

The Influence of the 14 Muscle Sequential Balance on Stroke Outcomes and Neuroplasticity

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Abstract

The neurology of stroke and the changes in ability to control physical movements or expressions that occur in stroke patients devastate thousands of people worldwide. Stroke is a major contributor to numerous disabilities from muscle atrophy and musculoskeletal deterioration to depression. This paper discusses the potential role of specific progressive muscle re-education (PMR), such as that used in the basic Touch for Health 14 muscle test and balance (hereafter "TFH14"), in reversing the impact of the stroke sequel, especially on the musculoskeletal system. The possible implications for caretakers, nursing and rehabilitation therapies are discussed in light of a single case study with the hopes of opening a dialogue for a more formal research investigation.

Stroke is the most common serious neurologic disorder in the United States and world-wide, comprising 50% of all hospitalizations for a neurologic disease. In most European countries, stroke is of great importance because of the tremendous expenditures arising from cost-intensive treatment and the large demand for continued nursing care. In Japan and other Asian countries, stroke is the second most frequent cause of death in patients aged 65 years or more. For Chinese stroke patients, disability at admission is the most important predictor of disability at discharge because of a lack of rehabilitation facilities and effective rehab methodology.

Stroke often presents as a disabling illness that not only involves many aspects of a patient's life but also places a substantial burden on family members and others. The aims of rehabilitation are to minimize the impact of the disability resulting from the stroke and to optimize the quality of life for both the patient and his/her personal caregiver. Progressive muscle re-education, as in the TFH14, may enhance rehabilitation and recovery by arming caregivers with a simple repetitive exercise to apply

helping the stroke victim to regain independence without increasing the financial burden.

Progressive muscle re-education, as in the TFH14, increases muscular coordination and endurance and enhances brain plasticity and the neurologic ability of the patient to recover more fully after a stroke, allowing them to regain their independence and resume Activities of Daily Living. The increase in motor coordination and ability may prevent falls and other injuries associated with musculoskeletal weakness and poor coordination. In the TFH14, the non-paretic and the paretic limb are used together to retrain balance between the hemispheres. Thus the TFH14 (PMR) benefits the muscles by soliciting specific responses that impact proprioception and the expression of movement as controlled by the individual. This results in a progressive effect on other neurons encouraging the return of some of the lost function. Research, ingenuity and technology have already developed a "robotic brace" intended to help people exploit their neural plasticity. While this device may affect physical function it will surely have a financial effect. Many of the medical devices aimed at treating patients afflicted with neurological disorders have not fundamentally changed in decades, or require costly, high-risk brain implants. Progressive muscle re-education as in the TFH14, may exploit neural plasticity but without increasing any of the financial burden. The TFH14 may give the brain a more dynamic way of forming neural connections to compensate for neurons whose links were injured or severed to grow new nerve endings.

History of one stroke

Introduction & Overview

On June 6th in 2004 at age 82, my mom Frances P suffered a stroke that left her with right side paralysis and expressive aphasia. After a thirty day hospital stay, which included a very rigorous rehabilitation component of conventional therapy

and utilizing the 14 muscle balance from TFH to re-educate the neural pathways, my mother was able to walk out of the hospital with minimal assistance. After three months of conventional outpatient therapy (three times a week) and the daily application of the TFH14 she continued to show positive results. Conventional therapy was discontinued after three months when insurance coverage was no longer available. The practice of the TFH14 was continuous and she continued mild exercise on her own at the rehab center. After two years of consistent application of mild physical exercise and the 14 muscle balance from TFH her expressive aphasia was minimal and she was able to return to full activities of daily living(ADL) including driving. She continues to exercise by walking her dog, ADL and the application of the TFH14 weekly.

Onset & "Crisis"

On the morning of June 6th my mother called me on my cell phone to ask me to come by her house after leaving our church where I was employed as the parish nurse. Her message said that she thought something was wrong with her face and she was having difficulty closing her beach umbrella. Her speech, on the message, seemed halting, the message itself seemed rather cryptic. It was 12 noon. I arrived at her home at 12:14 and let myself in. Frances was lying in bed fully clothed and expecting me. She said she felt extremely tired (extreme fatigue is often experienced at the onset of a stroke). She proceeded to try and convey her difficulties with the umbrella and that after giving up on closing the umbrella she came into the house. She reported seeing her image in the mirror and it seemed to her that her face was much distorted although she felt no pain or discomfort. She also attempted to describe the events of the morning with several words either mispronounced or backward. I immediately informed her that I thought we should go to the hospital. Her response was an emphatic "NO!" After 25 years of using techniques from TFH to assist her with her health issues, my mother had come to rely on TFH. She was confident that TFH would be able to "fix" whatever was going on. She raised her left arm and held it forward for me to "muscle test" her. Applying very gentle pressure to her forearm, her arm collapsed at her side. I rubbed the appropriate

points but she was unable to position her arm for me to retest it. Again I suggested that we go to the hospital but this time I added "before we have to call an ambulance". Reluctantly she allowed me to take her to the hospital which was located ten minutes from her house.

By 1:14 my mother was admitted to the hospital. During the admitting procedure she progressively lost her ability to move her right side or to speak coherently; she seemed to float in and out of consciousness. At my request a Neurology consult was ordered and it was determined that a total collapse of the left carotid artery was the cause of the stroke. She was not a candidate for the "clot busting" drugs or for surgery on the carotid. Initially it seemed as if our frantic drive to the hospital had all been in vain.

For the next few days our family hovered over her bedside preparing for the worse and hoping for the best. On about the fifth day she seemed to rally. She was able to remain conscious and alert for longer periods and her vital signs had stabilized. She was paralyzed on the right side and her speech was affected but her cognitive abilities seemed intact. There was a definite shift in her personality; her sharp, sometimes acerbic qualities seemed absent. Our priest called her the "new and improved" Frances P. We were yet to learn the unseen ramifications of a stroke. The ischemia (lack of blood) to the brain causes a breakdown in the entire neural network destroying years of input that defines our personality, who we are to everyone else. Some survive it with mild changes in personality while others have profound changes that re-define the personality.

On day seven the physician recommended that Frances be discharged to the in-patient stroke unit of the hospital. The stroke unit included the Physical Therapy (PT) department, Occupational Therapy (OT) department and the Speech Therapy (ST) department as well as the nursing staff and physician. Their multi disciplined team approach was aggressive. Frances was evaluated by each of the therapy departments to decide what her level of function was and what would be the best goals for her. Motor skills were the first priority followed by language, which included writing and word

interpretation as well as mathematical ability. On day nine we started the rehabilitation regimen.

Therapy in the hospital

The entire design of the in-patient stroke unit was to mimic, as closely as possible, an out-patient setting. Because no one went to the PT rehab area in a hospital gown, clothes were brought from home, including shoes so she could dress for her rehab sessions. The first morning on the rehab unit, the nurse bathed and dressed Frances. I arrived just in time to wheel her to the PT area. After being shown where to park the wheelchair, Frances and I waited for her name to be called. From where we sat, we could see the activity of the other patients as they were put through their therapy programs. Patients were in various stages of recovery. Some patients required the maximum amount of help while others required direction but no physical assistance. Frances was able to see that she was not alone in this situation and would not be the only person struggling with the various tasks.

The physical therapy area reminded me of circuit training at the gym. There were balls and various "games" designed to improve cognition and refine fine motor movement. There were tables where the patient could lie down while therapists guided them through various exercises to strengthen and lengthen limbs to prevent contractures. There were steps in varying degrees of physical endurance and a treadmill. There was other equipment, straps and blocks and pillows designed to help with gait training or transferring from a wheelchair to a bed or commode.

When her name was called she raised her left, unaffected hand so they would know who she was. Immediately a small dark haired woman approached us. She introduced herself as the speech therapist and led us off to a small secluded office. Once there she told my mother the goals she had in mind to help my mother regain control over her speech. Then she gave her some repetitious verbal tasks and a worksheet that contained pictures with fill in the blanks next to them. My mother is a lover of words so it was difficult for her to discover that even the simplest of words required so much effort to pronounce. In the area of the written word it did not

appear that she had lost much if any function. She could write what she wanted to say much easier than verbalize the words. She may have viewed that as a small victory in the war against stroke. The therapist congratulated her on not needing much attention in that area and informed her that since writing what she wanted to say was not an issue they would be focusing on getting her to speak sans the aphasia. The worksheet was simple but the task of trying to say what was written on the sheet was draining. Our first visit was about 45 minutes and we left with homework. We returned to the "bullpen" in the PT area and awaited further direction. Soon we were summoned again, this time for some fine motor training for her hand. We sat at a table with a therapist who explained to my mother the task she was expected to perform. She transferred cones from one slot to another, first with the left, unaffected hand, then with the right hand. After several tries at finding the right words my mother explained to the therapist "I can't use my right hand, I had a stroke." The therapist just nodded and told my mother to "just do what you can, use your good hand to help you." By lunchtime my mom was exhausted and hungry.

Lunch was in a common dining area so once again my mother could observe others who shared her affliction. Some people had to be fed, some were struggling to feed themselves and a few who were feeding themselves but required some assistance. Frances, sizing up the scenario, made the decision to feed herself using her left hand, but even that was challenging. I decided to follow the model of the therapist and encouraged her to do what she could on her own. Finding and operating her mouth was a task and after several tries and several misses she said she'd had enough. I could see she was tired but food was also a necessary part of the healing process. Swinging into nurse mode, I coaxed her into a few more bites with me assisting her. I think this humiliated my mother, a very strong, independent woman. I assured her this feeding thing was temporary but eating was important. After all, it took a lot of energy to get words out and move cones about and that was no joke!

After lunch there was a brief rest period then back to PT. This time she was called first and she played catch with the therapist and a huge exercise ball.

This exercise was primarily to stimulate a response in the affected limb to attempt to catch the ball. After twenty minutes of playing catch, another therapist took over and put Frances through some passive range of motion exercises to her affected right side. Finally we were done for the day and returned to her room to rest up for dinner. Frances was exhausted and wanted to rest. As soon as she was in bed she was asleep and had to be awakened for dinner. The intensive attention she had received throughout the day had come to an end. Dinner was served in her room and when dinner was finished patients were on their own for the rest of the evening until time for bed. She worked on her homework from the speech therapist so she would be ready for the next day's round of therapy. For the next three days, I observed these established routines. I also observed that none of the patients in the rehab unit (during the time we were there) had contractures. There was minimal apparent muscle atrophy observed in a few of the patients. This may have been the result of the patient not exerting sufficient effort to stress the muscles enough to retain muscle mass and tone.

The fourth rehab day fell on Saturday. The same routine was followed but less intense and the controlled rehab day ended around lunchtime. Since we had the afternoon "off" and having observed the various tools being used to stimulate recovery, I asked my mother would she be willing to try playing the piano. "What will I do with my arm?" "The same thing you do when they throw you the ball!" Most of the time when the ball came to her there was some movement in the right arm. I asked the nurse if they had a piano somewhere. They didn't have a piano but they did have a keyboard. The nurse brought out the keyboard and plugged it up. My mother looked at it and started to finger the keys with her left hand, and with some effort she got her right hand on the keys. To both of our amazement, she started to play with both hands. It was awkward, her hand kept sliding off but it was a huge step to see what was possible. They also had a computer the patients could access. I encouraged Frances to try typing on the keyboard of the computer. She was a secretary before she retired. Like the music keyboard, it was awkward, her hand would slide off but she was able to get some movement to occur. This took a lot of mental and physical effort and it exhausted her.

Sunday was similar with therapy being provided a half day (as opposed to going up until 5PM). On Sunday after lunch, I suggested to my mother that we could try some TFH. "But I can't raise my right arm" my mother protested. Using the phrase from the therapy team I responded with "just do what you can". We went to the deserted PT area and I assisted Frances onto one of the therapy tables. We started to test the supraspinatus muscle which was weak bilaterally. After using several of the reflexes to correct the deficit, she could lift her right arm about 20° and once again she was exhausted. For someone who has undergone a stroke activating the 14 muscles in a sequence is likely to be VERY exhausting because of the way energy is metabolized (put to use in the body). Rather than exhaust her even further I suggested a "meridian rub" (tracing all the meridians in sequence three times) before returning to the room for the night.

The rehab group continued to work on my mother during the day while I and my family continued to work with Frances until time to go to bed, reinforcing whatever the therapist introduced. Some evenings, and every weekend, I continued to do the TFH14 with my mother. In TFH the non-paretic and the paretic limb are used together to retrain balance between the hemispheres. Thus TFH benefits the muscles by soliciting specific responses that impact proprioception and the expression of movement as controlled by the individual. This results in a progressive effect on other neurons encouraging the return of some of the lost function.

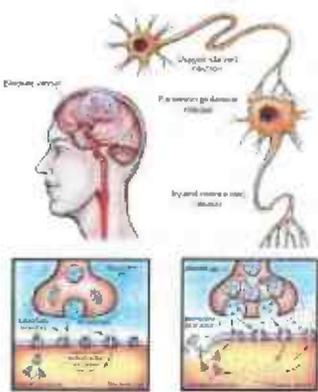
Frances continued to improve regaining use of her arm and hand and was able to walk with a cane or a walker before discharge. Her aphasia also continued to improve although being too tired or stress continued to aggravate lapses of correct speech. Thirty days after admission, Frances walked out of the hospital. Today she continues to live alone, manage her affairs and drive her car. Her aphasia is still there but minimal and only notable when she is under stress (physical or mental). The consistent, persistent redundant intensive routine of testing and correcting the energy to 14 muscle groups continues to benefit Frances; indicating that TFH benefits the entire physical and mental response of the body by soliciting specific responses that impact the individual on multiple levels.

Relevant Stroke Pathophysiology

The clinical syndrome produced by a stroke is determined by the artery or arteries that are occluded. Blood is supplied to the brain by two major sets of arteries, the anterior and posterior circulations. The anterior circulation consists of the right and left internal carotid arteries (ICA) which bifurcate into the anterior cerebral artery (ACA) and middle cerebral artery (MCA) (Figure 1). The MCA supplies most of the temporal lobe, the anterolateral frontal lobe, and the lateral parietal lobe. Perforating branches supply the posterior limb of the internal capsule, part of the head and body of the caudate nucleus and the globus pallidus. The MCA supplies the largest proportion of the brain and its occlusion is the most common cause of severe stroke. The ACA supplies most of the medial surface of the frontal lobe, the frontal pole, medial parietal and anterior portions of the corpus callosum. Perforating branches supply the anterior limb of the internal capsule, the inferior portions of the head of the caudate and the anterior globus pallidus. The anterior choroidal artery arises at the distal ICA and supplies the medial anterior temporal lobe and the genu of the internal capsule (Figure 2). The posterior circulation consists of the vertebral and basilar arteries and their branches. Following a stroke, the destruction of brain cells leads to loss of motor function.

Frances had a complete collapse of the left internal carotid artery (ICA type stroke). Collateral circulation was noted upon imaging. Her subsequent aphasia, muscle paralysis and generalized weakness resulted from the stroke and its effects on surrounding brain cells in the left hemisphere. Prior to the stroke she was totally independent with

optimum ADL ability. Earlier in the week preceding the stroke she was attempting to teach her great grandsons, ages 11 and 13, how to play tennis.



Media file 1: When the brain suffers an injury, such as a stroke, neurons

release glutamate onto nearby neurons, which become excited and overloaded with calcium, after which they die (left). Normal neurotransmission (above) is altered during injury, causing excess calcium to activate enzymes, eventually leading to destruction of the cell. Since this process occurs via glutamate receptors, including N-Methyl-D-aspartate (NMDA) receptors, scientists believe that damage can be stopped through the use of agents that block these receptors.

Neural Pathophysiology - Aphasia

Aphasia is an acquired disorder of language due to brain damage and develops abruptly in patients with a stroke or head injury. Aphasia, most often, occurs secondarily to brain injury or degeneration and involves the left cerebral hemisphere to a greater extent than the right. Most aphasias and related disorders are due to stroke, head injury, cerebral tumors, or degenerative diseases. The neuroanatomic substrate of language comprehension and production is complex, including auditory input and language decoding in the superior temporal lobe, analysis in the parietal lobe, and expression in the frontal lobe, descending via the corticobulbar tracts to the internal capsule and brainstem, with modulatory effects of the basal ganglia and the cerebellum.

Neuroplasticity (also called brain plasticity or brain malleability) is the brain's ability to reorganize itself by forming continuous neural connections throughout life allowing the neurons (nerve cells) in the brain to compensate. Brain reorganization takes place by mechanisms such as "axonal sprouting" in which undamaged axons grow new nerve endings to reconnect neurons whose links were injured or severed. In brain trauma or injury and disease neuroplasticity allows us to adjust activities in response to new situations or to changes in the environment. Undamaged axons can also sprout nerve endings and connect with other undamaged nerve cells, forming new neural pathways to accomplish a needed function. For example, if one hemisphere of the brain is damaged, the intact hemisphere may take over some of its functions. The brain compensates for damage in effect by reorganizing and forming new connections between intact neurons. For neurons to form beneficial connections, they must be stimulated through activity that is persistent, insistent and consistent as

in the 14 muscle balance. Neuroplasticity sometimes may also contribute to impairment. For instance, people who are deaf may suffer from a continual ringing in their ears (tinnitus) the result of the rewiring of brain cells starved for sound. Although the benefits of progressive muscle re-education such as that used in the TFH14 from TFH are not well documented in the literature, this form of neuromuscular re-education has been observed and documented. (Gowitzke-Milner, 1980).

Stroke most often occurs in the elderly creating a pseudo bias that it is highly influenced by age, which in turn creates another pseudo bias that recovery outcomes after stroke are also highly influenced by age. Risk factor profiles for stroke and mechanisms of ischemic injury differ between young and elderly patients citing changes in the brain, as a result of the aging process. Age is merely the chronological account of our existence. Health is influenced by our genetic makeup, our behavior and the general condition of our bodies -minimally by age. It is evident in the number of cognizant, active, productive people who are octogenarians that our general condition is influenced most by how well we care for ourselves in total. Elderly patients with ischemic stroke often receive less aggressive therapy because of age bias. Prior to a stroke the person does not "think" about moving their limbs even though thought is going on. Science tends to minimize our movements, such as walking, as a reflex or subconscious ability. However when that "subconscious" ability is compromised as in brain injury or stroke we must rely on a very conscious effort to restore it.

Providing a better understanding of the underlying causes of stroke and how health behaviors influence stroke across the ages may have important practical implications not only for recovery and rehabilitation, but also for prevention strategies and future health-care policies. In this presentation there is no attempt to disregard the effects of aging in terms of susceptibility, patient outcomes and response to treatment, it is an attempt to overcome those biases that impact effective treatment and improved outcomes regardless of the age of the individual.

The effects of a stroke can be costly on multiple levels and recovery can take years. Providing tools

that focus on the management of rehabilitation after acute stroke and are cost effective will improve outcomes in this vulnerable group. By educating more nurses, therapists and caregivers with simple methods such as in the 14 muscle balance from TFH that encourage and enhance recovery and rehabilitation are standards of care that can truly be called "health reform".

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Complementary and Integrative Approaches to Dementia

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Aphasia

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