Correcting Movement Imbalances with Yoga Therapy

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Abstract

Yoga teachers and therapists recognize the need for correct postural alignment. The quality of movement is equally important. When a person moves incorrectly, joints deviate from their centers of rotation. Mechanical stress occurs with repeated incorrect movement and results in degeneration of the joint and eventual pain from repetitive stress. Yoga therapists and teachers influence the movement patterns of their students by their choice of *âsanas*. By identifying an incorrect pattern of movement, a Yoga therapist can be more specific in the selection of *âsanas* to alleviate pain and to help students avoid pain in the future. This article offers an introduction to the principles of movement balancing and a classification of movement patterns in the low back to demonstrate the practical application of movement balancing in Yoga therapy.

Balance, Not Strength

Quality of movement refers to the way that we recruit muscles to perform an action. Every time we move, we make choices in a way that is unique. Lifting an arm or taking a step involves many joints and many more muscles. The quality of every move we make depends on how much power we apportion to different muscle groups. Sometimes, out of habit, we move in ways that are damaging. A movement that is performed repeatedly (sitting down, standing up, reaching into the cupboard, and especially the way we walk) could be slowly eroding the joints, leading to arthritis and avoidable pain.[1–3] This article will discuss variations in movement patterns, and it presents a system for identifying and correcting movement imbalances with Yoga therapy.

Here is an example of how a movement imbalance develops: When you play tennis, your shoulder may eventually tire. A certain amount of stress is beneficial, as it keeps you in shape, but if you play too long you move into a level of stress that causes some muscles to shorten and thicken and others to become longer than is ideal. Once these changes in muscle length occur, your shoulder no longer moves precisely on its axis of rotation. The stronger and shorter muscles pull harder, causing friction between the ball and socket. This is a movement imbalance. It causes wear each time you repeat the motion, not just when you overexert. The mechanical stress of repeatedly moving incorrectly is called repetitive stress.

Most people are not aware of a movement imbalance until they develop symptoms of pain, weakness, or numbness. Weight training can worsen a movement imbalance in the arms and legs as it increases both the frequency of repetition and the forces that are causing mechanical stress. This hastens the progression of soft tissue and joint damage.

Repetitive stress can also damage the back, which is designed to be the solid and stable center of the body. Without spinal stability (also called pelvic stability), the back moves more readily than the hips. Or, the back will move every time the hip moves. This contributes to the "wear and tear" kind of arthritis—osteoarthritis.

Movement balancing expands the common use of the term "repetitive stress" to include any stress caused from the repeated movement of a joint that is not moving with precision. This applies to true joints such as the spinal joints and the shoulder joint, as well as the scapulo-thoracic joint—the gliding of the scapula across the rib cage. This latter joint is a "functional" joint that also has an optimal pattern of movement that must be precisely maintained in order for the ball-and-socket joint of the shoulder to move precisely on its axis of rotation.

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Movement balancing is based on an understanding of joint structure and muscle function, supported by engineering principles. Its central premise is that mechanical efficiency will increase the longevity of our body's movement system. When mechanical precision is lost, the joint surfaces wear unevenly and the soft tissue develops small tears (cumulative microtrauma).

Shirley Sahrmann, P.T., Ph.D., F.A.P.T.A., professor and associate director for doctoral studies in the Program in Physical Therapy at Washington University School of Medicine, St. Louis, Missouri, developed Movement System Balancing as a method for identifying and treating movement imbalances for the pelvic girdle (low back, pelvis, and hips) and the shoulder girdle (shoulder and scapular area). Sahrmann's work suggests that "many of the syndromes that are seen clinically are the result of cumulative microtrauma and are not simply cases of 'age-related degeneration' or the result of a single relatively trivial incident as is so often described."[5] Her system has been used and adapted by physical therapists around the world, and this article demonstrates an application of this knowledge.

The information in this article is intended to offer an understanding of why certain *âsanas* are helpful in alleviating pain while others may increase pain in certain individuals. It explains the use of movement tests and offers suggestions for preventive therapy. Sahrmann's system allows us to assess the direction of movement that causes the repetitive stress before symptoms occur. With this information, we can avoid *âsanas* that would cause a joint or spinal segment to wear and instead select *âsanas* that stabilize the joints.

Joint stability requires a balance of active and passive forces acting on a joint. It is balance, not strength, that allows the body to function safely and freely. Specific movement tests inform us when this balance is lost.

The neuromuscular basis for understanding movement imbalances has three parts:

a) Motor control
b) Muscle length/tension
c) Relative flexibility

Motor Control—Teamwork

Motor control refers to the way that muscles work together. It is somewhat like the wizard behind the curtain (in the brain) who determines which muscle fires, how strong a player it is, and when it comes into play. These choices are at the heart of movement quality. If one muscle dominates another, there is an imbalance in the forces around a joint. This imbalance will cause the joint to deteriorate more quickly and become painful.

A common example of muscle dominance results in patello-femoral pain. This condition arises from an imbalance of forces acting on the knee cap (the patella). The muscles pulling the knee cap from the outside of the knee (vastus lateralis) often pull harder than the muscles pulling from the inside of the knee (vastus medialis). When this happens, the kneecap is pulled off its "track." It rubs against the edges of the groove through which it was designed to glide.[6] This example of poor motor control is corrected by retraining the two muscles to work as a team, each pulling with an optimal force that balances the other.

Movement balancing expands the common use of the term "repetitive stress" to include any stress caused from the repeated movement of a joint that is not moving with precision.

Pain also can be caused by an imbalance in the work done by two muscles with similar functions. For example, there are two muscles that abduct the hip: the gluteus medius and the tensor fascia lata (TFL). The TFL also flexes the hip and rotates it inwardly (medially). When the TFL dominates the gluteus medius, the person acquires a "habit" of walking and performing most upright movement with the hip rotated medially.[7] This is an example of poor motor control. It is a choice made by the brain unconsciously (i.e., subcortically). It can cause pain in the hip and knee. Often the imbalance is not identified until after the person has had hip or knee replacement surgery. The pattern usually persists after surgery and can be modified only to a degree because of the structural changes that have occurred. Years of pain and arthritic deformity could have been prevented with early correction of the movement imbalance.

Quality of movement requires a precise timing and degree of participation from muscles to keep joints healthy. When movement imbalances are not identified through movement testing, *âsanas* can increase patterns of dominance as the strong muscles become stronger. Correction involves reestablishing a healthy pattern of movement by retraining specific muscle groups (muscle reeducation). It is necessary to integrate the correct way of moving into every part of the daily routine—standing up and sitting down, getting into and out of the car, going up stairs, etc.

Muscle reeducation requires that the movements be performed slowly, with full attention and with minimal force. Yoga therapy is thus ideally suited for both muscle reeducation and the body awareness needed to integrate the corrected movements into the day's activities.

Muscle Length—Too Short, Too Long, or Just Right

A muscle's length plays a significant role in determining how much it will participate in a movement. The quality of movement is changed as one muscle shortens and thickens or becomes excessively long. A muscle that is too short will pull too hard on a joint; one that is too long will have less control over the joints that it influences.[8–10] The motor control will be affected.

The length of a muscle in the legs and arms is discussed in terms of the range of motion of the joint(s) that the muscle crosses. For example, the length of the hip flexors is determined by the number of degrees that the hip moves into extension. Muscles of the trunk are measured by the alignment of the bones to which they are attached (scapulae, pelvis, ribs, and spine).

An example of the effects of muscle length on posture is seen in "square shoulders," which refers to a posture wherein the scapulae and shoulders are held in an elevated position. This mal-alignment makes it clear that the upper trapezius, levator scapulae, and rhomboid muscles are too short. These shortened muscle cause premature aging of the cervical spine by the excessive pressures created on the disks and vertebral joints.

In the general population, the hamstring muscle is frequently too short. In the population of dancers, gymnasts, and Yoga teachers, it is frequently too long. Most teachers are aware of the pain that can result from hamstring muscles that are too short; however, excessive hamstring length can also be damaging.

Hamstring length is measured by lifting the leg with the knee straight (Figures 1A, B, C, and D). The optimal length is reached at approximately 80º of straight leg raising. When the hamstring muscle is too long, it affects the quality of movement. Even a very strong hamstring muscle that is significantly overstretched has altered its control over the segments that it influences (knee, hip, and low back).[11–13] When this happens, the joint deviates from its center of rotation and pressure points develop in the joint (repetitive stress) with each step. A person who is young or inactive may show no symptoms at first. However, with time, and especially with a physically demanding lifestyle, soft tissue and joint damage from the repetitive stress will eventually cause pain and inflammation.

The length of the back muscles (paraspinals) and abdominals (especially the external oblique) is particularly important to the health of the back as we will see in the next section.

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Relative Flexibility—Keep the Torso Stronger than the Extremities

Relative flexibility refers to the relationship between two segments of the body. When comparing movement between the torso and extremities, the sturdier joints of the shoulder and hip should move more readily (be relatively more flexible) than the smaller facet joints of the spine. It is extremely important to the health of the back that it is stable (unmoving) at least at the beginning of hip motion. This depends on muscle length and motor control as explained above; i.e., relative flexibility reflects how muscles are being recruited (motor control), and motor control is affected by the length of a muscle. Stability in the spine reduces the repetitive stress that leads to premature degeneration of the disks and vertebral joints, and it is similarly important to the health of the shoulder joint that the scapula remains fixed during the first part of shoulder movement.

Relative flexibility means that one segment is more eager to move than another, some tissues contract more readily than others, some tissues yield more to movement than others. In the case of a shoulder, the scapulo-thoracic "joint" (shoulder blade sliding across the ribs) may become relatively more flexible (quick to move) than the gleno-humeral joint. This means that the movement occurs at the scapula too soon after the shoulder begins flexion. This "unstable scapula" can become a source of pain.

Now that we have understood how the three neurological principles (motor control, muscle length/tension, and relative flexibility) affect our movement, we will consider a classification system that allows movement imbalances to be treated in a very specific and precise way.

The classification system below describes the directions in which the low back becomes relatively more flexible than the hips. We will see that the direction of relative flexibility in the spine is the same direction of movement that will cause pain. Pain caused by repetitive stress in the spine will be located in the segment that is too mobile.

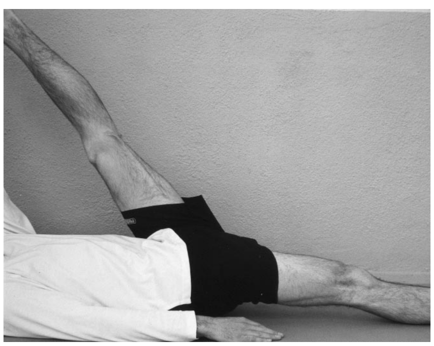

Figure 1A

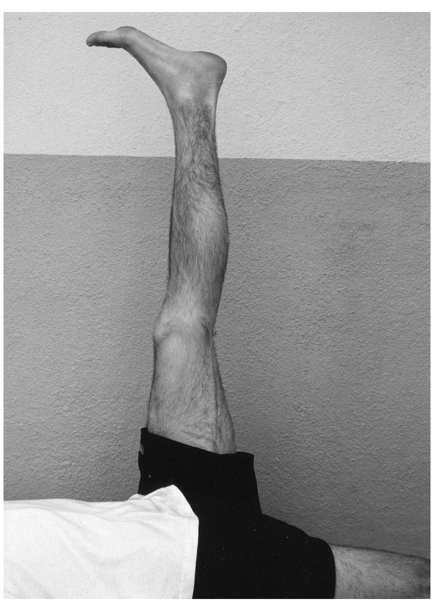

Figure 1B

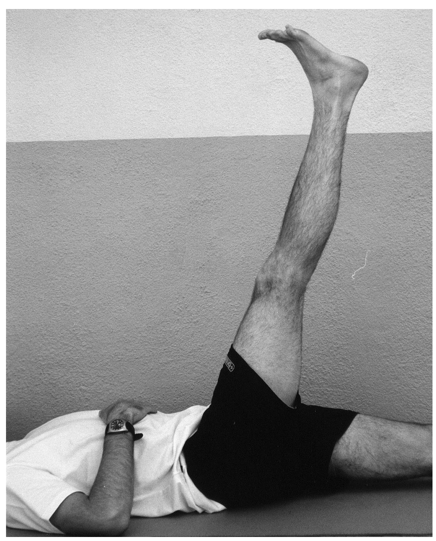

Figure 1C

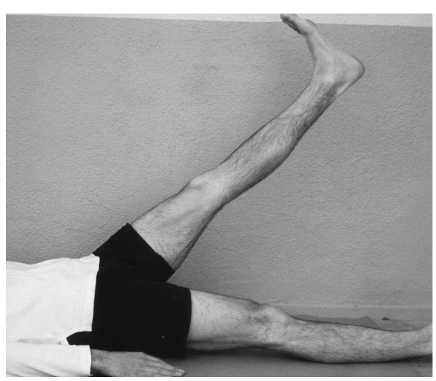

Figure 1D

Classification of Mechanical Low Back Pain

A movement assessment identifies the direction of movement that consistently causes pain. It is common sense to avoid that which causes pain and to choose those movements that decrease pain. By classifying the direction of a movement imbalance, that specific movement can be retrained. It is this ability to be specific that prevents the recurrence of pain by: 1) creating stability where there is too much motion and 2) integrating the corrected movement into daily activity.[14–17]

The movement classifications are based on the movements of the spine and their combinations: flexion, extension, rotation, flexion/rotation, extension/rotation, and flexion/extension.

The tests are performed in sitting, standing, side-lying, prone, supine, and in table (quadruped) position. If pain is produced consistently when the spine moves into flexion and rotation, then it is called a flexion/rotation fault. This information directs the choice of movements and *âsanas* to correct and prevent the movement imbalance and to relieve the symptoms of pain.[18]

In the movement test that follows, it is possible to determine which is relatively more flexible (yielding), the back or the hips. This test is one of several used to detect repetitive stress in the low back in the direction of flexion:

With no prior instruction, a person is asked to bend forward. If the movement is initiated from the hips while the back remains in the position of neutral spine, then the spine is stable. The hips are relatively more flexible than the back. However, if the back is too quick to round with little to no movement in the hips then the spine is unstable. The back is relatively more flexible than the hips. It is an indication that the low back may be receiving repetitive stress in the direction of low back (lumbar) flexion. If other tests confirm this, the imbalance would fall into the flexion category.

A person in the flexion category is likely to stand, sit, and perform daily activities with a flat back (lumbar flexion). The flattened lumbar spine indicates that the muscles that run along either side of the spine (paraspinal muscles) are overstretched. Cyclists commonly fall into this lumbar flexion category due to their position on the bicycle.

If the person in the flexion category were to perform *uttana-âsana* in lumbar flexion (flat or rounded low back), he or she could damage a disk.[19] However, modified *uttana-âsana* could be used to train the low back to move correctly in the following way:

With hands on a table to support the weight of the upper body, and with knees bent, the person is instructed to maintain a neutral spine (slightly bowed in) and slowly bend forward at the hips. He or she must stop the motion as soon as the back loses the neutral position. If the back is allowed to flatten (lose neutral), the flexion fault will be encouraged rather than corrected. Performed slowly and with full awareness, this is one step toward returning the relative flexibility to the hips. The spine is receiving its first lesson in stability.

A person is placed in the flexion category when: a) the majority of tests confirm that the low back (lumbar spine) consistently moves into flexion with certain movements of the hips and knees, b) if there is pain, then the pain would be consistently increased with tests that move the spine into flexion, and c) the pain would be lessened when the spine is stabilized (above example of forward bending at the hips only).[20,21]

A person in the flexion category is demonstrating that the muscles of the back are more yielding (relatively more flexible) than the muscles of the hip. The hamstring muscles are relatively stiffer. Thus it would not be reasonable to use the forward bend to lengthen the hamstring muscles (Figure 2A) unless the back can be protected in a position of neutral spine. Without a position of neutral spine, the forward bend in this category would only serve to increase the length of the already overstretched low back muscles (Figure 2C). In addition, it could cause excessive flexion of the upper back (Figure 2B).[22]

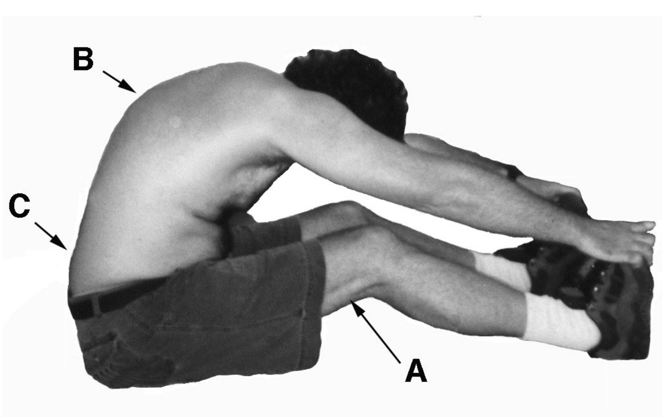

Figure 2

Seasoned tennis players tend to stand and move with their spine in extension, and their hip flexors are often too short. Testing may demonstrate a movement fault in the extension category. If this is true, and especially if they experience pain, repeated backward bending *âsanas* would reinforce the incorrect way of moving. They would be at risk of developing stenosis (narrowing of the vertebral canal) and/or damage to the facet joints and nerves. They would need to avoid *bhujânga-âsana* unless it is performed over a bolster and only to a position of neutral spine. Unfortunately, the damage occurs so slowly that the person has no way to correlate the bony changes to the performance of backward bends.

Correcting a movement fault in the extension category would begin with lessons in finding and holding neutral spine at the wall. This would progress to table pose and all the standing poses, especially those with arms overhead. The abdominal muscles, in particular the external oblique muscles, would need to be strengthened and shortened to balance the strength and shortness of the muscles in the low back (lumbar extensors).

Correcting Movement Imbalances

To summarize using the above examples, the corrective strategies are:

1. Stabilize the low back and pelvis by reeducating the muscles to work as a team. The first priority is to reeducate the dormant muscle (e.g., the external oblique muscle). This is done with a minimal load, or the dominant muscle will do the work.
2. Strengthen the newly trained muscles. In the second step, the

overstretched muscle is shortened through strengthening, and the shortened, dominant muscle responds by becoming longer. It may receive additional lengthening if needed.

3. Integrate the corrected movement into all the day's activities. This needs to be addressed through every level of training and requires constant vigilance.

The following case history will help clarify these steps.

Case History

A 54-year-old man, T.F., came to me with symptoms that had kept him from skiing and surfing for over a year. He also had so much pain in sitting that he could not travel as he should for his business. He had a diagnosis of osteoarthritis and degenerative disk disease of the lumbar spine. X rays showed thinning of the disks particularly between the last two lumbar vertebrae, L4-5 and L5-S1.

Symptoms:

1) pain at time of the evaluation was at the low back and L buttocks, 5/10 intensity, increasing to 7/10 with 10 min. of sitting. At 10 min., the pain radiated down the R inner thigh to the lower leg and to the sole.
2) pain in the R buttocks ranged from 0 to 6/10 but patient was pain free at the time of the evaluation.
3) pain in the R upper and central abdomen, intermittent with bloating and occasionally worse within one hour of having eaten.
4) pain in R groin was 2/10 at time of the evaluation and inversely related to R buttocks pain.
5) intermittent bowel and bladder dysfunction as well as sexual dysfunction.

Onset: gradual over 13 mos. with no known cause.

Tolerance levels:

Sitting: 0—immediate increase in pain on sitting.

Standing: pain increases after 2 min.

Walking: pain increases after 4 min.

This client had no prior limitations. His work allowed him to frequently change his positions to alleviate pain.

Standing posture:

The pelvis was tilted anteriorly causing excessive lumbar extension (back bowed in). The hips were mildly rotated inward. Visually, there was a decreased bulk of the gluteal (buttocks) muscles and mild pronation of the feet (flat feet).

Range of motion limitations:

The hip rotators and the hamstring muscles were shorter than optimal:[23]

Hip rotation, medial: R 10º, L 15º; lateral: R 15º, L 20º (active ROM).

Straight leg raising performed actively: 40º R and L (shortened hamstring muscles).

The hip flexors were shorter than optimal. (Negative figures show degrees of limitation in passive ROM):

Rectus femoris: -20ºR and -15ºL (hip flexor crossing 2 joints).

Iliopsoas: -10º R and L (hip flexor crossing 1 joint).

Iliotibial band: -5ºR and -10ºL (fascial band along the side of the leg).

Strength:

External oblique muscle strength (abdominal muscle needed to maintain neutral spine) was 20% of normal when tested in a functional position. That is, there was poor ability to maintain pelvic stability.

The gluteus medius and maximus had less than normal strength. The precise grade was unobtainable due to pain on testing.

Movement faults:

Twenty movement tests were performed in standing, sitting, prone, supine, side-lying, and quadruped (table) positions.

Pelvic (spinal) instability was consistently present in the tests for lumbar extension and rotation, but most noted in the following two tests:

Prone (stomach lying) knee flexion caused the low back to extend (bow in).

Prone hip rotation caused the pelvis and spine to rotate.

In performing these tests there was immediate movement (instability) of the low back.

Relative flexibility:

The stiffness of the quadriceps and other hip muscles caused the low back to move when it should have been stable. That is, the relative flexibility of the low back was greater than that of the extremities. The tests indicated that the spine was receiving excessive wear and tear in movements throughout the day's activities.

Assessment:

A movement fault existed in the extension/rotation category. The symptoms were consistently either caused, or increased by, movement into lumbar rotation or extension.

It is important to note that the pain level decreased from 5/10 to 2/10 when the client performed the movement test corrected for spinal stability. When the pain decreases by correcting the movement fault, it confirms the category. This must be done with every assessment.

Treatment:

The client was taught to stabilize the low back by correcting the movement tests that had demonstrated instability. In the process, he was learning how to use his external oblique muscles. These abdominal muscles are important for their role in maintaining a neutral spine.

This patient quickly grasped the concept of pelvic stabilization. By the end of the evaluation, he had shown improvement in the way he performed the test positions. In addition, he was able to maintain a neutral spine in sitting and in standing.

His home program began with mountain pose at the wall for breath and posture awareness. It continued with *vinyasas* to correct the movement faults that were most significant in the testing:

In prone position, the client allowed his knee to bend without bowing his back (lumbar extension). This not only reinforced kinesthetically the maintenance of neutral spine, but it also encouraged the lengthening of hip flexors. From this position, he moved into hip rotation while holding the pelvis stable (not allowing pelvic rotation). This corrected the most damaging of his movement faults, that of rotating the spine with each rotation of the hip. It also lengthened the hip rotators. This process of correction requires an increase in sensory awareness. The client thus felt for movement by placing his fingers on his pelvis, and all movements were performed slowly, mindfully, and coordinated with the breath. The use of *mûla-bandha* supported the reeducation of the external oblique muscle, the key to pelvic stabilization.

His program also included two restorative poses to lengthen the hip flexors:

Iliopsoas: Back-lying with the buttocks at the edge of a bed or table; the low back is held flat by holding one knee to the chest while the opposite leg is lowered, keeping the knee straight.

Rectus femoris: As above except that the opposite leg is lowered with the knee flexed 90 degrees.

Both of these stretches were held one to two minutes, working with the breath to return these muscles to their optimal length. (See range of motion limitations.)

Most importantly, this client was given instructions to integrate spinal stability into the day's activities.

At the time of the second treatment, this client reported 80% relief from pain and that his bowel, bladder, and sexual dysfunctions were no longer a problem. He had learned to use the external oblique muscles for stabilization at 60% of normal capacity. (He originally tested at 20%.) At that time, his practice was advanced to include a flow series that increases the challenge to the external oblique muscle. There are five levels of strengthening. All require careful monitoring for movement at the pelvis in order for the movement fault to be corrected; that is, if the pelvis moves in strengthening the abdominals, it reinforces the movement imbalance that caused the pain.

Yoga facilitates muscle reeducation by increasing body awareness and mental focus. Within the context of a yogic practice, this client learned more quickly to sense the movement of the pelvis in and out of neutral spine as the lessons advanced.

In the second week, the corrected test movements were integrated into a modified dancer's pose (*natarâja-âsana*) to actively lengthen the rectus femoris (quadriceps) and warrior I pose to actively lengthen the iliopsoas. Both were performed with a neutral spine. Table pose was used to teach neutral spine in rocking forward and then backward with an awareness of when neutral spine changed to lumbar flexion (bowing out) at the end of hip flexion.

In addition, child's pose lengthened the low back muscles. The external oblique muscle group was strengthened with modified *ûrdhva-prasârita-pada-âsana*. A variation of lateral angle (side-lying) pose strengthened the gluteus medius muscle at the side of the hip. And before doing *shava-âsana*, a restorative pose was done to lengthen the hamstring muscle.

Approximately two weeks later, the client reported that he was pain free. One month later, the physician confirmed that he was completely free of symptoms and had normal tolerance for sitting and standing. He was planning a ski trip.

Additional Considerations

It is important that the training of Yoga teachers include the ability to identify neutral spine and to understand the importance of spinal stability. When twists, forward bends, and backward bends are performed, a counterpose should be used to insure, neurologically, the "habit" of stability in the spine. Based on the movement balancing concepts, and clinical experience, the incidence of low back pain in the Yoga community would be reduced if practitioners maintained their torso stronger and relatively less flexible than the extremities. According to some clinicians, long-term Yoga practitioners who have emphasized deep spinal stretches seem to have a higher than average rate of disk degeneration.

Since a large class setting makes it difficult to address specific needs, some Yoga teachers create safety by reminding students to listen to their bodies and move carefully. In this way, even when performing *âsanas* in the direction of an imbalance, students may avoid immediate serious consequences. They will, however, reinforce an incorrect pattern that causes long-term repetitive stress in daily activities. Optimally, teachers should be trained to identify imbalances and direct students away from *âsanas* that cause joint stress before an injury occurs.

Conclusion

Modern activities create physical and mental stresses that were not part of the life of the ancient yogic saints. Activities such as carrying groceries, aerobics classes, or repeatedly lifting a child place great physical demands on us. With an understanding of repetitive stress, we can make choices in our fitness program and in our Yoga program that realistically reflect our needs. To choose wisely, we need to consider our age, body type (Ayurvedic), and general physical condition as well as movement and postural imbalances.

Yoga teachers and therapists can identify and correct movement imbalances just as they correct poor posture. The tests for movement imbalances can be performed as part of a sequence of *âsanas*. These tests allow the therapist to see the signs of repetitive stress before the symptoms of pain or numbness occur. The tests direct the choice of *âsanas* so that the joints once again move precisely on their axis of rotation.

Precision of movement creates stability in the spine and in the joints of the extremities. This stability enhances the life of our movement system. This process is effortlessly integrated into the day's activities with the increase in body awareness and mental focus that comes with regular performance of Hatha-Yoga.

This article is excerpted with permission from Marie Janisse's forthcoming book, Correcting Movement Imbalances with Yoga Therapy.

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