

Demonstration of Manual Biofeedback

– Part 3 of a 3 Part Series –

Dr. Philip Maffetone

In this third and final part in my series on manual biofeedback, I'll discuss the "how-to" aspect of manual biofeedback. If you're not familiar with manual muscle testing, or want to see the techniques described in this three part series, a DVD will be available soon for a better understanding of manual biofeedback. This video will include a demonstration of most of the major skeletal muscles in the body.

Manual biofeedback is a powerful technique that can dramatically improve body function by correcting mechanical imbalances quickly. At the same time, it's relatively easy to use. A key factor in successful manual biofeedback is experience – the more you utilize these procedures the easier and more effective it will be. In addition, the more familiar you are with muscle function, including the attachments, movement and ranges of motion, the more effective manual biofeedback will be.

Recall from the introduction that manual biofeedback is used to help weak muscles, with the 3-step process of assessment, treatment, and movement. Assessing a muscle's ability to contract is the first step, and if it is weak, treatment can help improve its function. *Both assessment and treatment involves using your hand to help the patient's muscle contract better by resisting its movement.* I'll explain exactly how this is done below.

Body Position

The first consideration in manual biofeedback is the patient's body position. This is the best position of the arm, leg or other body part that helps isolate the muscle, and maximizes its ability to contract. Once a muscle is in the best position we can begin manual biofeedback. For example, if we want the best position for the deltoid muscle, it's with both the arm abducted and the elbow flexed to about 90 degrees.

Sometimes, due to extreme weakness or discomfort, you may have to hold the patient's arm or leg in the best position. In other situations, when the muscle is significantly weak, such as the case with zero contraction, or if the muscle is very painful, it may not be possible to attain this best position. If the patient is unable to place their limb or other body part in the best position, consider it very weak. And, an alternative position for performing manual biofeedback is best used (these alternative positions are demonstrated in the video).

Here are some other important factors related to body position:

- It's important for the patient to maintain their position during manual biofeedback. If a muscle is weak, the patient's body may attempt to move into a different position that allows other muscles to assist during contraction. This may reduce the effectiveness of manual biofeedback because the weak muscle contracts less in this situation (i.e., fewer muscle fibers are integrated into the muscle's contraction) because other muscles are involved in the action.
- At times, however, it's not possible for the patient to obtain the best position, due to muscle tightness, excess pain or other factors. In this case, obtain a position that still allows for some amount of muscle contraction, knowing that other muscles may be participating in the movement. This will usually not preclude one from performing manual biofeedback, but the frequency may need to be increased to obtain the same results.
- The best position is associated with the body movement created when the muscle contracts. For example, when the deltoid muscle contracts, the shoulder abducts to bring the arm up to a near horizontal position.
- *Your* body position during manual biofeedback is important too. Use both hands, one to steady yourself and the patient, and the other to work on the muscle. Stand close to the patient with both feet bearing weight on the floor. When working on the deltoid muscle, for example, one of your hands stabilizes the shoulder while the other is placed on top of the elbow ready to provide an adequate force against the patient's contracting deltoid muscle.

Direction of Movement

Once the proper body position is attained, the *direction of movement* is the next factor to consider. This is the direction the patient's arm, leg or other body part will move when the muscle contracts. The direction of movement for the deltoid is further into abduction, moving the elbow in an upward direction. Your force will oppose the patient's direction of movement.

Assessment & Treatment

Once you and the patient are in the best position and know the direction of movement you're ready to begin manual biofeedback. The first step is assessment: evaluating the muscle's ability to contract. In the case of the deltoid, for example, place your hand on top of the patient's elbow and ask him or her to push against your hand in the direction of movement. While the patient pushes upward, you apply sufficient downward force to counter the patient's, so that your force is opposite to the patient's direction of the muscle's movement. Apply enough force to keep the arm from going any higher up, but not so much that you push the patient's arm down. While the patient is using only one muscle, you are using several muscles to resist their contraction, and it's often easy to over-test most individual muscles. You may need even less force to determine that a muscle is weak.

This initial assessment should result in one of three possible outcomes: 1) normal; 2) weak with minimal contraction; and 3) weak with no contraction. Let's consider each one.

1. A *normal* contraction occurs when the patient can push against your force for 2 or 3 seconds without weakness, significant pain or muscle fatigue. In this case, there is usually no need to treat the muscle. (There are times when manual biofeedback can be used to add strength to a normal muscle.)
2. A muscle that is *weak with minimal contraction* quickly fatigues or is unable to maintain its position with the force of your hand. This weak muscle can be treated as follows:
 - a. Treatment starts in the same position as the original assessment (i.e., the best position and in the direction of movement). When the patient contracts, ask them to keep contracting – and even push harder – continuously for about 5 seconds. Strongly and continuously encourage the patient to push harder for the full 5 seconds. You provide the least amount of resistance with your hand as the patient's muscle provides, plus slightly more to encourage a harder contraction. The goal is to get the muscle contracting at whatever level of function it has; it's important for you not to over-power the muscle during treatment.
 - b. Repeat this 3 or 4 times in slightly different positions along the direction of movement, with a rest period between of about 5-10 seconds. For the deltoid muscle, for example, begin the first biofeedback action with the arm horizontal; then bring the arm down slightly for a second treatment; then bring the arm down further for another treatment. You may find the muscle is much weaker in a certain position – if so, focus on this position during treatment more than the others.
 - c. Following treatment in 3 or 4 positions, assess the muscle again with the same muscle test as originally performed. The muscle should be stronger than when you started. If not, the treatment may have to be repeated. (Usually it's obvious if the muscle is stronger and it may not have to be re-tested unless you're not sure.)
3. A third possible outcome is a significantly *weak muscle with no contraction*. This is the case of a seriously injured muscle, such as a brain or spinal cord injury. A patient who had a stroke often has muscles that are weak with no contraction (with very tight antagonist muscles). In this case, before treating the muscle

increase the brain's awareness of it by stimulating various sensory and motor pathways, which can be done three ways:

- a. First, use *your* muscle and arm movement to show the patient how the body should move when the muscle contracts. This imagery informs the brain of the necessary action.
- b. Next, with the patient's arm very relaxed, passively move it through its range of motion (as if the muscle was contracting). This is sometimes difficult because of accompanying muscle tightness, but any amount of movement is helpful to stimulate proprioception in the joint(s).
- c. And third, stimulate the skin and muscle with both light and moderate massaging pressure for about 30 seconds. This increases local circulation, proprioception and the brain's awareness of the muscle.

Following these three steps, treat the muscle as described above. In most cases of weakness with no contraction, an alternative position may be required. The deltoid muscle's alternative position, for example, is with the elbow flexed at the side of the body since the patient may not be able to hold the arm in the best position.

- With the arm in the alternative position, ask the patient to push against your hand. Keep asking the patient to push while your hand is providing slight, encouraging resistance on their arm. In difficult cases it may take several minutes before a very slight contraction is noticed, even if the arm does not noticeably move. Continue with verbal encouragement. With the least amount of contraction felt, ask the patient to push more – and more. When you feel the muscle contract, strongly encourage the patient to maintain it for about 5 seconds, then rest. Repeat this 3 or 4 times with a rest period in between.

Movement

Once you have assessed and treated a muscle, or several muscles, the third step in manual biofeedback is *movement*. It's very important for the patient to use the muscle in daily activity. In the case of a severely weak deltoid muscle, for example, moving objects from a table to a shelf, combing the hair or putting on and taking off a hat utilizes this muscle. Or in very weak muscles, just contracting it may be the starting point. Most patients, once they experience contraction during the manual biofeedback session, will recall how to reproduce it.

Initially, this activity may be very minimal since the muscle contracts very little, or very little without fatigue. Be careful to not overwork the muscle, which can result in discomfort or pain. Any new movement obtained during treatment – even just contracting the muscle – should be incorporated into some activity no matter how minor the movement appears. This process increases the brain's awareness of the muscle, helps it move better, and eventually improves the muscle's power through

repeated movement. Follow up manual biofeedback for a muscle that was weak with no contraction is usually needed. In most cases, correcting a muscle that was weak with minimal contraction requires only one effective treatment. If weakness recurs, it's usually due to some other muscle that is more primary and must be treated.

In the case of a muscle that's not severely weak, movement often occurs naturally throughout the day. However, it may be necessary to encourage more normal use, and emphasize to the patient the importance of movement while cautioning against over use.

Pain

Correcting a muscle or muscles around a painful joint or other area usually reduces or eliminates the pain. Continued pain often indicates the need to perform manual biofeedback on another nearby muscle. Depending on the level of pain, manual biofeedback can usually still be utilized except in cases where *severe* pain makes it impractical. (It's also important to rule out other causes of pain, such as a fracture.)

Pain is often due to muscle weakness. For example, a weak muscle can cause an opposite muscle to tighten. A tight muscle is often painful. In addition, a weak muscle can allow a nearby joint to move improperly which can also cause pain and, ultimately, inflammation, causing more pain. Correcting the muscle weakness helps reduce muscle tightness, and helps the joint move more normal, reducing or eliminating pain, often quickly.

Pain may serve as an indicator that a weak muscle exists, helping you decide where to begin manual biofeedback. There is usually at least one weak muscle at or close to the area of pain, especially when there's a painful joint. Another indication of muscle weakness may be impairment or the lack of movement, which is usually associated with one or more weak muscles. A third clue regarding where to start using manual biofeedback is muscle tightness, which are often painful to the patient and painful to the touch. In this case, the opposite muscle(s) is usually weak.

As a reminder from Part 2 of this series, respiratory biofeedback often corrects muscle weakness. It's best to have the patient perform respiratory biofeedback first, to eliminate secondary muscle imbalance; the remaining muscle problems will be less in number, and most likely be primary. Correcting primary muscle weakness can have a profound effect on the brain and nervous system, and overall body function.

TMJ Muscles

When imbalanced, the muscles of mastication – TMJ muscles – are a common cause of TMJ joint and other head and neck dysfunction. These problems are often treated with painful procedures, mouth appliances, surgery or other remedies sometimes requiring numerous treatments or long-term care. While some cases may require these approaches, more conservative remedies should be performed first in the

hopes of avoiding more radical care. In short, manual biofeedback can quickly and successfully correct most TMJ muscle imbalances.

The TMJ muscles are innervated by cranial nerves and have a dramatic representation in the brain's cortex. Both these facts are among the reasons why any relatively minor imbalance in the TMJ muscles can have significant adverse effects in the brain and body. Because the TMJ muscles can't be manually tested like other skeletal muscles, the use of manual biofeedback for the jaw muscles employs a different assessment process.

Of all the neuromuscular areas of the human body, the TMJ muscles are the ones least understood. This is true in the areas of research and in the clinical environment. Both researchers and clinicians must rely on indirect measurements of TMJ muscles – a distinction between the jaw muscles and virtually all other skeletal muscles that are evaluated directly. Despite this, we can usually treat various types of TMJ problems successfully as most are due to muscle imbalance.

Over the past 40 years, various theories about which muscles are involved with different types of TMJ problems have evolved. The notion that TMJ muscles can be categorized as either jaw closers or jaw openers is an oversimplification. For example, the masseter and temporalis muscles are considered jaw closers while the external pterygoid a jaw opener. While it may serve to introduce these muscle actions during the learning process and is a good general starting point for treatment, there is a risk of addressing TMJ problems in a more cookbook manner. The details of TMJ muscle anatomy and physiology are quite complex and result in dramatic variations in mechanical actions.

In addition to their biomechanical complexity, the TMJ muscles have other interesting features:

- There are significant biochemical relationships – for example, GABA, glutamate and other receptor sites in the TMJ area influence muscle function.
- The brain is continuously modifying TMJ muscle contraction and relaxation, sometimes dramatically, during the course of simple mastication and even from one single chewing motion to the next.
- TMJ muscles, unlike most other skeletal muscles, have a more localized organization of motor control.
- While types of muscle fibers (for example, fast and slow twitch) are generally mixed in other muscles of the body, the TMJ muscle fibers commonly form distinct groups akin to the white and dark meat of birds.

TMJ muscles are compact, and their individual fiber attachments vary considerably. Even the normal attachments of one individual muscle can vary so much that its action may range from opening the jaw to closing it. This is due to the fanning out of many muscle fibers in a variety of directions. Consider these examples:

- The lateral pterygoid muscle can have opposite actions; the lower fibers constitute a jaw opening muscle while the superior fibers close the jaw when

contracted. This three-dimensional movement is one of the reasons these small TMJ muscles are so powerful.

- The masseter muscle also has elaborate fanning of muscle fibers within its three different layers, making for unique rotational forces. These and other issues make isolation for the purpose of assessment and treatment virtually impossible.
- The temporalis muscle is generally considered a jaw closer, but different fibers can pull on this muscle's tendon in various directions. These include the anterior, vertical and posterior directions with some medial and lateral movements, resulting in very diverse actions.
- The digastric, mylohyoid and geniohyoid muscles are also jaw openers but only if the hyoid bone is stabilized by other anterior neck muscles.

Since the TMJ muscles are not tested manually like other muscles, it's difficult to determine which specific muscles are weak and tight. Therefore, the approach to assessing TMJ muscle imbalance is different. Instead of individual actions of specific muscles, consider the main TMJ movements – jaw opening and jaw closing. In addition, lateralization of the TMJ is sometimes important (as are other movements in the occasionally very difficult case). Any of these movements can be used to implement manual biofeedback assessment and treatment.

The assessment of TMJ muscles is first done to determine which group – jaw openers, jaw closers, etc. – is weak and requires treatment. This process begins with a good history, and a physical examination that includes palpation of the accessible muscles, and full ranges of motion of jaw opening, closing and lateralization. As in other muscle patterns, weakness is typically found in muscles opposite those that are tight. (Various other techniques for determining the types of muscle imbalance are also used by different professionals.) The most common pattern is weak jaw openers and tight jaw closers.

Once this assessment has been made, manual biofeedback is performed on the weak movement. This involves using the mandible as a lever to generally contract jaw opening or jaw closing muscles (or the muscles that lateralize the mandible). The case history below further describes this process.

SE was a college student with chronic daily headaches that began around age 12. While many potential problems were ruled out, her problems continued and she could only rely on medication to control the pain. I examined SE and found a number of neck muscles that were weak with minimal contraction, including the general neck flexors and SCM muscles, bilaterally. Respiratory biofeedback improved all these muscles but without a change in her symptoms. Upon re-evaluation, I found an imbalance in the TMJ muscles causing painful tightness of the masseter and temporalis muscles on the symptomatic side. I performed manual biofeedback on the muscles that open the jaw. In this case, we began with her jaw open only a few millimeters. I asked SE to push her chin downward against my hand; then with her mouth open slightly wider, I asked SE to push her chin against

my hand; then a third time after opening slightly more; then a fourth time with the mouth fully open. Within the next few minutes, as I was explaining the muscles and TMJ, SE said her headache had disappeared. In a follow up email several months later, SE stated that her headaches had not returned.

Other Manual Biofeedback Case Histories

JB had fallen through a roof during the building of a new home. Despite severe pain and various lacerations, emergency room evaluations did not reveal fractures or other more serious injury. I saw JB several weeks later. Still unable to return to work, he was unable to move his shoulder or arm without pain. Most muscle tests had to be modified due to the restriction in ranges of motion. Nine different muscles were weak with minimal contraction and pain. Respiratory biofeedback reduced this to only two weak muscles: the serratus anterior and posterior deltoid. These muscles were treated with manual biofeedback with the reduction of pain by 90% and normal muscle function. All ranges of motion improved dramatically. JB was able to return to work four days later.

WM had a stroke that disabled some muscles on his left side. Within a month he came to my office for a two-day period, during which time manual biofeedback was able to improve function of almost all his weak muscles. Because he did not live locally, I did not see WM for several months. His neurological visits revealed significant improvement in successfully contracting the previously weak muscles. However, his tibialis anterior was still weak with no contraction resulting in a “steppage” gait. WM returned to my office for a follow up visit. After several minutes of attempting to elicit contraction of the weak tibialis anterior, WM finally showed minimal muscle activity, and after several more contractions improved from a zero to a 4 (on a scale of 0 to 5). Within two weeks after returning home his neurologist evaluated him again saying the muscle was normal and the gait had normalized.

It should be noted that before the TMJ is treated, other local muscles should be evaluated which can significantly impact TMJ function. These include the upper trapezius, neck flexors (especially the SCM) and neck extensors, although any imbalance in the head and neck (and sometimes any other area) can affect TMJ function.

Part 1 of this 3-part article introduced the neuromuscular aspects of manual biofeedback. In part 2, an important part of manual biofeedback, called respiratory biofeedback, was discussed in detail. This 3rd part addressed the “how-to” aspects of manual biofeedback on skeletal muscles. It is difficult to effectively describe these procedures with just words, and I encourage the reader to also view the video demonstrations when they become available.