

Original Article

Interference of strength training can obviously increase the effect of moxibustion treatment on patients with knee joints injuries

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Abstract: Objective: Observe the effects of Acupoint moxibustion combined with muscle training in treating the patients with knee joints strain. Methods: The 36 patients with knee joint strains were divided into the experimental group and control group with the method of random number table, each group including 18 cases. The control group was treated with Acupoint moxibustion, while the experimental groups were treated with Acupoint moxibustion combined with muscle training. Before the treatment and after the treatment lasting 12 weeks, the therapy effects and improvement of the knee-joint muscle force for the 2 groups of patients were respectively evaluated. Results: Through the treatment of 12 weeks, the clinical symptoms of control group were evidently improved than prior-treatment, but the improvement effects of the knee-joint muscle force (the peak torques of bend and stretch respectively were (32.8 ± 8.8) N·m and (35.0 ± 11.2) N·m were not significant ($P > 0.05$); while the clinical symptoms and knee-joint muscle force of experimental group (the peak torques of bend and stretch respectively were (40.3 ± 9.3) N·m and (42.3 ± 10.6) N·m were evidently improved than prior-treatment, and the improvement range was also evidently better than the control group ($P < 0.05$). Conclusion: The Acupoint moxibustion combined with muscle force training had synergistic effects in treating the patients with elderly knee-joint strain, could further relieve the pain on knee joints, and improve the joint's movement, such therapy was worthy to promote and apply in clinic.

Keywords: Strain, knee joint, muscle training, moxibustion, combination therapy

Introduction

The pain on knee joints is an important disease troubling human health and the incidence reasons are very complicated. The strain of knee-joint mostly strikes middle-aged and aged people. The pathogenesis includes: A certain action is frequently repeated, the chronic micro damage [1, 2], acute injury caused by excessive load on the knee joints have been not treated thoroughly, and the physical functions of middle-aged population are declined etc, so that the knee joints suffer degeneration diseases, and cause diseases [3, 4], death, and strained arthritis called as degeneration arthritis in clinic. Complaints of the patients mainly include pain, tumid and inconvenient bend and stretch etc at knees, which seriously affect the patients' limb movement ability and the quality of daily life. It is one of the main diseases in the motor system harming human health. The research conducted combination therapy to

the patients of experimental group by the physical means of muscle training and moxibustion therapy, according to relevant pathology characteristics of knee-joint strain, and the therapy effect was significant. The reports were as follows:

Data and methods

Data of the patients

36 patients with elderly knee-joint strain treated in the school community hospital were selected from February to June, 2014. And the selection criteria: Age: 60-75 years old; course of disease: Less than 18 months; they were confirmed as the patients with knee-joint strain through the medical consulting and inspection with X-ray. And all the patients knew about the therapy methods used in this experiment. While other patients of knee-joint diseases with acute injury, fracture, tuberculosis and tumors were

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Table 1. Comparison of general data of the 2 groups of patients ($\bar{x} \pm s$)

| Group | Male/female (cases) | Age (years old) | Attack on single-knee (Cases) | Attack on double knees (Cases) | Course of disease (month) | Pain degree on the diseased knees (Pieces) | | | Strain types of the diseased knees (Pieces) | | | |
|--------------------|------------------------|--------------------|----------------------------------|-----------------------------------|------------------------------|---|----------|---------|--|--------|-------------------|-----------------------------|
| | | | | | | Mild | moderate | serious | Pure | fleshy | trauma history | Inter-knee became narrow |
| Control group | 11/7 | 63.25±5.42 | 14 | 4 | 6.94±3.54 | 10 | 7 | 5 | 9 | 6 | 4 | 3 |
| Experimental group | 13/5 | 64.17±6.30 | 12 | 6 | 7.46±3.97 | 11 | 8 | 5 | 10 | 5 | 5 | 4 |

Note: $P>0.05$.

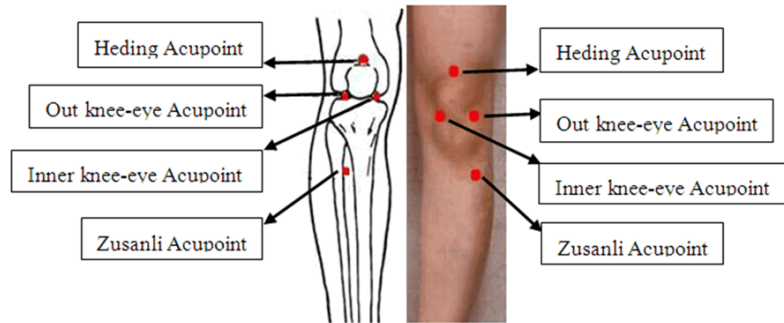


Figure 1. Ashi Acupoint is also called as Buding Acupoint and tenderness point etc. In general, its position is determined according to the disease situations, which is near the diseased parts and also may be far from the diseased parts. The acupoint is the reflection point of diseases, at the same time, it is also the best stimulation point for the therapy. Finding of the Acupoint: The main selected positions are pain points of the diseased parts. In the study, the Ashi Acupoint lies in the main pain points or tender points at positions of knee joints.

excluded. According to pain extent of the patients selected, the pain could range from mild pain, moderate pain to serious pain. The patients were also divided into experimental group and control group with the random number table, with each group including 18 patients to implement practical comparison research. According to the statistical analysis of the basic data of the 2 groups of patients, the inter-group difference had no statistical significance ($P > 0.05$), with comparability. See **Table 1**.

Therapy methods

Patients of the control group were treated with moxibustion therapy on Acupoints of the knee-joints. And the treatment process was as follows: The patients laid down, stretched straightly with both legs with the both knees upward; The selected moxibustion Acupoints mainly referred to the Acupoints around the diseased knee-joint, such as Ashi Acupoint, inner knee-eye point, out knee-eye point, Heding point and Zusanli point etc (See **Figure 1**); Lit the moxa stick, and the lighting segment was about 1.5-3 cm far from skins at the Acupoints, then conducted fire-cure with mild moxibustion combined with circling moxibustion. During the fire-curing, the patients would feel warm, but they could withstand. Each Acupoint shall be fire-cured for about 2 minutes. All the Acupoints selected should be fire-cured circularly in turn and the time of each therapy were about 30 minutes.

Patients of the experimental group were treated with moxibustion combined with muscle

training. Purposes of the muscle training were mainly to improve lower-limb muscle force, the forces and vitality of muscles and ligaments around the knee joints of the patients. The specific training modes were as follows: (1) Half-squatting training. The patients split their feet, (the spacing between both feet should be the same with their shoulders) against the wall, their bodies bent down, taking on half-squatting or slight half-squatting postures, and the half-squatting extent should

make the patients feel ache or no ache on inside knee-joints of the patients. It lasted for about 5 s, then the lower limbs drove the bodies to stand slowly. Repeat previous actions again and again, according to the bearing capacity of their own low limbs. Each group conducted the actions for about 10 times, adjusted the bodies and rested for about 1 minute, then the next round of training began and 2-3 rounds of training were made each time. The method could overall stimulate and train forces of muscles on thighs and cruses, as well as the forces of ligaments around the knee joints. (2) The training of stretching knees and raising legs in sitting postures: The patients sat in chairs or on platforms with their cruses drooping naturally, and the feet did not touch the ground. During the training, front-side muscles of the thighs drove the cruses to rise slowly up to the level position, then drooped down slowly (In the process of training, a sand bag with the weight of about 1 kg should be lashed on ankles on the diseased side according to strength of the patients and load-bearing capacity of knee joints.), such actions should be repeated for about 15 times and treated as one round of training. Each training included 3 rounds and the inter-group adjustment and rest lasted for about 1 minute. The method was mainly used to train the forces of front-side muscles on the thighs and the ligaments around the knee joints. (3) The training of bending knees and raising legs in prone postures: The patients were in prone postures. They laid on platforms or mats in prone postures with both of their legs stretched backward naturally.

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Table 2. The comparison of pt on the diseased knee joints before and after the treatment ($\bar{x} \pm s$)

| Group | Male/female (cases) | Numbers of the diseased knees (Pieces) | Measured angular velocity ($^{\circ}/s$) | Extensor strength (N·m) | | Flexor muscle strength (N·m) | |
|--------------------|---------------------|--|--|-------------------------|---------------------------|------------------------------|----------------------------|
| | | | | Before the treatment | After the treatment | Before the treatment | After the treatment |
| Control group | 11/7 | 22 | 60 | 31.54±8.17 | 32.79±8.78 | 33.59±9.04 | 34.96±11.24 |
| Experimental group | 13/5 | 24 | 60 | 30.75±9.30 | 40.31±9.25 ^{a,b} | 33.20±9.26 | 42.31±10.59 ^{a,b} |

Notes: a. Comparing results with prior-treatment: $P < 0.05$; b. Comparing with the control group after the experimental group being treated, $P < 0.05$.

Table 3. The comparisons for therapy evaluation of the diseased knee joints of the 2 groups of patients

| Group | Male/female (cases) | Numbers of the diseased knees (Pieces) | Clinical therapy effects of the diseased knees (Pieces, %) | | | | |
|--------------------|---------------------|--|--|-----------------|-----------|----------|------------------|
| | | | Healed | Evident effects | Effective | Invalid | Total efficiency |
| Control group | 11/7 | 22 | 3, 13.64 | 5, 22.73 | 9, 40.90 | 5, 22.73 | 77.27 |
| Experimental group | 13/5 | 24 | 6, 25.00 | 9, 37.50 | 7, 29.17 | 2, 8.33 | 91.67 |

Notes: Comparing with the control group after the experimental group being treated, $P < 0.05$.

During the training, the rear-side muscles on thighs of the patients made the knees bend, so that the cruses were raised slowly close to 90° , and fallen down to level position (In the process of training, a sand bag with the weight of about 1kg should be lashed on ankles on the diseased side, according to strength of the patients and load-bearing capacity of knee joints.). Such actions should be repeated four about 15 times and treated as one round of training. Each training included 3 rounds and the inter-group adjustment and rest lasted for about 1 minute. The method was mainly used to train the forces of rear-side muscles on the thighs and the ligaments around the knee joints. The content of the said three trainings should be implemented every other day and the training load should be gradually increased according to load-bearing capacity and adapting degree of the patients' knee joints, but the total amount of training time should not exceed 30 minutes each time. When the muscle-force training was conducted each time, the patients should adjust and rest for about 5 minutes, and then treated with moxibustion therapy in the same modes as that for the control group.

The two groups of patients above should be treated every other day and the total treatment time were 12 weeks.

Evaluation indicators

Before the treatment, and after the treatment lasting 12 weeks, inspection of the bending &

stretching peak torques (PT) on knee joints of the 2 groups of patients was conducted which were measured with the BiodexSystem3Pro-type isokinetic muscle strength tester made in America. The room temperature should be about 25°C , the testing angular velocity was $60^{\circ}/s$, and the torque unit of N·m. Before the testing each time, the routine self-calibration of the instruments shall be conducted.

Before the treatment, and after the treatment lasting 12 weeks, the motion range of the 2 group of patients' knee joints should be measured with common protractors, and therapy effects to the patients' knee joints should be evaluated according to the *Therapy Effect Criteria for Symptom Diagnosis of the Traditional Chinese Medicine*. The pain alleviation criteria was as follows: The mild pain referred to that pain the patients felt at the knees, slight local tenderness, and the red & swollen was not evident; the moderate pain referred to the acute pain and the local tenderness, and the red & swollen was very evident; Serious pain referred to the severe pain and local red & swollen with evident tenderness. The results of clinical therapy effects could be divided four grades: 1) Healing: Range of knee-joint motion (ROM) was $91^{\circ}\sim 120^{\circ}$ and the joint pain and swollen disappeared completely; 2) Evident effect: Range of knee-joint motion (ROM) was $61^{\circ}\sim 90^{\circ}$, local swollen and pain basically disappeared; 3) Effective: Range of knee-joint motion (ROM) was $31^{\circ}\sim 60^{\circ}$ and local swollen and pain

were slightly alleviated; 4) Invalid: Range of knee-joint motion (ROM) was 0~30°, local pain and swollen were not evidently improved, even worsen.

Data processing

The measuring data derived from this research was expressed as $\bar{x} \pm s$, which was handled with SPSS 13.0 statistical software package and t-test was adopted in the comparison of measured data; while χ^2 -test was adopted in the comparison of counting data. $P < 0.05$ means that the difference had statistical significance.

Results

After the treatment lasting 12 weeks, PT of the control group of patients was improved than that before the treatment, but the effects were not evident, and the difference had no statistical significance ($P > 0.05$); while PT of the experimental group of patients was evidently improved than prior-treatment. The difference between the prior and post treatment and difference between the two groups had statistical significance (in both cases, $P < 0.05$), see **Table 2** for specific data; See **Table 3** for the clinical therapy results of the 2 groups of patients. The data in the Tables indicated that the patients of experimental group who were healed or with evident effects and total efficiency were evidently better than those of the control group ($P < 0.05$).

Discussion

The traditional Chinese Medicines believes that the strains of knee joints belong to “Paralysis”, which are also called “Knee paralysis”, and that the knee is the confluence of various tendons and the external injuries and strains may cause qi and blood stasis on the knees, so that the tendons and vessels on knees lose moistening and nourishing of qi & blood and generate diseases [5, 6]. The theories of Traditional Chinese Medicines show that, if the knees are attacked by the cold and wet, or stayed some places with cold and wet for a long time, the dampness-pathogen and qi & blood blockage stasis may gather on the knees, which may induce strains of knee joints; in addition, the deficiency of qi & blood, and physique malnutrition of middle-aged and aged people are also the important

reasons causing strains of knee joints. The meridian-collateral theory believes that the qi & blood flow in the meridians circularly, if human bodies are attacked by external reasons, such as wind, cold, summer-heat, dampness, dry and fire, the qi & blood may be stagnated on human body or locality, and the meridians may be blocked, therefore the symptoms of swollen and pain and a series of functional disorders may appear [7, 8]. At the same time, special Acupoints on the body are treated with moxibustion therapy, thus can produce such effect as regulation of qi & blood, dredging the meridians, and balancing functions etc [9, 10]. The moxibustion therapy means to stimulate special parts of human body through the moxa fire, to achieve the purpose of disease prevention and treatment, and the therapy mechanism is mainly related to tepidity stimulation effects of the moxa fire, which can promote local dermohemia and angiotelectasis and strengthen local blood circulation as well as lymph circulation and relieve or eliminate smooth muscle spasm so that the metabolic capability of local tissues is strengthened, and to promote elimination and absorb of pathological products, such as inflammation, adhesion, exudation, and hematoma etc [11-13]. In this research, after the patients of control group were treated with moxibustion therapy on knee joints, the conditions of knee joints were evidently alleviated and the total effective rate was up to 77.27%; the bending & stretching muscle force of knee joints were also improved than prior-treatment, but the improvement effect was not significant ($P > 0.05$), which might be related to the myasthenia induced by lack of exercises in the period of therapy.

At present, clinical applications show that the patients with knee-joint pain frequently not dare to act their limbs because of the pain, and their muscle force and joint functions declined for lack of movement stimulation for a long time, so that the illness conditions become serious. Therefore, the patients with strains of knee joints shall be combined with muscle-force training of knee joints, which can improve blood circulation and metabolic level of the tissues, such as muscles, skeleton, joints and ligaments etc on some motor parts, to improve the functions of nerves and muscles, strengthen the muscle force, endurance and balanced capacity, and achieve the purpose of therapy [14-16]. On the basis of the above theories, in

this research, the patients of experimental group were treated with moxibustion therapy on knee joints, combined with muscle force training. After the interference lasting 12 weeks, the clinical effects and bending & stretching muscle forces of the knee joints were evidently better than prior-treatment, also better than the levels of control group ($P < 0.05$). Above results showed that the moxibustion therapy combined with muscle-force training had synergistic effects in treating the patients with strains of knee joints, and the therapy mechanism included the following: through half-squatting exercise against the wall, the muscles on thighs and cruses as well as ligaments around the knee joints of the patients were rained; through the training of stretching the knees and raising legs in sitting postures, the forces of front-side muscles on the thighs as well as the forces around the knee joints were improved; through the training of bending knees and raising legs in prone positions, the forces of rear-side muscles on thighs and the forces around the knee joints were improved. After being treated with muscle-force training, the patients were treated with moxibustion therapy, the moxibustion's hyperthermia effect as well as the stimulation effect of Acupoints could further stimulate the Acupoints, dredge meridians, promote metabolism and eliminate inflammatory products, accelerate the relief of knee-joint fatigue, and avoid accumulation of the fatigue, helping to further improve functions of the knee joints.

In conclusion, the research results showed that the moxibustion therapy combined with muscle-force training has synergistic effects in treating the patients with strains of knee joints, and the therapy effects are evidently better than the pure therapy of moxibustion. As the therapy method can further improve knee-joint functions of the patients and alleviate pain of the diseased parts, it is worthy of being promoted and applied.

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Disclosure of conflict of interest

None.

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