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Experimental Study on the Effect of Free Hand Exercise on Functional Scoliosis

Hong Yu*, Zhuangzhuang Zhu, Ying Yang, Yue Wang

Institute of Physical Culture, Liaoning Normal University, Dalian 116029, China
**Corresponding Author e-Mail: Yuhong5027@Sina.Com*

Abstract. *This Study Aimed to Prevent or Improve the Imbalance of Muscle Development of Functional Scoliosis and Improve the Body Posture of Scoliosis Patients through the Set of Exercises. This Study Used Documentary Method to Analysis the Literatures of Causes and Hazards of Functional Scoliosis. According to the Previous Research, This Study Designed the Practice Method of Free Hand Exercise for the Patients with Functional Scoliosis. the Patients Were Insisted on Doing Several Exercises Everyday in 12 Weeks, Which Included Sliding Exercise Against the Wall, Looking Back and Far Sighted Exercise, Lumbar Stretch Exercise, Single Leg Back Exercise, Lateral Bending Exercise, Left and Right Swing Leg Exercise, Hip Stretch Exercise. after 12 Weeks, the Body Function and Posture of Scoliosis Patients Were Improved*

Keywords: *Free Hand Exercise, Functional Scoliosis, Experimental Study*

1. Introduction

Adolescent is the High Incidence Period of Scoliosis [1], There Are Two Types of Scoliosis: Functional Scoliosis and Structural Scoliosis [2]. Adolescent Idiopathic Scoliosis is a Kind of Spinal Disease in the Rapid Growth and Development of the Body [3], Which is Often Accompanied by Three-Dimensional Curvature of the Spine, Vertebral Body and Thorax Deformation, Body Asymmetry, Proprioception Dysfunction, Movement Imbalance and Other Pathological Phenomena [4]. Functional Scoliosis is Compensatory Scoliosis, and the Internal Structure of the Spine Has Not Been Damaged .This Paper Mainly through Targeted Muscle Exercises, Increase the Muscle Strength Around the Spine, Improve or Prevent the Unbalanced Development of Muscle Strength of Functional Scoliosis, Improve the Body Posture of Scoliosis Patients, and Minimize the Complications Caused by Scoliosis.

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2. Research Object and Method

2.1 Research Object

The subjects were 30 female sophomores from Liao Ning Normal University, aged 19-21. The 30 students' AIT tilt angle tests were all in the range of 6 ° - 17 ° with no sports injury and other physical diseases, only one scoliosis. The subjects were randomly divided into two groups, 15 in each group. The basic information of subjects is shown in Table 1.

Table 1 Statistics Of Subjects

Group	AIT tilt angle	positioning	direction	number of scoliosis
Experimental group (N=15)	9.18°±2.06°	waist	Lt	0
Control group(N=15)	9.20°±2.23°	waist	Lt	1

2.2 Research Methods

1) literature review refers to a large number of books and related literature on physiology, anatomy, sports training and medicine, which lays a theoretical foundation for this study.

2) the experimental method is to train the female college students in the experimental group in 12 weeks' free hand exercise (seven sections in total), 7 times a week, once a day. The students in the control group didn't do free hand exercises. The practice method is shown in Table 2.

3) The following indexes of female college students in the experimental group and the control group were tested in the first and last week of the experiment. Body shape: AIT tilt angle, shoulder and hip balance; cardiopulmonary function: vital capacity.

4) Paired Sample t-Test. Then, spss25.0 was used to compare the data of the indexes before and after the experiment between the experimental group and the control group.

3. Research Results and Analysis

3.1 Integrity of Spine

The function of human spine is to support the trunk in various positions, provide

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enough mobility for trunk movement, and protect the spinal cord from injury [5]. The spine is composed of 23 discs, joints and ligaments connected by multiple vertebrae, including 24 vertebrae, 1 sacral vertebrae and 1 coccygeal vertebrae [6] (see Table 3).

3.2 Composition of Spine Bone

Table 2 Practice Methods and Precautions of Unarmed Exercise

Action name	practice part	practice method	precautions	load
sliding exercise against the wall	Trapezius muscle, Scapula muscle	The scapulae should stand upright with the upper back against the wall, and the heel should stand 18cm in front of the wall. The arms should be raised horizontally first, then the elbows should be bent to make the small arms vertical to the ground, and the elbows should be pulled down.	When two elbows are pulled down, the elbows and hands must be close to the wall	32 times / group
look back and exercise	The iliac muscle, Shaft sma	The erector spine muscle is opened on both legs, slightly bent on the knees, with the waist as the axis. Turn the head backward. Turn the hands from the side of the body to the front of the eyes in the form of two hands shed. Look at the distance for 2-3 seconds, and then change to the other side.	Use the eyes to drive the head, the head to drive the neck and upper limbs to rotate. The waist is upright. When the body turns to the maximum angle, the hands are brought to the front from behind.	Left and right 20 times / group
lumbar stretch exercise	Erector spinae	Open the spine muscle and feet, lean the upper body forward, and extend the arms forward.	You must reach your maximum limit when you extend your arms forward.	Keep the action still for 30s.
single leg back exercise	Erector spinae	Upper body straight, single leg try to back	During the practice, pay attention to the upper body should be vertical to the ground.	One side of the body should be motionless for 30s.
lateral bending exercise	The iliac muscle, Shaft sma	Spread your feet, put your hands behind your head, and turn your body to the left or right on the forehead.	The lower limbs should be fixed, and do not deviate from the frontal surface when the body is on the side.	One side moves and remains stationary for 30s.
left and right swing leg exercise	Abdominal muscles, erector spines	Lie on the mat with the two legs together and swing the legs left and right.	The swing range of legs must reach the maximum.	32 times / group
hip stretch exercise	Hip muscles, abdominal muscles	Body first upright, arms side to side, then one leg to side up, and then down.	The legs should be lifted and lowered slowly. Keep the upper body straight.	Left and right 20 times / group

Table 3 The spine is composed of 23 discs, joints and ligaments connected by multiple vertebrae, including 24 vertebrae, 1 sacral vertebrae and 1 coccygeal vertebrae

Name	cervical vertebra	thoracic vertebra	lumbar vertebra	sacral vertebra	caudal vertebra
Quantity	7	12	5	1	1

The flexion of the rod-shaped strut comes from the small displacement of multiple connecting devices. The advantage of this structure is that when the human body moves, each intervertebral disc and ligament only need to move a small range to meet the needs. There are many muscles and muscle bundles around the spine that make up the broad back. These muscles have different functions according to their own directions. For example, the trapezius muscle of the human body starts from the

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back of the neck and extends all the way to the surface muscle of the middle back, which is one of the most powerful muscles of the human body; the scapula muscle group is some very small muscle groups except the trapezius muscle, which is mainly distributed near the scapula, including the greater round muscle, the lesser round muscle, the infraspinatus muscle, the rhomboid muscle and the posterior bundle of the deltoid muscle; the latissimus dorsi muscle is the largest muscle in the back, which is doing All kinds of stretching actions will exercise this muscle; erector spine muscle is attached to both sides of the lumbosacral muscle, which is the main muscle responsible for extending the trunk, and its main role is to protect the lumbar spine from injury. Clinically, scoliosis is a common disease, [7], the incidence of scoliosis in China is about 1%, and it often occurs in young people, which can have a greater impact on the appearance of patients, while thoracic scoliosis can also have a negative impact on the respiratory function of patients.

3.3 The Influence of Free Hand Exercise on the Tilt Angle of Spinal Ait

Scoliosis can occur in any segment of the spine. No research has shown that the lower thoracic segment is the top vertebra concentration segment of scoliosis patients [8]. AIT tilt angle value reflects the rotation degree of human body trunk. After 12 weeks of practice, the tilt angle of the spine in the experimental group decreased significantly. From table 4, it can be seen that the experimental group $P < 0.01$, with a very significant difference. There was no significant difference between the control group and the control group before and after the experiment, and the p value was greater than 0.05. Therefore, we can conclude that muscle strength exercise can better improve the spine tilt angle of the practitioners.

Table 4 Comparison Of Tilt Angle between Experimental Group and Control Group Before and after the Experiment

	before experiment	after experiment	differences
Experimental group(N=15)	9.18±2.06	3.20±1.37	0.000
Control group(N=15)	9.20±2.23	9.21±3.15	0.597

3.4 The Influence of Unarmed Exercise on the Balance of Shoulder and Hip

When the human body is upright, scoliosis patients can not maintain normal body posture, and will have shoulder and hip askew; legs are not the same length and other symptoms [9]. The balance of shoulder and hip is mainly evaluated by measuring the angle between shoulder and hip and horizontal plane. The smaller the angle is, the more balanced it is. It can be seen from Table 5 that after 12 weeks, the shoulder balance of the experimental group has been significantly improved before and after the experiment ($P < 0.05$, with significant difference); the control group ($P > 0.05$, without significant difference). There was no significant difference

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between the experimental group (P > 0.05) and the control group (P < 0.05). However, the hip balance in the control group decreased, which means that the hip imbalance will be aggravated if the exercises are not carried out with bare hands. So we can say that barehanded exercise can improve the imbalance of hip and shoulder in scoliosis patients, and promote the balanced development of shoulder and hip. Its purpose is to change the asymmetrical stress on both sides of the spine, so as to control the development of scoliosis. Exercise can increase patients' coordination, proprioception and motor control [10].

Table 5 Comparison Of Shoulder and Hip Balance between Experimental Group and Control Group Before and after the Experiment

	Group	before experiment	after experiment	P
Shoulder	Experimental group(N=15)	0.89±0.67	0.62±0.67	0.029
	Control group(N=15)	0.92±0.81	0.93±0.96	0.699
Hip	Experimental group(N=15)	0.87±1.10	0.82±1.01	0.872
	Control group(N=15)	1.03±0.98	1.23±0.81	0.023

3.5 Effect of Free Hand Exercise on Cardiopulmonary Function

Patients with scoliosis will lead to reduction of thoracic volume, abnormal ventilation regulation, chest tightness, shortness of breath, chronic pain and other feelings. Scoliosis also affects the air exchange of human body, including local ventilation, blood flow, ventilation blood flow ratio and dispersion. Proper strength training can improve cardiopulmonary function [11]. After 12 weeks of practice, it can be seen from Table 6 that the experimental group's lung capacity has been significantly improved, while the control group's lung capacity has not changed significantly. P value of the experimental group is less than 0.01, there is very significant difference, P value of the control group is greater than 0.05, there is no significant difference. Therefore, we can think that barehanded exercise has a significant effect on improving the cardiopulmonary function of the practitioners.

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Table 6 Comparison of Vital Capacity between Experimental Group and Control Group Before and after the Experiment

	before experiment	after experiment	P
Experimental group(N=15)	2633.32±501.10	2911.23±509.11	0.001
Control group(N=15)	2628.54±499.78	2630.01±496.68	0.668

4. Conclusion

1) The Improvement of Body Function and Posture of Scoliosis Patients is Closely Related to Effective Physical Exercise.

2) Targeted unarmed exercise can significantly reduce the spine tilt angle of scoliosis patients, improve the imbalance of shoulder and hip, and improve the cardiopulmonary function of patients. The long-term practice of this set of barehanded exercises is of positive significance for the rehabilitation of patients with functional scoliosis and the maintenance of daily activities.

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