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Clinical Progress of Acupuncture in the Treatment of ACL after Reconstructive Surgery

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Abstract: Anterior cruciate ligament (ACL) injury of the knee is one of the common sports injuries, and ACL reconstruction is currently the mainstream treatment. However, ACL reconstruction often produces postoperative complications such as swelling, pain, muscle atrophy, joint adhesion and stiffness, and timely interventional rehabilitation is needed for patients to recover the expected level. Studies have shown that acupuncture treatment can regulate inflammatory factors and related signalling pathways, etc., and has obvious efficacy in joint rehabilitation after ACL reconstruction. The authors collated clinical reports on the use of acupuncture therapy such as general acupuncture, electroacupuncture, moxibustion with acupuncture, snap needling, and ethnic acupuncture in the rehabilitation process after ACL reconstruction in recent years, to explore the feasibility and effectiveness of the intervention of acupuncture therapy, with the aim of providing a more systematic reference for the treatment of ACL injury in the future clinic after surgery.

Keywords: Acupuncture Treatment; ACL Injury Reconstruction; Rehabilitation Treatment

1. Modern medical research on ACL injury

1.1 Epidemiology

ACL injury is a very common disease, with an annual incidence of 100,000 to 200,000 cases[3], the patients are mostly young people or athletes, and there are more males than females, of which males are mostly football, basketball sports injuries and accidental injuries, and females are mostly accidental injuries, badminton, skiing injuries[4]. If ACL injury is not treated in time, it is very easy to cause damage to the articular cartilage and meniscus, and promote joint aging[5].

1.2 Mechanism study

After ACL reconstruction, there are complications such as swelling and pain, and surgery is one of the main reasons. Even though minimally invasive techniques have minimised trauma, ACL tearing and intraoperative mechanical stimulation will still lead to different degrees of swelling and pain. Therefore, patients need to be under good pain management for a successful early rehabilitation programme. Currently, active contraction of the quadriceps muscle, ankle pumps, elevation of the affected limb, ice packs and other measures to promote tissue fluid return, anti-inflammatory and analgesic measures are generally recommended [6][7]. Furthermore, after performing ACL reconstruction, it is necessary to wear protective gear for a long period of time, and it is impossible to intervene in rehabilitation therapy early, which is prone to the adhesion of the joint. In addition, after ACL reconstruction, the joint-derived muscles will be in a state of inhibition, leading to changes in nerve pathways, quadriceps strength and activation is obviously insufficient, which will weaken the quadriceps strength, and postoperative knee swelling and pain will further aggravate the quadriceps atrophy through this state of inhibition [8, 9]. It has also been suggested that early after ACL reconstruction, due to changes in cortical signalling areas, the neural control of the knee joint on the affected side decreases, resulting in atrophy of the quadriceps [10]. In conclusion, the intervention of active and correct rehabilitation therapy in the early stage of ACL reconstruction is particularly important.

2. Knowledge of ACL injury in Chinese medicine

The motherland medicine, tendon is the bone joints attached to the tangible things. The Yellow Emperor's Classic of Internal Medicine says that "the tendons are rigid", "all tendons belong to the joints", and "the tendons bind the bones and facilitate the organs", which indi-

cates that the function of tendons is to restrain the bones and stabilise the joints. According to the theory of Chinese medicine, the etiology of ACL injury is mainly caused by trauma, which belongs to the category of "tendon injury" or "tendon breakage", and the basic mechanism of the disease is as follows: the local tendons of the knee joint are damaged after the trauma, and the qi and blood are not smooth, the qi is stagnant and blood stagnation, which results in swelling and pain; the tendons are unable to bind the bones and facilitate the organs, so the joint is unstable, and the flexion and extension are not favourable. Therefore, joint instability, flexion and extension are unfavourable [11]. The motherland medicine has rich means of rehabilitation treatment after ACL reconstruction, such as internal administration of traditional Chinese medicine, hot ironing, massage, etc., which have all achieved certain results [12].

Acupuncture and moxibustion have obvious advantages in the postoperative treatment of ACL reconstruction, which is the most characteristic diagnostic and therapeutic means of Chinese medicine, with the effects of dredging the meridians and collaterals, supporting the positive and dispelling the evil, and regulating the yin and yang. Acupuncture and Moxibustion A and B Jing said: "The pain outside the knee, can not flexion and extension, shin paralysis is not benevolent, Yang Guan main. Thigh paralysis leads to pain outside the knee and femur, not benevolent, tendon urgency, Yanglingquan is the mainstay." Acupuncture treatment is widely used at home and abroad to treat various diseases, such as neurological disorders, motor system disorders, etc., with remarkable efficacy [13]. Acupuncture treatment has the characteristics of easy operation, wide applicability, no side effects, and obvious efficacy in relieving pain, repair of injury, and psychological stress [14]. Studies have shown that in the treatment of orthopaedic and traumatic diseases, acupuncture therapy can reduce pain, improve joint mobility, bone metabolism and local blood circulation, as well as repair of injuries [15].

3. Clinical progress

3.1 General acupuncture treatment

The clinical efficacy of acupuncture combined with rehabilitation training for the treatment of quadriceps atrophy after ACL reconstruction in 92 patients by Fan Xiliang [16] and others. The total effective rate of the treatment group was 93.5%, by taking Fubu, Liangqiu, Shusanli, Blood Sea, Yanglingquan, Yinlingquan and Sanyinjiao points. It was found that the intervention of acupuncture therapy could regulate the immune function of the patients, shorten the course of the disease, improve the muscle atrophy and weakness, and promote the functional rehabilitation of the knee joint, which was more effective than the simple rehabilitation training. Zhou Bin et al [17] used personalised exercise prescription combined with knee three needles to promote the rapid recovery of pilots with multiple postoperative anterior cruciate ligament injuries in one case was reported. The affected side Liangqiu, Blood Sea and knee eye were taken as the main points, and the supporting points were the affected side foot Sanli, Sanyinjiao and Yinlingquan points. It was found that the combination of personalised exercise prescription and the three knee points was clinically feasible to promote the rapid recovery of ACL injuries after multiple operations. However, this report is only an isolated case and needs to be confirmed by a series of evidence-based medical studies and clinical application.

Modern medicine has shown that acupuncture can effectively relieve muscle spasm, improve local blood and lymphatic circulation, promote the recovery of atrophied muscles, and inhibit inflammatory factors. Acupuncture can also regulate the nervous system, such as stimulating the receptors and nerve endings of the human body, strengthening the activity of afferent coarse nerve fibres (α, β, γ class), and weakening the activity of efferent fine nerve fibres (C class), to achieve analgesia [18].

3.2 Acupuncture combined with moxibustion

Zhong Chongxin [19] and other use of warm acupuncture and moxibustion on the Sea of Blood, the inner knee eye, calf's nose, foot Sanli and other points in conjunction with isokinetic muscle training exercise rehabilitation treatment of anterior cruciate ligament injuries in 36 cases of patients for clinical observation. It was found that the clinical effect of warm acupuncture and moxibustion combined with isokinetic muscle training and rehabilitation was more obvious for ACL injury patients, and meanwhile, it was more important for the later recovery of ACL injury patients under long-term and effective exercise rehabilitation. Dai Juhong[20] and others observed 40 patients with ACL injuries with acupuncture and moxibustion in the 2nd, 4th, and 6th weeks, and found that the reduction of the difference between the circumference

of the healthy side and the affected side of the upper and lower legs was better than that of the control group in the 4th and 6th weeks after the treatment, indicating that patients with ACL injuries who were treated with acupuncture, warming and moxibustion combined with kinesiology had a better performance than the patients who were treated with exercise therapy alone in terms of the active maximum flexion of the knee, the VAS score and the Lysholm score, which was more effective in the later stage of rehabilitation. This indicates that patients treated with acupuncture and moxibustion in combination with exercise therapy for ACL injury rehabilitation have a significant advantage over patients treated with exercise therapy alone in terms of knee active maximum flexion, VAS score and Lysholm score, and the improvement of muscle atrophy of the affected limb is also significantly better than that of patients treated with exercise therapy alone.

Acupuncture and Moxibustion Volume 4" said: "Wang Jiezhai said: recent warm needle is the method of the Chu people. Its method, the needle points, to incense dahurica as a round cake, set on the needle, to moxibustion, more than to take the effect ....." In addition, warm acupuncture and moxibustion can be transmitted to the acupoints through the body of the needle, so that the warmth of the local limbs, enhance the stimulating effect of acupuncture points, and more effective in warming the menstruation and dispersing the cold, through the collaterals to relieve pain [21]. In addition, warm acupuncture and moxibustion can make the body maintain a high level of IGF-1, TGF-β expression, so as to achieve the role of promoting the repair of ACL injury, can effectively improve the ACL injury [22].

3.3 Electroacupuncture therapy

Zhou Xin [23] et al. treated 50 patients with partial ACL injuries with electroacupuncture on the 2nd day after surgery, and selected 4 points of the foot Shaoyang meridian on the affected side, namely, Hang Zhong, Yanglingquan, Knee Yangguan, and Huanjiao. It was found that for patients with partial ACL injury, electroacupuncture therapy with selected foot Shaoyang meridian points after ACL injury reconstruction surgery, knee joint proprioception was able to be improved more significantly to a certain extent, but long-term follow-up is needed. Yu Xiaoxia [24] et al. grouped 92 cases of ACL patients to observe the effects of electroacupuncture combined with systematic rehabilitation training on isometric muscle strength, joint mobility and body function of postoperative patients with anterior cruciate ligament injury (ACL). Fenglong, Xiangmen, Thigh Pass, Liangqiu, Ashigaru, Blood Sea, Diqi, Inner Knee Eye, Calvary and Sanyinjiao points on the affected side were selected. After treatment, it was observed that the knee joint mobility of the study group was greater than that of the control group ($P<0.05$), and the swelling of the affected knee was less than that of the control group ($P<0.05$). Wang Huajun[25] et al. randomly grouped 140 patients after reconstruction of ACL injury for observation, and took the affected side Fengshi, Fubu, Ashigaru, Shangjiuxu, Fenglong, Hangzhong, Diji, and Sanyinjiao points. Regular observation of the observation group showed that the knee ROM was greater than that of the control group ($P<0.05$), IKDC score and Lysholm score were higher than that of the control group ($P<0.05$). There were no complications related to laxity rupture in both groups within 1 year, and the axial shift test, the anterior drawer test, and the Lachman test were all negative. It is discussed that electroacupuncture combined with conventional rehabilitation training can significantly reduce the patients' knee pain, improve the degree of swelling, increase the mobility of the affected knee, promote functional recovery, and the efficacy is better than that of simple rehabilitation training.

Electroacupuncture is a therapeutic method that uses a certain frequency of electrical impulses to enhance the stimulation of acupoints after the millimetre needle is inserted into the acupoints. Electroacupuncture therapy can unblock the conduction of nerve pathways, inhibit inflammatory factors, and relieve stubborn pain through electrical stimulation.

3.4 Snap-needle therapy

Liu Xinyu [26] observed the effect of timely analgesia in 80 patients randomly grouped after ACL reconstruction, respectively, after 2 days of treatment. After sterilisation, snap needles were buried, and the following points were used: take Ah Yes point, calf's nose, inner knee eye, crane's top, Liang Qiu, Yang Ling Quan point. The timely analgesic effect of the observation group was found to be better than that of the control group, and the difference was statistically significant ($P<0.05$). Snap-needle therapy is safe, aseptic, convenient, effective in timely analgesia, easily accepted by patients, and meets the expectation of rapid recovery after ACL reconstruction, which is worth promoting in clinical rehabilitation treatment.

Snap-needle therapy belongs to intradermal needle therapy, which is the category of shallow stabbing and floating stabbing in acupuncture therapy, burying the needles under the skin or acupoints, and regulating the internal organs and meridians of the meridians and qi through the stimulation of persistent, weak and stable acupoints and subcutaneous nerves, which can promote the operation of qi and blood, and recover the imbalance of the organism.

3.5 Lotus Needle Cupping Therapy (Acupuncture and Moxibustion of Zhuang Medicine)

Lotus needle cupping and cupping and stasis expulsion method of Zhuang medicine is the core therapy of Professor Huang Jinming, a master of national medicine [27]. Liu Yongkun [28] et al. took 52 patients after reconstruction surgery as study subjects and randomly grouped 26 cases each. The control group was given conventional rehabilitation training such as quadriceps contraction; while the observation group was given postoperative rehabilitation by Lotus Needle Cupping and Blood Stasis Method of Zhuang Medicine with the following acupoints: taking the Sea of Blood, Sea of Qi, Baihui, Liangqiu, Calvary, Knee Yangguan, Inner Knee Eye and Outer Knee Eye, and so on. It was found that the Lotus Needle Cupping and Blood Stasis Removal Method of Zhuang Medicine, as a rehabilitation treatment plan, could better improve the stability and activity function of the knee joint and promote the effective recovery of the proprioception of the knee joint, which is safer and has certain clinical value.

According to Zhuang medicine, Lotus Needle Cupping and Blood Stasis Removal Therapy can dredge the three channels and two paths, balance the qi and blood, support the positive and eliminate the toxins, and synchronise the three qi. Modern medicine shows that Lotus Needle Cupping and Blood Stasis Relief Therapy can play a certain advantage in relieving knee pain and promoting the stability and functional recovery of the knee joint by improving the inflammatory factor [29].

4. Summary

ACL injury is a sports system disease with high morbidity and serious complications, and the main purpose of postoperative ACL injury is to restore the function and stability of the knee joint missing from the ACL and to promote the patients to return to the pre-injury activity level [30]. Therefore, rehabilitation research after ACL injury reconstruction has an important value. At present, many scholars have combined acupuncture treatment to rehabilitate patients after ACL reconstruction surgery, and all of them have achieved relatively significant therapeutic effects [31, 32-41]. The efficacy of combined acupuncture and moxibustion therapy is more obvious than that of single rehabilitation training, and it is very worthwhile to carry out extensive clinical research in the treatment of post-reconstructive rehabilitation after ACL injury, which can not only provide clinical scholars with multi-channel diagnostic and treatment means as well as different ideas of rehabilitation, but also enhance the patients' confidence in the treatment, and promote the patients' rapid recovery. However, at present, there is a lack of in-depth research on its mechanism, and more clinical scholars are expected to conduct in-depth investigations on how to choose better acupuncture treatment options, so as to provide better therapeutic ideas for post-reconstructive rehabilitation of ACL.

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