

Effect of Percutaneous Acupoint Electrical Stimulation Combined with Early Lower Limb Massage on Rehabilitation after Reconstruction of Anterior Cruciate Ligament Injury of the Knee

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Abstract

Objective: To investigate the effect of percutaneous acupoint electrical stimulation combined with early lower limb massage on knee rehabilitation after reconstruction of anterior cruciate ligament injury. **Methods:** 120 cases of patients admitted to our hospital from January 2019 to December 2022 were selected as the study subjects, and all patients were divided into observation group and control group, with 60 patients in each group. The patients in the control group took routine postoperative rehabilitation treatment. The observation group added percutaneous acupoint electrical stimulation combined with early lower limb massage on the basis of the pain and swelling before and for 6 months in the two groups, location perception and motion perception and knee function in the two groups. **Results:** The swelling value and visual analog scale (VAS) scores in the two treatment groups were significantly decreased, and the observation group was lower than the control group ($P < 0.05$); the knee and 45 degrees, knee extension and knee motion were lower than the control group ($P < 0.05$); the knee subjective (IKDC) score and knee function (Lysholm) scores were significantly lower, and the observation group was lower than the control group ($P < 0.05$). **Conclusion:** Percutaneous acupoint electrical stimulation combined with early lower limb massage can reduce the long-term pain and swelling after knee anterior cruciate ligament injury reconstruction, improve the patient's knee position and motion perception, and further improve the knee function and motor function.

Keywords

Percutaneous acupoint electrical stimulation, early lower limb massage, knee joint, reconstruction of anterior cruciate ligament injury

Although the success of anterior cruciate ligament reconstruction is related to the surgical skills, the postoperative rehabilitation of knee motor function also has the same important value [1]. The purpose of rehabilitation is to restore the knee function and stability of the missing anterior cruciate ligament and promote the return to the activity level before the injury. At present, routine rehabilitation treatment is adopted for patients after reconstruction of knee anterior cruciate ligament injury. Although it can promote early postoperative recovery, the improvement effect of knee function is not obvious [2]. Therefore, what kind of rehabilitation treatment has better effect has become the hot topic of postoperative rehabilitation treatment after reconstruction of knee anterior cruciate ligament

injury. Percutaneous acupoint electrical stimulation is a rehabilitation method developed on the basis of acupuncture and moxibustion. It is widely used in clinical practice. It can exert the effect of coordinating blood qi, tonifying deficiency and reducing reality, coordinating viscera, relaxing tendons and dredging collaterals [3] through the current stimulation of acupoints. In addition, some studies have found that [4] and lower limb massage can make up for the insufficient short-term motor function of patients after knee anterior cruciate ligament reconstruction, and further improve the long-term knee joint function of patients. However, it is not clear whether percutaneous acupoint electrical stimulation combined with early lower limb massage can further improve the postoperative rehabilitation effect of patients. Therefore, in order to improve the long-term rehabilitation effect of patients undergoing ACL reconstruction, 120 patients undergoing ACL reconstruction were selected and reported as follows.

1. Data and methods

1.1 General information

A total of 120 patients admitted to our hospital from January 2019 to December 2, 2022 were selected as the study subjects, and all patients were divided into observation group and control group, with 60 patients in each group. In the control group, 33 males and 27 females; aged 42 to 73 years, mean (56.25 ± 2.54), weight was 50 to 85 kg, mean (63.98 ± 6.47) kg; cause of sports injury, 27 of traffic accident injuries, and 19 related injuries. In the observation group, 31 males and 29 females; aged 40-71 years, mean (56.53 ± 2.65), weight was 49 to 83 kg, mean (63.24 ± 6.78) kg; cause of injury, 28 traffic accident injury, and 17 injuries. There was no significant difference between the two groups ($P > 0.05$), which was comparable. This study was approved by the ethics committee of our hospital.

1.2 Inclusion and exclusion criteria

Inclusion criteria: patients after knee anterior cruciate ligament injury reconstruction; age 18 years; conscious patient; complete clinical data; informed of the study and signed consent.

Exclusion criteria: Patients with cardiac dysfunction; patients with renal insufficiency; patients with mental illness; patients with severe cognitive dissonance; patients with immune system disorders; patients with hospital transfer or withdrawal from the experiment; patients who do not agree to participate in clinical trials.

1.3 Methods

Control group: the implementation of routine rehabilitation treatment, specific method is: communicate with patients, understand the problems in the process of rehabilitation, and the rehabilitation health knowledge, solution patients inner doubt and anxiety, anxiety, tension, fear and other emotions, to encourage patients, establish the patient's rehabilitation confidence. Patients with posterior leg lift, straight leg lift, lateral leg lift and other rehabilitation care, each movement for more than 20 times, each time for 5s. Observe the patient and guide the patient to get out of bed exercise. The goal for the first two weeks is to control postoperative pain and swelling with a joint range of 90. Six weeks after surgery, the patient's joint range of motion gradually reached 130 and reached a normal gait. Patients mainly after this time and need to focus on restoring muscle strength and body sensations. After the strength recovery 3 months after surgery, we can focus on improving the limb function performance. At 6 months after surgery, patients were allowed to gradually participate in physical activity when the quadriceps femoris and hamstrings were above 85%, with joint mobility > 130 degrees. However, the type, frequency and intensity of exercise are tailored to the physical and psychological condition of each patient assessed by the physiotherapist and orthopaedic surgeon. All patients in the supervised rehabilitation group are required to go to the rehabilitation center of the hospital once a week for a period of three months, and all patients are required to undergo relevant rehabilitation training by a dedicated physical therapist. After 3 months, the patient was followed up once every two weeks according to the judgment of the physical therapist, and the rehabilitation treatment plan was adjusted at any time.

Observation group: Add percutaneous acupoint electrical stimulation on the control group. The specific methods were: (1) percutaneous acupoint electrical stimulation, select Yingshi, Qinghai, Yanglingquan, Yinlingquan, Zusanli and Liangqiu, and apply microcomputer low-frequency treatment instrument (manufacturer: Yangcheng, Guangdong Province; model: YC-81D), even maximum power of 300 mW, pulse width of 30-200 μ s, and frequency of 0-300Hz. The 5cm * 5cm electrode was placed on the acupoints, gradually adjust the current intensity, and finally maintain it at 1-4 mA to achieve local muscle tremor for 30min, once a day, for 30d; (2) early lower limb massage, on the first day, the patient took the supine position, from leg to thigh, and the entermuscle and quadriceps muscle group were taken and rubbed, moderate intensity, to avoid excessive incision pain, 10min each time, twice a day,

and the family was taught how to operate, massage until 2 weeks after surgery. One week after the operation, the patient was pressed in blood, Kunlun, Jixi, Taichong and Fengcheng, repeated 20 times every acupoint, pressed for 3s, twice a day, and repeated massage for 2 weeks, with acid and swelling as the degree. After massage, the patient's families need to be taught how to accurately find the acupoints.

1.4 Observing indicators

(1) Pain and swelling: The visual analog scale (Visual analogue scale, VAS) was applied to evaluate the patient's pain before and after 6 months of the treatment, and the patient was instructed to choose one from the number of 0-10 to represent their own pain. The lower the score, the lower the pain degree [5]. A skin ruler was used to measure the middiameter of the patella and the affected side swelling value was calculated. The affected side swelling value = affected side- [6]. Take attention to keep the knee relaxed and do it after straightening.

(2) Location perception and motion perception: observe the knee position perception before and 6 months after treatment, the two groups were: determine knee joints by CPM instrument, 75 degrees, 45 degrees and 15 degrees, each patient tested 3 times, the average, the higher the score, the knee motion perception, each patient tested 3 times, the average, the higher the mean indicates the worse motion perception.

(3) Knee function: application of knee subjective (Knee subjective, IKDC) score, knee function (Lysholm) score for the knee function, the IKDC score is the degree of anterior cruciate ligament injury, including physical activity, function and symptoms, a total of 100 points, the lower the score represents the worse the knee function [7]. The Lysholm score was used to detect knee function, including limited squatting, difficulty in climbing stairs, swelling, interlocking, support, instability, instability, pain and waveform, a total of 100 points. The lower the patient score, the worse knee function [8].

1.5 Statistical methods

The statistical software SPSS 23.0 was used to analyze the study data, and the count data were expressed as cases / percentage (n /%) for χ^2 test; the measurement data conforming to the normal distribution were expressed by mean \pm standard deviation ($\bar{x} \pm s$) and t test; $P < 0.05$ was considered to be significant.

2. Results

2.1 Affected limb pain and swelling condition comparison

After treatment, the affected limb swelling value and VAS score in both groups were significantly reduced, and the observation group was lower than the control group ($P < 0.05$), as shown in Table 1.

Table 1. Pain and swelling in the affected limb ($\bar{x} \pm s$)

group	Example number	The swelling value of the affected side (cm)		VAS (grade)	
		pretherapy	post-treatment	pretherapy	post-treatment
observation group	60	4.75 \pm 1.25	1.58 \pm 0.12 ^a	6.24 \pm 1.49	1.52 \pm 0.31 ^a
control group	60	4.78 \pm 1.37	2.36 \pm 0.35 ^a	6.22 \pm 1.31	2.69 \pm 0.24 ^a
<i>t</i>	-	0.580	13.551	1.569	33.243
<i>P</i>	-	0.563	0.001	0.118	0.001

Note: A indicates $P < 0.05$ between groups compared before treatment.

2.2 Comparison of knee motion perception and position perception

After treatment, knee position perception was 75 degrees, 45 degrees and 15 degrees, and knee motion perception was decreased, and the patients in the observation group were lower than the control group ($P < 0.05$), as shown in Table 2.

2.3 Comparison of knee joint function

After treatment, the IKDC score and Lysholm score were significantly lower, and the observation group was lower than the control group ($P < 0.05$), as shown in Table 3.

Table 2. Comparison of knee motion perception and position perception ($\bar{x} \pm s, ^\circ$)

group	Example number	75°		45°		15°		extension of knee joint		go down on one's knees	
		pretherapy	post-treatment	pretherapy	post-treatment	pretherapy	post-treatment	pretherapy	post-treatment	pretherapy	post-treatment
observation group	60	5.23±1.21	4.49±0.95 ^a	14.78±2.64	7.98±1.68 ^a	21.04±3.38	14.87±2.56 ^a	15.63±2.21	5.03±1.11 ^a	12.56±3.64	4.36±1.12 ^a
control group	60	5.22±1.22	4.86±0.56 ^a	14.79±3.98	9.08±1.48 ^a	21.05±3.33	16.38±2.98 ^a	15.62±4.19	5.60±1.15 ^a	12.95±2.98	4.93±1.13 ^a
<i>t</i>	-	0.232	2.372	0.060	3.474	0.140	9.460	0.042	2.522	0.586	2.533
<i>P</i>	-	0.817	0.020	0.952	0.001	0.889	0.000	0.967	0.013	0.559	0.013

Note: A indicates P < 0.05 between groups compared before treatment.

Table 3 Comparison of knee joint function ($\bar{x} \pm s$, grade)

group	Example number	IKDC		Lysholm	
		pretherapy	post-treatment	pretherapy	post-treatment
observation group	60	63.75±9.25	95.58±11.12 ^a	58.24±13.49	72.02±9.31 ^a
control group	60	62.78±7.37	91.36±9.15 ^a	57.62±15.31	65.69±8.24 ^a
<i>t</i>	-	0.795	13.551	1.569	33.243
<i>P</i>	-	0.427	0.001	0.118	0.001

Note: A indicates P < 0.05 between groups compared before treatment.

3. Discussion

3.1 Percutaneous acupoint electrical stimulation combined with early lower limb massage effect on pain and swelling degree

The results of this study showed that the affected limb swelling value and VAS score were significantly reduced after treatment, and the observation group was lower than the control group (P < 0.05). It is suggested that adding percutaneous acupoint electrical stimulation combined with early lower limb massage. According to traditional Chinese medicine, knee joint injury belongs to arthralgia, which leads to loss of nourishment of bones and muscles, compensation of qi and blood operation, imbalance of qi machine, and trauma caused by surgery, which will lead to the condition to further aggravate the [9]. The different acupoints selected on the basis of electrical stimulation of percutaneous acupoints can achieve the effects of soothing static, relieving collaterals and relieving pain, dispelling wind and dispersing cold, promoting blood circulation and removing blood stasis, tonifying liver and kidney, strengthening bones and muscles, promoting joint qi and blood, reduce the degree of swelling and reduce pain [10]. At the same time, in the acupoints selected for early lower limb massage for patients, Qinghai point can adjust meridian and pass blood; Jixi point can treat ankle weakness; Kunlun point can improve lower limb paralysis; swelling and pain; Taixi point can treat lower limb impotence and medial pain in knee and femoral; capital point can strengthen muscles, remove cold, and activate meridians. The combination of acupoints to reduce the affected limb swelling, promote blood circulation, and further reduce the pain of patients.

3.2 Effect of percutaneous acupoint electrical stimulation combined with early lower limb massage on knee motion perception and position perception

The results of this study showed that after the treatment, 75 degrees, 45 degrees, 15 degrees of knee motion perception decreased, and the patients in the observation group were lower than that in the control group (P < 0.05). According to traditional Chinese medicine, cruciate ligament injury belongs to the category of tendon injury. After reconstruction, blood stasis and dampness can cause the obstruction of qi and blood veins, cause joint fibrosis and adhesion, and reduce knee motion perception and position perception. And take percutaneous acupoint electrical stimulation combined early lower limb massage can improve patients with knee joint motion and location, mainly because the percutaneous acupoint electrical stimulation is combined with percutaneous electrical stimulation and acupuncture treatment, noninvasive, can improve patients pain threshold, control can also adjust the blood composition, adjust tissues and organs, improve patients' immune ability, can help tissue rapid recovery, promote patients movement function recovery. At the same time, combined lower limb massage can activate meridians, improve the

movement of patients' knee joint, promote blood circulation and qi, promote fluid flow in the joint cavity, effectively prevent muscle atrophy, stiffness and knee adhesion, and improve knee motion perception and position perception.

3.3 Effect of percutaneous acupoint electrical stimulation combined with early lower limb massage on knee function

The results of this study showed that the IKDC score and Lysholm score of the patients in both groups were significantly reduced after treatment, and the observation group was lower than the control group ($P < 0.05$). This is mainly because the movement of each joint is mainly caused by the relaxation and contraction of muscle groups, and the lower limb joints also need to be caused by the movement of the main muscle groups during walking. The use of lower limb massage and percutaneous acupoint electrical stimulation can greatly improve the knee circle, reduce the postoperative pain degree of patients, promote swelling regression, improve the compliance of patients with rehabilitation training, and provide favorable conditions for rehabilitation training, which is conducive to the recovery of patients' knee function. In conclusion, percutaneous acupoint electrical stimulation combined with early lower limb massage can reduce the long-term pain and swelling after the reconstruction of knee anterior cruciate ligament injury, improve the knee position and motion perception of patients, and further improve the knee function and motor function.

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