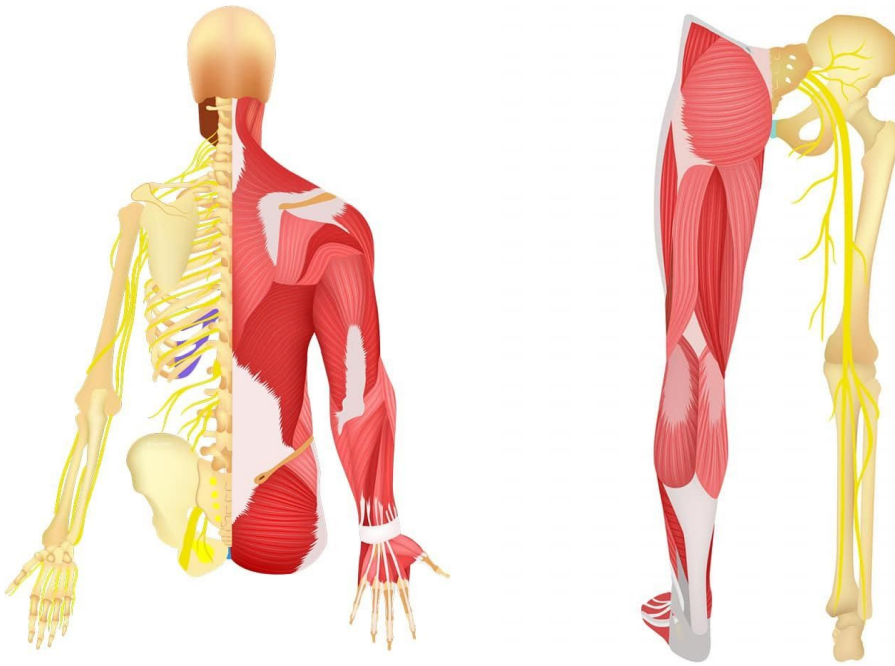


# Stroke Recovery and Exercise

## C.E.C Course



By, Tracy L. Markley, CPT  
Biomechanics Specialist

## Stroke Recovery and Exercise CEC Course by Tracy L. Markley

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[www.tracyspersonaltraining.com](http://www.tracyspersonaltraining.com)

[www.tracymarkley.com](http://www.tracymarkley.com)

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# **Introduction**

## **Stroke Recovery Training Course**

Welcome to the “Stroke Recovery Training” continued education certification course. It is wonderful that you have chosen to reach out and take this course to help bring the best care you can to each stroke survivor who comes to you for stroke recovery guidance.

Someone has a stroke every 40 seconds in the United States. Based on the latest statistics by the National Stroke Association (Stroke.org), there are nearly 7 million stroke survivors in the United States. Stroke is the 5<sup>th</sup> leading cause of death in the United States. A stroke can happen to anyone at any time. Twice as many women die from stroke than breast cancer. A stroke can happen at any age, but more common in older people and African Americans. It is the leading cause of disability in older people. Although the stroke numbers are high, studies show that up to 80 percent of strokes are preventable.

There are different types of strokes and different levels of brain damage one may obtain from the stroke. As fitness professionals, we usually meet a stroke recovery client after they have finished their therapy sessions with physical therapists. Depending on the intensity of the stroke, this can be after a month or up to many months spent in an in-patient care. The survivor may have received physical therapy every day in in-patient care, or after having out-patient physical therapy. In-patient care is when a survivor must stay in the hospital, or they are in a live-in rehabilitation recovery facility. Out-patient care is when the survivor is back living in their homes or with someone who is caring for them and they must travel to the physical therapy location for their therapy sessions.

We may find ourselves limited, in a sense, because we do not have the physical therapy access to machines, straps and safety devices therapists have. We must understand they are trained and licensed to work with these therapy devices. We are not. As fitness professionals we have an advantage. We can step out of the box with methods that therapist often cannot do. We can spend more time talking and getting to know our clients better. We can create a personal connection that often therapists are not able to do.

Since there is no cookie cutter program or a specific list of exercises to fix all stroke survivors on the same program, it is best to know where muscles attach and what movements they perform on the body. This will help you as a fitness

professional to put together specific exercises at specific times in a survivor's recovery journey working with you.

Both physical therapists and fitness professionals have options to seek out the most updated research and knowledge to help them bring the best care to their patients/clients. Not all work facilities require their staff of professionals to stay current in their studies. This leaves many to make a personal decision on their own to continue their education. Unfortunately, not all make that choice. It is important to understand, if we limit our continued education, we will limit the recovery in a survivor. If a client does not know any better, they will think their continued limits in their recovery are just from their stroke, when in fact, it is very possible, that they were limited by the limited education of their fitness professional or therapist. We change lives by our choices.

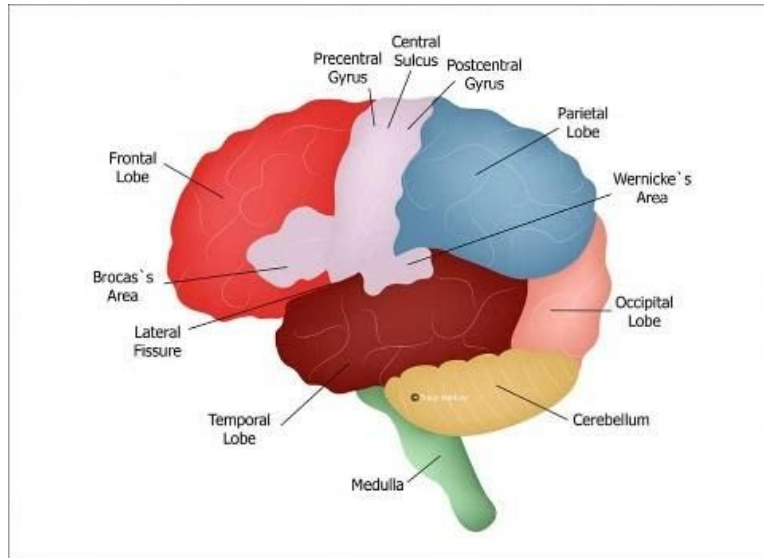
Each stroke survivor has their own unique recovery journey. Each survivor's recovery is based on their brain damaged areas ability to recovery, who is guiding them, and being consistent and persistent in their exercises and therapy.

As you continue through the course, you will find there is not a structured step-by-step format to use for each survivor. This is because every stroke survivor case is different.

This course manual has many muscles illustration included. Please remember there are many more muscles in the body that are not included in all the illustrations.

## **CHAPTER 1**

### **What is a Stroke?**



What is a Stroke? A stroke is damage to the brain by interrupted blood supply. A stroke can also be referred to as a brain attack or a CVA, cerebrovascular accident. This can occur when a clot blocks the blood supply to the brain or when a blood vessel in the brain bursts. A stroke is a medical emergency. Always call 911 or get immediately to the hospital. The longer any stroke is left untreated the more likely it is that the affected organs can be permanently damaged.

Blood supplies oxygen and nutrients to the brain. When an area of the brain tissue does not receive its blood supply, it results in brain damage. This is known as an infarction or infarct. An infarction can happen anywhere in the body, but in relation to a stroke, it is referring to the blood supply limited in an area of the brain. An infarct can affect a tiny or large part of the brain. Anything that cuts off blood supply to the brain compromises brain function. The neurons around the brain that has been cut off from blood supply begin to die, and the functions they support will be affected. Adult brains make few or no neurons, therefore the biological damage is permanent. Strokes can cause serious motor and cognitive problems and sometimes permanent damage. Recovery depends on the remaining undamaged area of the brain.

As in a heart attack, heart tissue dies. In a brain attack, brain tissues die.

Symptoms of stroke include trouble walking, speaking, slurring words, and understanding as well as paralysis or numbness of the face, arm, or leg.

Identify a stroke by using the **F.A.S.T** test

**FACE** Is their face drooping on one side? Can they smile normally?

**ARMS** Can they raise both arms, and keep them there?

**SPEECH** (Speaking) Are they slurring in their speech?

**TIME** Any signs of a stroke call 911 immediately! Time is brain.

It is crucial to get immediate medical attention with any sign of a stroke, even if it is a mini stroke.

In an **Ischemic Stroke** (Blockage), if caught within three hours it can be treated by tPA (Tissue Plasminogen Activator). It is FDA-approved for treatment for ischemic strokes. tPA is found naturally in the body to destroy blood clots. When tPA is promptly given in the limited time frame following a stroke it can save lives and reduce the long-term effects of stroke. It works to dissolve the clot and improve the blood flow to the part of the brain being deprived of the blood flow. Early treatment with medications like tPA (clot buster) can minimize brain damage. Time can be a determination of a full recovery. Time is brain.

In a **Hemorrhagic Stroke** (Rupture/leak) The treatment goal is to stop the bleeding ASAP. This occurs by surgery to clip or coil an artery to stop the bleeding from spreading farther into or through brain.

Other treatments focus on limiting complications and preventing additional strokes.

The body has contralateral organization. This means the brain's left hemisphere controls the right side of the body, and the brain's right hemisphere controls the left side of the body. This works even in the "Sensory" as in "Spatial awareness." The right side of the brain controls what we sense in our space around us on the left side of the body as the left side of the brain controls what we sense in our space around us on the right side.

Since research shows that 80% of strokes can be prevented, here are the top ten things to watch from the National Stroke Association.

1. Know your blood pressure.
2. Check for AFib (Atrial Fibrillation), AFib or AF is a quivering or irregular heartbeat (arrhythmia) that can lead to blood clots, stroke, and heart failure.

3. Do not smoke. Smoking doubles the risk of stroke.
4. Drink in moderation.
5. Manage cholesterol.
6. Manage diabetes.
7. Exercise.
8. Low fat and low sodium diet.
9. Watch circulation.
10. Call 911 at any symptoms of a stroke.

## **CHAPTER 2**

### **Types of Strokes**

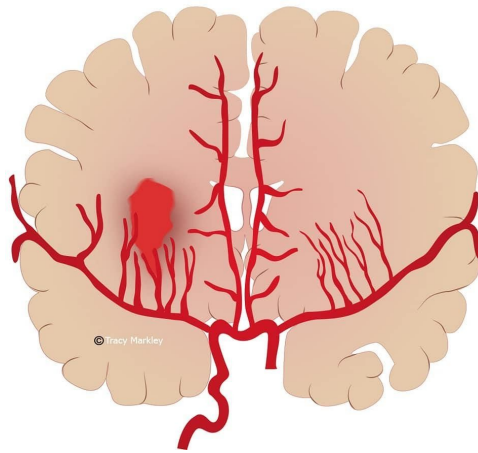
**The three main types of stroke are:**

- Ischemic Stroke
- Hemorrhagic Stroke
- TIA Transient Ischemic Attack. “mini-stroke” A warning sign

## **Ischemic Stroke**

Most strokes are ischemic strokes. According to the Center for Disease Control (CDC) about 87% of strokes are ischemic. An ischemic stroke happens when blood flow through the artery that supplies oxygen-rich blood to the brain becomes blocked.

Blood clots often cause the blockages that lead to ischemic strokes.

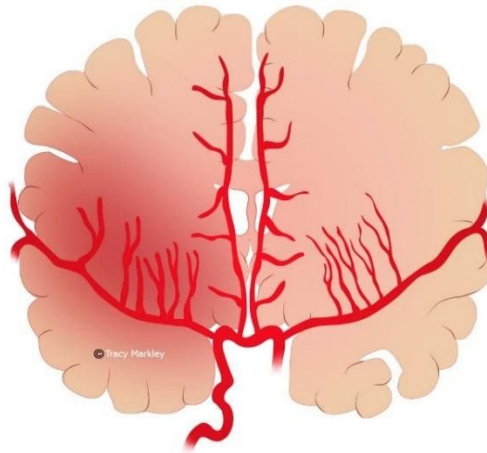


## **Hemorrhagic Stroke**

A hemorrhagic stroke happens when an artery in the brain leaks blood or ruptures (breaks open). The leaked blood puts too much pressure on brain cells, which damages them. High blood pressure and aneurysms, balloon-like bulges, in an artery that can stretch and burst, are examples of conditions that can cause a hemorrhagic stroke.

There are two types of hemorrhagic strokes:

- **Intracerebral hemorrhage** is the most common type of hemorrhagic stroke. It occurs when an artery in the brain bursts, flooding the surrounding tissue with blood.
- **Subarachnoid hemorrhage** is a less common type of hemorrhagic stroke. It refers to bleeding in the area between the brain and the thin tissues that cover it.



### **Transient Ischemic Attack (TIA)**

A transient ischemic attack (TIA) is sometimes called a “mini-stroke.” It is different from the major types of stroke because blood flow to the brain is blocked for only a brief time, usually no more than five minutes. It can be from a few seconds up to five minutes. Your blood delivers oxygen to every part of your body. Your cells need it to survive. When blood flow gets blocked anywhere, it can be dangerous. TIAs are short and usually will not cause lasting damage, but it is still important to treat them like an emergency and get care right away. It is common that some TIAs are unnoticed and undiagnosed. Often, if this is the case, the patient’s doctor can see in a scan that they have had one in the past.

It is important to know that:

- A TIA is a warning sign of a future stroke.
- A TIA is a medical emergency, just like a major stroke.
- Strokes and TIAs require emergency care. **Call 9-1-1** right away if you feel signs of a stroke or see symptoms in someone around you.
- There is no way to know in the beginning whether symptoms are from a TIA or from a major type of stroke.
- Like ischemic strokes, blood clots often cause TIAs.

- More than a third of people who have a TIA and do not get treatment have a major stroke within one year. As many as 10% to 15% of people will have a major stroke within three months of a TIA.

A stroke causes some brain cells to die and others to become injured. The injured cells are often found around the main area of damage. This area of injured cells is known as the penumbra. This is known as **Ischemic penumbra**. These cells may heal in the first few days and weeks after the stroke which can cause some **spontaneous recovery**.

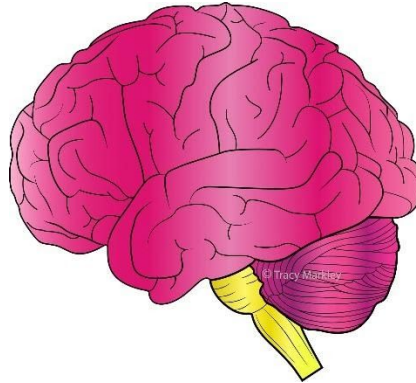
**Cardio-embolic stroke** A stroke due to a blood clot that has formed in the heart and travelled to the brain.

As I continue to meet new stroke survivors, I continually hear of names of strokes that I have never heard of, as well as many other reasons people have strokes. Do not be surprised if you run into this.

I mentioned previously that studies show that although strokes can happen at any age they happen more in older individuals. In my work I have met just as many survivors between the age of 30 and 50 that I meet of older survivors.

## CHAPTER 3

## Brain Damage and Stroke Recovery



Strokes can cause serious motor and cognitive problems and sometimes permanent damage. Recovery depends on the remaining undamaged area of the brain. The after effect of a stroke is brain damage. The brain is the engine to the body, it malfunctions due to the stroke. The brain normally sends messages through the nerves to parts of the body to make movement through neuro pathways. After a stroke, these messages hit roadblocks.

A simple way to describe this would be when the brain is trying to get a message to a specific part of the body to make a movement, the message cannot get through because the wires in the messaging system are not working properly. The brain now must create new pathways, to get the message sent and received properly, as it did before the stroke. For example, if you were following directions on a road map to travel from point A to point B and you run into roadblocks, you have to figure out alternative routes to get to your destination. In many cases, the brain rebuilds these new pathways. We cannot predict which new pathways will appear, the time frame they will appear, nor the order in which they will appear. There is no time frame or limits on this process, especially if the body stays in motion as much as possible.

When the brain is trying to make new pathways and repair itself, it is called brain plasticity, or neuroplasticity. Neuroplasticity is the brain's ability to reorganize and rewire itself. It is trying to heal. The brain has an amazing ability to form new connections between brain cells. It can change throughout life.

The brain uses about 20% of the body's energy, but after a stroke it is using much more of the body's energy since it is trying to repair itself. The brain needs rest and sleep to heal. You may find many survivor's common complaint or concern is their constant fatigue or the need to sleep. This is normal. It is always

important to know all their medical conditions and medications they are taking. Some brain injuries can cause insomnia as well.

When survivor clients are recovering, they often will fatigue more quickly than other clients. It is important to be aware of this and know their daily activities, sleep, and eating habits. Determining their exercise level and ability for each workout must be based on each individual session. Communication is essential. This means listening as well as talking to the client. The more knowledge as a fitness professional we have about the anatomy, physiology and movement of the body, the better chance the professional can connect to the survivor's needs. Professionals can adjust training sessions according to any changes in recovery the survivor's body has made.

With any client's goals in fitness, whether it's losing weight, getting stronger, training for an event or something such as stroke recovery, each client has to do their part every day, on their own, as well as in their time with a fitness professional. As we see with clients in weight loss that they have behaviors and mindsets that hold them back from results, you will find the same with stroke survivors.

As you continue through this course you will learn more about the many dynamics that play a role in stroke recovery.

There are many factors in play in recovery:

- Proper physical therapy
- Neurological exercises
- Staying consistent and repetitive in movements everyday
- A healthy diet
- Staying properly hydrated
- Mindset
- Support system
- Intensity of the brain damage from the stroke
- Time
- Patience
- Sleep and getting plenty of rest
- Other health conditions or injuries
- Motivation
- Emotional well being
- Sometimes age makes a difference

- Persistency
- Stress
- Other options a survivor is trying

Understand that stroke recovery is not an easy step-by-step process. I continually share with professionals that knowing as much as you can about the anatomy and biomechanics of the human body will help you as a fitness professional guide the survivor into greater recovery.

The body was made to move. The more the body tries to move, the more chance the brain can rebuild its pathways for the movements. Survivors have a better chance of recovering if they do their exercises and walk every day, if they are able. Unfortunately, not all survivors understand this. Once they begin their outpatient therapy, they usually see the therapist once or twice a week. This is not enough. They need to continue, if possible, to work on their physical recovery daily with movement. Physical therapists and fitness professionals rarely get to train any client every day or almost every day of the week. I have only experienced these two times.

Although I have trained many survivors in the last 20 years, I had this special opportunity to train a 65-year-old gentleman who had a stroke six months prior to us meeting. We met when he walked into the gym in a walker. He trained with me five to six days a week for three years. This opportunity to see his changes in recovery in a person on almost a daily basis, was not only incredible to witness the process, but extremely educational. It was also tremendous for his recovery. His journey was a perfect example of how the brain heals in no planned order. He was an example of a survivor who was connected to the awareness of the changes happening in his recovery, as well as what can happen when the trainer and client have good communication to help them work together as a team in survivor recovery.

Unfortunately, it is rare that a client or a survivor can meet with us daily. I find the more we can educate the survivor and their family and/or caregivers with them, (if they have them), the better chance they can try to push through. A survivor needs to move and exercise daily.

Repetitive movement and consistency are essential. Proper nutrition and hydrating are also essential for brain care and health.

Due to the vast differences of damage and challenges each individual survivor is facing after their stroke, their starting point when they meet us as fitness professionals will all be different. Their limitations, energy levels and fatigue point will all be different.

In my research of the brain, I listened to a neuroscientist discuss music therapy for the brain. In this lecture, he discussed music therapy in stroke survivors.

In this study they had survivors listen to an hour of self-selected music a day.

The study found that there were no changes soon after the stroke, but at three to six months, there were significant differences. In the cognitive tests, the verbal memory and focused attention were better than those who did not listen to an hour of self-selected music a day. The findings focused on mood measures showed those who listened to their music an hour a day showed significantly less depression than those who did not listen to music. They found that listening to this music enhanced cognition and mood after a stroke.

Those who listened to music did better on verbal memory, focused attention and may have felt less stressed.

Stress can also have a major effect on the brain. After someone has a stroke, it is normal if they feel major stress. Their body is not working, some may lose their job, their family, the ability to drive and other losses and challenges in their everyday life. If stress affects them to the point where the stress hormone enters the brain, it can affect the hippocampus, (learning and memory), frontal cortex (attention) and their amygdala (emotion regulation).

An MRI was also taken to look at the brain before and after the study. The brain study method used was *Voxel Based Morphometry or VBM*, to examine the changes in grey matter or white matter. They compared the first MRI performed right after they had their stroke to an MRI six months later. What they found was an increase of grey matter. An increase in grey matter helps sprouting of axons, branching of dendrites, formation of new synapses and an increase in small blood vessels in the brain. These changes are micro architectural of the brain. Those with left hemisphere strokes showed more grey matter in the superior frontal gyrus, which is cognitive processing. They also showed more grey matter in parts of the brain that is emotional processing. This showed that at six months post stroke they had structural reorganization in an adult brain of a stroke survivor. Although more studies are always being done, at the time of this study, they thought listening to

music the first six months after a stroke may be the most critical time to use music therapy. They also recommend going to a certified music therapist when able.

I shared that study to help understand why you will come across survivors who exercise better and understand direction better when there is music playing or they listen to it often on their own, not even being aware of this study.

I had an 89-year-old survivor who would walk faster forward and backward more coordinated when I played music from his favorite CD. If I had him walk for 10 to 15 minutes with his favorite music playing before our exercise session where we worked on balance and the spasticity in his hand, he performed better and had a better workout. He was happier doing it as well. He had a memory challenge. He could not remember what he ate for lunch an hour before I saw him, but he could remember the band he played in 50 years prior. He also had a touch of dementia after his stroke and sometimes would lash out, then he would forget he did it.

I had another survivor in his 60s who would stand on the BOSU® ball for 10 to 15 minutes listening to his favorite music before I even got to the gym in the mornings. I was not aware of this study at the time I was working with both survivors, although I was aware of the positive difference it made in the workout and progress.

## **CHAPTER 4**

### **Every Stroke Survivor Will Be Different**

When I asked several stroke survivors about what challenges they faced while trying to find good guidance in recovery, many said “They treat us all the same. They need to understand that not all stroke survivors are the same.” They were referring to physical therapist and personal trainers.

Common impairments for stroke survivors are balance, memory, spasticity, numbness, limitation of movement and/or paralyzed on one side, speech, ability to read lost, hearing, foot drop/drag and aphasia. Some have a new outlook on life and are grateful to be alive while others may be in a state of depression and/or terribly upset they had a stroke. They often are angry at their own body. I had two different male stroke survivors, who speak English, tell me when they became alert and first spoke at the hospital after their stroke, they spoke in Spanish. One of them told me he never spoke Spanish in his life, but as his memory continued to return, he remembered that he was in the military years prior and had to speak Spanish on occasion.

I have found that what the client did for therapy before they were released on their own can vary greatly. Some have had the best therapy, and some have encountered not so good. What they experience in therapy, as care and results, can leave a survivor extremely discouraged or motivated. When I asked groups of survivors what they wish we knew or did in our work with them as fitness professionals, most of them said they wished professionals, being trainers or therapists, would explain to them why they are doing a specific exercise. I find with every client, if they understand why they are doing a movement or exercise, it helps them become aware of their body better. It helps them relate the exercise to a movement in everyday life they are trying to get back. If they understand a particular exercise will help build the body to do a movement needed for an activity, like riding their bike again, driving a car or picking up a child or grandchild safely as examples, it gives them hope and motivation. This gives them a goal and something to push for.

The fatigue and energy levels will vary person to person. It will also vary individually day to day. You will meet survivors from weeks to years post stroke. It will depend on the level of their stroke, damage, therapy, and life occurrences.

Whatever a client had going on physically before their stroke is still there. For example: Here is the condition of the survivor I trained five to six days a week when we met.

- 6-month post stroke 65-year-old male.
- Using a walker and sometimes a cane.
- Knee surgery two weeks prior to his stroke. This left him with a weak hyper-extended knee, that never had physical therapy. Strokes can also cause hyperextended knees.
- A rotator cuff injury on the same side the stroke affected.
- Poor posture with Forward Head Posture (A condition where the position of the head moves forward from the center of the shoulders).
- He had never stepped foot into a gym or worked out, except being a surfer in his younger years.
- Numbness, spasticity, and loss of sensations throughout the right side.
- A brace on his right lower leg.
- Foot drop and turn out on the right side.
- Memory loss. It took him a couple months to remember my name. He always remembered me, but the name was a challenge to his memory.
- Lost the ability to read, write and do his artwork. He was an artist.
- Peripheral vision loss on the right.
- Loss of Cutaneous Sensation in right hand - (Touch and everything else we feel through our skin such as temperature, texture, pressure, vibration, and pain). These receptors also let the body know when things are hot or cold.
- Truly little core stabilization.
- Balance and stabilization challenges.
- Loss of spatial awareness and “Feeling safe” in everyday movements, like walking.

He did have a huge positive outlook and he was the most determined person I ever met to get better. He also had another important thing going for him. He told me he trusted me during our second meeting. If the survivor feels safe and trusts the fitness professional helping them, they will continue to come and do what is needed to get well.

As with all clients, when we make that kind of connection, the outcome can be better. As a fitness professional, you have encountered that we do not always have control of making this sort of connection. The client plays a key role in it, no matter how much we are there, some clients do not connect. Often, I find these clients also do not make a connection within themselves.

Besides the variety of challenges each survivor has, how in tune they are with themselves can make a significant difference in recovery. When they understand why they are doing specific exercises and the muscles they are working, it forces them to make a connection to their body.

When they can connect to even the smallest changes coming back in recovery, it helps us as professionals know where they are at each time, we train them. It is a good signal and direction from their brain telling them changes are taking place. For Example: A particular survivor client used to tell me in the beginning of workout sessions, “I know this doesn’t mean much but look what I can do.” He may show me that he can kneel on one leg and get up without holding on. It could have been he showed me that he can open his hand a bit further than the last training session or tell me he can move and feel his pinky finger now. Whatever he expressed, he would think it is no big deal, but he knew I wanted to know everything. As professionals, if we understand the mechanics of the body, this sort of communicating tells us what their body is doing. As for kneeling on one leg on the floor and getting up now, it just told me that his core, knee, pelvic, hamstrings, glutes and ankle stabilization are getting stronger and that he is feeling safer in movements. This showed me his body is on its way to gaining back some daily activities like washing a car, getting clothes out of a dryer, yard work and getting things out of and putting things into cupboards. His motivation, confidence and hope has built higher as well.

As for the feeling and movement coming back into the pinky finger, this tells me a few things. One, that the posture of his head and neck has improved. His gripping and holding objects will improve. The neck, elbow, wrist, hand, and fingers have more of a chance to begin having changes and building strength. He then could begin raising the amount of weight for biceps and triceps as well as can do more variations of exercises for the upper back, shoulders, and arms. The nerves to the hands and fingers come from the neck. The Laser Spine Institute explains the ulna nerve very nicely.

*“The ulna nerve roots are where the nerves branch off the spinal cord between C7 and T1 vertebrae. This nerve’s root helps facilitates the flow of signals between the brain and the arms. To accomplish this, the brain sends messages down the spinal cord, through the nerve root then along the ulnar nerve and back again instantaneously. Specifically, the ulnar nerve extends from the spinal cord through the arm, forearm, hand and into the little finger. But what makes the ulnar nerve*

*unique is that it is the largest nerve in the body that has an unprotected spot, known as the funny bone.”*

***See illustrations in the chapter one Regaining Arm Movement.***

Another Example: An 82-year-old survivor, has aphasia. His 82-year-old wife shared with me one day that when he was sleeping, his leg twitched, which is normal, but this particular night after we did some exercises with the legs, she said there was more twitching and more activity going on. This was a good thing. This was an excellent report back to me. I now knew how the work he was doing was changing the body. The more a survivor and/or their caregivers can be aware of things they see, even if they sound silly, the better the professional can help, especially if the professional has the knowledge to work with it.

The more awareness we have of a survivor's changes, the better for them as well. They may not notice changes like we can see. Another example when a male survivor walked up to a chair and sat down normally. I asked him if he noticed what he just did, he said “No. What?” I shared with him that he used to walk slowly to a chair, turned around very slowly sit down at the front of the chair as he held on to chair and slowly slide himself back in the seat. Which is quite common when one loses the awareness of where their feet are in space. This means he can step backwards safely and he had re-gained subconsciously the steps of his feet. (More about his in the Spatial Awareness chapter and the Walking Chapter).

## CHAPTER 5

## **Communication is Essential**

In the last chapter, I shared some examples of how communicating to the professional is extremely helpful for the survivor and the professional. It is crucial to have clear communication between my client and me. I ask clients questions to be sure they are feeling the specific exercise where the exercise was intended to be felt. When I asked the group of survivors what challenges they faced when trying to find help at gyms with trainers to further their recovery, the most popular answers were; “They don’t listen.” and “They treat us irrelevant.”

I find at times clients may appear to be doing an exercise correctly but may be feeling it in a different place than I planned for assorted reasons. They may need to correct their form, but they cannot. I need to know if it is because the client does not understand, or their body cannot physically do what I am asking. For example: A client is feeling their neck while doing a bicep curl because he is tensing his neck and shoulders internally but not enough for me to see his shoulders raise up, or when a client is in perfect form for a squat, but their knee begins to hurt. For me to serve the clients the best I can, these things are necessary for me to know. I also need to know how hard or easy an exercise is for them.

When a client has numbness in half of his body and the brain cannot connect to what the body is doing or feeling, it can make the communication a bigger challenge. The survivor client I worked with everyday could not understand what it meant to “feel fatigue” in a muscle from working out. This is when most of us know our limit. There is a difference between muscle fatigue and a muscle that is numb and not getting all the messages from the brain to perform at its best. He had never exercised on purpose before his stroke. He had not worked out with weights nor been in a gym, so this was a foreign language to him.

These situations are when professionals need to be aware and play the role as the client’s second brain to help them stay safe. I ask questions repeatedly to make sure they do not get up from a machine or the ball and collapse to the floor because the stroke-affected leg gave out. It is often difficult for clients to know and then explain what they were feeling or not feeling. A client may feel bad sometimes because they cannot communicate what they want to say. At times, the brain will not process a word they want to say as quickly as it did before their stroke. It can be exhausting for the client. Always be patient and kind when they are trying to communicate to you as the professional. It often will take longer than someone who has not had a stroke. This will make them feel better communicating with you as well as giving them a sense to be okay with where they are in their

communicating skills. Never make them feel like they are stupid or unimportant. I shared earlier; a big issue expressed by survivors was that they were treated as if they were irrelevant. No one wants to feel irrelevant.

You may come across a survivor who has aphasia. **Aphasia** is a communication disorder that impairs a person's ability to process language. It does not affect intelligence. Aphasia impairs the ability to speak and understand others. It can affect the ability to read and write. There is also **non-fluent aphasia**. This is when a person cannot talk or get words out, but they can sing a song or a sentence.

I have been working with a stroke survivor client who can say one word randomly, but he can sing songs and sing full sentences with no problem. I have been trying to encourage him and his wife to communicate in singing. It would be great for his brain and learning to talk again, as well as it could help a challenging situation be fun and bring them laughter. Laughter is always healing.

As a part of communicating with a client, we also must determine the balance of their exercises they are doing at home with each workout they attend with us. Like everyone, survivor's need to keep moving daily, but not overdo it. They also need proper recovery. Finding that balance when a client cannot feel all the sensations in their body, is quite difficult.

A cell phone is a great tool for communicating with a client in person. Since many survivors do not like looking at themselves in a mirror, especially when they are trying to exercise. I found taking a picture or video to show them has been an excellent source in communication. One example is when a client is working on their foot drop and turn out while walking. I would video the client's feet from the front of the treadmill or them walking down the hall, so they can see what needed to be changed or what had changed. Some clients if possible, who have a treadmill at home put a mirror in front of the treadmill to watch their legs and feet while walking on the treadmill. Here is another example with one of my male clients as he progressed and was able to perform a plank exercise. A survivor may not always understand verbal directions to get into proper form. If a client can see a picture of them doing a particular exercise, then I show me doing the same exercise. They can then see more clearly the directions I was giving. This process of communication is fabulous, not only for the communication aspect, but I am able to use the pictures later on in a survivor's journey, so they can see just how far they have progressed from earlier times. I have used this to help clients see their progress in their postural gains and other gains. They get excited to see how far they have come. They do not always understand or see the depth of progress

achieved. This makes them feel great and inspires them to keep pushing forward and to never give up.

You will find many survivors do not like looking at themselves in a mirror. One reason looking in the mirror is hard for some survivors is that their perception of where they are in space is off. If they try to watch themselves exercise in the mirror to check for proper form, it may not be easy for them. If they have a loss of peripheral vision on one side, that can make it more complicated. The message to the brain sent for movement is struggling. If they try to watch themselves in the mirror and make the movements, it may complicate things even more. Sometimes is best to keep them staying focused on the movement they are trying to achieve. Some clients still do not look at themselves in the mirror, this is quite common. When I was training a 65-year-old stroke survivor one day, he told me that he did not understand why. I explained to him that he spent 65 years knowing who he was when he looked at himself, but after the stroke, he saw himself differently. I shared with him that there was a time in my life when I was extremely ill for a few years, and when I looked in the mirror, I did not see me. I saw a stranger, and I felt like a stranger, in my own body. He responded with, “Exactly.” When one has a stroke, they feel like they are a stranger to their own body.

If a client feels frustrated or down because they are not making progress, I take out my phone and show the client the videos and pictures of their progress have achieved. This is powerful. They can see the changes that they sometimes do not connect or notice. They are looking for “big” changes most of the time and do not always understand how important the changes are they have achieved. The cell phone can be an excellent tool for motivation.

National Aphasia Association. [www.aphasia.org](http://www.aphasia.org) is a reliable source for Aphasia. Check out “Dear Stroke You Suck, The Journey of a Fitness Trainer and a Stroke Survivor,” by Tracy L. Markley.

## CHAPTER 6

## **Rebuilding the Body – Biomechanics and Muscles**

In this chapter, I will go over some of the important muscles for stabilizing and movement of the body. As you look at the muscle illustrations, you will gain a better understanding of how important it is to have the center of the body strong and stable. It is helpful to share muscle illustrations with clients.

Stroke survivors, as well as all of us, need these muscles to be strong and working together as a team for proper movement. That will help achieve a balanced body and walking gait that will lead to being safer in movement.

Scientific research has shown that in a healthy body, the brain sends a message to specific muscles in the core of the body before it sends a message to the legs and the arms for movement. This is called centrally generated motor pattern and means we recruit from the core outwards for movement of the body. This is the brain communicating to these muscles to stabilize and support the body, because it is ready to move. I like to call this the balancing system of the body. For example, if a client has had a stroke, the brain is already having a tough time getting messages throughout the body for proper movement. The brain is trying to create new pathways of communication because the old pathways are not working properly. It makes sense to me, that if the stabilizing muscles are weak and not functioning to their full potential, it could cause the rebuilding of pathways to the limbs to be more difficult to achieve.

When the core of the body is strong, it will stabilize the body mechanically as it is meant to do. The limbs then can become stronger and work in better movement with the body as a team, like it was meant to do. The core links the upper body and the lower body in movements.

There is less stress on the body physiologically when the biomechanics are functioning properly. Physiology focuses on the systems and organs of the body and their functions. Holding the body upright in a proper posture, not only looks better and helps the body to balance better, but it also makes the systems in the body work and function better. It helps the communication from the brain to the limbs to flow more naturally.

It is also important to understand that each muscle in the body has a specific job to do in moving the body. If some muscles are too weak to perform the job they were meant to do, other muscles try to do the job for them. This is like a sports

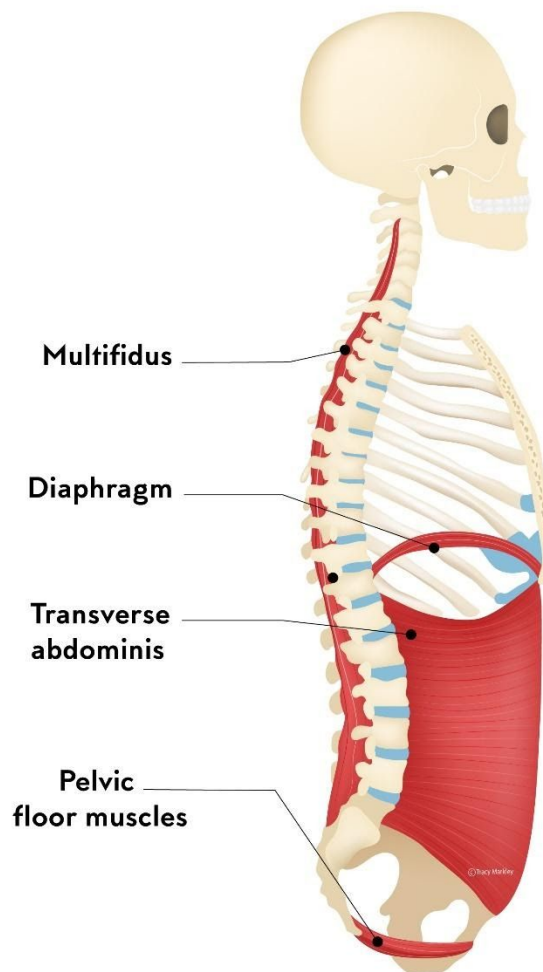
team with players that cannot play the sport very well, it throws the whole team off.

If certain muscles are spasticity and there is poor posture, the muscles in spasticity may try to work as core stabilizers and postural muscles causing more tightness, spasticity, and pain.

**Core stabilization, strength and proper posture is essential.**

## Anatomy

The **transverse abdominal muscle**, the **multifidus muscle**, **diaphragm**, and the **pelvic floor muscles** are all on the same neuromuscular loop. This means it is best if all those muscles are functioning properly; each needs to perform its job individually and as a team. If the transverse muscle is weak, the pelvic floor, the multifidus and the diaphragm cannot gain proper strength to perform their jobs in a healthy, functioning body.

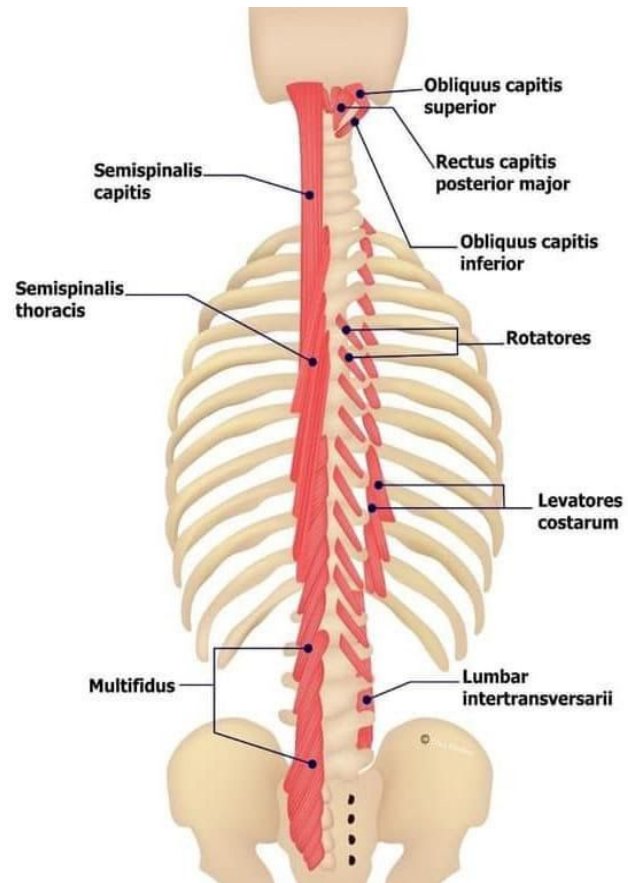
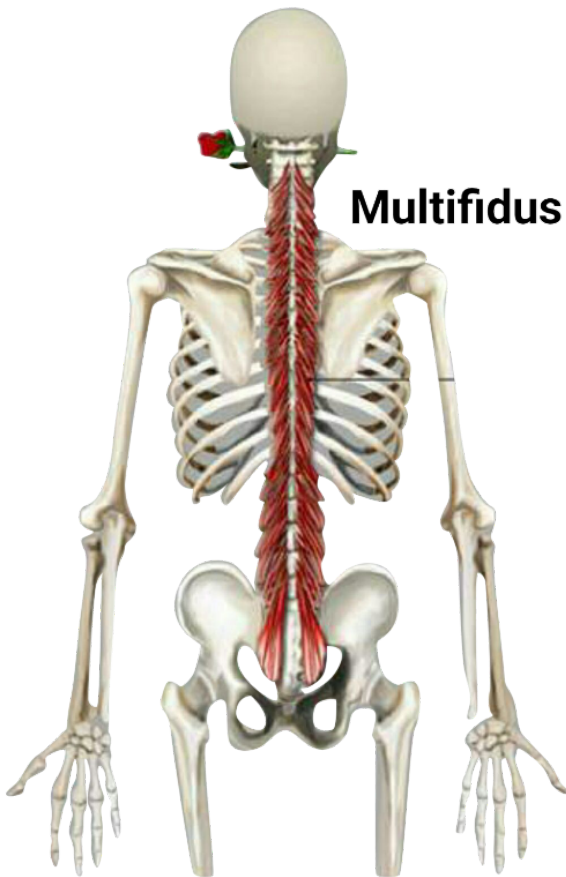


*Only part of the transverse abdominal muscle is shown in the illustration above.*



The **transverse muscle** is the deepest of the abdominal muscles. A critical function of this muscle is to stabilize the lower back and pelvis before movement. It is the deepest abdominal muscle, wrapping around the body to act like a corset. When engaged, it also pulls the belly in and provides support to the **thoracolumbar fascia**, and it is the stabilizer of the shoulder girdle, the head, neck, pelvis, and lower extremities.

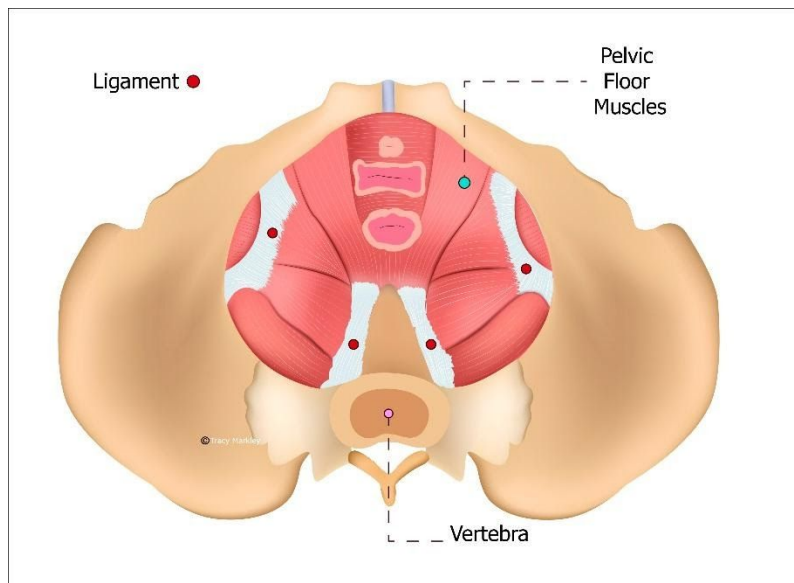
If a client has rounded shoulders and poor posture, it will not be corrected if the transverse muscle maintains the weakness. The transverse muscle needs to be strengthened, along with the other stabilizing muscles, to hold the body strongly upright so that it can achieve a posture in which the shoulders are stacked over the hips. If the head is upright and balanced over the shoulders, we have better balance. Clients need to rebuild stability in the pelvis and hips, so that the lower limbs and joints can gain strength, function in alignment, and perform properly for safe movements.



The **multifidus** is a small but powerful muscle. It is the main stabilizing muscle of the spine. This muscle takes pressure off the vertebral discs, so that the body weight can be distributed throughout the spine. If this is weak, you will also have weakness in the low back. The **multifidus** begins to activate before the body moves to protect the spine. It is part of the stabilizing system in the body. To gain better balance, this muscle must be stronger. Performing various exercises combining with the Swiss ball, balance disc and BOSU® ball will help gain a stronger multifidus. Better posture leads to better balance.

The small muscles near the vertebrae need to be activated harmoniously. These muscles are often known as the postural muscles. Exercising on an unstable surface, such as the Swiss ball, balance disc and the BOSU® ball, stimulates the central nervous system, which is the brain and the spinal cord. It strengthens muscles and ligaments, as well as activating and strengthening all the small muscles along the spinal column.

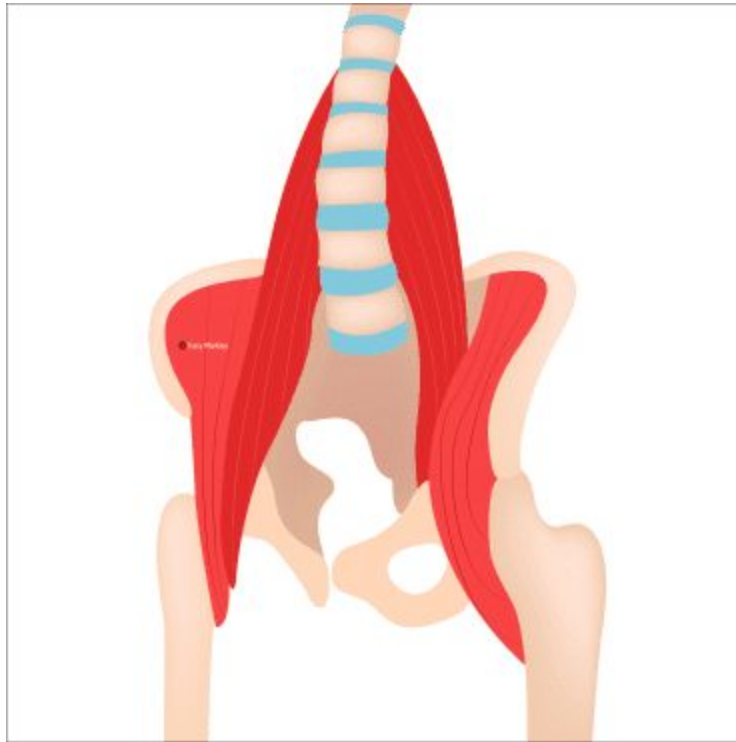
The **pelvic floor** muscles work as stabilizers of the abdominal and pelvic organs. The pelvic floor muscles and the gluteus (buttock) muscles are made to work and move in opposite directions. One must be able to engage the pelvic floor without engaging the gluteus muscles to obtain optimal core strength. These two muscles must be separated in the brain and nervous system for overall whole-body functioning. This plays a role in preventing back issues, and I do not want to build back issues in any client. The transverse muscle must be strong for the pelvic floor to become strong and function properly since they are on the same neuromuscular loop.



For the best results, I have the survivor engage the pelvic floor then visualize and feel that they are zipping up a zipper from the pelvic floor to their rib cage or sternum. The more conscious and present a client is when doing this, the better the chance, subconsciously, of these muscles contracting in everyday movements when needed, without thinking about it. It is important to remember to keep this focus throughout the exercises.

The **pelvic floor** works close to the diaphragm as well. If you sit or stand in good alignment and focus on engaging the pelvic floor, you can feel that the diaphragm pulls slightly towards the pelvic floor as the pelvic floor lifts slightly towards the diaphragm. There is a difference between doing a Kegel and engaging the pelvic floor. It is also important to be able to engage the pelvic floor without

engaging the buttocks (glutes) for the inner unit and stabilizing system in the body to work efficiently.

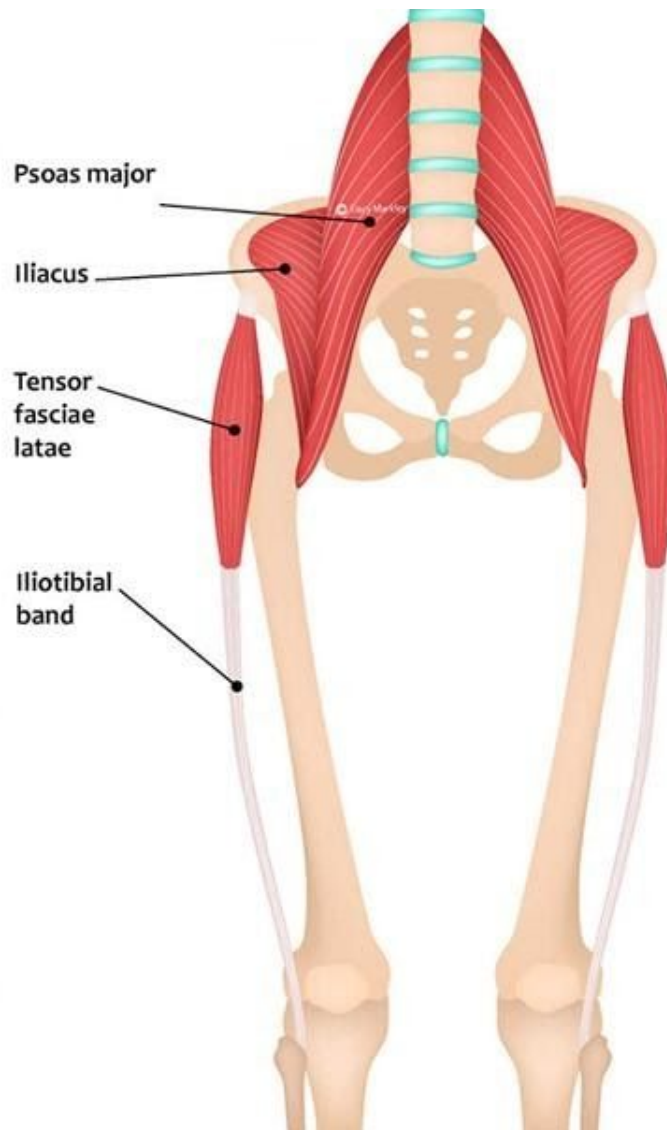


The **psoas muscle** is an extremely important muscle located in the center of the body. It lies deep underneath the transverse abdominal muscle. It is a deep back muscle. It is the bridge between the hips and the back. Often it is referred to as the iliopsoas. This is when the psoas and the iliacus muscle muscles are being grouped together. The psoas muscle is the only muscle in the back that crosses over the hips and attaches at the front of the body. It attaches at the last thoracic vertebrae and to four of the five lumbar vertebrae and at the femur, the upper thigh bone. It is also the bridge between the hips and the back.

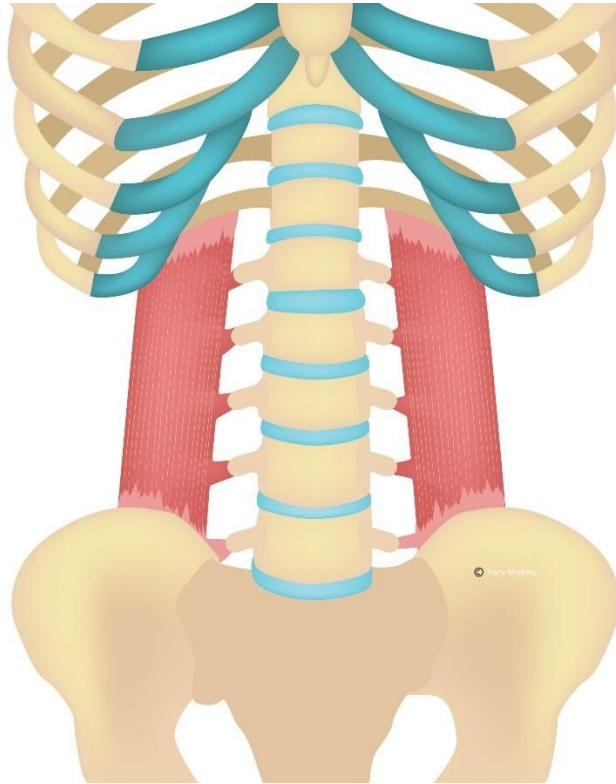
As Evan Osar explains in his book “The Psoas Solution,” *The psoas has extensive fascial attachments to the trunk, spine, pelvis, and hips. Additionally, it attaches with fascia to several muscles within these regions, including the diaphragm, quadratus lumborum, transverse abdominis, pelvic floor and iliacus.*

If the abdominals are weak, the **psoas** tries to perform the work of the abdominal. If the psoas is short, weak and/or tight it will be difficult to hold the body in an upright position with the shoulders stacked over the hips.

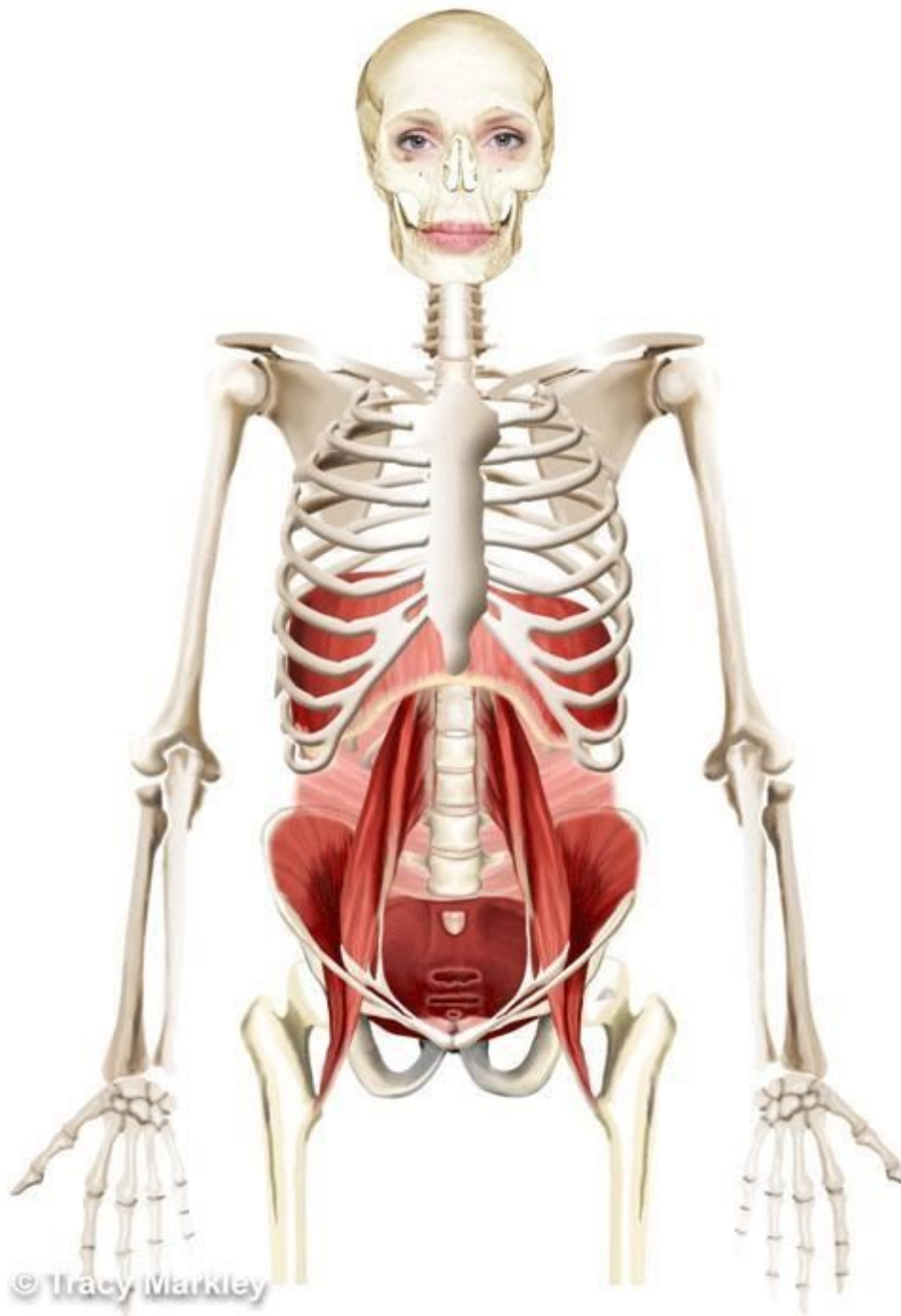
The psoas works closely with the diaphragm. The diaphragm is the main muscle for breathing. The psoas is the main muscle for walking. The psoas attaches at the lumbar spine and the crura of the diaphragm attaches there as well. The crura (plural for crus), are two fibroelastic bands that come up from the lumbar vertebrae and inserts into the central tendon of the diaphragm. There is one on the left side and one on the right side. Together they perform a muscle contraction. A person must walk and breathe at the same time. The psoas and the diaphragm must be strong for movement and walking.



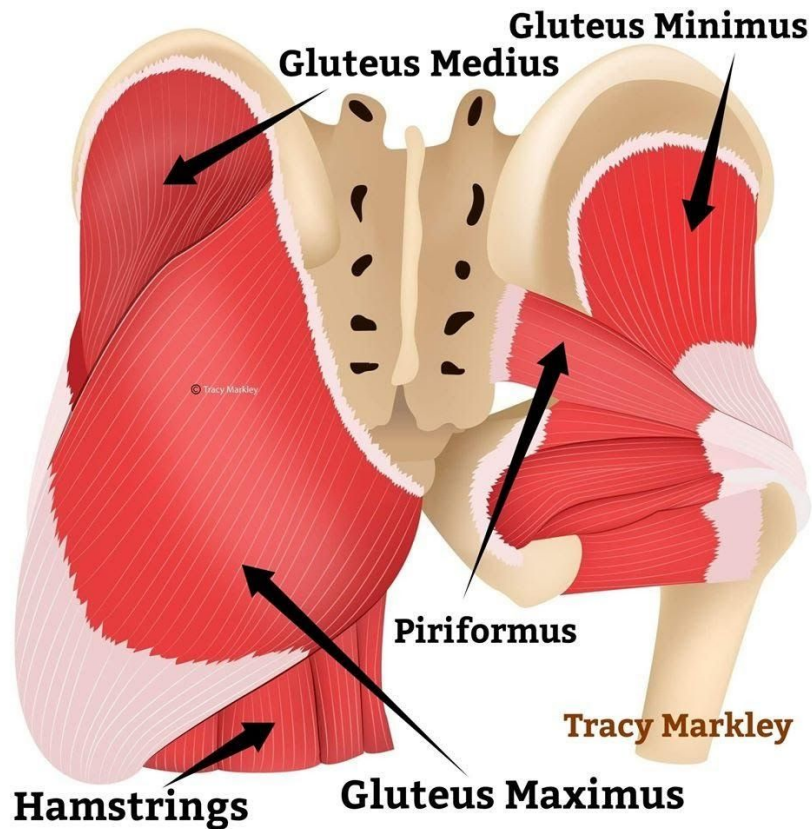
## Quadratus Lumborum



The quadratus lumborum (as you can see in illustration above) is attached from the lumbar vertebrae and rib 12 to the crest of the ilium. It stabilizes the pelvis (hip girdle), as in walking, and laterally flexes the spine. When this muscle is only activated (or in spasticity) on one side, the trunk is bent towards that direction.



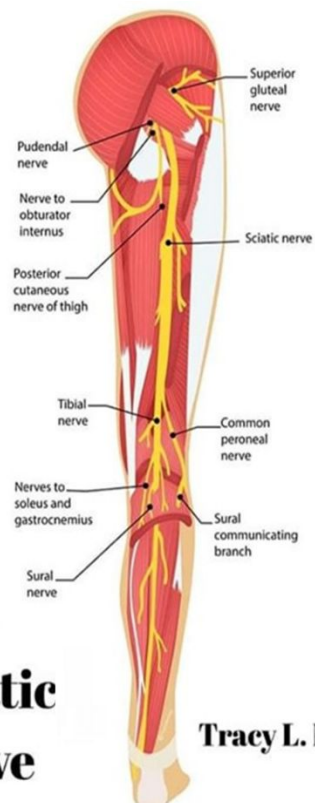
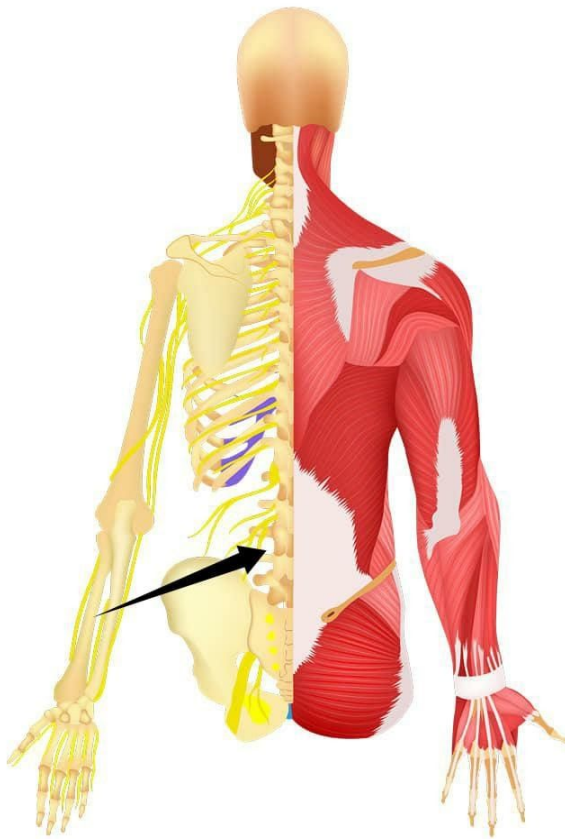
*In the above illustration you can see the pelvic floor, iliopsoas diaphragm and obliques muscles.*



*In this illustration, you will see the large glute muscles and the smaller muscles that are underneath. The large glute muscles extend the femur, which is the back swing of the leg in walking. It also rotates the femur outward. The smaller group of muscles work together to rotate the femur outward. The femur is the large upper thigh bone.*

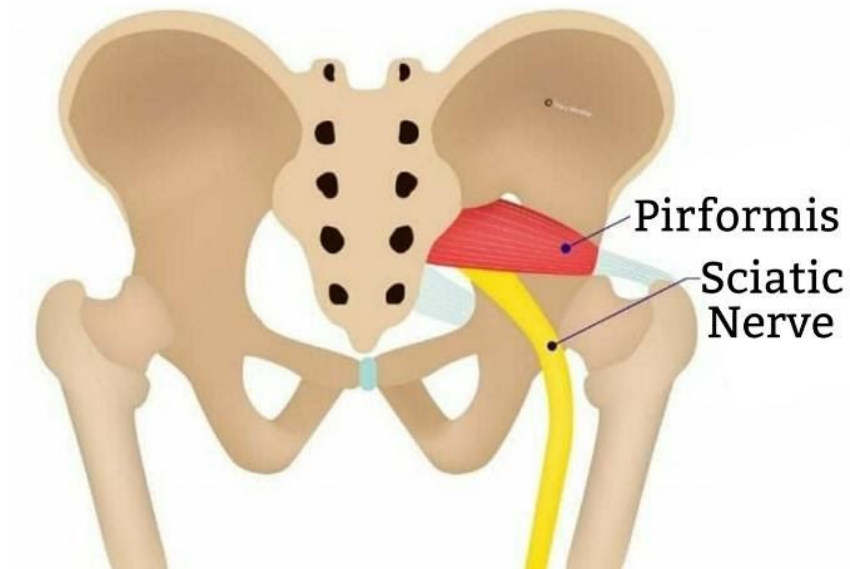
## **The Sciatic Nerve**

As trainers and therapist when we hear “sciatic nerve” we instantly think pain. Although the sciatic nerve is said to be the largest single nerve in the body, it is made up of five nerves. It is found on the right and left side of the lower spine by the fourth and fifth lumbar nerves and the first three nerves in the sacral spine. At the largest part of the nerve, it is as big as a male thumb. The five nerves group together on the front of the piriformis muscles and become one large nerve, known as the sciatic nerve. This nerve supplies sensation and strength to the leg and the reflexes of the leg. It connects the spinal cord with the outside of the thigh, the hamstring muscles and the muscles of the lower leg and feet. It provides motor and sensory functions to regions of the leg and foot. When the sciatic nerve is impaired, it can lead to muscle weakness and/or numbness and tingling in the leg, ankle, foot, and toes. The sciatic nerve and its nerve branches enable movement and feeling in the thigh, knee, calf, ankle, foot, and toes.



# The Sciatic Nerve

Tracy L. Markley



### ***Reminders and tips.***

If you have a client sitting in a wheelchair with pelvic twisted and/or one hip lower, then the sciatic nerve will not be in an appropriate position as well. Consider they sit that way for several hours a day. This will limit building strength to the legs. See Chapter in this manual on wheelchairs.



The center of the body must be strong to hold the body upright in proper alignment. In the above photo is an 82-year-old stroke survivor. He was four years post stroke when I met him. If a client has a drop foot, if the muscles in the center of the body becomes stronger, the leg and foot may begin to re-establish proper stepping. A survivor will have better recovery in their walking gait, if they combine a strong posture with their physical therapy exercises for drop foot.



*In this photo you can see her posture changed in just 3 months. She was 104 years old.*

To sum this chapter up, proper posture and sitting up tall does not begin at the shoulders. Let us strengthen from deep in the core to help straighten up. The center of the body must be strong to hold up the diaphragm, rib cage and shoulder girdles in proper alignment to have proper posture. The center of the body must be strong and balanced to keep the pelvic and hips stable and strong, which leads us to having a stronger, more balanced, and safer walking gait.

## CHAPTER 7

### Fascia and Movement

Fascia is a continuous structure that surrounds and intermingles tissues and structures throughout the body. It varies in density and thickness. Nerves and blood vessels also run through fascia. When the brain is sending messages for movement, it includes the fascia. Training survivors with knowledge of fascia is important, while choosing which exercises are the best for each client. Fascia is also interconnected with the structures it surrounds. The health and mobility of fascia plays a huge role for the body to have healthy movement, and to avoid pain and injury. There are ongoing studies on fascia and its mandatory importance for the body to move.

*“Fascia contains mechanoreceptors and proprioceptors. In other words, every time we use a muscle, we stretch fascia that is connected to spindle cells, Ruffini and Paccini corpuscles and Golgi organs. The normal stretching of fascia thus communicates the force of the muscle contraction and the status of the muscle regarding its tone, movement, rate of change in muscle length and position of the associated body part to the central nervous system.”* **From Dr. Warren Hammer, the chiropractic profession's leading expert in soft tissues and fascia (*The Fascial System is a Sensory Organ*).**

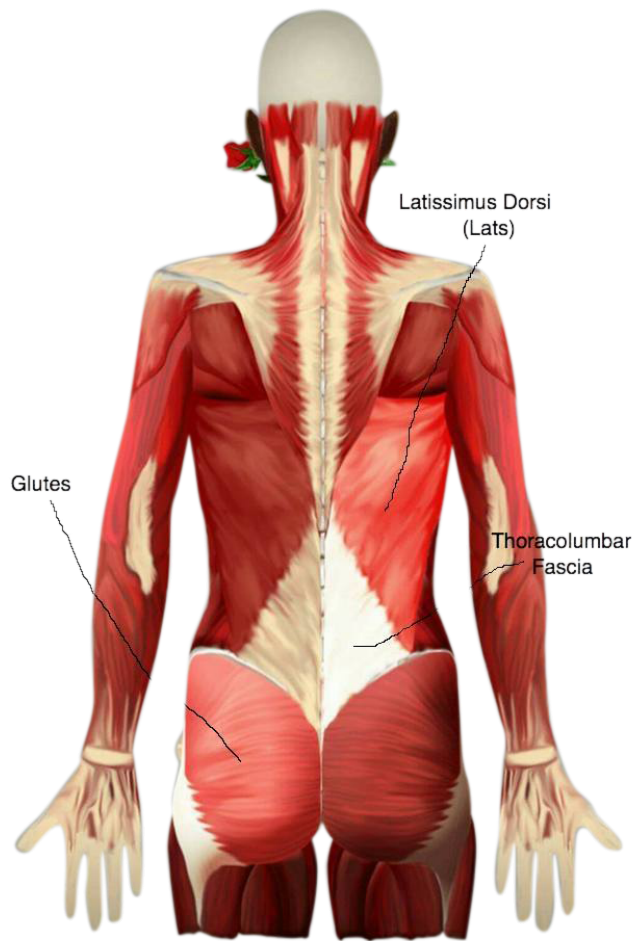
**Dr. Hammer went on to say in another article (*Why We Need to Fix the Mechanoreceptors*) that,** *"One of the most relevant discoveries in the world of anatomy over these many years is that muscle spindles, the chief proprioceptive cells affecting our muscles, are not in the muscle, but in the fascia surrounding the muscle and its muscle bundles. A mechanoreceptor is stimulated when it is deformed, but when it is restricted in fascia that is unable to glide... it is unable to stretch, which is critical for the function of the spindle cell."*

The thoracolumbar fascia is an important fascia to understand. It is necessary for walking, running and mobility. When a professional has the knowledge of the fascia and exercising through the fascia lines, it gives them more avenues to help survivors gain back movement. This sort of knowledge can be an excellent addition in training a stroke survivor and helping their brain make new pathways for the movements needed.

The thoracolumbar fascia is an important fascia to understand. It is necessary for walking, running and mobility. The thoracolumbar fascia supports the back muscles and helps them achieve the ability to move the body. It is made up of strong fibers and helps channel forces of movement as the back muscles contract and relax. The nerves to these muscles also cross through this fascia. This fascia goes deep to the spine and is made of three layers. It is essential for contralateral motions like walking. It works with the latissimus dorsi (lats) to coil the core of the body.

When the thoracolumbar fascia is supported, it allows all the muscles that connect to it function better. These muscles include the gluteus maximus, latissimus dorsi, trapezius, erector spine, quadratus lumborum, psoas, transverse, and internal obliques. It helps bridge the muscles of the back to the muscles of the abdominal wall. This fascia helps integrate the movements of the upper body with the lower body.

### **Thoracolumbar Fascia**



We also have a **Posterior Oblique Subsystem** (which is not the exact opposite of the oblique abdominal muscles despite the similar name). This system consists of:

- Latissimus Dorsi Muscle
- Thoracolumbar Fascia (not a muscle)
- Contralateral Gluteus Maximus Muscle (some also consider the Gluteus Medius a part as well).

### **Knowledge is Power for You and Your Stroke Survivor.**

Learning more about the following will help bring you, a fitness professional, to have a better understanding of the human body, fascia, movement/limited movement and pain triggers that clients will have as well as how to help them as

they are in changes in their recovery. The more we understand the body and movement the better we can help any client.

Listed below are different theories that can help you understand systems in the body and movement. They hold profound knowledge. I suggest reading more about these.

***The Oblique Subsystem***

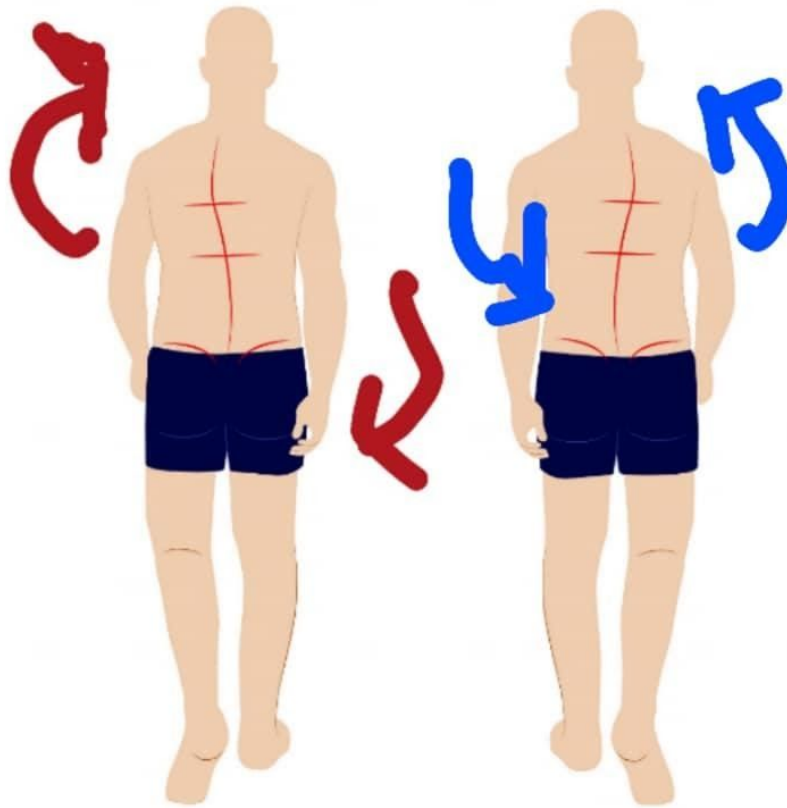
***The Kinetic Chain***

***The Spinal Engine***

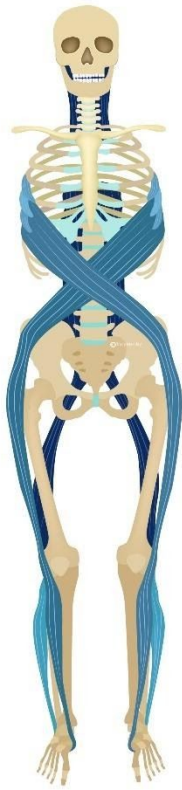
***The Fascia Lines – Exercising with the Fascia Lines***

## **The Spinal Engine and Working Through the Fascia Lines Theories**

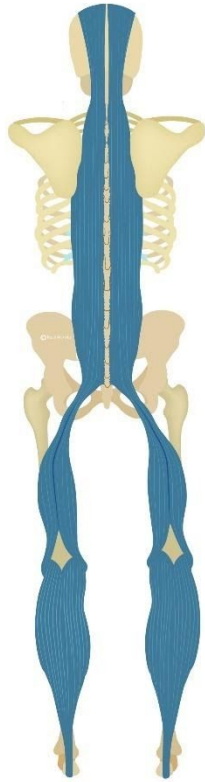
### **The Spinal Engine Theory**



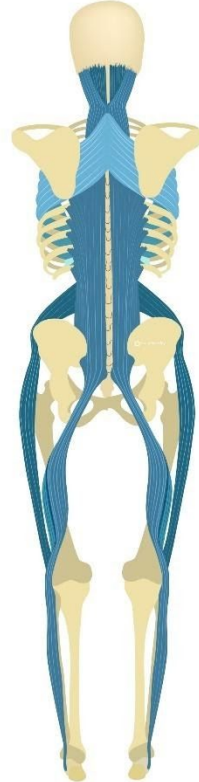
Above, you will see that when the left arm swings forward, the upper spine rotates forward on the left as the right hip rotates back as the spine rotates for walking steps. This follows the ***Spinal Engine Theory***, which I believe is the correct theory. The spine rotates as we walk. The spine and core in movement and rotation powers our movements.



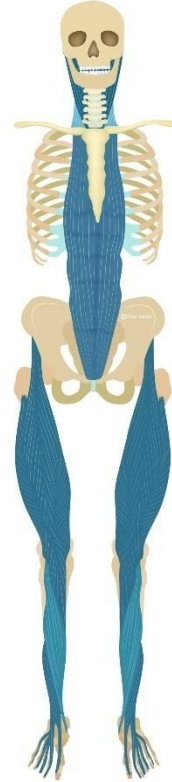
**Spiral Line**



**Superficial Back Line**



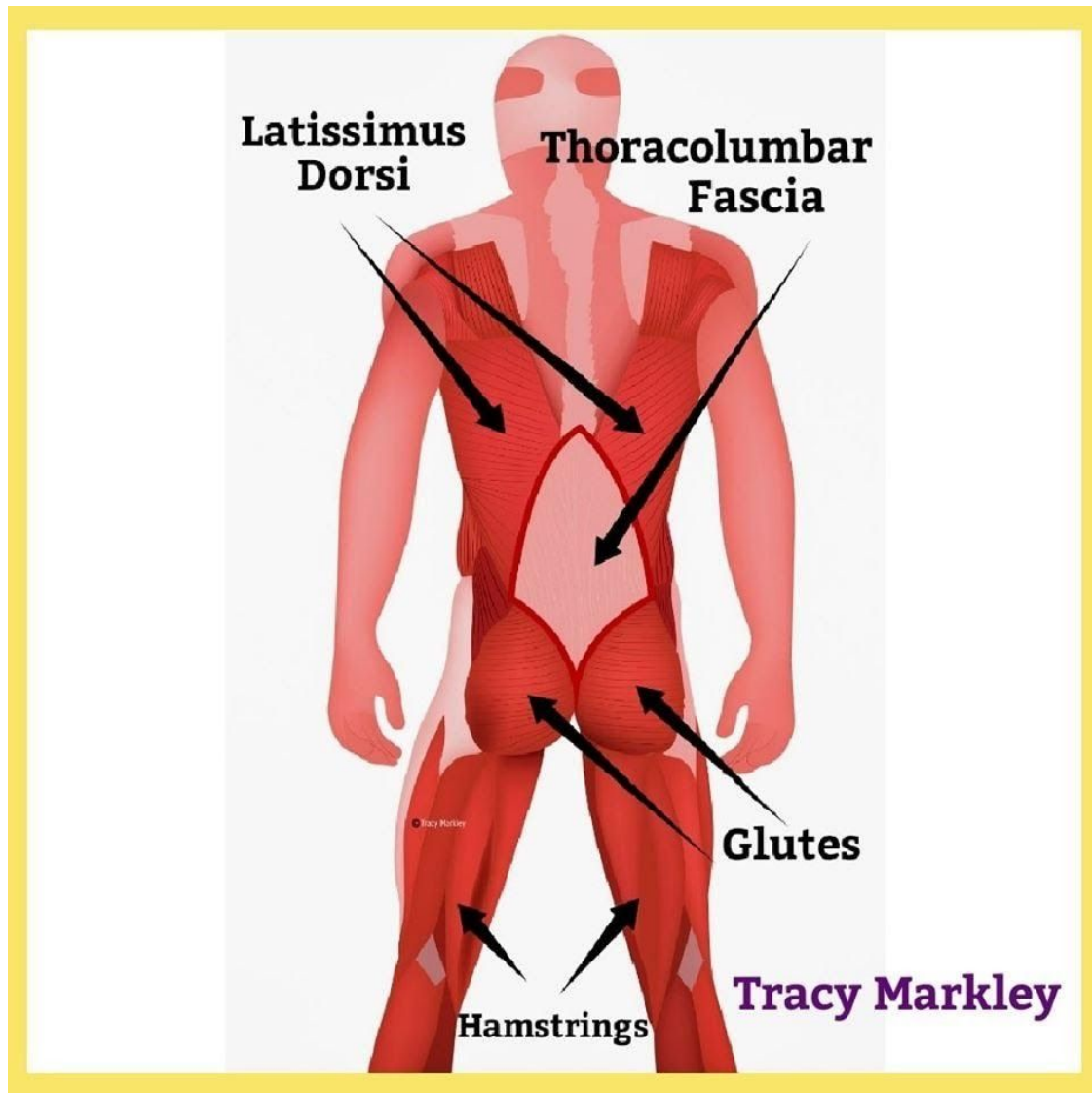
**Showing Back &  
Front Lines**



**Superficial Front**

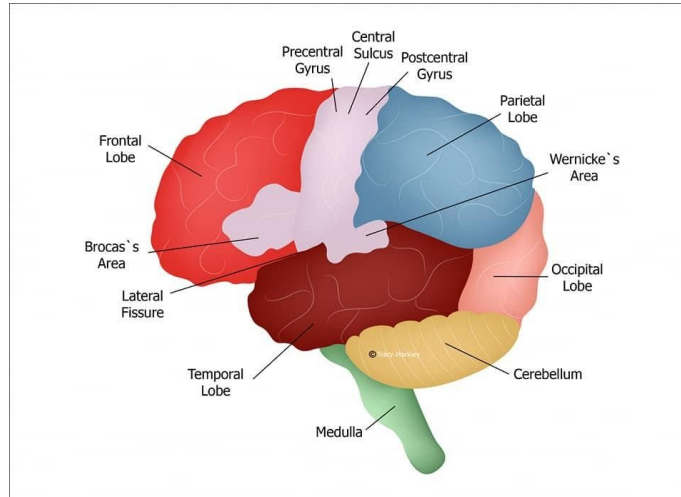
**The illustrations above are *only a few* illustrations of Fascia Lines.**

There are more fascia lines than shown here. Gaining knowledge of this will help strongly in stroke recovery training and with all your clients.



# CHAPTER 8

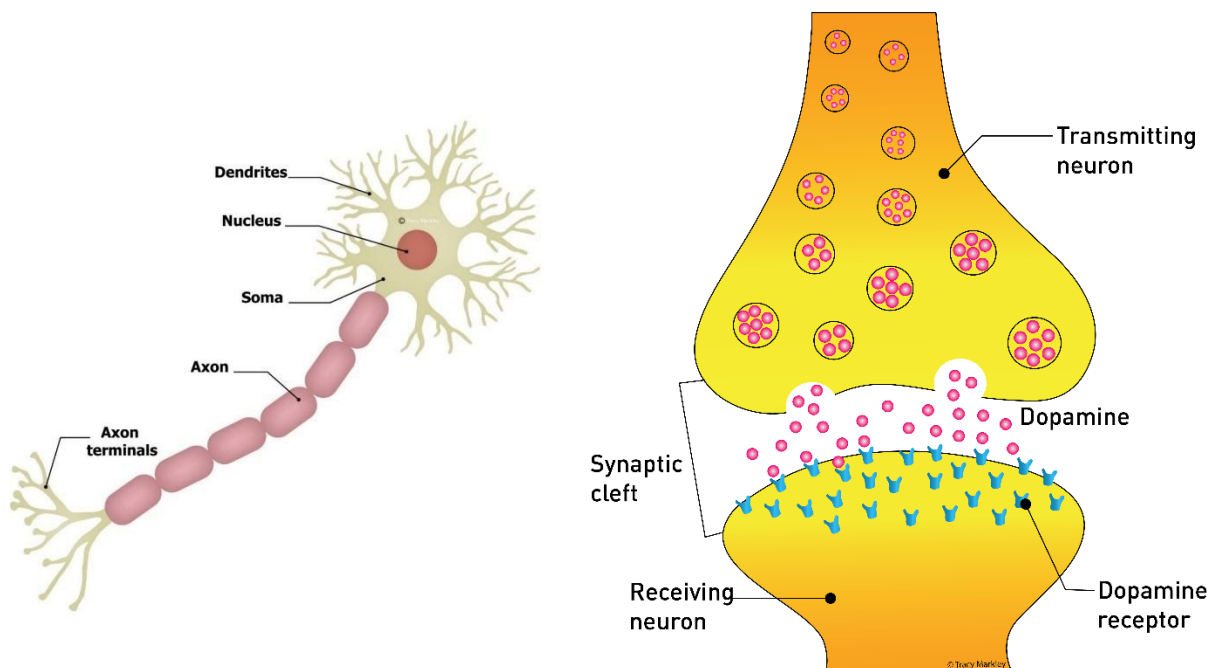
## The Brain and Brain Care



The brain is one of the largest and most complex organs in your body. It is made up of more than 100 billion nerves that communicate in trillions of connections called synapses. It is highly active metabolically. It receives 20% of the cardio output. The brain has truly little or no ability to store oxygen or glucose. Neurons die within minutes if deprived of oxygen. Anything that cuts off blood flow to the brain compromises brain function. Neurons die and they are not replaced.

The brain uses 20% of the body's energy in a healthy body. When the brain is trying to recover from a stroke and brain damage, it uses much more energy. This leaves survivors feeling fatigued. This is normal. It is important that they get the rest needed and understand that fatigue is what happens in the process of the brain trying to heal itself.

It is important do take care of neurons that take care of the vessels that supply oxygen to the brain. The entire blood supply to the brain is from two major arterial systems: The internal carotid and the vertebral system. The internal is part of the circulation primarily to the front of the brain. Vertebral arteries supply the brain stem and cerebellum. In a healthy brain the muscles move on commands from the brain. There are single nerve cells in the spinal cord, called motor neurons, and they are the way the brain connects to muscles.



To learn more about the brain see book: *Your Brain, The Engine to Your Body – A Fitness Trainer’s Guide to Brain Health*, by Tracy L. Markley

The brain is 80% water. The body is 75% water. The bones are 25% water. It is essential for us to drink water and stay hydrated. Many people go about their everyday life maintaining a stage of dehydration. When one combines a dehydrated brain, poor nutrition, and lack of exercise, it will encourage the aging process in all our organs, including the brain. When a brain with an injury maintains a stage of dehydration it can impair the healing process.

The brain needs water! It provides a fluid balance for all chemical reactions in the body. It is a lubricant and plays a vital role in regulating the body’s temperature. Water flushes out toxins and waste from the organs. The skin is the largest organ in the body and staying hydrated can create clearer skin and can help with anti-aging of the skin. In a dehydrated brain, the extraordinarily complex functions of the brain get disorganized and makes the whole body have issues. Even mildly or temporarily dehydrated brain can alter brain function. Even in the

adult brain, neurons continue to form new connections and strengthen existing connections

If the brain is dehydrated or even slightly dehydrated, it can lead to feeling brain fog, sluggish, tired, irritable, and more. It can even affect one's memory. It also can slow down the process of the brain making neurons and other incredibly essential functions the body needs as well as keeping the brain healthy and fit and able to function at its best.

Stroke survivors are people with brain injuries. The symptoms of dehydration and partial dehydration are the same of some stroke affects. In stroke recovery this is a "Double Whammy" to a stroke survivor's brain. It will slow down recovery and affect the survivor in a negative way.

Research has also shown that the brain volume peaks at age 40, then begins to decline 5% every 10 years. We must do everything possible to fight against this process by not adding to that percentage with poor hydration. A dehydrated brain shrinks in volume, slows down the metabolism and can increase cholesterol level.

Brain Specific Exercises stimulating the central nervous system.

Scientific studies show that aerobic exercise stimulates the hypothalamus.

Resources: *Your Brain: The Engine to Your Body, A Fitness Trainer's Guide to Brain Health*, by Tracy L. Markley

*The Great Courses on the Brain*

*Tipping Toward Balance: Stroke Recovery, What Now? When Physical Therapy Ends but Your Recovery Continues*, by Tracy L. Markley

## CHAPTER 9

### Walking Forward, Backward and Treadmill

By the time a survivor has met their fitness professional, they may have been already walking slowly on the treadmill in therapy and/or at home. It is not unusual if they have not been doing this. If they are able, get them walking on a treadmill, holding on safely to help get the locomotion for walking going. A study from the Cleveland Clinic stated that walking was one of the best things to do after a stroke. It stated that the soonest a survivor can try to get the body to perform locomotion, as in walking, the sooner the walking gait can come back.

One of the things to have a client focus on while on the treadmill is to be present and conscious and to keep the stroke-affected foot pointing forward as much as possible. This requires being focused every second on their foot placement when they walk. If a client just walks on the treadmill and watches television and/or is not paying attention to their posture, form and stepping, they will not gain the progress needed or possible.

An important impact of the walking gait is stabilization and strength of the pelvic girdle, which leads us right back to the core and the deep stabilizing muscles of the body. When all that is stable, the lower limbs will be more stable, and can build their strength for functional movement at its best while avoiding injury.

If the client can walk on the treadmill without you monitoring them, it is a good place for them to warm up, even if it is walking very slowly. I like to have my clients come early if, they are able, and walk on the treadmill on their own time, so we have the full session to focus on all the other exercises needed for their case. If they are unable to walk safely without your supervision, please stay with them for their safety and guidance. There will be survivors who are not able to use the treadmill when you begin working with them. If a survivor has spasticity in one of their arms, they will not be able to hold onto the treadmill with both hands for safety. They may have spasticity in their leg that limits them from lifting up the leg safely enough to be using the treadmill. Help them gain strong core, balance, and standing-up strength before trying to get them on a treadmill. **Safety First!**

In the best survivor patient cases, the most fragile time in a survivor's recovery is spent with a physical therapist, before we begin working with them. This is not always the case.

## **There are Many Muscles Involved in Walking and Standing**



This illustration is here to remind professionals how many muscles work together in stability and movement in people's daily activities.  
This just illustrates some of them.

## **Walking Backward and Backward Movements**

Walking backward might seem silly, but it is good for us physically and mentally. We take steps backward often in our daily activity. Walking backward enhances the sense of body awareness. It increases body coordination and movement of the body in space. Research has shown walking backward improves the walking forward skills. It is said to sharpen our thinking skills, enhance cognitive control and put the senses into overdrive. This movement also puts less strain on and requires less range of motion from the knee joints.

It is important for everyone to have awareness as to where the “body and limbs are in space.” It is important for athletes to practice and train with focused awareness to where their body and limbs are in space for function, speed, and agility. They gain better balance, speed, and quicker reaction time, which are important skills for sports, especially fast-moving sports. Stroke survivors need to regain these skills for everyday life movements and regain quick reactions. Some examples: if they drive; moving quickly to the brake pedal when needed; moving their foot quickly to avoid tripping and falling or avoiding dropping an object on the floor.

One of my stroke survivors used to take big, wide circles of steps to turn around. I remember the day this survivor turned around normally. He lit up and said, “Did you see that?” I excitedly said, “Yes I did; that is so cool!”

I read studies that suggest having a client walk backward on a treadmill to help increase awareness and foot placement, but I am not comfortable with that. I feel walking backward on a treadmill belt can be unsafe for most clients. I suggest having clients do it on the floor in front of a mirror so they can see and feel their foot placement. If they do not like looking in the mirror, have them focus and watch just their feet and walking gait in the mirror.

I feel strongly that clients in such fragile states must have their core stabilizing muscles before attempting to walk backward. Stability and safety are essential.

The following photos are of a client within two years of recovery. The first picture was the first month post stroke as he was still in the re-hab hospital. There were three physical therapists working with him. One pulled the machine; one was pushing it and the other was making his legs walk as he hung in the harness. Doctors did not think he was going to live the first two weeks. Every man in his family who had a stroke had died from it. He beat that odds, and after two weeks,

he was able to start some re-hab. I met him six months post stroke as he was in a walker still. He was told he would be in a wheelchair the rest of his life. He was consistent in our work together and this second picture is over two years post stroke and he was doing the running man on the BOSU® ball.



The pictures below are him a few months into rehab at the hospital he was still in. The picture with him walking with the cane is a couple months into our training together. The last picture of him walking and squatting on the BOSU® ball was taken about two and one-half years post stroke. His full recovery journey of us working together is now a book; “Dear Stroke You Suck; The Journey of a Fitness Trainer and a Stroke Survivor”. He wanted his journey shared to help teach professionals and to help other stroke survivors. I was happy to create the book.

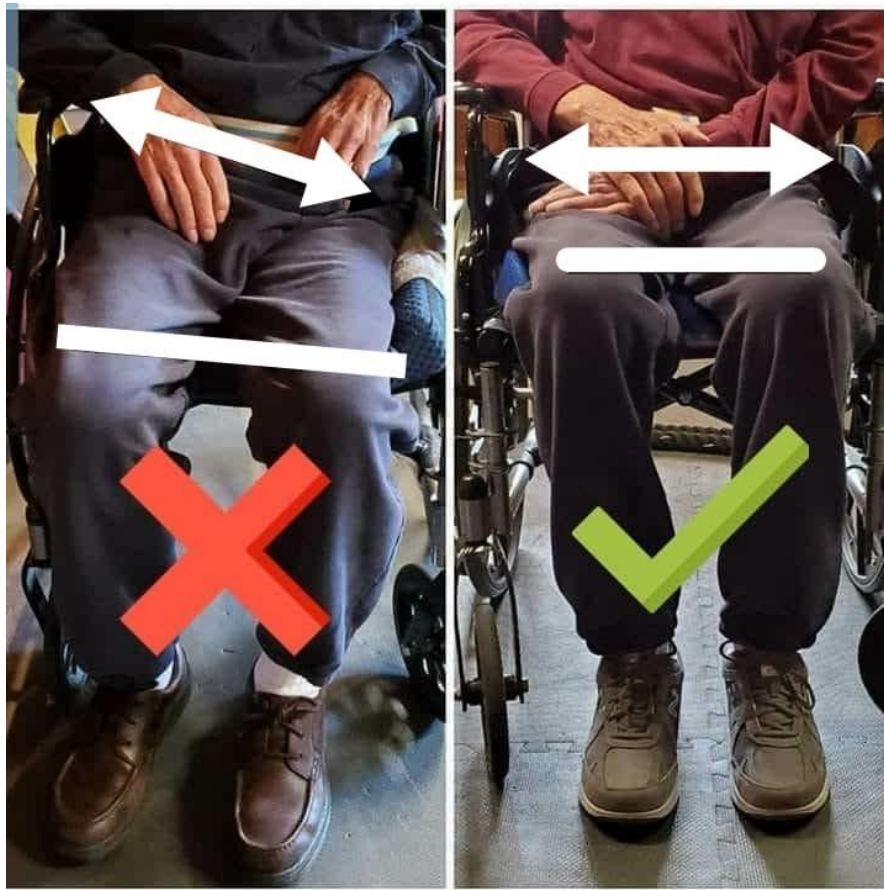


## CHAPTER 10

### Wheelchairs, Sitting and Standing Up

When a survivor is in a wheelchair, they will be more fragile to train than some other survivors. Most often when they are in the wheelchair, they have a tough time standing up and stabilizing themselves. Each case is different. It is essential to have a bar on the wall to train a client in a wheelchair. It is **not safe** to use the back of a chair or a countertop. They must **be safe**. It is important for them to be aware of their posture and sitting positions while they spend time sitting in the wheelchair.

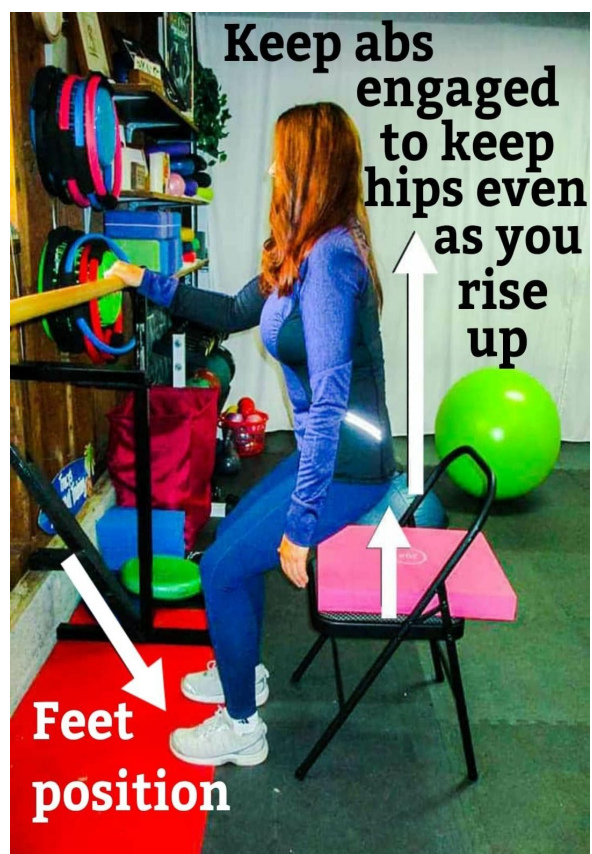
Here is an example of a client who is learning to walk again after a stroke. In the first picture, you can see how his hips are off to one side, and his posture is poor. When he tries to stand up from that position, it does not work. He is attempting to begin standing up from sitting to standing in a **faulty and weak functional position**.



In the second picture, you can see how his hips, legs, knees, and feet are in an appropriate position to move from sitting to standing. It may not be easy to see in these photos, but I had him change his sitting cushion in his wheelchair. In the first picture, he is sitting on a cushion that has no support for his hips and spine, and he just sank into it. In the second picture, he is sitting on a cushion that is made to give his hip and spine support in computer chairs. Switching the seat cushions helped him to maintain a proper seating position needed to aid the functional movement needed to stand and walk. **Be aware of the survivor's posture, hips, and pelvic positioning before they stand up.**

In the next pictures I am demonstrating how they practice standing using a bar. This can be used for clients in a wheelchair or those who are needing to strengthen standing up and standing ability, strength, balance, and cognitive skills.

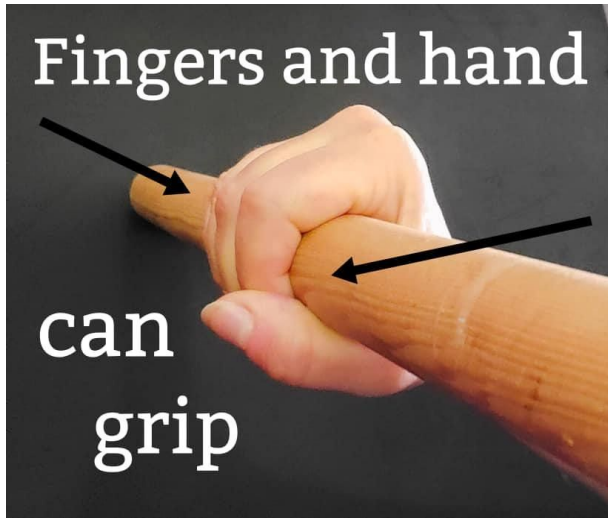
## **A BAR IS ESSENTIAL!**



You can put a chair or wheelchair near the bar and have them practice standing up from seated positions into a tall, proper posture.

Many survivors can only use one arm, as seen in the following picture. In this case, it may take a survivor longer to gain the body strength in the standing and squatting movements because they only have one arm to rely on.

- As they stand up from a chair or a squat position, have them work on keeping the hips stable by keeping the feet anchored to the ground and facing forward evenly.
- Keep the abs engaged. This will help *keep the hips from swaying to one side as these movements are performed.*
- Every time they stand up, stand up completely from head to toe.
- Try to keep feet level on the floor. Do not let them roll out to the sides. Keep all toes down, if possible.
- They are building the strength, balance, skills, and pathways to standing up strongly, so their walking ability can become stronger and safer.



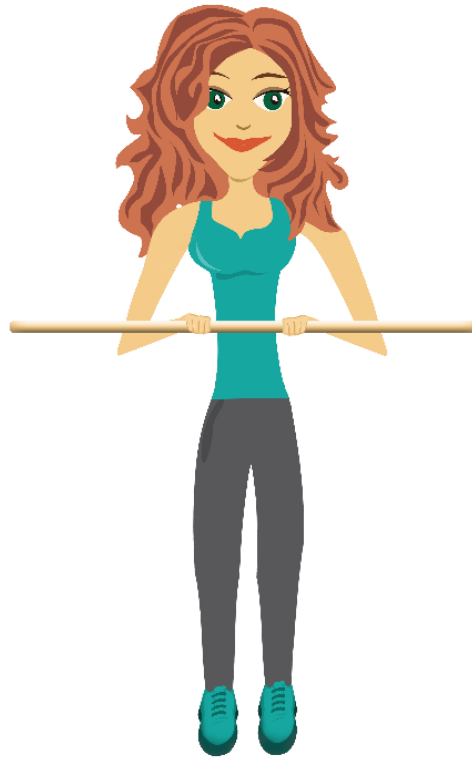
**Holding on to unstable furniture or flat surfaces, such as countertops the survivor will have nothing to grip onto for safety that will hold their body weight.**

Another plus to using a bar the survivor's unaffected hand and affected hand (if and when it can) grabs onto the bar, they are using their hands for gripping, grabbing, quick reaction time, which builds stronger arms, wrist, hands and finger strength. The hands and feet can begin to retrain moving and coordinating together with control, rebuilding pathways to arms, hands, and fingers, and much more.  
**Safety First!**

With the hand challenges, many survivors face practicing, gripping, and releasing the affected hand from the bar is good for hands that grip too much and for the hands that will not grip at all.

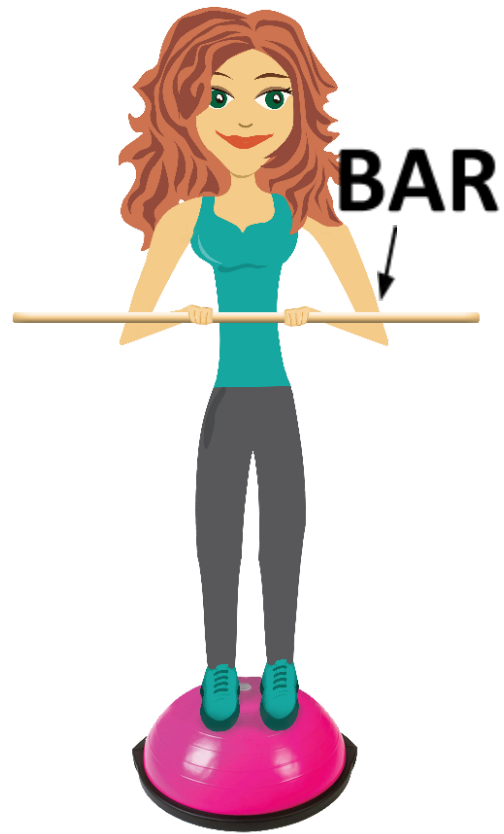
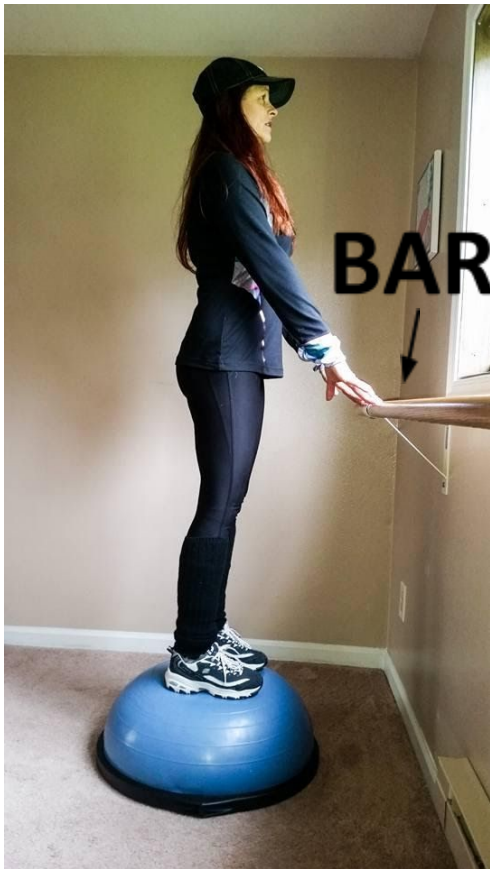
As you review the different exercises in this course, please take note that not all survivors are at the same place in recovery. There will be exercises that one survivor can do that another survivor cannot do. All survivors must begin at their own starting point and advance at their own pace.

When you see the exercises standing on balance pads, BOSU® balls and discs, know to **ALWAYS** have survivor begin standing on the ground first using the bar.



When practicing standing up from a chair or a wheelchair, **use the bar**. Each time they stand up, have them try to engage their abs, and **stand completely up**. Many times, when people are struggling with balance, stabilization, and walking, they do not complete their stand up and try to take steps with the body in poor posture. This makes it harder and risk for falls. **BUT**, if the survivor is having

trouble and feel UNSAFE, USE THE BAR until they are safe and **they can feel safe.**



## Safety First!

Many exercises can be done sitting in the wheelchair too. If they are sitting in a chair or a wheelchair, be sure the survivor is sitting in **proper posture in spine and hips** while performing all exercises.



### ***Reminders and tips.***

It is extremely important that survivors wear shoes with good ankle support. No old shoes or loose sloppy shoe tongues and laces. The feet and ankles need to be in a stable position. The feet should not be rolling out or in.

Unstable and unsupported shoes will affect feet, ankles, knees, hips, back and posture.

## **CHAPTER 11**

## Focus and Visualization

When a survivor is trying to obtain a particular movement, such as lifting a foot or opening up a hand that has spasticity, it helps to have them focus and visualize what they are trying to achieve. For example: I will have a survivor focus on the hand that has not been affected by the stroke. I have them watch the hand open and close and hold the fingers out extended as far as they can. I ask them to see it, feel it, then close their eyes and stay with the vision and feeling of it performing properly. Then I will have them close their eyes and visualize the stroke affected hand doing the same thing. I have them try to see it and feel it, and often this will cause movement. If I have them stand on a balance disc and do the same thing, the movement will be bigger. In time the achieved opening of the hand will begin to remain open. This takes practicing daily, if possible, and as much as possible. Focus is especially important. If they are standing on a balance disc, where the central nervous system is being stimulated, it can speed up the recovery progress. Some survivors get dizzy if they close their eyes. In this case DO NOT have them close their eyes. **Safety First!**

Mirror Neurons: The existence of mirror neurons means you can gain skills through observation. Mirror neurons are involved in imitative learning through interactions with neural motor areas in humans. The application of mirror therapy techniques in post-stroke patients has demonstrated good results, especially when combined with other techniques. I find it works better with focus and visualization; and it works even better when a survivor can use the balance disc and BOSU® ball. **ALWAYS** begin with them standing on the ground first, then when they are ready and **SAFE**, they can advance to balance pads, discs, and BOSU® balls.

Athletes often attribute their exceptional abilities to being able to “see” the ball and its flight prior to striking or catching it. The brain’s ability to learn in this way makes a biological case for the use of simulations and case studies. Such approaches not only promise effective ways of learning but are also potentially very efficient. ***There is more about this in the course video lectures and demonstrations.***

## CHAPTER 12

## **Spatial Awareness, Proprioception and Feeling Safe in Movements**

Spatial awareness is the ability to be consciously aware of where the limbs are in space. It is to be mindful of where your body is and how much room you have around it and knowledge of the distance of objects in your surroundings.

Proprioception is the placement of the body in relation to the things around it. It is the discernment of organized knowledge of the objects around oneself, in relation to the given space at any time, either still or when there is a change of position. It is relating to the height and depth of the objects around you, such as having to step over something on the floor when you are walking through a room. The word “proprioception” comes from two words. First is the Latin word “*proprius*”, meaning “one’s own.” The word “perception,” meaning the process by which one translates sensory input into a coherent and unified picture of one’s environment. Proprioception is the sense or “perception” of the relative position of various parts of the body in relationship to its environment. It is knowing where those various body parts are in space as well as how they are moving in relationship to each other. The brain integrates information from proprioception using all four brain hemispheres. The vestibular system keeps track of your overall sense of body position, movement, and acceleration. After a stroke this must be relearned in many survivors.

Spatial awareness and proprioception often are referred to as the same even though they are different. They work together in all of us for daily function and activities. You must be able to relate to the height of the object you need to step over, so your foot lifts high enough and steps far enough out before landing back on the floor to clear the object. Spatial awareness is a complex cognitive skill. We learn these cognitive skills and as children. It must be relearned in many cases after a stroke as is the case with many stroke survivors.

Without adequate proprioception from the trunk and legs, it is difficult simply to walk into a room and sit down in a chair. Example, when you enter a room and are aware of how far to walk to the chair, the brain calculates the distance, and the feet walk accordingly. The body starts taking smaller steps when needed, as well as adjusting the speed of each step as it approaches the chair to turn around. Now the brain calculates the turn and the size of steps and the direction of the steps required to place the body in the right position to prepare to sit. It then calculates the distance, height and where the seat of the chair is in space, as it coordinates with where the body is in space before it lowers the body to sit down safely. The brain

directs the body, so it knows where it is in space to guide it down into sitting position in the chair without missing the chair and falling to the floor.

After their stroke it can be difficult for a survivor to decipher verbal directions such as forward, back, right, or left. This is called **confused positionnel languages**. This can be common after a severe stroke. This makes it hard for a stroke victim to follow directions if they cannot see or follow something they can see. If a survivor also has proprioception and/or spatial awareness challenges, it will usually take them a bit longer to catch on to a movement or exercise. Do not give up on them. Be patient and understanding. Remember they are trying to have patience and understanding of their new “strange” body that will not do what they want it to do.

One day out of the blue, I had a client stop in a middle of a work out and explain to me that he knew there was the road with cars driving on it outside the gym and that there were people around him at the gym, but only because he knew it, not because he “saw” or “felt” them around him. The sense of his surroundings was not there. He was describing his loss of spatial awareness. I had not explained to him what that was, he just knew something was not normal in how he felt in his surroundings.

I remember the day this client began getting back his spatial awareness. He was at 18 months post stroke. He was standing on the balance disc when he stepped off the disc and said, “Wait, I need to share something.” He made a small movement with his arms close to his body as if he were making a small circle around himself with his hands and said, “It’s like my world used to stop here.” Then he reached his arms and hands out as far as he could making a large circle around his body then said, “But now it ends here.” I felt such joy for him. It was fascinating. It felt magical the way he explained it. I said to myself, “Wow, he just got his awareness back. We just experienced him getting his awareness back. This is phenomenal!” Then I thought, “Oh my God, I helped him achieve that.” I was joyfully overwhelmed in a “Wow” moment that lasted for days. It was beyond having a feeling of absolute fulfillment in my work. It remains one of my favorite moments with any client in my fitness career.

## CHAPTER 13

### Numbness and Loss of Sensations

Changes in sensation are one of the first things that people notice when they are having a stroke, particularly numbness in the limbs on one side of the body or one side of the face. Often a survivor does not remember anything but waking up in the hospital unable to move their body after the stroke. By the time we meet them, they still may not feel parts of their face when they touch it, as well as parts of their arm, hand, leg, and foot on their affected side.



I had the incredible experience of being with a client when he was in the middle of an exercise and he stopped and said, “The sensation just came back in my hand.” Currently, he was about two years post stroke, and he was able to do a plank while using two BOSU® balls. He had his hands holding onto one BOSU® ball as his feet were on the other BOSU® ball balancing in a plank. He stopped and said, “My feeling just came back in my hand.” I asked him, “What do you mean?” He said, “I knew my hand was holding onto the BOSU® ball, but I never felt the sensation of touching it before now.” We then walked to the front desk of the gym, and he got a water bottle out of the fridge and said, “I can feel the water is cold. I usually know I am holding the water bottle, but I had no idea the feeling of touching the bottle or the sensation of the hot or cold.” This is known as cutaneous sensation. Cutaneous senses include touch and everything else we feel through our skin such as temperature, texture, pressure, vibration, and pain. These receptors also sense whether the surface is hot or cold. This was a powerful moment.

## **CHAPTER 14**

### **The Importance of Posture**

The client in my first book was an artist. He spent a great deal of his life with his rounded shoulders and his head forward. This is known as Kyphosis posture, and it contributed to the rotator cuff injury he had. He had many challenges when we began training together. He was six months post stroke and in a walker. He also had a rotator cuff injury that he had before he had his stroke.

We had some work to do to correct this, but it is impossible to rehab a shoulder properly if the thoracic spine and shoulder girdle are not staying in proper alignment. The stabilizing muscles of the body must be strong enough to stabilize the rib cage, diaphragm, and thoracic spine. This proper posture is necessary to keep the shoulder girdle in proper alignment, so the rotator cuff muscles can heal and rebuild correctly to keep the shoulder stable. This then leads to the head being able to stabilize in proper alignment. Poor posture causes the body to have mechanical deficiency and slow down motor control. It can cause physiological and neurological stress. Rounded shoulders and poor posture also affect the thoracolumbar fascia.

In addition, we were dealing with the effects of the stroke that left his arm feeling weak, heavy, numb, and not taking commands from the brain for movements like it used to do.

We would work on the shoulder a bit, but there was not enough movement and stability to do this yet. He did go to the physical therapist for this in the beginning, but it was not working because he did not have the stability and strength in his core to hold his body upright in the correct posture to rebuild it. The body has a shoulder girdle and a shoulder joint. They are two different things. If the shoulder girdle is not held in its proper position for shoulder stabilization, the shoulder joint movement will be faulty. I wanted to build the body with proper mechanics for whole body performance and to avoid injuries now and in the future. Poor posture and body mechanics slow down motor control. We needed to speed up his motor control and not slow it down.

After a year of working together, he had gained enough core strength and stability that when he went back to the therapist for the rotator cuff injury, it had begun to heal properly. I strongly believe it was because by that time, his core was

strong enough that he was able to hold his shoulder girdle in proper alignment. This allowed the therapy exercises to work.

If someone does not have strong enough stabilizing muscles to hold the body upright, the shoulders are not going to be able to stay in proper alignment. It is biomechanics of the body. It is like piling a stack of boxes on top of one another. If the bottom box is half-full and unstable, everything that stacks on top begins to sink into the bottom box. They are unstable and out of balance, therefore they are unsafe and may fall.

When the head is balanced on the body correctly, we have better balance. If the core and rib cage are unstable, the shoulders cannot sit strongly in proper placement. Sitting on machines and working the upper back is not the cure for poor posture. It is important to strengthen the muscles at that angle as well, but there is more to it, as I just explained. It is crucial to understand muscle facilitation and recruitment patterns for the entire body. If posture is corrected, a client can do their exercises in the proper position and remain injury free. This also means when they exercise chest, biceps, and triceps, they will be in their correct position. They can now do some functional exercises and can build up healthy recruitment patterns throughout the body without creating an injury or malfunction.

In the third picture you can see there is something on his hat. I sometimes use a small bean bag and place it on a client's head, to help him or her stand up tall. I use this often when helping clients walk. Not only are they focusing on keeping upright, so they do not drop the bean bag, but it also gives them a sense of where their head is in space, spatial awareness. This is done when I know they are safe to do it. See my YouTube channel (Tracy L. Markley Fitness) for a notable example of the bean bag guiding a survivor to stand up tall when trying to walk. You will notice he had the awareness to where his head was in space by feeling the bean bag on his head and the body's "natural" instinct of not wanting it to fall off.



*Two years of posture changes shown as he is standing on the balance disc.*

*The Power of The Spine, How Back Strength and Posture Pilots the Entire Body*  
by Tracy L. Markley – Anatomy Book

*Dear Stroke, You Suck the Journey of a Fitness Trainer and a Stroke Survivor*  
By Tracy L. Markley

## CHAPTER 15

### **Leg Stability and Walking Gait Including AFOs, Foot Drop and Turn Out**

Many stroke survivors who have a foot drop are sent home wearing a leg brace on the lower portion of the leg on the affected side. These braces are called *Ankle Foot Orthosis*, known as *AFOs*. They are to keep the lower leg, ankle, and foot stable enough for walking as well as controlling the foot drop and turn out, after a stroke.

The problem I have found personally with survivors is that it limits that part of the leg to recover. Repetitive and consistent movement and use to the area needing recovery will not take place if the brace is on forever. Depending on the strength of a client and their ability, I will ask them to remove it (if they are comfortable), so I can access the foot movement and their whole-body strength and weakness with it off. If it is possible and safe for the client, I will have them train under my watch of course, without their AFO on and have them continue to wear it when they know they need it for safety. All my clients have done away with the AFO and regained a proper footstep and walking gait.

I give the client an option to remove it. I do not tell them they have to. I explain to them that it will limit the recovery of all that is needed for the proper use of that lower leg and foot usage to come back. Always be sure **safety** is the first concern. Not all survivors are ready to do this or can do this. Make your decision based on the strength of the rest of their body, coordination and walking and/or standing ability.

If you have heard me speak live, in videos or read my books you know that I highly recommend studying the biomechanics and movement of the human body as fitness professionals. Working with the foot drop condition is a perfect example why. The movement of the foot and lower leg in walking is not just based on the foot. It requires a stable pelvic, which comes from a strong core and proper posture

as well as some of the leg muscles. In the next few pages, you will find many illustrations.

I am not a physical therapist, but I have found as I researched and in personal experience training with many stroke survivor clients, the brace does to help build any functional, structural strength needed to fix the problem. It limits recovery of the muscles needed to fix the condition. The next several pages will show muscles and exercises for helping with leg stability, walking gait and foot drop and turn out and hyperextended knee.

Through all the exercises and time, you spend with the survivor in sessions, watch them closely as they stand and sit. Remind them not to slouch in poor posture with the recovery leg falling out to the side and foot turned out. This is teaching them to have awareness of where the foot is in space and what it is doing. They will have a harder challenge, if the rest of the day they continue to hold that foot and their posture in the position they are trying to fix when upright, standing and walking.

The body gets stronger in the movements and positioning it repeats most often. When there is a foot drop and leg turn out, it puts an imbalance up to the hip and to the spine. This is just as important to understand as knowing that having stable core and pelvis help keep the hips, knees, and feet in better alignment for best performance. Survivors need to be conscious (if they are able) of what the recovery leg and foot are doing as often as possible. In time, if they constantly remind themselves, they will begin to be aware. They will be able to move properly without thinking about it.

All the exercises combined can help bring walking gait to normal. Of course, doing them consistently and repeatedly is necessary.

As the fitness professional, it is best for us not to refer to the recovery leg as the “bad leg” as well as encouraging the survivor to be kind to the affected side. As mentioned in the communication chapter, we should encourage the survivor to be kind to the affected side.

## Hyperextended Knee and Foot Drop

A hyperextended knee is when the knee is pushed past its normal range of motion bypassing the straight position. This can be common for many stroke survivors. The exercises in this manual and my videos can help fix a hyperextended knee. **BUT the CORE MUST BE STRONG TO STABILIZE THE PELVIC GIRDLE AND HIPS.** I put that last sentence in bold because if the core is weak, the hips and pelvic girdle will be weak and unstable when sitting and standing. There is less chance that the knee will heal in those circumstances.

If the hips are not positioned properly, the knee cannot be properly positioned to perform the proper movements. I mentioned earlier in the course.

**Popliteus:** Attaches at the femur and the tibia. It flexes the foreleg and rotates it inward. It helps at unlocking the knee so that it can flex.

Foot drop is also known as drop foot. I also refer to it as foot drop and leg drag. This is when it is difficult to lift the front part of the foot. The exercises in this manual and my videos can help fix foot drop. **BUT THE CORE MUST BE STRONG TO STABILIZE THE PELVIC GIRDLE AND HIPS.** I put that last sentence in bold because if the core is weak, the hips and pelvic girdle will also be weak and unstable when sitting and standing, and the foot drop cannot successfully heal.

Movements that lift the foot off the ground for taking a step begin in the hips and upper legs, not the foot.

## Movements of the Hip and Knee Joints

### *The Hip*

The hip is a ball and socket joint. These joints allow multidirectional movement and rotation.

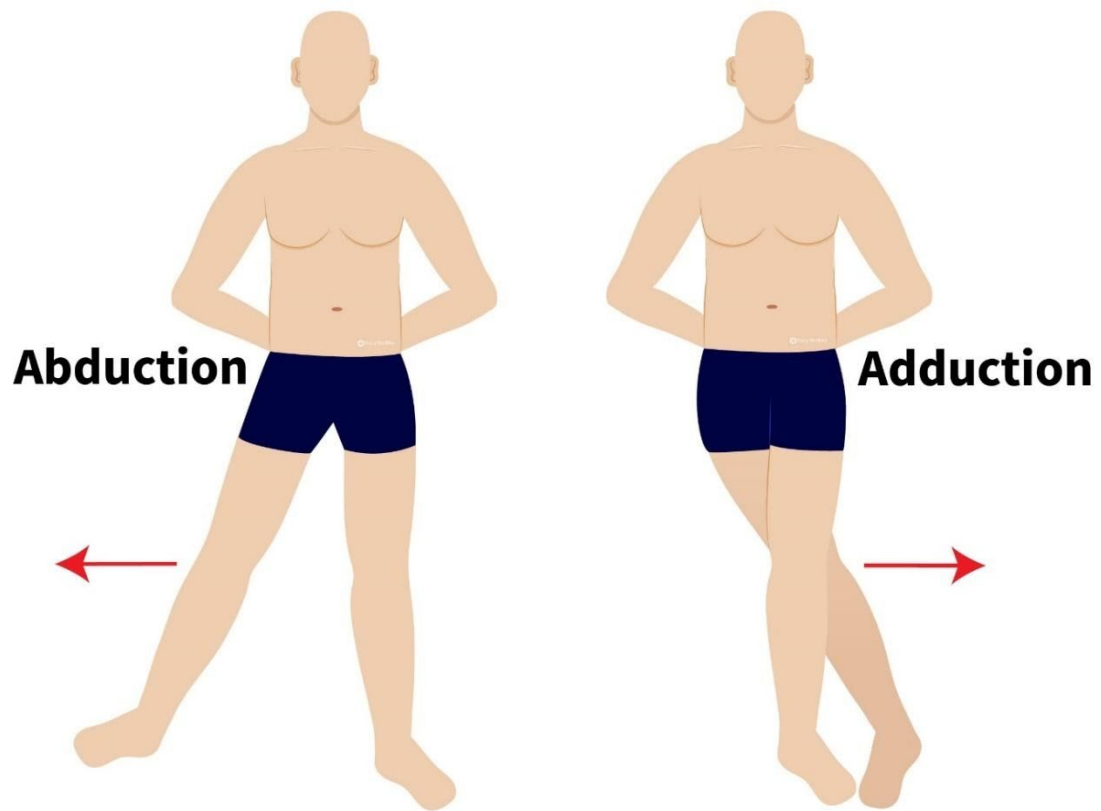
**Extension**



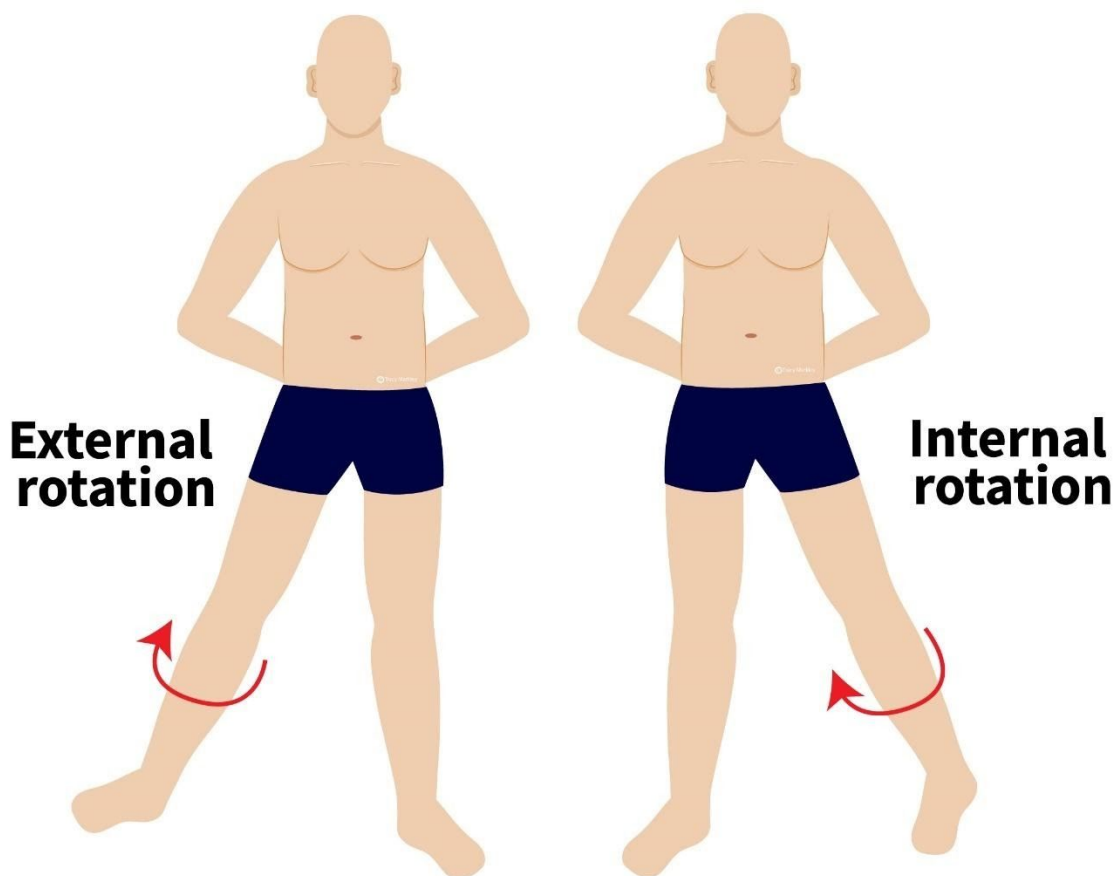
**Flexion**



**Hip flexion and Extension**



**Hip Abduction and Adduction**



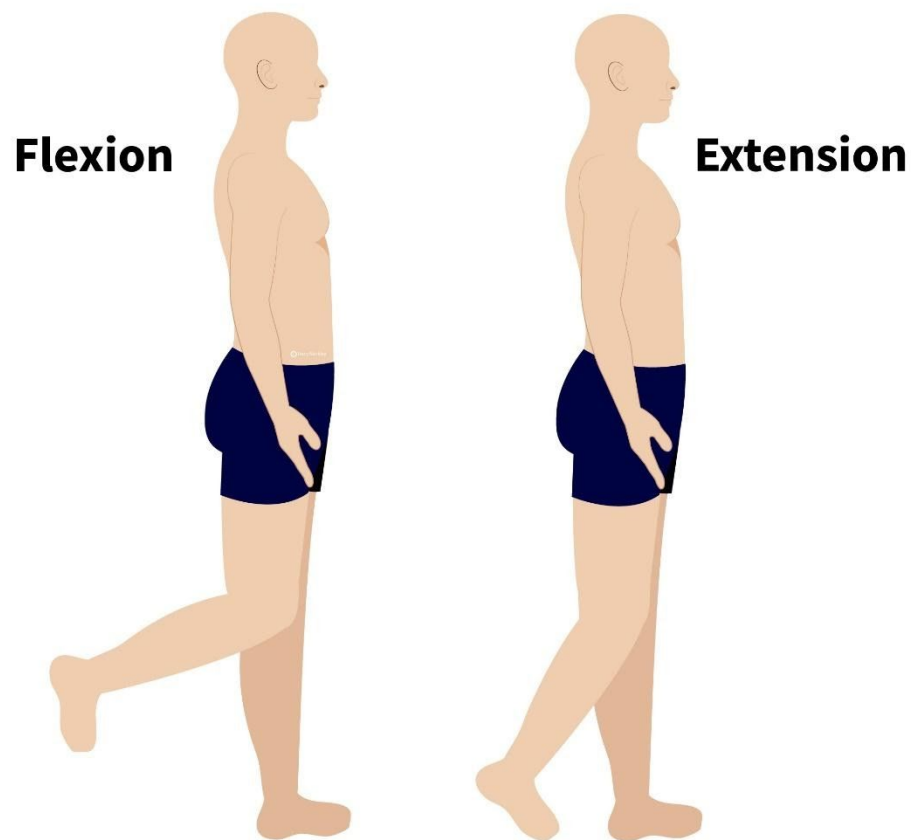
### ***Hip External and Internal Rotation***

The hip/joint also moves in **circumduction**. This is moving the leg in a circular motion. To perform this circular motion, **it requires flexion, extension, abduction, and adduction of the hip.**

Notice the foot positioning as the hip performs each movement. Stabilizing the core, pelvic, and hips is essential to fix the leg, knee, and foot challenges after a stroke.

## ***The Knee***

The knee joint is a hinge joint, and it allows the leg to extend and bend at the knee.

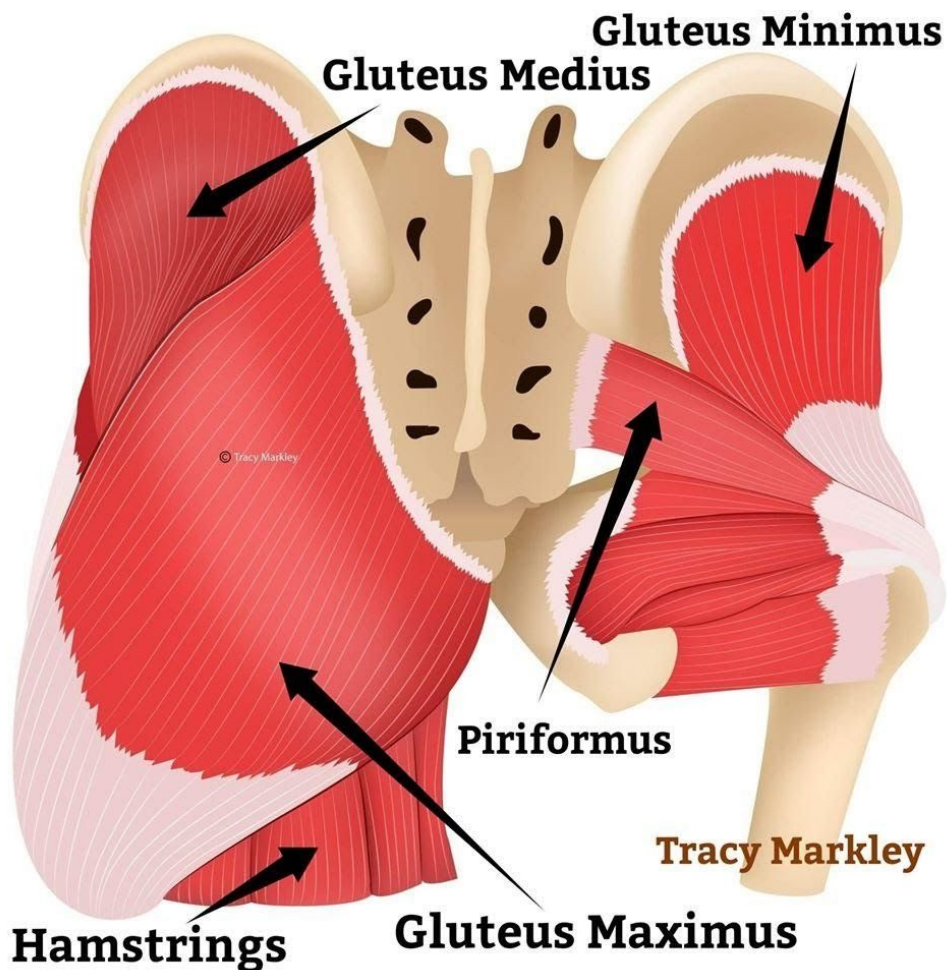


### ***Knee Flexion and Extension***

***Knowing the muscles involved in a movement helps us as professional choose and create the specific exercises needed for each individual survivor to regain movements back.***

The hips, pelvic, and the trunk of the body need to become strong to hold the body upright in the proper posture for the legs and arms to move freely through the many ranges of motions and movements they were made to perform.

As you look at the different hip movements in the illustrations in the previous pages, you can see that if the hips are not stable, these movements will be harder to perform at their full range of motion needed for walking and other everyday activities.



In the gluteus illustration, you will see the large glute muscle and the smaller muscles that are underneath. The large glute muscle extends the femur, which is the backswing of the leg while walking. It also rotates the femur outward. The smaller group of muscles work together to rotate the femur outward. The femur is the large upper leg bone.

We have a **gluteus maximus**, **medius**, and **minimus**. The **gluteus maximus** extends the femur and rotates it outward while the **gluteus medius** and **minimus** abducts and rotates the femur inward.

The glute muscles are immensely powerful. In walking, they complete the backward movement of the step. When someone has “saggy butt,” meaning, weak, non-toned, or non-strengthened glutes, this shows that the glute muscles are not performing their primary function in walking.

If the spine and back muscles are weak and there is poor posture, the hips and pelvic will not be strong and stable enough to allow these muscles and other muscles like the **piriformis** and the other hip rotator muscles that you see in this illustration to work properly. This leaves the spine and back muscles to try to assist in these muscles’ jobs, leaving the body trying to function and move out of balance, causing pain, weakness, and injury in the back as well as hips, knees, and ankles. Therefore, posture is essential.

As you continue through this manual, you will see other muscles involved in walking. Studies show that over 70 percent of the body’s muscles are involved in walking.

**Gluteus Maximus:** Attaches at the ilium and sacrum and to the femur. It extends and rotates the femur outward.

**Gluteus Medius:** Attaches at the ilium in a twist to the femur. It abducts and rotates the femur inward.

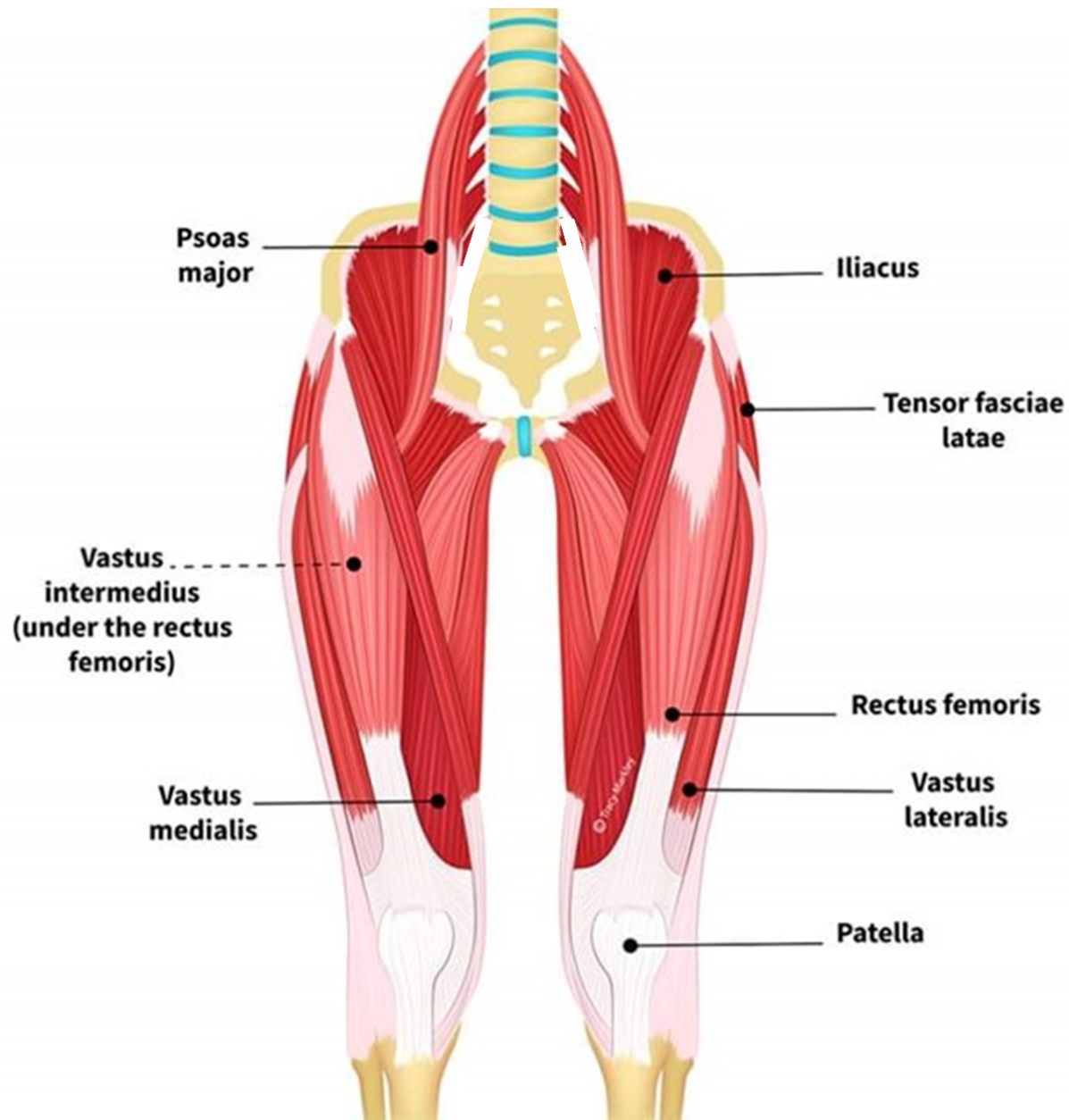
**Gluteus Minimus:** Attaches at the ilium in a twist to the femur. It abducts and rotates the femur inward.

**Piriformis:** Attaches at the ischium and the sacrum and to the femur. It rotates the femur outward.



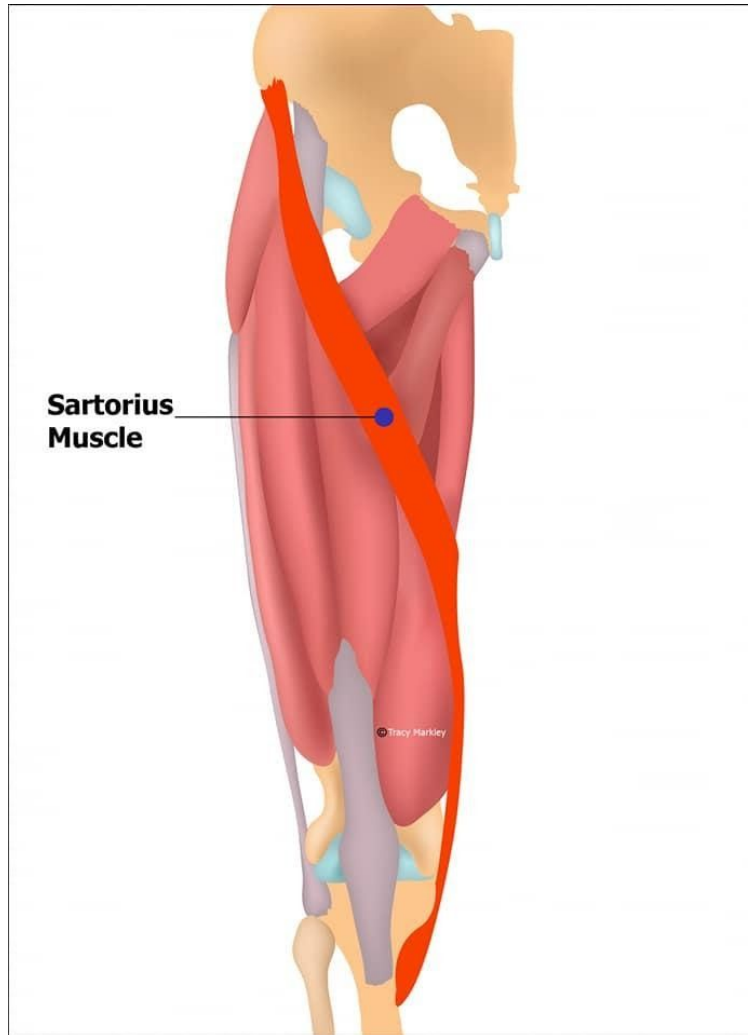
### ***Reminders and tips.***

When the hip is rotated out, this is when the foot turns out. Correcting the foot turn out, foot drag, and foot drop begin in the hips.



There are four quadriceps muscles. They are the **vastus intermedius**, **rectus femoris**, **vastus medialis**, and the **vastus lateralis**.

They are muscles of the front of the thigh. *The quadriceps help raise and push forward the thigh and leg while walking.*



The **Sartorius** is the longest muscle in the body. It attaches to the front of the ilium, crosses over the medial side of the thigh, and from the knee to the front of the tibia. Although it is an anterior muscle, it inserts into the tibia from behind the knee, and it flexes the foreleg. It also flexes, abducts, and laterally rotates the thigh at the hip. The more survivors, caregivers, and professionals know about the muscles of the body and the movements they perform, the better chance they have in strengthening the body appropriately to help in further and stronger recovery. The **sartorius** helps to lift the leg in taking steps while walking.

Did you know that having any or all these muscles tight or the fascia locked up around these muscles can add to shoulder, hip, knee, foot, and back pain as well as add to movement issues? Remember that the fascia intertwines through the whole body. When fascia is tight, locked up, or stuck (there are many ways to describe it)

anywhere in the body it can cause havoc, causing pain and/or limiting movement somewhere else in the body. See *the Spinal Engine and Working Through the Fascia Lines Theories* chapter in this manual.

**Rectus femoris:** Attaches at the ilium and to the tibia through its attachment at the patella. It extends the foreleg.

**Vastus intermedius:** Attaches to the femur and the tibia through its attachment at the patella. It extends the foreleg.

**Vastus medialis:** Attaches to the femur and the tibia through its attachment at the patella. It extends the foreleg.

**Vastus lateralis:** Attaches to the femur and the tibia through its attachment at the patella. It extends the foreleg.

**Sartorius:** Attaches at the ilium and crosses over the medial side of the thigh behind the knee, then attach at the tibia. It flexes the foreleg. It is also in the group of hip flexor muscles. This is the longest muscle on the body.

**Popliteus:** Attaches at the femur and the tibia. It flexes the foreleg and rotates it inward. It helps at unlocking the knee so it can flex. The **popliteus** is shown in a later illustration in this book.

**Tensor Fasciae Latae:** Attaches to the ilium, patella, and tibia. It flexes and abducts the femur.

**Tibia:** is one of the two lower leg bones. The other is the **Fibula**. The **Tibia** is the larger of these two bones

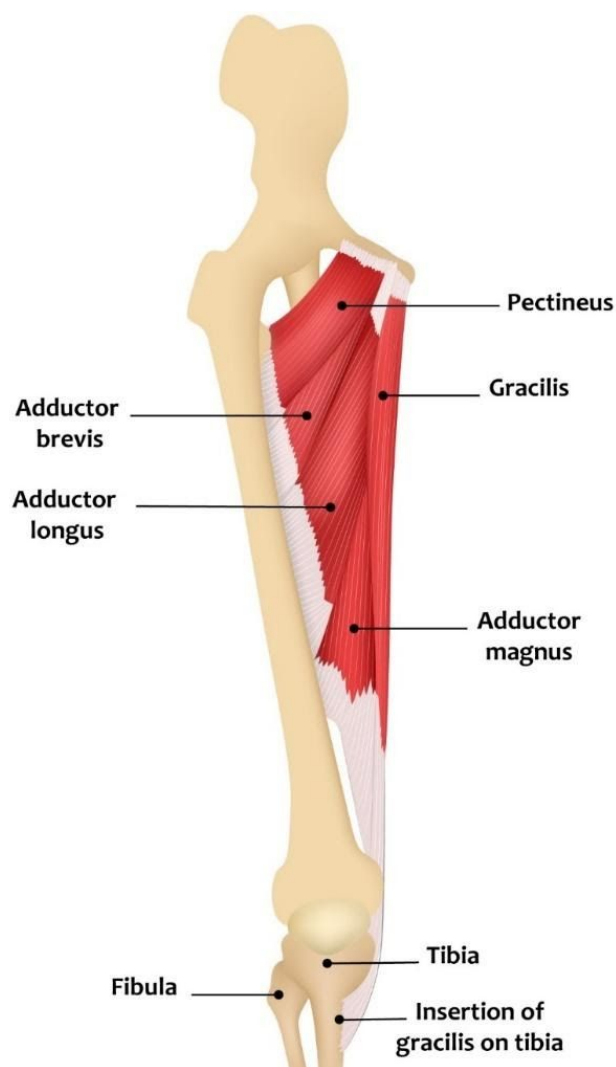
**Fibula:** is one of the two lower leg bones. The other is the **Tibia**. The **Fibula** is the thinner of these two bones.

**Ilium:** is the largest part of the hip bone and the upper part of the hip bone.

**Ischium:** is the posterior/inferior area of the hip bone. It supports the body while sitting.

**Quadriceps:** means four heads.

**Patella** is the kneecap bone.



**Pectineus** attaches to the pubis and to the femur. It flexes the femur.

**Gracilis** Attaches to the pubic bone and goes behind the knee and then attaches to the front of the tibia. It adducts the hip, flexes the knee, and flexes the foreleg.

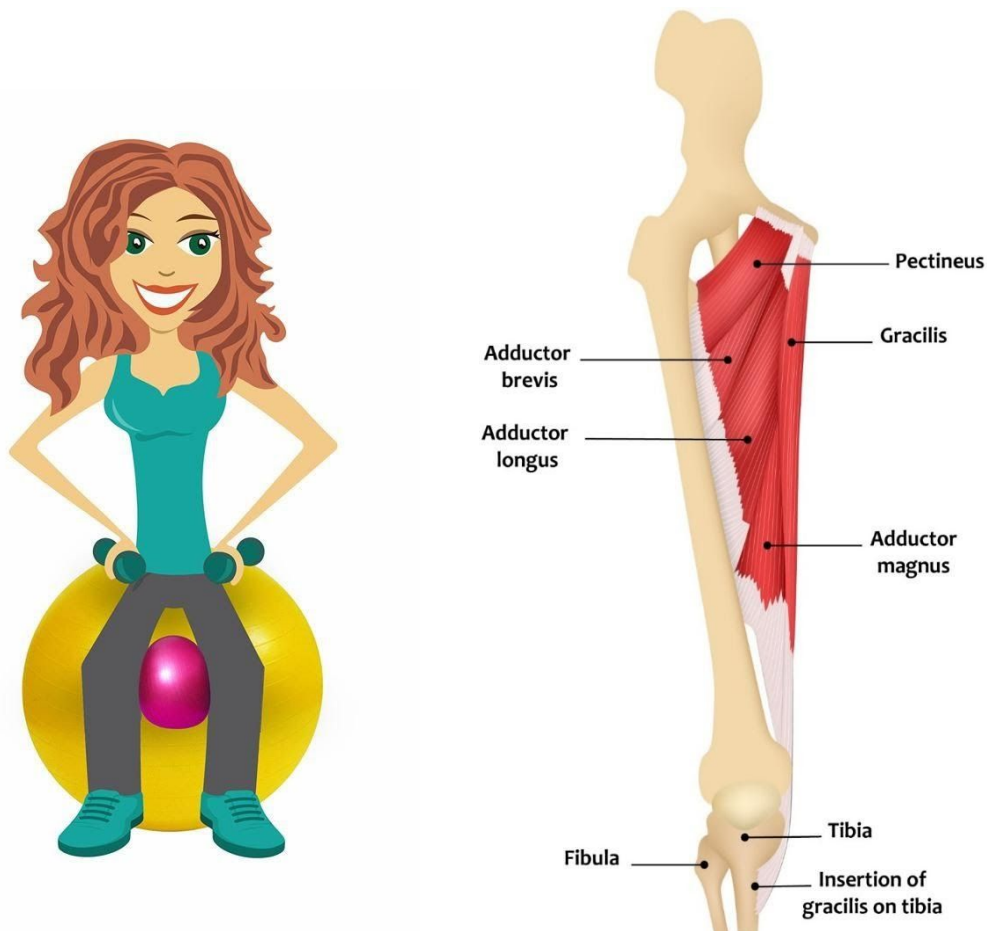
**Adductor Magnus** attaches to the pubis, ischium, and the back of the femur.

**Adductor Brevis** attaches to the pubis and femur. It adducts the femur.

**Adductor Longus** attaches to the pubis and the femur. It adducts the femur.

**Adductor Minimus** (NOT shown in illustration) It attaches to the pubis and the femur and adducts the femur.

All adductor muscles in the thighs pull the legs toward the middle of the body when walking. This helps maintain balance.

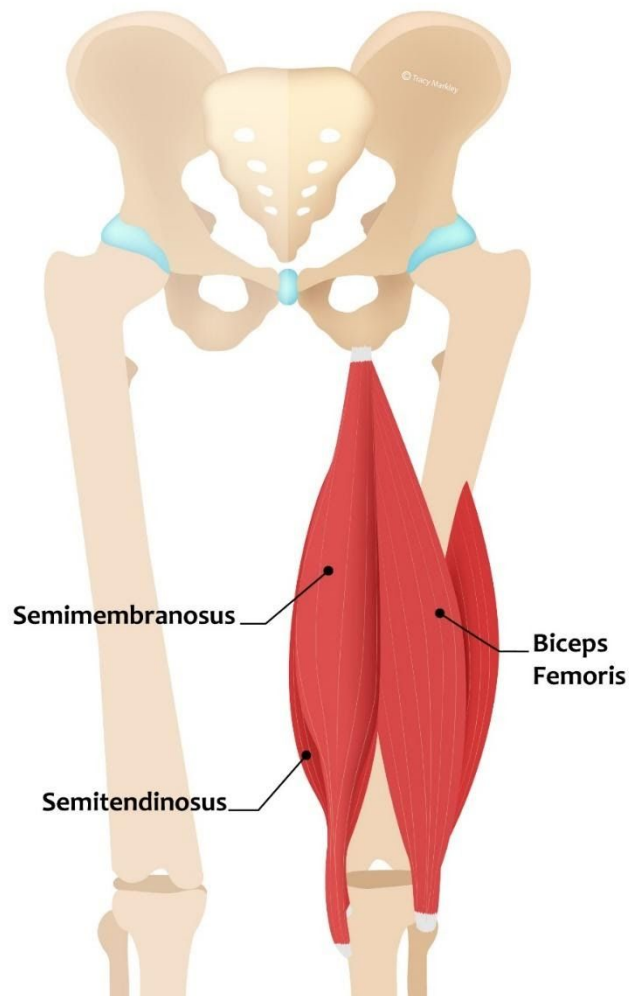


See my books *Tipping Toward Balance, A Fitness Trainer's Guide to Walking.* by Tracy L. Markley

*Stroke Recovery, What Now, When Physical Therapy Ends, But Your Recovery Continues,* by Tracy L. Markley. This book includes several exercises for walking, balance, back strength, posture, and stroke recovery.

*Stroke Recovery, Leg Stability and Walking Gait,* by Tracy L. Markley

# *Hamstrings*



The hamstrings are on the back of the legs. They move the leg backward in walking steps. When the glutes are weak, the back and/or the hamstrings will try to do the glutes' job. This causes and maintains imbalances and injury. It will limit a stroke survivor's recovery in walking.

**Biceps Femoris:** This muscle has a *long head* and a *short head*.

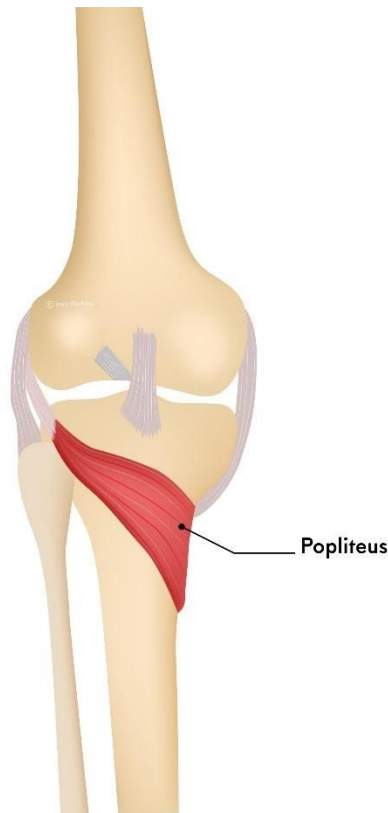
**Short head:** attaches to the back of the femur and the fibula. It flexes the foreleg (lower part of the leg) and rotates the foreleg outward.

**Long head:** attaches to the ischium and the fibula. It flexes the foreleg (lower part of the leg) and rotates the foreleg outward.

**Semimembranosus:** Attaches to the ischium and the tibia. It flexes the foreleg (lower part of the leg) and rotates the foreleg inward.

**Semitendinosus:** Attaches at the ischium and the tibia. It flexes the foreleg (lower part of the leg) and rotates the foreleg inward.

**Popliteus:** This is a small muscle. It attaches to the femur and the tibia. It flexes the foreleg (lower part of the leg) and internal rotation of the knee joint. This muscle unlocks the knee joint, bringing it from a straight position by helping to bend the leg at the knee joint, which is important for walking.

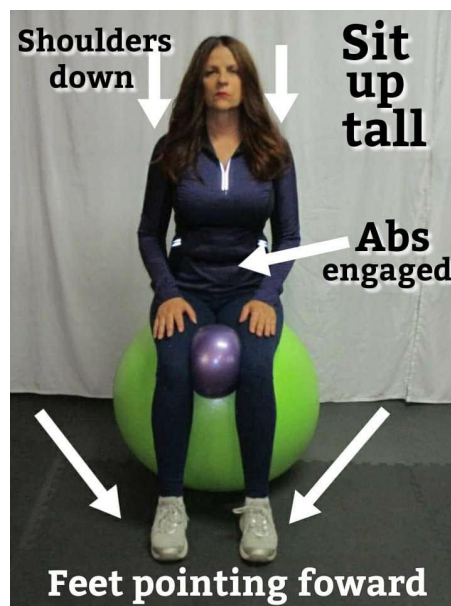


The next section will show more of the lower leg muscles and the ankle and foot movements.

## **Sitting on a Stability (Swiss) Ball Or Sit in a chair or therapy bench.**

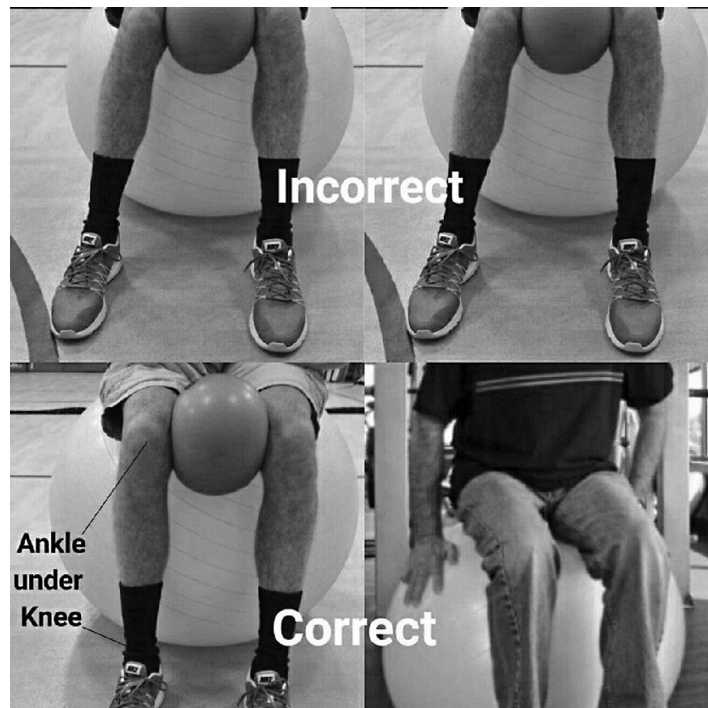
*The instructions listed are what the trainer needs to direct to the survivor.*

- Be sure the ball is firm.
- Be sure the ball is the right height. (Hips should be level with the knees. Do not sit on a mushy ball or on a ball where the hips are below the knees.)
- Sit on the ball so that legs are as close to the ball as they can be without touching it.
- Keep the knees directly over the ankles. This means the shin bone will be in a straight line from the ankle to the knee. Think of table legs coming directly out of the table joint, which allows the table leg to be positioned straight up and down.
- Do not let the knees fall in or fall out, and do not squeeze the legs together.
- Anchor the feet into the floor.
- Engage the pelvic floor (if possible), without engaging the glutes (not squeezing the butt muscles).
- Engage the core like they are putting on a snug girdle.
- Stack the shoulders over the hips.



In the beginning, a survivor may feel that there are too many things to remember. That is okay, it is normal. Keep them focusing from head to toe. This will help their body and brain regain better communication consciously, which will

help rebuild the communication subconsciously, as they strengthen the muscles in their spine and core. **Remember** as the trainer, at certain times in survivor's recovery, we are acting like their second brain and reminding them to give their brain the commands needed.



A survivor's stroke affected leg may fall out to the side and they may not be able to hold the ball between their legs without assistance from their own hand or a professional. I like to have the survivor sit near a wall in a chair. I then place a ball between the wall and the affected leg. Then they can use another ball between the knees to do the exercise the best they can.



*This picture is a bird's eye view of using both balls near a wall.*



In the pictures above, you can see that he is sitting with his upper body in a twist, and the left foot is turned out. A survivor's body may want to do this automatically but work on keeping the proper positions with the feet and posture as in the previous picture with me illustrating the proper setup.

This is a perfect example to see what we as trainers need to watch for in form and correct them. We must remain focused while training them.



### *Reminders and tips.*

- Remember when a foot turns out, it turns the leg out up to the hip and pelvic. This leaves the hips, pelvic, and spine in an uneven position. they want to build the body **evenly**, for proper mechanics, not “unevenly” for poor mechanics.
- Remember, studies show that when the body is in proper posture, all the systems work better.



This is a picture of my 86-year-old stroke survivor. Notice he is next to the bar to grab, has a bean bag on his head to help hold his head and spine in good posture. His wife usually stands right behind him, but she did like being in pictures. I also have a free weight in the ground directly behind the ball, so it will not roll backwards.

## ***The Foot and Ankle***

It is common for stroke survivors to have challenges with walking. One of the challenges is trying to recover things such as drop foot, spasticity, numbness, and more. Some survivors experience their toes curling up in spasticity. If a survivor has this, it interrupts exercises and will limit them in certain exercises. This can cause them to be unbalance and feel unstable. **Safety first!**



## **Inversion**



## **Eversion**

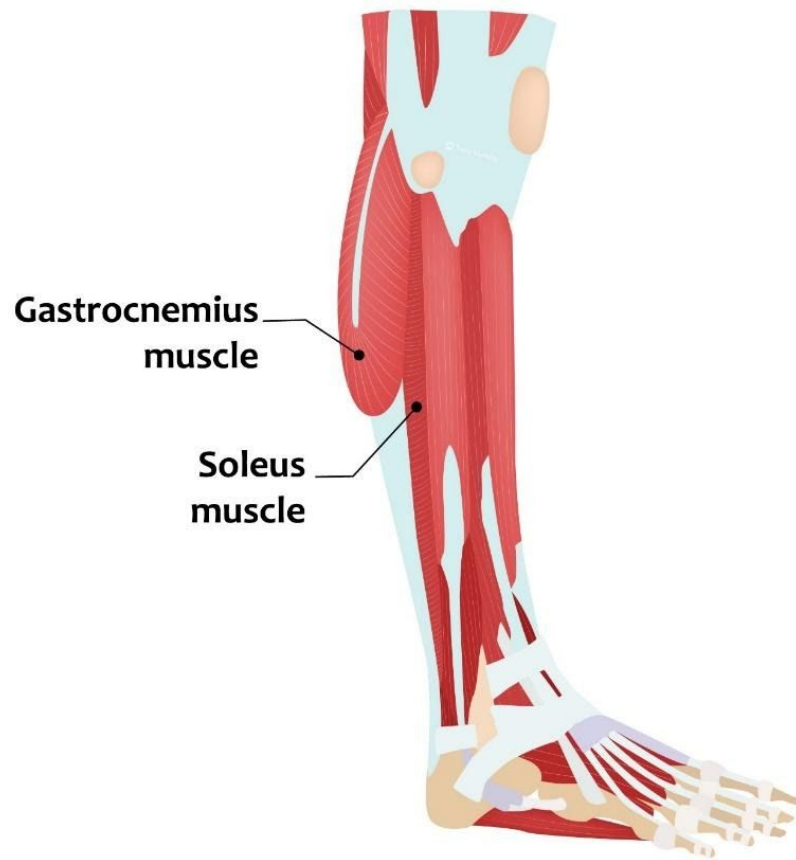


Remember if a survivor is only performing exercises to work the lower leg muscles to move the foot in these different movements, it will not create the complete movements needed to lift the leg, bend the knee and take a step for walking. The core and trunk of the body must be strong and stable to keep the hips and pelvic in proper alignment. This is essential to support the body so that the muscles that flex and extend the hip, thigh, knee, and foot can perform the movement that takes a step to walk.

**It is extremely important that survivors wear shoes with good ankle support.**

**No old shoes or loose sloppy shoe tongues and laces. The feet and ankles need to be in a stable position. If they are in inversion or eversion it will make recovery more challenging.**

**Unstable and unsupported shoes will affect feet, ankles, knees, hips, back and posture.**



**Soleus:** Attaches to the back of the tibia and the back of the calcaneus. It extends the ankle and foot.

**Gastrocnemius:** Attaches to the back of the femur and the back of the calcaneus. It extends the ankle and foot.

**Calcaneus:** The heel bone.

**Malleolus:** A bony part on the side of the ankle

**Plantaris:** Attaches to the back of the femur and the back of the calcaneus. It extends the ankle and foot. This muscle is not labeled in the illustrations in this book.

**Flexor Hallucis Longus:** Attaches to the back of the fibula and goes behind the ankle and under the foot to the end of the big toe. This toe is known as the toe

number one. It extends the ankle and foot. This muscle is not labeled in the illustrations in this book.

**Flexor Digitorum Longus:** Attaches to the back of the tibia and goes behind the ankle and under the foot to the end of four of the five toes. It does not attach to the big toe. It extends the ankle and foot. This muscle is not labeled in the illustrations in this book.

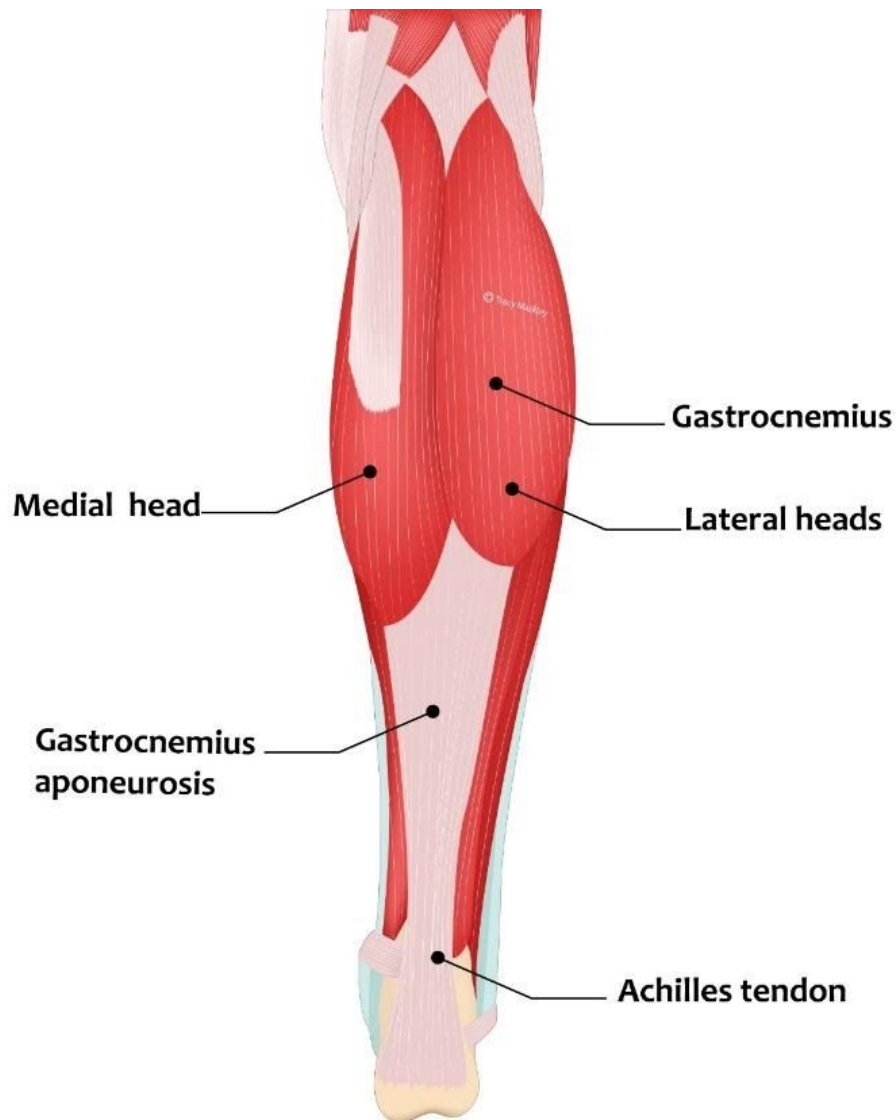
**Tibialis Posterior:** Attaches to the back of the tibia and goes behind the **malleolus** and under the foot to the three middle metatarsals. It extends and adducts the foot. This muscle is not labeled in the illustrations in this book.

**Peroneus Longus:** Attaches to the **fibula** and goes behind the malleolus and under the foot to the base of the big toe. It extends and abducts the foot. This muscle is not labeled in the illustrations in this book.

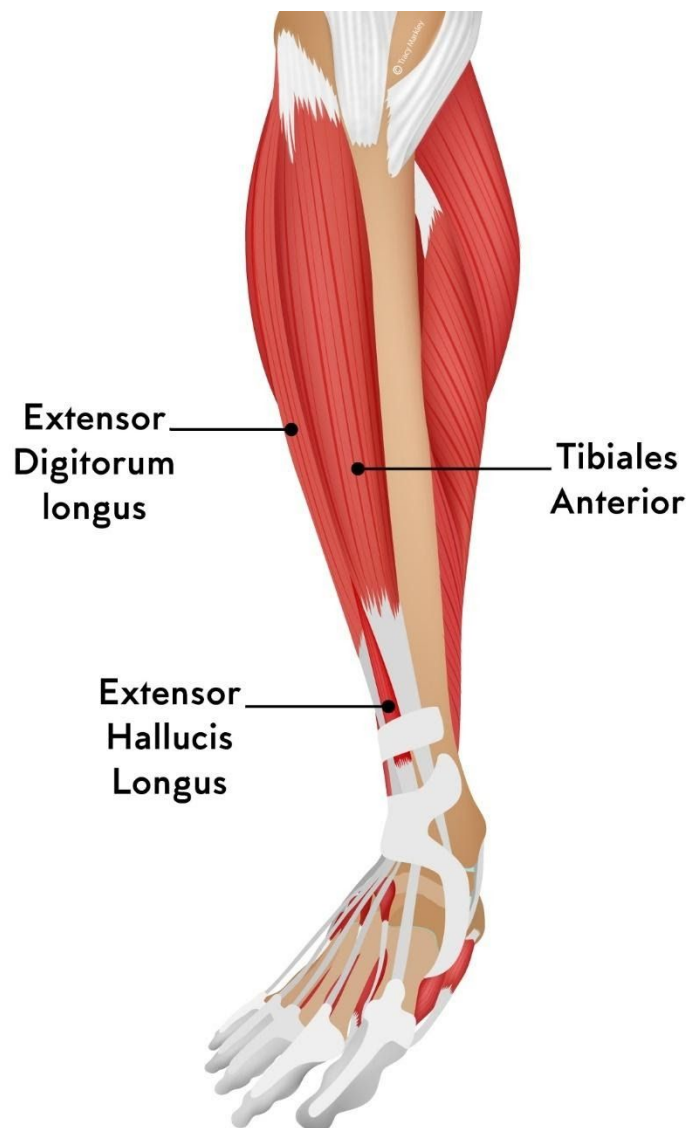
**Peroneus Brevis:** Attaches to the fibula and goes behind the malleolus to the base of the pinky toe. It extends and abducts the foot. This muscle is not labeled in the illustrations in this book.

**Extension** of the ankle and foot is when we stand on our tiptoes. It is also the position when we are sitting down and pointing the toes away from the body.

**Flexion** of the ankle and foot is when we are standing flat on our feet. It is also positing when we are sitting down, pulling the toes toward the body.



Did you know that having tight calves can add to shoulder, hip, and back pain, as well as movement issues? Remember that the fascia intertwines through the whole body.



At the front of the lower leg, there are the tibialis muscles. These raise the foot as one takes a walking stride. They keep the foot up so that it does not scrape the ground in steps. Walking and practicing walking helps keep these muscles strengthened for walking. Not all leg muscles are shown in this illustration.

**Tibialis Anterior:** Attaches to the front of the tibia and the base of the long bone behind the big toe. This would be the metatarsal number one; it flexes and adducts the ankle and foot. This muscle is not labeled in the illustrations in this book.

**Extensor Hallucis Longus:** Attaches to front of the fibula and the end of the big toe. It Flexes the Ankle and foot. This muscle is not labeled in the illustrations in this book.

**Extensor digitorum Longus:** Attaches to the front of the fibula and the ends of the number two to five toes. It **does not** attach to the big toe. It flexes the ankle and foot. This muscle is not labeled in the illustrations in this book.

**Peroneus Tertius:** Attaches to the fibula and goes in front of the ankle to the base of the long bone above the little toe. It flexes and abducts the ankle and foot.

*The reason for sharing all the different muscles is to teach why it can take many different exercises to help recovery the challenges of the leg and foot in walking.* Remember, as I mentioned, recovery is not a simple list of just a couple of “cookie-cutter” exercises. Any, all, a few, or just one of these muscles can have spasticity and/or the pathways from the brain to the muscles not communicating properly to complete a movement.

Therefore, finding simple answers for exercises to help foot drop and other foot movements after a stroke can be confusing. Every survivor may need something a bit different for them to see progress.



### ***Reminders and tips.***

- The calf muscles are commonly known as the **soleus** and **gastrocnemius**. Some studies say they are among the most heavily used muscles when we take a step.
- Sit down; calf raises isolate the soleus more.
- Stand up; calf raises isolate the gastrocnemius more.

## **Exercises That Help Fix Foot Drop**

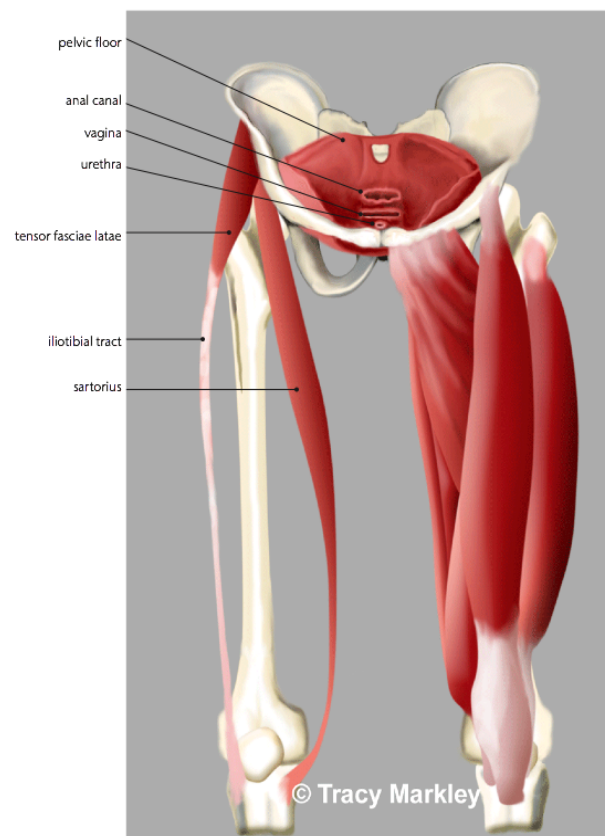
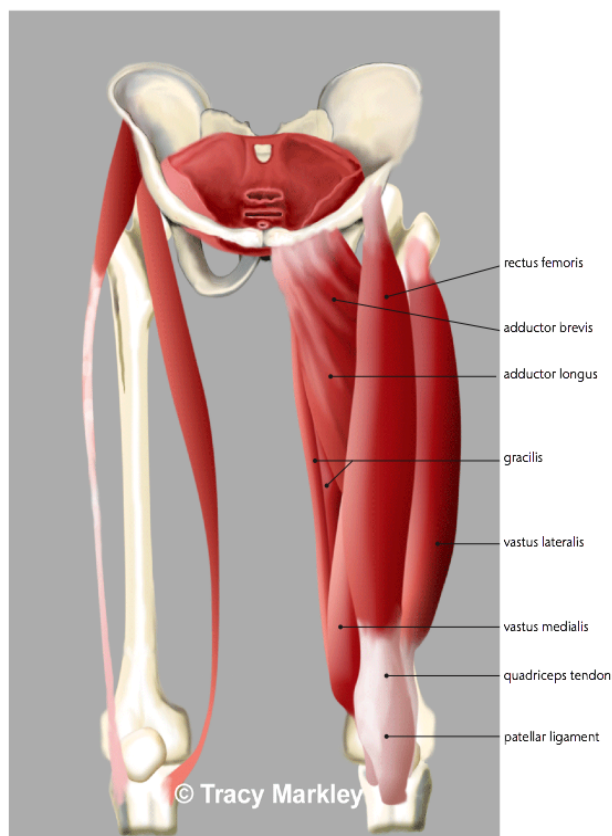
- Sitting on ball with smaller ball between the knees.
- Core/hip stabilization, as shown through the course.
- Standing on disc/BOSU® ball stepping up and down.
- Leg extension. Performing the exercise through the top 1/3 of the full extension.
- Taking side steps. This can be done holding a band on a bar or the Anchor Point Training bands. The Anchor Point Training bands with the neuro handles are my favorite. They are excellent to use with stroke survivors. They help bring more stimulation throughout the fingers, hand, and arms. This encourages recovery.
- Calve raise in proper positioning. Both siting and standing.
- Being aware of foot and hip placement while standing sitting and walking.

**It is extremely important that survivors wear shoes with good ankle support. No old shoes or loose sloppy shoe tongues and laces.**

**Unstable and unsupported shoes will affect feet, ankles, knees, hips, back and posture. They will make it harder for a survivor to maintain proper foot, hips, and pelvic placement in exercises and their everyday life activities.**

A reliable resource about the AFOs

<http://flintrehab.com/2017/afos-for-foot-drop-after-stroke/>



*The above illustration is to give another visual to the muscles that need strengthened and new neuro pathways built for movement to come back.*

*If you imagine the pelvic girdle tilted to one side in the illustration you can see how all the muscles below are affected in a negative way. This will limit them from performing certain exercises that could help them gain a better recovery.*

**Posture is essential!**

# CHAPTER 16

## Spasticity

Spasticity is high tone or activity in the muscles that makes them feel stiff and tight. Muscle spasticity **will tend to get worse the less the survivor moves**. The body must move to heal from a stroke. It is important to move as much as possible. Spasticity is one of the most common post-stroke conditions. If left untreated, spasticity can cause bone and joint deformities that are painful and debilitating. More than half of all stroke survivors do not seek treatment for spasticity

### How Stroke Causes Spasticity

Muscles have a certain amount of tone, or activity. The tone of muscles is controlled by signals from the brain. If the part of the brain that sends these control signals is damaged by a stroke, then the muscle may become too active. This is called spasticity.

### Effects of muscle spasticity

Muscle spasticity can cause:

- Stiffness in the fingers, arms, or legs.
- Muscle spasms.
- Overactive reflexes.
- Uncontrollable rhythmic contractions and relaxations in the muscles that lead to jerking. This is called clonus.
- Changes in posture. They may have spasticity in the psoas or another deep core muscle affecting one side and causing their spine to curve to one side.
- Pain.

Stroke survivors experiencing muscle spasticity may have:

- A clenched fist.
- A bent elbow and arm pressed against their chest.
- A stiff knee.
- A pointed foot.
- When attempting to move the stroke affected foot or hand, the upper body contracts and or swings forward to help.
- Neck muscles and upper back tightening up.

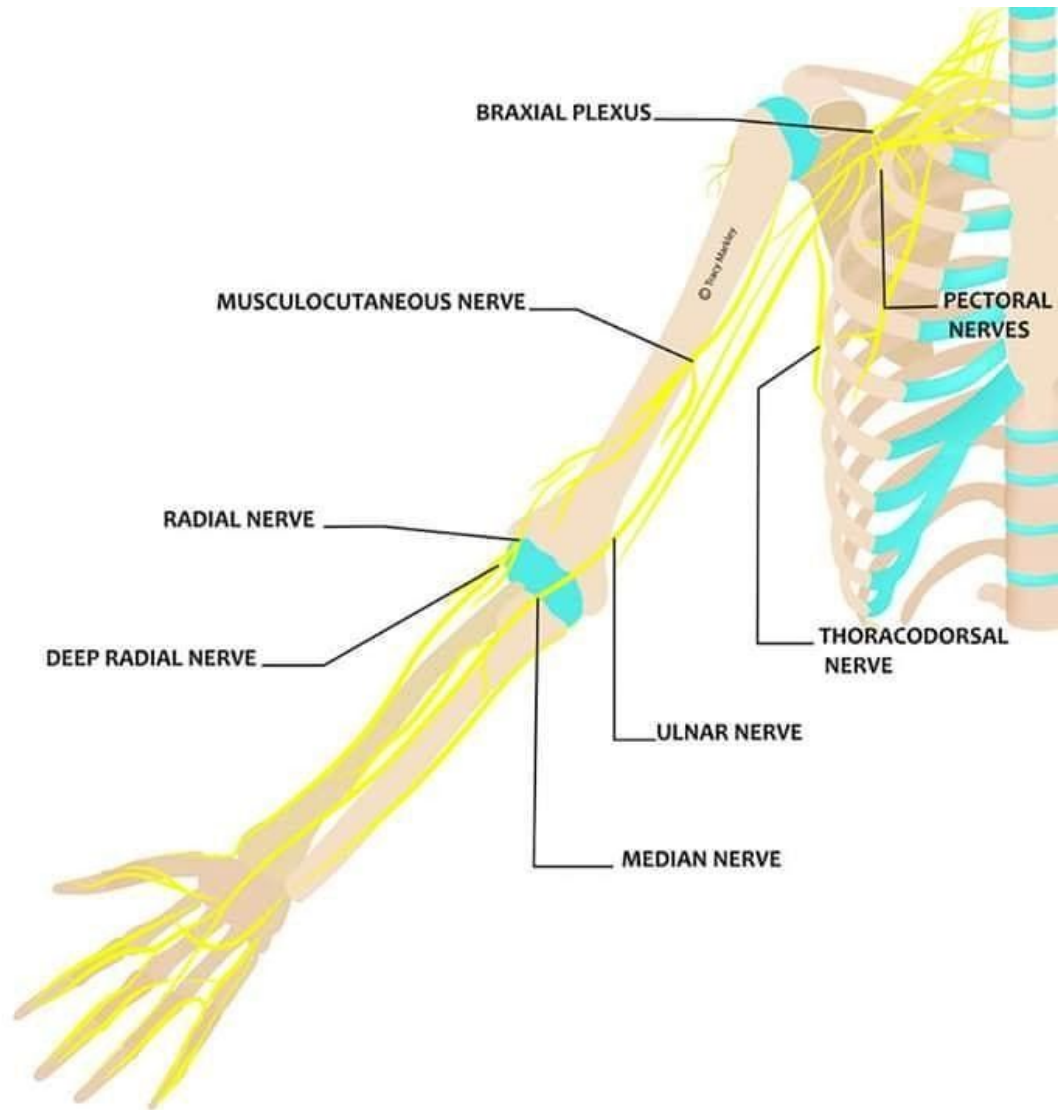
Spasticity in leg muscles can make it difficult to walk. It can affect a survivor's balance and increase their risk of falling. Muscle spasticity can also increase tiredness or fatigue because it is harder to move. This also uses more energy and will cause the survivor to be more fatigued.

Common changes to arm and hand function may include:

- **Weakness and paralysis**  
The shoulder, elbow, wrist, or hand may be weak, or they might not be able to move them. Hemiparesis is when one has weakness all the way down one side of his body. Hemiplegia is when one side of the body is paralyzed.
- **Sensation**  
Survivors might lose feeling in their arm, hand, legs (anywhere) and experience numbness or 'pins and needles.' Alternatively, they might have hypersensitivity or increased feeling, which can make even light touch painful.
- **Coordination**  
If the effected arm does not move in the way they want it to, they may have apraxia (also known as dyspraxia). This is when they have difficulty planning or coordinating movements.
- **Swelling**  
Fluid might build up in their hand or arm when it does not move as well as it used to. This is called edema.
- **Muscle tone**  
High muscle tone, called hypertonia or spasticity, makes a muscle stiff or tight. Low muscle tone, or hypotonia, makes a muscle floppy or loose.
- **Subluxation**  
The shoulder joint can become partially or incompletely dislocated. This happens when weakness or low muscle tone causes the top of the arm to drop out of its socket.
- **Contracture**
- **Muscle shortening** due to weakness or high tone can make joints less flexible, or even become fixed in one position.

References:

*The Spasticity Alliance* <http://www.spasticityalliance.org>



Look where the nerves originate that controls the arms, hands, and fingers. The upper back must gain a strong posture for the spasticity in the arms to recovery.

See more about the arm, hand, and finger recovery in the next chapter.

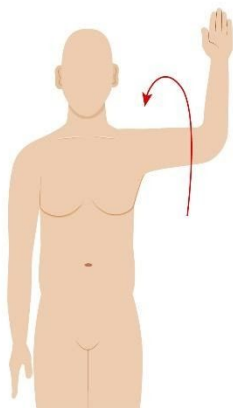
## CHAPTER 17

## Regaining Arm Movement

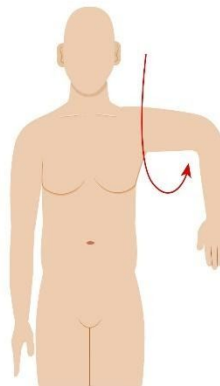
I have found more stroke survivors the last several years reaching out to fitness professions for gaining their arm, hands, and finger movements back. In the past this seemed to be done more with therapist.

**Here are the movements the shoulder (ball and socket joint) moves in.**

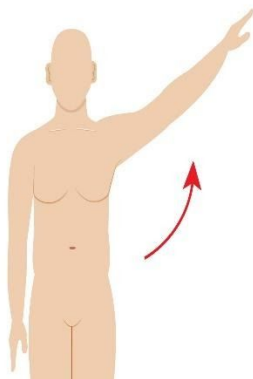
**Lateral rotation**



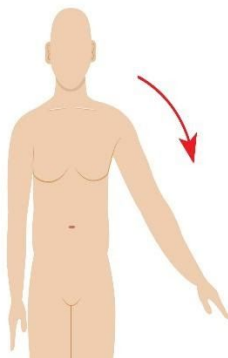
**Medial rotation**



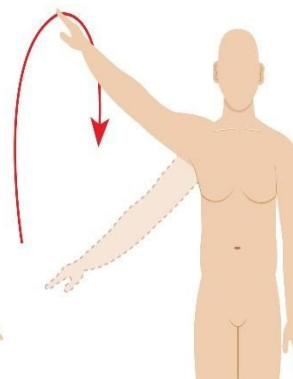
**Abduction**



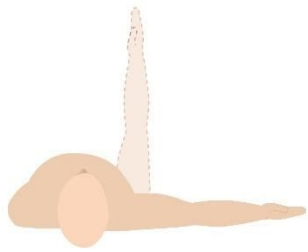
**Adduction**



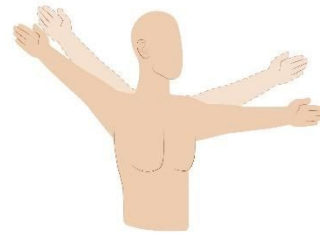
**Circumduction**



**Horizontal abduction**

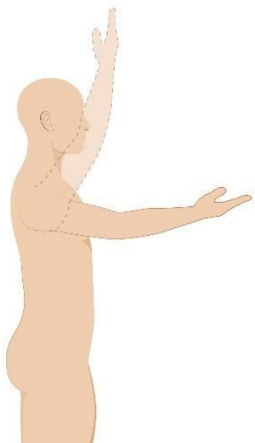


**Horizontal adduction**

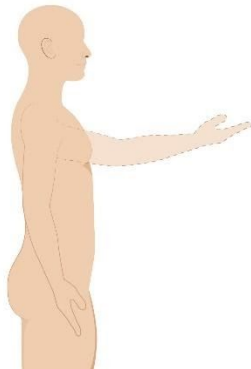


**Scaption**

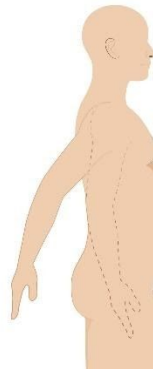
**Flexion**



**Extension**



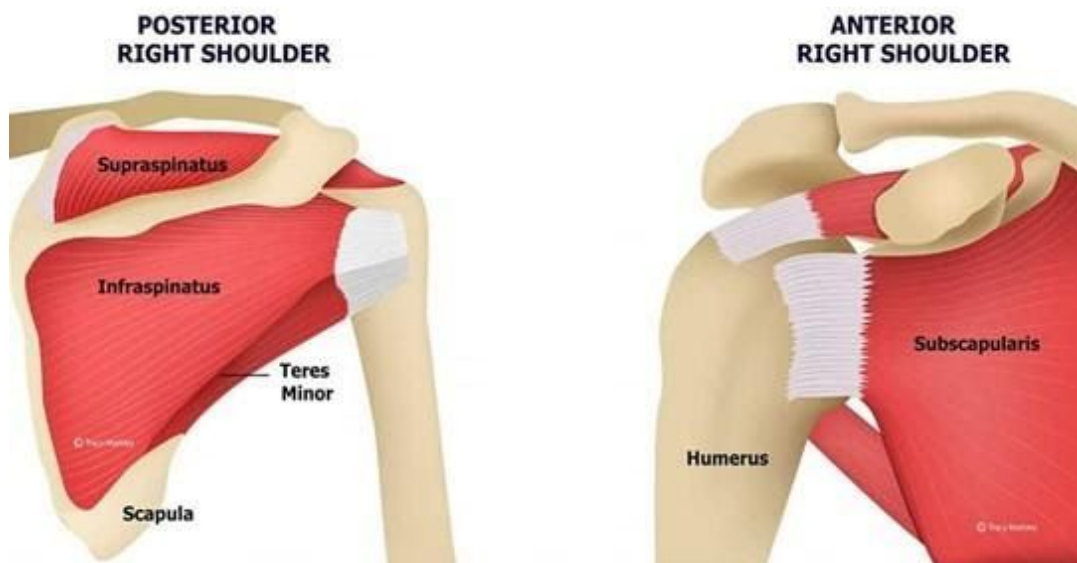
**Hyperextension**



***Knowing the muscles involved in a movement helps us as professionals choose and create the specific exercises needed for each individual survivor to regain movements back.***

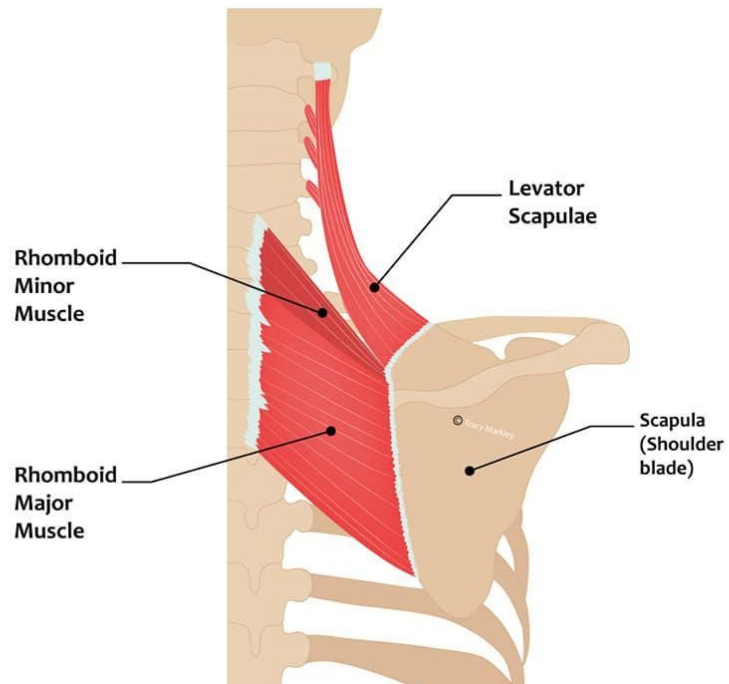
Please see my book: *Stroke Recovery, Regaining Arm Movement* for more in depth muscle anatomy and exercises for arm, hand, and finger recovery.

Here are some illustrations of muscles that help move the arm, hands, and fingers.

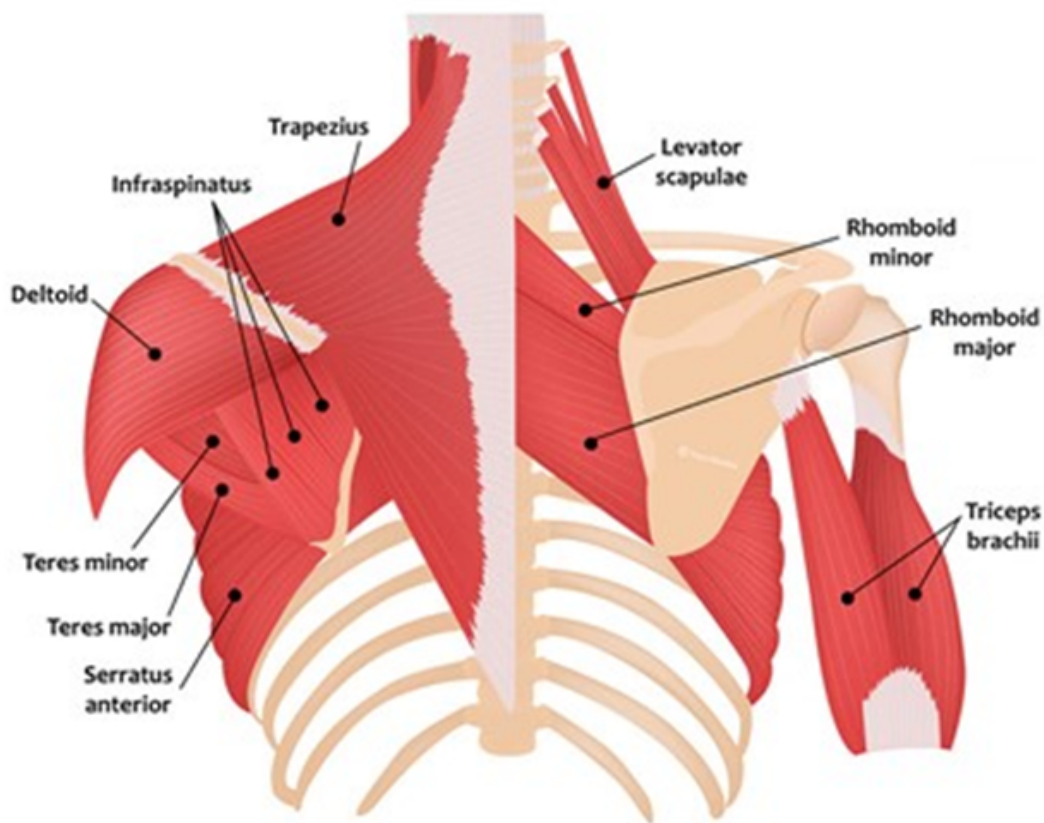


#### Rotator Cuff Muscles

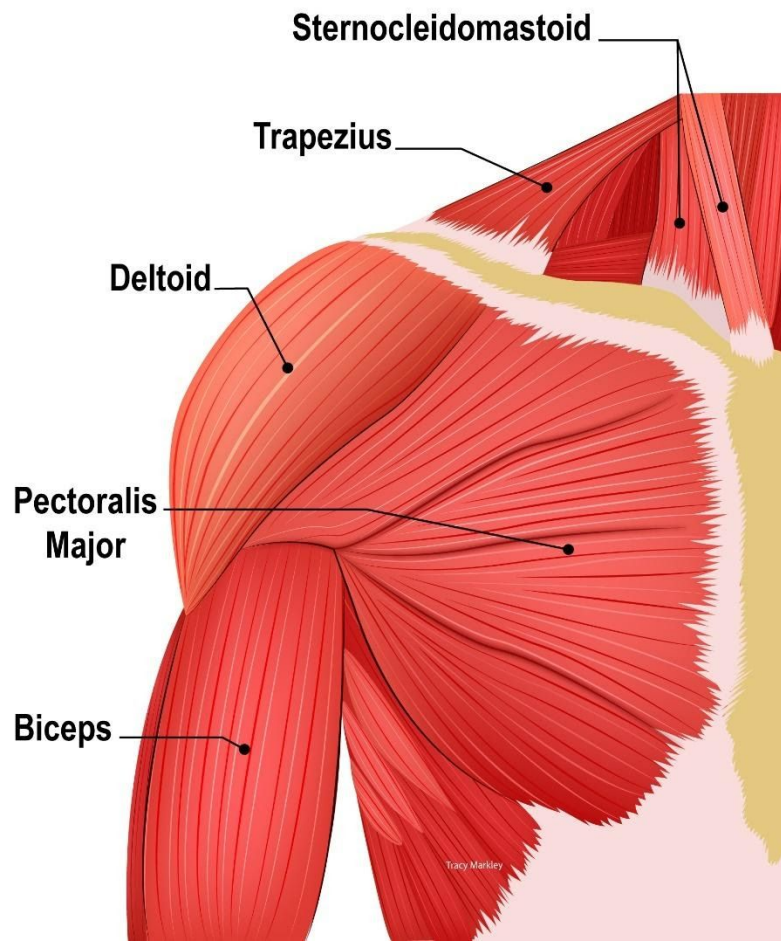
Proper posture is necessary for the rotator cuff muscles to hold the shoulder girdle in the proper position so the ball and socket joint can move through the many range of motions it performs without causing injury or limitations of any movements.



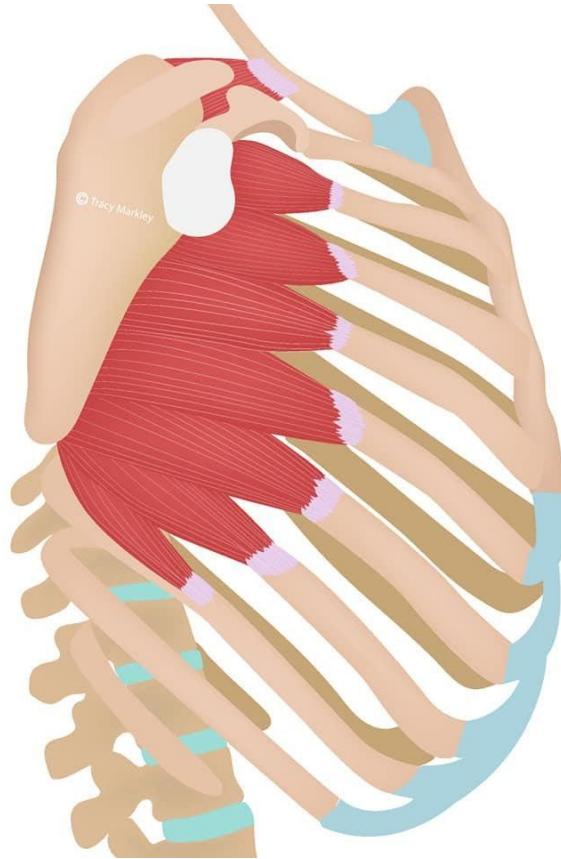
Some survivors get spasticity in their levator scapulae and upper trapezius.  
**Remember:** Spasticity can be anywhere and adds a great challenge for survivors and professionals working with them.



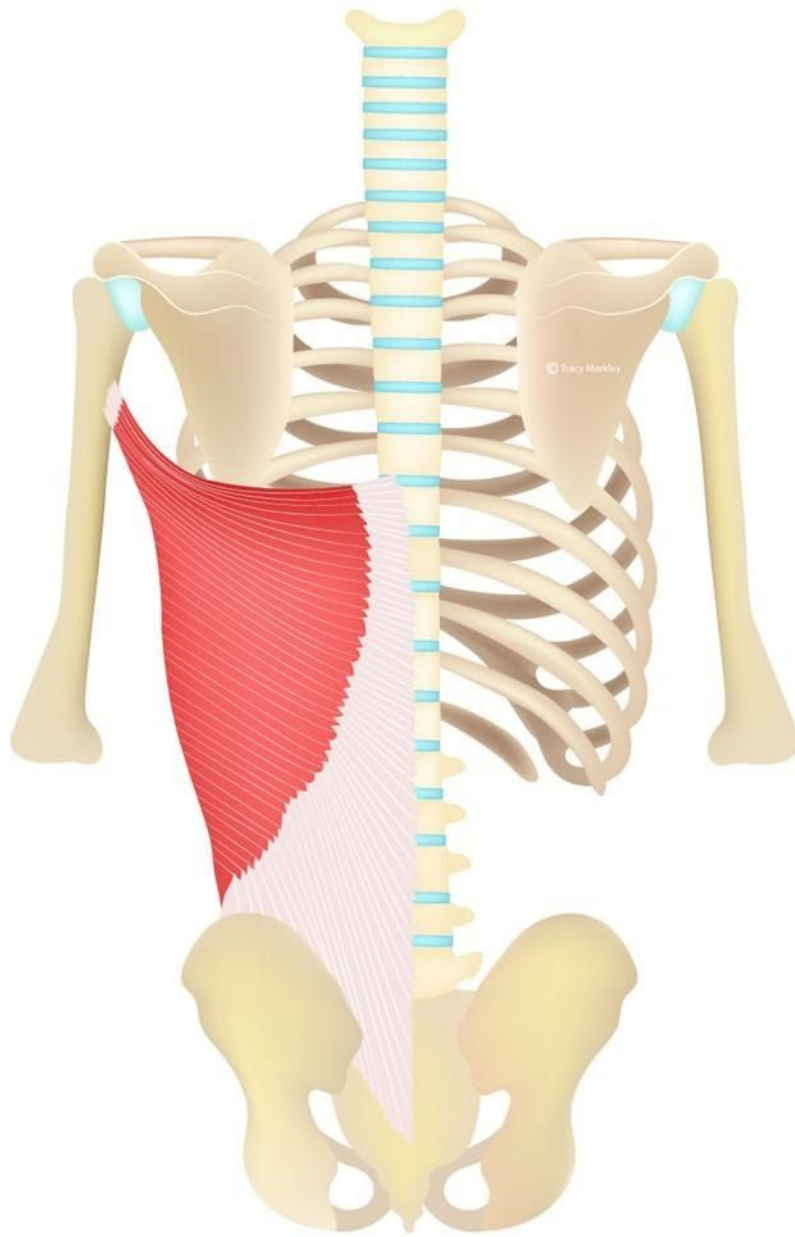
The scapulas move in different directions when the arm moves in different directions. The rhomboids and trapezius muscles need to be activated and warmed up before doing arm and hand exercises.



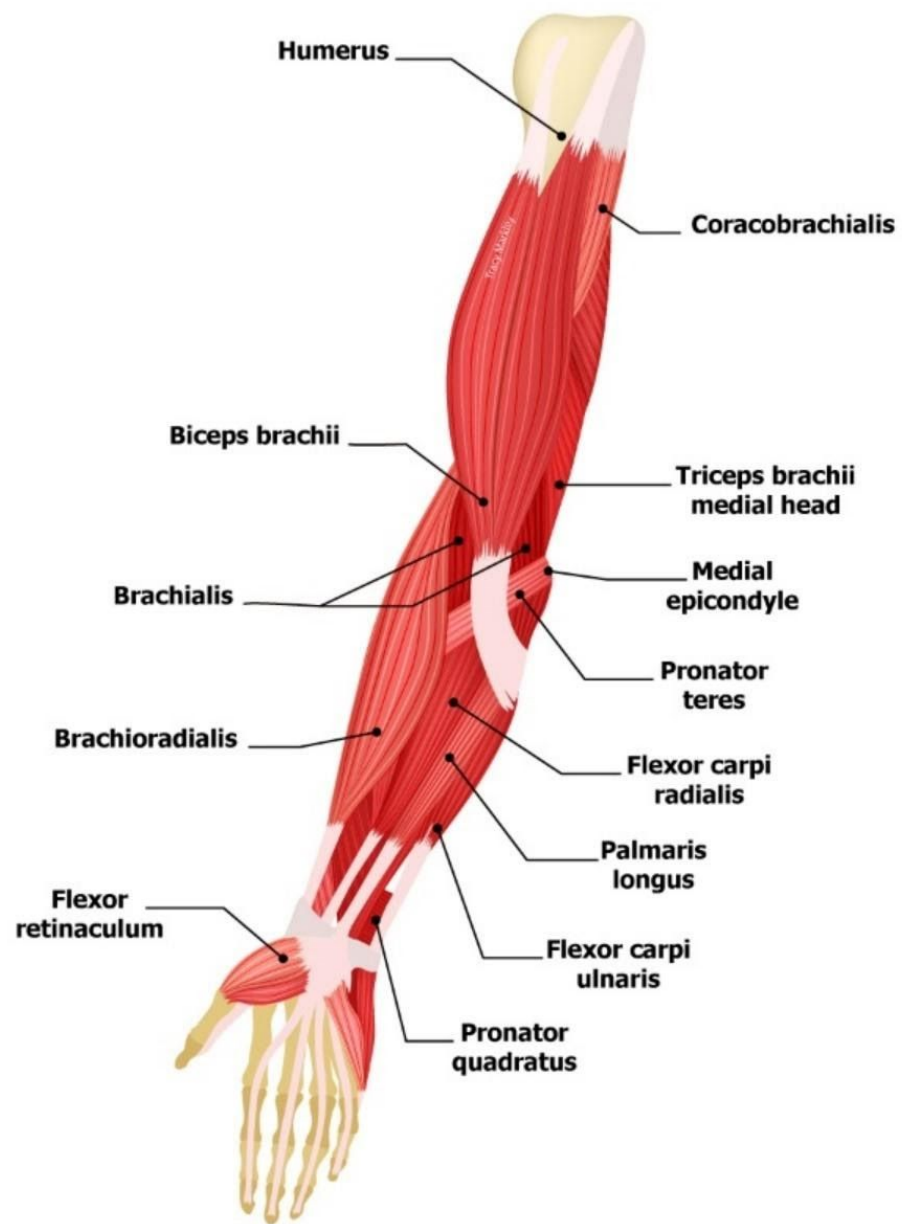
The Pectoralis muscles also move the arm.

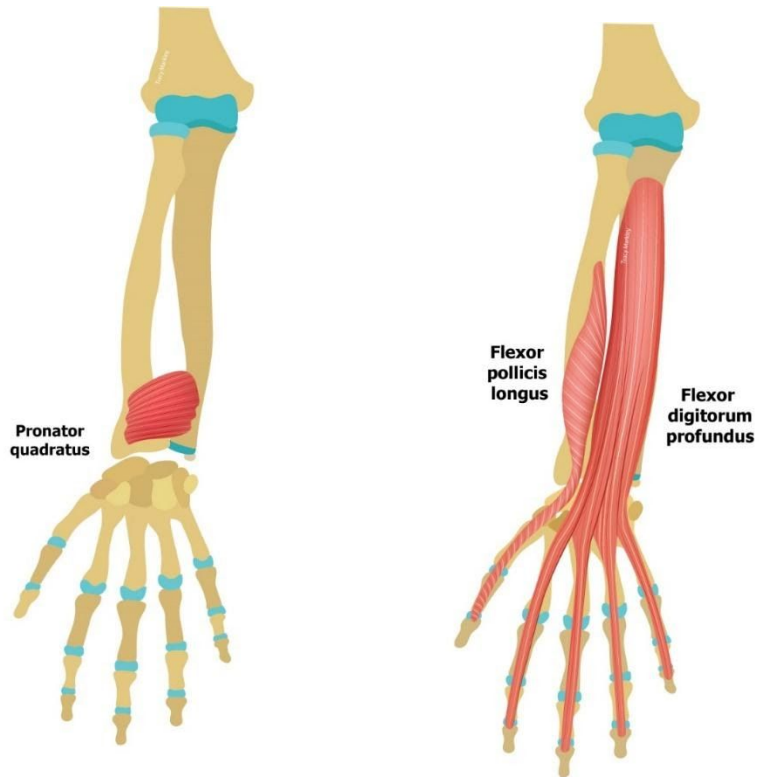


***Serratus Anterior*** is attached at the scapula and it rotates the scapula outward.

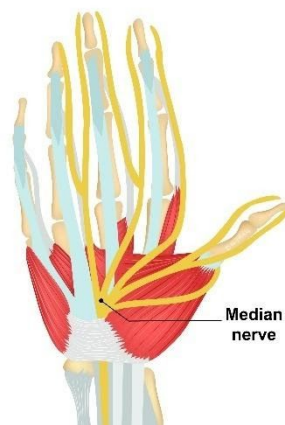
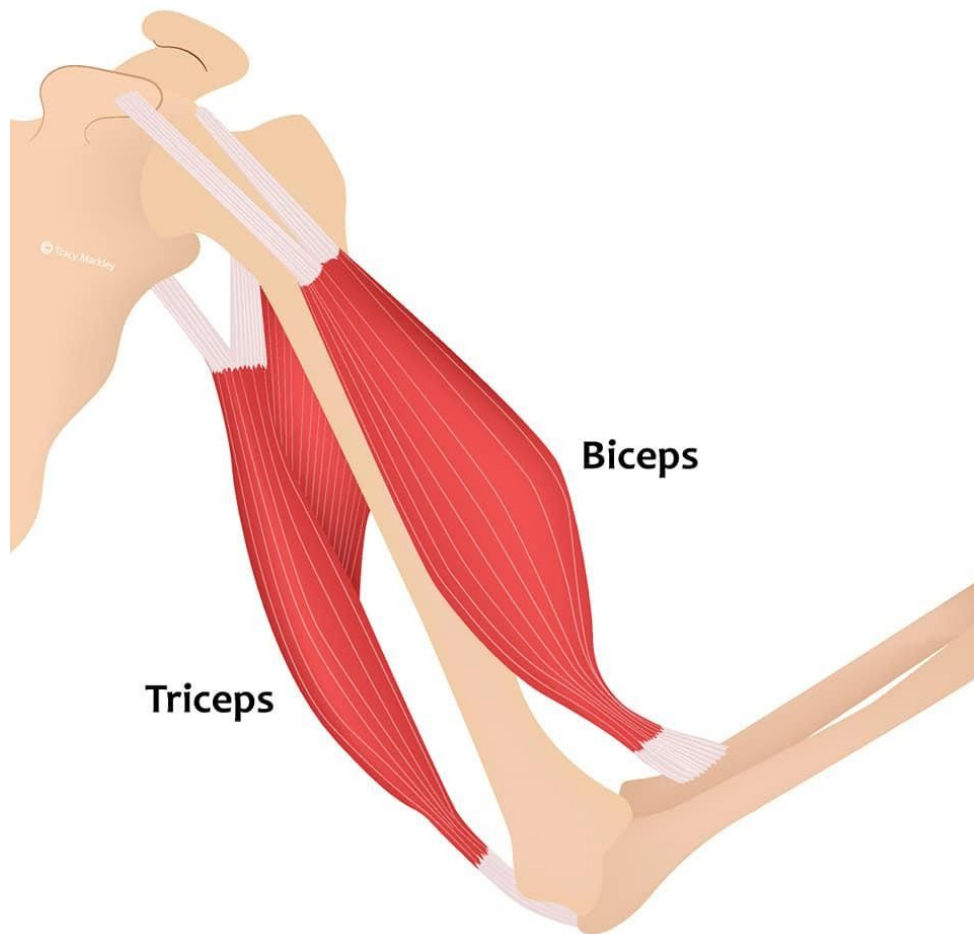


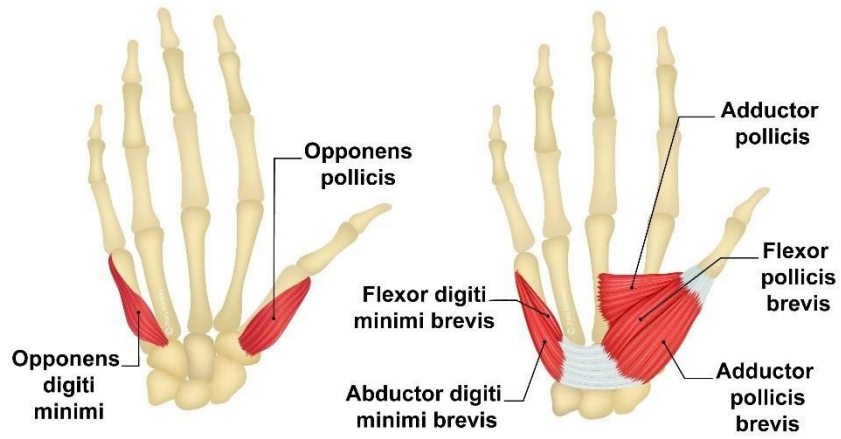
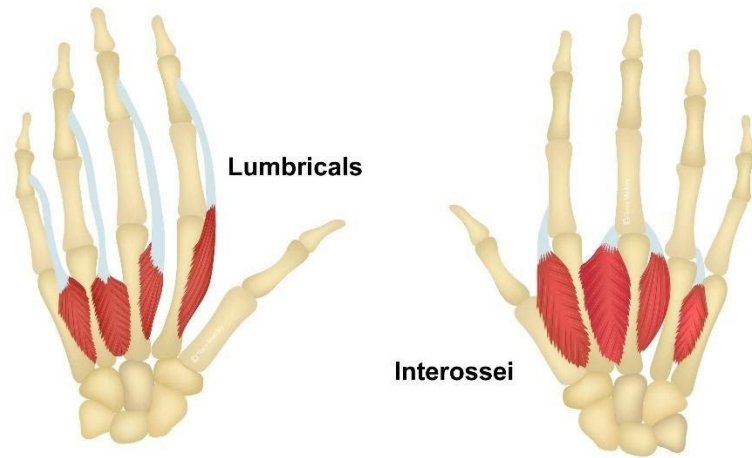
The latissimus dorsi helps bring the arm back down, helps pull the body up, like climbing a tree and pullups.





The biceps and triceps both have an attachment on the scapula.





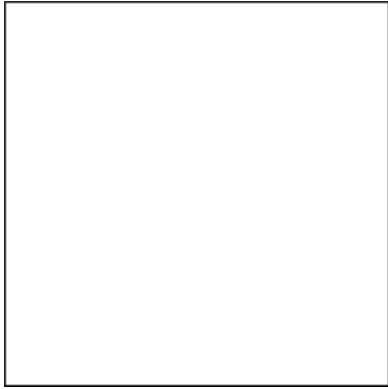
As I have shared before, I am not a physical therapist. I am a fitness specialist who sought advanced education to assist me in helping stroke survivors the best I can after they have finished their physical therapy.

This following exercise is a typical hand exercise that many survivors are given.

I try to remind my clients to open their hands as wide as they can between each finger to thumb touch. No matter what level they are at in this exercise series, try to begin with the hand as wide open as they can get and finish as wide as they can.

When standing on a BOSU® ball or a balance disc with their hand to their side and perform these exercises, the central nervous system is stimulated more, therefore creating better progress in the movements and recovery.





Try different angles and movements when exercising the hands to help bring the hand and fingers back to fuller functioning.

- Spread the fingers.
- Open the hand, close the hand.
- Make circles with the wrist and fingers.
- Touch each finger separately to the thumb. While doing this, try to open the hand back up between each thumb touch. Work on the full extension of the fingers and hand.
- Include their exercises given by their physical therapist too.
- If possible, and when safe, stand on BOSU® ball, balance pad, or balance disc and hold onto something for safety with the non-affected hand while working on the affected hand and arm.
- If safe and able, they can also sit on a balance ball while doing hand exercises.
- Try beginning with movements in the rhomboids and upper back before doing hand exercises. This will activate the muscles and nerves closer to the spinal cord first before moving down to the hand exercises.

- Pick up marbles, pins, or small objects from one pile or cup/bowl and move to another cup/bowl.



In this exercise above, begin by pulling the shoulder blades together, then have the arm follow through by bringing the elbows back, then strengthen the arms again and repeat. This can be done like in the picture or with a band, as you will see in other pictures.

- Bounce balls.
- Try to fold towels or cloths.



- While sitting at a table, they can use any of these tools or some other they may have.

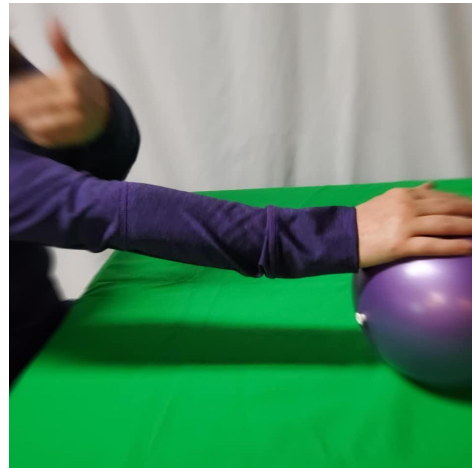
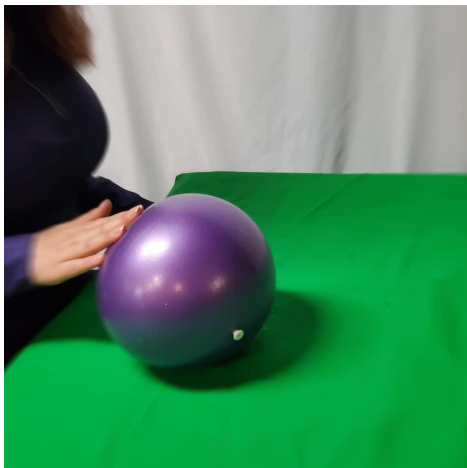


- The tools in this picture are:  
 Balance disc for sensation and holding as a tool.  
 A ball, bar, and foam roller to roll out and in with their hands and arms.  
 Small items, such as paper clips, paper clamps, therapy putty, therapy eggs, a small, weighted ball, and a therapy tool used to help spread the fingers and

other exercises. I will share some exercises here. Continue with other exercises from their therapist if they are working.



Roll out the foam roller flat with one hand and/or two hands.  
Stand roller up and rotate it in circular motions with the hands/arms.

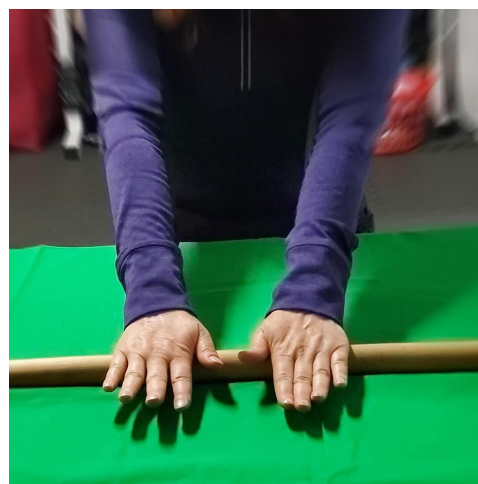
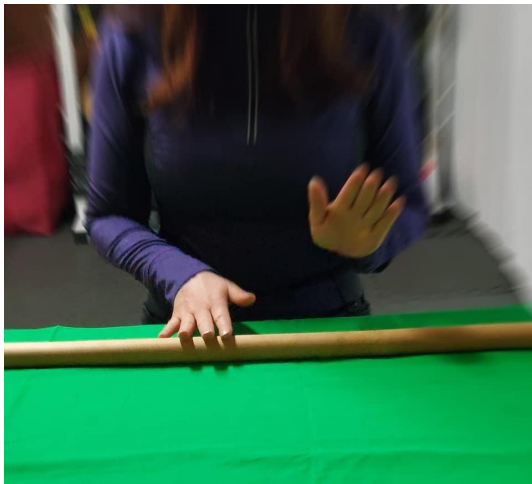


Roll the ball away from them, then bring it back towards them.

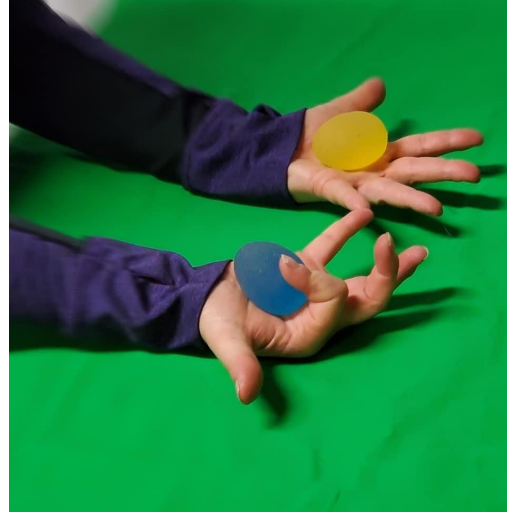


Rotate the ball side to side to help with range of motion with the shoulder and wrist.

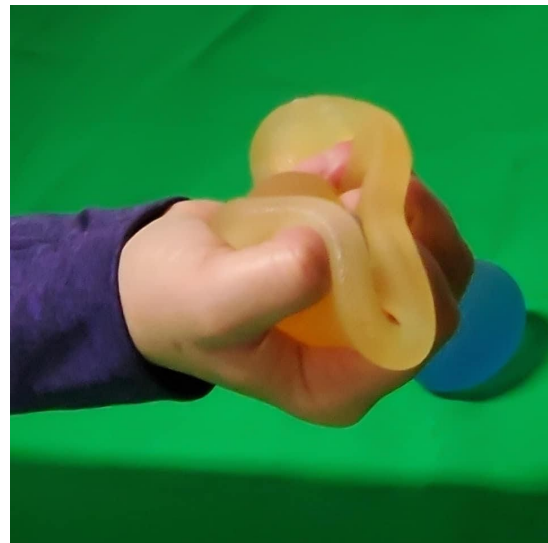
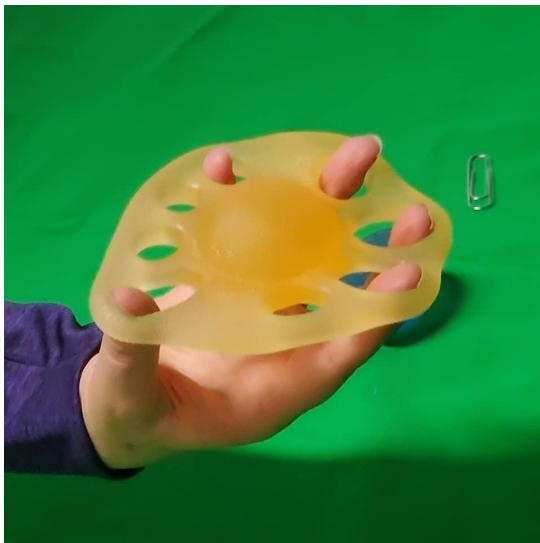
Remember, in all the arm exercises, whether they are sitting or standing, stay in good posture. Keep those shoulders in proper positing.



Roll a bar back and forth. With all the rolling out exercises, they can use both hands and one hand.



Play with the squishy therapy eggs. Try to close the hand and open the hand. Do the finger exercise you saw earlier in the manual, by trying to touch each finger separately to the egg. Keep playing with the tools and keep the hands and fingers continually trying to make all the different movements they can make.

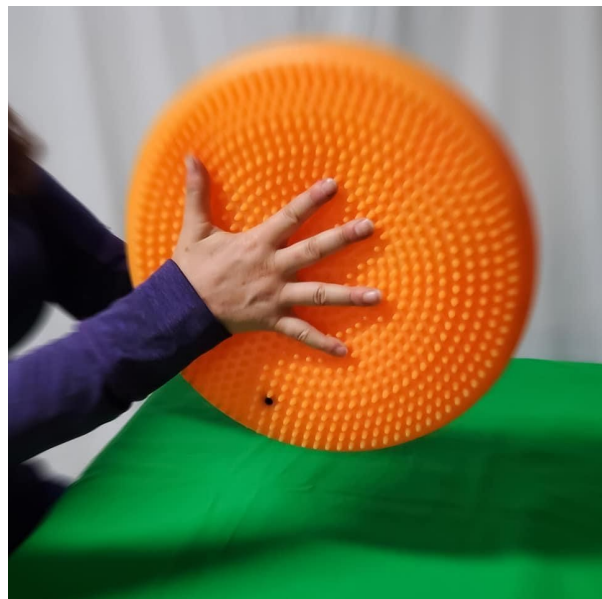


The fingers can go completely into this tool or keep the tool toward the fingertips. Open and close the hand. Play and experiment.

- Use therapy putty and other therapy sources that have been recommended or given to them by their therapist. The putty can be spread out on a table, and they can have their fingers spread it open and play with it. All these tools come with instructions, as well as a therapist may be able to teach them more.



- Continue the exercises that their therapist has given them as they add in other exercises.
- When able, work on making the different shoulder movements previously shared in the illustrations in this book.



One side of the balance disc has a bumpy side. By pressing the hands on this bumpy side, it can help stimulate the nerves in their hands and fingers. They can lay with their fingers on the disc, by trying to lift each finger individually. They can hold it between their hands and squeeze. They can rotate the disc around and do other finger and hands movements in this position. They can hold it like a

steering wheel of a car and make the movements as if they are turning the steering wheel. (Not shown in pictures)

Rotate the disc side to side to help with range of motion with the shoulder and wrist.

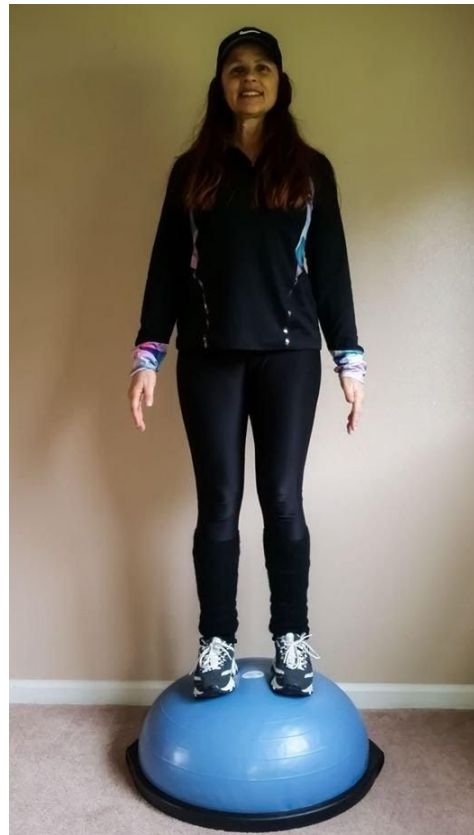


In the picture above, I am using the Anchor Point Training® band that is attached to the ceiling in my studio. I am pressing down with straight arms and slowly controlling the movement back up. This works the lats, traps, triceps, and shoulders. It is also working balance, stability, and the core. Their body must compensate for the pull of the band by not letting it pull them forward or move backward. **With all the exercises that require both hands, they can have the non-stroke affected hand hold the effected side so it can follow the movements if it is unable to move yet on its own.**

- Remember to have them keep their posture the best possible and engage their core while doing their arm and hand exercises.

Try to activate these different movements to help bring all movements back. Do them with the unaffected side first. Feel what it feels like. Do it with their eyes open, see it, and visualize it. If possible, do the movements with their eyes closed also. Have them stay focused and try to feel and visualize it. Then when they work on the stroke-affected side, try to feel, and visualize it doing what the other hand did. In fact, do this with all exercises for the arm, hands, and fingers. And remember, safety first!

**NOTE:** Some stroke survivors get dizzy and or feel unsafe if they close their eyes. Do not have those survivors close their eyes.



**Safety First!**



- Hold on with the non-affected hand and exercise the stroke-affected hand.
- Be sure to hold onto a secure object such as a bar secured to a wall.
- Stand in a proper posture with the abs engaged.
- If possible, do the exercises on the non-affected hand first.
- The exercises shared in this manual can be done sitting, standing, standing on BOSU® ball, balance disc, balance pad, kneeling on a BOSU® ball, sitting on a ball, or sitting in a chair. Ensure their safety first. Then when ready and safe, they can try the more advanced ways.



- As the core and postural muscles gain strength to hold their body upright in the proper posture, balance, stabilization, and arm movements can gain more recovery.
- Kneel in a proper posture with the abs engaged.
- Sit with proper posture with abs engaged.
- When they engage their abs, they must NOT squeeze their butt muscles.
- Many exercises can be with these different positional options being shared in this manual.
- In some cases, their therapist has hopefully given them some therapy exercises to do. If they seem affective have the survivor to continue to do them. Incorporate them into posture, balance, and core exercises whenever possible. This also helps the brain multitask again. These tasks bring balance and stabilization as the arm and hands move. This can take time, persistence, and repetitive safe exercising.

By this time, each survivor has already been through therapy, or they are still receiving therapy. Either way, here are some exercises that may assist them in getting movement back through their arms, hands, and fingers. As I mentioned earlier in this book, I am not a physical therapist. I am a fitness trainer who often gets clients who have finished their physical therapy and do not know what else they can do or how much further their recovery can go. Stroke survivor's recovery does not end when physical therapy ends.

They may only be able to do some of the exercises here as well as some of what their therapist has shown them. Have them do the exercises that they can do and are able to do safely.

- Begin with core and postural exercises.
- Standing on a balance pad, disc, BOSU® ball, or kneeling on BOSU® ball is a fantastic way to warm up the core and postural muscles. This also strengthens these muscles and stimulates the central nervous system. It also helps train the body to multitask again and helps rebuild spatial awareness and quick reaction time. This builds balance and stability. These are excellent warm-up and exercises to do for fall prevention.
- Move the shoulders and the shoulder blades.
- Get the muscles and nerves deep at the spine activated by standing on one of the balance tools or sitting on a ball (when ready).
- Do the upper back and latissimus dorsi muscle exercises.



This exercise above can be performed on the floor or on a BOSU® ball. Keep abs engaged, thigh bones (upper leg) straight up and down. Do not let them angle out into a plank. Hinge at

hips as the ball rolls out, then press arms/hands firmly into the ball as it pushes their body back upright in good posture. This strengthens the core, lats, triceps, shoulders, balance, and mobility.



While performing exercise on the BOSU® ball, it also works balance, legs, glutes, and stability.

- Move the shoulders/arm through the different movements that are on the page on shoulder joint movements the best that they can.
- The shoulder joint movement exercise can also be done, sitting, or standing with or without the balance tools. Always be in proper posture when exercising.





With the exercise above, really focus on where the hands and arms are in space. Try to control the height of both arms, making the goal to keep the hands meeting in the center of their body and staying at the same height as their gently and slowly move their arm to the side and bring it back slowly with control.

Using bands can be a great tool while trying to correct and strengthen posture and positing. In the following pictures, I am demonstrating my exercises using the Anchor Point Training® Band. These bands also come with a neuro handle. This handle helps stimulate nerves as doing the exercise. I have found they work fabulously with stroke survivors.



This exercise can be done sitting or standing. In the picture with me sitting on the ball (in the correct form), I also have my feet on a balance disc as I perform the

exercise. This is more advanced. Straighten the arms with control and pull the band back towards chest. I am also using the neuro handle from Anchor Point Training®. The brain is working extra hard as I am keeping my feet in good positing and maintaining proper posture as I do the exercise. This will also be a good time to gently move their fingertips along the spine in the area where the nerves exit the spinal cord.



ANYTIME they are performing any of their upper body, arm, and hand exercise, add this in if possible.

- Perform pushups on a bar, countertop, or against a wall. A pushup can also be performed sitting in a chair by a wall or the side of a table. When performing a pushup, move through a full range of motion. This means straightening the arms completely without snapping the elbows open during the exercise movement.



- Have survivor perform the exercises learned in this manual and the exercise they learned from their therapist. Some may be the same.
- If they are not too exhausted, repeat some things.
- Encourage them to Listen and feel what their body is telling them.
- There will be days they get exhausted quickly and other days they can keep going.
- See my videos at my YouTube channel at *Tracy L. Markley Fitness*  
[https://www.youtube.com/channel/UCQbpnj-LoB0R3nm7V2p\\_MLA](https://www.youtube.com/channel/UCQbpnj-LoB0R3nm7V2p_MLA)

When I train my clients in private, I can give directions for their personal needs at that moment in their recovery and where their progress is gaining. This manual contains tips and some of the exercises I do with clients. Each client has their path and exercises for their recovery progress.

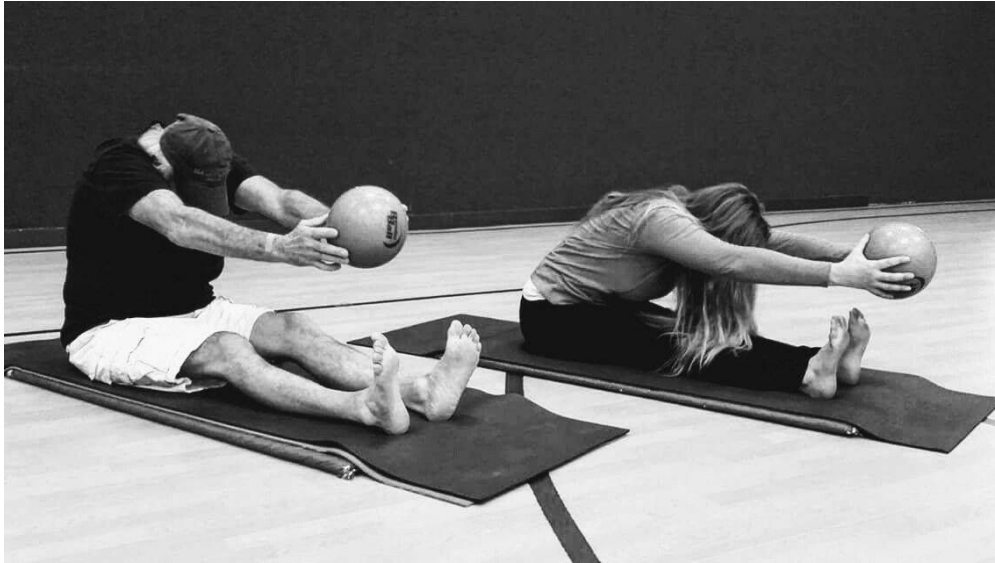
Remember to have the survivor pace themselves and honor their own personal journey and recovery path.

## **References**

The Extremities by Quiring-Warfel  
Kinesiology for the Public Schools, by J.A. Mastropaolo  
The Power of Your Spine, by Tracy L. Markley  
Stroke Recovery, What Now, by Tracy L. Markley  
Stroke Recovery Regaining Arm Movement, by Tracy L. Markley  
Albinus On Anatomy by Robert Beverly Hale and Terence Coyle

## CHAPTER 18

### Pilates



Pilates is another great resource in stroke recovery. I use much of the Pilates theory in my work. Pilates is an exercise modality that has the student focus on stabilizing and strengthening the center of the body to transfer power to the limbs and arms and decreases stress on ligaments and joints. It improves mental strength. Pilates flows with fluidity and grace. Pilates trains whole-body integration that reflects healthy fascia throughout the body. Focus is essential for a survivor in their therapy and exercises.

In Pilates, one should be focused on every movement as they flow through each exercise. I began teaching every client to understand this mindset needed in stroke recovery as they perform every exercise. It is difficult for many people to focus and be present when they exercise, but it is especially hard after one has a stroke.

I recommend a client use Pilates based on the Joseph Pilates method and to seek out a professional who has knowledge and/or a certification in the Joseph Pilates method.

As with all exercises that require a survivor to go to the floor, you will find several of them cannot get on the floor. In this case if you have a therapy bench or table for them to lay down on use that. Otherwise, have them perform another exercise.

## CHAPTER 19

### Pain

Some survivors may experience pain throughout their body. Some may have one painful area always. I find this to be more common in either a hip or a shoulder and sometimes both. Post-stroke pain can occur immediately, weeks, or sometimes even months after a stroke. Research shows that more than half of stroke survivors have some form of post-stroke pain. In some cases, the pain is constant (chronic), and in others, it comes and goes. This is because the messages between the brain and nerves are confused and the nerves are triggering pain.

Making new pathways of communication is part of the brain healing. Stimulating the brain and spinal column (the central nervous system) as the survivor performs their exercises to release the spasticity can aid in the healing and recovery. If the brain sends a message to the multifidus muscle and the balancing system (as I like to call it) first before sending messages to the limbs, it makes sense to heal and strengthen the muscles involved in the balancing system. If this area is weak and out of sorts, it can be a roadblock to clear communication from the brain to the muscles. Remember consistency, receptiveness and patience is involved in recovery.

There is also central post-stroke pain (CPSP) an effect of stroke where the person has painful burning, throbbing, or shooting feelings, although there is nothing present that would normally cause pain. Doctors may call this thalamic pain syndrome because it can be caused by damage to the part of the brain called the thalamus. While there is no cure for central post-stroke pain, some medicines can help manage it.

We may not know the exact cause of the pain, but we try to help them the best we can, by helping them recover as much of their body movement, posture, and balance as we can. This can often help the pain go away.

I find there are many avenues of exercise that different therapists have patients perform for their hand and arm therapy. I have clients stand on a balance disc or BOSU® ball if possible and safe for them, to perform these exercises. In therapy often, they give the patient something to squeeze. I like to have the survivor work on extension and opening motions of the hand, while on the unstable surfaces of the disc and BOSU® ball. In time, if done consistently, that clenching, tight hand begins to release.

There are many options survivors try. There are options for Botox or phenol injections, and some may have surgery options and intrathecal baclofen pump therapy. Some say these options work, others say they do not. I say as with many things, if it works, do it. If it does not work, try something else. Each survivor is unique to their own recovery. Persistence and patience are key. Trying an exercise, a couple times a week will not bring the healing one hopes for. Exercises need to be done daily if possible. The body was made to move, and it needs to try to do a movement repeatedly for the brain to make a new pathway. The brain is trying. Remember the brain needs to be hydrated, nourished, and stimulated to aid in its healing. This was also mentioned in other sections in the manual.

Resources and more information

<http://www.saebo.com/pain-stroke-symptoms-watch>

The Spasticity Alliance <http://www.spasticityalliance.org>

Tracy Markley Fitness and Author YouTube Channel  
<https://youtu.be/fF6blukxpAA>

## CHAPTER 20

### Vision, Peripheral Vision Loss and Hearing Loss

It is common for many stroke patients to have a loss of peripheral vision on one side. I conducted an experiment with a client who was having great physical gains. I thought if all these gains and progress in his condition were happening, maybe it could work as well on his peripheral vision loss. I spoke to a mentor of mine, and he supposed that no one had tried it, so it was not known if it could help or not. He encouraged me to go for it and see what happened.

I began by holding different objects and having him track them with his eyes as I moved the objects. Sometimes I would have him follow with his eyes without moving his head and other times moving his head. At our next visit, I grabbed items around the gym in assorted colors. I found things blue, red, green, purple, orange and yellow. I then discovered he could not see colors correctly. It took at least 15 seconds to a minute before he would say a color, and a couple colors were not programming in his brain at all. I then thought, “Let’s have him stand on the balance disc!” To our great surprise, his brain registered some of the colors instantly. Standing on an unstable surface, such as the balance disc, stimulates the central nervous system.

This helped me understand that the stimulation of the brain and the nervous system could do such a thing. This was an experience that clearly confirmed that both unstable surfaces, the balance disc and the BOSU® ball, stimulate the nervous system at a level I was not aware of. This helped me understand that because of client’s fragile neurological state, I was able to see, and not just be aware, that the nervous system was being stimulated. The next day, I brought in different colored construction paper, and we began working on seeing colors as he stood on the balance disc for 10 minutes each session. It was incredible to witness such dynamics.

At times, it was frustrating for him because he would see a color but would say a different color. Once I told him the correct color, he would explain how he knew it, but the brain was not processing the right color he wanted to say. Since he had been an artist his whole life, his brain would try to identify the exact shade of blue as we see in paint and crayons. It was a lot of work for his brain.

He continued working on getting quicker movements and reaction time with his arms and hands. This is when I suggested that he get the Simon® game and use it at home when he was on the disc. Simon® is an electronic memory game that came out in the 1980s and is still in stores. It has four big buttons to press, and they are all different colors. The game makes a different noise with each flashing color, and one must follow the pattern with memory. The idea was for him to stand on the balance disc and have the Simon® game to the side that was affected by the stroke. This would help stimulate his brain, help regain faster reaction time and help his memory.

Visual tracking also helps with spatial awareness and balance, especially if they can stand on an unstable surface while doing it. Visual tracking is following an object with the eyes. It can be done with just the eyes and leaving the head still or turning the head to follow the object. The client can do this alone or with assistance.

You may find that the survivors with spasticity on their affected side will be unable to do this on their own. They will need a trainer or a caregiver to help them.

It is also important to remember when clients get new glasses or need new glasses, they may have some brain changes and balance issues to adjust too. This is also true to hearing loss and wearing hearing aids. If a client needs to renew their glasses or hearing prescription and they have not done so, it can cause more, balance, spatial awareness, and cognitive issues on top of the stroke challenges.

Research has shown that hearing loss has also been linked to falls and dementia. Studies show that from the earliest months of life, hearing is intimately tied to the development of language, reading, learning, as well as cognitive and social skills. This is taken into adult life. When older adults lose their hearing, they can start losing their cognitive skills.

If someone needs hearing aids and they do not wear them, that part of the brain used for hearing can begin to shut down, because it is not needed anymore. This can lead to dementia. This can also be a risk factor of falls. For better balance, it's best to wear hearing aids in both ears, not just one.

When someone has had a stroke and they have hearing and or visual problems they will have a greater challenge with all their recovery.

# **CHAPTER 21**

## **Full Body Workouts**

It is important to work the full body if possible. As we continue to understand the human body and movement, we know that a muscle does not work alone to make a movement. Certain muscles help stabilize the body as other muscles are being activated to perform a specific movement. The brain needs to be retrained to multitask the nervous systems, the muscular system and fascial system throughout the whole body, because that is how the body naturally works. We need to do the isolated work, for example working on the hand opening up when fighting their spasticity in their hand, but doing this as they stand on the balance disc or BOSU® ball if possible will help bring it back faster.

When you think how the right lat muscles work in movement with the left gluteal muscles, it also makes sense as to why working the full body, not just the affected side, will bring greater recovery results for the survivor.

I conducted a survey that indicated many professionals have their clients work only their stroke-affected side and not the entire body. These clients usually have more limited recovery.

While training and getting to know each survivor individually, you will know when to do isolated exercises and movements and when to try to work the body as a whole.

## CHAPTER 22

### Medications

The range of medications will vary in each client. Survivors who had health troubles and took medications before they had their stroke, will be on more medications.

It is common especially in the first year after their stroke for a client to be on some form of blood thinner prescribed by the doctor.

#### **Commonly prescribed include:**

- Rivaroxaban (Xarelto)
- Dabigatran (Pradaxa)
- Apixaban (Eliquis)
- Heparin (various)
- Warfarin (Coumadin)

These medications decrease the clotting (coagulating) ability of the blood. They are sometimes called blood thinners, although they do not actually thin the blood. They do NOT dissolve existing blood clots. According to the American Heart Association ([www.heart.org](http://www.heart.org)) they are used to treat certain blood vessel, heart and lung conditions.

a side effect with statins that cause pain and/or weakness in parts of their body. I find it more often in the legs, but it can affect the whole body. It is difficult to determine sometimes if the statins are adding more stress to their bodies. Some doctors agree this is true while others say this is not true. I have had clients switch to another statin medication; this side effect has gone away.

I had one client tell me that he got so weak through his body that he could not open jars anymore. His doctor changed his medication, and he slowly got his strength back. He told me it took at least six months. This all happened before I met him.

#### **Cholesterol-lowering medications**

- Statins: Atorvastatin (Lipitor), Rosuvastatin (Crestor)
- Nicotinic Acids: Lovastatin (Advicor)
- Cholesterol Absorption Inhibitors: Ezetimibe/Simvastatin (Vytorin)

These medications are used to lower LDL “Bad” cholesterol. Various medications can lower blood cholesterol levels, but drugs other than statins should only be used for patients in whom statins are not effective enough or who have serious side effects due to statin therapy. They work in the body in different ways. Some affect the liver, some work in the intestines and some interrupt the formation of cholesterol from circulating in the blood.

Some cholesterol-lowering medications may interact with grapefruit, grapefruit juice, pomegranate, and pomegranate juice. Always refer a client to their health care provider about any potential risks they may have shared with you.

According to the American Heart Association:

A client who has had a TIA may be on Antiplatelet Agents and Dual Antiplatelet Therapy (DAPT)

Commonly prescribed include:

- Aspirin
- Clopidogrel (Plavix<sup>®</sup>)
- Dipyridamole
- Prasugrel (Effient)
- Ticagrelor (Brilinta)

Survivors may be also on diabetic medication, (such as insulin), blood pressure medicine, beta blockers, beta inhibitors, ACE inhibitors, diuretics, pain meds and/or others

For more details and lists of medications a stroke survivor and cardiac patient may be taking please see the American Heart Association at <http://www.heart.org/en/health-topics/heart-attack/treatment-of-a-heart-attack/cardiac-medications>

You will also find some may be trying alternative methods, natural medicines or essential oils, marijuana/cannabis, and others.

It can be difficult to keep up on all the medications and their side effects. Usually they are under a physician's care and they are encouraged to exercise to continue recovery and they are released to do the physical and neurological training we need to do as professionals with them.

Clients may also be trying massage, acupuncture, hyperbaric chamber, different types of light and laser therapies, etc., as well as different physical therapy tools, gadgets etc. It is a good idea to know what else they are doing. I usually suggest that a client **not to come and exercise** after certain treatments, such as a massage or acupuncture.

## CHAPTER 23

### Balance Disc - BOSU® Ball - Swiss Ball – Balance Pad



#### Swiss Ball

The Swiss ball was developed in 1963 by Aquilino Cosani, an Italian plastics manufacturer. A British physiotherapist used it in physical therapy in Switzerland. In the 1980s physical therapists brought the work to America, and soon it came into the fitness industry.

As years have passed, the Swiss ball has been labeled as an exercise ball, a yoga ball, a therapy ball, and many other names. It is used for various exercises. I use it frequently in my workouts, and with clients. It is a ball that is big enough to sit on, as shown in the pictures.

Important points when using this ball:

- Have the ball at a height where hips DO NOT drop below the knees.
- Be sure the ball is firm. They will not get proper spine support if the ball is gushy when they sit on it or when they use it for exercises.
- Sit with knees over the ankles, (shins straight up and down). They do not want to sink into the knee joints.
- Always begin with caution. When first using the ball keep them near something to hold onto for safety.

### **Bender® Ball**

The Bender® ball is a 9-inch inflatable plastic exercise ball. Other 9-inch balls are available and are often referred to as Pilates balls or small exercise balls. They will usually all work. They come in a variety of rubber thicknesses. I have used the Bender® ball for years, and I know exactly what I am getting when I place an order for myself or a client.

### **Balance Disc & BOSU® Ball**

The BOSU® ball is called a BOSU® Balance Trainer. Both the BOSU® ball and the balance disc is considered an unstable surface. I use the balance disc and BOSU® ball with most clients. Balance discs are round, air-filled discs that are strong enough to sit, stand and exercise on. They are added to workouts to improve balance and increase core strength. The discs, and the BOSU® ball, are considered unstable environments to exercise on. They both challenge balance, and they both stimulate the central nervous system, which is the brain and spinal column. I use the 13-inch balance discs with my clients.

The balance disc is referred to as an unstable-stable environment, whereas the BOSU® ball is referred to as a stable-unstable environment. It was scientifically invented to absorb the body's weight into its dome, allowing the bracing system in the body to relax. Therefore, the nerves are stimulated deeper into the nerve roots. Both these tools are fantastic to use at any age for many great advantages, I feel they are essential to use with my clients to gain the best functioning body. I share some basic balance and neurological exercises in this book. There are many other exercises all the tools listed in this chapter can be used for.

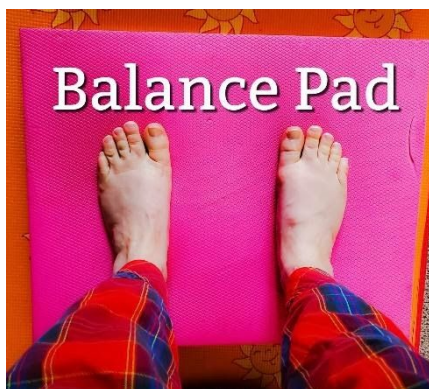
### **Balance Disc**

The balance disc is an air-filled stability wobble cushion. They usually come in varied sizes. I usually use a 13-inch balance disc. I have used the balance discs

with clients for 20 years to help strengthen the spine, core, posture, joints, and ligaments. Standing on the balance disc and BOSU® balls also stimulates the central nervous system. Clients use them to strengthen their balancing. We used them to warm up the spine with various gentle exercises, while standing or kneeling on them. We would do some free weights, while standing or kneeling as well. I explained to clients that we were activating and strengthening the small deep muscles around the spine and working on the core and balance. We were stimulating the nervous system. As I worked with stroke survivors and clients with neurological challenges, I never experienced just how much was taking place neurologically, until the last few years when I began working with more clients with strong neurological issues. When clients made neurological changes, they were very visible.

The disc is known as an unstable, unstable surface and the BOSU® ball is known as a stable, unstable surface. The BOSU® ball was invented to absorb the body's weight into its dome, allowing the bracing system in the body to relax. Therefore, the nerves get stimulated deeper into the nerve roots. Therefore, my clients with neuropathy, plantar fasciitis, fascia issues and various neurological issues had shown significant, unexpected improvements when they used the BOSU® ball. Just standing on the BOSU® ball increases muscle strength. It is due to adaptation in the neurological system and the resistance through the lower body from standing on the BOSU® ball. It is not only considered a balance tool but a resistance tool. It is a 3-D pressurized, elastic resistance tool that we compress with the feet as we stand on it and do specific exercises properly.

### **Balance Pads**



Balance pads are a mild unstable surface. They can be used for the same exercises as the disc and BOSU Ball. The pad would be used for those who cannot

stand on the disc or BOSU ball yet. I also use it to place on a chair to sit on as it helps make the chair height higher.

In the beginning of training some stroke survivors, they may not be able to be



on the BOSU® ball because of its height and width. We need the client to be in control and stay safe while they step on and off it. If they are challenged with the loss of spatial awareness and possible peripheral loss or blur on one side, they will have a harder time controlling their feet in placement. Standing and stepping off and on the BOSU® ball is excellent for survivors once they are safe to do it. I am not a physical therapist, nor do I have harnesses at my studio as they do in therapy facilities for safety. I must rely on the client being able to step on and off safely and to hold on to the bar and maintain stability on their own, to avoid falls and injuries.

In this photo, the 67-year-old stroke survivor is two and one-half years post stroke. He is squatting up and down slowly on the BOSU® ball, as he is bouncing a basketball. This was possible after a year of just standing and balancing on the balance discs and BOSU® ball and stepping on and off the BOSU® ball. His persistence and consistency were incredible for his progress. Clients must be willing to be consistent and persistent to achieve such great gains. In the first year of training with me, bouncing a ball was extremely frustrating for him. The coordination and hand control on the right side was not ready for such a task. As his spatial awareness, proprioception and different cognitive skills became

stronger, he was able to coordinate all the skills needed to combine the BOSU® ball and bouncing the basketball. In this picture, his nervous system is being stimulated and fired up as there is resistance force going up his legs. He is balancing and coordinating where to bounce the ball and how high so he can still control his hands. There are many amazing internal things going on. This is one of his most incredible and my favorite combination of skills in an activity he achieved. This includes spatial awareness cognitive skills to coordinate the reach to the ball, the controlling of the arm and hand to how much speed and power was needed to get the ball to bounce to the height he wanted, as well as controlling it in his space so it did not hit the BOSU® ball instead of the floor. He was also able to do this as he was in movements of repeated squats. This looks like it was easy for this stroke survivor, but it was not. He could do it well, but it took one hundred percent focus and concentration. He did it; then he stepped off and said, “Wow, that is hard.” We worked together over two years before he was ready to work on this.

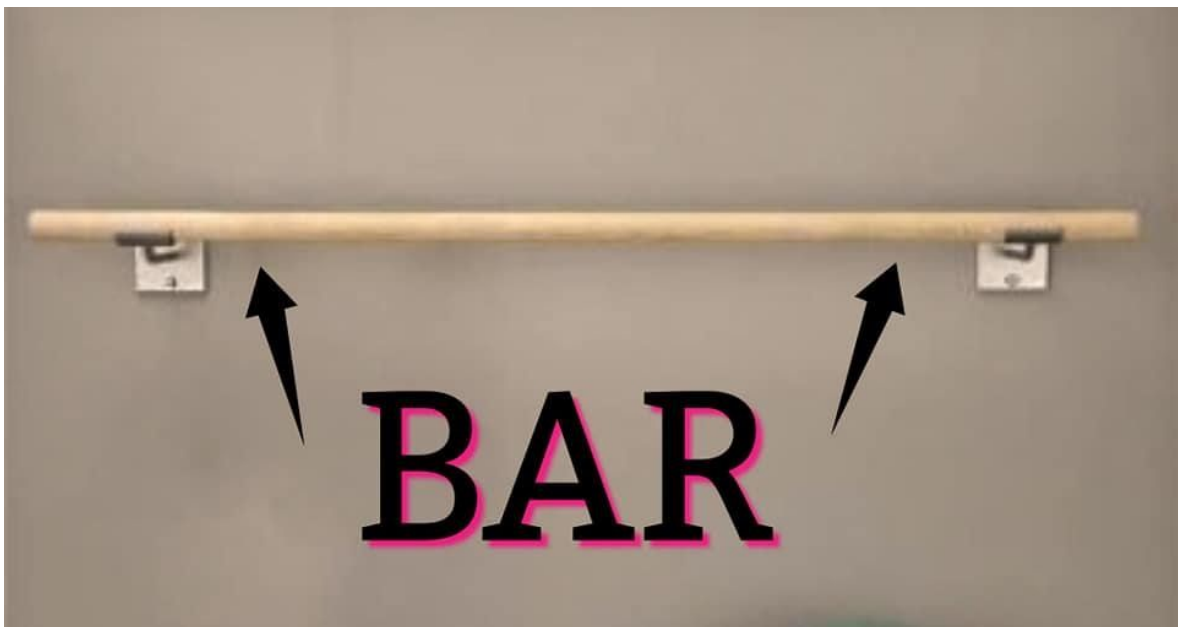
This also meant many movements and cognitive skills needed for everyday life had also developed. This achievement, as in all of them, was a foundation for the next functional gain his body was going to attain to help him in everyday activities and movements.



## CHAPTER 24

### EXERCISES

In all cases, especially in the beginning, I have the client hold on to a ballet barre or the squat rack bar, depending on what you have available for their safety. As I teach in this course lecture, the safer they feel doing exercises and movements the better results they are going to get. They will go farther in their recovery. Using the bar also helps to teach their brains to communicate quicker reaction time and spatial awareness. This is essential.



Here are some important exercises I have found essential to regaining balance, strength, and stability for safe movement. Depending on the client, I may have them start by sitting on a Swiss ball, standing on the balance disc, or I may have them start by standing on the BOSU® ball. If your client is trying these exercises at home or training with you via Zoom be sure to have a safe item to hold onto.

With most of my stroke clients and older clients that I train via Zoom, **I require them to have a bar on the wall for safety.**

*The instructions listed are what the trainer needs to direct to the survivor.*

In each standing exercise:

- Have them engage the core. Imagine zipping up a zipper to put on a snug girdle.
- Have them be aware of their body's location in space from head to toe.
- Have them be aware of feet placement. Feel them evenly anchored wherever they are standing. Try to keep feet evenly placed, do not let them roll out to the sides.
- Stand up tall, stack the shoulders over the hips, and imagine that they are lengthening their spine to the sky.
- Imagine their body weight is lifting, as the feet maintain the sense of being anchored in the ground.
- For safety, if needed, hold onto a bar or secure object, which allows them to maintain a good posture.
- Hold on enough to be safe, but do not become so stiff that they do not feel the balancing challenge of the disc or BOSU® ball.
- If they are sitting on the stability (Swiss) ball, anchored as described above, keep the knees over the ankles, and sit up tall with shoulders over their hips.
- Follow the instructions and tips listed with each of the following exercises.

### **Exercise 3**

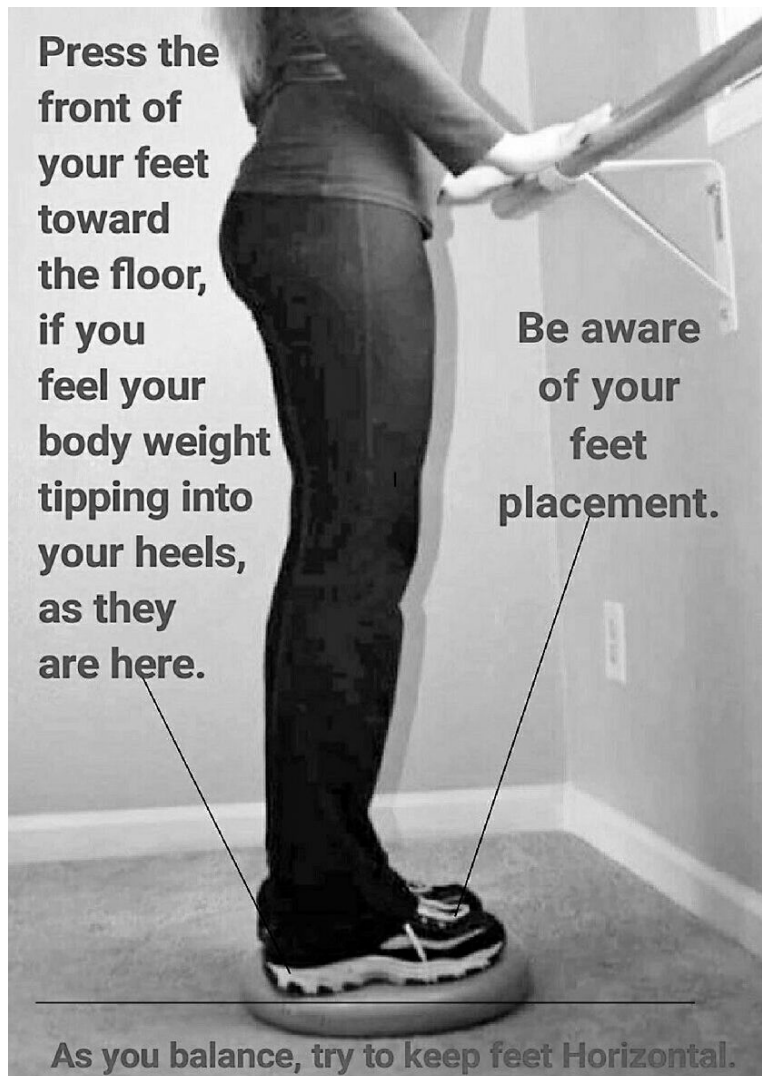
#### **Standing on the Balance Disc**

It is important to have a balance disc that is not too flimsy. I have found that the CanDo® brand 35cm/13 inch is a good one to use.

***The instructions listed are what the trainer needs to direct to the survivor.***

- Engage the core. Imagine zipping up a zipper to put on a snug girdle before even stepping onto the balance disc. Re-engage once they are standing on the balance disc.
- Be aware of the body's location in space from head to toe.
- Be aware of feet placement. Feel them evenly anchored where they are standing. Try to keep feet evenly placed, do not let them roll out to the sides.
- Stand up tall, stack shoulders up over hips and imagine reaching the top of their head to the sky.
- Imagine their body weight is lifting up as their feet maintain the sense of being anchored to the ground.
- Hold onto a bar or secure object so they can maintain a good posture, but do not hold the body so stiff that they do not feel the balancing challenge of the disc.
- Depending on each survivor's balance strength or challenges, they must begin at their own level.





**Exercise 4**  
Standing on a  
BOSU® Ball

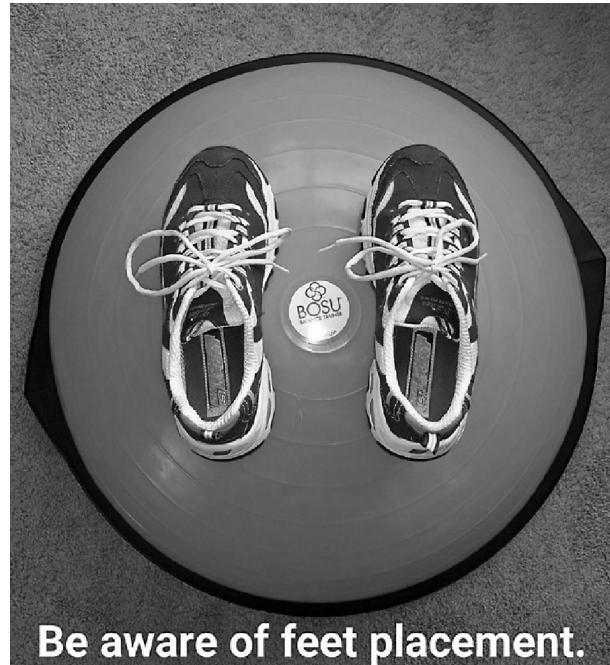
Step or the

This exercise is good to stepping on a step first. When the client is stronger and safe to use the BOSU® ball, incorporate that. When using the BOSU® ball, it is important that you have the BOSU® ball inflated to its proper firmness. Usually, if you turn the BOSU® ball over so that the platform is facing up and measure the distance from the floor to the top of the platform, it should be about 9 to 10 inches off the ground. I have noticed that BOSU® balls can vary a bit in size. A flatter ball DOES NOT MEAN IT'S A BETTER CHALLENGE. That is not how it works; it is not the science behind this piece of equipment.

***The instructions listed are what the trainer needs to direct to the survivor.***

- Engage the core. Imagine zipping up a zipper to put on a snug girdle before even stepping up from the floor. Re-engage once, standing on the stop or the BOSU® ball.
- Be aware of their body's location in space from head to toe.
- Be aware of feet placement. Feel them evenly anchored to where they are standing. Try to keep feet evenly placed, and do not let them roll out to the sides.
- Stand up tall, stack shoulders up over hips and imagine they are reaching the top of their head to the sky.
- Imagine that their body weight is lifting up, as their feet maintain the sense of being anchored.
- Hold onto a bar or secure object so that they can maintain good posture, but do not hold the body so stiff that they do not feel the balancing challenge of the BOSU® ball.
- Depending on their individual balance strength or challenges, they must begin at their own level.





### **Exercise 5**

#### **Stepping on and off the BOSU® Ball**

- Engage as explained in Exercise 1 or for the balance disc before even stepping onto the dome of the BOSU® ball.
- Spend a few minutes standing and balancing.
- When they are ready to step up and down, remind them to stay focused, and mindful of each individual foot's placement as they step up and step down.
- Come to a complete balance, once both feet are on the dome. Stand up tall, stacking their shoulders over their hips.
- When they feel balanced, have them stay focused, and then step back to the floor.
- Once they come to a complete balance on the floor, stand up tall, stacking their shoulders over their hips. Then step back onto the dome.
- If possible, begin by stepping up with the right foot and stepping down with the right foot. Do these five times; then switch to stepping up with the left foot and stepping down with the left foot.
- In time work them up to 10 on each side.
- If they have a foot drag, a drop challenge, or another physical challenge or weakness making this difficult to do, *KEEP PRACTICING*. It will get easier with time. *The more they are aware of a movement, the better chance their brain has of making the new pathway needed for such a movement.*

- When stepping off to the floor, focus on clearing the dome. The goal is not to let their foot drag down the dome or hit the plastic platform. If they have extra physical challenges, this movement will come with time. *KEEP PRACTICING.*
- When finished with stepping up and down, go back to just standing and balancing. They will find they can balance better now. If the first few times they do not experience this, it will come with time. *KEEP PRACTICING.*

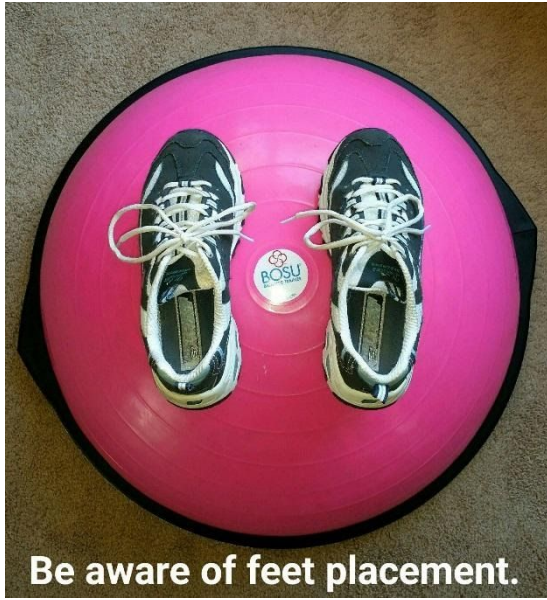
This is an especially important exercise to help them regain balance and rebuild a safe and strong walking gait. It helps to rebuild an awareness of the location of their feet in space during movement.

We take small steps stepping backwards many times each day:

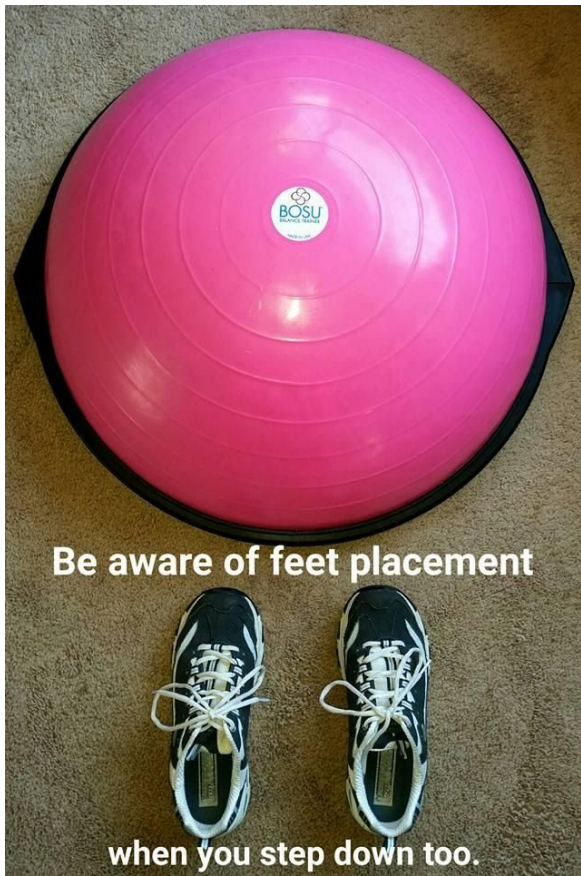
- When we open a door towards us.
- When we approach a chair to sit down.
- Doing laundry.
- Stepping down a ladder or step.
- Backing away from the bathroom or kitchen sink.
- Using their feet to push themselves in a chair away from a table before they stand and more.

*If they are having a tough time with the exercise of walking backwards, begin with Exercise 5 first, and/or include it in their workout program before they work on walking backward.*

***\*Remember, the brain sends a message to the deep core muscles to stabilize the body before movement. Exercise 5 will help rebuild the body's natural system of flow for stepping and walking backward.***



**Be aware of feet placement.**



**Be aware of feet placement**

**when you step down too.**





*If they are unable to step on the standard BOSU® ball, have them use a child size BOSU® ball, if they are able. The client in this photo was only 4 feet 11 and 105 years old.*

## **Exercise 6**

### **Walking Across 3 or more BOSU® Balls**

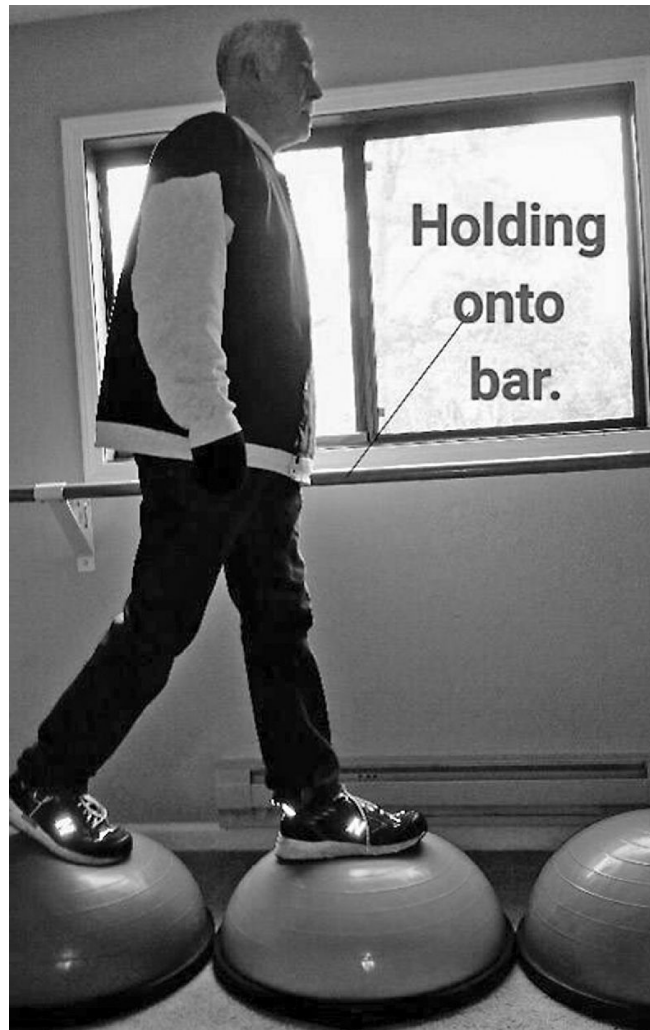
**This is more advanced.**

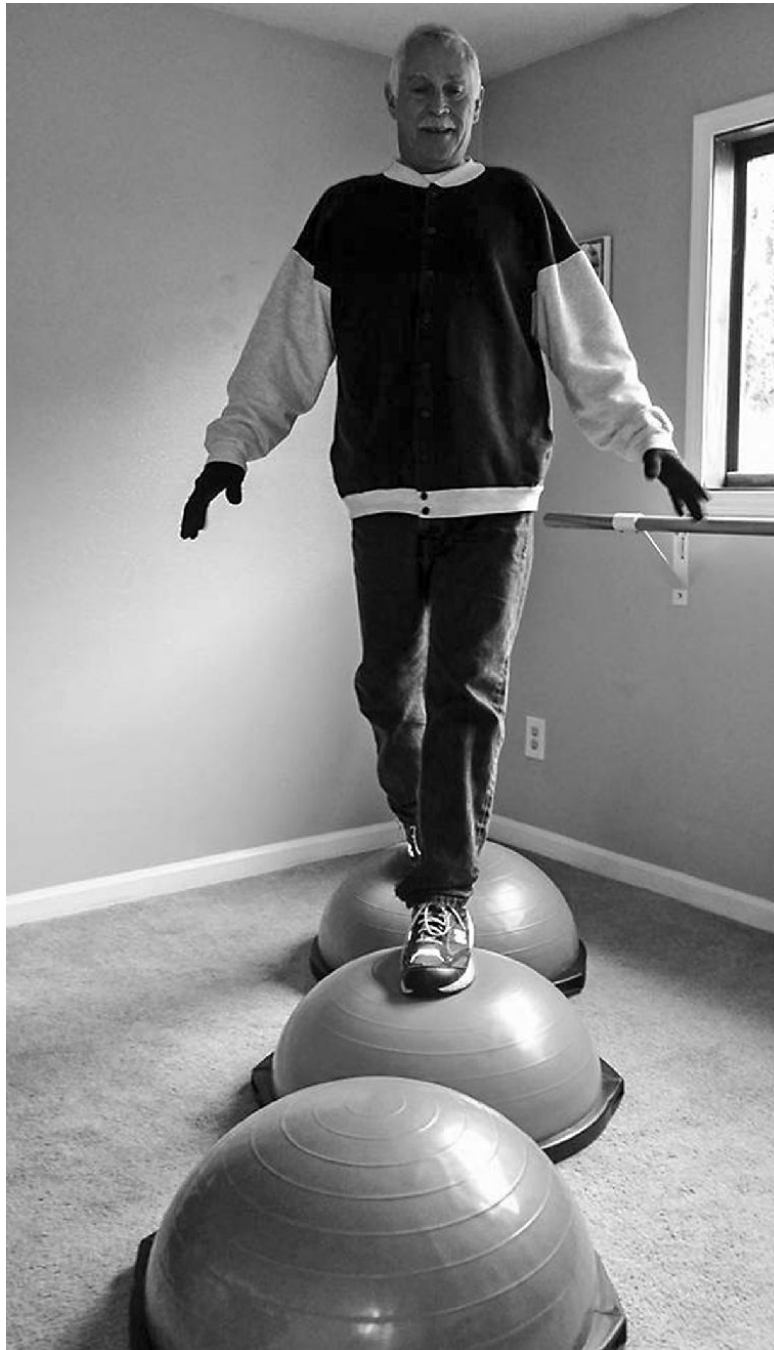
**Only do this exercise with those survivors who are stable enough to do it!**

- Begin with placing the BOSU® balls in a straight line next to a barre. Use a ballet barre or a squat rack bar at the gym that holds the rack securely in place or use something secure.
- Hold on safely with one hand, facing the end of the row of domes.
- Engage their core and be aware of their body from head to toe as explained in previous exercises.
- When they are ready, step up on the first dome.
- Find their balance and stand up tall, staying engaged.
- When ready, safely step from the first dome onto the second dome.
- When they are balanced and feel in control, safely step onto the third dome.
- Find their balance again, and when feeling safe and in control, step off the dome onto the floor.
- Turn around and repeat, going in the other direction. (They are now holding on with the other hand.)
- Depending on each individual, if they are more challenged on one side and are having a hard time holding on with a particular hand, do not walk on domes in that direction until they feel safe and/or have a therapist or qualified professional with them.
- Try stepping from one dome to the next, leading with the right foot for some steps. Then do the same, leading with the left foot.
- Start focused, try to control the step of each foot, and place it exactly where they want it to be.
- Do not let them randomly land their feet anywhere. Work on controlling their steps.
- *Advanced.* **If and only when** they are ready, instead of stepping on to the floor to turn around, turn around on the last dome very slowly, with small steps and with control.
- *Advanced.* **If and only when** they are ready, walk across the domes without holding onto a barre/bar. Remember, it is not necessary to do this without holding onto something to achieve results.

### **Incorporating BOSU® Balls**

Standing on a BOSU® ball is extremely good for balance, stability, walking, awareness of feet placement, quick reaction time, the neurological system, strengthening the core, pelvic and leg muscles, focus and more. In time, a client may begin to step from one ball to the other and possibly do a squat and then step to the next. As seen in the exercise section of this book, have client hold onto a bar of some sort for safety, until they are ready not to use a bar. They may always have to use the bar, and that is okay. In time they may begin to turn around on the last ball and go back across them instead of stepping on the floor to turn around. This may take months of practice and may never be perfected, but the outcome in strength, coordination, balance, and brain exercise is still taking place.





## **Exercise 7**

## Walking Backward

**Only practice walking backward if client can safely do so.**

Client can walk alongside a bar, or something to hold onto if needed.

If client does not have control of placing each foot exactly where they want it when they step, **walking backward will not be safe for them to do.**

### **Safety first!!**

After doing the previous exercises for some time, the ability to walk backward will feel safe again.

Once a client is ready to walk backward, find a safe area. I find it is best to have a mirror in front of a client, if possible, to watch themselves, but this is not always an available option.

**If client is using a walker, DO NOT WALK BACKWARD!**

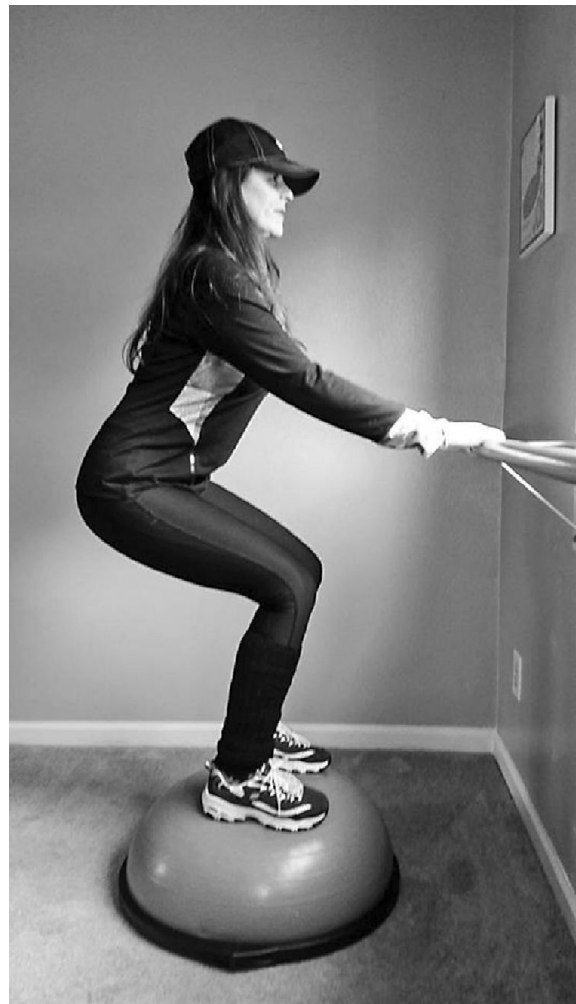
The picture below is my 105-year-old client walking toward the mirror forward, then walking backward as she still faced the mirror. Her posture is nice and strong from our work together. She was amazing.



## **Exercise 8**

### **Squats Holding on to a Bar**

This exercise can be done standing on the floor or standing on the BOSU® ball.



- Begin by doing this exercise with their feet on the floor first, to be sure they can hold the proper alignment safely before they begin performing this on the dome of the BOSU® ball. They can also do this standing on a balance pad as they become stronger to squat with the BOSU® ball.
- While facing the bar, evenly hold on to the bar with their hands, so that their body is centered between their hands.
- Engage their core, and focus. Hold the body in good form from head to toe, including the shoulders.

- Squat down as if they are going to sit in a chair, then raise themselves back up.
- Try to use their legs and glutes to do the movement. Do not allow the arms to do all the work.
- Do not drop the hips below the knees.
- If this bothers their knees, check their form. If it still bothers their knees do not do the exercise.
- If they are doing this standing on the floor, have them pull themselves up to a good posture between each squat.
- If they are doing this on the dome, have them pull themselves up to good posture, and balance themselves straight up and down in good form between each squat.
- Maintain control and focus throughout each movement.
- In each squat, make sure both feet are parallel, so that their hips and pelvis are moving evenly through both sides throughout each rep.
- If they are using the BOSU® ball, do about 8-10 squats, then spend a couple of minutes balancing on the dome. When they are stronger, work up to three sets of 10 squats, balancing in between.
- Work their way up to the squatting. Depending on each individual, they may not feel safe to do the squats in the first few weeks.



Practice walking forward every day. Practice all these exercises daily if they can. Encourage them to listen to their body and its guidance.

The body needs to heal. Each person's body heals at its own pace. Try to encourage them to have patience and respect for their body. Always being kind to themselves.

When they feel ready to add some free weights, they can sit on the Swiss ball, stand on the disc, stand on the BOSU® ball or even kneel on the BOSU® ball and do bicep curls, shoulder raises or other upper body exercises in proper form. I do not suggest doing overhead exercises when they are using these unstable surfaces, it can put pressure on their spine.

**Stay safe.**

If needed while standing on disc or BOSU® ball, hold on with one hand while doing a bicep curl in the other hand. This technique can be used with any specific exercise that the client can do safely and effectively one side at a time.

Often in the beginning one side will be harder to hold on with. Monitor each client individually to what they can and cannot do. This can be done sitting on a ball or in a chair if needed as well. Be sure the whole body is in the best posture it can be in from head to toes.

The more a survivor can do exercises as they are on the Ball, BOSU® ball, balance disc, or balance pad, the whole body will be working and challenged for movement, balance, and functional training. This is what is needed for everyday life.

Survivors can work on one side at a time to help with spasticity in the arms, hands, and fingers. Have them focus on the hand that is not affected by the stroke. Focus, concentrate, with eyes open and closed, visualize in the mind and feel what that hand is doing, so when they go to train on the stroke affected side, they can use the visualization and focus that is used on the non-affected side. Do this sitting, until able to do on an uneven surface as in the disc and BOSU® ball.

## **Exercise 9**

### **Battling Ropes**

Battling ropes, also called battle ropes, are a great tool for stroke survivors and clients with balance and neurological challenges. They work well for neurorehabilitation for stroke, brain injuries and cardiac rehab clients and excellent for age related disease. Battle ropes have minimal risk of injury and are non-impact weight resistance. There is a 2-vector force direction created, while using the battle ropes. This means one direction of force is pulling away from the client while a downward force from the pull of gravity from the weight of the ropes. This causes multiple contractions of different muscle groups at the same time. At the same time, they challenge the dynamic balance and stabilization while using them. They are being used more for rehabilitation and corrective exercises. They help clients with asymmetrical stabilization issues. Depending on the recovery stage in a client, one may only use one rope at a time or two ropes at a time. There are different wave patterns to use with the ropes that create velocity and challenges the core muscles in different patterns.

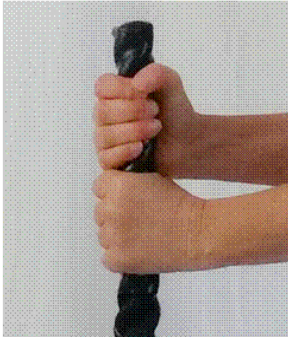
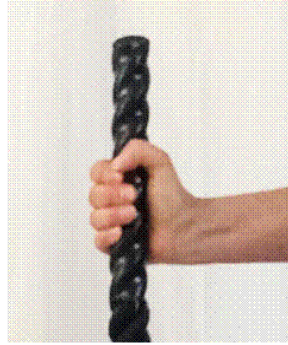
Ropes can be used by clients in wheelchairs and walkers. They can be seated in their wheelchairs or on a chair that is an appropriate height for their height and hip level. They can be used sitting on a ball, standing on the floor, and standing and sitting on the BOSU® ball, squatting, lunging, kneeling and more. I took a Battling Rope Coach Certification course with NESTA to better my knowledge using the ropes with clients. There is much more to battling ropes than I am mentioning in this book.

There are hundreds of exercises that can be done with them. They come in different lengths, diameters, and weight of the ropes. A few basic tips. Understand the purpose of the different hand grips. Keep the client in proper posture. Be sure that they keep their shoulder girdles set in proper alignment.

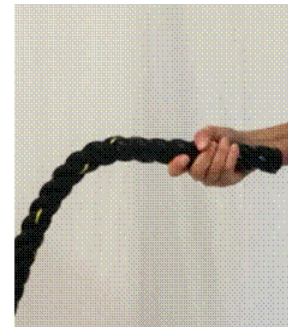
A survivor may be able to use both ropes and/or use a single rope. It will depend on the individual challenges they are working through. The way the hands grip the battle ropes have influence over which arm muscles get exercised more. If a client has an arm that will not work well with the ropes yet use a single rope with the double hand grip. If possible, perform the exercises in one position then rotate the hands, so the other hand is on top and perform the exercises again. The stronger arm of course will be in control, but the other arm will follow in movement and participate in the exercise as well, but with guidance with the other hand. I suggest having the client perform making waves with the battle ropes and the tsunamis.

These can be done standing or kneeling on the ground, sitting in a chair, wheelchair, roller walker, Swiss ball, standing and sitting on the BOSU® ball.

**Different Hand Grips May Be Used While Using Battle Ropes.**



In this hand grip, as the client performs Waves or the Tsunamis exercises with the battle ropes, the push muscles are being worked



In this hand grip, as the client performs Waves or the Tsunamis exercises with the battle ropes, the pull muscles are being worked



Combining battle ropes with some Pilates ab exercises is also can be a wonderful thing, if the survivor's arms/shoulders can do it. In this exercise, the ropes are wrapped securely around a pole. This client is keeping shoulders in place, abs engaged as she slowly lifts one leg and lowers it back down with control. Moving at the same speed both directions. Combining with the ropes as she is, she is strengthening the core, arms, and shoulder stabilization. These are 30-pound 30-foot ropes. They come in different lengths, diameters, and weights.

The ropes are also usually fun for the clients. There are many exercises that can be done with them. It is something they can purchase and use at home, once they can use them safely, and know how to avoid injury using them on their own. They are excellent for neuro, cardio, and full body workouts.

## CHAPTER 25

### Definitions

As Fitness professionals we do not need to be experts in the medical terminology about strokes, but having the knowledge and understanding of the common terms involving stroke survivors, will help

better understand and communicate with survivor clients and their caregivers. This will build a stronger relation between the survivor and yourself as a professional and a better opportunity to gain their trust and communicate with you through their recovery time with you.

#### **Acute stroke unit**

A stroke unit providing acute care in the initial stages post stroke. Treatment and care during the acute phase of stroke are crucial and will include several tests to confirm, the diagnosis, including a brain scan.

**Adaptations** to the home can make everyday life safer and easier for people who have had a stroke and can make it easier for people to get about and live independently. Adaptations can include ramps, rails, stair lifts and wet rooms (adapted shower rooms).

**Aneurysm** A balloon like bulge in the wall of an artery. The walls of an aneurysm are thin and weak and so they are more likely to burst and cause bleeding in the brain (a hemorrhagic stroke).

**Angiography** A type of X-ray used to examine blood vessels. It can help to diagnose conditions that affect the blood vessels and the flow of blood through them. These include aneurysms, coronary heart disease and atherosclerosis (narrowing and hardening of the arteries).

#### **Anticoagulant**

A type of medication used to thin the blood. Thinning the blood helps to reduce the risk of blood clots forming and reduces the risk of stroke. Anticoagulants are usually prescribed to reduce the risk of stroke in people with a type of irregular heartbeat called atrial fibrillation.

**Antiplatelet drugs**

A type of blood thinning medication. They stop the platelets in the blood sticking together and forming clots, which reduces the risk of stroke.

**Aphasia** Difficulty speaking (expressive aphasia) or understanding what is said (receptive aphasia) or a combination of the two. It is sometimes called dysphasia.

**Apraxia**

The inability to control and coordinate movements or carry out complex tasks. It can make everyday activities harder because the person may not be able to do the things they need to do in the right order.

**Arrhythmia** An abnormal or irregular heartbeat.

**Aspiration** can occur when someone has difficulty swallowing after a stroke. Food or fluid can enter the lungs through the windpipe, which can cause pneumonia or a lung infection.

**Atrial fibrillation (AF)**

The most common type of irregular heartbeat and a risk factor for stroke. AF increases the chances of blood clots forming in the heart, and these clots can then travel in the blood stream to the brain and cause a stroke. AF is usually treated with anticoagulant medication.

**Bilateral** A term which means involving or affecting both sides. With regards to stroke, it is usually used to describe something that affects both sides of the body, for example weakness.

**Blood pressure**

The measure of how strongly the blood presses against the walls of the arteries as it is pumped around the body. It is measured in millimeters of mercury (mmHg). A blood pressure reading has two figures, for example 120/80mmHg. The first figure is the pressure when the heart beats (systolic blood pressure) and the second figure is the pressure between beats (diastolic blood pressure). High blood pressure is the biggest risk factor for stroke.

**Blood vessels** Blood vessels form part of the circulatory system that transports blood throughout the body. There are three major types of blood vessels. Arteries carry the blood containing oxygen and nutrients away from the heart out to the rest of the body. Capillaries are tiny blood vessels within the tissues of the body, and veins carry blood containing waste products like carbon dioxide back toward the heart and lungs.

**Brainstem** This is the stem-like part of the brain, which links the two halves (hemispheres) of the brain to the spinal cord. It controls the flow of messages between the brain and the rest of the body. The brain stem contains some vital nerve cells involved with breathing, the heart, the eyes, and many other essential functions. A stroke that occurs in the brainstem can be profoundly serious and can leave someone with locked-in syndrome, where someone is completely paralyzed apart from eye movements, but they usually have full awareness

**Cardiovascular system** Made up of the heart, blood vessels and blood, it is responsible for transporting oxygen, nutrients, hormones, and waste products throughout the body.

### **Carotid arteries**

These are the two large blood vessels at the front of the neck. They carry oxygen-rich blood to the brain. A blockage in a carotid artery is a common cause of stroke. This is more likely if the person has a build-up of fatty deposits in their carotid arteries (atherosclerosis). Carotid endarterectomy is an operation to clear carotid arteries of fatty deposits. The surgeon makes a small cut in the person's neck so that they can clear any blockage. It is only recommended if the person has severe blockages as the operation carries a small risk of stroke.

**Cerebellum** A part of the brain that sits just underneath the back of the brain and on top of the brainstem. Strokes that damage the cerebellum can result in difficulties with balance or co-ordination.

**Cerebral cortex** the outer layer of the brain that is made up of grey-matter (brain cells).

**Cerebrum** The largest part of the brain, which includes the cerebral cortex and other areas just below the surface. The cerebrum is important for movement, vision and higher abilities like thinking, memory and talking.

**Cholesterol** A fatty substance that is made in the liver and found in some foods. The body needs some cholesterol to make things like vitamins and hormones. But too much cholesterol can result in narrowing of the blood vessels. This increases the risk of stroke. Eating healthily and taking medication called statins can lower cholesterol

**Dementia** A condition where damage to the brain causes cognitive problems such as difficulty with memory, understanding and mood. Dementia is a progressive condition. Stroke can cause a type of dementia called vascular dementia.

**Diabetes** A condition where the body is not able to process sugar (glucose). Diabetes causes elevated levels of sugar in the blood. This increases risk of stroke and other problems, like damage to kidneys. There are two types of diabetes. Type 1 diabetes is when the body does not produce any insulin. Types 2 diabetes, which usually develops in adulthood, is when the body cannot produce enough insulin. Diabetes can be controlled by eating healthily and taking medication if needed.

**Drop foot** A problem with walking that can be caused by a stroke. It means that the person's foot is difficult to lift and their toes might catch on the ground. This can increase the risk of tripping and falling.

**Dysarthria** Weakness in the muscles that control the mouth, lips, tongue or breathing. This can make speech slower or slurred and can cause problems with swallowing.

**Embolism** The blockage of a blood vessel by a blood clot or piece of fatty material or other debris in the blood stream. An embolism is a type of stroke.

**Gait** A person's manner of walking

### **Hypertension**

The medical term for high blood pressure. This is when the pressure of blood flowing through blood vessels is too high (consistently higher than 140/90mmHg). High blood pressure usually has no symptoms and is the single biggest risk factor for stroke.

**Hypotension** The medical term for low blood pressure. This is when the pressure of blood flowing through blood vessels is too low (consistently less than 90/60mmHg).

**Impairment** A general term used to describe loss of function such as weakness in an arm or leg, loss of sensation, loss of speech, or visual problems

**Incontinence** Loss of control of the bladder, bowel, or both (which is called double incontinence). Continence problems can develop for different reasons and there are many different types of continence problems. About half of people admitted to hospital with stroke will have lost control of their bladder and a third will experience loss of bowel control

**Ischemia** An inadequate blood supply to an organ or tissue, usually a result of vessel walls being narrowed due to a buildup of fatty material (atherosclerosis).

**Left hemisphere** the brain has two sides, known as the left hemisphere and right hemisphere, each controlling different functions. Amongst other things, the left side usually controls speech and writing, as well as controlling movement on the right side of the body

**Motor control** refers to the way the nervous systems produce movement. In humans the coordinated contraction and relaxation of muscles groups is mediated both by reflex mechanisms and higher-order executive systems that involve widely distributed parts of the brain

**Multi-infarct dementia (MID)** Multi-infarct dementia is the most common form of vascular dementia. It is caused by multiple mini strokes that take place over time giving rise to many tiny, widespread areas of damage. These strokes are so small that a person may not notice any symptoms, or the symptoms may not last exceptionally long, they are sometimes called silent strokes. A silent stroke differs from a transient ischemic attack (TIA)

**Muscle Tone** The degree of natural tension in a person's muscles. Abnormally high muscle tone can lead to muscle tightness and stiffness (spasticity). Exceptionally low muscle tone can cause floppiness (hypotonia).

**Nerves** In the human body, a whitish fiber or bundle of fibers that transmits impulses of sensation to the brain or spinal cord, and impulses from these to the muscles and organ.

## **Nervous Systems Include**

**Central Nervous System (CNS)** the part of the *nervous system* which consists of the brain and spinal cord, to which sensory impulses are transmitted and from which motor impulses pass out, and which coordinates the activity of the entire *nervous system* — compare *peripheral nervous system (PNS)*.

**Peripheral Nervous System (PNS)** connect the central **nervous system (CNS)** to sensory organs (such as the eye and ear), other organs of the body, muscles, blood vessels and glands.

**Neurology** The study of medicine that treats diseases and disorders of the nervous system which includes the brain, spinal cord, and nerves throughout the body. It includes disorders like stroke, epilepsy and degenerative conditions like Alzheimer's disease and Parkinson's disease.

**Neuron** The term for a nerve cell. The nervous system contains billions of neurons with three main types, sensory, motor and interneurons. If the cell body of a neuron is damaged the cell dies and is never replaced.

**Neuroplasticity** The ability of undamaged parts of the brain to take over the jobs of damaged areas. The ability for the brain to repair and heal itself.

**Paralysis** Complete loss of the ability to move muscles.

After a stroke, paralysis usually happens on one side of the body. If one whole side of the body is paralyzed, this is called hemiplegia

**Physiology** the branch of biology that deals with the normal functions of living organisms and their parts. The way in which a living organism or bodily part functions.

**Physiologically** Of or relating to physiology. Being in accord with or characteristic of the normal functioning of a living organism. Relating to the action of a drug when given to a healthy person, as distinguished from its therapeutic action.

**Platelets** Small cell-like particles found in the blood. They help the blood clotting process by clumping together to form a plug. They also release substances that promote clotting.

**Plaque** Fat, cholesterol, and other substances which have built up in the walls of our arteries and formed hard structures. These plaques can make arteries narrower and increase the risk of stroke.

**Retinal stroke** A stroke that happens when there is a blockage in one of the blood vessels to the eye. People who have a retinal stroke may have been aware of some blurring or blackouts of vision in one eye before their stroke.

**Statin** A type of medication used to lower cholesterol, which can reduce the risk of stroke.

**Stenosis** (of an artery) Stenosis means narrowing. If an artery has become narrowed, it increases the risk

### **Thalamus**

A part of the brain. Information about sensation from the body passes through the thalamus before reaching the cortex, the main part of the brain involved in complex tasks.

**Thrombolysis** An early treatment for some types of strokes caused by a blood clot. Thrombolysis is a procedure that involves being given a drug called recombinant tissue plasminogen activator (rt-PA). This drug breaks down blood clots and so can reverse the damage done by the stroke, but it must be given within four and a half hours of the stroke happening.

**Thrombosis** A blood clot that forms in an artery.

Transcranial magnetic stimulation (TMS)

A procedure which involves applying a magnetic current to parts of the brain to promote recovery.

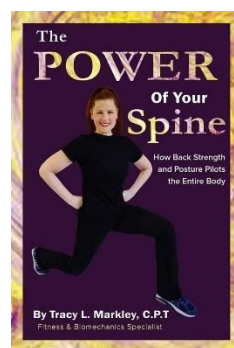
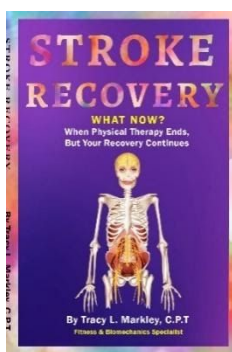
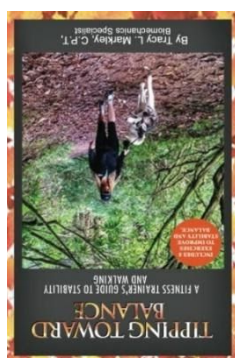
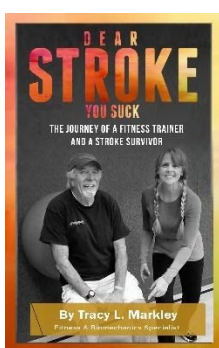
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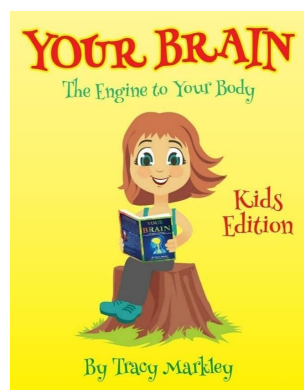
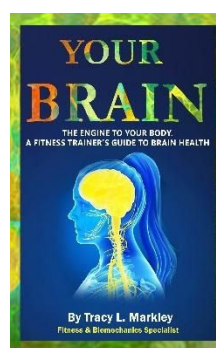
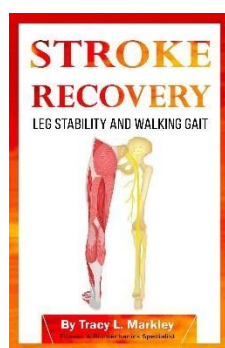
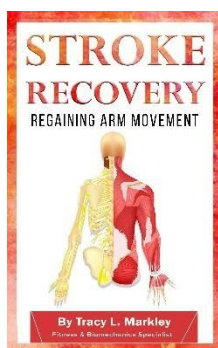
### About the Author

Tracy L. Markley has been working and studying in the fitness industry for over 20 years. She is the owner of Tracy's Personal Training, Pilates, and Yoga Studio. Previously, in Huntington Beach, California for 17 years and relocated to Oregon in 2013. She is a Certified Health Fitness Specialist, Personal Trainer, Dance & Group Exercise Leader, Fitness & Nutrition, Biomechanics Specialist, AFAA Group Exercise Examiner, BOSU® Master Trainer, FiTOUR Pro-Trainer, Reiki Master-Teacher, as well as a Pilates and Yoga Instructor. Her books and videos have helped stroke survivors and caregivers worldwide. Tracy is the author of nine books.

In 2020 Tracy was awarded the 2<sup>nd</sup> place Medical Fitness Professional of the Year Award with the Medift Foundation and she was also one of the three finalists for 2020 IDEA WORLD Personal Trainer of the Year Award. She received a Literary Book Award for her Children's book in 2020 as well. She has been in several magazine articles and has written fitness articles for the local newspaper in the town she lives in. She is the host of the radio show, *The Health and Fitness Show with Tracy* on KXCR FM radio on the Oregon Coast. Tracy is available for speaking events, book signings and training. She can be contacted at her websites [www.tracypersonaltraining.com](http://www.tracypersonaltraining.com) and [www.tracymarkley.com](http://www.tracymarkley.com)

[www.instagram.com/motivate\\_healthyfit](http://www.instagram.com/motivate_healthyfit) YouTube Channel: Tracy L. Markley Fitness





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