Visualizing Bones in Body Mechanics

By Mary Ann Foster
It's difficult to massage a client who wants relief from back pain when you're struggling with your own pain. Sooner or later, most massage therapists go through this dreadful experience and discover that to sustain a long and successful career, it's crucial to learn and use good body mechanics.

Many massage teachers cringe when they hear the words *body mechanics* because it implies that the body moves like a machine. The term is used here to describe the optimal alignment of adjacent bones during free-flowing movement. The human body is organic by nature. It cannot be reduced to separate parts in an overly mechanical orientation, which, when imposed on the body, can lead to rigidity of body and mind. Still, an understanding of the mechanical components of skeletal architecture can provide us with insights that will help us practice massage with an ease and efficiency of movement that protects us from unnecessary stress and pain.

In the last Somatic Anatomy article, we looked at the muscular chain that underlies good posture (“Muscles and the Postural Flute,” October/November 2006, page 76). Now we turn our attention to the bony struts and spacers that the muscles act on. In this article, we will examine key architectural features of the skeleton and the body mechanics that best suit their design.

**Imagery**

The skeleton is a well-defined tissue in the body, which makes it easy to visualize. In fact, practicing clear visualizations of the bones during slow, intentional movement is a highly effective tool when used to change faulty body patterns. The key to successful visualizations lies in using anatomically sound images rather than abstract ideas. This was the discovery of physical educator and researcher Dr. Lulu Sweigard, who used skeletal imagery to improve alignment in her groundbreaking posture lab research.

Sweigard found that the brain is so good at adapting neuromuscular pathways to an idea of how the body “should” be that if an abstract image clashes with joint mechanics, it can create more problems than it was designed to fix.

Sweigard was a student of Mabel Todd, author of the classic text *The Thinking Body* and one of the first physical education professors to stress the importance of using imagination to improve posture and coordination. The anatomically-accurate images they developed are still widely used by dance and movement educators (see Figures 1A-D). We will explore

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**Figures 1A-D. Sample of Dr. Lulu Sweigard’s images for improving skeletal alignment.**

A. Imagine your trunk like a sandwich and watch the back slice of bread slide down.
B. Watch the rear pockets on your pants sliding around to the front.
C. During hip flexion, see your thigh like the blade on a knife folding into your trunk.
D. Imagine the greater trochanters like handles on a wheel and turn them.
somatic anatomy

Figure 2. The trabeculae of the pelvis arrange themselves along lines of force transmission.

Bone Tissue

Bones come in many shapes and sizes, yet they all share similar basic units of structure. The hard outer layer of compact bone tissue is made up of osteons. The porous inner layer of spongy bone tissue is made up of trabeculae. The osteons and trabeculae arrange themselves exactly along lines of stress, giving our bones sturdiness and bending resistance (see Figure 2).

Bone is living tissue with the capacity to remodel itself to withstand a great variety of loads without acquiring too much weight.

Some of these therapeutic images can adapt itself to accommodate the direction and degree of force in our movement patterns, surely we can reshape our movement patterns to match the structural design of our skeletal architecture.

Pelvis as Braced Arch

Todd compares the human pelvis to a braced arch, where the femoral heads buttress the ilia, which in turn wedge the keystone of the arch—the sacrum—inward and upward into the spine. A typical arch made of stone blocks is forced together by the weight of the upper blocks, making the structure resistant to movement. Our pelvic bones form both a bony arch and a horizontal ring, joining at the sacroiliac and coxofemoral joints that allow for movement (see Figure 3).

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Figure 3. Force transmissions in the bony arches of the pelvis.

When you lean over your client, bend at the ball joints in your hips rather than sacrificing stability by bending in your spine (see Figures 4A–B, page 100).

Both passive and active forces stabilize the sacroiliac joints—the bony form-closure of the hip bones (ilia) wedge the sacrum in place and the tensional force-closure of lower abdominal muscles draw the pelvic halves together, respectively. To take advantage of this design, keep your legs under you while working, avoiding wide turned-out stances that increase diagonal forces between the sacrum and two pelvic halves (see Figure 5, page 102). Also, keep the lower abdominal muscles contracted to avoid a downward drag from distended viscera (see Figure 6, page 102).

Alignment of Hips, Knees, and Ankles

The human body has evolved an incredibly energy-efficient posture. Standing upright stacks the head, thorax, and pelvis over the legs, placing the major weight-bearing joints in an extended position. Extension requires minimal muscular effort and causes minimal stress to the joints. The key to this energy economy lies in standing with the center of gravity as close to a plumb line as possible, stacking the long bones one atop →

Figure 8. The spine balances on the keystone of this bony ring like a legless lizard balancing on the edge of a bowl. Underneath, the lower limbs attach at ball-and-socket joints, which serve as supporting columns when we are standing and swing like pendulums when we walk. To keep the spine aligned and stable as you work, imagine your trunk resting atop two bony billiard balls.
Figures 4A. To pull efficiently, sit back into flexion at the hips, keeping the spine extended.

Figures 4B. Avoid pulling with flexion that bends of the spine.

another so that the large muscles crossing them are in a resting position (see Figure 7, page 104).

When asked where the hips' joints are, most people put their hands on the sides of their pelvis. The actual sockets are about a fist-width apart, to either side of the pubic symphysis. To work with optimal lower limb alignment, stand with your knees under the hip joints and over the ankles, all facing front. To help get this alignment, imagine the patellae and hip sockets with headlights on them and shine their beams straight ahead.

The hips' joints are made for rotation, but the knees and ankles are not. To keep your headlights shining straight ahead, when you turn to the right or left, rotate at the hip joint.

Neutral for Centering, Starting, and Resting

The anatomical position aligns the weight-bearing joints in extension or neutral, being neither flexed nor hyper-extended, and not rotated. Simply standing in neutral with a sensory awareness of bony alignment is a great way to relax and center oneself at the start of a massage.

Many teachers advocate the horse stance, yet the additional muscle activity required for a bent-kneed stance wastes energy and is tiring. In addition, it places more than normal stresses on the ankle, knee, and hip joints. We don't do our usual daily activities in the horse stance; why use it for massage? It is a good idea to start your massage session the way you walk: simply stand close to the table in a relaxed, aligned posture, then step forward and place your hands on your client. Also, in the same way you let your car idle in neutral at a stop light, let your body pause at the end of each stroke for a resting moment.

Exercise 1. Images for Centering in Neutral

- Stand upright and sense your feet as two tripods, balancing your weight between your heels, big toes, and little toes.
- Imagine your feet having roots that grow into the ground while your head floats toward the sky.
- Imagine your ankles as ball-bearings. Allow your body to subtly sway from the ankles as you stand.
- Feel your heels extend behind your ankle rather than under the ankles.
- Imagine your tibias like sturdy pillars supporting your femoral condyles.
- Imagine your thighs spiraling in toward your knees.
- Imagine your pelvis as a bowl of water you keep level.

The Rocker Base

The same mechanics we use in gait apply to massage. While walking, the body's weight rolls from heel to toe in one foot after the other. In massage, this action translates into establishing a rocker base by standing with one foot ahead of the other, facing the direction of the massage stroke (see Figure 8, page 104). Step over the front foot to extend your stroke; step back to return the stroke or to lighten pressure. By facing your stroke and stepping toward and away from it, you move over the feet in the same
Massage and particularly deep-tissue work requires using the hands and arms in a weight-bearing capacity. Back heel to engage intrinsic muscles and avoid overstretching the Achilles tendon.

**Force and Leverage**

The leverage that works best in massage is the same leverage that works for all activities. When pushing a heavy door, a child’s stroller, or even a car out of the snow, we instinctively maximize leverage by leaning and pushing with the whole body. By leaning from the feet, the ankles become the fulcrum and the whole body works as a lever arm. Given this, all massage strokes, no matter how small, should be done with a full-body movement that maintains a neutral spinal alignment and involves leaning, pushing, and pulling from the feet (see Figure 9, page 104).

Massage and particularly deep-tissue work requires using the hands and arms in a weight-bearing capacity. Humans gave up their upper body weight-bearing capacity in exchange for mobility long ago, so it is crucial to align the joints so that compression passes through the center of each joint, from the hands to the feet. This greatly minimizes damage to the upper limbs from the ravages of uneven compression by distributing forces along a chain of bony articulations, from the hands through the spine to the feet. Since compressive and tensile forces have trouble passing around corners, avoid applying deep pressure with bent or locked...
Standing upright extends the joints in a neutral alignment.

joints, particularly in the vulnerable joint of the fingers, wrists, elbows, and knees.

**Shoulder Girdle as a Draped Yoke**

The shoulder girdle resembles a draped yoke balanced across the rib cage, from which the hanging arms are suspended as side loads (see Figure 10). Each arm is delicately balanced by a wheel of tensional supports made up of the muscles that act on the glenohumeral joint. The shoulder muscles work like a harness, with muscular reins that seat the glenohumeral joint in the center of the socket. When one rein pulls harder than another, a horse veers to one side. Likewise, uneven muscular pulls will tip the balance of the yoke and pull the shoulders off center.

The humerus moves independently of the scapula up to sixty degrees of abduction or ninety degrees of flexion. Given this fact, the scapulae should remain relatively stable while we give massage, resting flat against the rib cage (avoid “winging”) with their inside edges parallel to the spine. To keep your scapulae quiet as you work, imagine sandbags anchoring them toward the iliac crest. Also, have a knowing partner place her hands on them while you massage and give you feedback about when they move.

Ideally, compressive and tensional forces from massage transfer from the arms through the center of the shoulders into the trunk and spine. Unlike the hips, there is no direct skeletal pathway between the arms and spine. Therefore it is crucial while practicing massage to work

Exercise 2. Cues for Leveling the Shoulder Girdle

- Imagine your shoulder girdle as a suit jacket resting on a hanger.
- Keep your clavicles horizontal like an oxen’s yoke.
- Imagine your hands and forearms like buckets hanging from a yoke, keeping them weighted while you work.
- Imagine your lungs like balloons filling with air, expanding your armpits, and floating your shoulder girdle as you breathe in.
- If your shoulders creep up, rather than pulling them down, relax them first, then lengthen your spine and lift your sternum underneath them.
Figure 10. The shoulder resembles a yoke from which the arms hang as side loads.

with the shoulder yoke level and seated on the rib cage.

**Head and Thorax as Top Loads**

Let's finish our tour of skeletal architecture at the top. It can be a challenge to keep one's head on top while working. For some reason, the head likes to migrate toward the hands, as though the neck were a limb, craning closer to a computer screen, a trigger point, or whatever task is at hand. One need only look around at customers in a typical restaurant to see how common it is for most people to reach the head toward the table rather than bringing the food toward the mouth.

Most neck and thorax misalignments are associated with a head-forward posture. This posture is so common in office workers that it is now being called "computer neck." The head-forward posture is deadly to massage form, causing the converging forces crashing in the upper back of many busy practitioners to feel (and look) like a train wreck.

The top load of the head and thorax passes into the pelvis and legs through axial compression of the vertebral bodies and discs along the front of the spine. To test cervical alignment, gently push down on the top of your head and see if you can feel the compression in your spine (see Figure 11). To maintain the integrity of the cervical-thoracic junction, keep your spine and shoulders balanced in a dimensional cross by lifting your head to lengthen your neck along the vertical axis and widening your shoulders front and back across the horizontal axis.

**Exercise 3. Cues for Aligning the Head and Neck**

- Use peripheral vision as much as central vision. Look around rather than narrowing your focus to your hands. Systematically scan your client’s entire body every other minute.
- Lift and lengthen your head and neck the way a person lifts the face back from text that is too close to read.
- Imagine your chin and occiput balanced like children on a seesaw. Lift your occiput without lowering your chin.
- Imagine eyes in the back of your head and keep them level.
- Imagine your head floating up like a balloon.

Faulty body patterns can be hard to break. They creep up on many an earnest practitioner focused outwardly on the massage. Counter their staying power by equipping yourself with images that work best for your particular patterning needs, and use these images to self correct as you massage. Anatomically sound visualizations can only enhance our ability to develop body mechanics that move in sync with the clear articulations of the skeletal architecture.

**Notes**

7. Ibid. Also, the ratio of movement between the glenohumeral and scapulothoracic joints is known as the scapulothoracic rhythm.