

SPORTS REHABILITATION IN ATHLETES WITH MENISCAL LESIONS BASED ON ELECTROACUPUNCTURE ASSOCIATED WITH SPORTS THERAPY



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REABILITAÇÃO ESPORTIVA DE ATLETAS COM LESÃO MENISCAL BASEADA EM ELETROACUPUNTURA COMBINADA À TERAPIA ESPORTIVA

REHABILITACIÓN DEPORTIVA DE ATLETAS CON LESIÓN MENISCAL BASADA EN ELECTROACUPUNTURA COMBINADA CON LA TERAPIA DEPORTIVA

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ABSTRACT

Introduction: Meniscal injury is a common condition that can lead to disability due to pain and proprioceptive failure, requiring immediate attention. Combination therapies involve advanced approaches aiming to accelerate rehabilitation in athletes, and electroacupuncture presents therapeutic benefits, although there is still no evidence of its combination with sports therapy. **Objective:** This paper analyzes the performance of sports rehabilitation in athletes with meniscal lesions using electroacupuncture combined with sports therapy. **Methods:** The intervention in the control group was based on a traditional range of motion work, muscle strength, proprioceptive training, and other exercise therapies, while the experimental group received a 30 min electro-acupuncture protocol three times a week for four consecutive weeks. The surrogate data (gender, age, disease course, location) are the same. Before treatment, joint activity, muscle strength, total joint scale score of the LYSHOLM questionnaire, and other observational indices were measured during the 6th and 12th week of treatment. The non-parametric statistical method and T-test were used to analyze the changes of each index before and after treatment. After 12 weeks of treatment, the difference between the experimental group and the combination before treatment was significant. **Results:** The treatment effect of the experimental group was significantly better than the control group. **Conclusion:** The effect of sports rehabilitation of athletes with meniscus injury based on electroacupuncture combined with sports therapy showed high resolute application value, indicating an alternative for non-surgical treatment in knee meniscus injuries. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

Keywords: Exercise Therapy; Electroacupuncture; Tibial Meniscus Injuries; Physical Therapy Modalities.

RESUMO

Introdução: A lesão meniscal é um acometimento comum que pode gerar incapacitação por dor e falha proprioceptiva, exigindo atenção imediata. Terapias combinadas envolvem abordagens avançadas com o objetivo de acelerar a reabilitação nos atletas, e a eletroacupuntura apresenta benefícios terapêuticos, embora ainda não possua evidências de sua combinação com a terapia esportiva. **Objetivo:** Analisar o desempenho da reabilitação esportiva em atletas com lesão meniscal utilizando eletroacupuntura combinada à terapia esportiva. **Métodos:** A intervenção no grupo controle baseou-se no trabalho tradicional de amplitude de movimento, força muscular, treinamento proprioceptivo e outros tipos de terapias de exercício enquanto que ao grupo experimental foi adicionado um protocolo de eletro-acupuntura de 30 minutos de duração, 3 vezes por semana durante 4 semanas consecutivas. Os dados de substituição (sexo, idade, curso de doença, localização) são basicamente os mesmos. Antes do tratamento, a atividade articular, a força muscular, o escore total da escala articular do questionário LYSHOLM e outros índices de observação foram medidos na 6ª e 12ª semana do tratamento. O método estatístico não paramétrico e teste-T foram utilizados para analisar as alterações de cada índice antes e depois do tratamento. Após 12 semanas de tratamento, a diferença entre o grupo experimental e a combinação antes do tratamento foi significativa. **Resultados:** O efeito de tratamento do grupo experimental foi significativamente melhor do que o grupo controle. **Conclusão:** O efeito de reabilitação esportiva de atletas com lesão meniscal baseada em eletroacupuntura combinada à terapia esportiva demonstrou alto valor de aplicação resolutiva, indicada como alternativa para o tratamento não cirúrgico em lesões no menisco do joelho. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

Descritores: Terapia por Exercício; Eletroacupuntura; Lesões do Menisco Tibial; Modalidades de Fisioterapia.

RESUMEN

Introducción: La lesión meniscal es una lesión común que puede causar incapacidad por dolor y fallo propioceptivo, requiriendo atención inmediata. Las terapias combinadas implican enfoques avanzados con el objetivo de acelerar la rehabilitación en los deportistas, y la electroacupuntura presenta beneficios terapéuticos, aunque todavía no hay pruebas de su combinación con la terapia deportiva. **Objetivo:** Analizar el rendimiento de la rehabilitación



deportiva en atletas con lesión meniscal utilizando electroacupuntura combinada con la terapia deportiva. Métodos: La intervención en el grupo de control se basó en el trabajo tradicional de amplitud de movimiento, fuerza muscular, entrenamiento propioceptivo y otros tipos de terapias de ejercicio, mientras que al grupo experimental se le añadió un protocolo de electroacupuntura de 30 minutos de duración, 3 veces a la semana durante 4 semanas consecutivas. Los datos sustitutos (sexo, edad, evolución de la enfermedad, localización) son básicamente los mismos. Antes del tratamiento, se midieron la actividad articular, la fuerza muscular, la puntuación total de la escala articular del cuestionario LYSHOLM y otros índices de observación en la 6ª y 12ª semana de tratamiento. Se utilizó el método estadístico no paramétrico y la prueba T para analizar los cambios de cada índice antes y después del tratamiento. Tras 12 semanas de tratamiento, la diferencia entre el grupo experimental y la combinación antes del tratamiento era significativa. Resultados: El efecto del tratamiento del grupo experimental fue significativamente mejor que el del grupo de control. Conclusión: El efecto de la rehabilitación deportiva de atletas con lesión de menisco basada en la electroacupuntura combinada con la terapia deportiva mostró un alto valor de aplicación resolutoria, indicada como alternativa de tratamiento no quirúrgico en las lesiones de menisco de rodilla. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

Descriptor: Terapia por Ejercicio; Electroacupuntura; Lesiones de Menisco Tibial; Modalidades de Fisioterapia.

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INTRODUCTION

With the social progress, economic development, the improvement of residents' living standards, and the rise of national sports, people pay more and more attention to their physical quality and health, making more people join in sports. In the process of exercise, because of the lack of understanding of the exercise load, exercise time and correct posture, it is bound to cause sports injury in some parts of the body. There are many franchise situations in the sports field, and the special posture caused by the special situation has become the hidden danger of many athletes' various injuries. In daily sports training, it is often seen that athletes' knee joint injury, especially Meniscus Injury (MI).¹

Proprioception (PP) was put forward by Sherrington^{2,3} more than 120 years ago. It is the feeling produced by the moving organs such as finger muscles, tendons and joints in different states (motion or static).

Meniscus tear is the most common knee injury, which may occur in young patients with acute knee injury, or as part of the degenerative process in the elderly. Žarko Dašić et al.⁴ studied and analyzed the results of 99 cases of partial meniscectomy under arthroscope from 2005 to 2013, and found that the treatment of partial meniscectomy has a good therapeutic effect on medial meniscus injury. Xiao, F et al.^{5,6} analyzed 47 patients with meniscus anterior angle injury under arthroscopic suture treatment. Lysholm knee joint scoring system was used to evaluate and analyze the symptoms of preoperative and postoperative pain and lame embolism. Dariusz Boguszewski^{7,8} studied the effect of exercise therapy on the rehabilitation of patients with meniscus injury. 23 patients aged 20-41 years were selected as the study object, and the patients were randomly divided into experimental group and control group. Lin Zefeng et al.^{9,10} used motion capture system to observe the motion characteristics of the lateral discoid meniscus knee joint after the injury, and compared the difference between the lateral discoid meniscus knee joint and the normal knee joint. This study provides an important reference value for the dynamic function of knee joint with lateral discoid meniscus injury.^{11,12}

Based on the above background, athletes in the field may cause meniscus injury of knee joint due to various conditions, thus affecting their career. In order to promote the rehabilitation of knee meniscus injury, this paper discusses the effect of electroacupuncture combined with sports therapy on the sports function of athletes with meniscus injury.^{13,14} The aim is to study the rehabilitation effect of electroacupuncture combined with exercise therapy on the meniscus injury of the knee joint of athletes, and compare with the difference analysis of the use of simple exercise therapy.^{15,16}

METHODS

Meniscus injury and its diagnosis

Meniscus injury

Knee joint is one of the most important joints to complete various complex movements in human motion. Because the knee joint is located between the femur and tibia of two long lever arms of human body, it is a hinge joint with shallow position, large joint surface, relatively less protective structure, bearing body mass and greater stress, and not very stable. Compared with other joints in the body, the knee joint is more easily injured due to its special structure and position, especially the meniscus, which can directly affect the functional activities of the knee joint. The study and all the participants were reviewed and approved by Ethics Committee (NO. 2021SU305).

Diagnostic method

Clinical symptoms

MI has a history of knee injury. Pain, swelling and locked knee are the three main symptoms. There are two types of injury: acute injury and chronic injury. The most obvious characteristic of acute injury is severe pain and swelling of knee joint gradually.

Common specialized examination

Imaging examination

Clinically, meniscus injury caused by trauma, joint degeneration and other factors is more common. According to the results of MRI scan and arthroscopy, different types of meniscus injury are as follows: 1 bucket handle tear:⁹ sagittal position often lacks normal meniscus shape, meniscus fragments can be moved to intercondylar fossa, MRI shows double anterior or posterior cruciate ligament sign, while coronal position can identify the low signal meniscus tissue. 2 Horizontal tear: MRI showed that there were two or more levels of high signal shadow parallel to tibial plateau in sagittal position, and the medial side reached the free edge of meniscus. 3 Oblique laceration: the sagittal position is easy to diagnose.

Treatment plan

The experimental group was treated with electroacupuncture combined with kinesiotherapy, while the control group was only treated with kinesiotherapy. Here is a detailed introduction of electroacupuncture therapy and exercise therapy.

Electroacupuncture program

Acute stage (0-2 weeks)

Experimental equipment: electric acupuncture instrument (Huatuo), disposable acupuncture (Huatuo, 0.25 mm × 40 mm ~ 70 mm).

Acupoint selection: Quchi, Zhize, inner knee eye, calf nose, heding, Liangqiu, Xuehai, Ashi.

Operation method: subjects placed their lower limbs naturally, lying on their back on the treatment bed. 75% alcohol was used to disinfect the skin of acupoints from inside to outside, and then suitable disposable acupuncture and moxibustion were used to insert the acupoints at a faster frequency (100-150 times / min) for lifting and twisting.

Frequency: 25-30min / time, 3 times / week, 2 consecutive weeks.

Remission period (3-6 weeks)

Experimental equipment: the same as the first stage.

Acupoint selection: add Yinlingquan and Yanglingquan on the basis of the first stage acupoints.

Operation method: the operation method is the same as that of the first stage, which is different from that of the first stage. The first group is connected to Liangqiu and Yanglingquan respectively; the second group is connected to Xuehai and yinlingquan respectively; the regulating frequency is 15Hz / s. Density wave is measured by the subjects' self-conscious comfort.

Frequency: 30min / time, 3 times a week, 4 consecutive weeks.

Rehabilitation period (7-12 weeks)

Experimental equipment: the same as before.

Acupoint selection in this stage: add Zusanli, Sanyinjiao and Taixi acupoints on the basis of acupoint selection in the previous stage.

Operation method: the operation is the same as that in the previous stage, which is different from that in the previous stage, two groups of electroacupuncture wires are connected on the handle, one group of wires is connected to Liangqiu and Zusanli respectively, the other group of wires is connected to Xuehai and Sanyinjiao respectively.

Frequency: 30min / time, 3 times a week, 6 consecutive weeks.

Exercise Therapy Program

Acute stage (0-2 weeks)

1 Principle of price: in the acute stage, the patient's knee joint should be straightened under the protection of long leg steel bracket or kneepad to limit the flexion of the patient's knee joint; the patient's leg should take rest, no weight bearing and no flexion and extension of the knee joint;

2 Joint range of motion training: including active training or auxiliary training of equal length. 1-7 days after injury, it is feasible to train the peripheral muscles of the knee: quadriceps femoris, Myxocyprinus, adductor femoris, tensor fascia lata, gluteus medius and heel muscles.

Operation procedure:

- a. Ankle pump training: in the acute stage, the patient's knee is mainly resting, and ankle pump training is carried out under painless condition.
- b. Knee training

Specific operation: the patient takes the lying or sitting position, slightly flexes the knee joint, presses the heel down hard on the bed for 5-10 seconds, and can complete 1000 times as much as possible every day.

- c. The straight leg raising training in four directions (front, back, adduction and abduction), especially the straight leg raising in front and outside, is particularly important.

c1. Straight leg lifting training: 15 times / group, 4 groups / day, after the training, apply ice on the affected knee for 15-20 minutes.

c2. Side leg lifting training (abduction training in lateral position): 15 times / group, 4 groups / day, after the training, apply ice on the affected knee for 15-20 minutes.

Remission period (3-6 weeks)

1 Isometric training: straight leg raising training, knee pressing training, ankle pump training (the same operation procedure as acute period) in four directions (front, back, adduction, abduction), 20 times / group, 10 seconds each time, 5-8 groups / day.

2 Lower limb closed chain exercise (using the improved standing pile training): the patient stands against the wall, the knees flex painlessly, the patient pushes the wall with the back, and continues until the thigh muscles can feel soft and sour, three times in the morning and afternoon, each resting for 5 minutes.

3 Final knee extension training: the patient took the sitting position, put a small pillow under the affected knee, maintain the knee flexion about 30°, and then lift the heel off the bed, to the fully extended position of the affected knee, 20 times / group, 5-10 seconds / time, 3-5 groups / day.

Rehabilitation period (7-12 weeks)

1 Water sports therapy: in a constant temperature spa, patients are trained to stand on one foot, squat down, walk, cross step, "8" step, front, back, side kick, etc. for 30 minutes / day.

2 The operation procedure is the same as that in the remission period, which makes the training more difficult.

Specific operation: Pasteurized ball against the wall training - patient standing position, legs separated, shoulder width, back against the wall with pasteurized ball, active flexion and extension of the knee joint, avoid pain arc, 10-15 times / group. Internal resistance training of ball of pasteurization - the patient sits, bends his hip and knees, places ball of pasteurization on the inner side of both thighs, forcefully clamps ball of pasteurization on the inner side of both thighs, 10-15 times / group.

3 Balance training: single foot standing training is the same as the remission period; single foot swing balance training (patients who can stand for 2 minutes with one foot or stand for 20 seconds with one foot closed) can increase the difficulty of training, such as training on thick soft school, rubber air school, Biodex balance instrument and balance board, and make training groups according to specific projects.

RESULTS AND DISCUSSION

This experiment was designed by blind method (single blind), random, pre and post control, and inter group control. According to the ratio of 1:1 between the experimental group and the control group, the patients who met the criteria of inclusion and exclusion were randomly divided into two groups.

Changes of Knee Joint Activity Before and After

The changes of knee joint mobility before and after are shown in Table 1 and Figure 1. Combined with table 1 and figure 1, it can be seen that there is no significant difference in ROM between the two groups at the time of enrollment.

After treatment, the improvement of ROM may be due to the stimulation of acupuncture to promote the release of enkephalin, improve the tolerance of the body, play a role in reducing pain, the pain can be relieved, which can promote the early activity of patients. It has been proved that acupuncture and exercise therapy have obvious effect on knee joint mobility.

Changes of muscle strength before and after

The changes of muscle strength before and after are shown in Table 2 and Figure 2. Combined with table 2 and Figure 2, it can be seen that there is no significant difference in muscle strength between the two groups at the time of enrollment. In the 6 week and 12-week tests, the muscle strength of the experimental group and the control group increases compared with the time of enrollment, and the muscle strength of the experimental group is significantly greater than that of the control group, the difference is statistically significant ($p < 0.05$).

Table 1. Changes of knee joint mobility before and after.

Time	Experience group	Control group
When entering	110.78±15.67	107.66±21.33
6 weeks	123.45±10.22	113.41±10.56
12 weeks	130.41±5.24	121.35±11.21

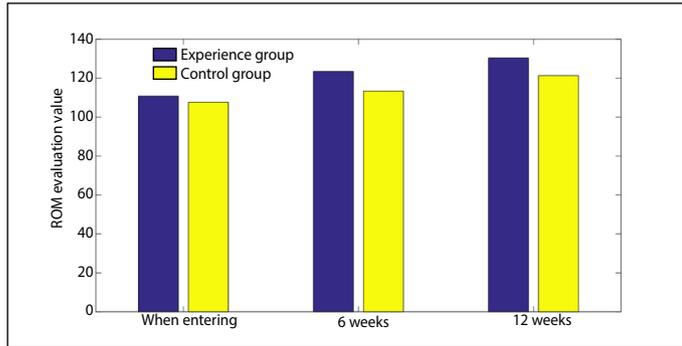


Figure 1. Comparison of changes of knee joint mobility before and after.

Table 2. Changes of muscle strength before and after.

Time	Experience group	Control group
When entering	4.23±0.67	4.31±0.53
6 weeks	5.13±0.52	4.69±0.66
12 weeks	5.46±0.42	4.82±0.73

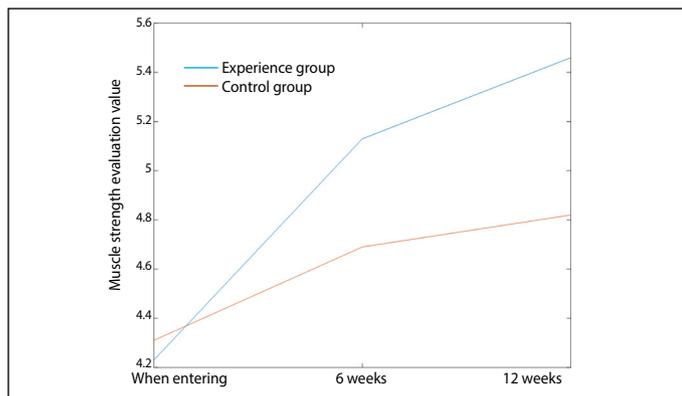


Figure 2. Comparison of changes before and after muscle strength.

After 12 weeks of treatment, the two groups compared the measurement of muscle strength, with differences. Compared with the two groups, the indexes of muscle strength measured at the time of admission, 6 weeks of treatment and 12 weeks of treatment were different. All rehabilitation training is carried out on the basis of painless, and that is no exception for the training of muscle strength.

Changes before and after lysholm score

The changes before and after Lysholm score are shown in Table 3 and Figure 3. Combined with table 3 and figure 3, it can be seen that there is no significant difference in Lysholm scores between the two groups at the time of enrollment.

After treatment, the main improvement of the patients with meniscus injury is the following 8 aspects: limp, support, joint lock, joint instability, pain, swelling, difficulty in going up and down stairs, and difficulty in squatting down.

Changes of pain before and after vas

The changes of pain before and after vas are shown in Table 4 and Figure 4. Combined with Table 4 and Figure 4, it can be seen that there is no significant difference between the two groups in pain VAS. In the 6-week and 12-week tests, compared with the control group, the pain vas of the

Table 3. Changes before and after Lysholm score.

Time	Experience group	Control group
When entering	48.35±13.76	48.06±16.25
6 weeks	70.21±10.33	53.67±23.45
12 weeks	83.67±9.63	70.35±15.35

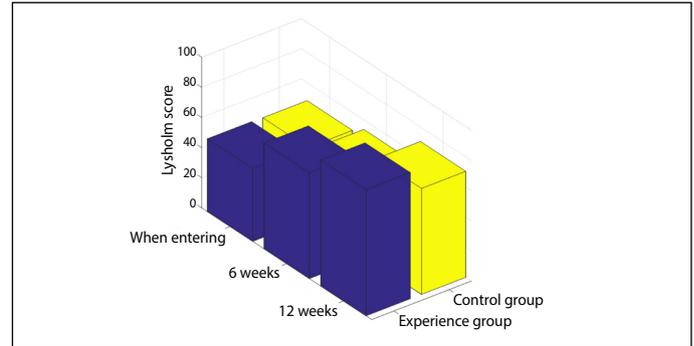


Figure 3. Comparison of changes before and after Lysholm score.

Table 4. Changes of VAS before and after pain.

Time	Experience group	Control group
When entering	4.37±6.16	4.44±5.36
6 weeks	14.61±4.37	10.77±3.88
12 weeks	20.23±3.14	15.17±4.15

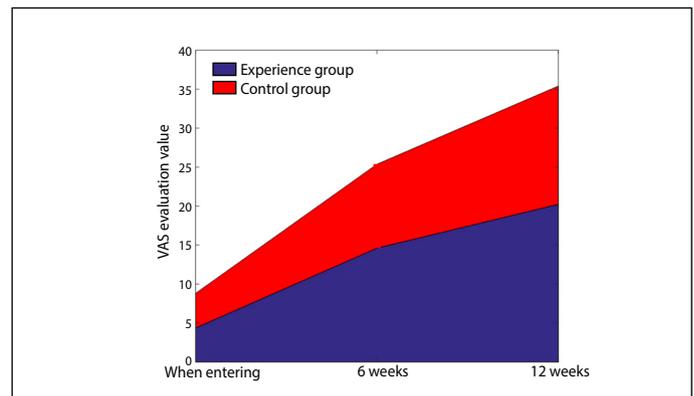


Figure 4. Comparison of changes of VAS before and after pain.

experimental group and the control group is significantly increased, and the muscle strength of the experimental group is significantly greater than that of the control group, the difference is statistically significant ($p < 0.05$).

From the perspective of traditional medicine, the early pain of meniscus injury of knee joint is due to the intertwined evil of blood and water dampness, which soaks the knee joint and leads to the obstruction of venation and “pain if there is no passage”, so that the knee joint has adverse activities, local swelling and pain.

CONCLUSIONS

With the development of society and the growing popularity of sports, sports have been a popular national activity. After treatment, ROM index of knee joint in experimental group increased from 110.78 ± 15.67 to 130.41 ± 5.24 , while that in control group increased from 107.66 ± 21.33 to 121.35 ± 11.21 . For myodynamia treatment, the experimental group increased from 4.23 ± 0.67 to 5.46 ± 0.42 , the experimental group increased from 48.35 ± 13.76 to 83.67 ± 9.63 , while the control group increased from 48.06 ± 16.25 to 70.35 ± 15.35 ; For pain VAS, the experimental group increased from 4.37 ± 6.16 to 20.23 ± 3.14 , while the control group increased from 4.44 ± 5.36 to 15.17 ± 4.15 .

The author declare no potential conflict of interest related to this article

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