Efficacy of Ischemic Compression Followed by Exercises Therapy Versus Rehabilitation Program in Treatment of Postural Scoliosis

Lilian Albert Zaky and Ghada Mohamed Rashad
Department of Physical Therapy Musculoskeletal Disorders, Faculty of Physical Therapy, Cairo University.

ABSTRACT

Background: *Postural scoliosis is the most common type of scoliosis; which occurs during the growing years from 10 years to the puberty.* ***Purpose:*** *this study was conducted to compare the efficacy of ischemic compression followed by exercise therapy versus rehabilitation program in patients with postural scoliosis.* ***Subjects and Methods:*** *Thirty female patients were assigned randomly into two equal groups: subjects in the group A (n = 15) received ischemic compression followed by stretching and strengthening exercises of the back muscles, and subjects in the group B (n = 15) received rehabilitation program of the spine; which consisted of postural, breathing, muscles stretching and strengthening, and active range of motion exercises. The following parameters including pain severity, functional disability and Cobb's angle were measured before and after treatment. Two treatment sessions were applied per week, for successive six weeks.* ***Results:*** *The results showed significant improvement in pain and function in both groups, in favor of group (A)while the Cobb's angle did not show any significant improvement in both groups.* ***Conclusion:*** *According to the present results, we concluded that both of ischemic compression followed by exercises therapy, and rehabilitation of the spine are effective as methods of treatment for postural scoliotic patients; concerning the improvement of pain and function, which were more improved in the former group. Cobb's angle did not improved significantly in either one of the groups.*

Key words: *Ischemic compression, exercises, rehabilitation program, postural scoliosis.*

INTRODUCTION

Scoliosis is simply defined as a lateral curvature of the spine[11]. Clinically, there are two major types, structuralcurve which is a fixed deformity, and non-structural curvewhich is a flexible deformity; such as postural scoliosis[29].

Postural scoliosis is a functional curve which is mild, non-progressive, and fully correctable by ipsilateral bending[2].

Postural stress such as found in scoliosis is a form of mechanical muscle stresses that has been considered to be a cause of myofascial trigger points formation and activation[17]. Myofascial trigger points are small nodules of hypersensitivity located in taut "rope-like" bands of skeletal muscle fibers that are detectable through palpatory examination; these points are painful in compression and give rise to referred pain when being compressed. The muscles containing trigger points are shortened and weakened by this syndrome[26].

Much of the research in scoliosis treatmentis focused on reducing the curvethroughstraightening of the spine, such as using braces and exercises which has been tried largely for the treatment of scoliosis[1,21]. However we should also focus on the relationship between the fascia and the vertebrae.

The lateral flexion of the scolioticspine translate abnormal stresses into the costovertebral joints predisposing them to articular dysfunction[11], this dysfunction leads to high muscle tension, or in another word, myofascialtrigger points (TPs) formation[15], and vice versa; an imbalanced myofascial structure aggravates the scolioticdeformity[3].

Treatment should be focused on eliminating the myofascial TPs through one of several manual therapy modalities;such as trigger pointsischemic compression, and exercises[26].

Ischemic compression can provide effective pain reliefin cases of scoliosis. The clinician uses pressure on each myofascial TP, until a state of tension relief is reached and, thus, inactivates the TP[14].

Taut bands containing the trigger points result in reduced active range of motion[20]. For

effective trigger point therapy, it must always be followed by myofascial stretching (MFS) exercise. The key to treating trigger points is to lengthen the muscle fibers that are shortened by these trigger points[31].

Maintaining a balance of the musculoskeletal system is obtained throughout specific exercises for scoliosis[3]. Many exercises approaches have been used to hinder the progression of scoliotic curves[18,25].

Exercises therapy is recommended in scoliosis for two reasons. The first is the mobilization and strengthening of the trunk and leg muscles that are related to posture, and is expected to slow down and possibly reverse the progress of the spinal curvature. Second, through training of specific muscle groups in the trunk, pulmonary functions such as vital capacity can be improved[27].

Assessment of scoliosis can be done by evaluation of pain intensity and functional disability; although a definitive evaluation cannot be made without measuring the Cobb's angle on a standing coronal radiograph[32].

This study was done to compare between the effect of myofascialischemic compression andstretching followed by stretching and strengthening of the trunk muscles, and the effect of rehabilitation program on pain, functional disability, and Cobb's angle in patients with postural scoliosis.

SUBJECTS AND METHODS

Subjects:

Thirty female patients was referred by orthopedic surgeons with postural scoliosis, with Cobb's angle ranged between 15-20^{o}, their age ranging from 13-18 years.

Patients were excluded from the study if they had history of previous back surgery, structural idiopathic scoliosis, leg length discrepancy, or any other disorders in the vertebral column such as spondylosis or disc prolapsed.

Patients were assigned randomly into two equal groups. Group A received Myofascial ischemic compression and stretching. This was followed by stretching (of tight structures on the concave side of the curve), and strengthening exercises (for back and abdominal musculature on the convex side of the curve), while Group B received rehabilitation program.

The research meets the ethical guidlines, and all patients have been informed with the steps of the study and have signed a consent form.

Instrumentations and Procedures (for evaluations):

1- Pain assessment:

Pain was assessed by visual analog scale (VAS)[19]. This scale allows continuous data analysis and uses a 10cm line with 0 (no pain) and 10 (worst pain).

The patient places a mark along the line to denote his level of pain, and this distance from zero to this mark is measured in millimeters which represent pain intensity.

2- Functional disability:

Functional disability of each patient was assessed by Oswestery disability questionnaire[6] which is valid and reliable tool.

The scale consists of 10 multiple choice questions for back pain, patients select one sentence out of six that best describes his pain, and higher scores indicate great pain.

The scores are as follows;

- Scores (0-20%) Minimal disability
- Scores (20%-40%) Moderate disability
- Scores (40%-60%) Severe disability
- Scores (60%-80%) Crippled patient
- Scores (80%-100%) Patients are confined to bed

3- X-ray:

For Cobb's angle measurement; loaded x-ray (postero-anterior view) was measured from standing position, the view was taken from the occiput to the sacrum to determine the location and severity of curve[14]. This was done by drawing lines perpendicular to the transverse axes of the upper and lower end vertebrae. Where these lines intersect is the Cobb's angle.

Treatment procedures:

1- Treatment procedure for group A:

The steps of treatment:

a- Myofascialischemic compression:

First of all, the trigger points were detected by palpating a taut band within the muscle belly, at both of the curve sides (concave and convex sides).These points were tender and refer pain to characteristic regions. The muscles which were treated were; Iliocostalisthoracis, iliocostalislumborum, Quadratuslumborum, iliopsoas and rectus abdominis. Pressure was applied moving inward toward the center of each TP. Once tissue resistance was felt, gentle pressure was sustained for 90 Sec. to 120 Sec. until a state of local tissue ischemia was reached, in this stage resistance dissipates (there is melting away of the taut band). This cycle was repeated several times[15]. The patients received 2 sessions per weak for 6 weeks[17].

b- Myofascial stretching:

For effective trigger point therapy, myofascial ischemic compression must always be followed by myofascial stretching exercises to maintain the degree of relaxation and bring the muscle to its full length. The stretch should be very slow in rate and exceeds 30 seconds each time, stretching was applied for three sets; each set was formed of three repetitions.

Myofascial stretch was also given to the patient as a home exercise program and was repeated four to six times daily with two repetitions each time[15].

c- Exercises:

Stretching exercises (of tight structures on the concave side of the curve), and strengthening exercises (for back and abdominal musculature on the convex side of the curve) were applied following myofascial ischemic compression and stretching.

2- Treatment procedure for group B:

According to Ebenzar[5] the rehabilitation program used for scoliotic patients includes;

- Postural rehabilitation: Each patient was learned to be aware of the body posture, be oriented by the defects of posture, and was learned to make active self-correction in the three plane.
- Deep breathing exercises: Abdominal breathing technique was applied which insures that the diaphragm is pulling air into the bases of the lungs.
- Balancing exercises: by instructing the patient to walk while trying to prevent a book on the head from falling down.
- Active range of motion exercises: Exercises in all directions of movement of the spine.
- Strengthening exercises: to the abdominal and back muscles.
- Passive stretching: of the muscles on the concave side of the curve.
- Strengthening exercise: of the muscles on the convex side of the curve.

RESULTS

Unpaired t-test was used to detect differences between groups before treatment. There was no significant difference between groups regarding each of the pain severity, functional disability and Cobb's angle (Table 1).

Table (1): Comparison between groups before treatment.

Variables	Group (A)	Group (B)	t-test	P-values
Pain Severity	6.073±1.057	6.413±0.982	0.913	0.37 (N.S.)
Function disability	28.07±5.52	32.27±5.89	2.015	0.05 (N.S.)
Cobb's angle	17.53±1.68	18.4±1.5	1.496	0.15 (N.S.)

N.S. Non-significant

After treatment paired t-test was used to examine within group difference of group A for: pain severity, functional disability, and Cobb's angle. There were significant differences after treatment except Cobb's angle (Table 2).

Table (2): Within group difference of group A after treatment.

Variables	Mean Different	t-test	P-values
Pain	3.45	11.16	< 0.0001**
Function	18.73	18.87	< 0.0001**
Cobb's angle	0.13	0.22	0.8 (N.S.)

**Significant at the .05 level N.S. Non-significant

After treatment paired t-test was used to examine within group difference of group B for: pain severity, functional disability, and Cobb's angle. There were significant differences after treatment except Cobb's angle (Table 3).

Table (3): Within group difference of group B after treatment.

Variables	Mean Different	t-test	P-values
Pain	2.19	10.35	<0.0001**
Function	10.6	5.49	<0.0001**
Cobb's angle	0.07	0.19	0.86 (N.S.)

**Significant at the .05 level N.S. Non-significant

Unpaired t-test was used to detect differences between groups after treatment. There was significant difference in favor of group A than group B of: pain severity, and functional disability, but no significant difference on Cobb's angle (Table 4).

Table (4): Comparison between group post treatment.

Variables	Mean Different	t-test	P-values
Pain Severity	2.62±1.13	4.62	< 0.0001**
Function disability	9.33±2.05	15.55	< 0.0001**
Cobb's angle	17.67±1.63	1.32	0.198 (N.S.)

**Significant at the .05 level N.S. Non-significant

DISCUSSION

Postural scoliosis is one of the most common causes of pain and inappropriate back function. All patients in both groups had symptoms of back pain, and functional disabilities. This agrees with Weinstein et al.,[32] who reported that scoliosis leads to back pain during bending, twisting, lifting, prolonged sitting and standing and various functional activities.

To examine pain relief in group A receiving myofascial therapy, comparison between pre and post results of pain assessment was done using visual analogue scale. The results showed a highly significant decrease in back pain at the end of treatment program. These results come in agreement with Le Bauer[17], Marcus[20] and Mense[23], who reported significant pain relief due to application of myofascial therapy for patients with myofascial trigger points.

The analgesic effect of myofascial therapy used in group A (myofascialischemic compression andstretching, followed by stretching and strengthening of the trunk muscles) could be attributed to the following mechanisms: The shortened sarcomeres are the main cause of myofascial trigger points formation and the local ischemia at site of trigger points. Thus, by the use of the myofascialischemic compression and stretching, the shortened sarcomeres will flatten and be lengthened. This local stretch reduces actin and myosin overlap, and also causes flush of blood at site of compression once the pressure is removed from the trigger point. This improves the local circulation and thus reduces release of noxious painful substances, all of this tends to inhibit the trigger points activity and decrease the sensitivity of myofascial trigger points[8,12,13,30].

Back pain also decreases the functional ability due to muscle spasm. To examine the effect of the myofascial therapy used in group A on reducing functional disability, comparison between pre and post results of functional ability was done using Oswestry Disability Questionnaire. There was a highly significant decrease in functional disability at the end of the treatment. The deactivation of trigger points and reduction of muscle spasm by removing myofacial restrictions can restore normal activation and function of muscles in cases of scoliosis, hence improve functional disability[20,28,36]. Stretching and strengthening exercises of the trunk muscles following myofascial therapy induce muscular relaxation and pain relief[10], and also helps to improve faulty posture[37].

Therefore in an attempt to decrease pain and improve function, the contribution of myofascial therapy in identifying and eliminating muscle spasm and trigger points is significant[4,7,16].

From statistical analysis of pre and post values of pain assessment in group B receiving rehabilitation program, there was a decrease of pain at the end of treatment and this difference was significant. Concerning functional disability there was a significant decrease of functional disability at the post treatment evaluation of the rehabilitation program group. This finding was supported by Gielen[9] who found that there is reduction of pain and improvement of functional ability in scoliotic patients after physical therapy program including strength and flexibility exercises. This improvement was explained to be due to increased muscle strength, decrease of muscle spasm leading to reduction of pain, and improved muscle flexibility.

Concerning the Cobb's angle in both groups, there was no improvement recorded between pre and post assessment. This result come in agreement with Weinstein et al.,[33] who stated that no definite evidence has shown that physical therapy decreases curvature angle, reduces the risk of Cobb's angle progression, corrects the existing deformity, or decreases the need for surgery. Results also agreed with Weiss et al.,[34] who stated that there are no prospective outcome studies showing the exercises program can reduce the curve progression risk.

The result of the current study disagreed with Weiss[35] who stated that there is improvement of Cobb's angle of up to 20 degrees in patients after rehabilitation. He stated that a supervised program of exercise therapy can reduce the curve progression in children with scoliosis. The study of Negrini et al.,[24] contradicts the study results as it showed that aim of physiotherapy to prevent rapid curve progression, and aggravation of the deformity can beachieved by rehabilitation of patients, especially those with mild scoliosis (i.e., curves less than 25°). Also results of Maude et al.,[22] substantiate the use of intensive exercise methods in the treatment of scoliotic patients, with the aim to reduce the Cobb angle.

It was concluded from the study that myofascial ischemic compression and stretching followed by exercises have better significant effect than using rehabilitation on reducing pain and improving function. There was no significant effect of each of them on reducing Cobb's angle, so both modalities can be used effectively for the treatment of scoliosis with preference of ischemic compression followed by exercises.

REFERENCES

1- Bouen, T.R., Keller, K.A. and Pelagic, S.: Adolescent idiopathic scoliosis managed by a night time bending brace. Orthop; 24(10): 967-970, 2001.

2- Cassar-Pullicino, V.N. and Eisenstein, S.M.: Imaging in scolioosis: What, why and How?. Clinical Radiology, 57: 543-562, 2002.

3- Charles, L. and Blum, C.: Chiropractic and pilates therapy for the treatment of adult scoliosis Journal of manipulative and physiological therapeutics; 25(4): 2002.

4- Davis, C.M.: Myofascial release as complementary in physical therapy for two elderly patients with osteoporosis and kyphoscoliosis – two case studies. Journal of Geriatric Physical Therapy; 25(3): 33, 2002.

5- Ebnezar, J.: Essentials of Orthopedics for Physiotherapists. 2nd edition by Jaypee Brothers (USA); Chap. 4: 288-293, 2011.

6- Feis, J.C. and Pynsent, P.B.: The Oswestery disability index. Spine; 25(22): 2946-2953, 2000.

7- Fernandez, C., Palomeque, L. and Carnero, J.: Manual treatmnet of post-whiplash injury. Journal of Bodywork and Movement Therapies; 9: 109-119, 2005.

8- Fryer, G. and Hodgson, L.: The effect of manual pressure release on myofascial trigger points in the upper trapezius muscle. Journal of Bodywork and Movement therapies; 9: 248-255, 2005.

9- Gielen, J.L.: Scoliosis and sports participation. Journal of sport Med; 9(3): 131-140, 2008.

10- Green, B.N., Johnson, C. and Moreau, W.: Is physical activity contraindicated for individauls with scoliosis? A systematic literature review. Journal of Chiropractice Medicine; 8: 25-37, 2009.

11- Hamm, M.: Impact of massage therapy is the atment of linked pathologies: Scoliosis, costoverletsral dysfunction, and thoracic outlet syndrome. Journal of Bodywork and movement therapies; 10: 12-20, 2006.

12- Hanten, W., Olson, S., Butts, N. and Nowicki, A.: Effectiveness of a home program of ischaemic pressure followed by sustained stretch for treatment of myofascialtrigger points. Physical Therapy, 80(10): 997-1003, 2000.
13- Hou, C.R., Tsai, L.C., Cheng, K.F., Chung, K.C. and Hong, C.Z.: immediate effects of various physical therapeutic modalities on cervical myofascial pain and trigger-point sensitivity. Archives of Physical and Medical Rehabilitation, 82: 1406-1414, 2002.
14- Kisner, C. and Colby, C.A.: Therapeutic exercises foundations and techniques. 4th edition by F. A. Davis, USA; chap 15: 591-536, 2002.
15- Kostopoulos, D. and Rizopoulos, K.: The manual of Trigger Point and Myofascial Therapy. Astoria, New York, Chap. 3,4,7,10: 14-64, 2001.
16- Kukban, J.: The effect of manual physical therapy in patients diagnosed with interstitial cystitis, high-tone pelvic floor dysfunction, and sacroiliac dysfunction. Urology; 57(Supl. 6A), 2001.
17- Le Bauer, A., Brtalik, R. and Stow, K.: The effect of myofascialrelease (MFR) on an adult with idiopathic scoliosis. Journal of bodywork and movements therapies; 12: 356-363, 2008.
18- Lehnert, S.D.: Redimensionale Skoliosebehandlung. 6th ed. Stuttgart; 2001.
19- Marc, A.: Pain measurement in P. prither Ray: pain medicine a comprehensive review, mobsy, Losangles, California, USA; 36-37, 2001.
20- Marcus, D.: Myofascial Pain. By Humana Press; Chap. 11: 194-209, 2009.
21- Mark, J., Spoonamore, M.D., Lori, A. and Dolan, R.N.: Use of the resenberger brace in the treatment of progressive adolescent idiopathic scoliosis spin; 13: 1458-1464, 2004.
22- Maude, E., Head, J. and Hobson, K.: The effect of a faour weak intensive scoliopsis-specific exercises programmes on Cobb angle in subjects with idiopathic scoliosis: An eleven patient case series. Journal of Scoliosis; 7: 1, 2011.
23- Mense, S.: Morphology of Myofascial Trigger Points: What Does a Trigger Point Look Like? Germany, Chap 3: 85-102, 2010.
24- Negrini, A., Verzini, N., Parzini, S., Negrini, A. and Negrini, S.: Role of physical exercise in the treatment of mild adolescent idiopathic adolescent scoliosis. Review of the literature. EuraMedicophys; 37: 181-90, 2001.
25- Negrini, S., Grivas, T.B., Kotwicki, T., Maruyama, T., Rigo, M. and Weiss, H.: Why do we treat adolescent idiopathic scoliosis? What we want to obtain and to avoid for our patients. Scoliosis; 1: 4, 2006.
26- Raj, P.P. and Paradise, L.A.: Myofascial pain syndrome and its treatment in low back pain seminars in pain medicine; 2: 167-174, 2004.
27- Rowland, T.W. and Bar, O.R.: Pediatric exercises medicine from physiological principles to health care application. 1st ed., 269-303, 2004.
28- Shea, M.J.: Treatment of scoliosis. Journal of Bodywork and Movement Therapies; 4(4), 285-286, 2008.
29- Simoneau, M., Mercier, P.A., Hard, P., Blouin, J. and Teasdle, N.: Does idiopathic scoliosis alter the sensory integration mechanisms participating to balance control. Development sensory and motor disorders; 14(22): 589, 2003.
30- Simons, D.G.: Understanding effective treatments of myofascial trigger points. Journal of Bodywork and Movement Therapies, 6(2): 81-88, 2002.
31- Travell, J.G., Simons, D.G., Simons, L.S.: Myofascial Pain and Dysfunction: The Trigger Point Point Manual - Upper Half of Body. Baltimore, Md: Williams and Wilkins; 1999.
32- Weinstein, S.L., Dolan, L.A., Change, J.C., Daielsson, A. and Morcuende, J.A.: Adolescent idiopathic scoliosis. Locent; 371(3): 1527-1537, 2008.
33- Weinstein, S.L.: Bracing in Adolescent Idiopathic Scoliosis Trial (BrAIST). National Institute of Arthritis and Musculoskeletal and Skin Diseases, (1): 2009.
34- Weiss, H., Negrini, S.H., Rigo, M., Tomasz, K., Theodoros, B. and Toru, M.: Physical exercises in the treatment of idiopathic scoliosis at risk of brace treatment. Scoliosis; 1: 6-10, 2006.
35- Weiss, H., Weiss, G. and Petermann, F.: Incidence of curvature progression in idiopathic scoliosis patients. Patient Rehabilitation; 6(1): 23-30, 2003.
36- Werner, R.A.: Massage Therapist's Gide to Pathology, second ed. Lippincott Williams and Wilkins, Philadelphia; 70-81, 2002.
37- Wright, E.F., Dommenech, A.D. and Fischer, J.R.: Usefulnes of posture training of patinets with temporomandibular disorders. Journal of the American Dental Association; 131: 202-210, 2000.

الملخص العربي

فاعلية الضغط المنقص لتروية الدم متبوعا بتمارين علاجيه مقابل برنامج تأهيلي في علاج الجنف القوامي

الجنف القوامي هو نوع الجنف الأكثر انتشاراً ، وهو يحدث خلال سنوات النمو من عمر عشرة سنوات حتى البلوغ . يهدف هذا البحث إلى مقارنة فاعلية الضغط المنقص لتروية الدم متبوعا بتمارين علاجيه مقابل برنامج تأهيلي في مرضى الجنف القوامي، وقد أجرى هذا البحث على 30 مريضة تم تقسيمهم عشوائياً إلى مجموعتين متساويتين وهما المجموعة الأولى وتضم 15 مريضة وتم علاجهن باستخدام الضغط المنقص لتروية الدم مضافا إلى تمرينات الإطالة وتمرينات التقوية لعضلات الظهر، والمجموعة الثاني ة وتضم 15 مريضة وتم علاجهن باستخدام برنامج تأهيلي مكون من تمرينات للقوام ، والتنفس ، وتمارين استطالة وتقويه للعضلات ، وتمارين المدى الحرك ي . وقد أجريت القياسات لهاتين المجموعتين قبل وبعد الفترة العلاجية . تم عمل جلستين أسبوعياً لمدة ستة أسابيع متتالية . وقد أوضحت النتائج وجود تحسن بالنسبة لتخفيف آلام الظهر ، وتخفيف العجز الوظيفي في كلا المجموعتين ، لصالح المجموعة التجريبية الأولى ، ولكن لم يكن هناك تأثير على زاوية الجنف عند قياس ما قبل وبعد العلاج في المجموعتين . لذا من خلال نتائج هذه الرسالة يمكننا استنتاج أن كلا من الضغط المنقص لتروية الدم متبوعا بالتمارين العلاجية ، والبرنامج التأهيلي طرق علاجية فعالة لعلاج الجنف القوامي وذلك بالنسبة للتحسن في الألم والوظيفة وقد كان التحسن أكثر في المجموعة الأولى . بينما لم تتحسن زاوية الجنف في كلتا المجموعتين .

الكلمات الدالة : الضغط المنقص لتروية الدم – تمارين - برنامج تأهيلي - الجنف القوامي .