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**THE BENEFITS OF TRX SUSPENSION TRAINING IN  
ADOLESCENT IDIOPATHIC SCOLIOSIS**

Ioana Curițianu (a)\*, Elena Balint (b)

\*Corresponding author

(a) Transilvania University of Brasov, No. 1, Universitatii Street, Brasov, 500068, Romania,  
ioana.curitianu@gmail.com

(b) Transilvania University of Brasov, No. 1, Universitatii Street, Brasov, 500068, Romania, liabalint@gmail.com

***Abstract***

There are several nomenclatures associated with scoliosis along with several causes. Idiopathic scoliosis (not associated with any other cause) occurs during life (infantile to adult) and includes infantile, juvenile and adolescent idiopathic scoliosis (AIS) sub classifications. The treatment for idiopathic scoliosis is based on age, curve magnitude and risk of progression, and includes observation, orthotic management and surgical correction with fusion. A child should be referred to a specialist if the curve is greater than 10° in a patient younger than 10 years of age, is greater than 20° in a patient 10 years of age or older, has atypical features or is associated with back pain or neurological abnormalities. The purpose of this study was to develop and test a TRX Suspension Training program for people with idiopathic scoliosis and to evaluate its feasibility. Ten participants (aged between 16 and 18) were investigated and followed a 6 week program. All participants trained using the TRX strips. The program consists of eight exercises including 2–3 progressively advancing stages of difficulty for every exercise. By changing the position, we could increase the intensity of the exercises. The subjects was evaluated using the following methods: Somatoscopy - body alignment (shoulders, scapula, basin, thorax, lower limbs); Functional test - lifting up the tips with arms up, ventral decubitus - positions that reduce functional scoliosis, sitting, squatting - reduces static scoliosis; The magnitude of the curvature by measuring the Cobb angle. The training intensity, duration and frequency were rated as optimal.

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**Keywords:** Trx training, idiopathic scoliosis, curve progression.



## 1. Introduction

Scoliosis is a spinal deformity which refers to deviation of the spine greater than  $10^\circ$  in the coronal plane. Idiopathic scoliosis is the most common type of scoliosis and spinal deformity as well. According to the age of onset, idiopathic scoliosis can be classified as infantile, juvenile, and adolescent (Koop, 1988; Janicki & Alman, 2007).

The sagittal spino-pelvic parameters have been assessed in numerous publications with normal, disease-free populations (Boulay et al., 2006; Vialle et al., 2005; Roussouly, Gollogly, Berthonnaud, & Dimnet, 2005; Zhu et al., 2014; Kobayashi, Atsuta, Matsuno, & Takeda, 2004) and in spine deformities, including scoliosis. (Mac-Thiong, Labelle, Charlebois, Huot, & de Guise, 2003; Upasani, Tis, Bastrom, Pawelek, Marks, & Lonner, 2007; De Jonge, Dubousset, & Illés, 2002).

Adolescent idiopathic scoliosis (AIS) is the most common form of idiopathic scoliosis, occurring at the age of 10 years or greater (Burton, 2013).

Partial physical deficiencies must be examined carefully to determine if they are in the stage of faulty attitude determined by a functional disorder of the musculoskeletal system or deformations resulting from changes in shape and body structure (Cioroiu, 2016).

Health is the support on which we must focus our attention in every stage of our life and during our growth. The period is considered to be the most dangerous in the transformation that take place on the human body, during which requires special attention from parents, teachers, doctors that must control and correct the development of children (Nechita, 2016).

Suspension training (ST) is defined as having one or more straps connected to one or more anchor point(s) as the user is suspended from the handles of the straps by either their hands or feet, while the non-suspended pair of extremities are in contact with the ground. This type of training changes how the muscles are recruited due to the unstable base of support (Nickelston, 2011).

The free-hanging straps allows for an unstable base of support during exercise, and result in a less stable base of support. Although there are a variety of studies that report the utility for STs for rehabilitation, physical fitness and wellness, (Pastucha, Filipcikova, & Bezdickova, 2012) few have comprehensively assessed the activation patterns of multiple muscle groups during functional exercises.

Recent studies by Snarr, and Esco (2013) found increased muscle activation in pectoralis major and anterior deltoid when performing pushups in a ST when compared to push-ups on the floor. Similar studies found that push-ups performed in a ST elicited greater muscle activation of the rectus abdominis and latissimus dorsi (Beach, Howarth, & Callaghan, 2008).

## 2. Problem Statement

### 2.1. Participants

The subjects that were studied are aged between 16 to 18 years and were investigated after following a 6 week TRX Suspension Training program. scoliosis. All patients had thoracic scoliosis (n=10) and trained using the TRX strips. The Cobb angle of the main curve in the patient group varied from  $40^\circ$  to  $50^\circ$  (average  $47.5^\circ$ ) (Table 1). The program consists of eight exercises including 2–3 progressively advancing stages of difficulty for every exercise. By changing the position, we could increase the intensity of the exercises.

### 3. Research Questions

The TRX Suspension Training program consisted of exercises with varying degrees of difficulty, modified depending on the response of patients and their particularities. The program was structured for 6-weeks and included two initial private training sessions, twice a week, where exercises were taught to the patient.

The program consisted of 60 minutes sessions, a warm-up of 15 minutes preceded every session and a cool-down of 10 minutes was required at the end of the working program.

The exercises included in the program targeted the strengthening of the core and adjustment of the spine. The accent was put on the correct execution of each exercise.

The TRX Suspension Training program included exercises for the shoulders, arms, chest, back, abdominal muscles which consisted of single and double arm push-ups, single arm-row, standing body crunch which is a good alternative for doing exercises with ab slide, standing oblique twist for toning obliques and lower abdominal muscles, suspended oblique crunch, suspended alternating crunch, suspended TRX plank, suspended crunch for lower and upper abs, pike, which is an enhanced suspended crunch, is also useful for shoulder training.

### 4. Purpose of the Study

The aim of treatment was to reduce the risk of progression by using TRX Suspension Training exercises.

Due to the fact that TRX Suspension Training exercises focus upon toning the trunk muscles that support the spine and helps maintain a good posture, this type of fitness activity is starting to be used more and more in correcting spine deficiencies.

The topic of this study is to show the benefits of well planned TRX exercises in achieving improvements in idiopathic scoliosis.

### 5. Research Methods

In the evaluation of the subjects we used the following methods: Somatoscopy - body alignment (shoulders, scapula, basin, thorax, lower limbs); Functional test - lifting up the tips with arms up, ventral decubitus positions that reduce functional scoliosis, sitting, squatting - reduces static scoliosis; The magnitude of the curvature by measuring the Cobb angle.

All tests were performed in the sports hall of the Faculty of Physical Education and Mountain Sports. After measuring the subjects we performed three muscle strength tests.

The Cobb angle test was performed by a specialist and was measured as the vertically intersecting angle after determining the vertebrae above and below the apex.

The flexibility test involved the bending of the upper body forward, as much as possible by keeping their legs in extension. This test was performed twice, the best value was recorded.

## 6. Findings

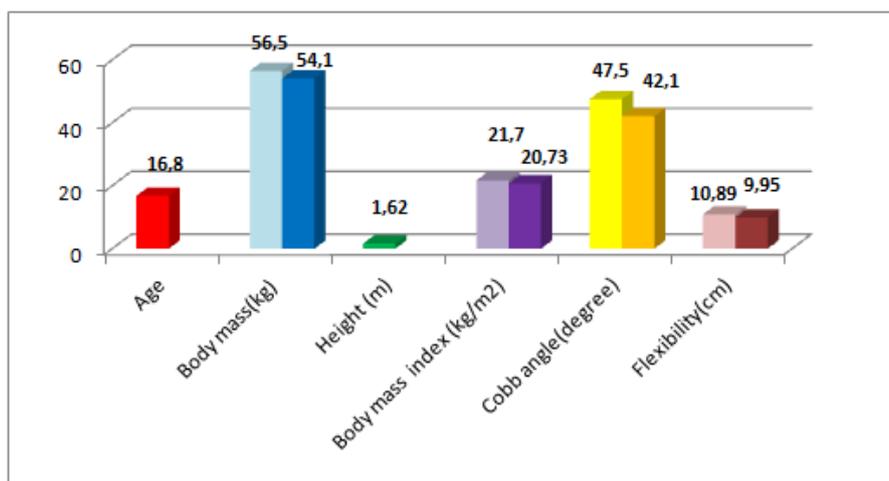
**Table 01.** Clinical characteristics of patients (mean + SD) – Pre and Post-test

Parameter	Patients (n=10) – Pre-test	Patients (n=10) – Post-test	t test	P-value
Age	16.8+0.788		-	-
Body mass(kg)	56.5+1.95	54.1+1.19	3.328	p<0.01
Height (m)	1.62+0.038		-	-
Body mass index (kg/m <sup>2</sup> )	21.7+1.63	20.73+1.13	1.564	p>0.05
Cobb angle(degree)	47.5+1.84	42.1+2.07	6.178	p<0.01
Flexibility (cm)	10.89 +0.58	9.95+0,16	5.628	p<0.01

The height measurement was important to monitor skeletal growth and the risk of scoliosis curve progression.

The process of examination evaluated balance, reflexes and motor testing in all muscle groups, and sensory testing of the lower extremities, back and chest. Rapid assessment of strength and balance was made by observing heel-to-toe walking along a straight line and hopping on one foot, toe-walking and heel-walking.

We evaluated the back of the patients by inspecting the shoulders and hips for asymmetry. Significant leg length discrepancies, quickly judged by feeling the top of the iliac crests or the level of the dimples made by the posterior-superior iliac spines. The forward bending test was performed by having the patient bend forward at the waist with knees straight and palms together. We looked for any asymmetry in the contours of the back resulting from the rotational deformity of the spine.



**Figure 01.** Graphical representation of the mean - analyzed parameters – Pre and Post-test

Figure 01 also indicates the graphical representation of the mean - analyzed parameters – Pre and Post-test

As shown in Table 01, the Cobb angle had effects between using the exercises that targeted the strengthening of core muscles and spine adjustments ( $p < 0,01$ ). Post-test results indicate a significant decrease in the thoracic and lumbar Cobb angles.

Also, flexibility shows an improvement, the values obtained by the subjects were better in the post-exercise test as they registered a significant increase of flexibility and muscle strength.

## 7. Conclusion

The goal of every scoliosis therapy is to stop the curves from progression into a range where a change in care would be warranted. Avoiding a more aggressive treatment even if only for six months of doing TRX Suspension Training Exercises is clinically meaningful.

The findings of the present research show improvement upon the subjects understudied, they obtained good results with significant decrease in the thoracic and lumbar Cobb angles ( $p < 0,01$ ) as well as an increase in their flexibility, from the average value of 10.89 pre-program to the value of 9.95 post-program.

Regarding the body mass index, the patients understudy went from an average of 21,7 in the pre-test to a value of 20,73. Even if the results aren't significant, the lot of subjects obtained good results, they lost weight by training with the TRX stripes.

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