How Pain Hurts and *Why Massage Helps!*

by Judith Walker, LMT

Long leg, short leg, rotation, tilt, torsion, loss of range of motion, hypermyotonia, joint dysfunction, misalignment, subluxation. The terms abound throughout health care professions to describe the numerous structural challenges that the human body can experience. Depending upon the school of approach, health care practitioners search through medications, poultices, techniques, supplements, exercises, thought patterns, tests, surgeries, books, articles, and finally, referral lists, in an attempt to find the answers to cases which elude their solutions. Where pain and dysfunctional biomechanics are concerned, anatomy and physiology remain foundations common to all health care fields. Practitioners can still return to them to understand the problem at hand.

CAUSES OF PAIN IN SOFT TISSUE

To get results in the area of Myofascial pain syndromes, a practitioner must address six factors of physiology which lead to pain in the body. If only one or two areas are addressed, the pain may be eliminated, but the results will be inconsistent and arbitrary. It may return in a few days of a few weeks because one or two of the underlying causes continues to irritate the nervous system. These six factors are:

1) **ischemia** - lack of blood and oxygen caused by muscular hypertonicity (spasm).
2) **trigger points** - areas of increased metabolic waste deposits which excite segments of the cord and cause referred pain or sensations to other parts of the body.
3) **nerve entrapment and/or compression** - pressure on nerves by soft tissue (muscle, tendon, ligament, fascia or skin) or by hard tissue (bone or disk), respectively.
4) **postural distortion** - when the body=s alignment deviates from anatomically correct position in coronal, sagittal or horizontal planes.
5) **nutrition** - the intake of nutrients necessary for cellular metabolism and the exclusion of nutrients irritating and stimulating to the central nervous system.
6) **emotional well-being** - in a word, stress.

These factors, individually and collectively, each play a role in stimulation of the central nervous system and the peripheral tissues. The humin body is designed to deal with a certain range of stimulation, efficiently and effectively. When stimulation for the external and internal environment of the body exceeds the CNS=s limits, changes begin to occur in the nervous system, including the registration of pain and the occurrence of dysfunctional integrity. A look at each of these areas will help the practitioner understand the role of his/her therapy and how to integrate with other health care professions to achieve a long lasting result.

An understanding of how the central nervous system responds to stimulation will clarify how muscular contraction and spasm occurs. In a recent article in Massage Therapy Journal (Summer 89), Dr. John Upledger explains the facilitated segment in a simple and eloquent manner. Therapists interested in understanding facilitation and the role that muscles play in visceral stimulation will find this an interesting and thorough explanation. In Leo Chaitow=s book, Soft-Tissue Manipulation, he refers to Michael Patterson=s explanation of facilitation as follows:

> AThe concept of the facilitated segment states because of abnormal afferent of sensory inputs to a particular area of the spinal cord, that area is kept in a state of constant increased excitation. This facilitation allows normally ineffectual or subliminal stimuli to become effective in producing afferent output from the facilitated segment, causing both skeletal and visceral organs innervated by the affected segment to be maintained in a state of over activity.@

In other words, when abnormal or extensive stimulation comes into the cord, it sets up a cycle of excessive stimulation back out to all the muscles (somatic) and organ (visceral) tissues served by that nerve segment. And, in the same respect, when a therapeutic modality interrupts the reflex cycle and removes the source of abnormal stimulation, all tissues affected by that cord segment will have decreased hyperactivity. It is important that each practitioner understand this concept in order to realize how his/her modality of treatment affects the reflex cycle and how it may be further enhanced with other modalities to end the vicious cycle of a physiopathological reflex arc. A look at the reflex arc in normal tissues and in hypertonic tissues will help to clarify how the therapist influences the tonus system.

THE NORMAL REFLEX ARC

In the normal reflex arc, stimulation from peripheral tissues enters the spinal cord at the dorsal (posterior) root. This stimulation may be from the muscles, skeleton, blood vessels or organs. It may register in long nerve fibers leading up to the brain or internuncial neurons to the same side out or both sides. These neurons can refer directly back out to the tissues. It may also register in both long nerve fibers and reflex circuits. Efferent impulses will then respond out through the ventral (anterior) root to effect a response. The impulses may be magnified many times greater than the incoming stimuli. Responses will include the muscles, vascular structures, skin, organs and cellular activity. This is a normal function and is what allows the body to respond to its environment on a second to second basis without conscious brain involvement. When stimulations from the environment occur, such as temperature changes, noise factors, increased muscular activity, etc., the body will reflexively respond to them without the need to consciously be aware of the stimulation or the response. This means that motor activity (including muscular contraction) may not only be influenced directly by the brain, but may also be influenced by the sensory system of that same muscle. In other words, the reflex arc is a nervous system on a smaller scale, by which a muscle can respond to its own world without our conscious influence.

To further understand acute and chronic pain, let=s spend the afternoon with Sam. Sam is 33 years old, is a successful computer wiz and enjoys both his high stress job and his love of sports. As Sam sits at his computer during the morning, he answers the phone on his right side. Because he is typing information from the phone conversation, he holds the phone with his shoulder, effectively shortening the levator scapula, scalene=s, trapezius and sternocleidomastoid muscles on that side. His hamstrings are shortened by his constant sitting, as are his hip flexor=s (iliacus, psoas and rectus femoris). His back has little support and he often finds himself slumping in the chair after hours of typing. His low back ache is fairly constant, as is his neck pain. Both are aggravated by his infrequent tennis, erratic running program and non-existent stretching. Sam is an accident - waiting to happen.

While working at a fast pace and under the pressure of deadlines, Sam drinks coffee in an endless stream and consumes breakfasts and lunches made of non-nutritive and neurostimulating substances, such as sugar coated, white flour pastries, colas. Preservative-laced sandwiches (to which he has an unknown allergy) and numerous junk food packets from the machine down the hall. Sam=s other mealtimes have become a part of his networking time, where he meets with business associates to complete transactions and sort out problems associated with the highly competitive computer services he offers. Often he leaves the meal with indigestion and stomach upset created by the stressful conditions of doing business over dinner.

Sam has just spent the morning producing a report for one of his biggest clients. Unsatisfied with his final product, but a week past his due date, he drops the report on his way to a lunchtime tennis match with his formidable opponent, Joe. Since he=s running a little late and court time is short, Sam skips his stretching and warmup strokes and begins to serve the ball. A couple of serves into the game, he feels a sharp pain in the right side of his neck as he tears his pre-shortened levator scapula muscle. After a few more hits, the pain increases to the point he has to leave the court. Joe, sympathetic to Sam=s pain, explains that a hot shower helps his own neck, so Sam heads to the showers. Instead of using ice to vasoconstrict the recent tear, Sam applies hot water, which increases the blood flow to the area. In an attempt to compress itself and reduce bleeding in the torn tissues, the muscle spasms even more and by the time Sam returns to his afternoon of work, his neck is immobile, his pain significant and his reflex arc well established. Sam=s ischemic tissues begin to build metabolic waste deposits.

THE PHYSIOPATHOLOGICAL REFLEX ARC

As the reflex arc becomes well established, the metabolic waste deposits begin to increase, including bradykinin, histamine, prostaglandin, acids, acetylcholine, excesses of potassium ions, and proteolytic enzymes. These substances will excite pain nerve endings and could even damage them. Nutrients and oxygen are decreased and neurostimulation to the cord establishes a vicious cycle of spasm and inflammation. The pain is now being caused by both mechanical (pressure) and chemical (waste product) stimulation. As muscular metabolism increases, pain increases. As pain increases, chemical substances are released, inducing more muscular spasm. Physiopathology of muscle tissue is created.

REFERRED PAIN

As more and more ischemia and its resultant wast products build in the tissues, stimulation into the cord is significantly increased, both by the pressure receptors of the muscle and the electrochemical stimulation of the waste products. Stimulation can then create spreading of internuncial disturbance to other segments of the cord. The impulses will tend to take the path of least resistance, that is, a previously facilitated cord segment. For Sam, within a few weeks after his neck injury, his low back ache turned to pain and he had even begun to feel an old running injury in his left hamstring caused by trigger point referrals from the quadratus lumborum and from the sacroiliac joint, which had been distorted by the contracted muscle. If left untreated, the resultant ischemia in his hamstring, and the postural distortions taking place, may develop into knee, ankle or foot pain and dysfunctional biomechanics of any or all of these joints. When the stimulation in the cord reaches the brain, the reticular activating system (RAS) becomes involved and muscular tonus of the entire body is affected. Sleep patterns may change and activation of other areas of the brain may effect motor activity.

What we have seen so far are individual reflex circuits, or neural pathways of information flow (stimulation and response). Millions of these are happening simultaneously. In fact, because of its electrochemical nature, one sensory perception can excite many neurons. This chain of events is happening all over the body constantly, and pertaining to a variety of information. Added to the physical stimulation may be a variety of emotional, visual, auditory, gustatory (digestive), and respiratory neuro-stimulating experiences. Disturbances develop in the neural system, creating even more stimulation into the reticular activating system, a portion of the brain stem. The RAS system, in turn, creates a general increase of tonus of the entire musculoskeletal system.

HOW MASSAGE HELPS RELIEVE PAIN

There are several ways in which massage will influence pain stimulation and pain perception. One way is through the physical removal of the waste products of the muscle tissue. As the body is kneaded, stroked and heated, blood flow is increased, taking oxygen and nutrients into the area, and waste products are removed, reducing the affects of the pain inducing chemicals. This removal of the chemical neurostimulators, is perhaps the most well understood explanation. However, there are other ways in which pain is decreased by massage.

The fascial casing of the muscle and muscle fibers varies from a thin, fluid (sol) state to a thick, solid (gel) state. The consistency of the ground substance can be influenced by heat. When the muscle becomes warm from the blood flow and from frictional stimulation, the fascia will become more liquid and malleable. The physical pressure on the muscles will be lessened and the muscular contractions reduced. With the fascia in a more liquid state, the muscle may also be more easily lengthen, thereby decreasing intra joint pressure and further reducing neurostimulating input into the cord.

As the body is touched, the pain control (analgesia) system of the brain and spinal cord may be activated. This system may affect both fast (sharp) pain signals and slow (burning) pain signals, therefore affecting both acute and chronic pain. Inhibition of pain transmission may be evoked by chemicals, such as enkephalin and serotonin. These chemicals are believed to cause pre-synaptic inhibition of neurostimulation, that is, they stop the transmission before the nerve fires to the next nerve. Other chemicals in the analgesic system, which resemble opiate-like substances, such as endorphin and dynorphin, may also be released.

Inhibition of pain receptor firing may also be caused by the brain itself. In the gate-control theory, it is discussed that a modulating spinal gate mechanism is located in the dorsal horn. This gate allows the transmission of impulses into the cord. However, these impulses can be over-ridden by other impulses, sort of like a train track which can be switched. Where the tracks merge, only one train can travel at a time. When the secondary stimulation comes into the cord, it overrides the reflex arc, which is transmitting the pain signals. Over-riding stimulation may include heat, cold, acupuncture, pressure, tactile stimulation (massage), electrical stimulation, vibration, and a number of other possibilities. This may be why most forms of therapy work, from hydrotherapy to skin rolling to TENS units. During the time of the secondary stimulation, the reflex arc is broken by the inhibitory gate, like a circuit breaker. If the arc re-establishes itself after the new stimulus is removed, it will be lessened and may have been completely eliminated.

The psychological effects of massage may also play a large part in the reduction of pain. The work of Candace Pert and Ashley Montagu have shown excellent researched proof that the emotions and touch play a powerful role in the physical and psychological well being of the person, from the immune system to the response to society. These factors cannot be measured easily in the massage session, but can be seen readily on the faces of the emerging newly massaged person.

The field of pain research is a fascinating and wide open area. Many books have been written, such as Textbook of Medical Physiology (Gideon), The Challenge of Pain (Melzack and Wall) and Job's Body (Juhan), which will support our understanding of a subject that all too often is undefined in our perceptions. Researchers, such as Upledger, Cailliett, Benjamin, Chaitow and the above mentioned writers, are consistently giving us verifiable and scientifically-based research and information. We can count on their articles, books and lectures to support our educational process. Our fascination with the unknown and unproven will remain a forever stimulus for us to reach out and to ask - "How, why, and who says so?"

THE ROLE OF MUSCLES IN PELVIC DISTORTION

When looking at structural balance in the body, the pelvis plays an important and dominating role. It is the foundation on which the spinal column rides. It houses the organs of reproduction, digestion and assimilation. And, according to Peter Bachen's world reknown anatomical charts, it is the center of gravity for the human body. But for those people who study dysfunctional biomechanics and neurophysiological pain

syndromes, the pelvis is a significant piece in the puzzle which perplexes physicians, dentists, therapists and, perhaps, you.

STRUCTURE

The pelvic structure is composed of three bones; the right and left ilium and the sacrum, and a series of ligaments which attach them to the spinal column cranially, the femur heads caudally, and to each other. These pelvic bones can move independent of each other, but, because of the ligaments which bind them together, will move in relationship and response to each other. (For simplicity, we refer to the fused bones of the ilium, pubis and ischium as 'ilium' in this article.) When the pelvis is an anatomically correct position, the anterior superior iliac spine (ASIA) and the posterior superior iliac spine (PSIS) will be approximately level to each other in men and appear tilted anteriorly about 7-10 degrees in women, since the lip of the ASIS in women will extend lower than in men. Unless there are significant joint compressions or developmental anomalies of bone length, the leg lengths will be equal.

The interior of the pelvis is a bowl-shaped vessel in which lies the organs of digestion, elimination and reproduction. The kidneys lie posteriorly and superiorly in most cases, with their ureters running posteriorly down to the bladder. In women, the uterus is approximately in the center with the ovaries to each side. Organs of digestion, the intestines and colon lie in the superior aspect and surround the other organs. Evacuation is through the rectum and the urethra.

NEUROPHYSIOLOGICAL LAWS

A law is a constant fact or principle. That is, if it is true for one body, it is true for another. Laws of neurophysiology are written in anatomy/physiology books and medical dictionaries and withstand the test of laboratory and clinical research. One such law, Davis' Law, tell us when muscle ends are brought closer together, the pull of tonus is increased, which shortens the muscle (may even cause hypertrophy); and if muscle ends are separated beyond normal, tonus is lessened or lost (thus the muscle becomes weak).

For instance, when a person's arm is placed in a cast in a static, flexed position for 6-8 weeks, the biceps, brakeless and brachioradialis are shortened, that is the two ends are brought closer together. When the cast is removed, these muscles will be hypertonic or tight. Stretching and therapy will be needed to restore range of motion to the joint. The triceps, because the ends are separated beyond normal, will be weak and will need to be strengthened.

DISTORTIONS

Muscles create movement of bones. This is normal and is how locomotion is possible. However, muscles can also create dysfunctional movement of pelvic bones, which may cause the pelvis to become unilaterally or bilaterally distorted. One of the most common distortions is an anterior rotation, which will be discussed here. Posterior rotation, lateral rotation, torsion and medial rotation may also be found. Often there will be combinations of these, which, unless individually acknowledged and addressed, may confuse the practitioner.

To envision which muscles are involved in a particular distortion pattern, imagine the function of the muscles which move that joint. If you know a muscle's function, you also know it's dysfunctional capabilities. For instance, the piriformis is a lateral rotator of the femur. If the person presents a laterally rotated leg, check the piriformis for hypertonicity. Then ask yourself, "What else could be involved in this pattern?" or "What other muscles create this movement?". Systematically examine each muscle which could laterally rotate the leg (the abductors, iliacus, psoas, remaining deep 6 hip rotators, gluteus maximus, etc.,). If a muscle has been shortened by the dysfunctional pattern, it will probably be hypertonic (Davis' Law), and will assist in holding the body in the distorted position.

Addressed here are the muscular causes of anterior rotation. However, contributing to the end result of muscular spasm and structural distortion may be a number of other underlying factors which must also be evaluated. The factors include anatomical bone structure (anomalies), the vertebral column, foot and knee structure, fascial tension, and, especially, the craniosacral system. Understanding how to work together with other health care practitioners, such as physicians, orthopedists, neurologists, chiropractors, physical therapists, dentists, exercise physiologists, podiatrists, and other evaluative and rehabilitative associates, as a team effort, will bring the greatest long lasting result for the patient.

Anterior rotation of the iliums may occur unilaterally or bilaterally, that is, one or both bones may rotate. The anterior rotation may be caused directly by a number of muscular spasms. Anterior muscles attaching to or near the ASIS, including the sartorius, the tensor fascia late (TFL) and the rectus femoris, will pull the ASIS interiorly, creating the anterior rotation. The adductor muscles may contribute to anterior rotation through their pubic attachments. A hidden muscle, the gluteus minimus, may play a direct role with its fairly large attachment on the lateral aspect of the ilium.

From a posterior aspect, the quadratus lumborum, by shortening, can directly rotate the pelvis anteriorly. The latissimus dorsi and obliques may also play a role in causing or retaining the anterior rotation. From an interior view, the iliacus muscle, attaching to the vast interior surface of the ilium, as well as the anterior aspect of the sacrum, can also directly make its contribution.

Indirect anterior rotation of the iliums may be influenced by several other muscles. The tensor fascia latae merges with the gluteus maximus to form the iliotibial band, which

attached to the lateral aspect of the knee and helps to stabilize it. The IT band, however, can become stuck to the vastus lateralis, which lies deep to it, by the fascia intended to separate them. When this happens, the vastus lateralis can then also become an anterior rotator via the IT band. The erecter spinae and multifidus muscles may aid in anterior rotation by pulling the sacrum into an anterior angulation. Since the sacrum is bound to the iliums by sacroiliac ligaments, the iliums will usually rotate with it. And, finally, the psoas muscle, attaching to the anterior surface of the vertebral bodies and their disks, can increase (sometimes drastically) the lumber lordosis, thus influencing the position of the sacrum and the iliums.

RESULTS

Anterior rotation will most often contribute to lower back pain, increased lordosis and a "locked-knee" stance. However, because neurophysiological laws are strongly influential in this case (Davis' Law) a common condition associated with an anteriorly rotated pelvis will be weak rectus abdominous muscles, and thus, the common "pot-belly" look. For this person, "situps" and other abdominal exercise will help much more if the listed associated muscles are effectively treated along with the strengthening program. Hence, the hypertonic muscles become lengthened by massage therapy and stretching and the hypotonic muscles become strengthened by removing the source of inhibition (the hypertonic antagonist) and through exercise.

This article has discussed the muscular causes of anterior rotation. The rotation may be unilateral or bilateral. If only one ilium rotates anteriorly, that leg will appear to be longer than the normally positioned side. The result will be other more complicated postural distortions, such as tortioning and scoliotic patterns.

There may be other causes of the distortions or pain syndromes. There may be perpetuating factors creating the muscular contractions, such as visceral-somatic referrals from internal organs, vertebral facet syndromes, myofasial trigger points and even spinal cord or cranial lesions. A thorough understanding of the work of Rene' Cailliet, MD, Janet Travell, MD, David Simons, MD, John Upledger, DO and other authors will help guide us as to when to refer cases for additional support and who to refer to. Constant refinement of our own skills and comprehension will help us to offer the best support we possibly can in the recovery process.

About the author: Judith Walker, LMT, is founder and director of the International Academy of NeuroMuscular Therapy, a certifying body which sets standards for the training of health care practitioners in the use of NMT. She is primary instructor for IANMT and is a dynamic speaker on the subject of muscular injury. She lectures internationally and is a published author of both manuals and articles on pain management. She has been awarded recognition for legislative work as well as outstanding instruction. She has been a featured speaker for several state AMTA conventions and has presented at numerous conferences, including the International Congress of Massage Therapy in Lazarote, Canary Islands. The instructors and staff of IANMT include therapists and physicians who have had extensive training to teach the NMT courses. Each staff

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