Dynamic Chiropractic

MUSCULOSKELETAL PAIN

Scoliosis and Chiropractic

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Scoliosis, as defined by Hippocrates, is an abnormal curvature of the spine. The usual medical interpretation is a sideways bending of the spine greater than 10 degrees, accompanied by vertebral rotation. Kyphosis, or "humpback," is a form of scoliosis. According to Renee Callet, MD, of the University of Southern California, scoliosis is nine times more common in females than in males. The Scoliosis Research Society (SRS) is a group of orthopedic surgeons that performs the majority of scoliosis surgeries. According to the SRS, two percent to four percent of the entire population has scoliosis of varying degrees, but only 10 percent of that number requires medical intervention. They further state that curves of 11-20 degrees should be watched for progression, and that if the curve progresses, some form of action can then be taken. If the curve is 21-40 degrees, bracing is recommended. (The current medically used braces were never designed or currently designed for correction, but only to maintain.) For curves greater than 40 degrees, surgery is usually recommended.

Using the SRS figures and those obtained from *American Family Physician*, July 2001, curves greater than 30 degrees occur in 0.2 percent of the population, and curves greater than 40 degrees occur in 0.1 percent. *Clinical Orthopedia of North America*, 1999, stated that in all cases, females have a 10 times greater risk of curve progression. According to the *Journal of the American Medical Association (JAMA)*, 1993, 19 percent of adult females with curves greater than 40 degrees have psychological illnesses, social isolation, limited job opportunities and lower marriage rates. An article in *Lancet*, 1994, stated that a child of parents who both have scoliosis has a 50 times greater risk of developing scoliosis than the general population.

School screenings for scoliosis is a controversial subject. In 1993, the U.S. Preventative Services Task Force came out in opposition to screening, due to the increased numbers of small curvatures and false positives that led to increased medical intervention costs. Thus, the main issues were the cost involved of school personnel doing each screening, and the related follow-up of the medical community to verify or deny the presence of a treatable scoliosis. The American Academy of Orthopedic Surgeons (AAOS) and the SRS recommend screening girls only at ages 11 and 13, and boys only once - at 13 or 14 years of age. The screening procedures currently in use nationwide usually detect a curve greater than 20 degrees, as that is the amount of curvature that causes the "rib-hump" to show.

The current medical approach to scoliosis is to react to symptoms of curve progression, not to prevent potential progression. It is mainly a "wait and see" attitude - yes, you have it, but we'll just watch it for a while and when it starts to get worse, we'll do something!" However, according to the *Journal of American Family Physicians*, 1999, underarm thorocolumbar sacral orthosis (TLSO) braces have a 74 percent success rate in slowing curve progression.

According to the AAOS figures, almost all cases of juvenile scoliosis (in children ages 3-10) progress. This group accounts for 15 percent of the scoliosis cases. Fifty percent of the cases progress to a point of surgical intervention. Adolescence scoliosis (in children older than age 10) comprises 80 percent of scoliosis in children, and 5 percent to 25 percent of these cases progress. The AAOS further states that if the curve is greater than 20 degrees at 10-12 years of age, there is a 68 percent chance it will progress. The AOS also concurs that even after bone maturity, especially in curves greater than 30 degrees, some progression occurs.

To understand the correction process of scoliosis, one must understand kinematics. A vertebra in motion has three axis of motion and may translate or rotate about any of the three. Until recent years, for clinical and experimental purposes, the motion has been measured in only two dimensions. This is explained fully in *Clinical Biomechanics of the Spine*.[1] In my correction procedures, I address all of these motions.

I have discovered a brace and treatment protocol that stops the curvatures, and has been shown to reduce the curves by an average of 45 percent in all age groups. Patients have been out of the bracing program for more than six years without losing any of their attained corrections. The basis for this form of treatment is noted in *Clinical Biomechanics of the Spine*. Referenced materials in that text substantiate that bone can remodel and be changed. This is explained in the following laws of physics of the human body:

Wolff's Law

Bone is rebuilt more if there are stresses on the bone, less if there are not. - *Wolff's law (1892)*

"Use it or lose it" is the modern version of this physiologic principle, which states that soft tissue and bone heal according to the manner in which they are stressed. Healing tissue responds to stress by reacting along the lines of the given stress. For optimum healing, tissue must be stressed gradually to accept a given force.[2] The relationship between the mass and form of a bone to the forces applied to it was appreciated by Galileo,[3] who is credited with being the first to understand the balance of forces in beam bending and with applying this understanding to the mechanical analysis of bone. Julius Wolff[4] published his seminal 1892 monograph on bone remodeling - the observation that bone is reshaped in response to the forces acting on it. This observation of fact became known as Wolff's law. For centuries, the scientific equipment did not exist to prove that this bone remodeling applied to adults as well as children. The medical community inappropriately applied the physics of the law to children only, as it was believed that bone modeling stopped when a person reached skeletal maturation. However, since 1990, medical evidence does exist to extend this law to adults as well. So, if the medical community accepts bracing for children, it should also accept bracing for adults - the physiologic principles are the same. The following is a brief overview of how this occurs:

Bone Remodeling

Bone remodeling is a dynamic, continuous process of formation by osteoblasts, which build new bone tissue and resorption by osteoclasts, which break down and destroy bone tissue. Bone cells are composed of these osteoclasts, which leave tunnels when the bone tissue is destroyed, and these osteoblasts deposit new bone tissue in these tunnels, thus forming what is called osteons. These osteons contain their own central blood vessel that supplies nutrients to the rebuilding bone. After the osteoblasts have deposited new bone tissue, they are termed "osteocytes," which continue to maintain the bone. This process should result in an approximate steady state during health in the first half of adult life. In later adult life, bone resorption may predominate slightly, leading to a gradual diminution in bone mass and strength. Ten percent of your bone is remodeling now. In the elderly, remodeling continues slower and less bone may regrow - thus, osteoporosis.[5] This bone remodeling is a very powerful force in the body. As an example, medical studies from 1976 have proven that after complete removal of a particular-shaped bone and its replacement with a graft consisting of a completely different bone, the graft becomes remodeled to resemble the original bone.[6] This is a powerful example of how dynamic the body is, especially when the conditions exist for the changes to occur. Other examples are bone loss in astronauts or in immobilized patients, and more bone growth in stressed regions (when a nearby bone is lost, or during fracture repair). Many relevant observations regarding the phenomenology of bone remodeling have been compiled and analyzed by Frost.[7,8] Salient points are as follows:

1. Remodeling is triggered not by principal stress, but by "flexure."
2. Repetitive dynamic loads on bone trigger remodeling; static loads do not.

It's easy to see how this dynamic bone remodeling applies to the vertebrae of the spine - maintain equal pressures on both sides of the vertebrae during motion, and they will model into their normal shape.

The very broad variety of experimental variables that have resulted in a "scoliotic" deformity suggests that maintenance of a normal spine is dependent upon a delicately balanced, easily disrupted equilibrium. Attempts to compensate for or re-establish that delicate balance are sometimes successful and sometimes not. The type, degree, extent and duration of the imbalance also influence the probability of return to a normal or new balance, either spontaneously or as a result of some intervention (*Clinical Biomechanics*, p. 133).

In my bracing concept, I utilize the above information as a basis to effect corrections. We must also remember the concepts of creep and relaxation. This phenomenon is due to the viscoelastic properties of the muscles, ligaments and bones. Creep is the deformation that follows the initial loading of a material and that occurs as a function of time without further increase in the load. When force is applied to correct spinal deformity, and the force continues to work after initial correction, the subsequent correction that occurs over a period of time as a result of the same load is due to creep. Chiropractic care adds mobility to the vertebral segments and the dynamic force vectors in the brace address this issue, thus allowing for more correction.

No single treatment protocol has shown the ability to stand alone in its purported correction of scoliosis. The use of an orthotic appliance is only one area to be considered. We must also consider the neurological aspects. There has been considerable interest in a variety of neurophysiologic abnormalities associated with scoliosis. Pincott and Tafts[9] stated that in scoliotic cases, there is damage on the convex side of the spinal cord, particularly in the posterior horn and posterior central gray matter (Clark's column). Asymmetrical weakness of the paraspinal muscles can be due to a loss of proprioceptive innervation. Yamada, et al.,[10] emphasized that virtually any disruption of the postural reflex system can result in scoliosis. The imbalance may be in the afferent system, either primarily or secondarily. The authors also indicated that there is clinical and experimental evidence that brain stem dysfunction may contribute to the etiology of scoliosis. These studies show that subtle muscle imbalance can create scoliosis, as can disruption of postural reflexes.

Another study by Yamada and colleagues[11] found that of 100 patients with scoliosis, 99 had abnormal equilibrium. This malfunction increased with the severity of the scoliotic curve. The dysfunction was noted in the proprioceptive and optic reflex systems. I test and document the postural reflex abnormalities by use of a surface EMG of the paraspinal muscles. I treat the paraspinal weaknesses with active exercises while patients are braced, and electrical stimulation of the muscles in the proposed corrected positions. This approach is supported by Schultz and colleagues,[12] who stated that trunk muscle stimulation can be expected to effect substantial changes in spine configuration. This was thought possible even with contractions of modest intensity. This is further supported by Brown and associates.[13] They concluded that the electrical stimulation was a viable alternative to orthotic treatment. They used surface stimulation and reported success in the treatment of single and double curves. Overall success was 84% in single curves and 83% in double curves. If only compliant patients are considered, the success rate goes up to 97% and 93%, respectively. Nerubay and associates[14] showed a statistically significant increase in osteoblastic activity with bone formation in the use of electrical stimulation. This is significant information when electrical stimulation is used in conjunction with a properly fitted TLSO.

I reinforce the optic/proprioceptive reflex using a stair stepper - with the patient in the brace. The patient utilizes the stepper, with no balance-assisted handrails, while concentrating on perfectly vertical lines on the wall in front of them, thus creating a new blueprint in the brain. In other words, the brain remembers where the new body is in space, rather than remembering where it was when it was uncorrected. Again, one treatment phase does not work independently, but is effective when used with other supporting methods.

At no time do any references referred to in *Clinical Biomechanics of the Spine* ever state that at a certain age range, all repair activity stops; yet, for some unknown reason, that is the accepted theory - growing children may be helped, but bone-matured adults can't be. This theory is supported by the studies reported by the AMA in which geriatrics patients age 80 and older increased bone mass 4 percent with the use of weight-bearing exercises.

I suggest that since 68 percent of the curves progress, according to the above figures, it is best to treat as soon as the curves are detected, rather than wait until they start getting worse. Conservative treatment at a lesser curvature is far more favorable and less costly than surgical care at greater curvatures. Figures from the National Scoliosis Foundation list the cost of a scoliosis surgery at $100,000. I feel that it is preferable to lean to the side of caution and stop any progression at earlier ages and lower degrees of curvature, and in fact effect some correction to the curvatures. None of the existing surgical techniques reduces the curves or the rotation of the vertebra that causes the "rib-hump" significantly, without removing parts of the ribs also. My stand is, "Why wait?? The more the curve progresses, the less overall correction can be obtained."

Summation

It is obvious that proper bracing is effective, and nothing has been found in the medical literature that proves that there is an age restriction on bone remodeling. The primary purposes of bracing are to stop the curve-forming pressures on the vertebrae and reverse and correct any existing vertebral deformity caused by the curvature pressures before treatment began.

The physiologic conditions do exist for both adult and child bracing to be effective. Increased pressures dynamically applied to the open-wedge side of a vertebra will cause it to remodel.

References

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