Study on Tmg Evaluating the Effect of Vibration Training on Rehabilitation of Cai Patients

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Abstract: Objective: To explore the TMG assessment of the rehabilitation effect of vibration training on CAI patients. Methods: Twenty-four patients with chronic ankle instability (CAI) treated in our hospital from November 2018 to November 2019 were selected as observation objects, and randomly divided into a control group and an experimental group, with 12 cases in each group. Vibration training was performed, and the control group was given routine treatment. Non-invasive measurement technology (TMG) quantitatively evaluated the rehabilitation treatment effect of the two groups of patients. Results: After 8 weeks of training, the two groups of CAI patients evaluated the rehabilitation effect of the two groups of patients through TMG. The Tc of the two groups of CAI patients changed. The experimental group was significantly better than the control group, and the difference was statistically significant ($p < 0.05$) ; The Tr change of CAI patients in the two groups, the Tr time of the GM in the experimental group was significantly shortened, the difference was statistically significant ($p < 0.05$) ; The Dm change in the GL of the experimental group increased by 44.6%, the difference was statistically significant ($p < 0.05$) ; in the experimental group, the standing time with one eye open was 122.32s, and the standing time with one eye closed was 18.97s, which was significantly different from that before the experiment and was significantly better than the control group, the difference was statistically significant ($p < 0.05$) . Conclusion: During the rehabilitation treatment of CAI patients, it is found that the clinical effect of vibration training is very significant, which can effectively improve the muscle contraction ability and balance ability of CAI patients, and has obvious promotion value of rehabilitation treatment for CAI patients.

1. Introduction

Chronic ankle instability mainly refers to patients suffering from ankle instability and has suffered multiple unilateral or bilateral ankle sprains. The symptoms mainly include pain, swelling of the affected area, and decreased leg function. Usually the patient ignores the sprain of the ankle too much and fails to give a correct and effective treatment, or improperly exerts force later, resulting in the patient's repeated ankle sprain, which may even cause damage to the other joints of the patient. According to relevant statistics, 40% of patients with ankle sprains may develop chronic ankle instability, affecting the normal function of the ankle and causing irreparable serious consequences. In the clinical treatment of patients with chronic ankle instability, the application of sports rehabilitation treatment methods in recent years has achieved significant results, but in terms of clinical practice, the application of sports rehabilitation treatment mostly depends on the doctor ’s subjective treatment experience and lacks a systematic Research support. Vibration training is mainly to control vibration stimulation through a special vibration table, and to stimulate the body through mechanical vibration and external resistance load, induce neuromuscular reflex, promote muscle contraction, and at the same time give the bone repetitive stress stimulation, thereby improving the training object Physiological function. Therefore, in this paper, vibration training is applied to the rehabilitation treatment of CAI patients, and the recovery status of muscle and joint abilities is evaluated by TMG method, so as to provide corresponding research basis for sports

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rehabilitation treatment of CAI patients.

2. Information and Methods

2.1 General Information

Twenty-four patients with chronic ankle instability (CAI) treated in our hospital from November 2018 to November 2019 were selected as observation objects, and randomly divided into a control group and an experimental group, with 12 cases in each group. The experimental group implemented vibration For training, the control group is given routine treatment, and non-invasive measurement technology (TMG) quantitatively evaluates the rehabilitation treatment effect of the two groups of patients. Among them, there are 4 patients in the control group, 4 males and 8 females, the control group is 16-34 years old, and the average age is (23.1 ± 3.52) years old; the experimental group has 12 patients, 5 males There were 7 females and the control group was 14-35 years old, with an average age of (24.2 ± 4.21) years old. There was no statistically significant difference between the two groups in the general data such as gender and age(p>0.05).

2.2 Inclusion and Exclusion Criteria

Inclusion criteria: clinical manifestations of ankle injury for at least 3 months, repeated ankle sprains, and a feeling of instability of the ankle joint. The patient felt ankle joint pain and swelling; clinical X-ray imaging showed no obvious fracture, Ankle joints show ligament damage performance, such as ligament loss, thinning, relaxation, etc .; patients who agree and cooperate with this study.

Exclusion criteria: patients with severe fracture history and acute musculoskeletal injury of other joints were excluded; patients with severe eye diseases and severe cardiopulmonary diseases were excluded; patients who could not cooperate with this study were excluded.

2.3 Treatment

In the course of this study, the specific training methods of the control group and the experimental group are as follows:

1. The vibration training program of the experimental group includes heel lifting exercises, ankle valgus exercises (putting your feet in a vibration assist belt for valgus exercises), squat training, and shear squat training (with the affected leg behind, placed on the vibration table, Fore legs do lunges, put on flat ground), step steps, one-leg knee support, cross-squat (one leg standing on the vibration table, two legs alternate) exercises, the vibration training group is completed on the vibration training equipment, the control group of patients Training is done on level ground.

2. The vibration training time of the experimental group is 2 times a week, 30 minutes each time, the stimulation frequency is 45 Hz, and the entire training period is 8 weeks. The training of the control group is also twice a week, 30 minutes each time, and the training period is 8 weeks. The training time and rest time of the two groups were the same.

3. In order to ensure the training effect of the two groups, before the formal implementation of the training program, the training actions of the two groups of patients should be learned and adaptive training should be performed to reduce the sports injury caused by the unfamiliar training actions. None of the groups did any special muscle relaxation activities.

2.4 Observation Indicators

In this study, the quantitative evaluation method of noninvasive measurement technology (TMG) was used to measure the rehabilitation effect of two groups of CAI patients. The specific muscle targets related to the ankle joint were observed, including the medial gastrocnemius muscle (GM), lateral gastrocnemius muscle (GL), and anterior tibia Muscle (TA), the observation indicators are as follows:

Contraction time (Tc), that is, the time from the start of stimulation to the maximum tension in the process of isometric single contraction of skeletal muscle, is related to the contraction speed and contraction ability of skeletal muscle; Relaxation time (Relaxation time , Referred to as Tr), that is,

the muscle response decreases from 90% to 50% of the radial displacement, which is closely related to the muscle recovery ability; Displacement (Dm for short), which is determined by the radial displacement of the abdominal muscle, it represents The degree of muscle stiffness or muscle tension; balance ability refers to the ability to adjust the coordination of different muscles, thereby causing changes in the body's adaptability and excitability.

2.5 Statistical Processing

Use SPSS 22.0 statistical software to conduct statistical analysis and other processing on the teaching experiment data. The measurement data is tested by t test and expressed in the form of "x ± s". The difference is statistically significant(p<0.05).

3. Results

3.1 Tc Changes in Cai Patients

After 8 weeks of training, the Tc changes of the two groups of CAI patients were analyzed as a whole. The Tc changes of the experimental group were more than those of the control group. There was no significant difference in the Tc changes of the two groups of CAI patients. After the experimental group, after the vibration training, The Tc change time increased by 6.2%, while the control group increased by 18.2% compared with before the experiment, the GM change time of the experimental group increased by 14.2%, the control group increased by 29.3%, and the experimental group GL changed by 13.8%. Time, the control group increased by 21.4% than before the experiment, the experimental group was significantly better than the control group, as shown in Table 1, the difference was statistically significant(p<0.05).

Table 1 Tc Changes Before and after the Experiment in Two Groups of Cai Patients (Unit: Ms)

muscle	test group		Control group	
	Before the experiment	After the experiment	Before the experiment	After the experiment
GM	22.13	25.27	22.32	28.87
GL	32.43	36.92	31.98	38.82
TA	19.44	20.64	20.12	23.79

Note: $P < 0.05$, with statistical significance

3.2 Tr Changes in Cai Patients

After 8 weeks of training, the Tr changes of the two groups of CAI patients, the GM Tr time of the experimental group was significantly shortened, while the control group was increased, as shown in Table 2, the difference was statistically significant (p>0.05). However, the Tr time of GL and TA was not significantly different and had no statistical significance(p>0.05).

Table 2 Changes in Tr Before and after the Experiment in Two Groups of Cai Patients (Unit: Ms)

muscle	test group		Control group	
	Before the experiment	After the experiment	Before the experiment	After the experiment
GM	61.22	53.78	61.43	57.22
GL	47.84	47.88	47.58	47.44
TA	50.32	47.12	50.44	47.37

Note: $P < 0.05$, with statistical significance

3.3 Dm Changes in Cai Patients

After 8 weeks of training, there was no significant difference in Dm between the two groups of CAI patients and TA between the experimental group and the control group(p>0.05). The change of Dm of GL in the experimental group increased by 44.6%, the difference was statistically significant (p>0.05), as shown in Table 3.

Table 3 Changes of Dm Before and after the Experiment in Two Groups of Cai Patients

muscle	test group		Control group	
	Before the experiment	After the experiment	Before the experiment	After the experiment
GM	2.11	2.45	2.88	4.22
GL	3.34	4.83	5.22	5.84
TA	3.23	3.62	3.89	3.82

Note: $P < 0.05$, with statistical significance

3.4 Balance Ability of Cai Patients

After 8 weeks of training, the two groups of patients had a standing time of 122.32s with open eyes and one leg with closed eyes of 18.97s, which was significantly different from that before the experiment and the difference was statistically significant($p>0.05$); the open-leg one-leg standing time of the control group was 79.87s, and the closed-eye one-leg standing time was 15.38s. Compared with before the experiment, there was no significant difference and no statistical significance($p>0.05$).

Table 4 Balance Ability Of Two Groups of Cai Patients Before and after the Experiment (Unit: Second s)

Balance ability	test group		Control group	
	Before the experiment	After the experiment	Before the experiment	After the experiment
Standing time with one eye open	74.87	122.32	74.38	79.87
Standing time with closed eyes and one leg	13.54	18.97	13.21	15.38

Note: $P < 0.05$, with statistical significance

4. Discussion

The effect of vibration training on the improvement of skeletal muscle fatigue recovery ability is more obvious, which is related to the improvement of local blood circulation of target muscles by vibration training. During the vibration of the target muscle, the capillaries inside the muscle will be released to promote the acceleration of blood circulation, and the viscosity of the muscle will decrease, thereby enhancing the contractility and flexibility of the musculoskeletal. However, in the actual vibration training process, how to carry out effective measurement indicators and adjust the training plan adjustment plan is particularly important. The TMG method can indirectly guide or sense the physiological and biochemical parameters of the living body through non-invasive measurement, often by contacting the measuring instrument with the skin of the measured object. In this study, the TMG method was used to evaluate the effect of vibration training on the peripheral muscle function of the ankle joint of CAI patients, mainly through the stimulation of the patient's muscles by the sensors, which caused the muscles to contract accordingly, which can effectively measure the ankle muscle response of the test subjects.

This study found that after 8 weeks of training, the two groups of CAI patients were evaluated by TMG for the rehabilitation effect of the two groups. The Tc changes of the two groups of CAI patients were significantly better in the experimental group than the control group, and the difference was statistically significant($p<0.05$); Tr change of CAI patients in the two groups, Tr time of GM in the experimental group was significantly shortened, the difference was statistically significant($p<0.05$); Dm change of GL in the experimental group increased by 44.6%, the difference was statistically significant ($p<0.05$); in the experimental group, the standing time for one-legged open eyes is 122.32s and the closed-eye one-legged standing time is 18.97s, which is significantly different from that before the experiment and is significantly better than the control group($p<0.05$). It can be seen that in the rehabilitation treatment of CAI patients, the TMG method is scientific and effective in evaluating the effect of vibration training, and has the value of popularization and application of rehabilitation treatment. Gao Xiaojuan and other studies found that TMG can be used

as an evaluation method and technical indicator of muscle function status in the rehabilitation process of CAI patients, which is consistent with the results of this study.

In summary, during the rehabilitation training of CAI patients, the contraction time and radial displacement of TA, GM, and GL all increased, while the relaxation time did not change significantly. This shows that vibration training can significantly improve the muscle ability and balance ability of CAI patients. Therefore, in the rehabilitation process of CAI patients in the future, TMG can be used to evaluate the muscle function status of CAI patients during the rehabilitation process. The effect is more obvious and has clinical application value.

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References

[1] Wang Lu, Yu Ge, Chen Yaping. (2019).A systematic review and meta-analysis of balance training on self-report function and dynamic balance stability of patients with chronic ankle instability [J]. Electronic Journal of Foot and Ankle Surgery,vol.6, no.4,pp.1-7 + 73.

[2] Zhang Jie, Xia Wen, Ding Jianwei, Zheng Jiejiao. (2019).Biomechanical analysis of functional ankle instability and research progress in rehabilitation training [J]. Chinese Journal of Bone and Joint Injury, vol.34, no.12,pp.1337-1339.

[3] Zhang Ran, Yu Huixian, Hu Zhiwei, Wang Jianguo, Chen Yaping. (2019).Study on ankle current sensory threshold in patients with chronic functional ankle instability [J]. Chinese Journal of Rehabilitation Medicine, vol.34, no.11,pp.1323-1327 .

[4] Shi Xiaojian, Han Jia, Liu Yu, Wang Xueqiang, Chen Peijie. (2019).Research progress on the pathological mechanism, evaluation and diagnosis of chronic ankle instability [J]. Chinese Journal of Sports Medicine,vol38, no.9,pp.816-824.