

Evaluation of the Practical Effect of Lumbar Muscle Strain Training in College Physical Education

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Abstract:

To evaluate the practical effect of lumbar muscle strain function training in college physical education class based on the combination of physical education and medicine pointed out by “Healthy China”, so as to provide reference for improving related intervention measures. A total of 306 students in physical education class were selected, including 44 patients with exercise lumbar muscle strain. All of them received flexibility combination training, which consisted of five parts: lumbar and hip synrotation, waist swinging and hip swinging, quick squat and slow rise, supine leg lifting and “arch bridge” pose. The training lasted for 16 weeks, once a week in class and three times a week in extracurricular homework. The symptoms of lumbar muscle strain, spinal range of motion and sEMG index were compared before and after training. Common strain of lumbar muscles through functional training for college students in physical education in colleges and universities to intervene, for students who did not have symptoms had preventive effect, to have symptoms, can alleviate the strain of lumbar muscles, improve spinal motion and sEMG index level, and improve patients may crowd of prevention and rehabilitation treatment provides a new Angle and means.

Keywords:

Functional Training, Motility, Lumbar Muscle Strain, Surface Electromyography, College Physical Education

1. Introduction

In 2019, the Opinions of The State Council on Implementing the Healthy China Initiative (hereinafter referred to as “Healthy China”) stated that prevention is the most cost-effective and effective health strategy; Promote the formation of disease management and health service model combining physical medicine and medicine. [1] The realization of “Healthy China” mainly relies on the popularization of health education. At the school level, it mainly relies on health-related courses, which have the widest audience and have been carried out for the longest time.

In addition to sitting in class, due to the popularity of electronic products, the daily sedentary time of college students has increased significantly, coupled with less movement and blindness, leading to physical dysfunction, such as common cervical and lumbar spine diseases, the incidence of which presents a significant younger trend [2]. Sports lumbar muscle strain refers to the damage to the lumbar muscles and vertebrae caused by long-term and repeated use of one or several sports positions. It is mainly manifested as low back pain forced to stop exercise or restricted activity, which is alleviated or improved after rest, and has the characteristics of climate, repetition and obstinacy [3]. Western medicine advocates that the rehabilitation treatment of exercise-induced lumbar muscle strain is mainly to reduce the load, reasonable conditioning exercise and rest, while traditional Chinese medicine mainly includes physical therapy, massage, acupuncture and traditional Chinese medicine treatment, but the specific methods and efficacy are still controversial. [4,5] found that patients with active movement is of great significance to the dynamic strain of lumbar muscles convalescence, such as function training can also have certain auxiliary treatment of some diseases, sensitivity of muscle development has an important role, in improving the muscle coordination, to improve the body balance has very good training effect, also can optimize the movement of body posture [6].

After seven years, this study, more than 5000 students of three universities for teaching and research basis, in order to “healthy China” pointed out that the body of the medical concept as the breakthrough point, the strain of lumbar muscles content into physical education in colleges and universities, teaching function training methods, to temporarily no symptoms or have symptoms of students as a preventive, for students with symptoms, evaluate its intervention effect.

2. Data and Methods

2.1. General Information

In September 2021, 306 students in the class taught by the author were selected as experimental subjects in Chongqing Vocational and Technical College of Water Conservancy and Electric Power. The teachers led the students majoring in social sports to evaluate all the students through the 2.2 psoas muscle strain symptom Grading Quantification Table [7], and 44 patients with psoas muscle strain were detected (83 cases with previous symptoms, 83 cases with previous symptoms). There were 32 males and 12 females, with a mean age of (19.64 ± 0.87) years, and a mean course of disease of (0.96 ± 0.18) years, ranging from 30 days to 2.0 years. There were 28 cases of unilateral pain and 16 cases of bilateral pain. 36 cases had muscle spasm. 31 patients had scoliosis. There were 12 cases with severe movement limitation. There were 9 cases of lower extremity traction pain. There were 10 cases with compressive pain in the waist. There were 6 patients without the above symptoms but with related discomfort. All show waist ache, bilge painful unwell, appear limb weakness when aching, repeat and weight alternate. The diagnosis of lumbar muscle strain was in line with the 1995 “Standard for the diagnosis and therapeutic effect of Traditional Chinese Medicine Diseases of the State Administration of Traditional Chinese Medicine” [3] : (1) long-term low back pain and recurrent attacks; (2) Pain and discomfort of one or both sides of the waist, feeling relieved at rest, aggravated and lingering after fatigue; Side or bilateral sacrospinous muscle mild tenderness, general lumbar and leg activities without obvious symptoms. Patients with lumbar disc herniation, intraspinal disease, spinal stenosis, sacroiliac joint and other diseases

were excluded. Waist pain caused by visceral and organic diseases of department of gynaecology. All subjects signed informed consent.

2.2. Observation Indicators

(1) Psoas muscle strain symptoms: Psoas muscle strain symptoms were evaluated from four aspects: pain, tenderness, dysfunction and insomnia by using the psoas muscle strain symptom grading quantitative table [7]. It is divided into light, medium and heavy grades, representing 2, 4 and 6 points respectively. The higher the score, the more severe the symptoms.

(2) Spinal range of motion: The patient bent down in a standing position and took the lowest position that could be touched by the fingertips of both hands as the scoring point, which was divided into 7 levels. The higher the score, the greater the range of motion: lower thigh (-1); Patella (0 points); The upper third of the calf (1 point); The middle third of the calf (2 points); Lower third of the calf (3 points); Instep (4 points); Contact with the ground (5 points).

(3) sEMG index: FlexComo Infiniti System SA7550 surface electromyography analysis system was used to detect the root mean square value (RMS) and average power frequency (MPF) in the relaxed state and bending state, respectively. The patient was in the training room with room temperature of about 25°C. Before the test, the skin was degreased and cleaned by alcohol cotton ball. Then the patient was placed in a standing position, and the three-pole electrode was pasted symmetrically on the part with obvious tenderness, and the surface of erector spines on both sides was used as the recording electrode. Electrodes in muscle belly and parallel to the muscle fibers.

2.3. Statistical Methods

SPSS 19.0 statistical software was used for data analysis. Measurement data were expressed as $\bar{x} \pm s$. Paired sample t test was used to compare the means before and after treatment. $P < 0.05$ was used to indicate statistical significance.

2.4. Teaching Steps

Import (the first lesson, dynamic strain of lumbar muscles symptoms and importance, and guide their thinking about his past and parents have similar symptoms, corresponding professional jobs was susceptible to the relationship between occupational disease, etc.) on pathogenic theory and prevention method (the first lesson, later again remind) teaching function training method (students with practice, Experience the correctness of actions) Students' practice (teachers' tour guidance, centralized correction of common problems)

Students demonstrate on the stage (students actively discuss, perfect details) Students practice in groups (teachers tour, correct mistakes again) summarize the sports skills, physical fitness.....

2.5. Functional training methods and exercise prescriptions

“Healthy China” puts forward the combination of physical education and medicine. Its purpose is to provide means and methods through physical education and ideas and paths through medical science, so as to make the intervention more targeted, practical and scientific [8]. To this end, AFTER rigorous evaluation and analysis of the

observed indicators according to medical ideas and paths, the intervention prescription is made by means and methods of sports.

All the students (306) received functional training in class, and each training lasted for about 10 minutes for a total of 16 weeks (one semester). Teachers will the training as homework, in the house of nailing school-based homework, each student that need to be completed in addition to the classroom practice three times a week, for the training time is the same as class, in the bedroom or 1 set 6 people, through the video upload, teachers in nailing and comments in the class, and the excellent and defect as next time to show and improve the course content. The training set is designed with 5 movements in total, including:

(1) Lumbar and hip corotation: legs upright, hands naturally droop. First, step your left foot out to the left, slightly wider than your shoulder. Gently support the opposite shoulder with both hands, rotate the upper body 45 degrees to the right and left, withdraw the left foot upright, change to the opposite side and repeat the above action, 15 ~ 20 times in total. During rotation, bilateral psoas muscles were tightened and the rotation intensity was gradually increased to avoid ligament and muscle strain. (2) Swing waist swing hip: feet apart, slightly wider than the shoulder. Bilateral elbow bending, with the mouth of the tiger at the waist, left and right swing waist hip about 15 ~ 20 degrees, a total of 15 ~ 20 times. When swinging, pay attention to the strength and Angle of the swing to avoid sprain; (3) fast squat slow up: feet apart, slightly wider than the shoulder. Bilateral elbow bending, to tiger mouth disposal in the waist, as far as possible squat, then stand up, need to squat slowly, a total of 15 ~ 20 times; (4) Supine leg lift: lie flat, lower limbs close together, straight, lift both legs, until the thigh vertical ground, pause, recovery, repeat 15 ~ 20 times. During leg lifting, try to keep your legs together and straight. The height of leg lifting should not exceed 90 degrees. Do not rely on inertia to complete the movement. (5) "Arch bridge" movement: lie on your back, bend your legs, form five-point support with your feet, elbows and back head, and raise your waist, back and hips vigorously, resembling an "arch bridge". When you feel tired, put it down slowly and rest in supine position for 3 to 5 seconds, for a cycle, a total of 15 to 20 cycles.

3. Results

Due to the systematic teaching of functional training methods in the class, and the consolidation through homework submission and error correction, and the teaching of prevention methods, only a few new cases occurred during the experiment, and all of them were effectively recovered through experimental intervention. Therefore, the following indicators were only compared before and after the experiment for 44 people with symptoms in the pretest.

3.1. Comparison of symptom scores of lumbar muscle strain before and after training

After training, each index of Psoas muscle strain symptom score was significantly lower than that before training, and the difference was statistically significant ($P < 0.05$). (Table 1).

Table 1. Comparison of symptom scores of lumbar muscle strain before and after training ($\chi \pm s$, $n=44$, points).

Time	Pain	Tenderness	Dysfunction	Insomnia	Total score
Before Training	4.92±1.49	4.00±1.05	3.80±1.03	2.50±0.85	15.25±1.99
After training	2.97±0.79	1.95±0.74	2.00±0.67	1.45±0.84	9.25±2.10
t	-3.038	4.583	4.630	4.714	9.000
p	0.014	0.001	0.001	0.001	0.000

3.2. Comparison of spinal motion scores before and after treatment

After treatment, the spinal range of motion score was significantly higher than that before treatment ($P=0.028$)

Table 2. Comparison of spinal range of motion scores before and after training ($\chi \pm s$).

Time	Spinal motion score
Before Training	1.30±0.82
After training	2.60±0.97
T	-2.623
P	0.028

3.3. Comparison of sEMG index levels before and after treatment

After 16 weeks of functional training, the levels of RMS and MPF were lower in the upright and bending posture than before training (both $P = 0.000$). (Table 3).

Table 3. Comparison of sEMG index levels before and after training ($\chi \pm s$).

Time	Relax (upright)		Bend down	
	RMS(uV)	MPF(Hz)	RMS(uV)	MPF(Hz)
Before Training	147.42±10.56	102.32±10.15	57.02±7.87	80.52±7.62
After training	115.92±19.03	74.53±13.32	29.54±13.34	36.93±8.72
T	6.425	8.842	6.349	5.342
P	0.000	0.000	0.000	0.000

4. Discuss

With the popularity of many sports programs, college students who sit for a long time and do little exercise are attracted to them. However, due to long-term lack of exercise and sedentary life, physical function decline, muscle strength deficiency, imbalance, etc. In addition, improper mastery of exercise techniques and movements, failure to do warm-up exercises before exercise, too long exercise time, and delayed and incomplete treatment after acute lumbar soft tissue injury are all causes of exercise-induced lumbar muscle strain [9]. Rehabilitation treatment of patients with exercise lumbar muscle strain is very important for the recovery of patients. Studies [10,11] have found that drug, physiotherapy and acupuncture combined with functional training can effectively improve the pain and tenderness of the lumbar muscle in patients with exercise lumbar muscle strain, and accelerate the improvement of activity function. But if the training is improper, it will aggravate the symptoms of lumbar muscle strain. Therefore, for the rehabilitation treatment of patients with lumbar muscle strain, not only need to relieve the pain of patients,

promote the affected area of blood circulation, but also pay attention to the positive effect of functional training on symptoms.

The muscles and soft tissues around the lumbar vertebrae are the main strength providers of the lower back and have various functions such as maintaining spinal stability and balancing posture. Research [12] that error motion will lead to the trunk to bear too much force, muscle mass force not harmonious or itself insufficient muscle strength, can make muscles keep tension for a long time, cause muscle in microcirculation system small vascular compression, organizational support is insufficient, the accumulation of metabolites, spur the local formation of traumatic inflammation, so that cause pain, If these injuries do not have sufficient time to repair, the long term will lead to musculofascial adhesion, hypertrophy, contracture or variation of rigid symptoms. Functional training can prevent sports injuries, improve recovery efficiency and sports performance by correcting muscle force balance, improving body stability and efficiency of movements [13]. In this study, functional training was applied to the rehabilitation of patients with exercise-induced lumbar muscle strain. After 16 weeks of intervention, the symptoms of lumbar muscle strain were significantly improved compared with those before training, and the spinal range of motion score was significantly increased compared with that before treatment ($P < 0.05$). In this study, functional training around the waist chain, based on mode of action, involving core muscle strength, balance, strength, stability, such as training, rather than isolated joints and muscles, respectively according to different muscles to the total design of five training: his hips with spin main increase his hips side waist muscle and spinal peripheral muscle flexibility; Swinging the waist and swinging the hip mainly increases the flexibility of the lumbar ligament and muscle; Fast squat slow rise mainly exercises waist and leg muscle strength; The supine leg lift mainly exercises the strength and flexibility of the abdominal muscles and the hip and lumbar muscles; The "arch bridge" movement mainly strengthens the muscles of the lower back. Therefore, functional training has a good rehabilitation effect on patients with exercise lumbar muscle strain.

sEMG is simple, non-invasive, real-time and multi-target, which is easy to be accepted by patients. Semg can be used to test a wide range of EMG signals, and clearly reflect the muscle activity state to a certain extent. It is a good biofeedback treatment technology. RMS can reflect the average discharge level in a certain period of time, which depends on the internal relationship between muscle load factors and the physiological and biochemical processes of muscle itself. MPF is an indicator of signal frequency characteristics, and its level is related to the conduction velocity of peripheral action potential, the type of motor units involved in the activity and the degree of synchronization. Studies [14-15] have proved that the bioelectrical signals recorded by sEMG can effectively determine the degree of muscle fatigue, analyze muscle coordination and stability, and evaluate the rehabilitation status of patients. In this study, after 16 weeks of functional training, the levels of RMS and MPF in the relaxed upright and bending posture were lower than those before training (both $P = 0.000$). It is further proved that functional training has a good rehabilitation effect on patients with exercise-induced lumbar muscle strain.

5. Conclusions and Suggestions

5.1. Conclusion

The research based on “health China” the body of medical philosophy, made useful attempt by physical education in colleges and universities, the common function of strain of lumbar muscles through training for college students in physical education in colleges and universities to intervene, for students who did not have symptoms had preventive effect, to have symptoms, can alleviate the strain of lumbar muscles, improve spinal motion and sEMG index level and improve patients.

5.2. Suggest

The combination of physical education and medicine makes the intervention method of PE teachers safer and puts forward more possibilities for the intervention content. College PE teachers can make beneficial attempts in class based on the common health problems found in the work, so that the “health first” can be better implemented and the construction process of “Healthy China” can be better promoted. Follow-up studies will involve more indicators, and the key will continue to move forward. For example, after screening for physical functions, targeted functional correction training programs will be developed to help students improve their physical test scores, improve their physical functions, and prevent and rehabilitate related musculoskeletal diseases.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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