A Study on the Rehabilitation of Patients with Osteoarthritis of the Knee

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Abstract: Rehabilitation refers to the integrated and coordinated use of various means, such as medical, educational, social and occupational, to restore the patient's physical and psychological injuries caused by accidents or sports injuries as far as possible and to the maximum extent possible, so that his or her physical, psychological and social adaptation can be maximally rehabilitated. Osteoarthritis of the knee is one of the osteoarthritic diseases, which is characterised by chronic, long-term pain in the affected area and degenerative changes in the function of the affected limb, and also has the potential to cause disability after the disease. As the population density continues to rise, the number of people suffering from osteoarthritis of the knee is also increasing year by year, which has brought about a considerable impact on the global healthcare services. Therefore, it is important to adopt healthy and effective rehabilitation techniques for the treatment of patients with osteoarthritis of the knee caused by post-exercise injuries.
***Keywords*:** rehabilitation therapy, osteoarthritis of the knee, sports injury

1. Introduction

The knee is a highly prevalent site for osteoarthritis, and its main clinical symptoms are chronic swelling, pain and dysfunction. In China, the survey study nearly ten years of patients with osteoarthritis of the knee, with the increase of age, the incidence and severity of osteoarthritis of the knee continues to rise, and the incidence rate is a trend of rejuvenation, which to the patients themselves, the hospital community medical system and the entire health economy and society has brought a huge burden, and has now become a non-negligible public health problem[1]. Knee osteoarthritis is associated with age, gender, body mass index, type of knee osteoarthritis, genetic factors, etc. During the period of 2000-2020, the incidence of knee osteoarthritis remained high worldwide, with 16.0% and 22.9% at the age of 15 years and after the age of 40 years, respectively. By 2020, knee osteoarthritis will occur in approximately 654/10,000 patients aged 40 years and older worldwide[2].

Rehabilitation is very important for many patients after sports injuries. Although some rehabilitation techniques cannot reverse the skeletal muscle injuries caused after sports injuries, some rehabilitation-assisted therapies can be used to make the patients' limb functions strengthened, so that the patients can regain their confidence, which in turn eliminates the effects of the disease on them and improves their quality of life[3]. At present, most of the knee osteoarthritis patients in China are still lacking in the prevention of sports injury and the knowledge of rehabilitation treatment after damage, so it is of great significance to strengthen the rehabilitation of knee osteoarthritis patients after sports injury. In this paper, we systematically collate the relevant studies at home and abroad, and make a review of the way of knee osteoarthritis rehabilitation and its significance.

2. Overview of osteoarthritis of the knee

Osteoarthritis of the knee, also known as knee arthrosis, is an injury caused by a combination of biomechanical, metabolic, and inflammatory factors; it is a progressive musculoskeletal disorder characterised by weight-bearing joints such as the knee and hip, which affects the body's muscular as well as skeletal systems, and can lead to long-term pain and dysfunction. The knee is the largest synovial joint in the human body and is one of the most pain-prone areas due to the fact that this joint is frequently used and carries a lot of pressure[4]. Structural changes in the organism for the joint area can cause physical pain, limb dysfunction, the development of psychiatric disorders, and a variety of chronic diseases, which can seriously affect the patient's quality of life. At the same time, there are other risk factors for osteoarthritis of the knee, such as: overweight or obesity, post-sport injuries of the knee, muscle weakness of the lower limbs, knee osteoarthritis, etc[5-6]. The prevalence of osteoarthritis of the knee in the Chinese population is 8.1%, and there is a significant gender difference: women suffer perhaps a heavier burden of disease than men[7].

Osteoarthritis of the knee is a degenerative disease of the skeletal muscles that occurs most frequently in the middle-aged and elderly population. In our country, 60.1% of people aged 60 years and above suffer from osteoarthritis of the

knee[8-9]. In people with osteoarthritis of the knee, the pain in the organism tends to evolve from an intermittent weight-bearing pain to a more persistent and deeper chronic pain[10].

Training can reduce patients' pain, increase muscle strength, improve muscle function, and delay the development of the disease, which is the most effective non-surgical therapy in clinical practice [11].

3. Rehabilitation therapy

Rehabilitation assessment for osteoarthritis of the knee mainly includes: body pain, proprioception, muscle strength, joint activity level, balance, walking gait, quality of daily life of the patient, psychological factors, and so on. The new guidelines for the diagnosis and treatment of osteoarthritis recommend that patients with knee osteoarthritis, especially those with early stage knee osteoarthritis, should preferably be treated with rehabilitation[12].

3.1 Chinese Medicine (TCM) massage

For knee osteoarthritis, the current clinical treatment is still based on Chinese medicine, and Tui Na, as a traditional external treatment method, has been recognised in several countries for its clinical effect.

Tui na therapy focuses on the treatment of soft tissues around the knee and can effectively reduce knee pain. By restoring the normal morphological structure and position of the meridian tendons and improving the function of the meridian tendons, the meridian tendons can be made supple, and the effect of constraining the bones can be achieved by softening the tendons[13], loosening the tendons, and strengthening the tendons, so as to allow the meridian tendons and the bones to achieve the therapeutic purpose at the same time.

According to modern research, tui na massage is a kind of mechanical force on the surface of the skin, the force gradually penetrates deeply and rhythmically squeezes the local tissues to improve the speed of blood circulation, thus accelerating the metabolism[14], and promoting the repair of limb tissues; in addition, tui na massage can improve the state of the lesion, and promote the recovery of the patient's organism. Patients with knee osteoarthritis are prone to form nodules in the joints, muscles and muscle connections. Under normal circumstances, the muscles around the knee joint will contract, and the force formed by this contraction is transmitted to the "bone" through the corresponding "tendon" to make the joint activity; similarly, the mechanical effect caused by massage can also be transmitted to the "bone" through the "bone" to the "bone"; in addition, massage can also improve the state of the lesion and promote the recovery of the patient[15-16].

In addition to synovium, cartilage and subchondral bone, the inflammatory response of the infrapatellar fat pad is closely related to the development of knee osteoarthritis. Due to trauma, chronic trauma, etc., the infrapatellar fat pad will adhere to the patellar tendon to varying degrees due to swelling and bleeding, and the infrapatellar fat pad will be pulled out of the tibiofemoral cavity by the patellar tendon when the knee is bent at 90° or more, resulting in peripatellar tendon pain in the knee and limited knee motion, especially when going down stairs and squatting. In terms of pain, stiffness, and joint function scores, the infrapatellar fat pad relaxation manoeuvre with general rehabilitation therapy has significant advantages over general rehabilitation therapy[17].

This is because in patients with osteoarthritis of the knee, pain often leads to spasm and stiffness of the skeletal muscles and tendons around the knee, which produces a kind of protective increase in muscle tone, leading to sharp contraction of the skeletal muscle meat spasm, which adversely affects the normal movement of the knee joint. Therefore, in the treatment of osteoarthritis of the knee, some relatively gentle massage and acupressure methods are usually used, such as: rolling, kneading and holding [18]. At the same time, it is also necessary to ensure that the rhythm of the technique is stable, gentle but powerful, so as to achieve the effect of soothing muscle contractures, promoting blood circulation of the organism, and protecting the joints [19-21].

3.2 Exercise

The Osteoarthritis Diagnosis and Treatment Guidelines (2018 Edition), issued by the Joint Surgery Division of the Orthopaedic Surgery Branch of the Chinese Medical Association, suggests treatment based on exercise therapy. There are many types of exercise therapy that are applicable for people with osteoarthritis of the knee, such as aerobic exercise, muscle strength training, and balance training[22-23].

3.2.1 Hip muscle training

Hip muscle training has an effect on the load of the medial compartment of the knee joint, the muscle strength of the muscle groups around the knee joint, and the electromyographic signals of the muscle groups around the knee joint, etc. Strong hip abductor muscle groups can reduce the degeneration of the articular cartilage, which in turn improves the load of the knee joint and the clinical symptoms of patients with osteoarthritis of the knee. There was also a significant increase in hip muscle strength in terms of knee pain relief and functional improvement. Strong hip abductor muscles can reduce

the degeneration of articular cartilage, so for strengthening hip abductor muscle exercise can improve muscle strength and play a protective role for articular cartilage, thus delaying the development of knee osteoarthritis. In addition, by increasing the strength of the knee flexor and extensor muscle groups and improving the blood flow in the knee joint, it has a better protective effect on the cartilage, ligaments, and skeletal muscles of the knee joint [24][26].

3.2.2 Home rehabilitation exercises

Designing rehabilitation exercises that patients with osteoarthritis of the knee can play and carry out by themselves at home can improve their physical condition[27].According to the principles of science, simplicity, safety and effectiveness. Based on the Clinical Practice Guidelines for Exercise Therapy for Osteoarthritis of the Knee and in consultation with experts, a series of rehabilitation exercise movements suitable for patients with osteoarthritis of the knee that can be performed at home have been designed. Based on the fact that patients with osteoarthritis of the knee have different levels of leg strength, all the movements are done in a sitting position in order to ensure safety during the exercise: ①Joint flexibility exercise; ②Hip abduction and adduction exercises; ③Quadriceps exercise; ④ Hamstring muscle exercise[11].

3.2.3 Aerobic exercise

A number of domestic and international guidelines have concluded that appropriate aerobic and strength exercise can maintain joint flexibility and delay disease progression, and is the preferred form of exercise for patients with knee osteoarthritis. Aerobic exercise (e.g., backward walking, jogging, etc.) is a simple, efficient, and economical form of exercise that promotes the regeneration of damaged cartilage[28].

Power cycling, as a low-intensity aerobic exercise[31], improves knee joint motor function and walking ability, relieves pain, increases the strength of knee extensors, counteracts some of the excessive bending moments of the knee joint, enables it to withstand more flexion force, and achieves effective control and stabilisation of the knee joint when power cycling is performed by patients with osteoarthritis of the knee joint[32]. In recent years, there has been increasing evidence that cycling-related exercise is feasible for the rehabilitation of patients with knee osteoarthritis[29-30][33].

3.2.4 Traditional Chinese physical exercise

Traditional Chinese physical exercise is consistent with that advocated by modern medicine. Knee osteoarthritis patients who were treated with exercises such as taijiquan and Baduanjin experienced changes in the fascicular structure of their brain white matter fibres and were able to significantly relieve pain[34][35].

The pain of knee osteoarthritis patients is closely related to anxiety, depression and other emotions, which seriously affects the quality of life of patients, while scientific and reasonable exercise can improve the psychological condition of patients [22]. Exercise therapy has attracted much attention because of its efficacy, low side effects, and operability. In recent years, the therapeutic effect of exercise on knee osteoarthritis has been remarkable, opening up a new direction for the treatment of knee osteoarthritis [24][36][37].

3.3 Drug therapy

Knee osteoarthritis is mainly manifested as degeneration of articular cartilage, the pathogenesis of which has not been fully elucidated, and is closely related to inflammatory factor-induced inflammatory response, chondrocyte hypertrophy, extracellular matrix degradation, subchondral bone remodelling, and synovial neovascularisation[38].

3.3.1 Etocalcin

Etocalcitonin is a man-made synthetic peptide derivative of eel calcitonin. Calcitonin is also a common anti-osteoporosis drug[39][40], and in the treatment of experimental osteoporosis, it also improves subchondral bone density, bone strength, bone cortical thickness, and osteocalcin, which serves to protect articular cartilage.

Osteoarthritis patients have an imbalance between subchondral bone bone resorption and osteogenesis, and changes in the amount of subchondral bone mass may be an important cause of joint degeneration before changes occur in the articular cartilage[41]. Therefore, calcitonin as an effective treatment is of great interest for an in-depth study of the mechanism of osteoarthritis occurrence[38].

3.3.2 Parecoxib.

Parecoxib is a highly selective non-steroidal anti-inflammatory drug class, which has low toxicity, strong targeting and good analgesic effect[42], and can effectively protect the articular cartilage.Parecoxib can promote chondrocyte autophagy, and short-term use of the drug can significantly alleviate osteoarthritic degeneration, and can alleviate osteoarthritic degeneration of the knee by inducing autophagy, while Parecoxib also has anti-inflammatory effects[43]. However, it is prone to bone loss, and its long-term use is unfavourable to the treatment of knee osteoarthritis[44].

3.3.3 Traditional Chinese medicine

Osteoarthritis of the knee belongs to the category of "paralysis" in Chinese medicine[45], and its etiology includes aging, damage to the tendons and bones, and poor qi and blood circulation[46]. Chinese medicine is known for its low price and low toxicity, and has an irreplaceable role in the prevention and treatment of osteoarthritis of the knee joint, whether used alone or in combination with Western medicine[47].

The use of herbs such as Chuanwu, Caowu, myrrh, frankincense, Weilingxian, and Duzhong with the introduction of ions in the introductory formula of traditional Chinese medicine can form the corresponding electrical stimulation at the joints, so that the active ingredients of the drugs can enter the blood vessels through the ionic mode and reach the lesion site directly, which can improve the penetration effect of the drugs and have a very good effect on the local blood circulation of the knee joints [48].

3.4 Acupuncture

Acupuncture at the acupoints "Foot Sanli" and "Calf Nose"in patients with osteoarthritis of the knee joint can increase the number of beneficial bacteria, maintain the stability of the intestinal flora, improve the barrier function of the intestinal mucosa, reduce the release of inflammatory factors, and inhibit the persistent development of inflammation in the cartilage, and reduce joint pain. development and reduce joint pain[49].

In addition to simple rehabilitation training, the addition of popping needle embedding has a better improvement effect on reducing patients' knee joint pain and function. Retaining the needles can provide continuous stimulation to the acupoints, which is very important to improve the effect of acupuncture. There is a saying in Acupuncture and Moxibustion Dacheng: "If the disease is stagnant, the needles are left in place for a long time." The method used is to fix the needles on the skin for a period of time and give weak and prolonged stimulation in order to disperse the tendons and channels, regulate qi and blood, and dredge the joints and tendons[50], which can achieve the effect of pain relief [51].

Warm acupuncture is an external treatment method with Chinese medicine characteristics that combines acupuncture and heat. It is a method in which moxa floss is kneaded into a ball after acupuncture and ignited on the handle of the needle, and the heat is transmitted to the acupoints through the body of the needle, resulting in localised soreness and numbness at the acupoints, coupled with the warming effect of moxa to dredge the meridians. It is characterised by warming the meridians, reducing inflammation and relieving pain[52], promoting blood circulation in the lesions, and achieving the purpose of reducing inflammation, swelling and pain. It can improve the circulation of qi and blood in the lesion area, and also inhibit the cartilage damage caused by the production of inflammatory substances and related metabolic substances, which can effectively inhibit the degenerative changes of the knee joint, thus achieving the purpose of alleviating the clinical symptoms of osteoarthritis of the knee joint[53].

3.5 Intramuscular effect patch

The knee joint is the most important weight-bearing part of the lower limb, and its risk of injury after sports is high, which may cause athletes to end their sports careers prematurely[54], or make ordinary sports participants fear sports from now on [55].

Intramuscular effect patch was created by Japanese medical doctor Kayori as a kind of elastic body tape, the principle of which is that it can improve the flexibility and strength of muscles, and it was firstly used for musculoskeletal disorders, shoulder impingement, sports injuries, sports protection, etc., and now it has been widely used in several industries. The contraction strength of an intramuscularly effective patch is closely related to the external force, shape and length of the patch. Under certain tension, intramuscularly effective patches can have some effect on the subcutaneous space at the patch site, but the mechanism of action is more important than the mechanism of direction of action. This is because different studies have used different methods of patching and obtained different results. Therefore, when using it, it must be combined with the specific situation of the patient, master its clinical manifestations, and be used correctly under the guidance of professional doctors.

The currently accepted mechanism of analgesia is that the intramuscular effect patch is applied to the skin, and by stimulating the mechanical receptors on the skin, the signal is transmitted to the spinal cord along with the pain, which in turn suppresses the pain and achieves the purpose of analgesia. At the end of the inotropic patch, folds appear, which is one of the main mechanisms by which it works, using the folds to lift up the surrounding skin, thus enlarging the subcutaneous space and speeding up the circulation of the surrounding blood and lymphatic channels[56]. The majority of patients with osteoarthritis of the knee are receptive to it, with no significant adverse effects or adverse effects that necessitate termination of treatment. In addition, patients with osteoarthritis of the knee showed significant improvements in knee flexion, gait speed, flexibility, and function, and the intramuscular effect patch reduced their pain on stairs, alleviated their postural changes in

daily activities, allowed them to pay more attention to their joint support, reduced their fear of exercise, and improved their knee osteoarthritic joint stability. In the long term, this effect may improve the mobility of patients with osteoarthritis of the knee, which in turn reduces their disability rate in daily life and improves their quality of life.

The American Rheumatism Association's guidelines also recommend intramuscular patching as an appropriate non-pharmacological approach to pain in patients with osteoarthritis of the knee [57].

4. Summary and prospects

Osteoarthritis of the knee is a disease that can lead to lower limb dysfunction, reduced quality of life, and endanger physical and mental health. With the increasing aging of the population, osteoarthritis of the knee may gradually rise to become a common and frequent disease, posing a great challenge to the healthcare systems of various countries[58]. Knee pain, limitation of physical activity, partial dysfunction of the organism and joint deformity are the main symptoms of osteoarthritis of the knee, whereas pain in the organism is the most common clinical symptom and the main reason for patients to visit the doctor[59-60]. The mechanism for the occurrence of knee osteoarthritis is still unclear, therefore, there is no completely effective treatment method in the clinic at present[61].

In summary, in recent years, with the aging of China's population rising year by year, the incidence of osteoarthritis of the knee is also on the rise[5], and there is an urgent need for effective clinical as well as rehabilitation treatment measures[60]. In recent years, the prevalence of osteoarthritis of the knee in young adults has also been on the rise, and the increasing incidence and prevalence will bring a heavy burden to the world health system[62].

In this paper, we summarise the effective rehabilitation treatments and the significance of each rehabilitation method, such as massage, sports, drug support, acupuncture and moxibustion, and intramuscular effect patch, for the prevention and treatment of osteoarthritis of the knee. However, compared to developed countries, China's perception of rehabilitation medicine is still relatively traditional, foreign countries pay more attention to rehabilitation and conditioning after surgery, but in our country, there are still a lot of people chose to rest at home after surgery, which is not conducive to the rapid recovery of the body. Therefore, the publicity of the rehabilitation of knee osteoarthritis still needs to be strengthened to make more people aware of the necessity of taking rehabilitation for knee osteoarthritis after sports injury. The search for conservative yet safe and effective non-surgical treatments still needs to be further elucidated in subsequent clinical and basic research[58].

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