Stretching Versus Mechanical Traction of the Spine in Treatment of Idiopathic Scoliosis

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Abstract. [Purpose] Traction-based therapies are non-invasive and probably cost-effective and have received interest recently. This study was conducted to compare two training programs, traction and stretching exercises, in rehabilitation of moderate scoliotic patients. [Subjects] Forty patients who were 15 to 25 years of age and had moderate scoliosis (Cobb’s angle of 20 to 40 degrees) were randomized to either a stretching exercises group (n=20) or mechanical traction group (n=20). [Methods] All the patients were informed about the testing and training procedure and were allocated randomly into two groups. Both the groups received a common physical therapy program of 3 sessions a week for 3 months. In addition, the stretching exercises group received stretching of muscles on the concave side with postural instructions for activities of daily living. The mechanical traction group received mechanical traction of the lumbar spine with postural instructions for activities of daily living. The outcome measures used were anteroposterior view of loading X-ray to detect any change in the Cobb’s angle of the lower spine, tape measurement to detect forward flexion of the trunk by using fingertip-to-floor test (FFT), and the visual analogue scale (VAS) for pain measurement. [Results] There was more significant improvement of the Cobb’s angle in the stretching exercises group than in the mechanical traction group. There was no significant difference in VAS and FFT values between the groups. [Conclusion] Stretching exercises led to significant improvement in the Cobb’s angle and resulted in improvement of scoliotic curves in moderate scoliotic patients.

Key words: Stretching exercises, Idiopathic scoliosis, Spinal deformity

INTRODUCTION

Idiopathic scoliosis is a multifactorial, three-dimensional deformity of the spine and trunk that can appear and sometimes progress during any rapid growth period in apparently healthy children1. Adolescent idiopathic scoliosis (AIS) is the most common form and affects children. Although its ultimate cause is unknown, there is evidence to support that there are two types of pathogenic factors called initiating factors and progression factors for AIS2. There is consensus that curve progression involves a mechanical process called torsion with eccentric loading of the spine and vertebral growth modulation (vicious cycle model)3.

AIS is defined by the Scoliosis Research Society as scoliosis whose onset occurs after ten years of age and whose cause is essentially unknown. It is a relatively common condition among adolescents. AIS has been described as having a prevalence of about 0.35 to 13%, depending on the defined Cobb’s angles, screening age and sex. Idiopathic scoliosis is estimated to affect about 2–3% of 10–16-year-old adolescent females. The prevalence rate is slightly higher in girls, and it more rapidly increases with age4, 5. Scoliosis is a spinal deformity characterized as a lateral curvature of the spine greater than 10°, as measured by the Cobb method on standing upright spine radiographs. While most cases of scoliosis are classified as idiopathic, a minority of scoliosis cases are traced to structural anomalies, such as wedged vertebral or abnormal soft tissue development. In addition to lateral curvature, scoliosis is also recognized in the sagittal plane. Although a distinct cause is unknown, it is postulated to arise from an injury to the vertebral growth plate during the adolescent period, causing cessation of further development6, 7.

Curve progression is related to both changes in the morphology of the spine and the trunk, as well as changes in the geometry of the spine8. Curves that affect both the upper and lower spine are called double major curves–S-shaped curves. Single curves are C shaped. In some cases, a curve in the lower spine may be compensatory (the body’s way of balancing the curve in the upper spine) rather than structural9, 10. A structural curve of the upper spine with a compensatory curve of the lower spine is not considered a double curve11, 12.

It has been recognized that low back pain (LBP) is a common condition, with a high rate of occurrence not only in adults, but also in children and adolescents. However, there have been a few studies regarding the details of back pain in adolescents with idiopathic scoliosis, with regard to the prevalence, severity, and location of back pain. Some studies have indicated that the prevalence of back pain in...
adolescents with idiopathic scoliosis is similar to that of the general adolescent population, while other studies have concluded that adolescents with scoliosis experience more back pain than their peers.

The Cobb angle is the angle formed at the intersection of these lines or the angle formed at the intersection of lines perpendicular to these lines (lines are drawn tangential to the superior endplate of the superior end vertebra and the inferior endplate of the inferior vertebra). A Cobb angle of at least 10° is essential for diagnosing scoliosis. The Cobb technique uses the position of the spinous process for assessing the degree of vertebral rotation. The vertebra is divided into 6 equal segments by drawing 5 vertical lines. The spinous process is normally situated in the middle part of the vertebra overlying the third line. With increasing rotation, the spinous process is rotated toward the convex side of the curve and is the most reliable method of measuring Cobb’s angle.

Scoliosis rehabilitation including physiotherapy methods and bracing can alter the natural evolution of this condition. The importance of multidisciplinary teamwork in scoliosis rehabilitation has been recently pointed out, and physiotherapists are an essential part of such a team. As part of the rehabilitation team, the role of the physiotherapist is to teach the patient to correctly perform specific exercises and to inform and educate the patient and patient’s family about activities of daily living.

Traction-based therapies are non-invasive and probably cost-effective and have received interest recently. For example, studies that have been reported that lacked a randomized comparison group, had a retrospective design, had sample that were small, studied heterogeneous patient groups or had authors who were commercially related to the evaluated therapy. Moreover, there is still controversy within this particular field because various different traction techniques and corresponding protocols exists.

The aim of the current study was to compare stretching exercises and mechanical traction in treatment of idiopathic scoliosis.

SUBJECTS AND METHODS

Subjects

Forty female volunteer patients with idiopathic scoliosis (Cobb’s angle ranged from 20 to 40 degrees) from 15 to 25 years were included in this study. The subjects were recruited from outpatient orthopedic departments of Cairo university hospitals. Patients with moderate idiopathic scoliosis suffering from pain and limitations of trunk forward flexion and ADL were included.

Methods

All the patients were evaluated by a therapist. After eligibility for this study was established and approval from an ethics committee was obtained, the subjects were randomly assigned to the stretching exercises or manual traction group.

All the patients participated in 3 sessions per week for three months.

The stretching exercises group had a mean age of 18.21±2.34 years and followed a physical therapy program of exercises, which included the following:

1) Strengthening exercises for the muscles of the convex side by instructing the patients to get into a side-lying position on the concave side and raise their upper trunk up as much as possible (10 repetitions with 3 sets, 6 seconds rest between each repetition, and 1 minute rest between the sets; the resistance progressed according to repetitions).

2) Abdominal strengthening exercises from the crock lying position in which the patient was asked to touch their knees with their hands (10 repetitions with 3 sets, 6 seconds rest between each repetition, and 1 minute rest between the sets; the resistance progressed according to repetitions).

3) Stretching of back muscles from the crock lying position in which the therapist moved both lower limbs toward the chest (5 repetitions, 30 seconds in position of stretching, 30 seconds in position of relaxation).

4) Stretching of concave side tight muscles in a side lying position on the convex side and upper trunk at the edge of the bed (5 repetitions, 30 seconds in position of stretching, 30 seconds in position of relaxation). Postural instructions for ADL were also given.

The program was carried out in 3 sessions per week for three months and was supervised by the same physical therapist.

The mechanical traction group had a mean age of 17.88±2.39 years and received a physical therapy program consisting of the following:

1) Strengthening exercises for the muscles of the convex side by instructing the patients to get into side-lying position on the concave side and try to raise their upper trunk up as much as possible (10 repetitions with 3 sets, 6 seconds rest between each repetition, and 1 minute rest between the sets; the resistance is progressed according to the number of repetitions).

2) Abdominal strengthening exercises from the crock lying position in which the patients were asked to touch their knees by their hands (10 repetitions with 3 sets, 6 seconds rest between each repetition, and 1 minute rest between the sets; the resistance is progressed according to the number of repetitions).

3) Stretching of back muscles from the crock lying position in which the therapist moved both lower limbs toward the chest (5 repetitions, 30 seconds in position of stretching, 30 seconds in position of relaxation).

4) Mechanical traction of the spine in a supine lying position on a bed designed for mechanical lumbar traction by fixing the upper trunk and pulling on the lower trunk by separating the middle of the bed by mechanical force for 15 minutes. Postural instructions for ADL were also given.

The program continued 3 sessions per week for three months.

The pre- and post-assessments of the patients were performed with the following:

1- Anteroposterior view of loading X-ray to detect any change in scoliotic curve by measuring Cobb’s angle (meeting of two lines, a horizontal line from the superior surface of the first vertebræ of the curve and a horizontal
line from the superior surface of last vertebrae of the curve) for the lower trunk.

2- Visual analogue scale to measure the pain, which was graded from 0 to 10. Zero represents no pain, whereas grade 10 represents unbearable pain. The subjects were asked to indicate the intensity of pain by placing a dash at the appropriate level on a 10 cm horizontal line.

3- Tape measurement to detect forward trunk flexion (fingertip-floor test) for both groups as follows: the patients were instructed to bend forward as far as they could with their knees straight and asked to touch their toes, and then the distance from their middle fingertip to the floor was measured.

RESULTS

The collected data were statistically analyzed by using a one sample paired t-test to compare pre- and post-test values within the group and two-sample unpaired t-test to compare post values between the groups at a confidence level of \( p \leq 0.05 \).

In the stretching exercises group, the results of the paired t-test between pre- and post-test values showed significant improvement in the Cobb’s angle, pain and forward flexion of the trunk at \( p=0.0001 \) (as shown in Table 1).

In the mechanical traction group, there were improvements in pain and forward flexion of the trunk at \( p=0.0001 \) and Cobb’s angle at \( p=0.001 \) (as shown in Table 2).

The results of the unpaired t-test showed that Cobb’s angle improved significantly in the stretching exercises group compared with the mechanical traction group (at \( p=0.0001 \)), whereas no significant improvement was found in pain scores and forward flexion of the trunk between groups (as shown in Table 3). The mean difference of Cobb’s angle was 9 degrees in the stretching exercises group, whereas the difference was only 2.4 degrees in the mechanical traction group.

The results of this study showed that stretching exercises are more effective than mechanical traction of the lower spine in treatment of idiopathic scoliosis.

DISCUSSION

The goal of nonoperative treatment of patients with...
scoliosis in our study was to correct and maintain the spine in a balanced position in the coronal and sagittal planes over a level pelvis. This goal was achieved through traction or stretching to correct the spinal deformity24).

We were unsure which intervention would be more effective. Both protocols showed improvement in all the outcome variables, but we found a significant decrease in the scoliotic curve in the stretching exercises group compared with the other group.

Stretching exercise for tight concave muscles was applied to decrease spasm and hyperactivity of concave side musculature and lengthening of the shortened muscles and to correct the scoliotic curvature of the lumbar region. Strengthening of the weak convex side muscles creates a muscle balance and normal path for the body’s line of gravity. The abdominal muscles, which are considered to form the anterior wall of the spine, must be strong enough to protect the spine from the anterior aspect25, 26).

Back muscles stretching decreases spasms in the muscles and improves the circulation, which in turn decreases the concentration of metabolites, hypertonicity, and hyperactivity of the lumbar erector spinae. This increase in elasticity of the back muscles results in improvement of forward flexion25, 27).

A recent focus in the physiotherapy management of patients with back pain has been the specific training of muscles surrounding the spine (deep abdominal muscles and lumbar multifidus), which is considered to provide dynamic stability and fine control to the lumbar spine28).

In the mechanical traction group, significant improvement in pain, forward flexion of the trunk, and Cobb’s angle of the lower spine was reported.

Traction of the spine was used in stretching of tight muscles by using the patient’s body weight which is giving equal stretching force on both sides of the spine which effects the whole length of the spine (longitudinal stretching).

The use of exercise alone for the treatment of idiopathic scoliosis has been suggested for many years. Although exercise has traditionally been used to stretch tight trunk musculature and strengthen muscles of the trunk, it has been shown that exercise alone will not halt the progression of or correct an existing moderate or severe scoliosis. Exercise alone may be beneficial as a treatment for patients with very mild idiopathic scoliosis. Exercise used in conjunction with other methods of correction such as traction which has been shown to be beneficial26, 28).

The abdominal muscles, which are considered to form the anterior wall of the spine, must be strong enough to protect the spine from the anterior aspect.

The program of traction and strengthening of the abdominal muscles was created a controlling and balancing effect between agonist and antagonist muscles of the spine.

In comparison the results of both groups, there was more significant improvement in the stretching exercises group than in the mechanical traction group in the Cobb’s angle of lower spine but no significant improvement in pain and the FFT of the trunk flexion. This is explained by the assumption that the power of traction is less than the power of stretching exercises and equally applied to both sides of the spine.

Addition of mechanical traction therapy to a standard graded activity program has been shown not to be effective. Nevertheless, the results of the current study seem to support the conclusions of recent reviews17, 30, 31) in which no uniform evidence of the efficacy of traction therapy as a treatment for LBP was reported23). A limitation of our study is the lack of follow-up concerning the effects for at least after 3 months. Future research should be focused on putting emphasis on a follow-up period to determine the long-lasting effects of various techniques.

The results of this study showed that stretching exercises are more effective than traction of the spine in treatment of idiopathic scoliosis.

From all of the above, we found that the stretching program, strengthening of the convex side and abdominal muscles, and following instructions concerning the correct manner of performing ADL make up the appropriate regimen for treatment of idiopathic scoliosis.

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