

# A novel noninvasive approach to reducing action hand tremor

## Abstract

Typical noninvasive interventions for action hand tremor are limited to compensatory techniques by using weighted equipment, adaptive equipment, and stabilizing devices. Those approaches provide only temporary effects during patients' performance of purposeful activities. The five step Stress Reduction Hand Tremor Control (SRHTC) approach demonstrated decreased action tremor in the hands and significant improvement of hand function for daily activities.

**Keywords:** hand tremor, essential tremor, intervention of hand tremor, rehabilitation of hand tremor, behavior and hand tremor, stress and hand tremor, pathophysiology and qigong

Volume 3 Issue 3 - 2018

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**Received:** April 16, 2018 | **Published:** May 04, 2018

## Introduction

A tremor is defined as a rhythmical, involuntary oscillatory movement of a body part that is produced by alternating contractions of reciprocally innervated muscles.<sup>1</sup> There are two basic ideas regarding tremorogenesis. One emphasizes a functional hyper excitability and rhythmic oscillation of neuronal loops in the absence of structural changes. The other is that of a permanent structural pathology with signs of neurodegeneration.<sup>2</sup>

Two sets of neuronal networks are of particular importance when thinking of tremors. One is the corticostriothalamocortical loop through the basal ganglia, whose physiologic task is the integration of different muscle groups for complex movement programs. The other circuit involves the red nucleus, inferior olivary nucleus (ION), and the dentate nucleus, forming the triangle of Guillain and Mollaret (Guillain-Mollaret triangle), which works to fine-tune voluntary precision movements. Among its components, the ION appears to play the most important role in the genesis of tremor through the synchronized oscillations of ION neurons. The  $\beta$ -carboline alkaloids harmine, harmaline, and tetrahydroharmine from the Harmal plant (*Peganum harmala*, "Syrian Rue"), increase ION neuron excitability.<sup>3</sup>

Tremors have been classified into two main groups: action tremors and resting tremors.<sup>4</sup> Action tremors occur with voluntary contractions of a muscle and can be further subdivided into postural, isometric and kinetic tremors.<sup>5</sup> Thus, they can make it very difficult for patients to engage in daily tasks such as eating, writing, drinking and washing.<sup>6</sup> They are especially prevalent among patients with essential tremors. Essential tremors, occurring with a frequency of between 5 and 12Hz,<sup>7</sup> are one of the most common movement disorders, affecting the hands, head and voice of about seven million people in the United States.<sup>8</sup> The most often encountered tremors have frequencies between 4 and 12Hz.<sup>1</sup>

Despite being one of the most common movement disorders, essential tremors remain poorly understood. Available pharmacologic and nonpharmacologic treatments are purely symptomatic and empiric.<sup>9</sup> Drugs are often used to control and manage different types

of tremors; however, patients respond differently to the drugs and may experience negative side effects such as blurred vision, confusion, fatigue and muscle paralysis.<sup>10</sup> Deep Brain Stimulation, which requires brain surgery, is a more invasive method to control the tremor when the responses to drugs are insufficient.<sup>6</sup>

Additional noninvasive methods have been researched, but all have required attached devices that are fixed and portable with passive and active controllers.<sup>6</sup> Another common strategy involves using weighted equipment to attenuate hand tremors, but even this has had mixed results. Dahlin-Webb<sup>11</sup> showed a positive result with a weighted wrist cuff, but a randomized control trial by Meshack<sup>12</sup> suggested no support for using weighted utensils or wrist cuffs.

Currently, the available therapeutic approaches to treat essential tremors provide only sufficient control for less than half of patients. This is due to the empiric nature of existing treatment options and persisting uncertainties about the pathogenesis of essential tremor.<sup>13</sup>

In addition, minimal research has been conducted on behavior and stress components related to hand tremors. Mental stress may enhance tremors amplitude.<sup>5,14</sup> Archer et al.,<sup>15</sup> found that increases in visual feedback increased tremors in the 4-12Hz range among essential tremor patients. Increases in visual feedback was also associated with abnormal changes in blood-oxygen level-dependent amplitude and entropy in regions within the cerebello-thalamo-motor cortical pathway and extended to visual and parietal areas. This finding supports the idea that essential tremors are not driven by a single oscillator or single pathway but are instead related to a larger network of neural regions.

One of the authors, Linda Liang, found that patients with action tremors reported more stress prior to performing purposeful activities and the use of more hand strength when attempting to control their hand tremors.

Because of the need for more proven and established treatment techniques to address tremors, Linda developed a novel non-invasive five step Stress Reduction Hand Tremor Control method that is clinically significant.

## Methods

This novel non-invasive hand tremor reducing method utilizes a five-step remedial approach.

**Step one:** the therapist instructs the patient to use less strength when engaging in tasks. The therapist may direct the patient by saying: “Touch it (object) like Jello,” which decreases the patient exerted effort during purposeful activities and improves their internal self-control.

**Step two:** the patient is given a verbal cue, such as “Just do it”, to reduce body tension. If the task does not require full visual attention, the therapist instructs the patient to look at some nearby location when perform the tasks. If the patient demonstrated increasing hand tremor, the therapist instructs the patient to stop. At that point, the process is restarted to allow the brain to rewire.

**Step three:** the therapist facilitates regular hand coordination training with the patient’s affected hand.

**Step four:** the therapist addresses the patient’s psychological coping skills, such as learned avoidance behaviors, negative self-judgments, and anticipatory anxiety. The therapist instructs the patient to “Just relax” and encourages acceptance of the tremors by stating, “Let’s try”.

**Step five:** the therapist incorporates qigong (the ancient Chinese practice of holistic healing) into a home exercise program to treat action hand tremor.

## Cases

The following case examples demonstrate the application of the SRHTC method. In each case, the patient was suffering from action tremors and was treated with the five-step tremor reduction method. All names used in the case studies below have been changed for the purpose of this article.

### Case I

Eric was a 66 year-old right-hand dominant male with a history of a brain stem cerebral vascular accident some 5 years prior. He presented with a severe tremor in his right hand, which affected his ability to perform most of his daily activities, including his ability to shake people’s hands and insert keys into locks. At the time of the initial evaluation, Eric was unable to reach and grasp an 8-ounce cup filled with water. After explaining the intervention, for which Eric expressed interest and support, the therapist initiated the SRHTC approach once a week for sixty minutes. Eric initially had difficulty understanding the first, second, and fourth steps. However, after a few therapy sessions, he performed tasks using decreased effort, including daily living activities, such as eating, and leisure activities like balloon volleyball. He also did tasks more automatically instead of over preparation. He utilized psychological coping skills and accepted his hand tremor, resulting in less fear when engaging in activities.

After the first session, Eric’s hand tremors began to decrease, and after four sessions, he could demonstrate appropriate qigong practice for his home exercise program. After 16 individual weekly sessions were completed, Eric’s right hand tremors had decreased significantly, enabling him to engage in most daily activities with the affected hand, such as practicing with chopsticks to pick up small

items like beads and using chopsticks to eat.

### Case II

Maria was a 51-year-old female with a history of traumatic brain injury with right upper extremity hyper tonicity that had no function for twenty-five years. She had developed essential left-hand tremor several months prior to occupational therapy evaluation. Maria had a caregiver five day per week and required assistance for most daily activities except for self-feeding and writing with a pen. Maria’s main complaints were having difficulties to feed herself and write with left hand due to hand tremor. The therapist treated Maria once a week with modified SRHTC approach (lesscomplex, such as one step commands) due to Maria’s cognitive status. After eleven sessions, her left hand essential tremor decreased significantly. Maria was now able to perform self-feeding without difficulties and write legibly with left hand.

## Discussion

Occupational therapy practitioners often see patients who exhibit hand tremors because of neuropathology, such as degenerative changes in the cerebellum, depletion of certain neurons, degenerative disease, or mercury poisoning. Common occupational therapy interventions typically use a compensatory approach, such as incorporating weighted equipment, adaptive equipment and stabilizing devices, or technology to improve upper extremity function.<sup>16</sup> Despite frequent usage, there is little evidence to support the efficacy of these interventions.

The SRHTC approach has demonstrated many positive outcomes. SRHTC has assisted patients by significantly reducing their severe action hand tremors, decreasing the stress among patients from over-thinking and over-preparation prior to engaging in tasks, and reducing the amount of force patients use to perform daily activities. Qigong is an ancient Chinese integrated mind-body healing method that uses qi, life energy that is a 1.9mm microwave,<sup>17</sup> to promote self-healing in a variety of health domains, including hypertension, heart disease, bone density, fall risk, immune dysfunction, and cancer.<sup>18,19</sup> Qigong facilitates a self-healing process by causing a “downshift” from beta waves (the fastest brain waves) to slower waves, such as alpha waves theta waves, or a combination of the two. In studies using electroencephalography, an electrophysiological monitoring method, people exhibited high-amplitude alpha waves and a measurable shift of alpha and theta concentration from the rear occipital regions to the frontal lobe regions of the brain after 3 or 4 minutes of qigong exercises.<sup>10,20–23</sup>

## Conclusion and future direction

Linda Liang has treated eight patients who suffered from moderate to severe action hand tremors with the SRHTC approach. All eight patients have demonstrated positive outcomes during outpatient occupational therapy sessions ranging from 5 to 18 visits. At the conclusion of therapy, patients demonstrated decreased hand tremors, significantly improved fine motor control during goal-directed movements, and satisfaction with their outcomes, which as a result also motivated them to continue their qigong home exercise program. Limitations of this report include: a small sample size, the need for qigong to be conducted by an experienced practitioner, and the importance of patients’ cooperation with the specific treatment method. Future study is needed to compare the results of the SRHTC approach with standard occupational therapy intervention.

## Acknowledgements

None.

## Conflict of interest

Author declares that there are no conflicts of interest.

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