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Feasibility Analysis of Progressive Resistance Inspiratory Muscle Training in the Treatment of Respiratory Dysfunction in Patients with Cervical Spinal Cord Injury

Jun Luo*

Department of rehabilitation，Suizhou Hospital Affiliated to Hubei University of Medicine, Suizhou, 441300, China

Abstract: Objective: To analyze the feasibility of progressive resistance inspiratory muscle training in the treatment of respiratory dysfunction in patients with cervical spinal cord injury. Methods: The 60 cases of patients with cervical spinal cord injury in a hospital are selected as the research object and randomly divided into experimental group and control group, 30 cases in each group. The control group is treated with routine rehabilitation therapy. The patients in the experimental group are treated with progressive resistance inspiratory muscle training after routine rehabilitation therapy. The degree of dyspnea and the incidence of respiratory complications are compared between the two groups. Results: The patients in the experimental group and the control group had significantly improved respiratory dysfunction after treatment, but the experimental group had a higher improvement in the degree of dyspnea and the incidence of respiratory complications is decreased. Conclusions: Progressive resistance inspiratory muscles training for patients with cervical spinal cord injury can effectively improve the respiratory system and reduce the incidence of complications.

Keywords: Progressive resistance; Inspiratory muscle; Cervical spinal cord injury; Respiratory function

1. Introduction

Cervical spinal cord injury is a spinal cord dysfunction caused by structural changes and functional damage of the spinal cord due to various reasons [1]. With the development of transportation in recent years and the widespread use of electronic products, the incidence of car accident injuries and cervical spondylosis has increased year by year, and the incidence and mortality of cervical spinal cord injury have also increased year by year. Although the survival rate of cervical spinal cord injury has gradually increased under modern medical treatment, its disability rate is still high, which not only affects the daily life of patients, but also increases the economic burden on families and society [2]. In addition to dysfunction of limbs and movements, patients with cervical spinal cord injury also have different degrees of respiratory function impairment. Patients with more serious conditions require long-term ventilator maintenance. Patients with cervical spinal cord injury will have various degrees of paralysis of respiratory muscles and loss of respiratory muscle function. Patients will have respiratory complications such as coughing difficulties, lung infections, and respiratory failure. Through the analysis of the existing data, it can be found that the respiratory complication becomes the complication with the highest incidence and mortality of cervical spinal cord injury [3]. Inhalation muscle training is mostly used for respiratory complications of patients with cervical spinal cord injury at present. It is mainly divided into threshold pressure load training, target flow training, speed limit threshold pressure load inspiratory muscle training, and nonlinear resistance breathing training, etc. However, in practical applications, it can be found that the existing training methods have some problems such as unstable training load, susceptibility to inspiratory flow and moisture flow, so they are only suitable for chronic obstructive diseases and other problems [4]. To help patients with cervical spinal cord injury recover better, a resistance training method for muscle strength that maintains a constant movement speed is proposed, that is, progressive resistance inspiratory muscle training [5]. By analyzing the feasibility of progressive resistance inspiratory muscle training for the treatment of respiratory dysfunction in patients with cervical spinal cord injury, it provides more possibilities for the treatment of respiratory dysfunction.

2. Experimental Subjects and Methods

2.1. Experimental subject

In the experiment, patients who meet the diagnostic criteria in the rehabilitation department and orthopedics department of a hospital are selected, and the selected cases all obtain patients' informed consent. The patients are graded according to the diagnostic criteria of Basic and Clinical Research Progress of Spinal Cord Injury: Spinal Cord Injury and the American Spinal Cord Injury Association Standard [6]. The selected cases are all treated for more than one week after surgery, and auxiliary training activities are allowed. The patient has a clear mind, stable vital signs, and is able to express himself clearly, and there is no respiratory infectious disease. In the process of case selection, exclude patients with unstable condition, cognitive impairment, unhealed rib fractures, severe cardiopulmonary and organ damage, and patients who are discharged before the treatment within four weeks or who experience discomfort during treatment [7]. 60 eligible patients with cervical spinal cord injury are selected and randomly divided into an experimental group and a control group. Of which, there are 30 patients in the control group, including 22 male and 8 female, age from 23 to 59 years, with an average age of (34.84±9.46) years. The average course of disease is (20.75±6.75) days, including 19 cases of incomplete injury and 11 cases of complete injury. There are 30 patients in the experimental group, including 23 male and 7 female, age from 22-60 years, with an average age of (35.76±10.08) years. The average course of disease is (19.97±7.06) days, including 20 cases of incomplete injury and 10 cases of complete injury.

2.2. Research method

Two groups of patients have received routine rehabilitation treatment for 5 days a week, lasting for 4 weeks. The experimental group adds progressive resistance inspiratory muscle training treatment, 5 days a week for 4 weeks. Of which, it includes muscle training for 2 times a day, lasting for 30 minutes each time, joint mobility exercises with 2 times a day, 30 minutes each time, balance function training with 2 times a day, 20 minutes each time, feedback resistance inspiration training of respiratory cycle with 2 times a day, 3 breaths each time. After 6 weeks of treatment, the incidence of pulmonary infection in both groups is observed. The patients in the experimental group are trained with the PowerbretheK5 breathing trainer, and the Breathe-link software program is used to monitor the treatment changes of the patients. The training and treatment should be conducted in a comfortable and quiet environment. After informing the patients in advance about the purpose, method and significance of the test, the patients should be explained that the test is harmless to reduce the tension of the patients and obtain the cooperation of the patient to ensure the accuracy of the experimental data [8]. Before the test, make sure that the PowerbretheK5 breath trainer is connected with the Breath-Link software, and debug to the test state after logging in the Breath-Link software. After the patient wears the nose clip and relaxes, he/she shall be in the sitting or semi-lying position and press the start button when ready. The patient holds the device to breathe as hard as possible, puts the mouthpiece into the mouth, and gently bites with the teeth, closes the mouth with the lips, tries to inhale quickly, and ensures that the inhalation time is more than 6s. When the patient inhales, the exhalation one-way valve is closed, and the patient needs to overcome the preset test load for the gas to be inhaled successfully.

3. Experimental Results

3.1. Baseline comparison

After the completion of the test, the general condition such as the basic information, injury level, course of disease, and severity of the two groups of patients are counted, and the baseline values of test patients in the two groups are obtained, as shown in Table 1:

Table 1. Comparison of basic data between experimental group and control group

Baseline value		Control group	Experimental group	p value
MMRC		3.6±0.95	3.55±0.883	P=0.746>0.05
PIF(L/s)		1.199±0.673	1.396±0.715	P=0.366>0.05
MIP(cmH2O)		23.03±9.57	26.20±11.44	P=0.36>0.05
ASIA Scale	A	4	5	x^2=0.62, p>0.05
	B	4	4	
	C	9	9	
	D	2	1	
Injury level		13/6	13/6	x2=0, p>0.05
Course of disease(day)		26.15±15.261	28.1±14.186	T=0.44, p=0.662
Weight(kg)		64.74±8.84	65.37±13.51	P=0.966>0.05
Height (cm)		167.53±6.92	65.37±13.51	P=0.36>0.05
Age(years old)		52.16±9.79	169.68±7.41	P=0.32>0.05
Gender(male/female)		12/7	48.32±13.43	x2=1.12, p>0.05

3.2. Comparison of MIP and PIF before and after treatment

After 2 weeks and 4 weeks of treatment, the changes in MIP and PIF values of the two groups of patients are more obvious. The results are shown in tables 2 and 3.

Table 2. Comparison of MIP value before and after treatment

Group	Control group	Experimental group
Cases	30	30
Before the treatment	23.03±9.57	26.20±11.44
2weeks after treatment	31.69±11.95	40.69±17.61
4 weeks after treatment	42.07±12.35	56.8±19.37

Table 3. Comparison of PIF values before and after treatment

Groups	Control group	Experimental group
Cases	30	30
Before the treatment	1.99±0.673	1.396±0.715
2weeks after treatment	1.689±0.742	2.23±1.073
4 weeks after treatment	2.277±0.764	3.140±1.089

3.3. Comparison of the degree of dyspnea before and after treatment

In the test, the degree of dyspnea after 4 weeks of treatment is lower than that before treatment. The results are shown in Table 4:

Table 4. Comparison of the degree of dyspnea before and after treatment

Group	Control group	Experimental group
Cases	30	30
Baseline value	3.55±0.945	3.6±0.883
4 weeks after treatment	2.175±0.99	1.825±0.847
The improvement value	1.375±0.741	1.775±0.835

3.4 Comparison of the incidence of respiratory complications

The incidence of respiratory complications in the two groups before and after treatment is shown in table 5:

Group	Control group	Experimental group	Total
Number of the infected	3	1	4
Number of uninfected people	27	29	56
Total	30	30	60

4 .Discussions

Patients with cervical spinal cord injury often exhibit abnormal breathing patterns. Under normal circumstances, the external intercostal muscles, internal intercostal muscles, and diaphragm are used to maintain human respiration. Under calm breathing, the pressure in the lungs decreases, the diaphragm and external intercostal muscles contract, and the lung space increases, forming an active inhalation exercise. The main respiratory muscles involved in human body are intercostal and diaphragmatic muscles, and diaphragm movement accounts for more than 70% of respiratory movements. However, after the patients' occurring cervical spinal cord injury, the function of the respiratory muscle and diaphragm decrease significantly, and the thoracic cage moves in reverse during breathing, which affects the respiratory function. Therefore, for inspiratory muscle training, increasing the inspiratory muscle resistance load appropriately can effectively increase the inspiratory muscle endurance and muscle strength, and fundamentally improve the patients' respiratory dysfunction.

References

[1] Yang Min, Liu Zhaohui, Wang Zhijie, et al. Effect of respiratory training on respiratory function of patients with cervical thoracic spinal cord injury. Clinical research and practice. 2020, 5(14), 167-169.

[2] Wang Wei, Lu Jing, Zhang Pei. Intervention effect of rehabilitation nursing on patients with cervical spinal cord injury and respiratory dysfunction. Clinical Research and Practice. 2020, 5(12), 172-174.

[3] Zhang Pei, Wang Wei, Lu Jing. Application effect of early respiratory function rehabilitation training and continuing nursing in patients with cervical spinal cord injury and its influence on respiratory function. Clinical Research and Practice. 2020, 5(09), 162-164.

[4] Zhang Meiying, Tan Zhihong, Ren Lanfen. The Effects of Feedback Resistance Inspiratory Muscle Training on Respiratory Function of Spinal Cord Injury. Journal of Hubei Minzu University (Medical Edition). 2020, 37(01), 46-49.

[5] Xu Mengting, Li Xiaoxu, Sun Wenyu, et al. To observe the effect of six-character formula combined with breathing training on lung function in patients with cervical and thoracic spinal cord injury. Tianjin Journal of Traditional Chinese Medicine. 2019, 36(11), 1065-1068.

[6] Liu Chenxin, Hou Xuliang, Meng Bing, et al. Optimal scale analysis of posttraumatic survival time in 65 cases of severe traumatic cervical spinal cord injury. Chinese Journal of Bone and Joint Injury. 2019, 34(03), 229-232.

[7] Di Luqin, Chen Caizhen, Cui Yi, et al. Application effect of cluster nursing on prevention of respiratory complications in patients with cervical spinal cord injury. Attend to Practice and Research. 2018, 15(16), 76-77.

[8] Li Weiling, Ding Qianqian, Luo Xiaomei, et al. Application of enhanced pulmonary function exercise in prevention of pulmonary infections in patients with thoracic spinal cord injury

complicated with paraplegia. Chinese Journal of Nosocomiology. 2018, 28(15), 2389-2393.