

CHIROPRACTIC AND PILATES THERAPY FOR THE TREATMENT OF ADULT SCOLIOSIS

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ABSTRACT

Objective: To describe the use of Pilates therapy and sacro-occipital technique in the management of a 39-year-old woman with scoliosis who had undergone spinal fusion many years earlier.

Clinical Features: The patient had progressive severe low back pain that had worsened over the years after her surgery and had prevented her from activities such as carrying her son or equipment necessary for her job as a photographer.

Intervention and Outcome: The patient was provided a series of Pilates exercises used to overcome her chronic habituation and muscle weakness. Although this therapy went on for some time, she did begin to stabilize and increase physical activity. At present, she is no longer limited in her physical activity, although she still exhibits some symptoms from her scoliosis.

Conclusion: The addition of Pilates therapy can be useful to care for patients with chronic low back pain and deconditioning. (*J Manipulative Physiol Ther* 2002;25:e3)

Key Indexing Terms: *Scoliosis; Chiropractic; Exercise Therapy*

INTRODUCTION

Surgical intervention for adult scoliosis carries risk.¹⁻³ The obvious question is, does the benefit outweigh the possible side effects of surgery? "The decision to proceed with surgical treatment . . . must be based on a thorough understanding of the anticipated benefits from surgical treatment and results that can be less desirable than the original condition."² Complications of surgery on an adult patient with scoliosis are relatively common, occurring from 30% to 53% of the time.⁴⁻⁹ Patients with scoliosis are at risk with epidural anesthesia.^{1,10} Complications as serious as a subdural hematoma have been reported, which in one case resulted in paraplegia.¹ Nonoperative treatment is best suited to those adults with mild pain or older patients for whom surgery is not prudent.¹¹

Chiropractic procedures have been shown to be helpful in the treatment of scoliosis.¹²⁻¹⁹ In one study, it was determined that "chiropractic spinal manipulation offers a possible treatment method for aiding in the reduction and correction of scoliosis."¹⁹ With chiropractic treatment, mechanical stability is considered, applying engineering prin-

cipals to understand buckling and critical loading. By examining the factors of spine slenderness and flexibility and strength of the trunk muscles and applying this understanding to curve mechanics and the biomechanics of scoliosis, the chiropractor has a rationale for the treatment of mild lateral curves.¹⁴ Another study suggested that chiropractic procedures may also have a favorable long-term effect of preventing reoccurrence of back pain and on retarding curve progression.¹² Because of the serious sequelae associated with surgery, conservative methods such as chiropractic, especially if they offer relief, are viable and necessary options.

CASE REPORT

A 39-year-old woman had sequelae caused by a long-term history of severe scoliosis. The patient had a 2-year-old adopted son (she was not able to carry a pregnancy because of her scoliosis), and the process of holding him and trying to play with him caused excruciating pain. She had been working as a photographer, but the carrying of cameras and the pain and discomfort that followed made working prohibitive.

In 1974 the patient underwent a spinal fusion of T9 through L4. The surgeons report noted that the incision was made from T9 down to L4. The spinous processes from T9 down to L4 were identified and split with a knife. Subperiosteal dissection of spinous process, lamina, and zygapophyseal joints was performed involving 9 lumbar and

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dorsal segments. The spinous process was split with the osteotome, and a facet fusion was performed with a gouge. An initial cut was made into the superior facet, and cartilage was removed with a small gouge. The second cut was made in the lamina just below this, and the spicule of bone was brought up dorsally and imbricated into the facet. The spinous process was cut with a gouge, and fish scale pieces were overlapped. The identical procedure was performed from T9 to L4 so that the entire dorsal lumbar spine was cut and imbricated. Bone grafts were removed from the right posterior iliac crest, and strips of cortical cancellous bone were removed. The bone was placed around the apex of the curve on the concave side to act as a bone graft.

Twenty years after her surgery, the patient's condition had continually worsened, until the fear of being confined to a wheelchair directed her to pursue active treatment. In early 1995 she began treatment and evaluation with a prominent orthopedist because of significant pain she was experiencing in the cervical and upper thoracic region. The orthopedist stated in his report on January 3, 1996, that he recommended a "strengthening program that is designed to produce proper muscular control and support for her spine with her scoliosis and severe radicular components which is the only hope that she has nonoperatively. The alternative is a spinal fusion of her cervical and thoracic spine and there is quite severe potential chance for complications. The estimated cost of the spinal fusion is \$150,000.00." He recommended extensive testing, including a scan, EMG, nerve conduction studies, and myelogram.

The patient underwent all the all of the tests that were recommended but needed to be hospitalized after the lumbar puncture for the myelogram for approximately 10 days. The tests essentially revealed that the patient's condition was worsening. By October 1996, simple activities such as bending down to pick up her son's toys were now prohibitive, and most of her activities were largely limited. Because of her fear of surgery, she continued with the physical therapy recommended by her orthopedist even though she was not seeing any progress.

When the patient came to my office in November 1996, she had essentially exhausted what she considered all her possible options, and believed that she could do no worse with chiropractic care. She was seen and evaluated, and a course of treatment ensued. The treatments were spaced initially 1 to 2 times a week for 6 to 8 weeks. Although she was making progress, symptomatically, there would be a gradual regression during the period between treatments. Specific exercises were given to her to aid in her recovery; however, because of her chronic habituation and facilitation, it was extremely difficult for her to isolate specific muscle groups and stretch or strengthen the weakened or fixated joints. As a result of these findings, the patient was referred to a Pilates trainer specializing in exercises for patients with scoliosis.

As treatment continued, the patient's ability to begin to use her body in a balance manner allowed her to proceed with her Pilates exercises. Although her progress was slow initially, 1 year after commencement of chiropractic treatment, she was beginning to stabilize and increase her physical activity. By the beginning of 1999 she was only being seen at the office for flare-ups, which consisted of approximately 5 to 10 office visits per year. The patient was continuing with her Pilates exercises and would see her Pilates trainer periodically to ensure that she was exercising with proper placement.

She now can infrequently carry her son, who is now 5 years old, and although she still exhibits symptoms of her scoliosis, she is not limited by her condition at this time. Her condition is consistently improving as of the last office visit.

DISCUSSION

An effective method of treating patients with scoliosis is sacro occipital technique (SOT), which was developed by M. B. DeJarnette, a chiropractor and osteopath.

SOT Orthopedic Block Placement

One method, called "orthopedic block techniques,"^{20,21} uses wedges or blocks placed in specific positions to "derotate" the spine and rib cage of the patient with scoliosis. DeJarnette noted that this type of orthopedic block technique approach is extremely valuable in multiple rotations because it permits proper muscle conformation as the correction is being made, and the correction is made without force and therefore without trauma. Blocks can be positioned under the pelvis, rib cage, and clavicles with the patient in either the prone or supine position. With the patient lying supine or prone, elevations of the pelvis, lumbar, thoracic spine, or rib cage is noted. Placement of blocks or wedges is determined by SOT protocol, essentially creating balance in the pelvis and rib cage by way of block placement as specific reflex points are monitored. As the musculature and fascia relax as a result of the block placement, reflex points and aspects of the body distal to the block placement also relax.

Cranial Manipulation

Because of the multiple interrelationships between the pelvis and cranium,²² it is common to see cranial restriction in patients with scoliosis. An evaluation of the cranial bone dynamics is often necessary. A good overview of the dural membranes in the cranium can be obtained by performing sphenobasilar ranges of motion.

In cranial therapy various terms are used to describe the relationship between the cranial bones and associated dural meningeal (falx cerebri, tentorium cerebelli, falx cerebelli, and diaphragma selli) structures. The sphenobasilar junction is often used as a focal point of movements or a way of determining positioning of the associated meningeal struc-

tures. A series of cranial bone and dural stress patterns are defined:

Flexion/Extension: Shortening of cranial anteroposterior diameter/lengthening of cranial anteroposterior diameter.

Torsion: A “twisting” of the sphenoid and occiput where the sphenoid greater wing will be positioned caudalward and the ipsilateral lateral aspect of the occiput will be positioned cephalward.

Sidebending: There is an approximation between the greater wing of the sphenoid and the ipsilateral occiput, whereas on the contralateral side, there is a lengthening between the greater wing of the sphenoid and occiput. The convex side of the cranium will rotate caudalward.

Vertical strain: The sphenoid greater wing will be opposite positioning to the occiput—the sphenoid will be positioned in flexion while the occiput will be positioned in extension or in the reverse configuration.

Lateral strain: The sphenoid greater wing and occiput on one side will be positioned anteriorly while the contralateral sphenoid greater wing and occiput will be positioned more posteriorly.

Compression of sutures: This refers to a suture under compressive forces caused by components such as muscular, morphologic development, and tension within (fascial) dural meningeal structures.

The movement between the sphenoid and the occiput has long been considered a primary focus in cranial therapeutic care. The sphenoid and occiput, which creates two thirds of the base of the cranium, is a place of attachment for the falx cerebri, falx cerebelli, and tentorium cerebelli, the major dural structures in the cranium. The sphenoid’s and occiput’s connections with the petrous portion of the temporal bones creates foramen through which pass most blood vessels and cranial nerves within the cranium.

To palpate for the various movements within the “sphenobasilar junction,” common palpatory landmarks are the greater wing of the sphenoid on the right and left sides and the base of the occiput, primarily the lateral angles as they approach the mastoid process. In testing for sphenobasilar movement, gentle pressure is applied to the cranium, while simultaneously a response to this gentle pressure is felt for. With each movement (flexion/extension, right/left torsion, right/left sidebending, superior/inferior vertical strain, right/left lateral strain and sphenobasilar compression), the testing is in two opposing directions to determine the manner in which the cranium will move in response to an initiating force. In palpating motion, it is important to determine if there is any restriction to the initiation of motion. Then, the amount of movement and the length and degree to this movement is evaluated. Much of this movement will be palpated as a compliance and tissue resilience. This compliance to an initiating force should be balanced in all directions throughout the cranium, specifically as related to the sphenobasilar junction.

Throughout the testing of the sphenobasilar junction, varying movements can be used to help correct the lack of movement or imbalance of movement occurring with testing. One of the most effective techniques is the “indirect technique,” which involves guiding the cranial mechanism toward its position of least restriction and greatest movement, then holding it in that position as the cranium “relaxes.” There will often be a softening, a “relaxing sensation, and a warmth occurring in the tissues as a balancing of the structures occur.

Flexion/Extension

With the patient lying in a supine position, and the examiner at the head of the table, the doctor will contact bilaterally the greater wings of the sphenoid with his/her thumbs while the occiput rests in the fingertips of both hands. As the head is held gently, a subtle force is initiated in the direction of flexion. Flexion occurs when the doctor draws the greater wings of the sphenoid and the occiput caudalward toward the patient’s feet. The sphenobasilar movement is monitored and allowed to return to a neutral position where at that point the sphenoid and occiput are gently directed into an extension position. Extension occurs when the doctor draws the greater wings of the sphenoid and occiput toward the cranial vertex.

Right and Left Torsion

Maintaining the same contacts as used in the flexion/extension technique, the right greater sphenoid will be directed caudalward while the left great wing of the sphenoid will be directed superiorly. Simultaneously, the right occiput will be directed superiorly, while the left occiput is directed caudalward. Movement will be tested in both directions, creating a torsive force directed through the sphenobasilar junction. A right torsion would mean that the right sphenoid was high in relationship to the left.

Side-Bending Rotation

Side-bending rotation in the sphenobasilar joint occurs when there is an approximation between the greater wing of the sphenoid and the occiput on the ipsilateral side. On the contralateral side, there is a lengthening between the greater wing of the sphenoid and occiput. As this convexity or bulge occurs, inferior rotation of the cranium will also occur on that side. The side-bending disturbance of the sphenobasilar junction is named by the side of the convexity. Therefore the lengthened distance between the sphenoid and occiput ipsilaterally with its caudal rotation along an anteroposterior axis on the right side would be termed a *right side-bending distortion*.

Vertical Strain

In testing for a vertical strain, the occiput is directed in an extension positioning while simultaneously the sphenoid is

directed in a flexion positioning. This is done by directing the greater wings of the sphenoid caudally while simultaneously directing the occiput superior/anterior toward the examiner. The exact opposite positions are then examined by directing the sphenoid's greater wings superior/posterior in an extension position toward the examiner, while the occiput is directed in a flexion position caudally. The amount of movement in each direction is then monitored.

Lateral Strain

Testing for a lateral strain involves the practitioner's awareness of the axis of rotation at both the sphenoidal body and at the foramen magnum of the occiput. While a lateral strain is tested for, the occiput and sphenoid on the ipsilateral side are directed anteriorward. An obliquity of the sphenobasilar junction is therefore tested and movement should be equal both on the right and left sides.

Aside from use of SOT orthopedic block placements and cranial manipulation for the treatment of scoliosis, the treatment is guided by specific indicators such as resistance + contraction (R+C) factors and trapezius fibers.

R+C Factors

As the name *sacro occipital technique* implies, there is a relationship between the sacrum and occiput, as well as between the cervical and lumbar vertebra.²³ DeJarnette²³ described a relationship existing between the atlas and the fifth lumbar vertebra, axis and the fourth lumbar vertebra and so forth, following that pattern all the way to the midthoracic region. He called this relationship R+C factors (for resistance and contraction) and found that each vertebra within a pair affected one another. In other branches of chiropractic, this relationship between the distal ends of the spine has also been called the "Lovett Brother" principle.²⁴ Palpating the cervical spine for swelling and sensitivity guides the doctor to which lumbar vertebra is of primary concern, as well as when that vertebra's position has been corrected.

For example, when there is rotation of the L4 spinous to the right side there will be sensitivity at the ipsilateral transverse process of C2. As L4 is rotated to the left by way of block placement or doctor's hand pressure, sensitivity at C2's transverse process will subside.

Trapezius Fibers

DeJarnette²⁵ also found a relationship between the trapezius muscle and the thoracolumbar spine. The trapezius muscle arises from the medial third of the superior nuchal line at the external occipital protuberance and continues its attachment along the nuchal ligament until the spinous process of C7/T1. The trapezius continues along the spinous processes, also attaching to the supraspinous ligaments, of all 12 thoracic vertebra. The lateral connections of the muscle insert at the lateral third of the clavicle, medial

border of the acromion, and the superior lip of the crest of the scapular spine.²⁶ DeJarnette²⁵ found a group of 7 myofascial fibers along the trapezius muscles located bilaterally from T1 to the acromion process. There is a direct relationship between one or more of these fibers when swollen and specific thoracolumbar vertebra. DeJarnette²⁵ postulated a relationship between the thoracolumbar vertebral pedicles, the temperature-sensitive spinothalamic tract and the trapezius muscle fibers. Correcting the malpositions of the specific vertebra balances and reduces tension in the fiber that affects the entire trapezius muscle, specifically its connection along the nuchal ligament with its attachment to the occiput.²⁵

Often, "fascial unwinding" is necessary with patients with scoliosis. This fascial unwinding uses a method of correction called "indirect technique." Indirect technique is most commonly used with cranial therapy corrections and involves encouraging or allowing the bone or joint to move in the direction it moves most easiest, and then exaggerate that position. Clinically, indirect technique or methods have been found to allow cranial bones, their accompanying fascia (the meninges) and tissue to relax and then allow for balanced motion in all dimensions. Although commonly used for cranial bone corrections, indirect technique procedures can be used for any body part. Patients with scoliosis will need to have their pelvis, rib cage, sternum, clavicles, and cranium evaluated and corrected as indicated. Any of the previously mentioned structures can be monitored through active range of motion testing. For example, in treating the lower rib cage the doctor can place one broad hand contact anteriorly at the xiphoid and slightly below this point with the other broad hand contact posteriorly at the T12/L1 junction (near crura of the diaphragm's attachment). Various motions can be performed by either hand. Some possible motions are as follows.

Either hand stabilizes while the other hand moves the tissues superiorly, then inferiorly, laterally to the right and then the left, torsive twisting clockwise and counterclockwise, and rotating the contact anteriorly on one side and then posteriorly. When restriction is felt in one direction, the contact is held in the position of easier motion, exaggerating this motion until a warm and releasing sensation is felt by the doctor.

Another possible method of treatment involves a similar set of motions; however, they would be performed simultaneously with opposing motions by the doctor's contacts. For example, the anterior contact at the lower rib cage could be directed superiorly while the posterior contact would be directed inferiorly. Again the correction is toward the direction of easy motion, and the contact is held and exaggerated until a release or a relaxation of the tissues contacted is perceived by the doctor.

Most chiropractic procedures are "passive" procedures performed on or with the patient's cooperation, and for long-term recovery active therapeutic exercises are neces-

sary to maintain musculoskeletal and neuromuscular integrity. DeJarnette^{20,21} noted that, although “the blocks will correct, the muscles must maintain [the corrected] position.” The orthopedic block correction “will have to be supported by proper exercises to develop^{20,21} the muscles needed to stabilize the body in its balanced position. This is essential, for the body must be able to be balanced in its static, as well as kinetic positions.

Katharina Schroth Hospital

In Germany at the Katharina Schroth Hospital, patients with scoliosis have been treated successfully with conservative procedures for decades.²⁷⁻³⁶ These treatments include chiropractic manipulation, craniosacral therapy, and various therapeutic exercise modalities to help “activate and strengthen supporting muscles.”²⁷ “Learning and internalizing the individual training components of the patient’s personalized exercise program at home”²⁷ is an essential part of the program.

In one study (n = 813) involving the physiotherapeutic rehabilitation program at the Katharina Schroth Hospital, it was determined that a “course of inpatient treatment by the Schroth method can lead to an increase in vital capacity and chest expansion so that, even in adult patients with scoliosis, effective treatment of the associated restrictive ventilatory disorder is possible.”³¹ Results from another study (n = 107) at the Hospital with an in-patient exercise program showed that even in severe scoliosis, the magnitude of the curve can be reduced by a specific rehabilitation program of physiotherapy.³²

Pilates Exercise Methods

A complex method of exercise rehabilitation was developed by Joseph Pilates in 1923. “The Pilates Method of Physical and Mental Conditioning provides thorough training to improve strength, flexibility, and postural awareness. Its philosophy integrates the mind with the musculoskeletal system. Although Pilates has traditionally been used by dancers, the method is becoming more popular for use throughout general physical therapy practice.”³⁷⁻⁴⁵ Exercise therapies have been shown to be effective tools in combating the progression and sometimes improving the condition of idiopathic scoliosis.^{46,47} Pilates’ focus of maintaining a balance in the use of the musculoskeletal system throughout movements are the ideal physiotherapeutic exercises for the patient with scoliosis.

It is theorized that scoliosis-related injuries may cause, or may occur, as a result of imbalances of the body and preferred patterns of movement. One weak or misaligned area may result in a propensity to overcompensate or overdevelop another area. Pilates conditioning works toward a rebalancing of musculature.³⁷⁻⁴⁵ The symmetrical nature of the Pilates exercise technique and apparatus (reformer)⁴² makes the Pilates method an excellent rehabilitative thera-

peutic agent with patients who experience imbalances in use as a result of scoliosis.

Practitioners teaching Pilates therapy can be certified. The certification process is quite extensive and involves years of study of anatomy and kinesiology along with at least 2 years of apprenticeship and assistant instructing. There are also both written and practical examinations required for the certification. One Pilates teaching facility, “The Pilates Studio”, (New York, NY) has an extensive teacher certification program that involves years of supervised teaching, studies in anatomy and kinesiology, written, oral, and practical examinations, as well as yearly recertification through continuing education courses.

Treatment

Treatment for the patient discussed here consisted of sacro occipital technique and “fascial unwinding” techniques. When patients with scoliosis are treated, a balance between structure and function must be determined. Then a balance between structure and function must be attained. Treatment focused on creating a release of the patient’s “fascial makeup,” which encased her spine, thoracic cage, and cranium. Although I was concerned about her scoliosis and imbalance, my focus was to unwind the 3-dimensional “scoliotic spiral” that her body presented.

Lower Extremities and Pelvis

The patient exhibited a pattern that affected her from head to toes. Treatment was focused on her whole body dynamics and fascial patterning. Initially it was noted that her right lower extremity was externally rotated. This was initially treated with SOT’s iliofemoral technique, which is a method that is designed to release a chronic contracture of the hip external rotators at their insertion at the greater trochanter. When this condition persisted, evaluation of the right knee, ankle, and foot revealed a continuation of the facial “twisting” with a posterior fibula and lateralization of the talus with the calcaneus presenting medially and in “hyper” inversion. The fibula and talus were adjusted to correct their position and the foot and ankle were taped in a neutral position, to decrease the persistent ankle inversion.

Lumbar/Cervical Relationship

With regard to her spine, the patient had a longstanding rotation of the L2 spinous to the left and T8/9 to the right, creating a significant rib cage distortion. This was present even though the patient had fusion from T9 to L4. Her lumbar paravertebral musculature was notably decreased on the right with increased height of the paravertebral musculature noted on the left in the prone and standing postures.

With SOT’s R+C therapy, sensitivity was noted at the patient’s left C4 transverse process, and an orthopedic block was placed under her right ilium, between the anterior superior iliac spine and greater trochanter. This placement

restricts pelvic bone rotation and elevates the right side of the pelvis and engages the right paravertebral musculature. As the right paravertebral muscles contract as a result of this block position, the fascia and musculature (iliopsoas and quadratus lumborum muscles) surrounding the rotated L2 “unwinds,” and sensitivity at the C4 transverse process decreases or is eliminated. Pressure to the left of the L2 spinous process rotating to the right assists the process of relaxation and neutralization of the reflex at the C4 transverse process. The procedure can take anywhere from 2 minutes to 20 minutes depending on the chronicity of the patient’s condition.

Diaphragm and Rib Cage

After orthopedic pelvic blocking, or concurrently, while the patient is prone, a block is placed under the rib cage on her right side to help unwind the rotation of the costovertebral region. When the patient was supine, a block was placed under her rib cage on the left side to aid in relaxation of the fascia surrounding the ribs, vertebra, sternum, and diaphragm. At home she now will sleep or rest with a block or wedge under her left side when she is supine in bed, and this gives her relief and eases her breathing.

With and without the block or wedge under her left side while she was supine, myofascial therapy was applied to her rib cage, beginning at its lower margins. This was achieved by the doctor’s hand being placed under the patient initially between T11-L2 at the level of the attachment of the crura of the diaphragm. The doctor’s other hand was placed over the lower ribs with a broad hand contact. While modifying pressures with the hands moving in opposite directions twisting, lateral flexion, rotational and various directs were tested (eg, one hand moving clockwise while the other moves counterclockwise). Also motion testing involved stabilizing with one hand while the other hand created various directional pressures, as well as both hands moving in the same directions (eg, both hands moving clockwise). If one direction moved freely and the other direction of pressure met resistance, then the contacts would be held in the direction that moved freely.

Gradually the hand under the patient’s back would move up superiorward until at the level of T6-T8. Then the hand at the lower rib cage would move to the sternum, and the process would be repeated. Once the rib cage and sternal regions were released, then the clavicles were contacted to “disengage” them and allow the fascial connections to unwind as they were held gently in a superior and anterior direction.

Cervical Relaxation

With specific “sutural technique”⁴⁸ cervical preparatory procedures, the cervical fascia is relaxed, with various techniques used to release any platysma, scalenus, sternocleidomastoid fixation, and the deeper posterior vertebral muscu-

lature of the cervicothoracic, cervical and suboccipital regions. After relaxation of the cervical myofascial a procedure called “cervical stairstep” was used. This procedure will localize and correct “loosened motor units” of the cervical vertebra. DeJarnette recommends using a treatment called the “figure eight,” which he described as the “ideal cervical technique as it involves no violent motions or thrusting forces, rather a gentle controlled motion to reset the processes of the loosened cervical motor units.” The “resetting of the vertebra” involves a mechanical repositioning of the vertebra, normalizing any limitations in ranges of motion during stairstep range of motion testing.⁴⁹

Cranial Bone/Meningeal “Unwinding”

Often, in patients with scoliosis who have had surgery fixating parts of their spine, a “build up” of tension can be palpated in the cranial aponeurosis and meningeal structures. Sutural technique involves a step-by-step method of analyzing myofascial and cranial sutural fixation with procedures to gently relax and unwind any sutural or meningeal restrictions. Often, when the patient’s cranial base is affected, a procedure entitled “sphenobasilar range of motion technique” is used to effectively determine the magnitude of cranial base fixation and subsequently can be used to release this fixation.

Pilates Rehabilitative Exercises: Precision of Alignment, Breath, and Body Placement

Although various Pilates exercises were used, the following gives an example of the exercise methodology and relationship to a patient with scoliosis. Only 2 of the many exercises are described: (1) the prone latissimus dorsi pulls with twist and (2) the side leg lift.

The patient had significant spinous vertebral rotation in her mid thoracic region, convexity of the curve toward the right with apex of the curve at T8/9. The prone latissimus dorsi pulls with twist exercise was modified for the patient to create an exercise to address this asymmetry. In the lumbar region the patient had significant spinous vertebral rotation with convexity of the curve to the left and apex of the curve at L2/3. The side leg lift was modified regarding repetitions to address the decreased muscle mass of the right lumbar paravertebral musculature.

Prone latissimus dorsi pulls with twist. This exercise was modified for this patient and was not performed the same on both sides because of the vertebral spinous rotation in the mid thoracic region. To address the asymmetry a “twist” or upper body rotation to the right was added when the ipsilateral right arm was used, whereas no “twist” when using on the left arm. This exercise is performed on alternating sides through 3 to 5 repetitions.

The exercise begins with the patient lying on his or her stomach with a small pillow under the abdomen to reduce any lumbar lordosis. Both arms are straightened and extended above the head.

Right side. Keeping the neck relaxed, have the patient lift the head and arms approximately 10 degrees off the floor. The patient breathes in and then while slowly exhaling, reaches, extending outward, with the right arm and in unison rotates the neck 90 degrees toward the right while slowly describing a semicircular arc toward the right hip with the right arm. The patient then slowly returns the arm and head to the starting position (held 10 degrees off floor) as they inhale. Then have the patient lower their head and arms, so that the forehead and arms touch the floor.

Left side. The exercise varies on the left side because the head and arm do not lift off the floor. The patient breathes in and then while slowly exhaling, she reaches, extending outward, with the left arm, while slowly describing a semicircular arc toward the left hip with the left arm. At a few inches from the left hip the arm makes a pulsing action (3 times), abducting and adducting, to activate the left latissimus dorsi, trapezius muscles, and adjacent musculature to encourage strengthening of the left mid thoracic paravertebral muscles. After the 3 pulses the left arm is replaced in a semicircular arc to its starting position, extended over the head. Sometimes a light weight (3 pounds) can be used on this left side procedure.

Side leg lift. This exercise relieved tension in the patient's upper trapezius musculature and was modified by performing greater repetitions (5 repetitions on "weaker" side versus 3 repetitions on "stronger" side) on the side of weaker or less muscle development in the lumbar paravertebral musculature.

Side leg lifts are performed with the patient on their side with a pillow under their head in a neutral position, without any lateral flexion. Alignment of the body is essential, keeping the head, shoulders, hips, knees, and feet in a "perfect" line. (1) Initially have the patient breath in and then exhale, engaging the abdominal muscles without altering pelvic position. (2) Then have the patient reach the superior leg "out" of the hip without contracting the ipsilateral quadratus lumborum muscle nor having the superior hip and costal margins approximate themselves. (3) The superior leg is then lifted approximately 10 to 20 degrees and held for 3 seconds before gradually replaced to the starting position as the patient breaths in. All motions are fluid, gradual, with emphasis on precise body placement.

CONCLUSION

Pilates-type exercises are essential whether the patient chooses a surgical or conservative route of care. It appears from the research performed at the Katharina Schroth Hospital that exercises focused on balancing spinal curvatures and the associated muscles in conjunction with chiropractic/cranial therapy have been successful options to surgical intervention.

Much of the research in scoliosis intervention is focused on whether the curves are reduced and whether the spine

appears to be "straighter." What is difficult to measure, to some degree, is the ability of the fascia to allow for motion in various positions. Sometimes there will be a "freeness" in the fascia but that will not be found by increases of range of motion. This means that the skeletal structure might still have a fixed anatomic structure, but the fascia and musculature will not. Wolfe's law notes that as stress is applied to osseous structure the trabecular pattern will modify or reconfigure itself to the amount, direction, and location of the stress by increased localized bone mass. Because osseous structure is constantly responding to stress, a balanced non-fixated myofascial structure is theorized to create a 3-dimensional template by which a scoliosis might reconfigure over time, measured in years.

Another theory regarding releasing of the myofascial structure in patients with scoliosis relates to Hilton's law. Hilton's law states that the motor nerve to a muscle tends to give a branch of supply to the joint, which the muscle moves and another branch to the skin over the joint.²⁶ The neural intercommunication might also help the osseous reorganization of the patient with scoliosis as their muscles act in a more "balanced" manner.

The ultimate result of treatment is to determine whether the patient has decreased pain and increased function. It is imperative that chiropractic, in conjunction with exercise modalities such as Pilates, team together to formulate studies on the efficacy of cotreatment for patients with scoliosis. Greater communication and education of our fellow health care practitioners is necessary, so that many forms of care are available for patients with scoliosis, and surgery is the last resort after other conservative methods have been exhausted.

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