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Scoliosis
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Management Protocol

In discussing the role of the chiropractor in caring for patients with scoliosis, there are some important considerations to be made. First, in light of the current emphasis on “evidence-based” approaches to care, chiropractic clinicians are faced with a significant lack of evidence. In fact, the only clinical trial of the effectiveness of chiropractic in scoliosis management showed no effectiveness in reducing scoliotic curve magnitude.1 Second, the broad nature of the term scoliosis sometimes obscures the fact that there are very different types of scoliosis, and therefore, there ought to be different approaches to care. And lastly, because clinicians must always be alert to signs that their approach may not be effective, they need to know what modifications or changes in approach are warranted, when to make that decision, and be ready and willing to refer when necessary.

The primary focus of this protocol is idiopathic scoliosis, the most common subcategory of scoliosis. It should also be acknowledged that our approach is focused primarily on the maintenance of spinal function, and providing a thoughtful, logical, conservative approach to the care of the patient, and not focused on treatment of the disorder. As such, it is recommended that any Health Center patient who has been identified as having a progressing curve, or who is at risk for progression, be referred for orthopedic consultation or co-management. Any suspicion of congenital or pathological causes should also result in an orthopedic consultation. Adults with scoliosis typically look to the chiropractor for pain relief, and generally respond well to chiropractic care. Here again, however, the presence of severe pain or instability should result in orthopedic consultation.

Diagnostic Algorithms for Congenital Scoliosis, Idiopathic Scoliosis and Adult Scoliosis are included in this protocol. 2

Introduction to Idiopathic Scoliosis

The traditional view of idiopathic scoliosis has been that it is a complicated deformity characterized by both lateral curvature of the spine and by vertebral rotation, with no identifiable causative factors. Rotating thoracic vertebrae displace and deform the ribs on the convex side of the curve posteriorly, and cause the ribs on the concave side to crowd together and deform anteriorly. Disc spaces and vertebral bodies become wedged (decreased on the concave side), spinous processes displace and bend into the concavity, and vertebral bodies and the vertebral canal distort, widening toward the convexity, and narrowing toward the concavity.3

While this view is still basically sound, it has become clear that it is not complete. A more accurate view is that it is a three-dimensional disorder, which takes place around the y-axis of the torso, in both the sagittal and coronal planes, and that, in fact, the lateral curve changes may be the last to
occur. This lateral curvature is most often associated with decreased A-P or sagittal plane curves in the thoracic and lumbar spine.3,4

Classification
The most commonly used broad category of classification of scoliosis is that of “structural” versus “non-structural” curvature, based upon the degree of flexibility of the coronal plane curve. It is useful to see where within this classification idiopathic scoliosis falls.

Non-structural Curves: Curves that remain permanently flexible are generally compensatory in nature, secondary to some congenital or developmental process, such as leg length discrepancy, shortened hemi pelvis, another primary or structural curve, or even transient muscle spasm. These curves are classified as non-structural (or “functional”).

Structural Curves: Inflexible curves have numerous subcategories. They may be:
1. Congenital. Structural curves may be associated with spina bifida occulta, block, or hemi-vertebra, congenital rib fusion. A congenital scoliosis with neurological deficit may be seen in cases of myelomeningocele.
2. Secondary to, or associated with a named disease or disorder. Examples include polio-myelitis, cerebral palsy, muscular dystrophy, neurofibromatosis and Marfan’s Syndrome.
3. Traumatic. Structural curves are often sequelae of asymmetric vertebral fractures, surgery, radiation therapy, or scar formation.
4. Idiopathic. It is estimated that 70% to 80% of all structural scolioses fall into this category. Subcategories, based on age of onset, include:
   a) adolescent idiopathic scoliosis (onset at ages 10 to 16)
   b) juvenile idiopathic scoliosis (onset at ages 4 to 10)
   c) infantile idiopathic scoliosis (onset under age 3) (While labeled idiopathic, this form may be a different disorder from the other two, in terms of both its course and prognosis. Most resolve spontaneously.)

While included in the structural category, idiopathic scoliotic curves generally don’t begin as inflexible curves. The rigidity of the spine associated with idiopathic scoliosis is better viewed as a process brought about by bone and ligamentous remodeling, rather than as a precondition for its diagnosis. Primary curves progress to complete inflexibility at varying rates, and at different degrees of curve magnitude, in different individuals. For example, a patient with a right thoracic curve of 17˚ magnitude may demonstrate a capability for reversal to 14˚ on side-bending into the convexity or distraction, but six months later, with the curve having progressed to a magnitude of 19˚, may be totally inflexible to reversal. Additionally, curves that are totally inflexible to reversal may still progress to a greater magnitude, although progression typically slows dramatically after cessation of bone growth. While females are at significantly higher risk for development and progression of idiopathic curves, males who are at risk seem to remain so for a slightly longer time.5,6 Risk of progression in females is considered greatly reduced once a Risser’s sign of 4 is reached, while in males, risk remains until Risser’s sign of 5 is achieved. Regardless of gender, earlier age of onset
increases risk of progression by increasing the length of time between onset and skeletal maturity. Risk of progression also increases with magnitude of the curve at the time of detection. Currently, classification by curve magnitude is as follows:

- **Mild** – curves with a magnitude of 11° to 19°
- **Moderate** – curves with a magnitude of 20° to 29°
- **Severe** – curves with a magnitude of 30°+

**Presentation**
The most common presentations for idiopathic curves are listed below, in order of incidence. It is important to understand that these presentations are “typical”. Presentations other than these may in fact be idiopathic, but should alert the practitioner to a stronger possibility of a pathologic or congenital cause. Causation is not always readily determined by radiography, and different views or advanced imaging may be the prudent course of action. 6

1. **Right Thoracic curve** – extends from T4 to T11 or 12; when present it is usually primary; highly structural; severe cosmetic defect possible; when over 60°, serious risk of impaired cardiopulmonary function.

2. **Right Thoraco-lumbar curve** – extends from T6 to L3 or 4; usually a lesser degree of distortion and cardiopulmonary compromise.

3. **“Double Major”, or “S” curve** – combination of a primary thoracic curve and a secondary functional left lumbar curve; risks same as right thoracic. This pattern has a higher risk for progression than single curves.2

4. **Left Lumbar curve** – extends from T11 to L5; usually not very distorting; lumbar muscular changes; in females, may lead to difficulties in childbirth.

**Etiology**
While traditionally referred to as an “idiopathic” disorder, a clearer picture of causation is developing. Some clearly identifiable risk factors for its development appear in the literature, some widely accepted, some still questionable.2,7,8,9,10,11 It is generally accepted today that idiopathic scoliosis develops only in the presence of multiple risk factors, and that no one etiological factor leads to its development. Despite agreement that there are genetic factors associated with its development, no “scoliosis gene” has yet been identified, nor is it likely to be. Instead, genetic predisposition to various traits, both biomechanical and neurological, defines risk. Hormonal and metabolic abnormalities have been mentioned in the literature as well, but are still poorly understood. Some of the biomechanical risk factors that have been implicated include:

a) an earlier than normal growth spurt during early or pre-adolescence,

b) an unusually “slender” vertebral column,
c) decreased sagittal plane spinal curves, and
d) generalized familial ligamentous laxity.

The biomechanical risk factors are typically accompanied by developmental delays in the maturation of the nervous system. While the peripheral pathways of the postural righting system (vestibular apparatus, oculomotor system, and proprioception) were once thought to be primary, most researchers now believe the problem to be an inability of the central nervous system at the cortical level, to process sensory data from the periphery, or at the cerebellar level, to provide “appropriate output information regarding body orientation in space”.7 A common thread running through the theories regarding neurological risk factors is that there appears to be discordance between musculoskeletal growth, and the rate of maturation of the nervous system.2,7,10,11

History
In addition to standard history-taking, an attempt should be made to determine if the onset of the distortion was acute or slowly progressive. Is there a family history of scoliosis? If the patient is a child, has either the child or the parents noticed if the visible changes have worsened over time? Has there been a recent growth spurt? If a female child, has she reached menarche? Is there any associated pain? (Most childhood idiopathic scolioses are relatively painless. Pain becomes a more significant feature of adult scoliosis.)

Evaluation (See Diagnostic Algorithm) 2,12

A. Postural Assessment
- A thorough plumb line analysis from multiple views should be done for identifying asymmetries of the trunk and lower extremities. If head and trunk are not centered over gluteal fold, the scoliosis is poorly compensated, and therefore more likely to progress.
- Perform Adam’s Test, and measure the Angle of Trunk Inclination using an inclinometer or scoliometer.

B. Imaging Examination
- Radiographic studies should include standing P-A and lateral views of the spine from the base of the occiput to the sacrum, and a P-A lateral bending view, into the convexity. (Don’t assume that radiographs taken by another practitioner were taken erect.) Make sure that the P-A view of the lower spine and pelvis includes a full view of the iliac crests.
- Assess skeletal maturity via Risser’s Sign. The less mature, the greater the risk for progression.
- Assess curve magnitude via the Cobb angle.
- Assess degree of vertebral rotation.
- Assess degree of flexibility of the scoliotic curve by measuring the Cobb angle of the lateral bending view, and subtracting the result from that of the P-A erect view.

Management
The goal of a chiropractic approach to management is to be active rather than passive during the earliest days of progression. Traditional medical management usually involves a period of “watch
and wait”, to determine if a curve progresses to a point where bracing should be attempted. This typically occurs at about 25\(^{\circ}\). (Bracing is standard in pre-menarchal females with progressing curves, regardless of curve magnitude.)

Our goal is to maintain normal physiological movement of all spinal motion segments, and provide stimulation of the nervous system, encouraging sensorimotor coordination. At the same time, close monitoring of curve magnitude is done for establishing a history of progression or lack of it. Radiographic monitoring is done every three to four months. Moire topographic measurement is a less perfect option. Monitoring changes in the Angle of Trunk Inclination (ATI) had been used as a correlation to changes in curve magnitude in an attempt to reduce repetitive exposure to ionizing radiation, but is no longer considered reliable.

A major problem in determining whether chiropractic management or co-management is appropriate is that a majority of curves that are identified in their early stages, will not progress, and there is currently no reliable method for predicting what the actual risk of progression might be.

Theoretical risk can be gauged, as stated above, by assessing:

- skeletal maturity
- curve magnitude
- curve flexibility
- familial tendencies
- gender.

But the fact remains that most identified curves will not progress. Further, while there may be some reason to believe that with treatment, partial reversal of some curves may be possible, the primary goal of conservative management is to prevent progression long enough for achievement of skeletal and nervous system maturity.

Advocates of chiropractic management or co-management suggest that intervention is most appropriate during that narrow window of opportunity when there has been some history of progression, but not too much. Patients with mild to moderate curves appear to be good candidates. Patients with curves approaching 30\(^{\circ}\) present a significantly greater challenge for the conservative practitioner. Also, there appears to be a point where the pressure dynamics of gravity, acting on the curve, result in continued progression even after the cessation of musculoskeletal growth, and 30\(^{\circ}\) seems to be a benchmark for this problem. Additionally, most such curves have typically lost all flexibility by that point, and have become rigid.

The Health Center management protocol should include the following:

1. Maintenance of spinal intersegmental joint function (i.e., correction of joint dysfunction), using chiropractic manipulative therapy (CMT). High velocity low amplitude (HVLA) adjusting, in addition to maintaining spinal function, may reduce accompanying muscle pain when present, and
prevent recurrence of pain. Recognition must be given that the nature of the disorder involves the progressive loss of spinal flexibility. Care should be taken to avoid excessive thrusting into segments that have become immobile due to bone remodeling.

CMT can also be performed on spinal and extra spinal joints that are rich in proprioception, namely the upper cervical motion segments, the sacroiliac joints, and the joints of the feet. (See sensorimotor stimulation, below)

2. Mechanical curve correction, using Flexion/Distraction Technique. After de-rotating coronal plane curves, and distracting the spine in its long axis, flexion and extension of all motion segments should be performed. While very effective in relaxing intrinsic spinal musculature, this will also help to restore spinal function and stimulate proprioceptive nerve endings at each level within the curve. This protocol is taught in the 6th trimester Flexion/Distraction course, TCH6604.

3. Correction of postural imbalances.

4. Sensorimotor Stimulation, via use of therapy balls, wobble boards, balance shoes, etc. Procedures should be demonstrated to the patient in office. Observe the patient performing them. Monitor their progress, and increase levels of difficulty over time. Attempts at stimulating proprioception are designed to overcome delayed nervous system development during adolescence.

The role of home exercise in case management is relatively unclear. While unilaterally dominant exercises are generally avoided in favor of those that challenge one side of the body against the other, there appears to be no widely accepted form of exercise supported by the literature. One chiropractic author recommends the avoidance of aerobic exercise (due to its estrogen-suppressing effects), in favor of anaerobic forms. There is some evidence that aerobic exercises will improve pulmonary function in scoliotic patients. Yet, cardiopulmonary compromise is not a problem in the patient population that this protocol addresses. At this time, active home exercise programs are excluded from this protocol, although clinicians may wish to discuss options for exercise with their patients or their families.

Bracing, which has been traditionally an allopathic medical approach to management, has been found to be somewhat effective in halting the progression of idiopathic curves. In recent years, there have been attempts to market bracing as a treatment option to chiropractors. At least one such device (which is more a flexible harness than a brace) is described by its promoters as the only orthosis for idiopathic scoliosis that supports and maintains spinal function. At this time, however, bracing is not part of this clinical protocol.

Similarly, lateral electrical surface stimulation, which has not fared well in clinical trials, is excluded from this protocol.
Frequency and Duration of Care

Patients should be monitored for progression radiographically every three to four months. Clinicians should be alert for signs of rapid progression, such as progression of 10° or more within a re-evaluation period. This should result in referral, as should any curves greater than 40°. Monitoring should continue for 18 months after the cessation of skeletal growth.

Decisions as to frequency and duration of care should be made by the clinician on an individual basis, assessing the patient’s level of risk, and history of progression (or lack of it). Clinicians must also be able to fully explain to patients and their parents the natural history of progressive curves, and the risks associated with conservative care as an alternative to bracing and/or surgery.

References:

2. Souza, T., Differential Diagnosis and Management for the Chiropractor, 3rd ed., Jones and Bartlett Publishers, Sudbury, MA
11. Banks, S., Idiopathic scoliosis: Evaluation and Management in the 1990’s. (Audiocassette series); Chiroventures, LTD., Virginia Beach, VA