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B Trigger Points: Diagnosis and Treatment 121

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1 Introduction

Role of Muscle Chains in the Body

The musculoskeletal system and **muscle chains** are the primary focus of this book. Myofascial structures participate in all somatic functions: Emotional states present as muscle tension. Physical labor requires muscle activity. Circulation, breathing, and digestion depend on an intact locomotor system.

Manual therapists—physical therapists, chiropractors, osteopaths, or Rolfing practitioners—examine and treat the locomotor system differently and with different motivations. Physical therapists and Rolfing practitioners treat the musculoskeletal system primarily to resolve discomfort (pain, tension, etc.) in the area being treated. Chiropractors and especially osteopaths view the myofascial system as a component of the body that can cause or result from dysfunction or pathology in other body systems. Another group of professionals—podologists or posturologists—are aware of the negative impact on the whole body that can result from minor shifts in weight or foot misalignments.

All somatic functions depend on well-functioning myofascial structures. The nervous system takes on the role of coordinator and controller. To avoid overloading the cortex, many activities are managed by subcortical reflexes and behavior patterns. Viscerosomatic and somaticovisceral reflexes have also been scientifically proven, which emphasize the special significance of muscle imbalances, especially of the paravertebral muscles.[79,112]

Motor and posture patterns of the human body involve the entire organism, in the same way that all physical activity results from interactions of all body systems. Osteopaths and chiropractors employ this fact in their diagnosis and therapy.

Segmental innervation of all body structures and adaptation mechanism patterns provide indications for structural involvement. Many sports injuries or musculoskeletal pain result from dysfunctions in parts of the myofascial chains. Understanding myofascial connections enables diagnosis and appropriate treatment. The osteopathic mindset provides a thought-provoking explanation for the mechanisms involved in the development and treatment of disorders.

Dr. Still's Osteopathy

When Dr. Andrew Taylor Still presented his philosophy of healing, during a phase when he rejected the medicine practiced at the time, he called it **osteopathy.** He knew full well that this term had a different meaning in the medical world at the time. His desire was to help medicine return to its origins by placing humans at the center and natural laws in the foreground. Osteopathy was the most appropriate term to illustrate that disease (pathos) results from dysfunctions in the body. Dr. Still viewed the musculoskeletal system and especially the spine as playing a central role. He recognized that all diseases and functional disorders involved mobility limitations of the spine. Osteopathy is derived from the Greek words "osteon" for bone and "pathos" for disease.[140]

Dr. Still knew from experience that treating symptoms did not bring about healing. Successful healing required expert treatment of the causes of disease. He had no doubt that disease started with circulatory disorders and that the cause was to be found in the **connective tissue**.[140] Therefore, this is where disease needed to be examined and treated. Myofascial tissue is of special importance in this process[82,140] because of its ability to serve as the following:

- Connector (connective tissue).
- Pathway for veins, lymphatics, arteries, and nerves.
- Supporting tissue (stroma, matrix) for organs and bones.
- Protective structure.

For Still, the nervous system and its surrounding fluids (**cerebrospinal fluid** [CSF]) are possibly even more significant than connective tissue. The nervous system serves as a control center and regulating organ and is responsible for all adaptation mechanisms between individual body systems. It initiates and coordinates all functions in the entire body and is responsible for all adaptation and compensation mechanisms.

Still refers to CSF as possibly "the highest known element" in the entire organism. Its composition is similar to blood and lymph serum. CSF is connected to blood via the choroid plexuses and with lymph via the peripheral nerves of the interstitium. In addition to its protective and nourishing functions for the central

nervous system, Still and especially his student William Garner Sutherland attributed a special function to the CSF:[54,140,142,143] it carries the "breath of life" into all cells of the body.

Still's experience in his early years likely gave rise to the development of osteopathy. As a physician, religious believer, and son of a Methodist preacher, Still had a close connection to religion and to God. This is reflected in all his writings: God gave humans health and disease is abnormal. Still believed that the osteopath's task is to search for health in the body of patients.

In his search for true medicine, Still was inspired by two opposing directions: spirit healers and bone setters. In his view, **spirit healers** embody therapists who believe in God. They tune into tissues and, through their hands, focus energy into a pathologic area. The "breath of life" (Sutherland) then performs the healing. **Bone setters,** on the other hand, also achieve great success through physical manipulation (adjustments).

Still combined both directions in his osteopathic treatments. His special talents as a therapist derived from his precise understanding of anatomy and his excellent sense of touch, combined with his belief in the power of self-healing and his intention to help. His anatomical and physical knowledge enabled him to precisely visualize structures. His sense of touch allowed him to feel tension in tissues and apply targeted, appropriate techniques in each individual case.

As an osteopath, Still embodied both the spirit healer and the bone setter. He compared the human body to a machine and the osteopath to a mechanic who repairs the mechanics of the machine.[140]

One characteristic of Still's osteopathy was that he combined **biodynamics** with **biomechanics**. Nowadays, it seems that some of his successors have divided this duality. Some osteopaths are pure "mechanics" who emphasize the laws of anatomy and physiology and manipulate the whole body using gentle and less gentle techniques. They represent the biomechanical direction of osteopathy.

Others are more biodynamically oriented. They place less importance on biomechanics and more emphasis on their sense of touch and the body's power of self-healing. Like spirit healers, they attempt to activate the self-healing powers in tissues, with the difference being that they employ the body's rhythms in diagnosis and therapy.[8,9,72]

Of interest in this context is a statement by Viola Frymann (continuing education 2000). She says that (Sutherland's) primary respiratory mechanism (PRM) clearly manifests in healthy tissue. However, with dysfunctions, the PRM's power of expression is impeded. This means that the PRM can be employed in diagnosis and therapy. Biodynamic therapists take advantage of this phenomenon by using their hands to establish a fulcrum in the tissue.[8,72,135] After a certain period of time, the PRM expresses itself in its various rhythms, which is an indicator that the tissue is regaining its function.

The difference between classic cranial osteopathy and biodynamics is that classical cranial osteopathy examines the tissue for motion and motion limitations and then guides the structure to be treated into unrestricted motion and holds it there. This allows the PRM to develop freely without tension and carry out its therapeutic effect.

The motions of the sphenobasilar synchondrosis (SBS) palpated and described by Sutherland correspond to motions of the head in the three planes of space, plus translations in the sagittal plane (**up and down strain**) and in the horizontal plane (**lateral strain**)**.** Functional techniques applied to the locomotor system work according to the same principle. Therapists search for a balance point in all planes (**stacking**) and maintain the tissue in a relaxed position until automatic relaxation takes place. This shows that the principles employed in cranial osteopathy are identical to those that apply to the rest of the body.

Opinions vary about which mechanisms are ultimately responsible for tissue relaxation. Practitioners of biomechanics maintain that it involves a reflexive response originating in the tissue receptors. Biodynamic practitioners believe in the effect of the PRM.

In his therapy, Still employed a combination of so-called direct and indirect techniques. Direct techniques manipulate the segment to be treated in the corrective direction. Indirect techniques move the segment in the direction of dysfunction.

Richard Van Buskirk[23] conducted research into Still's treatment methods by asking older patients, who were treated by osteopaths in their childhood or youth, to recall the techniques used in their treatment. Some of these patients were still able to describe those techniques and Van Buskirk was surprised to find that they resembled the few techniques described by Still himself.

A short video clip still exists in which Still can be observed treating a rib. This video along with statements of patients and the limited documentation written by Still about his techniques show the following: After thorough diagnosis, the segment to be treated is placed into the lesion position until the contracted muscles relax. Then the segment is moved into the corrective position using slight pressure that is focused on the blocked joint throughout the motion.

Scientific Evidence

As has been mentioned, the **nervous system** plays a **central role** for Still. It forms the link between the visceral, parietal, and cranial systems. The importance of the central nervous system and especially of the spinal cord in the genesis of dysfunction and pathology has been scientifically documented in research by Korr, Sato, Patterson and others.[79,81,112]

These scientists experimentally verified the significance that Still and other manual therapists placed on the spine in the development and maintenance of pathological states. They confirmed the central, regulating role of the spinal cord. Korr[79] was able to provide scientific explanations for generally accepted phenomena observed in experiments. He referred to the locomotor system as "the primary machinery of life" and maintained that the other systems (digestion, endocrine, heart, and circulatory systems) serve the locomotor system.

The autonomic nervous system (ANS) plays a special role in this context. Both parts of the ANS are complimentary rather than antagonistic. Roughly speaking, the parasympathetic (craniosacral) nervous system (PNS) regenerates the organism. It also plays a regulating role in processes of longer duration. The sympathetic nervous system (SNS), on the other hand, adapts body system functions to current needs. It intervenes in the regulation of blood supply to active muscles, for example, by reducing blood flow to the digestive system to benefit muscles during physical activity. At the same time, the SNS increases respiration and pulse rates. The SNS enables the body to spontaneously adjust to immediate requirements.

Korr supplied neurophysiological explanations for many phenomena observed by clinicians. He coined terms such as **facilitated segment** and **neurologic lens**. A facilitated segment is a segment of the spinal cord where the stimulus threshold of all nuclei is lowered by repeated stimulation or by dysfunction of the segment due to chronic stimulation. In this condition, subliminal stimulation of the facilitated segments suffices to cause disproportional reactions. One example is acute torticollis resulting from exposure to drafts.

The term neurologic lens describes the following phenomena: If a spinal cord segment is chronically irritated, it becomes susceptible to stimuli that should normally only be able to stimulate other, more distant segments. The irritated segment is said to "attract stimuli."

In their experiments, the research team led by Korr produced other interesting results:

- Increasing the sympathetic tone (locally or generally) lowers the stimulus threshold of the segments involved and increases muscle tone for the muscles supplied by those segments.
- Blocking of vertebrae increases the sympathetic tone of the segments involved and lowers the stimulus threshold.
- Stress of all types increases muscle tone, especially in facilitated segments.
- Posture imbalances impact the muscle tone of paravertebral muscles and of muscles supplied by facilitated segments.
- Reducing the muscle tone of paravertebral muscles lowers sympathetic tone in those segments.

Taken together, research results in this area clearly illustrate two facts:

- The musculoskeletal system is one of the main agents involved in the development and maintenance of somatic dysfunctions.
- The spinal cord plays an important role as a control element and organizer in the genesis of pathological states.

Korr's characterization of the locomotor system as the "primary machinery of life" is therefore by no means an exaggeration.

Myofascial structures play a main role in all important bodily functions, from respiration (thoracic as well as cell respiration), circulation (diaphragm and muscles as venolymphatic pump), and digestion (as mobilizer of organs) to being a means to express emotions. The locomotor system enables motion, communication with others, food intake, etc.

The fact that more than 80% of all afferents originate from the locomotor system further underscores the importance of the musculoskeletal system.[79,112,158] The extreme sensitivity of muscle spindles (1 g of traction and a stretch of 1 mm cause a reaction of the muscle spindle[79]) makes the locomotor system a highly sensitive organ. This enables quick reactions, but at the same time, it increases susceptibility to dysfunctions. This results in contractions, malpositions, and coordination disorders.

Irvin [in[155]] and Kuchera and Kuchera[82] describe how a 1- to 1.5-mm tilt of the base of the sacrum suffices to change the muscle tone of the paravertebral muscles. Korr described the resulting impact on the SNS and on the entire body. However, the spinal cord as a controlling and organizing center is not influenced by only peripheral stimuli.

The emotional state of a person is a significant factor in the genesis of dysfunctions and pathologies. The limbic system plays a decisive role in this process.[158] As the body's memory, it evaluates all stimuli and impressions as either positive or negative for the person, depending on previous experience. If a stimulus is experienced as pleasant, it provides positive feedback. If the stimulus is perceived as harmful, it provides negative feedback.

The hypothalamic–pituitary–adrenal (HPA) axis controls the neuroendocrine system, which regulates hormone balance as well as the neurovegetative system. Facilitated segments are especially impacted by positive and negative emotional stimuli (e.g., weekend migraine or stress ulcers). Segments with lower stimuli thresholds remain "chronically irritated" after a certain amount of time when they are subjected to persistent stimulation.[112] **Therapy for this condition requires treatment of the entire lesion pattern to erase the imprinting of the pathological pattern at the level of the central nervous system**. In this context, Korr talked about the spinal cord as organizer of disease processes.[79]

The embryologically determined metamerism of the spinal cord leads to segmental affiliations of certain muscles, organs, vessels, skin area, bones, and joints.

Stimulating one of these structures influences the functions of all other structures associated with this segment.

Since neighboring segments are connected by interneurons, facilitation usually impacts several segments. The plurisegmental supply of organs and muscles also supports this concept. In our opinion, it is wrong to associate an organ or function with a single spinal cord segment, especially since the brain knows only motion patterns, not individual muscles. Congenital and acquired patterns are of equal importance in this context.

The digestive system has considerable autonomy due to the enteric nervous system, but it is nevertheless subordinate to overall body function, with the endocrine and neurovegetative system also providing a regulating function.

It is safe to assume that both congenital and acquired behavior patterns are found in this system, just like with the locomotor system. These patterns likely correlate with posture and locomotor system patterns and create a certain type.[151]

Mobility and Stability

The locomotor system consists of muscles and bones. It needs to serve two contradictory functions simultaneously: provide stability and allow movement.

The cerebellum and the vestibular system enable both functions. They both receive their information from receptors that are primarily located in myofascial structures.

Both functions are carried out by muscles: adequate basal muscle tone, ability to react quickly, and well-coordinated muscle tension enable delicate, harmonious motions as well as subtle and appropriate adjustments to ensure balance in the most efficient manner.

In its wisdom, nature (or the Creator) has provided a simple solution for this problem. Centrifugal force (expanding force of the organs) is balanced by the imploding force (inherent muscle tension) of the musculature. The extraordinary sensitivity of muscles supported by the precise coordination provided by the nervous system enables optimal and efficient stabilization of the locomotor system.

To perform harmonious motions, muscles need stable support, a central organ that coordinates activity (nervous system) and structures that guarantee their supply (metabolism). These activities are controlled by the nervous system, which activates agonists and synergists and inhibits antagonists precisely to the extent needed to perform targeted, harmonious motions.

Most motions occur unconsciously with the help of several spinal reflexes. This is necessary for humans to act anticipatorily. The cerebrum needs decision autonomy.

The spinal cord acts as a control center for all physical activities. Dysfunctions can have disastrous consequences. All afferent signals from the locomotor system reach the spinal cord and efferent signals to the muscles originate there. This is where motor and posture patterns are processed.

In the 1950s, Sherrington described several reflex actions that explain these patterns [in[21] and in[160]]. Muscles consist of different muscle fibers with different characteristics. White (fast-twitch) fibers are more suited to fast contractions, while red (slow-twitch) fibers support longer lasting tension. Both fibers exhibit different pathologic tendencies. White fibers tend toward weakness and atrophy, whereas red fibers tend toward contracture and shortening. These characteristics need to be addressed during treatment.[40,41,86,87]

The Organism as a Unit

At the beginning of this chapter, we pointed out that the organism always responds as a unit. We do not intend to reproduce the basic foundations of osteopathic thinking in this book, but only those concepts necessary for understanding the following chapters.

Our organism *always* acts as a unit, in physiologic as well as in pathologic states. The *entire* body participates in each physiologic process. Respiration, for example, involves all muscles. It not only activates the respiratory system muscles, but also mobilizes digestion in a certain pattern. Circulation is also supported by muscles. These activities always follow a specific process. During inspiration, the entire locomotor system, including the head, carries out a motion pattern that Sutherland called "flexion–external rotation–abduction".[101,102,142,143] Exhalation reverses this pattern: "extension–internal rotation–adduction."

Walking follows a similar pattern. Gait is a harmonious sequence of motions from the tip of the big toe to the root of nose, in the same repeating patterns. We also find this holistic behavior in pathologic states.

The best indicator of holistic behavior can be found in the embryologic development of humans. When an ovum cell is fertilized by a sperm cell, the ovum cell divides into two cells that have the same genetic code. This division continues until the cells join into cell units to form organs, muscles, bones, nervous system, etc.

This shared origin of all cells in the body supports the conclusion that all cells also jointly react to a given situation. The nervous system seems to have a special function in this process as a control and coordination center.

Sutherland bases his explanation of the human body as a unit on the membrane system and on the fluctuation of liquor.[101,102,142,143] He uses the term **reciprocal tension membrane** to describe that traction on the base of one membrane system influences all other bases. These reciprocal tension membranes consist of the cranial and spinal dura mater.

Sutherland describes the following attachment points for the dural system:
- Crista galli, in front.
- Clinoid process.
- Petrous part of temporal bone, left and right.
- Inion, in back.
- Foramen magnum.
- Cervical vertebra C2.
- Sacrum.

One practical consequence is that a position change of the sacrum, for example, automatically changes the positions of the occipitoatlantoaxial (OAA) complex and the cranial bones.

The dural system is filled with nerve tissue and fluid (CSF) and continues via the nerve sheaths to the interstitium, which is also filled with fluid. In other words, changes in the dural system exert pressure on the fluids in the dural sac. These pressure changes disperse throughout the interstitial fluid and therefore the entire body.

The PRM described by Sutherland and consisting of flexion and extension phases causes pressure changes in the entire dural system and intercellular tissue. These changes display a specific rhythmicality, and their direction and amplitude is tissue specific. The direction of movement correlates with thoracic respiration: cranial flexion corresponds to inspiration and cranial extension corresponds to expiration.

The anatomy of fasciae provides further proof of holism. Embryologically, all connective tissues originate in the mesoderm. Basically, the different layers form a single cover that divides the organism, envelopes organs and muscles, and forms the body's skin. The body's three fascia layers are connected. This continuity causes changes in one location, for example, tension or pressure, to manifest throughout all tissues. This reciprocity makes fasciae so extraordinarily important for posture, locomotion, and physical response to mechanical stress.[111]

The continuity of fasciae, the continuity of fluids, and their common origin are indicators of unity, especially since all cells share the same DNA.

The entire body will always respond as a unit, in physiology as well as in pathology. Any organ dysfunction will impact the muscles and joints that are segmentally connected to the organ. The continuity of myofascial tissue causes changes in tension and pressure ratios in the *entire* body and, via the dural system, in the cranium. Posture, cranium, and organs adapt in a specific pattern. The body endeavors to leave the functions of the entire organism undisturbed for as long as possible.

Interrelation of Structure and Function

All osteopaths are familiar with the interrelation of structure and function. Structure depends on function and function impacts structure.

The most effective illustration of this concept is joint mobility. Joints need to remain mobile to prevent ankylosis. If the mobility of a joint is impaired, the synovial joint membrane produces less fluid. Lack of loading and unloading of weight on the cartilage reduces its supply. The joint capsule and the cartilage become brittle. This results in reduced joint mobility and may lead to arthrosis or ankylosis. Arthrosis results from joint dysfunction, whatever the cause.

The locomotor system provides an especially instructive example of this adaption of structure to function. Muscle dysfunctions lead to structural changes. This process happens surprisingly quickly,[2,46] but fortunately, it is partially reversible. It takes about 30 days for functional problems to cause structural changes.[41,82]

At the same time, structure determines function. For example, certain joint changes cause gait changes and impact the normal functioning of other structures. Osteopaths who work in pediatrics are especially familiar with the impact of structure on function. Still writes about the significance of osteopathic treatments for newborns.[140] Sutherland,[142,143] Magoun,[101,102] Frymann,[57] and Arbuckle[4] provide details about this topic.

Structural changes in the cranial base of newborns due to prenatal or perinatal complications are the starting point of dysfunctions in cranial nerves (X, XI, XII) and posture problems of the spine (scoliosis, kypholordosis). Magoun explains this as due to the craniosacral connection and growth impairment caused by membrane tension.[101] Korr confirms his theory.[79]

Still stated the same view 50 years earlier when he posited that circulation disorders are the beginning of disease.[140] For Still, circulation included venolymphatic and arterial circulation as well as the circulation of nerve impulses. Structural changes are subject to the laws of mechanics. The following are significant:
- Gravity.
- External forces.
- Shape and condition of joint surfaces.
- Impact of muscle traction.[107]

Biomechanics of the Spine and Locomotor System

No other researcher analyzed the biomechanics of the spine in as much detail as Littlejohn[53,95,96,97,98,126] and Fryette[56] [from a different perspective]. Littlejohn takes a holistic view of the spine and attempts to provide mechanical explanations for commonly found dysfunctions. Fryette describes the behavior of individual vertebra during motion and in the presence of certain dysfunctions. Littlejohn supplies mechanical explanations for the behavior of the spine (globality).

The behavior of the spine and of the locomotor system in general is directed by mechanical laws. The spine consists of anteroposterior arches. The movement of joints is dictated by ligaments, muscles, and joint