

Muscle Balance and Function Development

BY GEOFF GLUCKMAN, MSc.

The increase in chronic musculoskeletal symptoms is becoming more prevalent, and workers' compensation claims and repetitive strain injuries are driving the corporations and insurance companies to their knees. What is the answer? Surgery? New medications? New modalities? Rest, ice and elevation works for some, but what about the others? Let's take a step back in time and explore an ancient concept: segmental alignment.

What is segmental alignment? This element of human structure underlies the design of the human body. It is defined as the proper alignment of the body segments that is maintained through unconscious neurological and muscular controls. Humans, existing as the only erect species in the presence of gravity, are designed to have our primary weight-bearing joints vertically aligned and horizontally parallel with each other and with the ground. Thus, shoulders, hips, knees and ankles line up over and above one another from the side, while from the front and rear, shoulders are level, hips level, knees point straight ahead, and feet are straight ahead and held at the width of the hips sockets. The right and left sides, being mirror images of one another in both form and function, each bear half the weight. This creates a perfect four-socket-position frame with a right angle at each primary weight-bearing joint. This right-angled design confers the greatest structural integrity (neutrality) to the human form in relation to the force of gravity.

Correct segmental alignment allows the body to move fluidly and efficiently. Muscles and tendons are less susceptible to restriction and strain. The bones move such that gravitational force is evenly distributed across joint surfaces. Proper segmental alignment also permits the

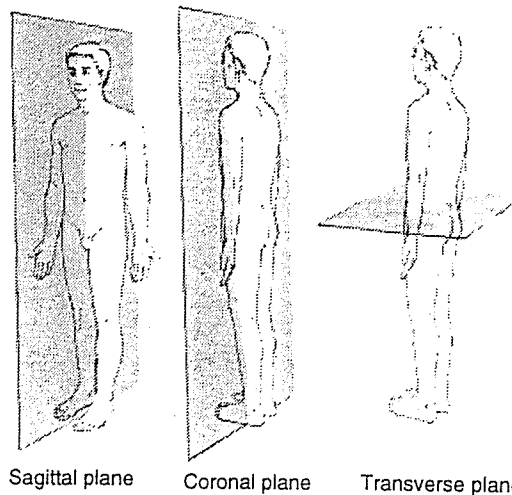
internal organs to function properly. Overall, good posture allows the body to perform its daily functions with less effort and energy.

The concept of segmental alignment has existed for eons. The structural premises of yoga are the same as those of segmental alignment. These concepts of alignment were investigated and proven by the U.S. government's Department of Commerce in 1955. That study measured the centers of gravity of each body segment, and the results showed the predisposition of the human frame to be vertically and horizontally aligned through the center of gravity of each segment. This research was based on studies by two German researchers, Braune and Fischer, that had been conducted in 1889.

Research in the field of segmental alignment continued into the mid-twentieth century. The first edition of *Muscles: Testing and Function* by Kendall and McCreary (1949) included lengthy portions on segmental alignment oriented toward physical therapy evaluation and treatment. The collective research findings were so powerful that the Los Angeles school system of the 1950s was motivated to incorporate a postural analysis and treatment section into their handbook. In 1960, there was an article by Arthur Michele, MD, on the implications of muscular imbalance and its effect on structural alignment, especially pertaining to the treatment of scoliosis. That article touches the tip of the mountain of postural deviations facing the health care practitioner today.

Planes of the body and planes of motion

The basis of structural alignment is the three planes of the body. Ideally, each plane is perpendicular to the other. The point at which the three planes converge is the center of the body and, hence, the



The three planes of the body [As shown in Muscles Testing and Function, by Florence Peterson Kendall and Elizabeth Kendall McCreary (Williams & Wilkins, 1983), 3rd ed., p. 20.]

center of gravity. The center of gravity is dependent on the alignment of the body's segments, and any new body position or alteration of body position changes the center of gravity. In addition, the body has a plane of motion associated with each of the three planes. These planes of motion are parallel to the planes of the body.

The planes of the body are:

- ◆ Sagittal Plane (also referred to as the anterior/posterior plane). This is the vertical plane dividing the body into right and left sections. The corresponding plane of motion is represented by the motions exhibited by the arms and legs during walking.
- ◆ Frontal Plane (also referred to as the lateral or coronal plane). This is also a vertical plane, separating the body into front and back sections. The corresponding plane of motion is represented in the arm and leg actions during jumping jacks. The intersection of the midsagittal plane and the frontal plane creates the center line of gravity.
- ◆ Transverse Plane (horizontal plane separating the body into upper and lower sections). The exact bisection will vary with individuals, but the midtransverse plane typically bisects the body at the acetabula of the hip joints. The corresponding plane of motion is exhibited in twisting actions as the body rotates around the vertical center-line of gravity.

Muscular Balance and Function

The three-dimensional concept of the body must now be completed with the addition of over 600 muscles. Each of these muscles has a unique origin and insertion, and a unique function: no two muscles do exactly the same thing. Every muscle is connected to the skeletal system through tendons located at the terminal ends of the muscle. The function of the muscles is to generate force, via the neurological signals sent from the central nervous system, and move the bones,

hence accomplishing motion. The connection of nerve to muscle to tendon to bone illustrates the importance of a body-as-a-unit approach. All links in the chain must be sound in order for proper function; any interruption along the path affects the integrity of the whole.

The muscles can be divided by function into postural (tonic) and dynamic (phasic) muscles. Some of the muscles may have mixed properties; however,

they can be classified by predominant tendencies. The postural muscles are designed to maintain their constant length despite the application of force. The dynamic muscles adjust to varying positions and tensions through a constant analysis of muscle length sensed by receptors within the muscle-tendon complex (muscle spindles and Golgi tendon organs).

All of these actions occur in the presence of gravity. The importance of gravity and its relationship to muscular balance was studied in great detail at NASA. The findings were voluminous and were presented by Sandler and Vernikos in 1986. The studies showed properly aligned humans using a consistent set of anti-gravity muscles to retain an erect posture in the presence of gravity. These muscles are the rectus femoris, the cervical and lumbar erectors, the gluteals and the iliopsoas. The hamstrings and the anterior abdominals are used in conjunction with the anti-gravity muscles to create a balanced pelvis and torso. This balanced system allows for minimal muscular tension and effort in all three planes of the body. The force of gravity of a segmentally aligned system is applied

through the eight load-bearing joints and the long bones of the body such that the gravitational force is applied as evenly throughout the body as possible.

However, any loss of equally distributed weight bearing removes the proper loading of the spine, long bones and joints, and the balanced pull of the muscles. Unequal load-bearing in the presence of gravity also removes proper proprioceptive signals from the periphery

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to the central nervous system, including the cerebellar and vestibular pathways.

The scientists at NASA realized the importance of gravity and weightlessness for understanding the astronauts' experience. In order to reproduce a zero-gravity experience on earth, they used inactivity or bed rest. Sandler (1986) states: “the human body is designed for movement;”. In fact, the authors point out that prior to the 19th century, bed rest as a modality for curing illness was seldom used — And the studies proved the devastating effects on the body of inactivity and lack of motion.

The specific changes NASA documented to the locomotor apparatus in response to inactivity were:

- ◆ decreased basal metabolic rate of up to 100 percent,
- ◆ decreased peripheral blood-flow of 15-20 percent,
- ◆ decreased oxygen supply (i.e., hypoxia) to periphery,
- ◆ orthostatic intolerance (autonomic dysfunction), and
- ◆ altered sensory input from both tonic and phasic musculature, resulting in
- ◆ diminished motor skills, especially the

ability to perform rapid motion and fine motor skills.

The studies revealed that these changes occur very rapidly — within 24 to 72 hours of inactivity. The loss of postural cues to the anti-gravity muscles occurred in the same time-frame. Since most cases handled by health care providers involve a person who has been disabled for much longer than this time-frame, the serious implication of this research is obvious.

The aforementioned effects were found to take place in some subjects in as little as six to eight hours. This is an average workday for a desk bound employee in North America. The lifestyle changes from 10,000 years ago to the present day are enormous. We began as movement creatures, hunters and gatherers, dependent on motion for survival. We have "progressed" into the muscular passivity of the super technological age. Is it any wonder that 80 percent of our population suffers from some kind of musculoskeletal pain? Is it a "natural result of aging"?

Rebalancing the muscles of the skeleton and restoring muscle function are commonly used solutions. This process is often over-analyzed and over-complicated by breaking the locomotor apparatus down by quadrants or segments, and this often fails because the body does not function neurologically or musculoskeletally in this fashion.

The technique called Muscle Balance and Function Development affords the health care practitioner a simple and easy-to-apply method of full function restoration for patients through the application of the three planes of motion and of the entire body. Results are often seen and felt by practitioner and patient, respectively, by the end of the session. These results begin to take hold neurologically and muscularly in four to eight sessions with weekly re-evaluations and program redesign.

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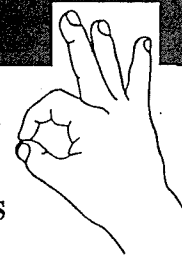
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