Proceedings of the 2nd International Conference on Biological Engineering and Medical Science (ICBioMed 2022), Part I
DOI: 10.54254/2753-8818/3/20220207

Factors of Knee Joint Injury and Rehabilitation Measures

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Abstract. Knee joint is one of the most important joints to participate in human daily activities and various sports. However, at present, knee joint injuries are still common for both athletes and ordinary people. Wrong exercise style and bad living habits will cause knee joint injury. Weak rehabilitation concept after knee joint injury also leads to poor prognosis in most cases of knee joint injury. Based on the above background, this paper will analyze and sort out the causes of knee joint injury, and explore the rehabilitation methods after injury, so as to provide ideas for future research on knee joint protection and rehabilitation after injury.

Keywords: knee joint, causes of damage, rehabilitation

1. Introduction

Knee joint is one of the parts of the human body that are prone to disease, and it is also the most complex, weak and unstable joint. It bears heavy loads but has little structural protection. The clinical manifestations and treatment measures of knee joint in different parts and ages are different. In the face of various causes of knee disease has not formed a perfect classification, various views at home and abroad are unique. Next, I will classify and supplement the causes of knee disease from internal and external causes. Due to the high participation of the knee joint in various activities of the human body, but the poor prognosis of relying on clinical diagnosis and home repair alone, it will cause varying degrees of inconvenience to the life of patients. In order to improve the objective symptoms and exercise ability of the injured, how to use rehabilitation techniques to reduce pain, restore skills, and heal wounds is also one of the important reasons for writing this article.

2. Internal factors of knee joint injury

2.1. Gender

According to epidemiological studies conducted by Luo Xiao in 2017, there is a difference between male and female in knee joint injury. In general, the risk of male meniscus injury is higher than that of females. However, in some special sports and specific parts (posterior root tear of medial meniscus), the risk of female knee joint injury is higher than that of male. Hawker et al. compared the knee arthroscopy cases in England and Lake Ontario in 1993, 1997, 2002 and 2004, and found that the knee injury rate of women was significantly higher than that of men in specific sports. Xie Wenpeng found in the statistics of knee joint injuries from 2013 to 2014 that the onset age of female patients was significantly earlier than that of male patients.

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DOI: 10.54254/2753-8818/3/20220207

2.2. Race and region

Race and region also bring about differences in knee joint injury rate and injury characteristics. In 2003, Xu Ling's research found that the prevalence rate of knee joint injury among elderly women in Beijing is much higher than that of white elderly women in the same age group in the United States. A study on knee joint injury conducted by the Johnston team in the United States shows that there are differences in knee joint injury rates among different races. Compared with Caucasians, African Americans have a higher knee joint injury rate. The relevant research on knee osteoarthritis (KOA) conducted by Li Yufei in 2004 shows that knee joint pain symptoms in northern China are more common and more severe than those in southern China. However, the latest research shows that there is no significant difference in the prevalence rate of KOA between the north and the south. The reason may be that although the northern areas of our country are cold and dry in winter, the heating measures are relatively perfect, and the residents' outdoor activities are significantly reduced in winter, which makes the prevalence rate of KOA in the northern areas lower and approach to the southern areas. It can be seen from this that the research results of relevant regions are still controversial and need to be confirmed by further research.

2.3. Age

Due to the serious sports damage, knee joint symptoms are mostly degenerative diseases, of which the elderly are an important factor to induce knee joint injury. Taking KOA as an example, it is most common in patients aged 40-70 years old and most common in people aged 50-60 years old. The influence of age on knee joint injury is reflected in the research in different countries or regions. Chung calculated in 2017 that the number of male medial meniscus injuries gradually increased with age. However, sports-induced lateral meniscus injuries are more common in young men under 25 years of age. In other Asian countries, the prevalence rate of KOA is 38.1% in South Korea and 21.2% in Japan. In some European and American countries, the prevalence of KOA is also very different. Fernandez-Lopez et al. showed that the prevalence rate of knee joint in Spain was 10.2% for people over 60 years old, while the study of Rotterdam in the United States showed that the prevalence rate of KOA in people over 55 years old was 29%. With the increase of age, symptoms such as muscle tissue atrophy, ligament relaxation, joint cavity hydrops and calcified joints appear, which greatly increase the morbidity and injury rate of the knee joint. From the perspective of traditional Chinese medicine (TCM), it is the invasion of positive deficiency and evil that causes knee joint injury and pathological changes to increase with age.

2.4. Gene

At present, researches believe that genes play an important role in the pathogenesis of KOA. A disintegrin and metalloprotease (ADAMs) is a kind of membrane-bound glycoprotein found in recent years, in which the subtype of fusion protein-a participates in the fusion of myoblasts and the formation of myotubes. It exists in the differentiation process of osteoblasts and is closely related to the development and pathological changes of knee joints. According to a related genetic investigation, the polymorphism of the ADAM 12 gene may also be related to arthritis. According to the analysis of data integration by REN et al., the polymorphism of TLR-19 gene and rs187084 is positively correlated with the occurrence of KOA, which may increase the risk of KOA. In addition, in the analysis and research of racial subgroup, some scholars have found that there are racial differences in the polymorphism of the loci of PvuII and XbaIAG, and there is a close correlation between the estrogen receptor α gene and KOA in Asian population, but this correlation does not exist in western population. However, due to the limited sample size available at this stage, the related conclusions are still controversial.

2.5. Body weight and BMI

Weight, as one of the important factors affecting sports injury, also plays an important role in the process of knee joint injury. Therefore, it is of great practical significance to study the relationship between overweight population and knee joint injury. According to Wang Kaichao's epidemiological investigation and analysis of KOA, more than 95% of the 411 patients participating in the investigation

DOI: 10.54254/2753-8818/3/20220207

have obvious overweight tendency. Therefore, obesity may be one of the important reasons leading to knee joint diseases. Li Yufei compared the symptoms of patients with different BMI in Xiangya Hospital Central South University. The results showed that with the increase of BMI, the severity of knee joint pain of patients increased, and the risk of KOA was higher for obese women. Other research results show that weight loss can reduce the incidence of KOA and improve symptoms such as pain and sequelae such as disability caused by KOA. To sum up, overweight and obesity will increase the risk of knee joint injury. Weight loss is beneficial for patients to improve related symptoms, and also plays an important role in the prevention of knee joint injury.

2.6. Constitution and chronic diseases

According to the TCM body five elements concept, physical abnormalities and various chronic diseases will destroy the stability of the human body, which may cause certain impact on the knee joint. According to the classification of Wang Qi of Beijing University of Traditional Chinese Medicine, the human body is divided into 9 major constitutions. According to this constitution theory and the correlation of LRP-5 gene polymorphism, the epidemiological investigation and analysis on the relevant pathogenic factors of patients with KOA by Chen Xian were carried out. It was considered that the three constitutions of yang-deficiency, yin-deficiency and qi-deficiency were the risk factors of KOA. Wan Xiaomin and others conducted research on KOA patients in Tongxiang city, Zhejiang Province and found that the constitutions of KOA patients are mainly phlegm-dampness constitution (31.7%), yang deficiency constitution (20.0%) and blood stasis constitution (18.3%). Therefore, the constitution of TCM may be an important factor affecting the onset of KOA, and those with phlegm-dampness constitution are mostly obese, which is consistent with the research on the high correlation between body mass index and the onset of KOA in western medicine. Based on the theory of western medicine, the study of the correlation principle of the five internal organs of TCM shows that hypertension and hyperglycemia are metabolic disorders which will cause damage to the heart, kidney and blood vessels of patients, and will affect the nutrient supply of various tissues for a long time, resulting in the destruction of the fibrillar structure of the original bone. At the same time, excessive pressure will lead to the disintegration of collagen fibers, which in turn will lead to the reduction of the synthesis of lubricating substances such as proteoglycan, accelerate the interstitial degeneration, and affect the normal function of the knee joint.

3. External factors

3.1. Bad postures of knee joint

3.1.1. Sports training. In various sports, the knee joint, as an important lever, has the function of stably supporting the body. However, the wrong technical movements will easily affect the stability of the knee joint, resulting in structural damage, fracture, ligament, tendon and infrapatellar fat pad injury. Different postures have different injuries to the knees. When the knee joint is in the semi-flexion position for flexion, extension and torsion movement, it is easy to cause ligament damage. The injury of medial collateral ligament is mostly caused by sudden outward rotation and extension of the lower leg, which increases the rotational force, or the medial landing when the knee joint swings, resulting in injury. The unbalanced athlete falls forward, gravity falls backward, and the knee joint touches the ground, hitting the upper end of the tibia and the lower part of the patella, causing posterior anterior displacement and anterior cruciate ligament injury. Violence acts on the front of the lower leg and the tibia moves backward, resulting in the injury of the posterior cruciate ligament. Tang Tao et al. have found that excessive long-term running may aggravate cartilage lesions. It affects the metabolism of local tissue cells of joints, causing the damage and destruction of tissue cells, causing ischemia, degeneration, hyperplasia and calcification and pathological changes such as swelling, fibrosis, cracking and stripping of chondrocytes. Zhang Jumin's research on the knee joint injury of Hebei province's young basketball players found that the strong impact force would cause the knee joint meniscus and ligament injury.

DOI: 10.54254/2753-8818/3/20220207

There was a positive correlation between the change of knee joint angle and stimulus intensity. From the above, it can be seen that wrong technical actions can cause serious knee joint injury, and effective self-protection of standardized actions and emergency situations can reduce the injury to the knee joint.

3.1.2. Knee joint gait. As the pivot of lower limbs, the knee joint increases the load of lower limbs when the human body walks upright, and the difficulty of maintaining body balance is increased due to the increase of the center of gravity. When a human walks, the two lower limbs cause the knee joint to swing up and down from left to right and the upper body to rotate. Under the action of long-term bad gait, the knee joint will inevitably be affected to a certain extent. Through the research on the influence of walking gait on knee joints, it is found that the number and frequency of steps with splayed gait are positively correlated with people's age, while the stride length is negatively correlated with age, especially for women. Long-term walking with abnormal gait is one of the important causes of chronic strain of knee joint, especially the influence of external splayed gait is the most common. The study by You Guijie found that in all age groups, women use less time than men to step into a single step, receive more ground impact when fixing walking distance, and have a higher probability of knee joint damage. The number of Chinese and foreign figure-of-eight gait in women is more, which is one of the reasons why their knee joint injuries are more than that of men. Weight-bearing labor and overweight people with splayed gait are also more likely to suffer from knee injuries.

3.2. Overuse of knee joint

3.2.1. Overtraining. In addition to the knee joint injury caused by technical movements, overtraining is also one of the important causes of knee joint injury. During most of the time of epee, the athletes' joints are in semi-flexion position with continuous lunges. At this time, maintaining joint stability mainly depends on the quadriceps-patella-patella tendon structure. The long-term local load of quadriceps femoris exceeds the tissue physiological limit, which will cause unstable tendency and overuse injury of the knee joint, causing serious injury to muscles, bones and soft tissues. Tian Fei's comparative study of Shanghai Marathon athletes shows that the movement perception and passive position perception of the Marathon group are significantly lower than those of the control group, which may be caused by the dysfunction of the body's proprioceptive function caused by the accumulated load, which will weaken the body's sense and control of the knee joint and cause the knee joint injury.

3.2.2. Daily life use. Climbing stairs and mountaineering are common exercises for office workers who sit quietly and do not move much in the city due to their convenience. However, this process will significantly increase the pressure on the knee joint, resulting in over-use of the knee joint and inducing knee joint diseases. Kneeling and sitting on one's knees and asian squat, as the culture and working habits of some ethnic groups and regions, have different degrees of injury to patella, meniscus, infrapatellar fat pad and ligaments. Appropriate rest and posture changes can relieve the symptoms of knee joint discomfort.

3.2.3. Other external factors. Sitting for a long time and lying down for a long time can also bring about knee joint injury, which may be caused by muscle atrophy due to lack of training, resulting in knee joint injury due to insufficient supporting force. Failure to carry out effective rehabilitation or continuous training when the old knee joint injury recurs will lead to an increase in the probability of knee joint re-injury, resulting in an increase in knee joint injury. The unique regional climate will also produce different degrees and types of knee joint diseases: rheumatism will be induced in coastal water-dependent areas and humid and cold regions, while the meniscus abrasion of the knee joint is more common in mountainous areas than in plain areas and patella softening. Poor eating habits may also induce knee joint diseases. Seafood, as a high-protein and high-calorie food, may cause gout in uric acid is too high. In the theory of TCM, excessive heat can also induce arthritis.

DOI: 10.54254/2753-8818/3/20220207

4. Rehabilitation therapies

4.1. Physiotherapy

The study found that physiotherapy protects the knee joint by promoting anabolism, inhibiting catabolism and improving the structure of each tissue of the knee joint. Physiotherapy represented by the treatment of KOA has been clinically proved to be able to relieve pain, stiffness, improve joint function and improve the KOA patients' ability of activities of daily living (ADL). Other experiments show that in physical therapy, pulsed electromagnetic field and ultrasonic therapy have relatively good effects, and hydrotherapy, thermotherapy and suspension therapy are also gradually developed and applied in clinical practice.

4.1.1. Mechanical therapy. In 2015, Cochrane pointed out that the effect of sports training on the relief of knee pain and the recovery of exercise function can last for 2-6 months. As an important adjuvant therapy, the instrument combined with exercise can strengthen the recovery effect.

4.1.2. Instrument therapy. Other exercise therapies that are widely used in clinical practice and can form industry standards, such as muscle strength training, neuromuscular training, power cycling and walking, are all important means of knee physiotherapy. The latest research shows that suspension therapy can improve the muscle strength, ADL and active joint activity around the knee joint of patients. In Wang Yi's experiment, it is concluded that suspension therapy has significant effect on relieving clinical symptoms and functional recovery of patients with knee joint disease. For the comprehensive consideration of cost and rehabilitation effect, the above are more commonly used physiotherapy rehabilitation measures.

4.1.3. Other physiotherapies. Wax therapy, as a representative therapy of thermotherapy, has good curative effect on pain relief and active activity improvement. Hydrotherapy has obvious advantages in relieving pain and stiffness of knee joint, improving sports function and social participation ability, and is also safer.

4.2. Occupational therapy

Homework therapy always emphasizes the rehabilitation of knee joint patients' physiological, psychological, emotional and social abilities, so as to improve the quality of life of patients and finally achieve the ability of patients to live independently.

4.2.1. Physical activities. Through active physical activities, the design imitates the work and entertainment activities required by the knee joint and uses specific instruments for targeted training to improve the motion and perception functions caused by knee joint disease damage. For professional particularity, such as football players, it is necessary to carry out targeted training on sports function before returning to the post to achieve the sports ability required by the profession.

4.2.2. Orthosis. In addition, orthoses and assistive devices are also one of the important means of occupational therapy. They can achieve the functions of stable support and protection, correction of deformities, auxiliary improvement of patients' motor function, prevention and compensation of patients' function through mechanical principles. The pressure suit has extremely high effect in treating hypertrophic scar and swelling of knee joint skin, and can also prevent degeneration of knee joint caused by scar contraction. As a therapeutic aid introduced from Japan, intramuscular plaster has been found in various studies to promote proprioceptive recovery, muscle strength enhancement, neuromuscular control and lymphatic drainage to eliminate swelling and spatial position perception, and is an important adjuvant for occupational therapy. Knee joint effect therapy involves a wide range of aspects, and only the combination of occupational therapy techniques and treatment strategies can achieve the maximum effect.

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4.3. Others

Comprehensive rehabilitation therapy based on TCM, including rehabilitation training, acupuncture, fumigation of knee joint with TCM and oral administration of TCM, can significantly relieve the symptoms of knee joint. It has the characteristics of long-lasting curative effect and few adverse reactions, and is favored by patients and researchers. Now boxing and food supplements are also gradually added to the therapy. In the comprehensive rehabilitation therapy of TCM, rehabilitation therapy mainly has the functions of relieving the further decrease of knee joint function and restoring joint function.

4.3.1. Acupuncture. Acupuncture can achieve the effects of dredging meridian passage and improving qi and blood by acupuncture points, accelerate blood circulation, improve the regulation of local nerve and body fluid of knee joint, regulate metabolic disorder, and promote the repair of articular surface. Scalp acupuncture, ear acupuncture, umbilical acupuncture, seven-star acupuncture and plum-blossom acupuncture, all of which can effectively treat knee joint diseases through acupuncture at specific points, are currently one of the treatment methods generally approved by western countries.

4.3.2. TCM. TCM fumigation and TCM oral administration have the effects of improving local blood circulation and promoting the recovery of soft tissue and tendon elasticity. The recovery principle is related to the pharmaceutical composition to a certain extent. Among them, the ingredients contained in the prescription, such as speranskia tuberculata, have the main pharmacological effects of anti-infection, analgesia, bacteriostasis and anti-allergy. Jatropha curcas can reduce the accumulation of inflammatory substances, enhance muscle strength and promote the recovery of joint function. Clematis chinensis mainly contains anemonin, which has antibacterial, anti-infection, analgesic and antispasmodic effects. Hematoxylin mainly contains hematoxylin and other components, and has anti-infection, antiviral and antioxidant effects. Lycopodium mainly contains triterpenes or alkaloids, and has anti-infection, antibacterial, analgesic and antioxidant effects. Radix Aconiti mainly contains alkaloids, which have anti-infection analgesic and antibacterial effects. The volatile oil and other components contained in Rhizoma Ligustici Chuanxiong have the effects of promoting vasodilation, resisting infection and relieving pain.

4.3.3. Boxing. As traditional sports with Chinese characteristics, Taijiquan and Baduanjin are aerobic sports with moderate intensity and safe intervention process. It has effects in dredging channels and collaterals, promoting blood circulation, removing blood stasis, tranquilizing mind, and tranquilizing mind. They can effectively relieve chronic knee joint pain. Chen Lizhen believes that activating the deep tissue sensory afferent analgesia mechanism through local limb stretching can play a wide range of neuroendocrine and immune regulating role by promoting the sympathetic-parasympathetic balance, and may relieve the pain mood by intervening in the brain regions related to emotion and pressure. In addition, traditional Chinese food therapy is also widely used in knee joint diseases such as osteoporosis and physical improvement. TCM pays attention to form and complement form, and advocates the use of the sexual taste of food to regulate yin and yang, thus achieving the effects of replenishing qi and nourishing blood, invigorating spleen and appetizing, and harmonizing viscera. The curative effect of TCM comprehensive rehabilitation on knee joint can obviously improve a series of problems such as knee joint function and bone metabolism balance, which is worthy of being introduced by the western rehabilitation system.

5. Conclusion

According to the analysis of the causes of knee joint injury and rehabilitation techniques, the internal causes of knee joint injury are summarized. The incidence rate is closely related to gender, race, region, age, body shape, heredity and physique. In terms of external factors, the knee joint injury can be effectively reduced by adjusting the bad movement posture and movement duration of the knee joint, correcting gait problems, paying attention to a balanced diet in life, and selecting a suitable climate and

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terrain for life. The existing rehabilitation treatments are represented by physical therapy, occupational therapy and other rehabilitation with TCM. Physical therapy is the core part of rehabilitation therapy. Homework therapy mainly supports, protects and compensates for the improvement of patients' living ability through targeted training in clinical practice. TCM therapy and food supplement combine Chinese-specific Chinese herbal medicines, acupuncture, boxing and dietotherapy to relieve symptoms and improve physical fitness. However, at this stage, the public does not attach much importance to rehabilitation and the concept of rehabilitation is conservative, which greatly affects the prognosis. In addition, the cost of rehabilitation is high and the recovery time is relatively slow, which makes patients ignore rehabilitation even more. In the future, we need to raise the masses' attention to rehabilitation through publicity and education. It is also necessary to improve rehabilitation techniques and seek for high efficiency. At the same time, it is necessary to strengthen the application of family rehabilitation instruments and the cultivation of self-rehabilitation ability. Further research and exploration are needed in these aspects to seek more opportunities and development.

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