

Idiopathic Scoliosis: Treatment with Manual Therapy and Therapeutic Exercises

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Scoliosis is a general term for a lateral curvature of the spine, but the deformity is usually much more complex, 3 dimensional, body-wide, rotational pattern and to describe and measure it, three planar and three-dimensional terminology and measurements are required. However, for practical purposes the deformity is most conventionally measured on standing coronal plane radiographs using the Cobb technique.

Idiopathic scoliosis is a scoliosis that has no known pathological cause. Of all the scoliosis it is the most worrisome due to its potential compression of the viscera, the lungs and pericardium. The scoliosis begins normally during childhood or adolescence. Idiopathic scoliosis can appear at different ages. Infantile idiopathic scoliosis that appear from the birth to 3 years old, accounts for 0.5% of idiopathic scoliosis. Juvenile idiopathic scoliosis that appear from the 4 to 10 years old, account for 10.5% of idiopathic scoliosis. Adolescent idiopathic scoliosis that appear after the age of 10 years, account for 89% of idiopathic scoliosis. From these statistics, it seems that individuals are at highest risk of developing idiopathic scoliosis during adolescence.

Most infantile curves present in the first six months of life, the most common curves are left thoracic apex, and males are more frequently affected, whereas the most common juvenile curves are right thoracic apex and females are more frequently affected. This makes juvenile curve similar to adolescent curves. At the juvenile/adolescent interface it is almost certain that many of the younger adolescents had their curve well established during their later juvenile years. As the prognosis with juvenile presentation scoliosis is worse than it is for adolescent presentation scoliosis, inclusion of juvenile cases in adolescent series will tend to adversely affect the natural history of adolescent scoliosis. Finally, adult scoliosis occurs after maturity. Scoliosis is prevalent in 4.5% of the general population.

The scoliosis can be either thoracic, thoraco-lumbar or lumbar. Thoracic is identified by the involvement of the ribs, which produces a so-called "high-side", a phenomena in which the ribs are thrust backwards on the side of the convexity.

Untreated, idiopathic scoliosis does not increase mortality rate, but on rare occasions it can progress to the $>100^\circ$ range and cause premature death. Patients with 50° curves at maturity or 80° curves during adulthood are at increased risk of developing shortness of breath. Compared to non-scoliotic controls, most patients with untreated adolescent idiopathic scoliosis have increased pain prevalence and may or may not have increased pain severity. Self-image is often decreased. Mental health is usually not affected. Social function, including marriage and childbearing may be affected, but only at the threshold of relatively larger curves.

Etiology

Idiopathic scoliosis can probably best be considered as a complex genetic trait disorder. There is often a positive family history but the pattern of inherited susceptibility is not clear. Current information suggests that there is genetic heterogeneity. This indicates that multiple potential factors are acting either dependently or independently in its pathogenesis. Many of the proposed etiologies of idiopathic scoliosis are neurological in origin, including brain asymmetry, neural axis deformities, and central nervous

system processing errors. Additionally, many coexistent neurological alterations are present in scoliosis patients, such as visual deficiency and decreased postural stability. Therefore, the goals of the proposed treatment are not only to reduce the scoliotic curvatures, but also to rehabilitate any underlying postural and neurological weaknesses or imbalances. For a few of the patients an underlying cause can be determined, including congenital changes, secondary changes related to neuropathic or myopathic conditions, or later in life from degenerative spondylosis. However, the cause of most scoliosis is not known and since about 1922 such patients have been diagnosed as having idiopathic scoliosis.

Scoliosis has recently been associated with a lower quality of life, lower scores on the SF-36 health questionnaire, and makes patients prone to developing chronic pain more often than the general population. Therefore, reducing scoliotic curvatures, even in the absence of symptoms, seems to be a worthy outcome objective for clinical practice. This opinion is further supported by recent evidence of the deleterious effects of abnormal spinal loading. Given that the average curvature progression in idiopathic scoliosis is 7.03° per year, the traditional method of regular observation without treatment seems to be reactionary rather than corrective or preventive.

Scoliosis as a body wide pattern

Nothing occurs in isolation in the body: scoliosis is a body-wide restricted purely to the thoracic spine, even though this is where it is most visibly obvious. It is also where many traditional textbook definitions of scoliosis stop - tending to refer to scoliosis purely in terms of lateral curvature of the spine, though in the last 5 years most of the literature has started referring to it more accurately as a 3-dimensional rotary pattern in the spine. Rotations in the thoracic spine do not occur independently of the function of the rest of the trunk but are intimately related to what occurs above and below in the cervical and lumbar spines pattern.

The body wide pattern manifests in the girdles and limbs and in the axial skeleton - not just the spine but also the jaw, face, dentition, roof of the mouth and cranial vault above. The shoulder girdle is affected directly by thoracic rotations, continuing out to affect rotation in the upper limbs. Because it is a body-wide pattern, there is a need to work with the whole body, not just the spine.

Spinal rotation also affects rib shape. Thoracic shape affects the pathomechanics of the pleural viscera, and thus the potential impairment of respiratory and circulatory function makes this one of the sites of great physiological impact. The heart and lungs are the two most constant, mobile viscera in the body, both housed in the thorax, thus affecting the whole physiology of the body. Because of the need to accommodate the constant motion of these two organs, the thorax needs to be able to deform quite markedly while still providing protection for its enclosed viscera. Most movement in the body can be related to the respiratory function; indeed, many disciplines utilize this interface between breathing and movement. To work with scoliosis you need to work with the whole body, the whole broad canvas, to be truly effective.

Treatment

The three medically-sanctioned methods of scoliosis treatment - observation, bracing, and surgery - have been around for decades. A great deal of research has been done on the risks & benefits of each option. However, the general conclusion of this research suggests that a new paradigm is desperately needed as there are many conflicts and inadequacies present in the current model.

Surgery & Bracing

When surgery is used to correct adolescent idiopathic scoliosis, a spinal fusion is performed. This means that a previously mobile spinal column is partially converted into a stiff solid spine. In order to achieve correction of the scoliotic curvature, spinal instrumentation is usually placed (rods, hooks, screws, wires...). This is complex surgery and a perfect result is impossible to guarantee. Even in the best of hands suboptimal results occur and complications can develop.

Non-operative treatment consists of bracing for curves of 25° to 40° in patients with one to two years or more of growth remaining. 44 percent of bracing attempts are considered failures because they do not cease scoliosis progression. Long-term wear of back braces may lead to gradual weakening of the supportive muscles due to an effect of unloading and may therefore not be desirable. Additionally, many patients feel that bracing handicaps their lifestyles while others feel that it leaves psychological scars.

Manual and Rehabilitative Therapy in Treatment of Scoliosis

There is a number manual and rehabilitative therapy techniques that are found effective in treatment of scoliosis, especially if used in combination. Spinal manipulation alone does not appear to significantly alter spinal structure when administered as a sole treatment modality. Over-manipulating or adjusting the spine seems to create a certain amount of instability, possibly leading to further buckling of the scoliotic curvature. Therefore treatment should include the use of both manipulative and rehabilitative procedures, so that structural changes can be achieved.

Osteopathy

Osteopathy (Est. 1874, USA) is an approach to healthcare that emphasizes the role of the musculoskeletal system in health and disease. The practice of osteopathy began with the work of Andrew Taylor Still. It has been considered a form of alternative medicine, emphasizing a holistic approach and the skilled use of a range of manual and physical interventions in the prevention and treatment of disease. Osteopathic principles teach that treatment of the musculoskeletal system (bones, muscles and joints) facilitates the recuperative powers of the body. Structure and function are inter-relate, the musculo-skeletal system is capable of influencing the well-being of the body as a whole. Manipulation is the means whereby areas of dysfunction are diagnosed, appraised and treated. Even when such treatment is aimed at relieving symptoms such as a backache or stiff neck, the result will be to normalize the physiological functions by reducing spinal dysfunction.

Schroth Rotational Breathing Method

Katharina Schroth (Est. 1921, Germany) was a physiotherapist who suffered from scoliosis and devised her own treatment method using stretches and mirrors. Following her own success she opened a clinic to treat others. One particularly useful resource is the work of Katerina Schroth, a German physiotherapist active in the treatment of scoliosis since the 1920s. Her work has been continued by her daughter Kristina, also a physiotherapist, and has been described by her (Lehnert-Schroth *The Schroth Method: Three-Dimensional Treatment for Scoliosis* 2007.) While mainstream medicine and surgery was referring to scoliosis as a lateral curvature of the spine until the last 15 years, Schroth had been describing it as a 3 dimensional, body-wide, rotational pattern since the 1920s. Many of the manual

therapy treatment protocols that are effective with scoliosis are based on principles that were first expounded by her, often many years in advance of mainstream thought on scoliosis: the idea of the pelvis having a profound effect on the measurement of Cobb angle and spinal rotation; the major concept of the trunk as a series of trapezoidal blocks stacked around the spine which become asymmetrical in 3 dimensions when in dysfunction; and the concepts of 3 and 4 rotations of the axial skeleton, among others, all owe their origin to her.

Rigo-Schroth Method

Rigo-Schroth (Est. 1980's, Spain) is a modified version of the original Schroth method, created by Dr Manuel Rigo. While the exercises are still similar, the main difference is the course structure and increased therapist attention for patients.

FITS Method

Functional Independent Treatment for Scoliosis (FITS) (Est. 1990's, Poland) takes into account the dysfunctions accompanying scoliosis. Treatment consists of an individually adjusted program of exercises depending on curvature angle and following clinical examination of the patient. The FITS concept consists of two stages, firstly to eliminate the myofascial restrictions which limit a three-plane corrective movement and secondly to build a series of new corrective posture patterns in everyday activities.

PNF Technique

Proprioceptive Neuromuscular Facilitation (PNF) (Est. 1940/50's, USA) is a physical therapy procedure designed to increase range of motion, flexibility and coordination. Herman Kabat, a neurophysiologist, began to look for natural patterns of movement for rehabilitating the muscles of patients. He believed combinations of movement would be better than the traditional moving of one joint at a time. An institute was later started in Washington, DC to apply his discovery and teach the technique to other therapists.

Myofascial Release

Myofascial Release (Est. c. 1940's, USA) is a form of soft tissue therapy used to treat an impaired musculoskeletal system, accompanying pain and restriction of motion. This is accomplished by relaxing contracted muscles, increasing circulation, increasing venous and lymphatic drainage and stimulating the stretch reflex of muscles and overlying fascia. It developed from the findings of a number of medical practitioners including Dr Ida Rolf, Elizabeth Dicke and Andrew Taylor Still (father of osteopathic medicine).

The role of Myofascia:

- Transmission/lines of force
- Continuity in kinetic chains
- Neuro-myofascial web –proprioception, mechanoreception.

- containment of muscular structures
- transportation
- structural homeostasis & repair (fibrinogen)

How it can affect scoliosis:

- Asymmetrical growth or localized pinning of the structure blocks congruent development and the body is forced to react at the “pinned” block. As soft tissue, it is the fascia that responds to long-term change first, before the bone.
- Soft tissue shortening goes hand in hand with the spinal curvature; therefore straighten initially by lengthening the fascia. Unknown whether it is cause or effect but possibly irrelevant so treat anyway as it has an affect.
- Consider the curvature continuing into the neck/cervical spine and through into the cranium. Shortened sub-occipitals, TMJ dysfunction, dural changes, vestibular dysfunction – all manifestations of fascial continuity – as well as autonomic/ parasympathetic responses.

Like bone, fascia is subject to Wolff’s Law. It changes and remodels in response to the forces placed on it. Muscle fibers can contract and relax, unless in spasm. Fascia, on the other hand, can’t relax as readily and will respond to poor usage by remodeling negatively. This can be quite rapid - it doesn’t take much to change its length. However, this plasticity is also a blessing because it doesn’t take much for it to remodel positively as well.

Fascia / connective tissue can respond to the stress of chronic postural change in various ways:

1. Thickening
2. Shortening
3. Calcifying
4. Eroding

Chronic muscle shortening can easily be treated by Swedish/relaxation massage, stretch and trigger point type work. Prolonged muscle tightness or shortening if not addressed will manifest in changes in the fascia, and is beyond treatment by simple massage. This, primarily, is what we are working with in scoliosis: a long-term pattern that has led to the fascia and connective tissue being affected and subsequently remodeling (or modeling) in a less than optimal manner.

So far this has been about appendicular relationships one side to the other. From here, in the axial skeleton, osseous changes come into play. The sacrum, vertebrae and ribs can be asymmetrical in shape one side to another. This is the result of the prolonged force of soft tissue pulling on the bone. It doesn’t start out that way, but it will rapidly develop like that. Asymmetrical pulls in a juvenile body increase with the adolescent growth spurts that accompany puberty; at the same time the bone is increasing in ossification.

Over a period of time appropriate manual therapy on any connective tissue with a collagenous component (bone, ligament, tendon, various types of fascia, adipose tissue) will see the structure of the body change and adapt. This is the whole basis of Structural Integration (Rolfing©, Hellerwork©, Tom

Myers' Kinesis©, etc), myofascial release, deep tissue massage and connective tissue massage. If done with skill and intelligence, this can profoundly affect scoliosis.

Trigger Point Therapy

Trigger Point Therapy (Est. 1930's, USA) was the result of the work of American Physician Janet Travell. Trigger points have been a subject of study by a small number of doctors for several decades although this has not become part of mainstream medicine. The existence of tender areas in muscles has been recognized in medicine for many years; indeed studies have shown that around 75% of pain clinic patients have a trigger point as the sole source of their pain. However the trigger point concept remains unknown to most doctors and is not generally taught in medical school curricula.

Orthopedic Medicine

Orthopaedic Medicine (Est. 1929, UK) is the examination, diagnosis and treatment of non-surgical lesions of the musculoskeletal system. Dr James Cyriax observed a number of patients where the diagnosis was vague and the treatment non-specific. There appeared to be no satisfactory method for testing the function of soft tissues to achieve a clinical diagnosis. He developed a system of assessment aiming to accurately diagnose lesions of the musculoskeletal system and a non-surgical method of treatment for soft tissue lesions.

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