AI CHI for SCOLIOSIS AND MULTI LEVEL FUSIONS

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Prior to discussing Ai Chi specifics, it is necessary to review scoliosis. It develops mostly in children and teens and appears to be related to several things, including genetics, as it often runs in families. Scoliosis is also being identified in adults. Scoliosis is an abnormal curvature of the spine that affects approximately 7 million people in the US. In most cases, the cause of scoliosis is classified as idiopathic – or not known. The curvature can be to the right or the left side and also involves a twisting or rotation of the bones of the spine. As the vertebrae rotate, this may cause clinical change in the appearance of the patient's back and may also lead to painful degeneration of the spine leading to back pain or nerve pain or alter lung and heart function and resultant breathing difficulties. The term adult scoliosis refers to an abnormal curvature of the spine in a patient who has finished growing.

There are two types of scoliosis: nonstructural and structural;

**Nonstructural (functional) scoliosis**: involves a curve in the spine, without rotation, that is reversible. In adults, scoliosis may result from changes in the spine due to aging (degenerative changes). Ergonomic positioning is being investigated such as sitting over a computer for multiple hours, holding the telephone between the ear and shoulder, and women carrying heavy shoulder purses. These degenerative changes may be caused by osteoarthritis or overuse activities. Nonstructural scoliosis involves a temporary change of spinal curvature. This is caused by an underlying condition such as a difference in leg length, muscle spasms, or inflammatory conditions, (e.g. appendicitis), which may produce muscle spasm. Functional scoliosis is treated by correcting the underlying problem. The spine itself needs no treatment as the curvature is due to muscle imbalance. Addressing the muscle imbalance is primary.

**Structural scoliosis** involves a curve in the spine, with rotation, that is irreversible and is usually caused by an unknown factor (idiopathic) or a disease or condition.

Our focus in today's discussion with Ai Chi is on structural scoliosis, primarily adult scoliosis that has required multi level fusion surgery. The same exercise comments apply for anyone with identified muscle imbalances and for those recovering from Traumatic Brain Injuries. Adult scoliosis can develop as the result of a curvature that was present in childhood and was never treated. However, adult scoliosis can also develop in a patient without any previous history of a scoliosis. Adult scoliosis that develops in a patient with a previously straight spine is called adult degenerative (or adult de novo) scoliosis. Adult scoliosis typically arises from a combination of spinal degenerative conditions including disc degeneration, compression fracture, osteoporosis, and spinal stenosis.

Symptoms of structural scoliosis may include back pain, leg length discrepancy, uneven hips, or abnormal gait. The patient may notice that one shoulder is higher than the other, a prominent shoulder blade, or visual curvature of the spine. Some patients with
scoliosis first notice that their clothes no longer fit correctly. As the curvature leads to degeneration of the discs and bones of the spine, a number of symptoms can occur such as:

1. Leg length discrepancy
2. Irregular gait
3. Pain
4. Difficulty standing or sitting upright
5. Spinal stiffness
6. Nerve damage
7. Truncal imbalance
8. Rib prominence
9. Spinal instability
10. Cardiac or pulmonary (heart and lung) problems

Surgery to correct adult scoliosis is an option for the patient if the nonsurgical treatments do not relieve their pain or symptoms. Surgery is also needed for patients whose curves are getting bigger over time or who have curvatures that are leading to nerve compression and causing symptoms such as numbness, weakness, or pain. In general curves greater than 45º and curves with severe degenerative changes are best treated with surgical reconstruction. Surgical reconstruction for adult scoliosis involves some correction of the curvature. The goals of scoliosis correction surgery are to relieve pain and to prevent the curvature from progressing further during the patient’s life. For patients with large scoliosis curves or significant growth remaining, surgery is the best option in order to prevent further progression of the curve.

Adult scoliosis correction surgery utilizes spinal implants (rods and screws) to correct the scoliosis and hold the spine stable in that position while the spine fuses or mends. When the spine fuses, those segments of the spine heal together and are no longer mobile. Spine fusion is achieved using bone graft taken from the patient’s spine intraparatively in the area of surgery and for some patients bone morphogenetic protein is utilized to increase the chance that the spine will fuse correctly. Scoliosis surgery is often a dual surgery – posterior and anterior.

For patients with scoliosis, the surgeons try to fuse the smallest number of vertebrae possible. This helps to preserve the greatest amount of motion in the spine. As far as scoliosis surgery being the best treatment option, it’s difficult to say because there are so many factors that are specific to each case that the doctor must take into account. For instance, surgery is generally reserved for patients with progressive scoliosis curves greater than 45º, or curves that do not respond to bracing treatment. The level of fusion is a decision between surgeon and patient.

A number of surgical advances allow for greater curve correction and spinal stability. Many patients begin walking immediately after surgery and can resume activities over the following months. Initially, the patient upon sitting or standing realizes a new center of balance. This is especially evident upon sit to stand and walking.
When the patient is cleared for aquatic therapy, awareness of the new balance challenges requires heightened vigilance for any unsteadiness. Ai Chi is the best place to begin for a patient returning to aquatic therapy of exercise as a result of fusion surgery. Surgery and land therapy began to address the symptoms, but Ai Chi is where greatest strides forward are found. Along with balance, Range of Motion is permitted only as a whole torso and with evidence of fusion restricted to 25°. Basic restrictions include no raising the arms overhead until cleared to do so, no bending, no twisting, no running or bouncing. Occupational therapy is needed for everyday tasks such as dressing, household duties to include kitchen tasks, and driving – inability to twist requires learning to drive with dependence on mirrors. Balance, range of motion, and mobility of the rib cage in diaphragmatic breathing are the primary initial concerns. Ai Chi becomes a form of meditation – thinking body, higher consciousness – beyond the mind.

Ai Chi begins with the shoulders submerged in the warm pool. Land evaluation has noted any leg length discrepancy which can be accommodated in many pools and the basic position requires maintaining an upright posture that has the benefit of re-enforcing proper posture in the upright position. Shoulder depth immersion also has the benefit of addressing the breath that is often compromised with scoliosis and breathing difficulties resulting from the rotation or protrusion of the ribs restricting breathing. Diaphragmatic breathing involves the sympathetic nervous system that prepares us for activity, crisis activity. It increases heart rate, increases breathing rate, increases tactile – Yang. Chest breathing is the bridge between mind and body and the key to control over our autonomic nervous system. The Parasympathetic nervous system – relaxation, rest – Yin – calm/static, slows heart rate, reduces blood pressure, and reduces reticular activation system around us.

Preparation movements are the beginning of achieving the benefits of Ai Chi as a means to healing the body after radical surgery. First of all - ensure they know where their body is - I know this sounds odd, but a full spinal fusion that's new leaves the patient not quite aware of where they are holding their body. Was the fusion due to scoliosis? Were they able to straighten or did the surgeon fuse according to curvature? In the later case, pelvis will be twisted to some degree and one leg will probably be shorter because of this. This is neutralized in Ai Chi, but be aware of this in gait and other aquatic shallow water activities. Ensure they can control their core - strengthen - such as from the powerhouse used in Pilates. I often start back patients/clients seated against the pool wall to ensure they strengthen the core before moving to center of pool. Add initial Upper Extremity Ai Chi preparation movements at this time. I do this to reinforce correct alignment with tactile feedback. Moving to Ai Chi
in the center of the pool, the basic wide leg, bent knee stance is taken - make sure the shoulders are submerged and stay submerged. Assess their position.

Explain the "geometric box" (shoulder to shoulder, hip to shoulder, shoulder to hip) and watch for either side leading before the other. This makes it easy to identify weakness between the two sides of the body – especially with scoliosis one side of the body often lead before the other side.

Breathing and Upper Extremity movements
- Contemplating – Breathe with arms in front – palms up inhale, palms down exhale, emphasize diaphragmatic breathing. Check shoulders to see that they are symmetrical; scapula are depressed; stable position maintained.
- Floating Shoulder extension and flexion – Exhale as arms flex downward from shoulders and palms are turned downward. Inhale as arms extend upward to just below surface of water with palms upward. Arm movement is symmetrical; no body lean; feeling of lengthening through the spine. This will be a movement of initial concern, but is the beginning of mobilization of the muscles in the back and realization of balance.
- Uplifting – Shoulder abduction and adduction – with arms extended to side, the same movement of the arms brings more movement to the scapula. These beginning movements initiate activation of the primary muscle movers in the back while requiring activation of the Transverse Abdominus and Multifidus to maintain alignment and stabilization.
- Enclosing – Horizontal shoulder adduction and abduction continuing with palms down on exhalation and palms up on inhalation. This may be the first indication of one arm moving before the other arm as they enclose toward mid-line. The scapulas continue to experience the varied range of motions.
- Folding – Adduction crossing the midline at navel by bringing the elbows in toward the waist. Open and close the lower arms with elbows in. This requires maintaining a static position with small movement.

Trunk stability movements
- Soothing – Unilateral horizontal adduction and abduction is the beginning of isolated movement. As the arm that is moving, start without following the arm and then follow the arm that is moving with the eyes or the head. This should increase the range of motion. For anyone with a tendency to dizziness, eyes should focus in front.
Note: This may be an initial session for a scoliosis patient with a multi-level fusion. It is also the first set to use with Traumatic Brain Injury patients whose symptoms often include poor balance and dizziness, impaired vision, and ability to follow commands.

For all the movements that we say to pivot to the side, it is important to teach them to step to the side so they move the torso as a whole.

- **Gathering** – Turn and unilateral horizontal posterior adduction and abduction. Gathering requires no modification because the head is not following the rotation of the body, but does encourage opening of the lower rib cage and improvement of adding the diaphragm to the breathing. Maintaining a forward focus limits rotation that is within what they are able to accomplish at that point without trying to increase the range of motion.

- **Freeing** – Combination of the two above movements (step to side, and back arm horizontally abducts and adducts. With Freeing, eyes follow the arm only as is comfortable. You always want to ensure rotation is limited to no more than 25 degrees - this is with fusion in place. Visual dizziness must be monitored.

- **Shifting** – Unilateral horizontal adduction and abduction with weight shift. Shifting is a great exercise as it provides the stretch that they may have problems with on land. An option is to practice this shift facing the wall and holding the edge of pool to achieve balance. Once again, the geometric box protects the torso and strengthens it. Make sure the shoulders stay submerged rather than popping up and down between sides. This will assist not just the stretch, but strengthening the quadriceps.

- **Accepting** – Turn and bilateral horizontal abduction and adduction. Accepting with the step to the side, they open arms, limited back extension/lean back, and observe that arms return equal – one side of the body does not lead. I often stand behind them and place my hands on their shoulder blades to give them confidence and assist with the correct return. Another option is to stand in front of them and hold a piece of PVC pipe that they bring their arms toward and permits the therapist to assist with symmetrical return.

**Lower extremity movements**

- **Accepting with Grace** – Lift forward leg during abduction of bilateral horizontal abduction and adduction. Follow the comments for Accepting. Do not encourage the front leg lift more than a few inches - they may lose balance, drop their "tush" and misalign the back. Don't let them sit into it.

- **Rounding** – Lift back leg during adduction of bilateral horizontal abduction and adduction. Rounding is extremely difficult and they will not round. The back leg can be brought forward, but the back will not round. Encourage them to reach towards the leg brought forward. This can be very frustrating for them without therapist encouragement. Rounding has important significance but its the idea, not the rounding of the spine that matters.

- **Balancing** – Lift back leg with shoulder extension and palms upward, extend leg back with shoulder flexion. Palms remain in the supination position throughout the movement. Balancing is a big challenge because of balance which is often uneven. Coming forward (pretzel) is limited, but stretch back (superman) is good for them as long as you enforce no twisting of the body.
Coordinated total body movements

- Flowing – Shoulder adduction crossing midline at navel with legs in wide stance, open with elbows in as legs cross. Main goal here is to watch their alignment – look for a twist or shift towards one side. This is a complex skill, but can be practiced without concern except as previously mentioned.
- Reflecting – Shoulder adduction crossing midline at navel as legs cross, open with elbows while pivoting in half circle. No adjustments needed as the half turn is with the full body.
- Suspending – Simultaneously float into arms and legs crossed, pivot and open. I suggest deleting this until they are past needing specific therapy.

Cultivating the Chi

- Encircling with a Shift – Observe movement of the body with the shift. Many will have a tendency to rotate the shift on one side depending on the remaining curvature and the position of the pelvis.
- Encircling – no adjustments.
- Nurturing – This can include a gentle rocking with the scoop inwards to make movements more free.
- Surrounding – Caution. Very limited rotation and limit rotation of head. Follow the guidelines on maximum rotation provided by surgeon. Most spinal fusion patient will rotate from their feet. This is acceptable as long as the body is rotating as a whole.

Fusion surgery for scoliosis is major surgery with long recovery. The top and the bottom of the fusion are the points likely to fail if stress is put on them before full fusion is achieved. The initial Ai Chi movements are excellent in beginning to retrain and reactivate the muscles of the back that were cut or moved during surgery. Since most complete spinal fusion surgeries also include anterior surgery, the core muscle for stability have all been disturbed – front and back. The Oblique’s face new challenges because of lack of lateral or frontal rotation. The pelvis is now set and all movement adjusted to the position it is now secured along with the curvature that remains through the spine. Although scoliosis surgery results in many personal changes, the ultimate outcome is full participation in an active lifestyle and freedom from pain. Sports participation is encouraged as tolerated. Swimming and deep water exercises are excellent reconditioning and fitness activities. Enjoying playing with your children can once again be achieved. Return to a full productive life begins with Ai Chi and progresses as the patient desires.

References:
Ai Chi – Balance, Harmony and Healing. Ruth Sova and Jun Konno
Lumbar Stabilization Progressions and Exercises DVD. Mary Wykle, PhD
Virginia Spine Institute, Reston, VA