

Muscles, Fascia and Stress

The key to understanding injuries that are related especially to postural patterns is to understand the nature of **stress**, and how muscles respond to stress. There are many kinds of stress; yet despite the variety, muscles pretty much always adapt to stress in terms of **muscle tone**. The relationship between stress and muscle tone is especially well described by Leon Chaitow in his book, *Fibromyalgia and Muscle Pain*.³

How muscles react to stress

Muscle **tone** is the state of firmness or contraction that we find in a muscle. Muscle tone increases when called upon to do some action or work. If this happens often — such as when the muscle is repeatedly asked to do the same thing, hold the same position for a long time, or when its actions are consistently accompanied by a strong emotion — then its increased tone can become fairly permanent or chronic, and we call the muscle ‘**tense**.’ Tension in a muscle is a state of persistently heightened tone.

Repetitive stress injuries result from the kind of tension that comes with tasks such as typing and computer work, in which muscles are used in a repetitive, imbalanced and tiring or stressful way.

There are other, less obvious cases of stress which also can lead to chronically increased muscle tone are:

- **Emotional stress** — It can take hours (or more) for emotions to calm down; the resulting tension in the muscles that these emotions bring can last even longer. Emotional tension in the neck and shoulders is pretty familiar; but such tension can manifest at deeper levels, such as in the psoas at the core of the body. Strong emotions habitually held for years can be physically devastating.
- **Breathing patterns** — Breathing can be distorted as a result of disease (asthma, bronchitis), habit or emotion, and the distorted patterns bring heightened muscle tone, particularly in the muscles that have to work harder, such as in the shoulders and neck.
- **Fascial imbalances** — A good part of our study in this book will focus on imbalances in the tone of fascial tissue that result from structural factors such as posture, habits of movement, and traumas from injuries. The **fascia** is the slightly elastic tissue that both supports and gives shape to a muscle, and provides connection and continuity between muscles. Dr. Chaitow goes so far as to say that fascia “comprises one single, continuous web of material from the inside of the skull to the soles of the feet.”⁴ Fascial imbalances can exert a fascial ‘drag’ that affects muscle tone. We’ll be exploring the patterns by which this web gets distorted, leading to common injuries and therapeutic problems.
- **Posture** — When misalignments and deviations in posture demand that some muscles hold or stabilize the posture, then the tone of those muscles increases. This can also be due to structural imbalances such as one leg being shorter than the other, or loose ligaments in the joints that have to be compensated for in order to stabilize posture — such as with fallen arches or hyperextended knees.
- **Restricted movement** in a particular joint, such as in the case of **arthritis**. This can alter muscle tone around the arthritic joint, as well as around other joints.
- **Reflex connections** between the eyes and muscle muscles involved in movement. When your eyes habitually move or are held in a particular direction, such as when gazing at a computer screen off to one side, then the body responds with a constant state of readiness

3 Leon Chaitow, *Fibromyalgia and Muscle Pain*, p. 83-91

4 *Ibid.*, p. 84

to move in that direction, increasing muscle tone in the neck and so on.⁵

Dr. Chaitow points out the relationship between eye position and back and pelvic tension. As an experiment, turn your eyes upward (without tilting your neck or head) and bend forward, as in Uttanasana, without forcing. When you reach your limit, turn your eyes downward toward your nose and, without exerting further effort, see how much further you bend.

He points out that, when looking upward, the tone of the muscles in your back increase, limiting your forward bend. He expands upon this insight to say, “These eye reflexes are intimately connected with the position of various pelvic structures. If there are muscular or joint imbalances in the lower back or pelvis, this can affect the eyes and the eyes can further affect other muscles.”⁶

The tone of the muscles in your neck — particularly at the base of your head — is also affected by your eye movements, especially when your eyes are consistently turned in one direction.



The Problem of Increased Muscle Tone

A **vicious cycle of stress** often ensues from chronically increased muscle tone:

1. Tension brings a higher **demand for oxygen** in the muscles — and thus a **demand for greater blood flow**. But that very tension *prevents* the needed circulation, leading to aches and pain in the oxygen-starved muscles.
2. Lack of circulation leads to the build-up of **waste products** in the muscles — since the natural cleansing process is hindered. This brings still more aches and pains.
3. The aches and pains bring even more tension/muscle tone.
4. The muscles and surrounding fascia **harden** to **adapt** themselves to this cycle of pain and stress, **changing their structure**. Collagen accumulates in the muscle (by a process described below) and the muscle becomes more fibrous, turning into something more akin to a hardened band.⁷

The Consequences of Stress⁸

—When the muscles become **fibrous**, turning into tight ‘bands,’ they pull at the tendons and attachments to the bones, causing the same changes to come about in the tendons. The insertion point of the tendon into the bone becomes sensitive; these points of insertion are called **periosteal pain points**.

— Tight muscles burn lots of energy. Since the musculoskeletal system already uses the most energy of any of the body’s systems, the result is a great deal of **fatigue**, which can become chronic.

—A tight muscle **weakens its antagonist**. When one muscle is tense, short and fibrous, its opposing muscle is pulled or ‘locked’ into a ‘thin’ or ‘long,’ compromised, weakened position.⁹ The tone of *both* muscles is increased from this imbalance. The weakened muscle

5 Ibid., p. 85

6 Ibid., p. 86

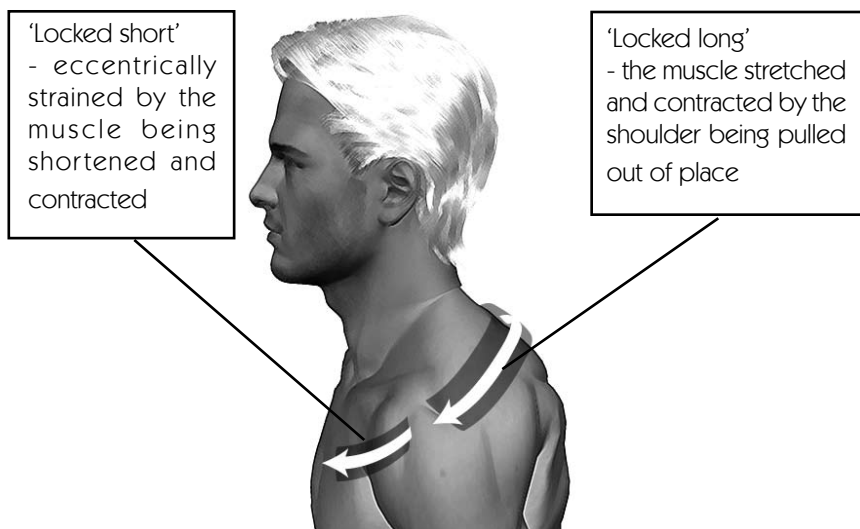
7 Ibid., p. 86-7

8 Ibid., p. 88-9

9 Thomas Myers, *Anatomy Trains*, p. 18-19

tries to do its job but is overpowered by the opposing hypercontracted or 'tense' muscle, resulting in **muscle spasms and trigger point pain** in the weaker muscle.

- The further result of these imbalances in muscle tone and strength is a lack of coordination in ordinary movements, which **wears upon the joints**.



An Example of the Process: Stress in the Fascia

Consider the common 'slump' – which can develop for a variety of

reasons (work, driving, stress, postural deviation and stress from poor eyesight, emotional issues, or injury). This slump is part and parcel of the 'forward head' posture, in which the head is held forward of the axis of the spine. When this is the case, the neck and upper body muscles have to work overtime to hold this posture.

Usually muscles get time to relax: they're designed to work in tandem with each other with revolving breaks. But in this posture, particular muscles are under constant stress as they are asked to work like structural cables holding the head up.

We already saw Leon Chaitow's description of the vicious cycle of stress which leads to a hardening of the muscles. Thomas Myers elaborates upon this with a biochemical account of the process, which I paraphrase here:

The strain of increased muscle tone creates a 'piezo-electric' charge that runs through the fascia within and around the muscle, and even beyond it. This charge stimulates the secretion of collagen in and around the muscle. The collagen molecules are polarized by this charge, and orient themselves along the lines of tension. The muscle hardens from the influx of collagen into a fibrous and tough fascial 'cable' better suited to hold the muscle in this stressful position.¹⁰

The muscle fibers themselves are usually supple and elastic, like rubber; after stretching or lengthening, muscle fibers return to their original resting length. Fascial tissue, on the other hand, is more like plastic. It is engineered to hold its shape. If you stretch fascia quickly, it will tear. But if stretched *slowly* enough, the fascia reshapes like plastic — i.e. it will change its length and **retain** that change.¹¹

Thus fascia can become 'locked long' into a weakened position, such as in the case of the muscles of the upper back when the shoulders are chronically 'slumped.' The reshaped fascia, having been pulled to a weakened position of greater length, hardens from the stress so that the muscle is better able to hold that length. And as we've already seen, the overworked and undernourished muscles stuck in this position, will usually suffer reduced function, trigger-point pain, and weakness, along with a buildup of toxins within

¹⁰ Ibid., p. 18-19

¹¹ Ibid., p. 18

the muscle.

The very nature of fascial tissue brings us through a **vicious cycle** to this condition. But this nature also makes possible a **virtuous cycle** of proactive work — i.e. yoga — by which to return to greater health.

That is to say, the changes are not necessarily permanent. When the postural pattern is changed, new fibers can be produced (albeit slowly) to form the area into a different shape.

Cycles of Pain and Healing

It's really quite important to understand that in these matters, we are either in an upward, constructive spiral of caring for our health, or in a downward, destructive spiral. Health is not a static state.

Therapeutic work can reverse the downward spiral and replace it with an upward spiral. But this is where we have to understand yoga as being **more than just 'stretching,' and more than just alignment.** Yoga enters realms of energy that involve feeling, responsiveness, and intention that brings this reshaping. It's a process in which the mind and body must *communicate* with one another, rather than one simply acting upon the other. The vicious cycle came about largely through a disconnect by which the body suffered; healing through a virtuous cycle comes about with a conscious reconnection.

Given our understanding of the nature of fascial tissue hardened through chronic stress, we know that 'stretching' too aggressively will only bring more injury. Realignment of posture also doesn't just happen overnight. A therapeutic understanding of yoga includes the insight that beyond working with muscles and alignment, we are manipulating fascia, and the fascia is not elastic. It has its shape and *holds* its shape — that is both its gift to the body and the reason why lasting change is rarely immediate. Action and steadfast intention is as important as alignment, if not more so, and action includes a balance of both lengthening and strengthening through steady practice and steadfast remembrance. Otherwise we fall back under the sway of unconscious habits and patterns of feeling and emotion.

How does yoga promote fascial release? Through its approach as a balance between **engagement** and **extension**, in which muscles are both consciously firmed or engaged, and also lengthened or extended in and through the poses. **Engagement** — firming the muscles — strengthens the muscles weakened by stress, and protects those that are hypercontracted from overly aggressive 'stretching.' **Extension** — which includes the *intention* to expand and extend, and not just mechanical 'stretching' — brings fascial release. Engaging and extending in yoga poses is rather like a massage from the inside out, in which the firmness of engaged muscles provides the kind of massage-like 'pressure' on the tight muscles that encourages release. Along with this, the intention behind the conscious practice brings restored circulation and pranic flow.

Thus therapeutic work involves two elements, both of which must be present:¹²

1. **Stretching** or 'reopening' the muscle that was previously tight or 'locked short.' This can happen in yoga poses through work with good alignment in the pose — which provides the 'stretching' — and proper muscular action (which in this case involves a certain softening or 'letting go'). As the poses are held, this encourages the muscles to regain their suppleness.

and

2. **Strengthening** the muscle that was previously placed in a weakened position or 'locked long.' This aids the overall process of reshaping. The process extends beyond yoga practice to include bringing the strengthening work into your daily life, maintaining the same principles of alignment and action in your everyday posture as you work to educate your body to hold a new pattern.

12 Thomas Myers, *Anatomy Trains* p. 19

The link between these two - strengthening and stretching - will often be what is known as eccentric stretching. An **eccentric** action (pronounced 'eee'—centric) is an action in which the muscle, paradoxically, is both engaged *and* progressively lengthened, making it *both* a strengthening and lengthening action at once. Eccentric action in a muscle means that it is **engaged, exerting a 'brake' upon the opposing muscle** (in this case, the quadriceps) even as it lengthens — while at the same time not exerting a competing pull or contraction. This is generally the case in yoga poses, in which a muscle remains engaged even as it is being stretched.

The process works like this: muscles are generally **engaged** by drawing energetically **from insertion to origin** — and thus draw toward the core. A clear example of this kind of contraction is to do a 'bicep curl,' in which the barbell is lifted by the muscle pulling from the insertion at the elbow toward its origin at the upper arm. Eccentric stretching works the bicep in the opposite direction: we both maintain the engagement of the bicep, and progressively lengthen it. We do this with the barbell by releasing it down slowly with the bicep still acting as a brake; the bicep then **extends eccentrically**. This is an extremely effective method for strengthening the bicep while at the same time increasing its resting length — so that we don't become 'muscle-bound,' but instead remain supple as well as strong.

This is a significant goal for working with long-term patterns of injury to muscle tissue resulting from patterns of stress, the causes of which include, but are not limited to, postural patterns. We want to create both suppleness (release fascial patterns of stress) and strength.

A second kind of injury involves the tendons and ligaments themselves, which does involve a different, though still related, approach.

Injury to Tendons and Connective Tissue

So far we've covered the consequences of structural tension due to stress in muscle and fascial tissue. But **injuries** also do happen. We may be 'set up' for particular injuries (e.g. hamstring pulls) by structural tensions, but injuries also just plain happen, whether from a fall, bicycle or auto accident and so on. In the short run we see a doctor for an injury; in the long run we have to deal with its aftermath.

There's a distinction to be made here. **Muscles** are injured frequently, but they heal relatively easily. **Tendons, ligaments and joints**, on the other hand, take a long time to heal, and can even stay injured for a lifetime. In this section, we look to the latter kind of injury.

The reason for **long term pain** that follows after injury is the **adhesive scar tissue** that forms in **tendons, ligaments and joints** afterward. This happens especially after repeated re-injury, and these hurts can be really quite small yet long-lasting. A common example quite familiar to yogis is injury to the hamstring attachments at the sit bones. While this may happen suddenly from an overly ambitious hamstring stretch such as Hanumanasana (a 'split'), it builds and perdures over time from little additional tears — from a hundred swan-dives into Uttanasana.

The solution can and often should include some form of body work (e.g. massage) to clear up the scar tissue and promote healing. Yoga also has a significant role to play in this healing process. Obviously from what we've said, yoga can be a cause of injury as well, which is why it is all the more necessary to understand how yoga can be a healing art, when practiced with the kind of mindfulness and self-awareness it was originally intended to have.

There are some basic principles to understanding injury, which have been set forth by Ben Benjamin in his article 'Principles of Orthopedic Massage and their application to Ankle Sprains.'¹³

13 Massage and Bodywork Magazine, February/March 2004, p. 68-75

Specific areas of the body are prone to specific kinds of injury.

This understanding takes some of the mystery out of dealing with injuries. In each area of the body, some structures — i.e. tendons, ligaments, or the body of the muscle — are more likely to be injured than others. For instance, in the shoulders, the **tendons** of the rotator cuff act both as tendons *and* as ligaments which hold the arm bone in place. A ‘rotator cuff injury’ refers not so much to the body of the rotator cuff muscle as to the tendon, and the injury needs to be treated as a tendon injury.

On the other hand, in areas such as the legs, where the hamstrings or quads are large and strong, there is more likely to be a tear in the body of the **muscles**.

Finally, in complex joints such as the ankles and wrists, the structures most commonly injured are the **ligaments**, such as when an ankle is ‘sprained.’

Ligaments need to be tight.

This bit of wisdom is especially appropo to yoga, where stretching and flexibility are so greatly emphasized, and the stretching even extends to the ligaments, especially in styles of ‘hot’ yoga, in which the ligaments are loosened through the heat. While the ‘stars’ of a yoga class are often the amazingly loose and flexible, they are the ones most likely to suffer long-term from injury. Hypermobility has as much to do with the ligaments as it does with muscular flexibility. And while it is often admired in yoga enthusiasts, is actually a condition that needs to be remedied for the sake of greater health, rather than an achievement to be admired and pursued. In Ayurveda, hypermobility is actually treated as a disorder, rather than a goal.

While it *is* healthy for us to have **muscles** that are flexible, supple and relaxed, it is *not* healthy for us to have **ligaments** that are loose. Ligaments hold a joint stable. Loose ligaments allow too much movement in a joint, and can lead to injury not only to the ligaments, but also to the joint capsule, tendons and muscles. Like fascial tissue (and even more so) their nature is like plastic: when reshaped, such as through excessive stretching, they do not return to their original ‘tightness.’ Unlike fascia, there is little chance of returning the proper tone to the ligaments. To make up the difference, greater muscular tone has to be created to protect the joint.

As Dr. Benjamin points out, ligaments can become loose in three ways:

1. **Heredity:** one can be born with ligaments that are too long, granting the mixed blessing of both flexibility and vulnerability to injury from lack of joint stability.
2. **Trauma:** a sudden blow or accident can stretch a ligament permanently.
3. **Adhesive scar tissue:** whether the scar tissue came from repeated injury or from surgery, it can stretch and distend further over time, leaving one vulnerable to further and even more serious injury.

How to distinguish an injury to ligaments from other injuries: Injured ligaments result in a ‘capsular pattern,’ which limits movement in the joint because of **swelling**. The swelling of the joint from an injury is called ‘traumatic arthritis’ — an inflammation of the joint as the result of trauma. With knees and elbows, a capsular pattern always makes it more difficult to bend the joint than to straighten it. With ankles, it’s more difficult to point the toes (plantar flexion) than to flex the ankle (dorsiflexion).

Dr. Benjamin set forth principles for working with such injuries in his series of articles in ‘Massage and

Bodywork' magazine,¹⁴ which can be summarized here:

Passive testing tells you when passive structures are injured. A 'passive test' is one in which the student remains relaxed while the tester takes a joint through its range of motion, 'doing all the work' for the student. (An 'active' test, on the other hand, involves movement initiated by the student against resistance provided by the tester). Ligaments, joints and bursas are called passive structures because they do not initiate movement. Ligaments support the joints of the body, joint capsules hold the bones together, and bursas cushion the gliding surfaces of the muscles, tendons and ligaments. Thus a passive test will tell us that if a passive structure is injured. If there is pain or limitation of normal movement, then there is damage to the passive structure.

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External adhesions need to be eliminated if healing is to occur. Soft tissues react to injury by forming internal or external scar tissue. When *internal*, the adhesive scar tissue forms *within* the structure — such as within a tendon or ligament itself. When *external*, it is between two structures, such as between a ligament and the bone it is supposed to glide over. The process of the formation of adhesions can be quite random and uncontrolled, especially when movement is limited; then the scar tissue may adhere to whatever it touches. When the person is immobilized such as with a cast, more scar tissue forms in odd places. But we can minimize the formation of external adhesive scar tissue if *movement* is practiced during the healing process.

An appropriate form of therapy in the case of injuries to tendons involves both movement and strengthening exercises, and the therapeutic application of 'friction.' This is friction massage applied to a tendon or ligament with the finger or thumb to break up the external adhesions.

This form of therapy as taught by Dr. Benjamin will be covered in greater detail in later sections of this manual. For now we can give an overview of the approach as he describes it, in terms of the following four steps:

1. Warm-up of the joint.
2. Some applied friction to eliminate scar tissue.
3. (Mild) Strengthening exercises focused on the injured tendons.
4. Ice and rest.

Friction in some cases simple enough that we can do it for ourselves; in other subtler and harder-to-reach cases it can be given by a professional body worker. What yoga has to offer as therapy in the case of these injuries is very specific strengthening exercises in the context of the asanas.

14 'Massage and Bodywork' magazine (June/July 2004, August/September 2004 and October/November 2004)