Case Report

Assessing the Effects of Proprioceptive Training and Conventional Rehabilitation on Recovery after ACL Reconstruction

Dai Haojie[1], Tanima Bhattacharya[1,2*]

[1]*Department of Nutrition, Faculty of Applied Science, Lincoln University College, Petaling Jaya, Selangor Darul Ehsan, Malaysia*

[2]*Center For Global Health Research, Saveetha Medical College, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, India*

Corresponding author:
Prof. Dr. Tanima Bhattacharya, Department of Nutrition, Faculty of Applied Science, Lincoln University College, Petaling Jaya, Selangor Darul Ehsan, Malaysia, E-mail: btanima1987@gmail.com

Received: 27-Sep-2024, Manuscript No. amhsr-24-150139;
Editor assigned: 30-Sep-2024, PreQC No. amhsr-24-150139 (PQ);
Reviewed: 14-Oct-2024, QC No. amhsr-24-150139;
Revised: 21-Oct-2024, Manuscript No: amhsr-24-150139 (R);
Published: 28-Oct-2024, DOI: 10.54608.annalsmedical.2024.173

Abstract

Objective: To survey the effect of neuromuscular electrical stimulation combined with rehabilitation training on rehabilitation after arthroscopic anterior cruciate ligament reconstruction.

Methods: A total of 82 patients with anterior cruciate ligament injury were selected as subjects, all of whom underwent arthroscopic reconstruction from January, 2023 to January, 2024 and were grouped by dichromatic sphere method. The results of rehabilitation were compared in 41 cases of routine training and 41 cases of neuromuscular electrical stimulation.

Results: The knee function scores of the study group at 4 weeks, 8 weeks and 12 weeks after surgery were not only higher than those before surgery, but also significantly higher than those of the conventional group, with statistical significance ($p<0.05$). The excellent and good rate of postoperative rehabilitation in the study group was higher than that in the conventional group (95.12% and 78.05%, respectively), which was statistically significant ($p<0.05$).

Conclusion: Neuromuscular electrical stimulation combined with rehabilitation training after arthroscopic anterior cruciate ligament reconstruction can improve the overall rehabilitation effect and it is worth popularizing and applying.

Keywords: Neuromuscular electrical stimulation; Rehabilitation training; Arthroscopic anterior cruciate ligament reconstruction; Rehabilitation

Introduction

The Anterior Cruciate Ligament (ACL) is an important part of the knee joint and its main function is to connect the tibia and femur together. After severe impact, it is easy to destroy the normal physiological structure and joint stability and then cause ACL injury [1]. If the treatment is not effective in a short period of time, it will affect the ability to exercise, joint function and the ability to live. In recent years, surgical techniques have been developing in the direction of minimally invasive surgery and arthroscopy has been applied in ACL reconstruction, which can reduce surgical trauma and accelerate postoperative rehabilitation. In order to achieve the ideal rehabilitation effect of joint function, rehabilitation training should be strengthened to improve the stability and flexibility of joint after operation. Neuromuscular Electrical Stimulation (NMES) is a modern rehabilitation technology. Through low-frequency current stimulation, motor nerve function can be repaired, which is of great significance for postoperative rehabilitation [2]. In order to further improve the postoperative rehabilitation effect of patients with ACL injury, our hospital combined rehabilitation training and NMES to conduct research to survey the application effect.

Materials and Methods

General information

The patients selected for this study were 82 patients with ACL injury who underwent arthroscopic reconstruction after admission from January, 2023 to January, 2024 and were divided into two groups according to the dichromatic sphere method, with 41 cases in each group. The patients in the conventional group were 25-69 years old, with an average age of (46.35 ± 3.28) years old, 19 cases were female and 22 cases were male. The injury causes were as follows: 23 cases were traffic accidents, 11 cases were falls during exercise and 7 cases were others. The patients in the study group were 22-67 years old, with an average age of (46.02 ± 3.37) years old, 20 cases were female and 21 cases were male. The causes of injury were as follows: 25 cases were traffic accidents, 10 cases were falls during exercise and 6 cases were others. The basic data between the two groups were close ($P>0.05$), which met the requirements of the study.

Methods

Patients in the conventional group received postoperative rehabilitation training only:

One week after surgery: Lying on the bed, wearing support tools, stretching legs, getting out of bed with the assistance of crutches and gradually performing iso-length contraction of lower limb muscles and foot and ankle exercises for 15 minutes each time, twice a day.

2-4 weeks after surgery: In the state of rest, use support tools to protect the knee joint, completely straighten and use crutches

How to Cite this Article: Haojie D, et al. Assessing the Effects of Proprioceptive Training and Conventional Rehabilitation on Recovery after ACL Reconstruction. Ann Med Health Sci Res. 2024;14:1060-1062.

during daily walking. At the same time, carry out straight leg lift training, calf raise training and stimulate the joint self-perception through a fixed bicycle, 15 minutes each time, training twice a day. The patient lay flat on the bed, with the help of others, passively flexion and extension of the knee joint, gradually expanding to 120°C for 30 minutes each time and training twice a day.

5-8 weeks after surgery: Wear support tools, actively perform knee flexion to 10°C; At the same time, the lower limb muscle strength training such as resistance knee extension and active walking was performed, or the patient stood on a soft pad with one knee for muscle strength and balance strength training.

9-12 weeks after surgery: The knee joint should not be over-extended at rest, but flexion as far as possible under the protection of support tools; At the same time, the half squat training was carried out, the squat amplitude was 0~45, each time was 15 minutes and the training was twice a day; In addition, the patient was guided to perform lateral step training to improve the flexibility of lower limbs.

12 weeks after surgery: Proprioceptive training, muscle strength training, jogging forward at a uniform speed, 15 minutes each training, twice a day; If the physical strength is not good, you can reduce the amount of exercise, if the physical strength is good, you can gradually increase the amount of exercise and carry out forward variable speed running, lateral running and backward running.

The patients in the study group received NMES at the same time

Starting from the 3rd day after surgery, the patients were lying flat on the bed with their head straightened and the electrodes were placed on the semitendinosus muscle, femoris thin muscle and biceps femoris muscle of the affected limb during treatment. The parameters were set as follows: The anteriorness of action was 20-30 mA, the frequency of action was 30 Hz, the pulse width was 30 μs and the intermittent time was 10-15 secs. The treatment was effective with visible stiff muscle relaxation and muscle tremor and continued for 30 minutes, once a day. The intervention time of both groups was 12 weeks.

Observation indicators

The knee function was evaluated before surgery, 4 weeks after surgery, 8 weeks after surgery and 12 weeks after surgery. The Lysholm knee score system was used to evaluate the knee function in eight aspects, including stairs and stairs, squatting, swelling, pain, knee stability, whether there was interlocking, weight bearing and lameness. The maximum score was 100 and the joint function was proportional to the score. To evaluate the rehabilitation effect of the patient,

- The knee joint function is completely restored, the activity is not limited and the patient can do difficult movements;
- Good recovery of knee joint function, mild limitation of activity and doing difficult movements, is good;
- The function of the knee joint is recovered and the daily activities are affected.
- If daily walking is seriously affected, it is poor.

Statistical analysis

Counting data and measurement data were analyzed using SPSS24.0 software and the test methods were described as x^2 and t and the ratio (%) and (± s), which were statistically significant when $p<0.05$.

Results

Comparison of preoperative and postoperative knee function scores

The knee function scores of the two groups were basically the same before operation ($p>0.05$). The score of 4-12 weeks after surgery in the study group was significantly higher than that in the conventional group ($p<0.05$) (Table 1).

Comparison of postoperative rehabilitation effects

Compared with the conventional group, the recovery rate of the study group was higher ($p<0.05$) (Table 2).

Table 1: Comparison of preoperative and postoperative knee joint function scores (± s, points)

Group	Number of cases	Before operation	4 weeks after surgery	8 weeks after surgery	12 weeks after surgery
Research group	41	48.62 ± 6.15	62.55 ± 5.04	68.15 ± 4.73	78.31 ± 4.06
Conventional group	41	49.24 ± 6.37	57.39 ± 5.71	61.57 ± 5.34	70.33 ± 4.58
t	-	0.448	4.338	5.906	8.349
p	-	0.655	0	0	0

Table 2: Comparison of postoperative rehabilitation effect

Group	Number of cases	Optimal	Good	In between	Poor	Merit ratio
Research group	41	29 (70.73)	10 (24.39)	2 (4.88)	0 (0.00)	39 (95.12)
Conventional group	41	23 (56.10)	9 (21.95)	7 (17.07)	2 (4.88)	32 (78.05)
x^2	-	-	-	-	-	5.145
p	-	-	-	-	-	0.023

Discussion

The In the knee joint, ACL is the most fragile and functional structure, which can guide and constrain the physiological movement of the knee joint [3]. After ACL injury, the normal physiological function will be damaged, the stability of the knee joint will be reduced and the load transfer disorder will occur and it is easy to cause osteoarthritis. Because ACL injury cannot be repaired by itself, timely surgical treatment is required. At present, arthroscopic ACL reconstruction is the main measure, which can reduce complications and restore the stability of the knee joint as soon as possible. Postoperative rehabilitation training is the most effective and safe way to ensure the overall rehabilitation effect. Different training programs can be developed according to the rehabilitation process and appropriate stimulation can be carried out to rebuild the neural reflex network and restore the transmission function. At the same time, it can also prevent the waste and atrophy of leg muscles, laying the foundation for postoperative rehabilitation [4]. For example, insisting on pushing the patella can improve local blood circulation, promote congestion absorption, relieve postoperative joint swelling and pain symptoms and help increase joint motion; Simultaneous isometric contraction training can stimulate the function of neurons and improve the balance and coordination of the body after surgery.

NMES is a new type of therapy combining myoelectric biofeedback and low frequency current, which can consolidate the training effect and even replace the effect of active exercise. Through electrical stimulation, the physiological feedback mechanism of the nervous system is simulated to stimulate the muscles of the affected limb, make the muscles contract regularly and enhance muscle strength [5]. At the same time, it can also improve the internal microcirculation of the joint and gradually improve the function of the knee joint. Combined with routine rehabilitation training after surgery, it can fill the defect of active activity, promote local blood circulation and speed up the repair of affected tissues. Adherence to NMES therapy after surgery can reduce synaptic resistance, rebuild neural motor network, improve neuronal paralysis and improve motor neuron function [6]. In this study, patients in the study group were given the above combined intervention program and the knee function scores at 4, 8 and 12 weeks after surgery were higher than those in the conventional group and the overall recovery rate was also higher than that in the conventional group ($p<0.05$).

Conclusion

In conclusion, neuromuscular electrical stimulation combined with rehabilitation training after anterior cruciate ligament reconstruction under arthroscopy can improve the overall rehabilitation effect and is worth popularizing and applying. The combination of rehabilitation training and NMES can better improve the postoperative knee joint function and range of motion and improve the daily living ability of patients. Because rehabilitation training is mainly to restore the normal physiological function of muscles and NMES helps to re-establish the central nervous-motor nerve conduction pathway, the combination of the two can achieve the ideal rehabilitation effect faster.

References

1. Li Qi, Gao Mingwei, Li Shihao. The relationship between muscle and functional performance after anterior cruciate ligament reconstruction. Journal of Tissue Engineering. 2024;28:5536-5543.
2. Yuan Li, Fangyuan X, Dayong Z. Effects of wearable vibration feedback training on balance and walking function of patients after anterior cruciate ligament reconstruction. Chinese Journal of Rehabilitation Medicine. 2023;38:325-330.
3. Liming Z, Bin H, Xinsheng W. Effects of virtual reality balance training combined with neuromuscular electrical stimulation on knee function, hamstring muscle strength and walking function of patients after anterior cruciate ligament reconstruction. Advances in Modern Biomedicine. 2023;23:294-298.
4. Lunlun S. Effect of rehabilitation training on arthroscopic cruciate ligament reconstruction in patients with triad knee injury. Clinical Medicine Research and Practice. 2023;8:137-139.
5. Wei H. Effect of routine rehabilitation training combined with intensive proprioceptive training on postoperative rehabilitation of patients with exercise-induced anterior cruciate ligament and meniscus injury of knee joint. Chinese Journal of Practical Medicine. 2022;17:186-188.
6. Qiong H, Qiang L, Nanxin Z. Effect of neuromuscular electrical stimulation combined with early rehabilitation training on rehabilitation after anterior cruciate ligament reconstruction under arthroscopy. Chinese and Foreign Medical Research. 2021;19:121-123.