and done in a relaxed way, prepares the nervous system for more dynamic, rapid, and even, ballistic functional activities. The slow movement of TC is the roadmap to motor efficiency and power, and precisely why many martial artists practice TC on the way to mastering their more explosive martial arts practices.

Weight Separation – enhances dynamic control of the center of mass (postural control and balance). Unless we learn to separate our weight, we will always be stuck in one place. Weight separation is what allows us to step forward, step backward and side-step the troubles in our lives. Mindfully separating and accepting one's weight as we walk is fundamental to safe movement in our environment. The weight separation and stepping transitions of TC practice readily satisfies principle #1 of Sherrington's best practice exercise guidelines for falls prevention. TC provides mid- to high- level balance challenge by 1) moving the center of mass over the base of support, 2) reducing the base of support from double limb to single limb support and 3) decreasing the need for upper limb support in standing.²² TC is a readily adaptable exercise accessible to a wide variety of ages and skill levels. Traditional free-standing TC can be modified to seated, standing with side support, and or walker support versions.^{23,24} TC

can be used in individual or group community-based settings to promote weight-separation, kinesthesia (static postural awareness) and dynamic postural control.¹⁻²³

Integrated Movement form the Core – proximal stability for distal mobility. All the Grandmasters of TC tell us to return to the core (*dantian*) when we are having trouble in our TC practice. The dantians (e.g. upper [forehead between the eyebrow], middle [at the level of the heart] and lower [below the navel]) are important points of reference in TC and other practices (e.g. qigong, Reiki, traditional Chinese medicine). The lower dantian, also known as the qi (energy) center is particularly important as it is the focal point of breathing as well as the body's center of gravity.²⁵ All TC (and indeed human) movements are initiated from the core. In rehabilitation medicine, this phenomenon is known as *proximal stability for distal mobility*.²⁶⁻²⁸ Core muscles provide stability that allows generation of force and motion in the lower extremities, and a stable base of support for upper extremity function.²⁸

Benefits of TC exercise

The benefits of exercise have a historical precedence established long before they were touted by 13th century Chinese TC practitioners. Ancient physicians including Susruta of India (600 BC) and Hippocrates (480-370 BC) prescribed exercise to promote health.²⁹ In modern times, the health benefits of exercise cannot be denied by the health care system. Physical exercise is the only intervention that consistently attenuates age-related declines in physical function.³⁰ Hutson and McFarlane (2016) noted the general health and fitness benefits of TC to be balance, aerobic capacity, strength, well-being, sleep, and flexibility.⁷ Both these family physicians felt there was robust evidence to recommendation TC to their patients. Furthermore, key features of TC practice include: mindfulness (awareness of the present moment), imagery (images used as mental learning strategy), structural alignment (postures and movements that are effective and efficient), flexibility and relaxation, strength and balance, natural (diaphragmatic) breathing, social support (positive interactions within a community) and integration of body, mind and spirit (holistic health practice).⁵⁻³¹ As with any physical activity, the health benefits of TC are inevitably associated with practice duration, intensity, level of mastery, and commitment.

Summary

TC is a meditative movement therapy that fosters optimal functional movement patterns that can be applied to all human movements. TC has the capacity to go far beyond its widely accepted use for balance and falls prevention and has benefits for a wide variety of health conditions.⁵ Its preventative qualities can be traced back to its original Chinese tenets. TC is a readily adaptable exercise accessible to a wide variety of ages and skill levels. While TC is considered a mind (intellectual) and body (physical) exercise, it can impact all domains of wellness within the human experience (Figure 3). It has the potential to mindfully impact our ability to move efficiently and effectively in our personal, social and occupational environments. This in turn, provides human beings with emotional stability expanding our sense of purpose and providing meaning to our lives (spiritual wellness). While the opening statement to this paper – *Transforming society by optimizing movement to improve the human experience*,³² is the vision statement of the American Physical Therapy Association (APTA), it is also precisely *why* Tai Chi (TC) works: "Movement is life. Life is good, therefore, movement must be good."

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Conflict of interest

The author declares there is no conflict of interest.

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