

## ***Preparation Method for Repairing Sports Exercise Injury Based on Tissue Engineering Ligament***

**Bisen Mayank\***

*Taif University, Saudi Arabia*

*\*corresponding author*

**Keywords:** Tissue Engineered Ligament, Preparation Process Method, Sports Rehabilitation Therapy, Ligament Injury

**Abstract:** Ligament injury is one of the common diseases with the highest incidence in sports diseases, which seriously affects people's physical exercise. Once the ligament is injured, the body's automatic repair ability cannot achieve self-repair. In recent years, with the rapid development of tissue engineering, its application range gradually involves the medical field. The ligament prepared by tissue engineering has the advantages of anti-infection and will not cause immune rejection with the human body. The replacement of damaged artificial ligaments by tissue engineered ligaments can enhance the self-healing ability of ligaments to a certain extent. In addition, the postoperative recovery process also has an impact on the overall treatment effect. As an important nursing method in ligament treatment, tissue engineered ligament repair can circulate blood, strengthen muscles and improve joint flexibility. Based on this, this article proposes a preparation method based on tissue-engineered ligaments to repair sports exercise injuries. The research in this article is mainly divided into three parts: The first part is the study of tissue engineering on ligament damage, whether the newly prepared ligament will rub against the human body after being implanted in the human body, and the ability of tissue engineering to repair ligament damage is evaluated; The second part of it is the study of tissue engineering in the treatment of ligament injuries, which explored the mechanism of Tai Chi to enhance the recovery ability of patients. The third part is a clinical study, which draws conclusions based on the comparison of various indicators between the observation group and the control group. The results of this experiment show that in the clinical repair treatment of ligament injuries, the ligaments prepared by tissue engineering have good antibacterial properties and good histocompatibility with human bones because of the endophytes. The observation group combined with Tai Chi exercise therapy had minor complications, such as swelling, repeated dislocations and contractures, which could effectively avoid repeated injuries to the patients' ligaments.

## 1. Introduction

As one of the important tissue fibers of the human body, ligament [1] has important functions that many other tissues do not lack, such as enhancing the stability between joints, muscle flexibility and muscle mobility. Ligament injury [2-3] is a partial dislocation of the joint caused by improper exercise, which is very common in clinical treatment. When a certain part of the human body stretches the ligaments beyond the normal range due to irrational movement, the human ligaments will be damaged to varying degrees. When damaged, the damage includes non-articular dislocation injury, partial joint dislocation injury, complete joint dislocation injury, and ligament tear [4]. Relevant investigations have shown that nearly 10 million ligament patients are required to undergo implant repair [5] and other related ligament operations every year. Some patients undergo a series of complications such as internal infections and repetitive ligament injuries after reoperation. The recovery process is slow. This not only brings a crisis to the patient's personal and property conditions, but also reduces the efficacy of surgery. Therefore, in order to solve a series of possible problems, the commonly used treatment method is to use alternative organic materials implanted in the human body to repair the damage. Clinical treatment has shown that this clinical treatment method will cause the patient to have a strong immune rejection reaction and repetitive injury [6] and other complications. Therefore, the search for artificial ligaments with high compatibility with human tissues has become increasingly urgent for improving the clinical treatment of ligament injuries.

Infection of the implant site in ligament treatment [7] is one of the most difficult complications in ligament repair surgery, ranging from prolonging the treatment time and increasing the treatment cost to repetitive damage to the ligament due to infection. There are generally two reasons for infection in the treatment of ligament injury: firstly, bacterial adhesion [8] forms a biofilm on the surface of the implant, which prevents the body from receiving drug treatment and the killing effect of antibiotics on bacteria. Secondly, because of the poor biocompatibility of implant materials [9], it cannot form a firm bond with human tissues. Therefore, looking for nanomaterials with excellent antibacterial properties and good histocompatibility has great applications for reducing the infectivity of internal implants and promoting the development of high-end ligament implants with independent intellectual property rights. value. After ligament injury repair surgery, sports rehabilitation training will affect the overall treatment effect on the postoperative recovery process. Tai Chi exercise rehabilitation therapy [10-12], as an important nursing method in ligament treatment, can circulate blood, strengthen muscles and improve joint flexibility. It can enhance the recovery effect of the patient's tissue function, and greatly reduce the patient's repetitive ligament injury and disability rate after surgery. Based on this, nano-ligaments combined with Tai Chi exercise rehabilitation therapy have great application potential in the treatment of ligament injuries.

Nanomaterials are widely used in materials, biology, medicine and other fields due to their superior physical and biological properties. With the development of tissue engineering, the treatment of ligament injury has been further developed, and its focus is on repair and remodeling. It has always been a difficult point in tissue engineering to find materials with good human tissue compatibility, strong mechanical properties and strong antibacterial ability. Nanofiber silk [13], as a newly developed material in recent years, has better human tissue compatibility than commonly used repair materials such as autologous and foreign materials, natural polymer biomaterials, artificial synthetic materials and composite materials. Strong anti-infection performance. In addition, by changing the thickness, pore size and fiber density of nanofiber filaments, the implanted human body can form a porous scaffold [14], which can realize the carrying of cells in it. At the same time,

through the distance between the built-in filaments, to achieve adhesion between cells. In addition, its nanoporous morphology can be suitable for the adhesion and growth of body cells, realizing the formation of new human tissues, so that damaged ligaments can be repaired. In addition, Tai Chi exercise rehabilitation therapy, as an important nursing method in the treatment of ligament recovery, can circulate blood, enhance joint flexibility and reduce pain. Systemic rehabilitation training can reduce the generation of joint scars [15] and reduce postoperative complications. The incidence of disease.

The research carried out in this paper is mainly divided into three parts: The first part is the study of artificial nano-ligaments in ligament injury. The nanofiber filaments developed by tissue engineering are used as the scaffold materials for endopplants. After being implanted in the human body, it needs to adhere to human cells while achieving Slow degradation in the body, but for patients with bone defects due to the slow bone formation rate, there may be a potential risk of friction. The repair of ligament damage not only needs to restore the function of the original tissue, but also has no traces and beauty after the operation. This puts forward the requirement of strong affinity with the human body for the nano scaffold; the second part is the research of Tai Chi exercise rehabilitation therapy in the treatment of ligament injuries. Tai Chi rehabilitation exercises for patients with ligament injury can reduce postoperative pain, eliminate the swelling and scars that occur in the injured area and surrounding areas during ordinary surgical treatment, and improve joint flexibility. During the exercise after ligament repair, if you can grasp the intensity of exercise according to your own condition, and complete the systematic Tai Chi exercise training within a certain time frame, the treatment time will be greatly shortened. The third part is the clinical investigation and research part. Investigate the therapeutic improvement degree, clinical effect and patient satisfaction of nanofiber filaments as artificial ligaments in the treatment of ligament repair. This article will discuss in detail the advantages and disadvantages of nano ligament in clinical application, and explore the feasibility of nano ligament combined with Tai Chi exercise rehabilitation therapy to treat ligament injury.

## 2. Research on Nano Ligament in Ligament Injury

The nanofiber yarn prepared in the research of tissue engineering has a simple production process, and the process parameters of the fiber yarn can be effectively controlled. Compared with ECM, the diameter of nanofiber filaments produced by the process ranges from nanometers to micrometers, and the stretching direction of the drawn filaments can be controlled by the strength of the electric field. Observing the nanotube fiber filaments under an electron microscope, it can be found that the entire fiber structure has a large specific surface area, a relatively large volume, and superior mechanical properties such as a porous shape. This is a special structure used for drug carrier adsorption. The application research of nanofiber filaments in ligament injury can be divided into two aspects: one is to study the histocompatibility of nanofiber filaments with the human body, that is, to study cell fusion and fiber scaffold degradation; The applicability of artificial ligaments with good antibacterial properties, including bioactive factor loading, bioactive factor release, and fiber scaffolding. Related studies have found that nano-ligaments can resist the adhesion of bacteria. The surface of the fiber filaments is covered with island-like structures with a height of 12nm, and the surface layer can resist the adhesion of bacteria and promote the production of biofilm. Because of this characteristic, it can reduce the risk of infection for patients, so it is a new type of antibacterial nano-biological material.

## 2.1. Histocompatibility of Nano-Ligament

### 1. Study on histocompatibility of autologous cells

The nanofiber yarn itself has a special structure with a large number of free surfaces. The frosted shape of the surface is beneficial to cell adhesion, cell proliferation, cell differentiation and apoptosis.

(1) Compared with traditional biological materials, the multi-pore morphology of the cells on the surface of the filaments improves the value-added ability of the cells.

(2) Previous studies have shown that the enhancement of the tissue-forming ability on the surface of nanofiber filaments is related to the diameter of the filaments. The diameter of nanofiber filaments can significantly promote the attachment and proliferation of autologous cells, thereby affecting cell differentiation and growth. speed. When the surface of the filament is covered with island-like structures with a height of 39nm, the cell adhesion is the highest. Under this condition, the autologous cells can spread on the surface of the filament in a large amount, the cell skeleton tends to be perfect and the proliferation speed begins to accelerate. Suitable for ligament injury repair surgery.

(3) The biocompatibility between the surface layer of the nano-ligament and the autologous cell is very good, which can make the nano-material and the original tissue cell fuse, thereby improving the successful spread of the internal scaffold.

(4) The special structure of nano-ligament not only promotes cell fusion, but also eliminates the self-immune rejection reaction.

### 2. Research on the affinity of autologous cells

As an artificial ligament, nanofiber filaments can use scaffold materials to enhance tissue repair and promote the formation of new tissues. Nanofiber filaments can be used as carriers to carry self-cells and growth factors to achieve tissue repair. Relevant studies have shown that the three-dimensional model materials constructed after the nanofiber filaments are implanted in the human body can greatly promote the differentiation of stem cells in the human body into tissue cells, thereby obtaining better surgical results. However, although nanofiber filaments can improve the adhesion and activity of fibroblasts, no studies have shown that the degradation rate of nanofiber filaments will not affect the clinical treatment time of patients.

## 2.2. Application of Nano Ligament in Tissue Engineering Scaffold

In recent years, nanofibers have been widely used in tissue engineering research fields such as skin, blood vessels, cartilage, and bone.

### 1. Wound dressing and skin tissue engineering

Wound dressings should have the advantages of hemostasis, antibacterial, absorbing wound fluid, painless after use, and low cost. The nano-ligament has a large comparative area and a special structure such as porous channels, which promotes sufficient blood supply and normal water and oxygen in the wound. Collagen, which is an important component of the extracellular matrix, is electrocuted into collagen nanofibers and wrapped by extracellular matrix proteins.

In the observation of ligament repair after treatment, the wound was completely covered by fragments of fibrous tissue, and there were fibrocytes at the base, while there were no tissue fragments in the nano-collagen fiber group, and new capillaries and tissue cells were dominant. Generally, after 4 weeks of surgical treatment, the wound skin has almost formed and the connective tissue is dense. Relevant research results show that nano ligaments have the function of rapid wound healing and are suitable for wound dressing. Chitin has a similar structure to

nanofibers, and its specific surface area is larger and its degradation rate is higher than that of ultrafine fibers. Studies have shown that the repair of ligaments treated with nanofibers has better cell adhesion and value-added properties than microfibers, which greatly contributes to wound healing and skin tissue regeneration. Because of its good histocompatibility and no immune rejection, it has become the main endophyte material for skin tissue engineering. In recent years, with the continuous development of science and technology, the autologous cell affinity of the nanofiber scaffold has been greatly improved, and the cells can smoothly pass through the fiber layer to form a new generation of tissue in the artificial scaffold.

#### 2. Vascular tissue engineering scaffold

The inner membrane of the blood vessel wall is a basement membrane composed of a single layer of epithelial cells. The surface roughness is small and contains a variety of proteins. On the cell membrane, smooth muscle cells are surrounded by three thick layers of extracellular matrix, which contain 36% type 1 collagen, 54% type 3 collagen, and 10% protein. The outer membrane is composed of loose connective tissue, dominated by fibroblasts containing type I collagen. Collagen gives the wall a strong tensile strength, and elastin has an effect on the elasticity of the blood vessel wall. Both are used as nanofiber scaffold materials for human angiogenesis scaffolds. In addition, a nanofiber scaffold with a diameter of 4.75 mm obtained by StitzeI et al. The longitudinal and transverse mechanical properties of the stent are not significantly different, and the puncture pressure is 10 times higher than the vasoconstrictive pressure of its own. Cell experiments show that nanofiber scaffolds can support the proliferation and adhesion of cells in tissues.

#### 3. Bone tissue engineering scaffold

When nanofiber materials and autologous cells are co-cultured, it is found that the cells adhere to the fiber scaffold and differentiate into osteoblasts, and the fiber scaffold can retain its own stability and support the formation of bone tissue. Nano-ligaments have the advantages of anti-infection and good compatibility with human tissues. The application of nano-fiber filaments to carry drugs to treat osteoarthritis can repair bone to a certain extent and relieve patients' pain symptoms. Infection of the implant site in bone tissue treatment is one of the most difficult complications in orthopedic surgery, ranging from delaying the treatment cycle and increasing treatment costs to amputation or death due to infection. There are generally two reasons: firstly, bacteria adhere to the surface of the implant to form a biofilm, which hinders the body's immune response and the killing effect of antibiotics on bacteria. Secondly, because of the poor biocompatibility of the implant material, it cannot achieve good adhesion with the human bone. The fibrous layer of the implant osseointegration interface will reduce the local resistance of the host. As a newly-developed material, nanofiber filaments have better human tissue compatibility and strong anti-infection performance than commonly used orthopedic materials such as stainless steel, titanium alloy, polyethylene, ceramics, etc. In addition, by changing the diameter, direction, drug loading, and stent width of the fiber filaments, the damaged bone tissue can be targeted and the drug can be released, and the internal implant has a long-lasting antibacterial effect. In addition, its nanopore morphology can be suitable for a variety of cell adhesion and growth, achieving good compatibility with human tissues. It can enhance the recovery effect of the patient's function, which is very conducive to the recovery of the patient's body, and greatly reduces the postoperative mortality and disability rate of the patient.

#### 4. Cartilage tissue engineering scaffold

Related studies have shown that by embedding human chondrocytes and autologous bone marrow stem cells into nanofiber scaffolds, the cultured bone marrow stem cells can successfully differentiate into chondrocytes and play a certain role in promoting cell proliferation. Since

cartilage is composed of type II collagen, Matthews and others cultured the cartilage cells from the type II collagen joints in vitro. Therefore, after a week, the cartilage can be positioned in the cells.

### **2.3. Preparation Method of Tissue Engineering Artificial Ligament**

The seed cells are pre-encapsulated by gel, and when the degradable polymer scaffold is prepared by electrospinning, the seed cells are evenly sown on the scaffold, so that the seed cells and the scaffold can be organically combined to form an artificial tissue containing living cells with the function of reconstructing ligament tissue.

## **3. Research on Tai Chi Exercise Rehabilitation Therapy**

In the rehabilitation process after ligament repair, the postoperative recovery process also affects the overall treatment effect. Tai Chi exercise rehabilitation therapy, as an important nursing method in ligament treatment, can circulate blood, strengthen muscles and improve joint flexibility. The effect of independent exercise is unmatched by other treatment methods. It can enhance the recovery effect of the patient's function, which is very conducive to the recovery of the patient's body, and greatly reduces the postoperative disability rate and repetitive injury of the patient.

### **3.1. Necessity of Tai Chi Exercise Rehabilitation Therapy in Ligament Repair**

Symptoms of tissue tightness usually occur after a person is undergoing repair operations, which will greatly affect the patient's walking posture and reduce the subjective well-being of life. Relevant studies have shown that after ligament repair surgery, proper exercise, light stretching, and regular walking can cause significant repetitive damage.

This article studies the therapeutic effect of Tai Chi exercise rehabilitation therapy combined with nano-ligament on ligament injury. 90 patients with ligament injury treated in our hospital are the research objects, including 58 males and 32 females, with an average age of 32 years. The order divides the patients into three groups equally. The results of the investigation show that the patients with ligament repair have obtained good therapeutic effects in early Tai Chi rehabilitation training.

### **3.2. Method**

Group 1 adopts common clinical methods of ligament repair and conventional medical care, group 2 uses nano-ligament as implanted artificial stent for ligament repair treatment and conventional medical care, and group 3 uses nano-ligament as implanted artificial stent for ligament repair Treatment and Tai Chi exercise rehabilitation therapy, in which group 1 and group 2 are used as control group, and group 3 is used as observation group. The specific method is as follows:

#### **(1) Psychological counseling.**

In the course of rehabilitation training after ligament repair, the patient's confidence in recovery plays an important role in the recovery of the disease. Because of the stiffness of the knee, the patient's flexion and extension and lying down are restricted to a certain extent, which greatly affects the patient's recovery. Therefore, nurses should actively and closely follow the patient. For patients with a long medical history, they should carry out appropriate help exercises to make the patients have an optimistic and confident attitude towards recovery. In addition to eliminating the patient's psychological dependence on surgery, we should also actively cooperate with nursing staff to carry out early functional exercises.

## (2) Carry out the initial training of Tai Chi activities.

According to the division of the control group and the observation group, organize group 3 to participate in customized Tai Chi exercise learning and training. During exercise, patients are required to always pay attention to the pain in the injured part of the ligament. During the operation, the control group used common clinical methods of ligament repair, and the observation group used nano-ligaments as implanted artificial stents for ligament repair. During the early treatment period, nursing staff need to provide some help to the patient's rehabilitation training. At this stage, the focus of recovery is to prevent joint instability, and the patient's exercise training requires corresponding guidance from Tai Chi experts. When the joints move, Tai Chi is used to allow the two forces to penetrate each other, move the whole body, and parallel to the whole. During the training process, the patient needs to improve the center of gravity, move the center of gravity as far as possible to or around the injured ligament to avoid further injury, and perform simple basic Tai Chi exercises.

## (3) Carry out mid-term training for Tai Chi activities

In the mid-term treatment phase, the focus of this phase of recovery is to prevent repeated recurrence of ligament injuries. Patients in the observation group received Tai Chi training and began to increase their exercise volume. During the mid-term training, patients can exercise on their own under the supervision of a nurse. On this basis, the body's center of gravity needs to be slowly lowered, and there is no need to complete a complete Tai Chi movement. During this period, the control group performed some weight-bearing exercises, starting with two weight-bearing exercises a week, and then increasing the number of weight-bearing exercises. As the ligament injury gradually recovered, the center of gravity of the Tai Chi observation group continued to decrease to increase the working distance of the muscles and the physical pressure on the joint ligaments. The control group started weight-bearing walking training and gradually increased the training time to more than 40 minutes.

## (4) Tai Chi exercise training in the later stage of rehabilitation

In the later stage of rehabilitation, the two groups continued to undergo surgical treatment. At this stage, Tai Chi exercise treatment focused on the functional recovery of the damaged ligament. Patients in the experimental group can exercise Tai Chi independently, and complete the complete Tai Chi movement. In the control group, high-intensity exercises such as running, jumping, and up and down steps were required in the later stage of rehabilitation.

The postoperative ligament function rehabilitation assessment records of the control group and the observation group this time are shown in Table 1. The ligament repair of the two groups of patients has improved, but the improvement of the observation group is significantly higher than that of the control group.

*Table 1. Rehabilitation evaluation of three groups of patients*

Group	Excellent	Good	Poor	Total (number of people)
Group 1	15	13	2	30
Group 2	17	12	1	30
Group 3	22	8	0	30

### 3.3. Evaluation Index

After the observation group received Tai Chi exercise rehabilitation training for 7 weeks, the efficacy of the observation group and the control group in the follow-up investigation was evaluated according to the rehabilitation evaluation index.

The simple life scale is used to assess the quality of life of patients after surgery. The indicators include physical pain, limb stretching, mental health, social activities and overall health. 10 points in the score is the upper limit, the higher the score, the better the patient's quality of life. The quality of life scores of the observation group were higher than those of the control group in all indicators. Therefore, it can be concluded that compared with ordinary clinical methods of ligament repair and conventional medical care, nano-ligament as an implanted artificial stent for ligament repair treatment and Tai Chi exercise rehabilitation therapy can effectively speed up the recovery of ligament function, not only improve The patient's quality of life during the illness, and can make the patient's recovery better and better.

### 3.4. Statistical Methods

SPSS statistical software can analyze the relationship between univariate and multivariate, and the t test is used for comparison between groups. When  $P < 0.05$ , it is considered statistically significant.

### 3.5. Advantages of Tai Chi Exercise Rehabilitation Therapy

In the recovery process after ligament repair, the recovery process will have a great impact on the overall treatment effect. Tai Chi exercise rehabilitation therapy is an important nursing method in ligament treatment. It can circulate blood, strengthen muscles and improve joint flexibility, so that the patient's confidence in recovery plays an important role in the recovery of the disease.

(1) In the early postoperative period, the patient may have complications such as pain, joint adhesion, and stiffness, which will limit the patient's recovery progress to a certain extent, which greatly affects the patient's confidence in recovery. Tai Chi exercise can promote blood circulation and remove blood stasis, and is beneficial to blood circulation. Following the principle of painless exercise can greatly reduce the trauma of damaged tissues.

(2) Choose the appropriate exercise intensity according to the patient's physical condition. Tai Chi exercise rehabilitation training can coordinate the smooth operation of various organs of the human body, make the patient feel calm and relax, soothe the patient's psychology and shape a beautiful body shape. effect. Sports rehabilitation training is an important part of injury recovery treatment, and the effect of independent exercise is unmatched by other treatment methods.

(3) During the training period, attention should be paid to reducing the pain of the patient, the rehabilitation training program should be gradual, and the intensity of exercise should be grasped. During exercise, an analgesic pump can be used to reduce the pain caused by exercise. After the analgesic pump is relieved, analgesic drugs can be taken immediately to reduce pain and accelerate the recovery of tissue function.

## 4. Survey Results and Analysis

In order to study the therapeutic effect of Tai Chi exercise rehabilitation therapy combined with nano ligament on ligament injury, 90 patients with ligament injury treated in our hospital were

taken as the research object, including 58 males and 32 females, with an average age of 32 years. Divided into three groups.

Group 1 adopts common clinical methods of ligament repair and conventional medical care, group 2 uses nano-ligament as an implanted artificial stent for ligament repair treatment and conventional medical care, and group 3 uses nano-ligament as an implanted artificial stent for ligament repair Treatment and Tai Chi exercise rehabilitation therapy, in which group 1 and group 2 are used as the control group, and group 3 is used as the observation group. Investigation and research found that among the three contrasted groups, the observation group had higher scores on mental health, physical pain, joint function, and reduction in repetitive injury compared with the control group. It can be seen that Tai Chi exercise rehabilitation therapy combined with nano ligament has a good clinical therapeutic effect on ligament injury.

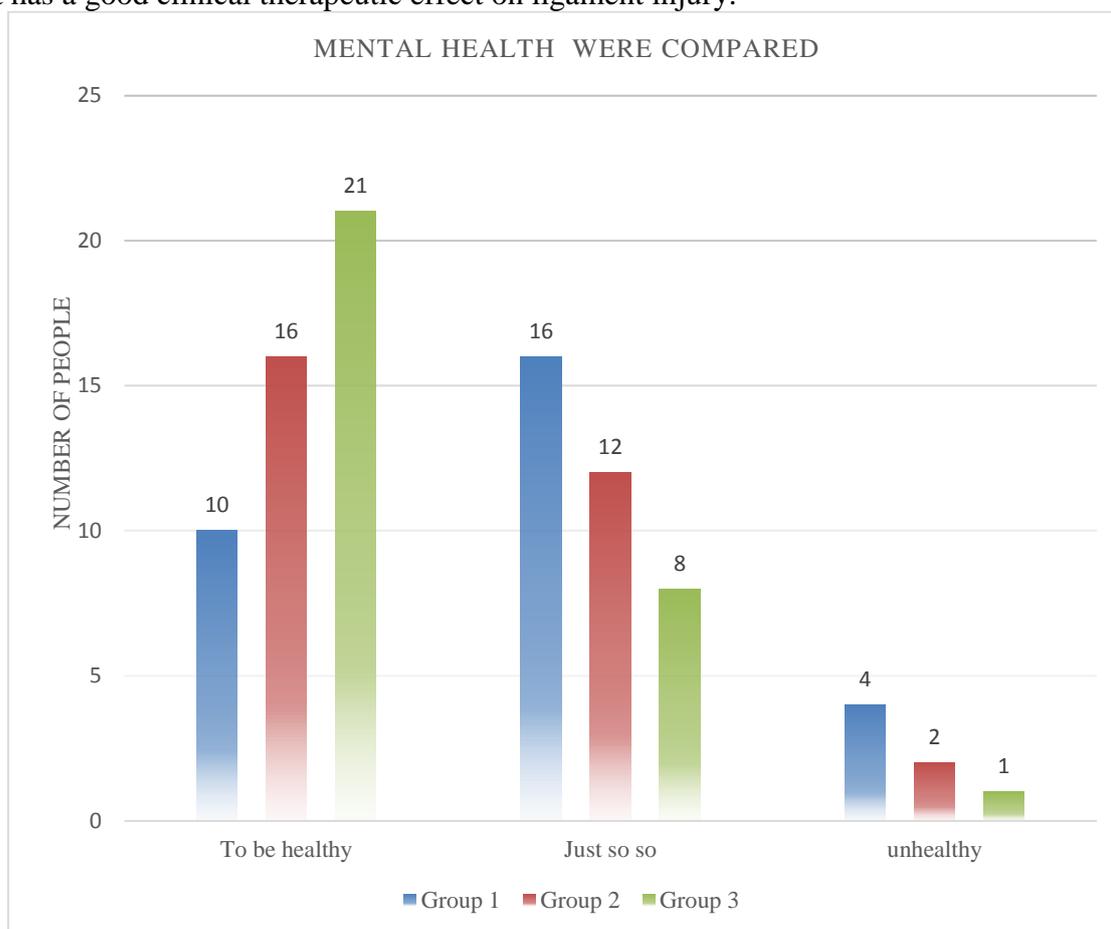


Figure 1. Comparison of mental health between the three groups after treatment

It can be seen from Figure 1 that the mental health of the three groups is significantly different after treatment. In the follow-up rehabilitation training after treatment, group 3 had the highest proportion of mentally healthy people, and the proportion of patients with healthy mental ratio was the smallest. Compared with the control group, the mental health score of the observation group increased significantly. In the course of rehabilitation training after ligament repair, the patient's confidence in recovery plays an important role in the recovery of the disease. Because of the stiffness of the knee, the patient's flexion and extension and lying down are restricted to a certain extent, which greatly affects the patient's recovery. Therefore, nurses should actively and closely

monitor patients and actively carry out appropriate help exercises so that patients can have an optimistic and confident attitude towards rehabilitation, which is beneficial to patients' physical and mental health.

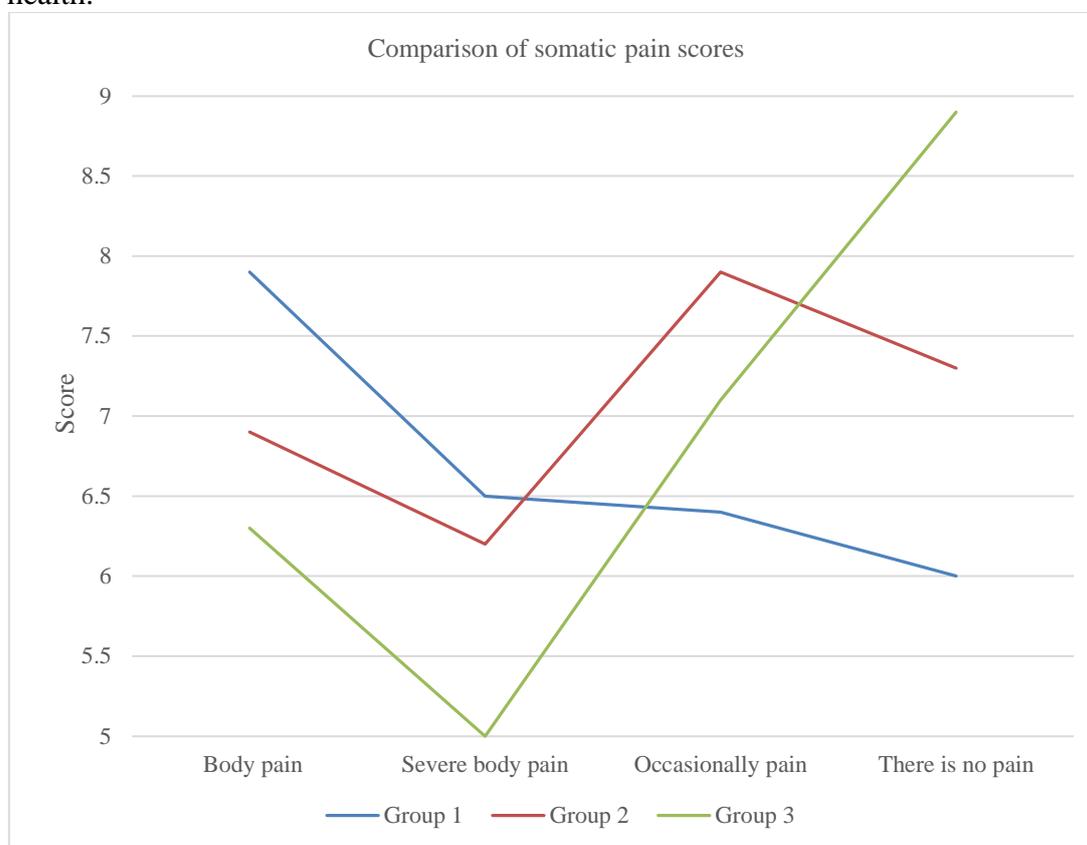
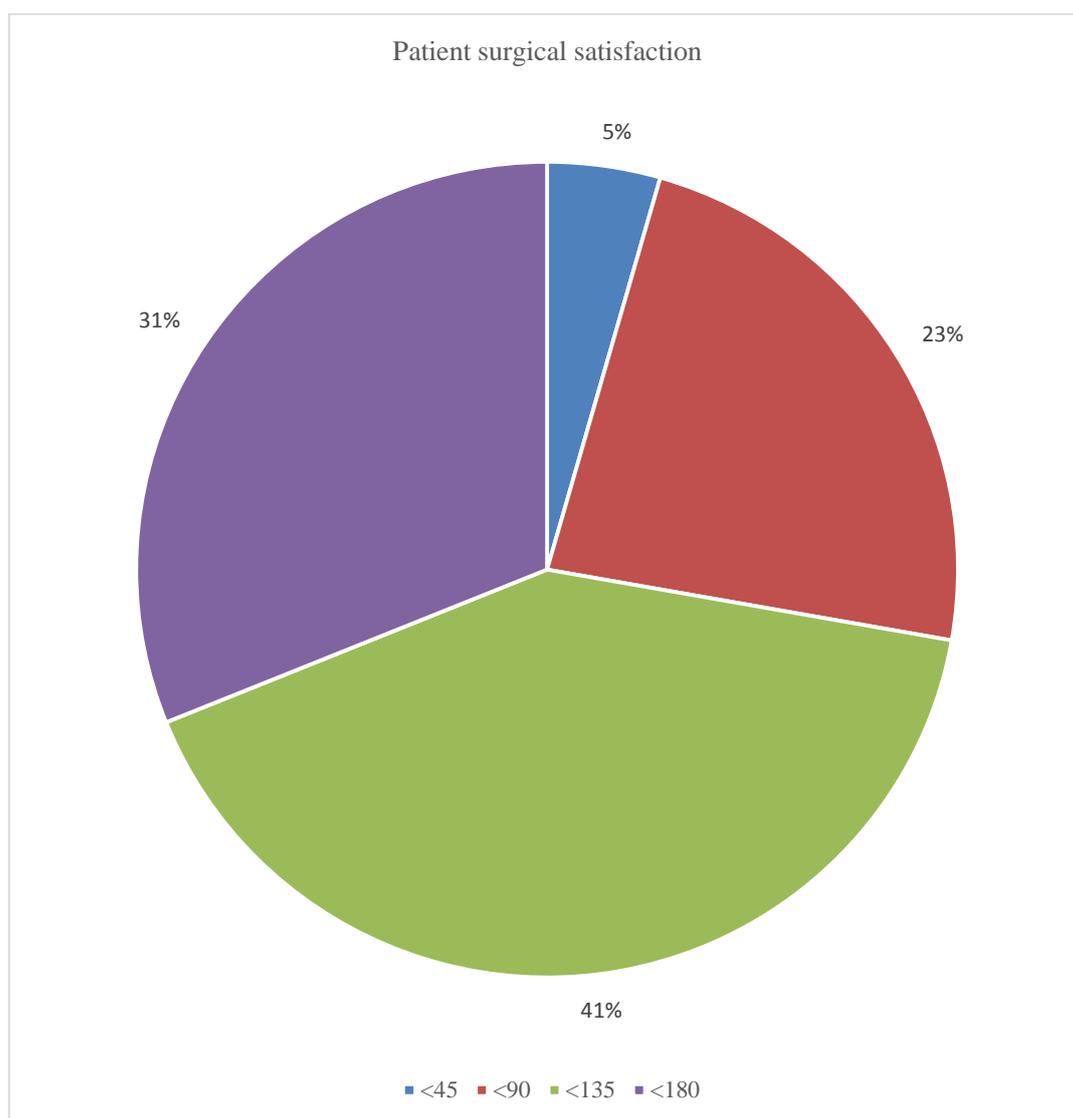


Figure 2. Comparison of body pain scores after three groups of treatment

It can be seen from Figure 2 that the physical pain scores of the three groups are significantly different after treatment. The pain score of group 3 is significantly lower than that of group 2 control group, and the pain score of group 2 is significantly lower than group 1 control group. According to the division of the control group and the observation group, group 3 participates in customized Tai Chi exercise learning and training. During the training period, attention should be paid to alleviating the patient's pain. The rehabilitation training program is also gradual and the exercise intensity is grasped. During exercise, nurses use analgesic pumps to relieve pain caused by exercise. After the analgesic pump is relieved, analgesic drugs can be taken immediately to reduce pain and accelerate the recovery of tissue function. In the early stages of training, to avoid further injury, patients only perform simple Tai Chi exercises. In the later stage of rehabilitation, the two groups continued to undergo surgical treatment, and the patients in the observation group were able to perform Tai Chi exercises on their own, and completed complete Tai Chi movements. In the control group, high-intensity exercises such as running, jumping, and up and down steps were required in the later stage of rehabilitation. After comparison, it was found that the clinical pain treatment effect of group 3 was the best.



*Figure 3. Postoperative patient ligament stretch range*

It can be seen from Figure 3 that among all the study subjects, the postoperative ligament stretching range between 90 °and 135 °accounted for the highest proportion. During the postoperative recovery period, patients in the observation group received Tai Chi training and began to increase their exercise volume. At this time, the patient can exercise on his own under the supervision of the nurse, the body's center of gravity needs to be slowly lowered, and does not need to complete a complete Tai Chi movement. During this period, the control group performed some weight-bearing exercises, starting with two weight-bearing exercises a week, and then increasing the number of weight-bearing exercises to relieve the working distance of muscles and the physical pressure on joints and ligaments.

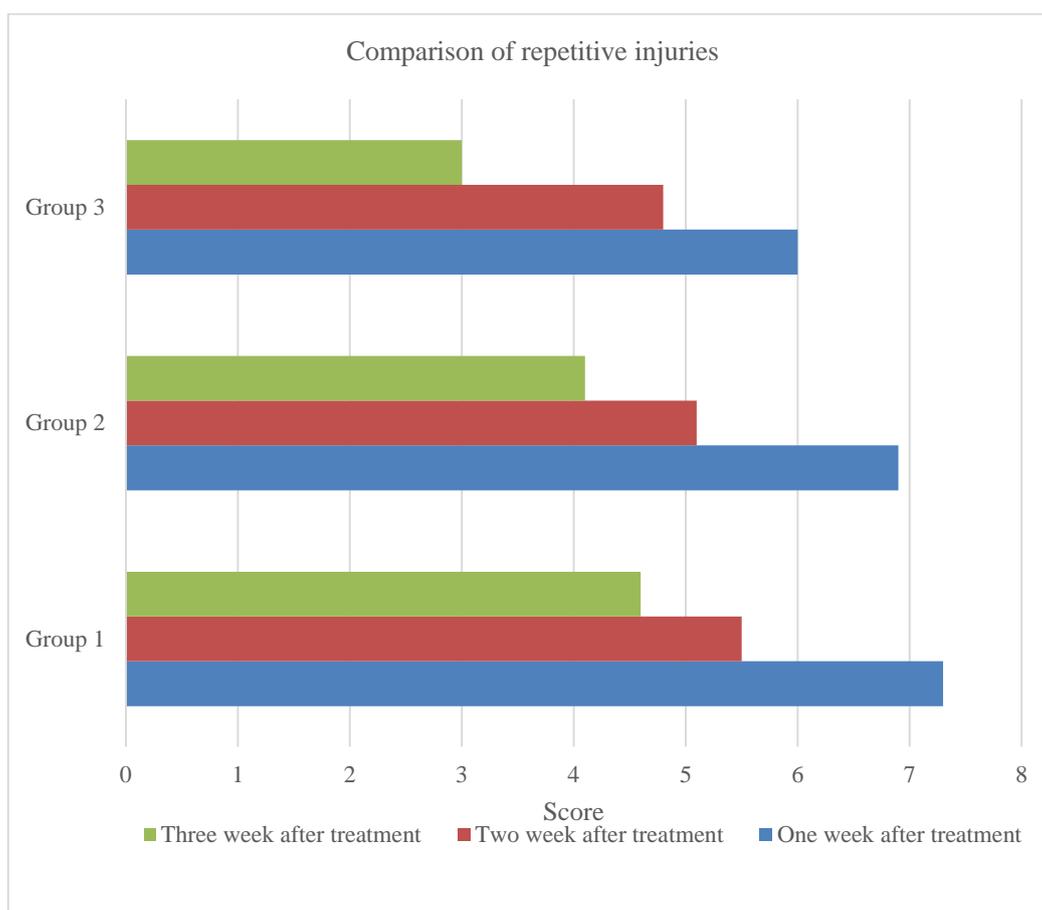


Figure 4. Comparison of repetitive injury scores after three groups of treatment

It can be seen from Figure 4 that the repetitive injury scores after treatment in the three groups are significantly different. Before treatment, the scores of the three groups of patients were relatively high, but the scores of group 3 were significantly lower than those of groups 1 and 2. The repetitive injury scores of one, two, and three weeks after treatment were significantly reduced. Compared with the control group, the repetitive injury score of the observation group decreased more significantly. Tai Chi exercise rehabilitation therapy is tailored for patients with special conditions. The exercise used for postoperative recovery can achieve circulation effect on the blood circulation of the patient's body, help to restore the muscle elasticity of the patient, and accelerate the recovery and extension of the original ligament function of the patient, and enhance the recovery of the patient.

## 5. Conclusion

As a sports disease, ligament injury is very common in clinical treatment. Once the ligament is injured, it will cause movement disorders and various complications such as infection, swelling, and repetitive attacks. In recent years, with the rapid development of tissue engineering technology in the medical field, artificial ligaments made of nanofiber materials have the advantages of anti-infection and no immune rejection reaction with the human body. The use of nano-ligaments as a scaffold to support the value-added of autologous cells has been applied In the clinical treatment of

ligament injury. In the course of clinical treatment, it was discovered that Tai Chi exercise rehabilitation therapy, as an important nursing method in ligament treatment, can circulate blood, strengthen muscles and improve joint flexibility. In this paper, the research on the therapeutic effect of nano-ligament combined with Tai Chi exercise rehabilitation therapy on patients with ligament injury is carried out. The diameter, direction, drug loading and stent width of nano-ligament are explored. At the same time, the Tai Chi exercise rehabilitation therapy can strengthen the muscles of patients and improve the flexibility of joints. Clinical investigation and analysis showed that, according to the assessment of the simple life scale, the observation group had higher scores on mental health, physical pain, joint function, and reduction of repetitive injury compared with the control group. To sum up, in the clinical treatment of ligament injury, nano-ligaments have good antibacterial properties as endoplasts and good cell affinity with human tissues. In the observation group combined with Tai Chi exercise therapy, various complications such as pain, joint flexibility and repetitive injury were relatively small, and the clinical treatment effect was better.

## References

- [1] Ambrosio, L., Santis, R. D., Iannace, S., Netti, P. A., & Nicolais, L. (2015). *Viscoelastic behavior of composite ligament prostheses*. *Journal of Biomedical Materials Research Part B Applied Biomaterials*, 42(1), 6-12. DOI:10.1007/s00167-015-3532-9
- [2] Lopes, O. V., Gomes, J. L. E., & Leandro, D. F. S. (2016). *Range of motion and radiographic analysis of the hip in patients with contact and non-contact anterior cruciate ligament injury*. *Knee Surgery Sports Traumatology Arthroscopy*, 24(9), 1-6. DOI:10.1007/s00167-015-3532-9
- [3] Westin, M., Reeds-Lundqvist, S., & Werner, S. (2016). *The correlation between anterior cruciate ligament injury in elite alpine skiers and their parents*. *Knee Surgery, Sports Traumatology, Arthroscopy*, 24(3), 697-701. DOI:10.1007/s00167-014-2974-9
- [4] Tornaiainen, J., Ristaniemi, A., Sarin, J. K., Mikkonen, S., Afara, I. O., & Stenroth, L., et al. (2019). *Near infrared spectroscopic evaluation of ligament and tendon biomechanical properties*. *Annals of Biomedical Engineering*, 47(1), 213-222. DOI:10.1016/j.dib.2021.106976
- [5] Yao, & Shao. (2018). *Comparison of clinical efficacy between immediate implant repair and delayed implant repair of maxillary single front teeth*. *Chinese Journal of Oral Implantology*, 23(01), 14-17.
- [6] Mugnai, R., Della Rosa, N., & Tarallo, L. (2016). *Scapholunate interosseous ligament injury in professional volleyball players*. *Hand Surg Rehabil*, 35(5), 341-347.
- [7] Kowara, M., Agnieszka Koodzińska, Grabowski, M., Winter, J., & Opolski, G. (2017). *A subcutaneous implantable cardioverter-defibrillator (s-icd) implantation in infection high-risk patient - a case study*. *Heart Beat Journal*, 2(1), 15-18. DOI:10.24255/hbj/80701
- [8] Chaichana, K. L., Kone, L., Bettegowda, C., Weingart, J. D., Olivi, A., & Lim, M., et al. (2015). *Risk of surgical site infection in 401 consecutive patients with glioblastoma with and without carmustine wafer implantation*. *Neurological Research*, 37(8), 717-726. DOI:10.1179/1743132815y.0000000042
- [9] Prigent, H., Pellen-Mussi, P., Cathelineau, G., & Bonnaure-Mallet, M. (2015). *Evaluation of the biocompatibility of titanium-tantalum alloy versus titanium*. *Journal of Biomedical Materials Research*, 39(2), 200-206. DOI:10.1002/(SICI)1097-4636(199802)39:2<200::AID-JBM5>3.0.CO;2-T
- [10] Choi, H. J. (2016). *Effects of therapeutic tai chi on functional fitness and activities of daily living in patients with parkinson disease*. *Journal of Exercise Rehabilitation*, 12(5), 499-503.

DOI:10.12965/ijer.1632654.327

- [11]Plummer, M., & Bradley, C.. (2017). *Tai chi as a falls prevention strategy in older adults compared to conventional physiotherapy exercise: a review. International Journal of Therapy & Rehabilitation, 24(6), 239-247.*
- [12]Yldrm, P., Ofluoglu, D., Aydogan, S., & Akyuz, G.. (2016). *Tai chi vs. combined exercise prescription: a comparison of their effects on factors related to falls. Journal of Back and Musculoskeletal Rehabilitation, 29(3), 493-494. DOI:10.3233/BMR-150645*
- [13]Lee, S. H., Kim, T. W., Suk, K. L., & Paik, K. W.. (2015). *Nanofiber anisotropic conductive films (acf) for ultra-fine-pitch chip-on-glass (cog) interconnections. Journal of Electronic Materials, 44(11), 4628-4636. DOI:10.1007/s11664-015-4021-0*
- [14]Lode, A., Meissner, K., Luo, Y., Sonntag, F., & Gelinsky, M.. (2015). *Fabrication of porous scaffolds by three-dimensional plotting of a pasty calcium phosphate bone cement under mild conditions. J Tissue Eng Regen Med, 8(9), 682-693.*
- [15]Vahedpoor, Z., Saeidi, A., Khamechian, T., & Roostaie, O.. (2015). *Cesarean scar pregnancy: a case report. Chinese Medical Journal, 117(2), 316-317.*