DOC TALK

CASE STUDY - A Functional Approach to Treatment of Scoliosis

Author: George K. Petruska, DC, DACRB

ABSTRACT

Patients that present with idiopathic scoliosis usually have a combination of four areas of deficit. The areas of deficits are usually histologic, structural, endocrine and neurological. There are usually complaints of associated neck, upper thoracic and lower back pain as well as muscle imbalances. The presentation includes abnormally shaped vertebrae, increased growth hormone secretion, muscle imbalances including strength and neurologic deficits. The research indicates that for idiopathic scoliosis to occur, all four components must be present to some degree. The originating mechanism is usually genetic and therefore difficult to resolve; however, positive functional outcomes are possible based on a variety of factors. Age and curvature are important predictors when determining the potential for a positive outcome from treatment. The younger the patient and the greater the curve, the more likely the condition will progress negatively if untreated. With appropriate treatment, the potential for positive change is generally good.

There are a number of traditional approaches for treating idiopathic scoliosis. Allopathic approaches include surgery, braces, and muscle stimulation. The outcomes gained by these treatment approaches vary little from one treatment protocol to another. Progressive curves greater than twenty five degrees usually require surgery. Conservative approaches for less severe conditions can be more effective than typical allopathic approaches where a functionally oriented treatment program is selected.

A functional approach to the treatment of scoliosis is proving to be a highly effective form of treatment. The success of such programs are based on how well they address the following key condition components:

Histologic: Strengthening type I and type II fibers with exercise will result in increased histologic balance.

Neurologic: The neurologic component of this condition is addressed with endurance and strength training along with core and postural stabilization. The outcome of this component of the treatment will improve muscle balance resulting in improved proprioception.

Musculoskeletal/Structural: Manipulation and muscle stimulation will improve the biomechanics or structural component.

Endocrine: The endocrine component, usually evidenced by increased growth hormones, can be addressed with nutritional and dietary counseling as well as through facilitation of increased muscle development to counteract the abnormal growth patterns that are usually associated with this condition.

Considering each of these components as part of an intensive program of in-office rehabilitation is required for successful outcomes. In the case example that follows, the patient initially began a phase II rehabilitation program and eventually transitioned into a phase III rehabilitation program. During Phase II and III of the rehabilitation program manipulation was utilized to address noted joint dysfunction as necessary. The treatment provided in this case proved effective in providing a long-term resolution of the postural deficits, and improved the patient's capacity for occupational, recreational, social and daily activities.

KEY WORDS

Idiopathic and Functional Scoliosis, histologic, structural, endocrine, neurologic, Phase II & III Rehabilitation, Chiropractic, Low Tech, Outcome Assessment.

INTRODUCTION

Idiopathic scoliosis can be hereditary or have a functional (acquired) onset. In cases of idiopathic origin, thirty three percent of parents or siblings of patients with idiopathic scoliosis have curves greater then ten degrees. Scoliosis usually occurs in females at a four to one ratio as compared to males. If both parents have scoliosis the risk is increased fifty times for their children.

Scoliosis is a three dimensional deformity. Scoliosis has lateral curvature resulting in a coronal component, rotational curvature resulting in an axis component and a decreased sagittal plane or sagittal component. There are four areas of deficit present in patients that present with idiopathic scoliosis. These areas of deficit are histological, structural, endocrine and neurological.

Histologic:
The histological component involves increased type I fibers on the convex side. These changes are consistent with muscle hypertrophy and are considered adaptive. Hence the treatment program should promote muscle balance on each side of the curve. The pattern of the muscle in patients with scoliosis appears to be one that is attempting to resist or reduce the curve. The rehabilitation program should therefore facilitate the body's natural mechanism in this regard.

Structural:
The structural component involves abnormal shaped vertebrae facilitated by abnormal growth patterns. Females usually have a more slender spine that matures at a much greater pace as compared to men resulting in the four to one disposition to scoliosis. A treatment approach oriented toward promotion of structural change would be beneficial. Such treatment would involve manipulation, electric stimulation, core and postural stabilization, strength and endurance training.

Endocrine:
The endocrine component is evidenced by increased growth hormone levels. The patient may also have amenhorrea. The treatment approach for this component would involve nutritional and dietary counseling as well as a focus on endurance rather than aerobic training. Research shows that these patients generally have decreased bone mineral content. Increasing calcium intake would then be a consideration.

Neurologic:
Scoliotics generally have poor proprioception. Research indicates that poor proprioception generally precedes development of the curvature. On this basis, the treatment program should be oriented toward increasing proprioception through activation or strengthening of core and postural stabilizers. Scoliotics also generally have abnormal breathing patterns. Correcting the breathing pattern would help the neurological and musculoskeletal component.

Patient activation and rehabilitation concepts of treatment are key components in the emerging quality care paradigm. In order to provide comprehensive neuromusculoskeletal care, the healthcare practitioner must know when to manipulate and when to move from passive to active care. Passive modalities, such as thermal or electrical physical agents that are applied for pain relief or to reduce inflammation, while appropriate for treatment of injuries, have a limited role in the management of chronic musculoskeletal disorders. There is a definite tendency to overemphasize the promotion of tissue healing and reduction of inflammation for symptomatic benefit. This generally results in an overemphasis on passive modalities beyond the early stages of acute care. The danger of the injury/inflammation model is that it promotes overuse of physical agents and results in the physical and psychological deconditioning that leads to chronicity. As idiopathic scoliosis is a developmental disorder, passive forms of therapy generally provide on palliative relief of the secondary symptoms

associated with this condition and offer little in the way of long term resolution or improvement to the underlying primary condition.

The primary focus of functional restoration opposes the application of an injury/inflammation model. The active care model embraces emerging rehabilitation standards. Functional restoration addresses improper motor control (spinal instability), joint dysfunction and muscle dysfunction. Such rehabilitation focuses on the entire locomotor system. Its focus is to restore function in the locomotor system using a multifaceted approach involving dynamic therapeutic activities, education and manipulation. It is recognized however, that most patients do not seek this type of treatment for their condition.[1] Instead, they seek treatment of their symptoms and often depend on ineffective measures. Even after a certain age when scoliosis curvature becomes arrested, the biomechanics can still deteriorate resulting in the need for radical medical intervention. In those cases where this is not yet necessary, decreased strength, muscles imbalances, abnormal posture, poor endurance and lack of flexibility are implicated in the development of the condition.[3] This suggests that a comprehensive rehabilitative program including exercise for flexibility, trunk strength, endurance, and stability can significantly reduce the risk of functional loss.[4]

Obviously, the sooner scoliosis is diagnosed and the sooner active care is implemented, the greater the chance for a favorable outcome. Current research shows that it is beneficial to proceed to a rehabilitative phase of care as rapidly as possible, and to minimize dependency upon passive forms of treatment. Prolonged periods of inactivity are related to increased risk of failure. This may be why some patients that go through bracing protocols eventually need surgery. Studies indicate that low-tech rehabilitation protocols produced significant improvements with the longest periods of relief. It is a more cost effective approach to management of this condition.

The following case study demonstrates the value of early activation and transition from Phase II to Phase III rehabilitation. It further demonstrates the necessity of functional evaluation so as to determine the appropriate protocol of rehabilitative treatment. Finally, it demonstrates the achievability of the long-term functional outcomes that are demanded by patients and carriers alike.

LUMBAR SCOLIOSIS
Clinical Presentation: Chronic neck and back pain, postural defects, poor gait and diminished capacity for functional activity.

Areas of deficit: Histologic, Structural, Endocrine or Neurological.

Histologic

Tight, overactive muscles on the convex side.

Inhibited or weak muscles on the opposite side.

Structural

Abnormally shaped vertebra

Evidence of Rapid growth of vertebra

Ectomorphic body type

Endocrine

Increase growth hormone

Decreased Estrogen

Neurological

Decreased proprioception

Lack of Neuromuscular coordination.

Outcome Assessment Forms

General Health, Roland Morris, Oswestry Back, VAS, Pain Drawing,

Functional Testing

Postural Analysis

Proprioception

Muscle

FINDINGS

High hip and shoulder on concave side

Diminished proprioception on both sides, worse on the involved side, especially with the eyes closed.

Tight Piriformis, Quadratus Lumborum and TFL

Weak Rectus Abdominus

Weak/inhibited spinal stabilizers (Mutifdus)

Weak/Inhibited gluteus medius

Joint Dysfunctional, multiple levels (C/T/L Spine)

Abnormal breathing patterns. (Shallow breathing)

DIAGNOSIS

Primary:

Idiopathic Scoliosis

Muscle Weakness/Disuse Atrophy

Muscular Incoordination

C/T/L Joint Dysfunction

Secondary:

Abnormal Posture

Abnormal Gait

Neck, Mid-back and Low Back Pain

Rehabilitation Concepts
*SAID principal
*Sherrington's Law of reciprocal inhibition.
*Neuromuscular Crossover Effect

GOALS
*Activate/Increase strength of Multifidus, Rectus Abdominus, Gluteus Medius

*Stretch Tight Muscles: TFL, Quadratus Lumborum, Piriformis

*Increase proprioception and neuromuscular coordination.

*Correct Spinal Biomechanics

TREATMENT PRESCRIPTION

1. 2 minutes each on the Round board, Rocker board and Baps board initially with eyes open progressing to 2 minutes eyes open and 2 minutes eyes closed. Initially using small foot transitioning to standard foot.

The primary focus of this treatment is the strengthening of spinal stabilizers in the weight bearing position. When the spine is bearing weight it is part of a closed kinetic chain. This is the manner in which we use the joints and connective tissue of the spine during most daily and sports activities, and it requires the co-contraction of accessory and stabilizing muscles. Weaker or injured muscles can be quickly strengthened with the additional use of isotonic resistance to stimulate increases in strength. Isotonic resistance can come from a machine, from weights, from elastic tubing, or just using the weight of the body.

2. Teach ***correct breathing patterns*** beginning from the lower abdomen ending in the upper chest. (Correct breathing patterns activate spinal stabilizers)

3. Use **PIR, PNF or Flex Building** muscle energy technique to stretch and strength TFL, Quadratus Lumborum, Gluteus Medius and Piriformis

4. Gluteal muscles, Spinal Stabilizers and the Rectus Abdominus will activate and strength from **Balance Board** work. The balance board work should be enhanced by using thera-bands to strength the involved muscles.

5. **Gym Ball** protocols should be added to strengthen the spinal stabilizers, Gluteals and abdominal muscles. Sitting on a ball with one leg in the air at 90 degrees for two minutes, then extended for two minutes, followed by the opposite leg. The patient should then perform 3 sets of twelve of abdominal crunches in all three position encompassing the upper, middle and lower abdominal muscles. Once this can be performed the obliques should be added by touching the elbow to the opposite knee.

6. Once the patient's progress reaches a plateau from the above prescription, new more neurologically challenging procedures should be added such as two-handed **Otis Ring** work in the transverse and horizontal planes. The patient should perform two minutes each with all three size rings. The patient should then transition to both clockwise and counter clockwise performance with all three rings in the transverse and horizontal planes for two minutes each. The next transition is to single-handed performance in both planes, with all three rings in both directions for two minutes each.

7. The next progression is to add **Body Blade** exercise in the X,Y & Z planes with both hands for two minutes each. Once the patient can successfully perform this exercise comfortably, the patient should transition to single hand protocols in all three planes for two minutes.

8. The final progression is to perform the single handed Otis Ring and Body Blade exercises while balancing on a balance board.

9. Manipulation should be performed on a PRN basis to address joint dysfunction throughout care. It is expected that the need for manipulation will diminish as the patient progresses through the rehabilitative program.

10. Electric Muscle Stimulation (surged) should be applied for the first several weeks to assist with the reduction of the scoliosis.

11. The home care should engage the patient in the participation of unskilled activities that will support the therapeutic effect of in-office care. Basic stretching exercises that can be safely performed without supervision will assist with the effectiveness of in-office care. Diet and nutritional recommendations should also be followed to improve the effectiveness of the in-office program.

12. The patient should be re-evaluated when significant progress occurs justifying a change in the treatment (progression). Noted objective problems should be formally re-evaluated at a maximum of 30 day intervals for progress. When the patient reaches a functional plateau, scheduled treatment should be discontinued and care should either be withdrawn or the patient should be offered a maintenance care program that would include scheduled in-office care (at the patient's expense given that maintenance care is generally not covered) as well as a more aggressive home exercise program involving the use of balance board and gym ball exercises as well as participation in skilled recreational/exercise activities.

The example and analysis above is related to the evaluation and treatment of idiopathic scoliosis; however, it should be noted that the evaluation, diagnosis and treatment of functional scoliosis would be the similar. The key difference in evaluating functional vs. idiopathic scoliosis is that during evaluation, the examiner will note that with a functional (acquired) scoliosis, the curve will straighten with forward bending and that the imbalances are generally one sided (overactive and tight on one side, inhibited and weak on the other).

From a treatment perspective, the only difference is that the patient with a functional scoliosis will generally benefit from aerobic conditioning.

CONCLUSION

The allopathic model of treatment for the patient with scoliosis has shown limited success rates and offers little hope for a favorable outcome. A low-tech rehabilitation program concentrating on proprioception training, restoration of muscle balance, endurance, joint stability and functional strength offers a more cost effective and more viable treatment option. The success of this treatment and the outcome achieved was objectively evaluated and documented using "Functional Evaluation" and "Outcomes Assessment" forms completed on initiation of care, during the progression of treatment at 30-day intervals and upon discharge. The case presented above demonstrated the viability of functional assessment for development of a treatment program aimed at improving the functional performance capacity of the scoliotic patient. This approach, while involving more aggressive treatment in the short term, is more cost effective and in this case provided high patient satisfaction with less risk than allopathic alternatives. As such, it should be considered a valuable approach in today's outcome focused healthcare environment.

REFERENCES

1. Cassidy J D, Research Associate, Department of Orthopedics, University Hospital, University of Sockatchervan. An overview of the problem of low back pain D.C. Tracts1989; 1:345-356.

2. Meade T W, Dyers S, Browne W, Townsend J, Frank A 0.Low back pain of mechanical origin: randomized comparison of chiropractic and hospital outpatient treatment. British Medical journal 1590; 256:1431-1437.

3.Deyo R A, Tsui-WI YJ. Descriptive Epidemiology of low back pain and its related medical care in the United States. Spine 1587; 12:246-268.

4.Gilbert Jr, et al. Clinical trial of common treatments for low back pain in family practice, British Medical Journal 1585; 291:791-754.

5.Cherkin D C, Mackornack F A, Berg A 0. Managing low back pain - a comparison of the beliefs and behaviors of family physicians and chiropractors. Western Journal of Medicine 1388; 149:475-480.

6.Biering-Soiensen F. Physical measurements as risk indicators for low back trouble over a one-year period. Spine 1589; 9:106.
7.Mayer T G, Gatechel R J, Kishino N, et al. Objective assessment of spine functioning following industrial injury; a prospective study with comparison group and one-year follow-up. Spine 1985; 10:482-453.
8.. Sanwan K 5. Myofascial pain syndromes; their mechanism diagnosis of treatment. Manipulative Physical Therapy 1981; 4:237-242
9. K D Christensen. Rehabilitation guidelines for chiropractic. Chiropractic Rehabilitation Association 1992; I(edition):3-4.
10. Mayer T G, Smith, Keeley J. Mooney V. Quantification of lumbar function; part II: sagittal plan trunk strength in chronic low back pain patients. Spine 1985; 10:765-772.
11. Beimborn D S, Morrisey M C. A review of the literature related too trunk muscle performance. Spine 1988; 13:655660.
12. Smidt G L, blonpied, White R W. Exploration of mechanical and electromyograhic responses of trunk muscles to high intensity resistive exercise. Spine 1989; 14:815-830.
13. Jinkins J R, Whittemore A R, Bradley W G. The anatomic basis of vertebrogenic pain and the autonomic syndrome associated with lumbar disc extrusion. American Journal of Neuroradiology 1989; 152:1277-1289.
14. Hiering-Sorensen F. Physical measurements as risk indicator for low back trouble over a one-year period. Spine 1989; 9:106.
15. Hochschuler S Rehabilitation of the Spine: science and practice St. Louis MI Mosby 1993
16. Liebenson C. Rehabilitation of the spine: a practitioner's manual. Baltimore: Williams & Wilkins, 1995.
17. Studde D. Spinal Rehabilitation Stamford, Conn. Appleton & Lange 1999
18. 1996 peer reviewed journal publication "Physiotherapy-Rehab Guidelines for the Chiropractic Profession" from the Council on Physiological Therapeutics and Rehabilitation authored by Dr. K.D. Christensen, D.C., C.C.S.P., D.A.C.R.B.
19. Richardson J Clinical Orthopedic Physical Therapy Philadelphia, Pa Saunders 1994
20. Pettibon B Spinal Biomechanics Tacoma, WA Pettibon Biomechanics Institute Inc. 1989
21. Jaskoviak PJ, Schafer RC. Applied physiotherapy: microcurrent therapy. J Chiropr 1993; 381-400.
24. Andrews Physical Rehabilitation of the Injured Athlete Philadelphia, Pa Suanders 1991
25. Magee D. Orthopedic Physical Assessment:second edition Philadelphia, Pa Saunders 1992
26. Christensen KD. Chiropractic rehabilitation: protocols, vol. 1. Ridgefield, WA: Chiropractic Rehabilitation Association, 1991.
27. Williams MH. Beyond Training Champaign, Ill Leisure Press 1989
28. Christensen KD. Clinical biomechanics. Roanoke, VA: Foot Levelers, Inc. 1984:171-268.
29. Christensen KD. Clinical chiropractic orthopedics. Roanoke, VA: Foot Levelers, Inc. 1984:171-268.
30 . Hellerbrandt FA, Krikorvian AM. Cross education. J Appl Phys 1950;2.-446-452.
31. Yeomans S. Clinical application of outcome assessment. Stamford, Conn. Appelton & Lange 2000
32. Benardi D. A systematic Approach to therapeutic exercise: rehab rings Salt Lake City, UT J-Tech 1998
33. Hymanson, Inc. Body Blade Playa Del Rey, CA. 1991