ORIGINAL RESEARCH

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An Osteopathic Paradigm of Ideal Muscle Function: The Posterior Body Lifts the Skeleton into Gravity

Introduction

An ideal posture as predicted by osteopathy would incorporate all of the osteopathic principles. After discussing the proper physiologic motion of the thoracic and rib cage areas, Dr. Sutherland advised that the military posture—characterized by throwing the shoulders back, throwing out the chest and assuming a strut attitude—"disregards a physiological law not framed by human hand."[1] The popular belief in the preferability of the military posture has not changed, and many patients distort their posture and function based on observation of the people around them or on perceived ideals such as throwing the shoulders back.

In addition to recommending changes in posture, this paper will show that posture partially results from the way in which the body creates movement. Using the principles of osteopathy to understand how the muscular system moves the skeleton and maintains ideal biomechanics dictates a change in the quality of muscular activation.

Dr. Philip Greenman,in his work with Dr. Vladimir Janda, utilizes "proprioceptive balance training, stretching of tight muscles, retraining of inhibited muscles and finally aerobic training."[2] This includes brain retraining in muscular initiation patterns. In the paradigm being proposed in this paper, the brain not only changes the muscular initiation patterns, it changes their quality of function.

Dysfunctional postures utilize myofascial rigidity to deal with the pressure of the force of gravity. Changing the stiff, thick tissues found in patients with these more severe postural problems requires changing the way they move. Removing the compensatory stiffening mechanisms used to maintain posture in the face of gravitational demands through osteopathic manipulative treatment, retraining muscular initiation, and improving the quality of initiation will, in this approach, also replace those stiffening mechanisms, helping the patient become aware of and choose to use the ideal system.

The following osteopathic principles regarding posture and movement are vital to the process described herein, and, when followed, will optimize the health and function of the body to create ideal posture and ideal movement.

- The value of optimal tissue texture quality (tissue texture that does not have chronic or acute changes)
- The benefits of enhanced tissue respiration and optimized cell

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- The importance of the functional relationship between the thoracic and pelvic diaphragms to enhance the pumping action through the abdominal area for optimal lymphatic function
- The desirability of posture and movement that maintains the spine in a more neutral functional mode, free of somatic dysfunction
- Gait that stresses the muscular role in creating the alternating posterior and anterior rotation of the innominates as described in the walking cycle of the Mitchell Moran Pruzzo Manual[3]
- Posture and movement that facilitates the optimal function of the Primary Respiratory Mechanism (PRM), including the ideal fluid quality of this system
- The principle that the body is a dynamic unit of function. As a response to a request by the central nervous system, a specific muscle creates movement between bones in a unit of function. Each of these units of function builds on each other, supporting the skeletal system in stance and motion in the gravitational field, until the body is a single dynamic unit of function.

When these osteopathic principles crucial to ideal muscle function were incorporated, there was a marked improvement in what appeared to be lymphatic function, described by patients as the sensation of a "tide."

This approach will look at diagnosing somatic dysfunction by the diagnosis of the somatic dysfunction in a unit of function, working sequentially through the individual units of function that impair, for instance, hip lateral rotation, until the integration of all the units of function has been completed. If possible, multiple units of function are treated simultaneously rather than sequentially. A major portion of the information presented in this paper is original research in that it was derived from patterns of patient observation over many years, and no references will be provided for these remarks.

The Posterior Body

The muscles of the body work through the fascia to create and integrate motion. Serge Gracovetsky, PhD presented this point of view in his lecture at the March 2015 AAO Convocation.[4] While the emphasis of this paper will be on muscle function, this function should be understood to include the action of muscles through fascia–the myofascial system. We will explore the use of ideal muscle function to 1. maintain ideal biomechanics with the body as 2. the myofascial system initiates motion and 3. responds to gravity by lifting the body cephalad in stance and in motion. This will be contrasted with the development of myofascial stiffness employed to stiffen the body against gravity in the lock and sway postures. The major elements of the muscular biomechanics that, when optimized, allow the ideal muscular system to lift the skeleton cephalad in response to the action of gravity will be covered, described as elements of the Posterior Body. No one activity so epitomizes this capability as does the leap in ballet. A video of the dancer Mikhail Baryshnikov demonstrates the powerful capacity of this muscular system to contact the floor, appearing to light gently, but using that contact to respond by lifting. The muscles appear to float the skeleton through the air, keeping the spine beautifully supple and upright while doing so. The buoyant function and spring-like action of the lower extremities is quite evident in some videos that can be obtained on the internet.

The quality of function of these posterior body muscles and the way they are rehabilitated is critical to this thesis. There are different perspectives about the muscle function of the body. For instance, in a conversation with Richard Lieber, PhD, the Director of the Chicago Rehabilitation Institute, we were discussing the ballet performance he had just attended. I mentioned that ballet dancers have beautifully long muscles. His response was that muscles don't get long, they concentrically contract. Even eccentric contraction of the muscle is a response to an opposing concentric contraction and doesn't make the muscle long. In contrast, as a teaching fellow working under Viola M. Frymann, DO when she was the chair of the department at Western University College of Osteopathic Medicine of the Pacific, I was told by her that she would never send a patient to physical therapy because patients' muscles were already too short. In her teens, Dr. Frymann was preparing to audition for a prominent British ballet company when she severely fractured her ankle. Forced to give up her dream to become a ballerina, she instead became an osteopathic physician, which led to her profound contributions in the field of osteopathy. She was commenting to me on the effects of strengthening as it was generally seen in physical therapy—to emphasize the function of the concentrically contracting muscle. Dr. Frymann had clearly trained her muscles with a different emphasis, one in which the function might have been thought of as assisting the muscles in maintaining their ideal length.

The muscular posterior body handles the forces of gravity without strain, either on the lumbar spine as gravity bears down on the lower extremities as they move in the gait cycle, or on the upper spine as the upper extremities reach forward to lift heavy weights, arms extended at shoulder height. It builds function to become the dynamic unit of function that lifts the skeleton extending from the foot to the support of the head. These muscles were selected based on their ability to manage the forces involved in the biomechanics of movement, not because they are ordinarily thought of as postural muscles. The elements of the posterior body include:

- the muscles that create the muscular arch
- the hamstring group of muscles
- the gluteal muscles
- iliopsoas as the foundation of the abdominal core
- latissimus dorsi as the foundation of the shoulder
- trapezius as the foundation of the cervical core, longus colli

Altering the Quality of Muscular Function Initiated by the Central Nervous System

When the central nervous system chooses to create movement, it initiates action at the level of the motor cortex, extending through the peripheral nervous system to the contractile voluntary muscular system. The active creation of movement extends through the myofascial system beginning with the contractile muscular element, which then influences the fascia and tendons (with influence on the tension of the ligament relationships) to influence the skeletal system. When the muscle concentrically contracts (shortens), it acts through this muscular system to cause the origin and insertion of the tendons to move toward each other. The contracting muscle is defined as "the prime mover of a joint… the muscle(s) that would create the opposite movement at that joint relax but do not actively elongate."[7] When making that specific motion these muscles are defined as opposing muscles and their interaction will be described as ideal opposing muscle function throughout this paper. Opposing muscles work in harmony to create ideal movement. In the protocol of Drs. Greenman and Janda the opposing muscle is reciprocally inhibited. "Synergists are muscles which assist a prime mover or complement its action."[7] Muscles work in synergistic teams with groups of muscles functioning to carry out a specific goal.

One example of such synergistic function would be the many muscles which assist the action of iliopsoas, as iliopsoas spans a large number of joints and participates in many activities. It works with opposing muscle function through rectus abdominus to act on the core and create flexion motion through the thoracic spine. Iliopsoas also acts with synergistic muscles to hold the body upright and to run. "The major functions of the gluteus maximus during running are to control flexion of the trunk on the stanceside and to decelerate the swing leg."[8] While the function of iliacus is not well understood, it does appear to fire as the foot moves forward to plant on the ground in the gait cycle. The author's clinical experience is of iliacus problems in patients who don't rotate the innominate posteriorly in the gait cycle. This would be the time the innominate would be posteriorly rotating in the Mitchell gait cycle.[3] Thus iliacus and gluteus maximus are synergistic muscles. Finally, the term antagonist describes a muscle that would have the opposite action of a prime mover. A classic example of agonist/antagonist muscles are the biceps and the triceps. "These muscles (antagonists) are not active when the opposite prime movers are contracting....They are called into play at the end of a violent action to protect the joint…"[9]

There is apparently no active muscular process that restores the shortened muscle to its ideal length, but it would appear that our muscles can become shortened and can stay that way for years. Clearly, stretching as an activity to improve mobility, to prepare for athletic activities and to relax is quite popular, and sometimes seems to give people improved function. However, the common approach to stretching must usually be repeated frequently to continue to notice the effects. The word "stretching" used in this context usually implies taking the muscle to its full length, stopping when the stretch reflex is activated, and then working to make the muscle get longer by other interventions. However, it is possible to stretch with relaxation.

The specific approach used by the skilled ballet dancer to strengthen and maintain mobility yields superior tissue texture quality when compared to the tissue quality found in my patients resulting from any of the physical therapy approaches to strengthening the author has been able to assess. Ballerinas and some yoga practitioners describe a quality of active muscular elongation in motion, one that occurs with a quality of relaxation:

> A concentric contraction is the gradual shortening of a muscle against a resistance. An eccentric contraction is the gradual lengthening of a muscle in the direction of an outside force such as gravity, momentum or other muscles.… Usually one describes the lengthening of the antagonistic muscles as "relaxation of the antagonist." This "relaxation," however, in full-ranged, effortless, graceful movement, is an active eccentric contraction.[10]

This active elongation doesn't feel like the usual quality of muscle activation, but rather involves thinking about a more relaxed movement, a quality of motion that is described in this paper as *ideal opposing muscle function*. The key to changing this function involves changing the brain's perception of ideal function, to sense muscle function as being different, something soft and flowing.

To give an example of how muscles can become shortened, based on years of observation, the lack of ideal opposing function of the hamstrings to quadriceps groups of muscles appears to be related to the development of short hamstrings. Dr. Greenman and Janda identified the shortened or hypertonic hamstring as being a significant problem and devoted several pages to stretching it.[12] Interestingly, in my experience both the counterstrain treatment of rectus femoris in the Compendium Edition of Counterstrain will assist in the resolution of this lack of ideal opposing function of the hamstrings.[12] The dysfunctional muscle initiation forcibly contracts or "punches" the contraction, not allowing the hamstring to fully return to its resting length. The ideal opposing function creates a lack of strain in the knee ligaments with quadriceps concentric contraction as the non-activated hamstring returns to its ideal length. This is best experienced with the aid of a skilled instructor.

With the patient supine, the instructor stands at the side of the patient and lifts the heel while stabilizing the back of the knee. The area anterior to the femoral head is palpated to insure that the hip stays posterior as the heel is raised, keeping the hip flexors from activating. The femur is allowed to drop posteriorly into the hamstring group, with the hamstring group cradling the knee like a hammock. The patient with hamstring shortness can't do this until the quadriceps group stops gripping the femur—when the knee *trusts* the hamstring group of muscles to support the knee without any fear of strained hyperextension of the knee. After the opposing muscles are rebalanced in this way, the patient always describes the extremity as feeling relaxed, but many also describe a feeling like a tide of fluid in the extremity. The ability of the patient to recognize the sensations of this quality and to make different choices about how to move is a major factor in the extent to which he can maintain his improved function. This "brain retraining," or altered activation from the central nervous system based on a feeling of experiencing more relaxation or well-being, enables and requires the patient to participate in her own health care. The word "trust" as used above is accurate because enacting such a change requests more general engagement of the brain and begins the process of brain retraining. Even though the activation of muscle function happening at the motor cortex creates only muscle shortening, change in the totality of brain perception probably allows the ideal opposing muscle reaction. Thoughts regarding this from other disciplines will be addressed shortly.

The goal of the following exercise experience is to contrast this relaxed lengthening with a usual hamstring stretch. This process begins to demonstrate how movement can change muscle length. The usual stretch would be done by standing, bending forward at the hip to stretch the hamstrings by reaching the fingers toward the floor, engaging the stretch reflex and waiting for a release, bouncing off the barrier or using other approaches to create more length. To contrast this with a more active but relaxed elongation experience, instead imagine your hamstring muscles "working long." It is easier for the average person to think about moving a bone than to think about using a muscle. Using this principle, in order to bend forward to flex at the hip, an active elongation would have the motor cortex initiate movement of the ischial tuberosities toward the ceiling. Note the origins of the hamstring group of muscles at the ischial tuberosity and the insertions on the tibia and fibula areas. If the knee is fixed (straight but not hyperextended), a lengthening hamstring would move the ischial tuberosity cephalad to create anterior rotation of the innominate as it rolls over the femoral head. Rather than bounce on a stretch reflex, fully relax the muscular system, especially the quadriceps group, particularly vastus intermedius, while keeping the knee fully extended but without strain until the fingertips no longer move toward the floor. This motion of the innominate around the hip, creating flexion of the hip with the concomitant relaxation of the muscular system, moves the distal tibia slightly posteriorly and *assists in further decreasing the joint strain across the knee*. Measure the distance of the fingertips from the floor. Then come back to the upright position and repeat the action several times and again determine whether the fingertips have moved closer to the floor.

Moshe Feldenkrais placed a great deal of importance on awareness of quality of function in rehabilitating function. Feldenkrais had a PhD in Engineering. He studied movement both as a scholar in the study of biomechanics, and as a martial artist in the practice of Ju-Jitsu. He addressed changing the brain's activation of the muscular system in a process termed *Awareness through Movement*. He describes his process as follows:

> …begin bending the fingers of the right hand "as in you're going to make a fist"…undo it, as if you stopped thinking of the fist...That is the easiest movement we can do. It's almost like moving the eyelid. Close and open, as slowly, as comfortable, and as little as is necessary for you to feel that you're actually flexing and stretching [pause]... We can do everything to our own comfort....You'll find that in order to be able to do a thing comfortable, elegantly, and aesthetically right...we must do it with a minimum, of exertion, with the feeling of lightness....Your entire motor cortex, the entire nervous system is now pervaded with that feeling, light, and you should know that in our motor cortex the hand occupies, nest [sic] to the lips, the largest area...so very slowly there will be a feeling of lightness permeating the entire musculature,...the entire self..[13]

This description of the quality of motion includes sensations experienced with movements like bending to the floor, twisting, and lifting the arm overhead using ideal muscle function. Ballerinas have shared with me the feeling of ecstasy they feel when dancing. Few people have muscles conditioned to maintain this function and therefore few people have felt that lightness, exhilaration and ease of movement. In order to maintain this quality it is necessary for the muscular system to maintain the biomechanics of the skeletal system. If this doesn't happen, more myofascial chronic and acute tissue texture changes will develop. One of the sources of this lightness in movement appears to be in strengthening the spiral nature of these myofascial relationships. This spiral relationship originates in the embryonic development of the system and will be discussed at greater length when discussing the supination-pronation phases of gait.

Proper Balanced Muscular Function Maintains Ideal Biomechanics

Biomechanics is the study of the movement of the biologic system. The muscular system provides the motive force which creates the motions at the joints, motions that occur when the body moves through space. The function of the muscular system is threefold: to lift the skeleton up (cephalad) in response to the force of gravity, to move the bones in space, and to stabilize the joints in the midst of movement. It must fulfill these requirements with tissues that are an ideal arena for the fluid tides of the PRM and optimal function of the extracellular matrix. Ideal posture and ideal muscle function must abide by the structure/function principle of osteopathic medicine. If this does not happen there will be changes in the tissue texture in the myofascial structures that are a result of these forces being handled improperly. Based on the structure/function concept of osteopathy, the bones are designed to bear the weight of the body in the gravitational field. Thus an ideal posture would, for example, place weight-bearing directly from the femoral condyles over the tibia and would maintain that weight-bearing through the long axis of the tibia and onto the talus. This requires precise muscular control of the biomechanics of the skeletal system, depending on the functional needs of each joint.

The needs of each joint are different and therefore the ideal muscular function at each joint is unique. The following three different types of muscle function are examples of the diverse functions of the muscular system: 1. Stabilization of the hip motion that precisely controls the femoral head, allowing only rotation in relation to the acetabulum in the face of marked torque forces that would tend to create translation of that femoral head; 2. muscular movement of the thigh and leg with the knee as the joint between these bones—a function that requires a spring-like action and supple motion in many directions in order to perform activities like hiking up boulders or rock climbing. During these activities, precise stabilization through the muscles that cross the knee is required in order to maintain ideal joint relationships in cooperation with the collateral ligaments. A final example of the different types of muscle function would be 3. activation of the muscular arch — in which muscles may extend from a localized origin to multiple insertions to organize a complex motion like flexion of all the toes while lifting the midfoot at foot plant.

Each of these "units of function," the muscle that moves the bone and the bone that is being moved within the myofascial structure, integrates, building from the ground up to the hip. This larger unit of function maintains the hip to the foot and provides part of the stabilization of the pelvis, including the innominates and sacrum in the gait cycle and in posture.

The reciprocating supination then pronation phases of motion in the gait cycle create forward movement as the extremity is moved forward to foot plant with the supination phase, and then as the pelvis (and the entire torso) is moved forward or anteriorly by the gluteals and the hamstrings in the pronation phase of gait.

The stabilization of the hip is a good example of how the force of a "moment arm" must be managed by the body.

> Moments are forces that act at a distance and/or produce rotation of an object…The magnitude of a force moment is the product of the force applied and the distance of application from the center of rotation. This latter distance is referred to as the moment arm.[14]

The force moment is also called "torque." Torque is defined as the tendency of a force to rotate an object about an axis. For example, when standing with the right hip flexed to 90° and the lower extremity straightened with pointed toe and held in front of the body, the distance from the femoral head in the acetabulum to the toes is the moment arm.

A comparison to using tools further illustrates the concept of torque. When using a torque wrench, the proximal end of the wrench is applied to the head of a bolt (femoral head) and that is stabilized. The distal end of the wrench (toes) is grasped by the hand and a rotary force is applied that magnifies the ability to tighten or loosen that bolt. In terms of body mechanics, the force moment applied to the hip, the object that rotates, is the weight of the lower extremity distributed across this moment arm, the length from the hip to the toe. The extremity is acting like a torque wrench, in which the torque would oppose that rotation of the hip that brought it to 90° at the request of the brain. The function of the muscular stabilization of the hip is to resist that counter-rotation so the extremity can be held at a 90° angle as the brain/motor cortex requested.

The muscle most affected when these forces are not able to resist the torque appears to be iliopsoas, which acts from the thoracic to lumbar, sacrum, innominate and lower extremity areas. Imbalance between the hip flexors/quadriceps group of muscles and the powerful gluteal/hamstring group of muscles is one of the causes of this breakdown. When psoas starts shortening and the innominate starts rotating anteriorly in the face of this torque, the lumbar spine becomes extended. To experience the effect of an anteriorly rotated pelvis (innominates and sacrum rotated anteriorly as a unit), anteriorly rotate the pelvis in that same standing position and feel the effect of the strain of holding the extremity on the spine. When the pelvis is in neutral (the pelvic diaphragm is parallel to the floor with the ischial tuberosities oriented toward the floor), the muscular system can manage this torque. However, if the pelvis becomes rotated anteriorly, the torque will create repetitive force on the spine and create an increased lumbar lordotic curve with a shortened psoas muscle, as demonstrated in the Thomas test. While the Thomas test has come to be seen as a test for hip flexor contracture, the test in its entirety evaluates not just the action of the iliopsoas as a hip flexor, but the length of the psoas by addressing the position of the lumbar spine as it is kept pressed to the table for the hip evaluation. A longer psoas will decrease the compression on the lumbar discs.

Characteristics of Myofascial Tissues: The Development of a Movement Pattern

If muscles do the same thing continuously for many months to years, the myofascial system becomes stiff and thick, and it takes considerable work on the part of the patient to restore the active function of these muscles. These patterns of stiffness with chronic and acute tissue texture changes are more pronounced if the action of these muscles requires an inappropriate amount of force utilization. This pattern of tissue stiffness is called a "movement pattern" and will control motion until these muscles are reconditioned. A movement pattern can sometimes be diagnosed by observation of a preferred motion. The alternating muscle functioning in the supination and pronation phases of motion in the gait cycle, which will be discussed later in the paper, is one example of this rhythmic, changing motion. These repetitive motions improve the likelihood of maintaining ideal tissue texture quality. For example, if the supine patient's extremity is lifted, then placed back onto the table, and the thigh spontaneously tends to roll internally into pronation, bringing the knee into relative valgus, that is indicative of an overused pronation and underused supination phase of function in the gait cycle. It should be possible to note that pattern of early pronation in the movement of the gait cycle. This movement pattern creates an ease of motion in the direction in which the muscles are used to working, and a marked restriction to the lesser-utilized pattern of motion. These are examples of some of the patterns of tissue stiffness which shape the function and movement of the patient and create abnormal postures such as the swayback posture. Changing this stiffness, especially using muscles that are so relatively unused, can require vigorously repetitive and precisely focused muscle function in opposition to the direction of ease. It also requires a change in brain activation; it requires changing an old movement habit.

A "dominant muscle" is one that has become so thick and stiff that, while it appears to the patient to be a strong muscle, it doesn't actually have strength, but rather is controlling. In fact, this thick stiffness or chronic tissue texture changes will inhibit the ability of the opposing muscle to move. A common example of this principle is that of a dominant quadriceps group of muscles that inhibit the hamstring group of muscles from elongating, resulting in a perpetually short hamstring function. Patients often stretch their hamstrings daily, demonstrating that the hamstrings didn't change function since the last time they stretched.

In order to assess these movement patterns, you can also observe, for instance, whether your patient utilizes too much hip flexor activity when moving the foot toward foot plant in the gait cycle by palpating to determine dysfunctional tissue texture quality in the hip flexors. Stand by the side of the supine patient at the level of the knee with the operator's cranial hand palpating for movement of the hip by placing the fingers at the anterior hip area, cephalad to the lesser trochanter and inferior to the anterior inferior iliac spine. Then place the operator's caudad hand posteriorly underneath the heel and proceed to lift the heel up to create flexion of the hip with a relaxed, not flexed, knee. In ideal motion the hip will rotate into flexion through this entire range of motion until the hip flexion reaches 90°, unless the motion is stopped by hamstring shortness. This motion could begin to create a hamstring stretch reflex in the patient with a shortened hamstring, but do not take the leg far enough to initiate that reflex. It is common in the patient with thick, stiff quadriceps group muscles to overuse the hip flexors. This can be palpated for the appreciation of changes in these muscles as the operator lifts the heel and the hip flexors spontaneously activate, as if to pull the hip anteriorly. This anterior translation of the hip is not a part of the ideal biomechanics of the hip, and results in hip flexor tissues that do not exhibit ideal tissue quality.

One of the major functions of gluteus medius and minimus are as stabilizers of the pelvis in one-foot stance; in gait, the use of these muscles prevents the Trendelenburg gait. They are chosen as examples of the muscular generation of hip mobility because, through strengthening these muscles, it is possible to begin to perceive the spiral nature of function of the lower extremity muscles to the hip, most specifically the motion of the knee. In order to maintain full function of these muscles, a surprising amount of hip motion occurs in the gait cycle. The spiral function in the extremity extends through the thigh to the leg and foot. During fetal development the limb buds go through a rotation so that the foot can approximate the ground.

> The lower limb rotates medially so that the knee points cranially and the original ventral surface of the limb bud becomes the caudal surface of the limb…this rotation causes the originally straight segmental pattern of the lower limb innervation to twist into a spiral.[16]

The activation of the hamstrings can be felt 1. as opposing muscles to the anterior thigh when the foot moves toward foot plant in the supination phase of gait and 2. when they shorten, or concentrically contract in conjunction with gluteus maximus in order to move the pelvis forward in the pronation phase of gait. These powerful muscles perform a powerful function in the supination phase of gait, one in which they cradle the femur and optimally participate to move their insertion on the tibia forward toward foot plant, creating a quality of motion that feels like skating. Without adequate function like this, the hip flexors will be used without proper opposition. Therefore, if diagnostic movement patterns in the hip flexors are found (indicating excessive force in use), following treatment an alternative to this function will be taught, that of this opposing use of the hamstrings. The

Supination Phase of Gait

The muscular function that creates the supination phase of gait includes a number of fairly intricate motions that stabilize, in a dynamic unit of function, the hip through the leg to the foot. The supination phase of gait begins at the moment the brain prepares for a foot to move forward in foot plant, with the initiation of gluteus maximus, a long hip lateral rotator; followed by the short hip lateral rotators, especially quadratus femoris, which initiate function to prepare the hip to stabilize posteriorly into the acetabulum. The action of quadratus femoris as it brings the insertion on the intertrochanteric crest of the greater trochanter toward the ischial tuberosity is to initiate external rotation (motion around the long axis of the extremity) of the extremity beginning at the hip. This function is critical to foot stability and function (addressed in the next paragraph). This is another difference between this system and that of Drs. Greenman and Janda, as they emphasized piriformis action more than quadratus femoris. In personal communication with a ballerina who travels around the country teaching other ballerinas, she indicated that she will not allow a youngster to continue in ballet if the student can't learn to work the hip kept "below (inferior to) the innominate," as it is dangerous to ask the hip to do the many hip lateral rotation functions practiced in the strengthening aspect of ballet. The concentric contraction action of quadratus femoris creates a foundation for the action of the rest of the hip lateral rotators. In order to feel the function of this muscle, stand and palpate the most inferior aspect of the medial greater trochanter at the origin of this muscle; then, pointing the toes of that extremity ahead and resting lightly on the floor in a ballet-like pose with the heel kept off the ground, bring that greater trochanter toward the ischial tuberosity. That should result in the rotation of the limb such that the heel moves cephalad medially as the toes continue to point anteriorly.

The hip adductors, when concentrically contracting, will bring the knee toward the midline, creating a valgus motion of the knee. Therefore, if someone moves the knee into valgus in the gait cycle they are concentrically contracting the hip adductors; because the hip adductors act in opposition to the gluteals, this will create strain in the gluteus medius and minimus. Conversely, if the hip adductors work in balanced opposition to gluteus medius and minimus, this will result in hip and knee motion which places the femoral condyles of the knee over the tibia. From there the pes anserine group—sartorius, gracilis and semitendinosus—will spiral the hip from their origins to their common insertion at pes anserinus medially just below the knee. Biceps femoris also acts in this mild spiral pattern. Proper opposing function of the hamstrings will give length to the extremity as it moves to foot plant; this is described as "working long." This function will sweep from the hip to the foot in a mild external rotation spiral, one that will ultimately stabilize the tibia over the talus with a gentle external rotation of the tibia around a vertical axis. This spiral function contributes to the springy ease and lightness of movement, and as such is considered an important part of the function of the posterior body. This motion actually generates significant hip motion in order to integrate all the hip stabilizing muscles. You can experience that as you treat the gluteals to feel the smooth management of hip rotation when these muscles work as a cohesive unit opposed by the hip adductors. As the hamstrings group of muscles opposes the quadriceps group of muscles, they act by working long.

The ligaments of the foot are stabilized when the tibia is rotated subtly into external rotation around the long axis of the bone as the weight of the body is placed on the talus; there is significantly less ligamentous stability when the tibia internally rotates at contact with the talus. This latter function generates pronation. This is largely facilitated at the hip by proper hip stabilization of the hip lateral rotators, predominantly quadratus femoris. Without this critical activation by a stabilized hip, the muscular spiral that extends from the hip to the foot does not control the tibia/talus relationship at weight-bearing. This screw tight mechanism of the tibia on the talus keeps the talus stable and allows the foot ligaments to disperse the force from the calcaneus and midfoot through the metatarsals to the phalanges. This relationship is guided by the muscular system that controls the arch.

Force from a tibia that is internally rotating at foot-strike into midstance creates ankle pronation and weakens the ligamentous structure of the foot, one that is designed to manage weight-bearing. This somatic dysfunction is best diagnosed by tenderness in the postero-medial distal tibia when it is motion tested into external rotation. Because of the ligamentous laxity of the foot when the talus is allowed to pronate, this internal rotation strain moves into the bony system of the foot, with the 2nd and other lateral metatarsals moving into flexion, internal rotation, and sidebending with the metatarsal heads moving medially. The toes then extend and continue this rotation, becoming severe enough in some strains that the lateral toes cross over the medial toes.

When the foot is moving in the gait cycle toward foot plant, tibialis anterior and posterior lift the midfoot where they insert, and flexors hallucis and digitorum longus insert at the phalanges, moving them gently into flexion. With this action, as the phalanges reach toward the floor, spreading to gain a wide base for the support which is established by the great toe and also by the lateral toes, the phalanges engage the metatarsals. This function tends to lift the metatarsals, holding them stable and compressed into the base articulation with the midfoot. The inability of these long flexors to work long sufficiently to allow the phalanges to engage the metatarsals makes the patient struggle with "hammer toe dysfunction."[16] The metatarsals, acting from the base to the heads, spread the weight in a fan-like suction cup manner from the midfoot to the phalanges. At midstance this arch is fully active. The toes connect with strength to the ground, significantly decreasing the amount of load-bearing placed on the metatarsal heads. The ideal function of this system in the gait cycle involves bearing weight on the entire muscularly prepared foot mechanism simultaneously rather than using the common heel/toe gait. The active foot connects to the ground lightly, with this muscular system transmitting an opposing lifting reaction up through the body. This gait does not utilize the heel strike or toe-off phases of gait, as the arch must function to gain the lift through the muscular system. Most shoes don't allow either the ankle motion or the flexion function of the toes that the muscular arch requires. When barefoot running became popular, shoes became available that allowed "barefoot function." This term describes the ability of the foot to fully function in the manner described above. Habitually barefoot shod foot function (meaning foot function in cultures who habitually don't wear shoes) has been studied and it was found that the toes were held wide in a fan-shaped appearance.[17]

The Pronation Phase of Gait

This phase of gait begins at midstance, when the body is directly over the foot. At this point, gluteus medius should be activated in order to stabilize the pelvis, decreasing the tendency to concentrically contract the hip adductors. A surprising number of patients don't actually activate this muscle in one-foot stance, but rely more on the hip adductors to stabilize the pelvis. The motion of the muscular system reverses to generate pronation so that the spring reverses direction. The hip lateral rotator activation persists, although changing to some extent such that the external rotation of the tibia is diminished, with no pronation at the ankle and no strain generated into the ligamentous stability of the foot. At this point the pelvis has to translate anteriorly, requiring the other foot to move forward toward foot plant. Recalling the moment arm of the lower extremity and the need for the femoral head in the acetabulum to rotate and not to translate, this is one of the most, if not the most powerful repetitive activities that the body routinely performs. A surprising amount of the strength to move the body forward in the gait cycle comes from muscles in the posterior aspect of the body. The use of gluteus maximus and the hamstrings, working in opposition to the quadriceps group of muscles, to move the pelvis forward creates a balance of muscle function which markedly lessens the needs of the hip flexors to lift the lower extremity up in flexion of the hip in preparation for foot plant. If the heel is kept on the ground rather than used to create toe-off, it appears to potentiate the hamstring function while the dynamic unit of function from the foot extends from the arch through the calf and hamstrings to gluteus maximus. At this point in the gait cycle the muscles tibialis anterior and posterior, along with the long flexors, have changed their function in addition to changes occurring in length of the calf musculature. This function appears to be an important phase of the function which gives lift to the body and adds more anterior propulsion capability without biomechanical strain.

Exploring the Muscular Creation of Hip Biomechanics

The process of strengthening gluteus medius and gluteus minimus in concentric contraction, with the hip adductors opposing this function, provides an excellent opportunity for the clinician to experience ideal opposing muscular function in the creation of smooth, gliding joint function in a way that decompresses the joint. In addition, it is possible with some practice to perceive a spiral or supination motion of the femur through the full range of motion of the full fan-like action of gluteus medius. Through this process the need for the hip adductors is to relax and stretch to allow a smooth gliding motion of the hip as gluteus medius shortens, bringing the insertion toward the origin of that particular fiber. If the patient attempts to abduct the hip without proper relaxation of the hip adductor, the area of the trigger point in gluteus medius will forcefully clench. After the balanced opposing muscle function has restored the entire range of gluteus medius function, that clenching will not be resolved until the central nervous system changes the action of the muscles in the gait cycle. This smooth gliding function must occur during the gait cycle in order for this muscle to retain its ideal tissue quality so that it gives clues about specific motions during the gait cycle. In addition, the patient must utilize the gluteals at mid-stance. The counterstrain approach to trigger point treatment of gluteus medius trigger points in *Clinical Applications of Counterstrain* treats many trigger points quite effectively by introducing pronation function and may well balance these gluteus medius trigger points to hamstring group trigger points introducing the pronation motion through the thigh. Treatment of gluteus medius using this approach induces a pronation spiral to the gluteal/hamstring muscles which can be appreciated by balancing gluteus medius trigger points and simultaneously treating a hamstring trigger point (Figure 1). If you own a copy of *Myofascial Pain and Dysfunction: The*

Figure 1.

Trigger Point Manual, the position of the trigger points should be palpated through the course of this movement retraining process. The first motion that will be initiated will be abduction of the hip, making certain there is no flexion of the hip, but that the femur can glide in the acetabulum to create abduction. Standing behind the side-lying patient, hold the foot and lift, palpating at the area of gluteus minimus anterior to appreciate the glide of the femur/acetabulum relationship. If this motion is difficult to achieve, add some traction at the foot to decompress the hip. When the hip is able to abduct, then cradle the knee with your caudad forearm, not allowing any hip flexion and introduce some hip lateral rotation, mimicking the action of the hip lateral rotators. The rest of the process of strengthening will involve physician generated abduction of the hip, simulating the action of concentric contraction of gluteus medius based on the direction of the fibers from origin to insertion. Note especially the action of gluteus medius.

This will involve some hip rotation which will be initiated by the physician initiating some rotation of the knee, the portion of the femur distal to the femoral head. This process must always involve maintaining the posterior hip stabilization as if maintained by the hip lateral rotators. In addition, the physician will encourage some decompression of the joint by applying slight traction of the knee. With ideal opposing muscle function between the gluteus medius and opposing hip adductors and the decreased compression of the femoral head into the joint which had been caused by shortened, overly concentrically contracted muscles, the motion of the femoral head in the acetabulum is smooth as the ideally rehabilitated muscles work through their range of motion and the trigger points are resolved. At that point the patient could participate in this strengthening to begin to teach the brain how to activate ideal opposing function, with the physician able to provide immediate feedback to the brain if a clenching motion is found. In summary, the process involves:

- Palpate gluteus minimus anterior, making certain that those fibers can shorten. Be aware that the hip adductors need to lengthen for this motion to happen and note the smooth glide of the femur in the acetabulum.
- Palpate gluteus medius tissues at trigger point areas
- Create a slight traction at the knee to decompress the hip and activate hip stabilization
- Bring insertion of gluteus medius to origin and simultaneously
- Lengthen hip adductor, noticing how much active relaxation needs to happen in the adductor compartment
- Proceed across the broad origin of gluteus medius
- Feel the smooth rotation of the femoral head at acetabulum
- Proceed ahead with gluteus minimus posterior

Ideal Function and Posture: Understood from the Structure-Function Relationship

Ideal posture and ideal muscle function must abide by the structure/function principle of osteopathic medicine. If this does not happen, there will be changes in the tissue texture in the myofascial structures that are a result of the improper stabilization of the force of gravity onto the body. The structure of the muscular tissue is designed to create movement and manage joint stabilization. For example, the ideal muscular system moves the knee and foot while simultaneously holding the femoral head stable relative to the acetabulum so that there is only rotation of the femoral head in the acetabulum, irrespective of the many potential positions in which the foot can be placed—a function that is common in climbing boulders or rock climbing. It does so allowing only rotation at the hip joint and no translation. Once again, the force is applied through the bone, a structure designed to handle force.

Ideal tissue texture quality of those muscles responsible for maintaining hip stability then becomes a fundamental criterion with which to ascertain whether ideal joint function is being maintained by the muscular system. The lack of proper stabilization of the hip will create muscles that become thicker and stiffer, muscles more designed to hold force than to place the bone in a position to handle that force. The example of the hip flexor movement pattern is a common diagnostic finding of loss of hip biomechanics and often consists of rather severe tissue texture changes. The force which has been embedded into the muscular tissue creates density and, if enough force has been applied to the tissues, results in a very painful compressed core within that density that resists deeper palpation. A relatively common example of this most intense strain into the muscular tissue can be readily palpated in the medial calf. The inability of the muscular system to properly direct the positioning of the femoral condyles over the tibia onto the foot with a valgus movement pattern of the knee requires that the myofascial structures withstand this ongoing repetitive force. The palpatory perception of the effects of this force which has been embedded into the tissues is a fundamental aspect of the diagnostic approach presented in this paper.

The Ideal Function of the Muscles Included in the Posterior Body Creates Ideal Posture

The muscular system acting through the fascia creates posture. The manner in which it does this determines the extent of lordotic and kyphotic curves of the spine, making it appear as if the spine is creating this pattern. It would ideally place the force of gravity on the skeleton, as the structure/function relationships would predict. In the ideal posture, the muscular arch supports the foot with a suction-cup like activation that roots the foot. From this broad-based support, the lower extremity musculature maintains the bony relationships such that the long bones of the legs accept the force of gravity because the hip is balanced over the foot. With the hip ideally stabilized by shortening contraction of the hip lateral rotators, and with the hip muscles ideally balanced to each other so the hip is always maintained correctly biomechanically without a hip flexor movement pattern, iliopsoas is free to provide the ideal "scooping" to maintain a neutral pelvis and a lumbar spine that is lifted rather than extended and compressed. This requires that the gluteal muscles contract at midstance.

There are many approaches now available that strengthen the "core." The concept of the core as is practiced in physical therapy in this country evolved from the understanding of the initiation of transversus abdominus by activation of the pelvic diaphragm, especially the anterior fibers, beginning with the work of Hodges, Richardson and Sapsford looking at the causes of urinary stress incontinence.[19] The core was considered to involve the lumbar multifidi, the pelvic diaphragm and transversus abdominus. In this paradigm of core function, iliopsoas will be considered the foundation of the core, lifting the spine up into the gravitational field. This process cannot take place without opposing muscle function from the superficial core, defined as rectus abdominus, and the external and internal obliques. Within this area lies the "respiratory core" which includes transversus abdominus and the pelvic diaphragm. The girdle-like action of transversus abdominus, in addition to muscular stabilization functions, maintains the cylinder that contains the piston-like force occurring between the pelvic and thoracic diaphragms, one that is important for lymphatic function throughout the body. This respiratory core acts as a cylinder, allowing the thoracic diaphragm to act as a piston within this cylinder to coordinate the pelvic and thoracic diaphragm movements in secondary respiration. This core is activated by anterior fibers of the pelvic diaphragm, pubovaginalis in the female and levator prostatae in the male,[18] another indication of the link between the function of the pelvic diaphragm and transversus. The respiratory core function is also potentiated by active muscular foot arch function.

The superficial core moves the ribs in respiration and through the action into the ribs, moves the thoracic spine in flexion and rotation. This correlates with the location of the anterior thoracic as well as the anterior/lateral thoracic counterstrain points. The iliopsoas, working in conjunction with lengthening hip adductors (among a number of other muscles), is capable of maintaining a neutral innominate, one in which there is alternating anterior and posterior innominate rotation during the gait cycle. When iliopsoas concentrically contracts it creates an increased lumbar lordotic curve and if this becomes a movement pattern it will create an anteriorly rotated pelvis. When the hip adductors lengthen in response to concentric contraction of the gluteals, a necessary function at midstance, the pelvis is maintained at a neutral position. With iliopsoas being the foundation of the core, an ideal relationship between iliacus and psoas major can be strengthened by an exercise experience termed "coiling the spring." The active process originates beginning with rotating the pelvis posteriorly without use of muscles that act on the coccyx (without pulling the tail between the legs) then beginning to move the spine into flexion by the activation of iliopsoas. This is done by bring the muscle deep behind the umbilicus to the spine and then moving the spine with that muscle. Following this muscle rebalancing, it is possible to appreciate activation of longus colli, the "cervical core" muscle, via tension on the anterior spinal fascia. When the core activates, it also creates tension into the thoracolumbar fascia, a portion of the origin of latissimus dorsi. Without the core activation, latissimus dorsi is not able to maintain the stability of humerus in neutral into the glenoid fossa and is likely the dominant cause of the upper cross syndrome of Greenman/Janda. When latissimus dorsi has regained its ideal length, it stabilizes the insertion at the intertubercular groove of the humerus at a position that 1. causes the palm of the hand to face the thigh as the extremity falls down the side of the body, and 2. stabilizes the scapula, holding it up into gravity and assists in stabilization of the thoracic spine.

When that core activation creates a tension into the thoracolumbar fascia, it also affects the lower origin of the trapezius as it originates in that fascia. It is helpful to divide the function of this muscle into the lower, middle, and upper trapezius. The three portions of this muscle should be integrated into function which is rarely seen in the patient who presents with musculoskeletal problems. When the lower trapezius shortens in contraction, it stabilizes the spine of the scapula inferiorly toward the lower thoracic origin of this muscle. This empowers the middle and upper trapezius muscles to lift the upper thoracic and cervical spine vertebra and extends this lifting to the head.

Dissection studies revealed the fascicular anatomy of the trapezius. Its occipital and nuchal fibres passed downwards but mainly transversely to insert into the clavicle. Fibres from C7 and T1 passed transversely to reach the acromion and spine of the scapula. Its thoracic fibres converged to the deltoid tubercle of the scapula. Volumetric studies demonstrated that the fibres from C7, T1, and the lower half of ligamentum nuchae were the largest. The essentially transverse orientation of the upper and middle fibres of trapezius precludes any action as elevators of the scapula as commonly depicted. Rather the action of these fibres is to draw the scapula and clavicle backwards or to raise the scapula by rotating the clavicle about the sterno-clavicular joint. By balancing moments the trapezius relieves the cervical spine of compression loads.[19]

In addition to lifting the body up into gravity, these muscles of the posterior body have the capability of managing the force of lifting weights in the hands or moving the feet with the leg outstretched and the hip flexed to 90°, simultaneously maintaining good stabilization of the spine. The muscular stabilization of the upper extremity, especially when force is required, uses large muscles like latissimus dorsi and trapezius to extend the stabilization from the spine to the scapula, utilizing it for leverage. The breakdown in the stabilization of the hip, especially with the loss of the power of hamstring and gluteal function in the gait cycle, creates a thickening of the hip muscles and creates a strain in iliopsoas such that it no longer maintains a neutral pelvis. When this happens it creates the excessive lumbar lordotic curve. This breakdown results in the loss of the core stabilization, and, secondary to this loss, the loss of the ability of latissimus dorsi and trapezius to stabilize the upper portion of the body.

When motion testing the ideal posture in the standing position, if the physician puts a small force at the anterior lateral aspect of one shoulder, the stabilization of the body that begins by "rooting the arch into the ground" will allow the body to gently yield to this impulse of motion testing with no loss of upright posture. This is an excellent way to feel the quality of the muscular arch that roots the foot to the ground as opposed to a tendency to sway from heel to ball of foot, using the foot as a paddle.

Test whether the muscles stiffen the lower extremities by attempting to 1. move the knees apart then 2. move the mid-thighs apart then 3. move the upper thighs apart. When testing the body in the supine position, the actions of lifting a leg, dorsiflexing an ankle, and rotating the limb reveal a relaxed body in which there are no substantial movement patterns—patterns which would be clear indications that some motions are preferred over others. When the hamstrings are working well, the knee feels well-stabilized as the limbs are moved.

Characteristics of Dysfunctional Postures as Compared to an Ideal Posture

An ideal posture is one in which the muscular system acts to stabilize the bones over each other, creating a "balance-based posture." The person yields to that slight pressure rather than resisting it, then returns to upright when the motion testing force is removed. Most people use their muscular system to brace against gravity. The nature of this rigid stance can be assessed by motion testing—for instance, trying to push the patient backward by pressing against one shoulder at the most lateral aspect to sense rigidity. Many people don't even tense just to resist that motion testing—they permanently stiffen their bodies when they stand. This motion testing approach can also give the practitioner information on how the patient stabilizes on his feet. Patients often use the foot as a paddle, rocking back and forth from the heel to the ball of the foot. This is done by locking a part of the body such as the knees back, then swaying from that lock till the abdomen is held forward, then locking by extending the back, and so forth, as this locking and swaying process continues up the body. This "lock and sway" posture approach doesn't utilize the muscular system to respond to gravity by lifting the body up into gravity.

Approaching the Patient – Diagnosis of the Dysfunctional Posture and Treatment

It is helpful when beginning both diagnosis and treatment to think differently about the goals of treatment. The goal in this case will be to restore a breakdown in the muscular support of both posture and movement. The lower extremity will be selected as an example to illustrate the diagnostic and treatment approaches. After diagnosis of a foot problem, treatment will include the muscles (along with associated structures), and those bones on which they act, muscles that create the muscular arch and that integrate this movement through the calf into the spiral function of the hamstrings, and finally integrate this into hip stabilization and gluteal activation. At each point of this treatment process the goal will be to restore a unit of function, until each of these elements is restored to a more comprehensive unit of function. The ultimate dynamic unit of function is of course that of the entire body.

The patient history will give clues to the inability of the muscular system to maintain function, especially if trigger point radiation is reported. Treatment may, for example, begin with restoring the muscular arch function in the gait cycle that prepares the foot for weight bearing. This may be needed because the patient has problems with that hip function. In ideal muscle function, to have a stable hip you must have a stable foot, and in order to have a stable ideal muscular foot you must have a stable hip.

As the treatment progresses in this example, strains in the next element of that arch function, the muscles that move the calcaneus and manage the tension of the plantar fascia, are addressed. Assessment and treatment then moves to the next strained unit of function. Thus the function of each of these groups builds on each other, restoring the capability of the muscular system to lift into gravity. This process continues like building blocks until the entire muscular system is capable of carrying out ideal stance and movement. Often at the conclusion of the treatment of the lower extremity, the muscular relationships in the posterior body cephalad to the hips will have changed, and the patient's shoulders are more equal in height, for example. As health moves up through the body, the areas of compensation will often become symptomatic. At times these symptomatic areas need treatment to resolve, although often the symptoms will abate in a short period of time.

Creating change will involve treatment, then patient education regarding 1. how they use their muscles to move and stabilize their system biomechanically and why it isn't working, and 2. what they should do to change it. When treatment removes the somatic dysfunction and the physician assists in rebalancing the muscular system, the patient then replaces their function with ideal function, that is, function that incorporates all of the listed osteopathic principles outlined earlier.

The Lock and Sway Postures

The common swayback posture involves swaying the abdomen forward and pressing onto the balls of the feet. This pattern stiffens the feet like paddles rather than using the feet like a suction cup that functionally roots the body into the floor. It then utilizes variable bands of muscular tightness that can extend through long portions of the body as the upper thoracic area is brought posteriorly and the head then forward to complete the swaying. This use of the tissues requires the abdominal area, especially rectus abdominus, to become a truss rather than functioning like a muscle to oppose the iliopsoas. The paraspinal tissues will also change to a more cord-like tissue quality as they control a thorax that is not centered over the body.

No matter what shifts the body makes in any process of stiffening against gravity, the eyes will look forward. Therefore, once the abdomen moves forward and the upper thoracic area moves back to comply with the childhood messages to "pull the shoulders back," the head must sway forward. Sutherland complained that the postural admonitions to "throw our shoulders back" were wrong and recommended that they be discontinued. However, these cultural patterns have clearly persisted. This pattern can be observed by determining whether the head is over the thorax, whether the thorax is over the abdominal core, and whether the pelvis is stabilized over legs that are held vertically. Motion testing this when standing by pushing gently on one shoulder will detect an inability of the body to stabilize without stiffening against that motion testing. It is often relatively easy to push this patient over. Even if she views herself from the side in a mirror and you point out that she is not erect, she will characteristically feel she is slumping if she doesn't thrust the shoulders back. This demonstrates that the brain has defined this posture as upright. When lying supine, it is common to feel limited mobility of the ankle in dorsiflexion, with the tendency of the ball of the foot to forcibly resist dorsiflexion. This is reflective of a movement pattern, an action that the calf musculature maintains most of the time the patient is upright.

The second main group of lock and sway postures involves those in which the patient locks the thighs together rather than stabilizing at the hip using the hip lateral rotators and gluteals—hip adductor dominant concentric contraction postures. When the hip adductors concentrically contract they bring the knees together. A gait pattern in which the knees are brought together in a valgus-like movement will repetitively train the hip adductors to concentrically contract. This movement pattern means that the gluteals will not have proper opposing muscle function. In addition, all the hip adductors have substantial origins on the pubic bone. The walking axis in the gait cycle is a horizontal axis through the pubic bone.

The pubic transverse axis constitutes the locomotion axis of the pubis, the axis between the two innominates upon which they rotate in opposite directions as they accompany the movement of the legs.[20]

By definition, an axis is a theoretical line around which motion happens, but one which does not in itself move. When there is a repetitive force in the gait cycle that pulls down first on one pubis, then the other, it 1. strains this axis so that the innominates can no longer rotate anteriorly and posteriorly in the gait cycle and 2. results in a pubic bone that is pulled inferiorly bilaterally – resulting in an anteriorly rotated pelvis.

There is a gradation of strain in this pattern of movement which can be tested by the extent of the resistance when attempting to move the knees of the standing patient apart, pressing into the thighs halfway toward the groin to feel the body's reaction to oppose this force, usually associated with tenderness, or more cephalad in the groin area to feel how posture is a result of clenching the thighs together and causes the most severe forces pulling the pubic bone inferiorly. A second test to determine the role of the lower extremity movement patterns in the creation of upright posture involves working with the patient to stop locking the legs long enough for the purposes of this diagnostic testing. The patient will stand with the knees less internally rotated and more of a muscular upwrap, and it is often possible to see a rather dramatic change in the ability of the pelvis to move toward a neutral position. This test most clearly informs the patient that the locking is causing a problem.

Figure 2.

The patient pictured in Figure 2 concentrically contracts her hip adductors, locking at the groin, which forcefully pulls the pubic bones caudad and thus creates a severely anteriorly rotated pelvis. The center of gravity for her locomotion is shifted anteriorly and changes the balance between her quadriceps group of muscles and the hamstrings group. As her quadriceps group and hip flexors become more dominant in locomotion they become stiffer and thicker, pulling the ASIS inferiorly and increasing the anterior pelvis rotation so she becomes more unable to posteriorly rotate the innominate in the gait cycle. She cannot access her hamstrings effectively with her pelvis so anteriorly rotated, so she has no way to resolve her condition. In order to bring herself upright, she "throws her shoulders [actually upper thoracic area] back." This is done by extending the spine. The arrow points to the apex of the extension created. The compensatory changes her body makes to keep her upright result in a marked head forward posture. Her abdomen is protuberant because she cannot activate her core secondary to the density of her shortened iliopsoas and the subsequent shortness of the lumbar spine. The thoracic diaphragm is not aligned to function as a piston in its ideal relationship to the pelvic diaphragm in respiratory function. Her chief complaint is of midthoracic trapezius and latissimus dorsi pain. You can see that she has no core function to generate latissimus dorsi ideal function. In general her muscles are quite thick and stiff, especially her shoulder musculature. Pushing posteriorly on a shoulder would readily demonstrate the density she creates to keep herself upright. Her trapezius and latissimus dorsi stiffness is compensatory and originates from an iliopsoas strain caused by the anteriorly rotated pelvis and improper motion in the gait cycle. Her muscular system is conditioned to stiffen and hold rather than to generate movement; this can be seen by a lack of supple motion in her gait. Supine motion testing of a patient with this pattern will demonstrate a marked pronation or downwrap pattern in the lower extremities. There will be severe chronic tissue textures resembling "steel" cables in the hip adductors as these muscles absorb the force.

Treatment Approaches

Counterstrain approach is used extensively. This is especially true of the approach to trigger point treatment outlined in *Clinical Applications of Counterstrain, the Compendium Edition* by Harmon Meyers. This approach is excellent because not only are the trigger points being addressed as treating problems with muscle balance, but the positions for release bring in additional elements of the spiral nature of the strained relationships. One example of this would be the treatment for the long head of the biceps. The placement of the dorsum of the hand on the forehead allows a complete release of this trigger point. Treatment of many of the shoulder points, including upper infraspinatus, allows the physician to experience the integrated spiral function that brings the power of the spiral function of the core into the shoulder musculature so that the rotator cuff is seen as the local portion of a whole that supports this function.

Indirect "fascial release" has also been used extensively. This approach was taught by Viola Frymann when I worked as a teaching fellow in her department. Her scapular release treatment approach is very like the principles of treatment laid out in OCF, in which you take the tissues to the point of balance, then provide either a suggestion of compression or one of distraction. Dr. Frymann used to use decompression for treating the bilateral sacroiliac compression, but used compression when applying the scapular release technique.

Exercise Experiences

These exercises, experiences that are to assist the patient in changing his muscle function in his activities of daily living, are probably the most significant difference between this system and that of Drs. Greenman and Janda. Two of these experiences will be covered; one, "coiling the spring," to gain better length in psoas and function of iliacus; and the other, "lifting a semi-truck like a weight-lifter," to activate the ideal length of latissimus dorsi and feel the power of the scapular rotators. Before either of these exercise experiences, quadratus femoris must be activated. When this is done at the hip, the entire limb will externally rotate around a vertical axis and the calcaneus will move cephalad medially. This will allow the quadratus femoris to cause the hip to operate inferior to the innominate.

"Coiling the spring" is an exercise intended to allow iliopsoas in conjunction with rectus abdominus to function ideally to manage the lumbar spine in motion so that the muscles make all these motions, carrying the vertebra and managing the intervertebral discs. This exercise is not intended for the patient with a herniated disc problem, but it has been used successfully with the selected patient with degenerative lumbar disc disease and with lumbar spondylolisthesis — as long as the patient has good gluteal stabilization in the gait cycle and slowly builds increased mobility and strength of iliopsoas.

It begins with assuming an upright, athletic posture with hip lateral rotators actively engaged, abduction in the hips with patella over second toe, knees slightly bent and ankles dorsiflexing, and stabilizing strongly with the activated muscular arch of the foot. Then the patient posteriorly rotates the entire pelvis, accomplished by bringing the ischial tuberosities toward the ground (without contracting levator ani) and, using the hip adductors which attach to the pubic bone, lifting the pubic bone cephalad while contracting the hip lateral rotators and gluteals. Once the "spring is coiled" in this manner, the patient begins to lift the spine up into gravity, then slightly begins to flex the lumbar spine using psoas (acting deep behind the umbilicus) while simultaneously bringing the thorax anteriorly in space, an action that involves a great demand for strength of the iliopsoas (as the foundation of the core.) As this becomes easier and is no strain on the lumbar spine, the head moves toward the floor. This allows the weight of the thorax to assist in the lengthening of psoas. Then, to come out of this activated position, the posterior tilt or the "coiled spring" is increased, which brings the lumbar spine and then the thoracic spine and finally the head to move back into full weight-bearing. This motion of the pelvis is done with more aggressive control of the gluteals and the hip adductors and keeps the lumbar spine quite protected through the entire motion.

"Lifting a semi-truck like a weightlifter" is an exercise designed to experience the power of latissimus dorsi and the muscles that rotate the scapulae, muscles that a male ballet dancer might use to lift a ballerina overhead. Again, it begins with the athletic posture, with the palms facing anteriorly and the arms down by the side. The core is activated by "coiling the spring" to tense the thoracolumbar fascia. Then, thinking about lifting the 5th finger, allow the elbow to bend slightly as the little fingers move up, carrying the hand with them. This approach effectively cues the latissimus dorsi and other scapular rotation muscles to activate and, when properly done, the arm seems to float up with ease. As the hand continues abducting toward the ceiling, it stops at about 35° from vertical but continues lengthening away from the body. At this point the muscle feels very powerful, as if you could "lift a semi-truck." If there is adequate core function, this exercise will help to effectively lengthen latissimus dorsi to treat the upper cross syndrome of Drs. Greenman and Janda.

Conclusion

Interestingly, as the tissue quality and function of the musculoskeletal system continues to improve, the presence of the Chapman reflex points becomes more evident and symptomatic. Frank Chapman, DO, in his book published in 1932, described these points as lymphatic reflexes. Shortly after this, in the foreword to *An Endocrine Interpretation of Chapman's Reflexes* by Charles Owens, DO, Fred Mitchell, Sr., DO, referred to them as:

> neurologic reflexes that were clinically useful in three principal ways: 1. for diagnosis, 2. for influencing the motion of fluids, mostly lymph and 3. for influencing visceral function through the nervous system.[21]

These Chapman reflex points maintain a restriction between the posterior and the anterior point(s), a restriction that is much more apparent when the muscular system exhibits an improved level of tissue quality following treatment. This restriction is evident as a limitation in movement. When these strained patterns become more apparent, in order to allow ideal musculoskeletal function to fully manifest, the involved Chapman points must be fully treated. The author would suggest that when some of these questions are explored, the active muscular function will be found to be an integral part of the Medicine described in the term Osteopathic Manipulative Medicine.

When the physician takes the time to work as an educator, giving the patient information about the function of his body, it gives the patient an understanding and ability to improve his own function for the rest of his life. Giving the patient these tools enables her to improve not only her posture and her biomechanics, but the homeostatic self-healing mechanism her body provides for optimal function and well-being. It does take considerable time and energy on the part of the osteopathic physician to impart this information to patients, but it can help them move from individuals who live in fear of their pain to persons who are empowered to improve themselves and become more functional as they age.

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