What Are Trigger Points?

Characteristics of Trigger Points

Muscle is the largest organ in the human body, typically accounting for almost 50 percent of the body's weight. There are approximately **four hundred muscles** in the human body (surprisingly, there are individual variations), and **any one of them** can develop trigger points, potentially causing referred pain and dysfunction. Symptoms can range from **intolerable**, **agonizing pain** to **painless restriction of movement** and **distortion of posture**.

Travell and Simons describe them without overstatement as the

"scourge of mankind".

Trigger points

Are described as hyperirritable spots in skeletal muscle that are associated with palpable nodules in taut bands of muscle fibers.

The palpable nodules are said to be **small contraction knots** and a common **cause of pain**. Compression of a trigger point may elicit

- local tenderness,
- referred pain,
- or local twitch response.

The trigger point model states that most unexplained pain radiates from these points of local tenderness, suggesting that therapy should be addressed to the relevant trigger points.
Many chiropractors and **massage therapists** find the model useful in practice,

"however the trigger point theory is not widely accepted by the medical community at large"

Table 2.4B. ***Recommended Criteria for Identifying a Latent Trigger Point or an Active Trigger Point***

Essential Criteria
1. Taut band palpable (if muscle accessible).
2. Exquisite spot tenderness of a nodule in a taut band.
3. Patient's recognition of current pain complaint by pressure on the tender nodule (identifies an active trigger point).
4. Painful limit to full stretch range of motion.

Confirmatory Observations
1. Visual or tactile identification of local twitch response.
2. Imaging of a local twitch response induced by needle penetration of tender nodule.
3. Pain or altered sensation (in the distribution expected from a trigger point in that muscle) on compression of tender nodule.
4. Electromyographic demonstration of spontaneous electrical activity characteristic of active loci in the tender nodule of a taut band.

Knots, Tight Bands, and Tenderness in the Muscle

Muscles consist of many muscle cells, or fibers, bundled together and surrounded by connective tissue. Each fiber contains numerous myofibrils. Most skeletal muscles contain approximately one thousand to two thousand myofibrils, and each myofibril consists of a chain of sarcomeres connected end-to-end. **Muscular contractions take place in the sarcomere**. When a trigger point is present, numerous sarcomeres are contracted into a small thickened area and the rest of the sarcomeres in the myofibril are stretched thin. Several of these contractures in the same area are probably what we feel as a **"knot"** or **"tight band"** in the muscle. These muscle fibers are not available for use because they are already contracted, which is why you cannot condition (strengthen) a muscle that contains trigger points.

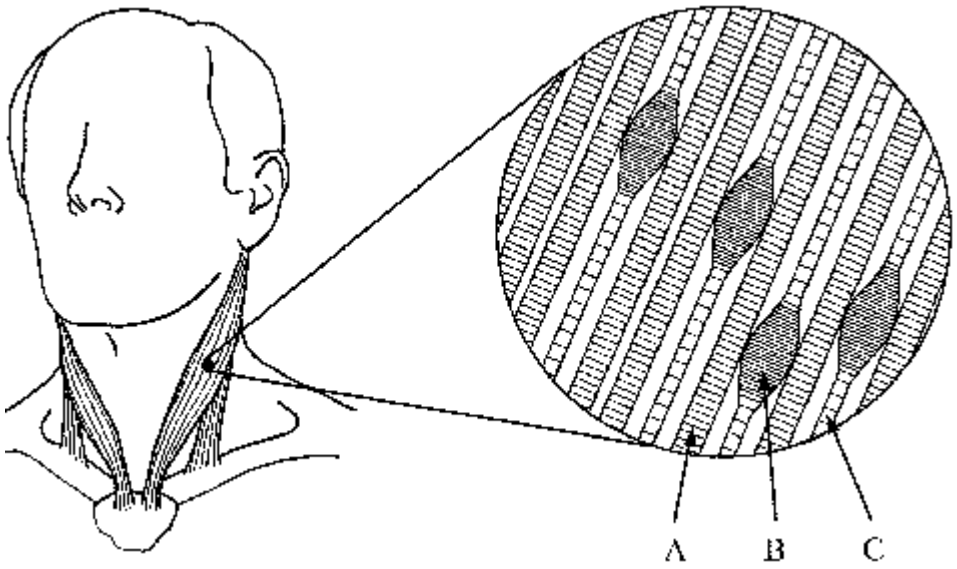
When pressed, trigger points are usually **very tender.** The sustained contraction of the fibril probably leads to the release of sensitizing *neurochemicals* (body substances that affect the nervous system), producing the pain that is felt when the trigger point is pressed. Pain intensity levels can vary depending on the amount of stress placed on the muscles. The intensity of pain can also vary in response to flare-ups of any of the other perpetuating factors, such as emotional factors, illnesses, and insomnia.

Healthy muscles usually do not contain knots or tight bands, are not tender to pressure, and, when not in use, **feel soft** and **pliable** to the touch, not like the hard and dense muscles found in people with chronic pain. People often tell me their muscles feel hard and dense because they work out and do strengthening exercises, but healthy muscles feel soft and pliable when not being used, **even if you work out.**

A Microscopic View

The drawing is a representation of several muscle fibers within a trigger point. It's based on a microscopic photograph of an actual trigger point.

This particular trigger point would cause a headache over your left eye and sometimes at the very top of your head.



Letter A

is a muscle fiber in a normal resting state, neither stretched nor contracted. The distance between the short crossways lines (Z bands) within the fiber defines the length of the individual sarcomeres. The sarcomeres run lengthwise in the fiber, perpendicular to the Z bands.

Letter B

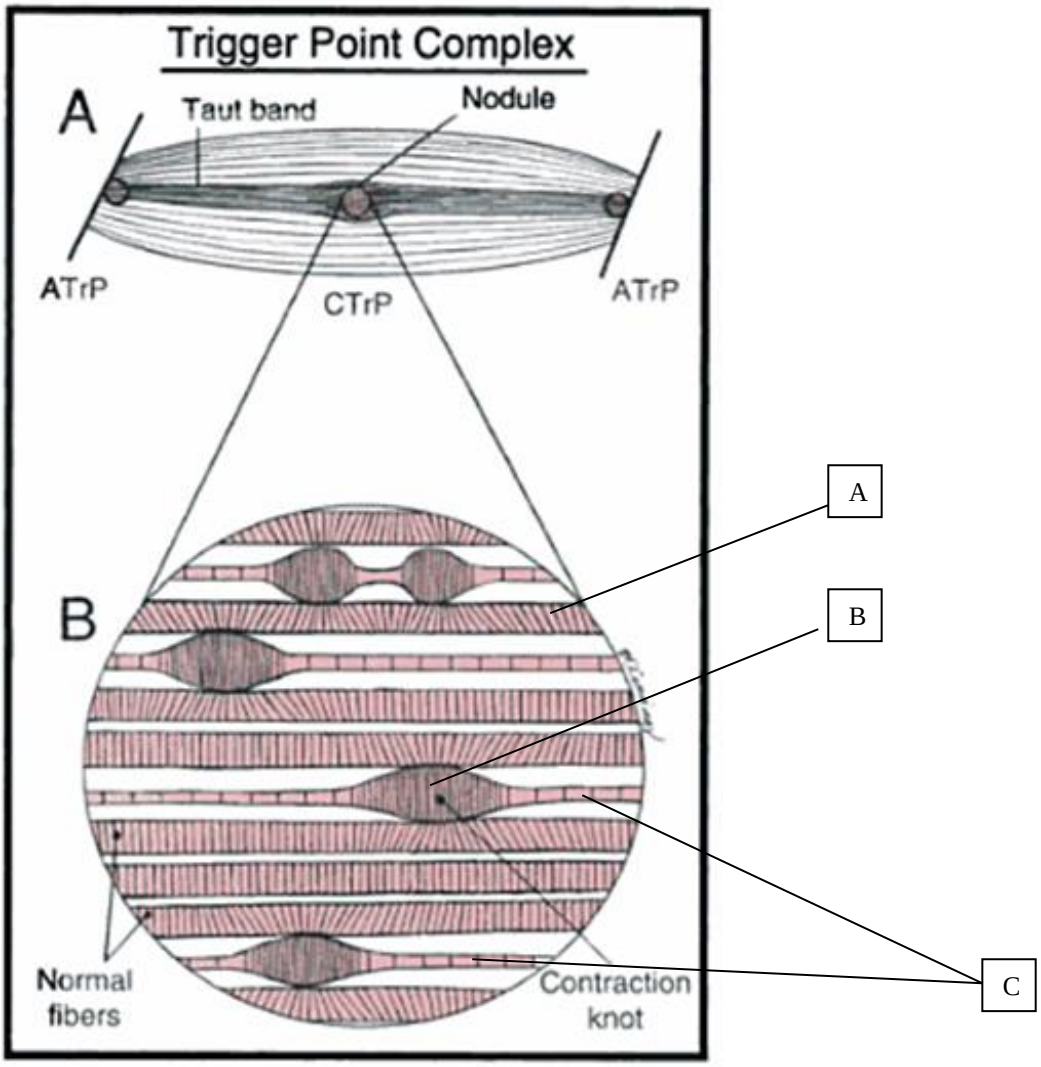
is a knot in a muscle fiber consisting of a mass of sarcomeres in the state of maximum continuous contraction that characterizes a trigger point. The bulbous appearance of the contraction knot indicates how that segment of the muscle fiber has drawn up and become shorter and wider. The Z bands have been drawn much closer together.

Letter C

is the part of the muscle fiber that extends from the contraction knot to the muscle's attachment (to the breastbone in this case). Note the greater distance between the Z bands, which displays how the muscle fiber is being stretched by tension within the contraction knot. These overstretched segments of muscle fiber are what cause shortness and tightness in a muscle.

Normally, when a muscle is working, its sarcomeres **act like tiny pumps**, **contracting** and **relaxing** to circulate blood through the capillaries that supply their metabolic needs. When sarcomeres in a trigger point hold their contraction, blood flow essentially **stops** in the immediate area.

The resulting **oxygen starvation** and **accumulation of the waste products** of metabolism irritates the trigger point. The trigger point responds to this emergency **by sending out pain signals**.



Referred Pain

Trigger points may refer pain both in the local area and/or to other areas of the body, and the most common patterns have been well documented and diagrammed. These are called *referral patterns.* Approximately half of the time, trigger points a**re not located in the same place where you feel symptoms**. This means that if you only work on the areas where you feel pain, you probably won't get relief.

Unless you know that you need to search in that location, you probably won't get relief. For example, trigger points in the upper portion of the trapezius muscle (between the neck and the shoulder) can cause headache pain in the temples, the base of the skull, in the angle of the jaw, and possibly above the ear and over the eye.

When you apply pressure to the trigger point, you can **often** reproduce the referred pain or other symptoms, but being unable to reproduce the referred pain or other symptoms by applying pressure does not rule out involvement of that specific trigger point. Try treating the trigger points that could be causing the problem anyway, and if you improve, even temporarily, assume that one of the trigger points you worked on is indeed at least part of the problem. For this reason, don't work on all the possible trigger points in one session, since you won't know which trigger point treated actually gave you relief.

Referred **tingling, numbness**, or **burning** sensations are more likely due to trigger points constricting around or putting pressure on a nerve. For example, the sciatic nerve runs either under or through the piriformis muscle in the gluteal area, and trigger points in the piriformis muscle can compress the sciatic nerve, causing a pseudosciatic pain that mimics true sciatica (Travell and Simons 1983).

Weakness and Muscle Fatigue

Trigger points cause **weakness** and **loss of coordination** of the involved muscles, along with an inability of the muscles to tolerate use. Many people take this as a sign that they need to strengthen the weak muscles, but if the trigger points aren't inactivated first, strengthening (conditioning) exercises will likely encourage the surrounding muscles to do the work instead of the muscle containing the trigger point, **further weakening and deconditioning the muscle containing trigger points**.

Muscles containing trigger points are **fatigued** more easily and **don't return** to a relaxed state as quickly when use of the muscle ceases.

In addition, trigger points may cause other muscles to tighten and become weak and fatigued in the areas where you experience the referred pain, and also cause a generalized tightening of an area as a response to pain.

Other Symptoms

Trigger points can cause symptoms not normally associated with muscular problems, such as **swelling**, **ringing in the ears, loss of balance**, **dizziness**, **urinary frequency**, **buckling knees**, **abnormal sweating**, and **tearing of the eyes**. You may suffer from **stiff joints**, **fatigue**, generalized weakness, twitching, trembling, and areas of numbness or other odd sensations.

For example, the sternocleidomastoid muscle, in addition to causing a tension-type headache, can also cause dizziness, nausea, sinus congestion, eyelid twitching, hearing problems, eye problems, a chronic sore throat, and other symptoms. It probably wouldn't occur to you that these symptoms could be caused by a trigger point in a muscle.

Active Phase Versus Latent Phase

A trigger point can be in either an active or a latent phase, depending on how irritated it is. If the trigger point is *active,* it will refer pain or other sensations and limit range of motion. If the trigger point is *latent,* it may

cause only a decreased range of motion and weakness, but not pain. The more frequent and intense your headaches, the greater the number of active trigger points you're likely to have.

Trigger points that start with some impact to the muscle, such as an injury, are usually active initially. Poor posture or poor body mechanics, repetitive use, or a nerve root irritation can also form active trigger points. Active trigger points may at some point stop referring pain and become latent. However, these latent trigger points can easily become active again, which may lead you to believe you're experiencing a new problem when in fact an old problem—perhaps even something you've forgotten about—is being reaggravated. Latent trigger points can be reactivated by overuse, overstretching, or muscle chilling. Any of the perpetuating factors discussed in part II can activate previously latent trigger points and make you more prone to developing new trigger points initiated by impacts to muscles.

Latent trigger points can also develop gradually without being active first, and you don't even know they are there. In a study of thirteen healthy people with the same eight muscles examined in each (Simons 2003), two people had latent trigger points in seven of those muscles, one person had latent trigger points in six muscles, three had latent trigger points in five muscles, two had latent trigger points in three muscles, two had latent trigger points in two muscles, two had latent trigger points in one muscle, and only one person didn't have latent trigger points in any of the eight muscles! This means that most people have at least some latent trigger points, which can easily be converted to active trigger points. This also means that some people are more prone to develop problems with muscular pain than others (Simons 2003).

Locations of Trigger Points Within the Muscles

Trigger points tend to form where the nerve ending that causes the muscle to contract attaches to the muscle fiber, generally in the middle of the muscle fiber. These are called *central myofastial trigger points.* Trigger points also tend to form at the muscle's attachments; these are called *attachment trigger points.* Since you may not know where the middle of the muscle fiber is or where the attachments are.

A primary, or *key,* trigger point can cause a *satellite,* or *secondary,* trigger point to develop in a different muscle. It may form because it lies within the referral zone of the primary trigger point. Alternatively, the muscle with the satellite trigger point may be overloaded because it's substituting for the muscle with the primary trigger point, or it may be countering the tension in the muscle with the primary trigger point. When doing self-treatments, be aware that some of your trigger points may be satellite trigger points, in which case you won't be able to treat them effectively until the primary trigger points causing them have been treated. Part III offers guidance in this regard.

What Happens When You Leave Trigger Points Untreated?

When people first develop some kind of pain problem, **they usually wait to see if it will go away**. Sometimes it does, and sometimes **it doesn't**. The problem with **"waiting to see"** is that when **trigger points are left untreated**, muscles can be **damaged**, and eventually changes to the central nervous system can lead to a vicious cycle of pain. This central nervous system involvement probably explains why you are experiencing chronic headaches and pain.

Damage to the Muscle Fibers

Remember how trigger points cause portions of the myofibril to stay contracted?

If this goes on too long, the myofibril **may break** in the middle, causing it to retract to each end and leave an **empty shell** in the middle.

Muscle fibers damaged in this way **cannot be repaired** and will never be **available for use** again (Simons,

Travell, and Simons 1999).

Facilitated Nerve Pathways

When pain travels repeatedly through the same nerve, it will cause *a **facilitated nerve pathway***.

This means that any time a new injury or other stress occurs in an area where pain was previously experienced, pain will tend to travel along the same nerve pathway again. **Remember that the most common patterns have been well documented and diagrammed?**

A facilitated nerve pathway can cause the pain referral to deviate from the most commonly found pattern. It may also cause trigger points **in several muscles in the region** to refer pain to the **same area**, making it all the harder to determine the **actual source** of the referred pain.

This means you can't absolutely rule out the role of a potential trigger point based only on consideration of common referral patterns, since other factors may cause you to have an ***uncommon*** referral pattern. The more intense the earlier pain and the more intense the emotions associated with it, the more likely the facilitated nerve pathway will cause deviation from the most common referral patterns (Simons, Travell, and Simons 1999).

Sensitization of the Opposite Side of the Body

You may be surprised to discover that **the same area** on the opposite side of your body is also **tender to pressure**, even though that **side isn't otherwise painful.**

Over half of the time, the opposite side is **actually more tender** with pressure. Unless it is a recent injury, it's typical for **both sides** to eventually get involved

(for example, if the right midback is painful, there are likely to be tender points on the left midback).

For that reason**, I almost always work on both sides**, and I recommend that you do **self-treatments on both sides**.

This observation has been supported by a study in which the researchers used needle electrodes placed in the same spot on both sides of the neck or back to record muscle electrical activity (Audette, Wang, and Smith 2004).

When an active trigger point was stimulated on one side of the body, it induced electrical muscle activity on the corresponding opposite side.

Latent trigger points did not produce the same results. This further supports the concept of central nervous system sensitization, which would cause corresponding trigger points to form on the opposite side of the body over time.

How Trigger Points Form

Trigger points may form after a sudden **trauma** or **injury**, or they may **develop gradually**. Common cinitiating and perpetuating factors are **mechanical stresses**, **injuries**, **nutritional problems**, **emotional factors**, **sleep problems**, **acute** or **chronic infections**, organ dysfunction and disease, and other medical conditions..

Part of the current hypothesis about the mechanism responsible for the formation of trigger points is the **energy crisis component theory**.

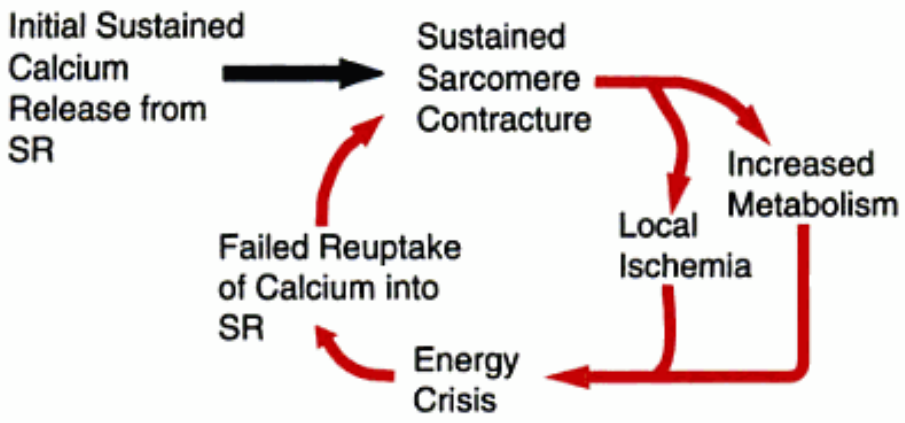


Figure 2.26. Schematic of the energy crisis hypothesis which postulates a vicious cycle (*red arrows*) of events that appears to contribute significantly to myofascial trigger points. The function of the sarcoplasmic reticulum (SR) is to store and release ionized calcium that induces activity of the contractile elements, which causes sarcomere shortening. An initiating event such as trauma or a marked increase in the endplate release of acetylcholine can result in excessive release of calcium from the SR (*black arrow*). This calcium produces maximal contracture of a segment of muscle which creates a maximal energy demand and chokes off local circulation. The ischemia interrupts energy supply which causes failure of the calcium pump of the sarcoplasmic reticulum, completing the cycle.

The ***sarcoplasmic reticulum***, a part of each cell, is responsible for **storing** and releasing **ionized calcium**.

The type of nerve ending that causes the muscle fiber to contract is called **a *motor end plate***. This nerve ending releases ***acetylcholine***, a neurotransmitter that tells the sarcoplasmic reticulum to release calcium, and then the muscle fiber contracts.

If it is operating normally, when contraction of the muscle fiber is no longer needed, the nerve ending **stops releasing** acetylcholine and the calcium pump in the sarcoplasmic reticulum returns calcium into the sarcoplasmic reticulum.

If a trauma occurs or there is a large increase in the motor end plate's release of acetylcholine, an excessive amount of calcium can be released by the sarcoplasmic reticulum, causing a maximal contracture of a segment of muscle, leading to a maximal demand for energy and impairment of local circulation. If circulation is impeded, the calcium pump **doesn't get the fuel** and **oxygen** it needs to pump calcium back into the sarcoplasmic reticulum, so the **muscle fiber continues to contract**.

The areas at the ends of the muscle fibers (either at the bone or where the muscle attaches to a tendon) also become tender as the attachments are stressed by the contraction in the center of the fiber (Simons, Travell, and Simons 1999).

Once the central nervous system has been sensitized, various substances are released: ***histamine*** (a compound that causes dilation and permeability of blood vessels), ***serotonin*** (a neurotransmitter that constricts blood vessels), ***bradykinin*** (a hormone that dilates peripheral blood vessels and increases small blood vessel permeability), and ***substance P*** (a compound involved in the regulation of the pain threshold).

These substances stimulate the nervous system to release even more acetylcholine locally, adding to the perpetuation of the dysfunctional cycle (Borg-Stein and Simons 2002).

This vicious cycle continues until some sort of **outside intervention** (there is NO tablet invented for this) **stretches** the **contracted** portion of the muscle fiber.

Anxiety and nervous tension also increase ***autonomic nervous system*** activity (the part of the nervous system that controls the release of acetylcholine, along with involuntary functions of blood vessels and glands), which commonly aggravates trigger points and their associated symptoms (Simons 2004).

Conclusion

Trigger points are **tender when pressed**, and the multiple contractures forming the trigger point may feel like **a small lump** in the muscle. **Healthy muscles don't contain trigger points, and they don't feel tender with pressure**. If trigger points are left untreated, the damage to the muscle cells can be irreparable and can even cause long-term changes in the central nervous system, leading to a self-perpetuating cycle of trigger points, pain, and muscular damage. Trigger points can cause symptoms other than pain, which should be taken into consideration and may help you determine which muscles contain trigger points. This is particularly important when the referral pattern deviates from the common pattern, making the location of the trigger points harder to determine.