Hindawi
Journal of Nanomaterials
Volume 2023, Article ID 9870843, 1 page
https://doi.org/10.1155/2023/9870843

Retraction

Retracted: Application Effect Analysis of a Nanotube Combined with Orthopedic Exercise Rehabilitation Therapy in the Treatment of Patients with Knee Arthritis

Journal of Nanomaterials

Received 18 July 2023; Accepted 18 July 2023; Published 19 July 2023

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/participant consent to participate, and/or agreement to publish patient/participant details (where relevant).

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] J. Zhang and Z. Xing, "Application Effect Analysis of a Nanotube Combined with Orthopedic Exercise Rehabilitation Therapy in the Treatment of Patients with Knee Arthritis," *Journal of Nanomaterials*, vol. 2022, Article ID 1275250, 9 pages, 2022.

Hindawi
Journal of Nanomaterials
Volume 2022, Article ID 1275250, 9 pages
https://doi.org/10.1155/2022/1275250

Research Article

Application Effect Analysis of a Nanotube Combined with Orthopedic Exercise Rehabilitation Therapy in the Treatment of Patients with Knee Arthritis

Jie Zhang[1] and Zhongyou Xing[2]

[1]*Physical Education Teaching and Research Section, Zhumadian Preschool Education College, Zhumadian, 463000 Henan, China*
[2]*College of Physical Education, Xuchang University, Xuchang, 461000 Henan, China*

Correspondence should be addressed to Zhongyou Xing; 11992005@xcu.edu.cn

Received 2 March 2022; Revised 6 July 2022; Accepted 8 July 2022; Published 24 August 2022

Academic Editor: Pandiyarasan Veluswamy

Knee arthritis is one of the common diseases with the highest incidence in osteoarthrosis, which seriously affects people's health, and as the patient's medical history prolongs, the pain degree becomes more and more serious. In recent years, with the rapid development of nanotechnology, its application scope has gradually been involved the medical field. The application of nanotube-targeted drugs to treat osteoarthritis can repair bone to a certain extent and relieve patient pain symptom. Sports rehabilitation therapy, as an important nursing method in orthopedic treatment, can improve the patient's body recovery ability and enhance the therapeutic effect of surgery. Based on this, this article proposes the application research of a nanotube combined with exercise rehabilitation therapy in the treatment of patients with knee arthritis. The research carried out in this article is mainly divided into three parts: the first part is the research of titanium dioxide nanotubes in orthopedic treatment, studying the diameter and drug loading of nanotubes, research on how to target the damaged bone tissue and release drugs, and discussing the tissue compatibility and safety of nanotubes to the human body; the second part is the study on exercise rehabilitation therapy in orthopedic treatment and study on how to exercise properly to enhance the patient's body recovery; the third part is clinical investigation and research, according to the observation group in contrast with the indicators of the control group to draw conclusions. The results of this experiment show that in the clinical treatment of knee arthritis surgery, in the analysis of postoperative patients, the scores of the three groups of patients before treatment were relatively low, with scores ranging from 5 to 8, but the scores of the observation group were significantly higher than those of the first and second groups. The observation group ranged from 7 to 10. The joint scores of the observation group gradually increased at 1 week and 2 weeks after treatment. The increase in functional score was more pronounced. For patients with a longer medical history, perform appropriate helping exercises. Titanium dioxide nanotubes have good antibacterial properties as an endoplant and good histocompatibility with human bones. In the observation group combined with exercise therapy, various complications such as pain, swelling, and muscle atrophy were relatively small, allowing the patient to speed up the recovery of various body functions.

1. Introduction

As one of the human organs, bones have important functions that many other organs do not have, such as maintaining body posture, exercising, and supporting muscles and organ tissues. Degenerative osteoarthritis, also known as osteoarthritis, degenerative arthritis, senile arthritis, and hypertrophic arthritis, is a degenerative disease caused by aging, obesity, strain, trauma, congenital abnormalities of joints, joint degeneration of articular cartilage, and joint edge and subchondral bone-reactive hyperplasia caused by many factors such as deformity. Osteoarthritis [1] is a kind of synovial arthritis, which is very common in clinical treatment, and knee osteoarthritis [2, 3] has the highest incidence. It is more common in middle-aged and elderly people and occurs in weight-bearing joints and joints with

more activities (such as the cervical spine, lumbar spine, knee joint, and hip joint). Excessive weight bearing or use of these joints can promote degenerative changes. At the onset, symptoms include cartilage damage, joint pain, infection, and a prolonged medical history. Relevant investigations have shown that every year, more than one million arthritis patients undergo implant repair [4] and related knee joint surgery. Some patients undergo a series of complications such as internal infections after the surgery, which leads to implantation failure. A second operation is required. Curing OA can only slow symptoms or delay the progression of the disease. OA treatment methods are divided into surgical treatment and nonsurgical treatment. Relieving or eliminating pain and controlling the development of inflammation are the main methods for the treatment of OA at present. With the continuous development of tissue engineering and materials science, researchers have used nanoparticles as drug carriers to inhibit the inflammatory response and promote cartilage repair in OA patients. Therefore, in order to solve a series of problems that may arise, it is a common method to use therapeutic drugs to treat bone diseases. It is a common method to transport the therapeutic drugs to the damaged bone tissue through a certain carrier. Because the composition and function of bone tissue are quite different from other human tissues, especially in cases of fracture, trauma, or cancer with impaired blood supply, the effect of medication is not good.

Infection of the implant site in orthopedic treatment [5, 6] 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 for orthopedic prosthesis infection: firstly, bacterial adhesion [7] forms a biofilm on the surface of the implant, which hinders the body's immune response and the killing effect of antibiotics on bacteria. Secondly, because the implant material has poor biocompatibility and cannot form a firm bond with human bone, the fiber layer of the implant osseointegration interface will reduce the local resistance of the host. Therefore, finding nanomaterials with excellent antibacterial properties [8] is of great value for reducing the infectivity of internal implants and prolonging the service life and promoting the development of high-end orthopedic implants with independent intellectual property rights. In the nursing process before and after orthopedic surgery, rehabilitation training is an important part of fracture recovery treatment and 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 mortality and disability rate of the patient. Based on this, nanotubes combined with exercise rehabilitation therapy [9–11] have great application potential in the treatment of knee arthritis. As a plant medicine carrier in orthopedics, it has a good clinical effect and has great potential for improving the clinical treatment of knee arthritis. However, for the research on knee arthritis injury caused by nanotubes and exercise rehabilitation therapy, the definition and thinking of traditional exercise therapy have not been removed, so that the two cannot be well combined.

Nanomaterials are widely used in energy, materials, biology, medicine, and other fields due to their superior physical and chemical properties. With the development of materials science, osteoarthritis has been developed and its focus is on repair and reconstruction. Finding materials with good human tissue compatibility, strong mechanical properties, and strong antibacterial ability has always been a difficult point in orthopedics. As a newly developed material, TiO_2 nanotubes [12, 13] have better human tissue compatibility and strong anti-infection performance than commonly used orthopedic materials such as stainless steel, titanium alloy, polyethylene, and ceramics. In addition, by changing the diameter of the nanotube, the thickness of the tube wall, the length of the tube, and the amount of drug loaded, the damaged bone tissue can be targeted and the drug can be released, which has a long-lasting antibacterial effect of the implant. In addition, its nanopore morphology [14] can be suitable for a variety of cell adhesion and growth, achieving good compatibility with human tissues [15]. On this basis, as an important integrated treatment, nursing staff must develop a corresponding rehabilitation exercise plan for the patient. And according to the degree of disease and medical history of orthopedic patients, the patients are arranged for corresponding preoperative and postoperative exercises. Compared with injection of DEX or CDMP-1 alone, intra-articular injection of CDMP-1 and DEX-loaded discoid lipid nanoparticle DLNPs can significantly reduce the levels of inflammatory factors in serum and synovial tissue of knee arthritis and can significantly reduce the levels of inflammatory factors in knee arthritis. Promote the repair of damaged cartilage, and delay or avoid the occurrence of joint replacement surgery. This study suggests that the discoid lipid nanoparticles loaded with synergistic drugs with sustained release have broad development space in clinical practice [16].

The research carried out in this paper is mainly divided into three parts: the first part is the research of titanium dioxide nanotubes in orthopedic treatment. Titanium dioxide nanotubes are another form of TiO_2. Because nanotube nanofilms have a relatively large surface area ratio, so, it has a high adsorption capacity and can achieve compatibility with human tissues, especially the addition of other equipment to the nanotubes for assembly into advanced nanomaterials, which will improve all aspects of the performance of titanium dioxide to a certain extent. In this paper, TiO_2 nanotubes are used as antibacterial drugs and growth factor carriers to study the application of knee arthritis; the second part is the study of sports rehabilitation therapy in orthopedic treatment. Rehabilitation exercises for orthopedic patients can reduce postoperative pain, eliminate swelling in the surgical area and surrounding areas, avoid various complications such as muscle atrophy, and enable patients to speed up the recovery of various body functions. In the orthopedic nursing process, the nursing staff should pay close attention to the various indicators of the patient's body and do a good job in the communication between the doctor and family members and the content of family care. The self-

confidence of recovery must be established for the patient, so that the patient's sports rehabilitation can be realized. The third part is the clinical investigation and research part. Investigate the therapeutic improvement degree, clinical effect, and patient satisfaction of titanium dioxide nanotubes as a new nanomaterial in the treatment of knee arthritis. This article will discuss in detail the advantages and disadvantages of nanotechnology and explore the feasibility of nanotechnology combined with sports rehabilitation therapy to treat knee arthritis. In this paper, the efficacy, clinical effect and patient satisfaction of titanium dioxide nanotubes as a new nanomaterial in the treatment of knee arthritis were investigated. This article will discuss in detail the advantages and disadvantages of nanotechnology and explore the feasibility of combining nanotechnology with the rehabilitation of knee arthritis [17].

2. Treatment of Knee Arthritis Based on Titanium Dioxide Nanotubes

The TiO_2 nanotube materials prepared in orthopedic research are often prepared using the surface layer of pure titanium or titanium alloy. Observing the TiO_2 nanotube under an electron microscope, it can be found that it is composed of a large number of uniform tubular structures. Each tubular structure is hollow in the middle, the top is open, and the bottom is closed. The specific surface area of the entire tubular structure is large and porous. This is a special structure used for drug carrier adsorption. The research of TiO_2 nanotubes in orthopedics can be divided into two aspects: one is to study the biocompatibility of TiO_2 nanotubes, that is, to study bone fusion and bone growth, and to study the application of TiO_2 nanotubes as antibacterial drug carriers, including drug load, anti-infection, and antitumor. Related studies have found that TiO_2 nanotubes can resist the adhesion of bacteria and the surface layer of nanotubes with a diameter of 80 nm can resist the adhesion of bacteria and promote the production of biofilms. Because of this feature, it can reduce the risk of infection for patients, so it is a new type of simple antibacterial nanomaterial.

2.1. Biocompatibility of TiO_2 Nanotubes

2.1.1. Research on Histocompatibility. TiO_2 nanotubes have a special structure that promotes bone formation. The frosted surface of the nanotube is conducive to cell adhesion, cell proliferation, and cell diffusion. Its structure diagram is shown in Figure 1.

It can be seen in Figure 1 that it has the following characteristics:

(1) Compared with traditional titanium, the growth capacity of osteoblasts on the surface of nanotubes is increased by 200%–300%, which can greatly improve the activity of osteoblasts and the deposition of materials on the surface of bone cells

(2) Previous studies have shown that the enhancement of bone formation ability on the surface of nanotubes is related to the diameter of nanotubes. The diameter of TiO_2 nanotubes can significantly promote the adhesion and proliferation of osteoblasts, thereby affecting the differentiation and proliferation of osteoblasts. When the diameter of the nozzle is about 30 nm, it is conducive to cell adhesion; when the diameter is 100 nm, the cell adhesion begins to decrease. Under this condition, the proliferation of osteoblasts and the increase of alkaline phosphatase activity begin to accelerate. When the diameter is between 30 nm and 100 nm, TiO_2 nanotubes are very suitable for osseointegration surgery

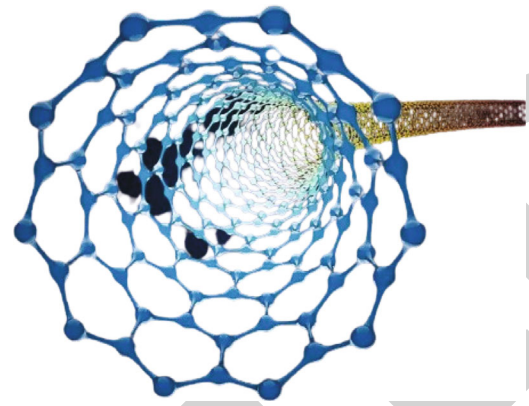

Figure 1: Structure diagram of titanium dioxide nanotubes.

(3) The biocompatibility of titanium nanoparticles' surface layer with osteoblasts is quite good, which can cause the nanomaterials to merge with primitive bone cells, boosting the stability of the interior components [18]

(4) The special structure of nanotubes not only promotes bone fusion but also eliminates the body's immune rejection response

(5) The research on nanotubes is limited and not comprehensive enough

2.1.2. Research on Improving Biocompatibility with Growth Factors. TiO_2 nanotubes can use the combination with growth factors to enhance bone formation and promote tissue compatibility. The TiO_2 nanotube array can be used as a carrier to achieve bone cell fusion of human bone. Relevant studies have shown that the combination of TiO_2 nanotube array and bone morphogenetic protein can greatly promote the differentiation of stem cells into bone cells in the human body, resulting in better surgical results. However, although TiO_2 nanotubes can improve the adhesion and activity of fibroblasts, no studies have shown that TiO_2 nanotubes can promote the adhesion and growth of fibroblasts [19].

2.2. Application of TiO_2 Nanotubes as Drug Carriers

2.2.1. Loaded Silver (Ag). Silver has been widely used as an antibacterial substance a long time ago, and its antibacterial mechanism is more complicated. In recent years, with the production of nanosilver, silver as an antibacterial drug has become more and more popular. Due to its good electrical

conductivity, nanosilver particles occupy an extremely important position in the field of microelectronics. The surface effect and quantum size effect of nanosilver particles also make them have some special uses, such as surface-enhanced Raman applications and medical applications [20]. Silver nanoparticles have a large surface area, so they can be in contact with microorganisms. They can attack bacteria and release a substance to damage the cell wall, which can effectively kill bacteria. The study found that the antibacterial activity after loading silver was significantly higher than that of the control titanium surface and the nonsilver nanotube surface and it had no adverse effect on the adhesion and growth of bone cells. Zhao et al. found that the surface layer of titanium dioxide nanotubes containing silver nanoparticle bubbles immersed in AgNO solution can effectively kill early bacteria and effectively inhibit bacterial adhesion. However, it is worth noting that Ag+ may also cause cell toxicity in humans, especially in areas where Ag+ may accumulate. Therefore, it is necessary to deeply study the regulation of the nanotube structure and the release control of silver and other metal ions.

2.2.2. Contains Antibiotics. TiO_2 nanotubes are used as a powerful carrier to release antibacterial drugs, thereby forming a local receptor system on the bone surface. The research results of Popa et al. showed that lyophilization of gentamicin into TiO_2 nanotubes can resist the growth of bacteria to a certain extent and will not affect the adhesion, proliferation, and proliferation of osteoblasts near the nanotubes. Differentiation. Research by Gulati et al. found that a titanium rod with a diameter of 70 mm was placed in a TiO_2 nanotube in a PBS solution, and it was found that the drug was released slowly within 6 hours before the rapid release and the drug was released with zero-order kinetics. The above two-stage drug release stage shows that TiO_2 nanotubes meet the needs of targeted drug release. In addition, in order to delay the release time of the drug and achieve long-term antibacterial effect, the TiO_2 nanotube drug carrier can be covered with a polymer coating and the drug release can be controlled by a slow speed.

2.2.3. Containing Antimicrobial Peptides. Antibacterial peptides (AMPs) are a kind of peptides, composed of no more than 50 amino acids. This is an antibiotic and is unlikely to develop resistance. Related studies have shown that the use of vacuum-assisted physical adsorption technology to fill antimicrobial peptides into TiO_2 nanotubes can achieve targeted effective sterilization and inhibit bacterial adhesion and the release kinetics of nanotubes is closely related to the crystal type. Nitric oxide (NO), also known as an endothelial relaxing factor, can relieve the body's vascular tension, and by producing some substances, it destroys the bacterial cell membrane and DNA, thereby producing antibacterial effects. Smith et al.'s experimental research on animal implantation showed that the NO release system with titanium dioxide nanotubes as a carrier was discussed. The surface of titanium dioxide nanotubes can significantly reduce the surrounding NO level, fibrous tissue thickness, and macrophage concentration. Therefore, the NO release system using titanium dioxide nanotubes as a carrier needs further research and demonstration. In addition, the combination of antibacterial drugs albumin and quaternary ammonium salts with titanium dioxide nanotubes must be further studied for verification. So far, more than 1200 antimicrobial peptides have been identified. The antibacterial peptides were loaded onto the titanium dioxide nanotubes by physical methods to study the antibacterial ability of the antibacterial peptides against Gram-positive bacteria and *Staphylococcus aureus*. After 2 hours of cultivation, the antibacterial peptides on the surface of the nanotubes can destroy bacteria and reduce the number of bacteria.

2.2.4. Antibacterial Agent. Gentamicin in the antibacterial inner plant coating is a broad-spectrum antibiotic that has been extensively studied and is more sensitive to *Staphylococcus aureus*. Related studies have found that 80 nm nanotubes loaded with gentamicin have better antistaphylococcal effects than nanotubes without gentamicin. Compared with traditional titanium sheets, TiO_2 with or without gentamicin can significantly facilitate cell adhesion, proliferation, and differentiation of adult bone. Gallium nitrate is a new type of antibacterial agent. The gallium ions formed by ionization can strongly resist the production of iron ions, thereby inhibiting the metabolic activity of bacteria. Gallium nitrate can resist the production of *E. coli* and the accumulation of *E. coli*. The titanium gallium nitrate plate was immersed in the serum and incubated at 36°C. Antibacterial activity can be maintained for up to 30 days. Therefore, implants coated with gallium nitrate can resist the reproduction of bacteria on its surface.

2.2.5. Contains Antitumor Drugs. Because of the larger specific surface area and better surface activity of TiO_2 nanotubes, a large number of researchers have studied in vitro the filling, release, and anticancer effects of doxorubicin and 5-fluorouracil on TiO_2 nanotubes. The physical adsorption method can be used to fill doxorubicin into the TiO_2 nanotubes, and the pH value can be adjusted by adjusting the release solution. Corresponding in vitro experiments show that the best loading time is 12 hours, and the total release rate of doxorubicin is greater than 75%. Nanotubes loaded with uracil have very good drug release kinetics and selective killing ability to cancer cells. In summary, TiO_2 nanotubes are promising anticancer drug carriers.

2.3. Problems with TiO_2 Nanotubes. At present, although a large number of studies have been conducted on TiO_2 nanotubes at home and abroad, there are still deficiencies in clinical application treatment, so there is no generally recognized stable application. TiO_2 nanotubes have better human histocompatibility and strong anti-infective properties. At present, the preparation of uniform and stable nanotubes requires a lot of material research. The study of TiO_2 nanotubes in knee arthritis is mainly limited to in vitro studies, so it is impossible to specifically express the specific conditions in vivo. The coating and drug loading of TiO_2 nanotubes are incomplete in terms of drug loading, targeted drug release, and stability. Based on this, although the

research on TiO_2 nanotubes is not thorough enough, the preparation process of TiO_2 nanotubes is less complicated and less harmful to the human body, has large drug loading, and has good antibacterial properties. It is a promising orthopaedic implant material with great potential value.

3. Research on Sports Rehabilitation in Knee Arthritis

In the nursing process before and after orthopedic surgery, rehabilitation training is an important part of fracture recovery treatment and 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. Through postinjury rehabilitation training, the body's energy metabolism can be balanced, preventing weight gain and shortening the time required to resume exercise after injury [21].

3.1. Necessity of Sports Health Treatment in the Treatment of Knee Arthritis. Symptoms of knee stiffness usually occur after knee surgery, which will greatly affect the patient's walking posture and reduce the subjective well-being of life. Relevant studies have shown that the incidence of knee stiffness after knee surgery is 10% to 16%. However, proper exercise, light stretching, and regular walking can significantly reduce the occurrence of knee stiffness. This article studies the effect of sports rehabilitation therapy on knee stiffness. It is found that good therapeutic effects have been obtained in the early rehabilitation training investigation of patients with knee stiffness.

This study selected 60 patients with knee stiffness after surgery, including 38 males and 22 females, with an average age of 47 years. The patients were divided into three groups according to the order of admission.

3.2. Method. Group 1 uses common knee joint treatment clinical methods and conventional medical care, group 2 uses TiO_2 nanotubes to carry antibacterial drugs for knee arthritis treatment and conventional medical care, and group 3 uses TiO_2 nanotubes to carry antibacterial drugs for knee arthritis treatment and professional sports rehabilitation therapy, among which group 1 and group 2 are used as the control group and group 3 is used as the observation group. Before rehabilitative training, their body will experience different pain conditions; the specific method is as follows:

(1) Psychological counseling

In the course of rehabilitation training after knee arthritis surgery, the patient's confidence in recovery plays an important role in the recovery of the disease. Because of the stiffness of the knee, the flexion and extension of the patient are restricted to a certain extent, which greatly affects the quality of life of the patient, and the patient often feels a decrease in inner happiness. Therefore, nurses should pay close attention to the patients actively and give them a certain degree of psychological counseling, so that the patients can control their emotions and have an optimistic and confident attitude towards recovery. In addition to eliminating the patient's dependence on psychological surgery and equipment, we should also actively cooperate with nursing staff to carry out functional exercises.

(2) Pain care

Patients with stiff knees will experience pain after surgery, which is the main reason that affects the recovery of patients. Before the anesthesia effect disappears, advance recovery training is required. 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 knee joint function.

(3) Actively exercise

From the patient's activity ability, guide and encourage the patient to exercise actively and tell the patient not to rush to achieve the immediate effect of overexercising, but to exercise patiently and confidently, so as to promote fracture recovery.

(4) Dynamic auxiliary physical therapy

For patients with a long medical history, appropriate assistance exercises should be carried out. Because the patient has not recovered well, he cannot carry out voluntary exercise training and needs to rely on others to carry out exercises within a certain range of strength. Only in this way can the health recovery of the illness be achieved. Therefore, the nurse or family member must provide some help to the patient, especially when lying down [22].

(5) Massage

For patients with stiff knee joints, caregivers should actively tell their family members to massage the biological part of the patient's muscles. Massage can promote blood circulation and increase the blood supply to the osteoarthritis surgery site, reduce muscle swelling and pain, and improve patient satisfaction with nursing. However, it is worth noting that during exercise, the strength of the massage should be adjusted to avoid secondary injuries. The intensity should not be too high; otherwise, the exercise effect will be difficult to achieve.

The observation group adopted the above nursing methods, while the control group adopted methods (1), (2), and (3). The postoperative active and assisted activity records of the control group and the observation group are shown in Table 1. The autonomous and assisted movement ranges of the two groups of patients have been expanded. However, the movement angle of the observation group was significantly higher than that of the control after recovery. ($P < 0.05$).

3.3. Evaluation Index. The range of flexion motion between the maximum flexion and the maximum elongation of the

Table 1: The range of physical activity of the three groups of patients.

Group	Before recovery		After recovery	
	Autonomous range of motion	Power range of motion	Autonomous range of motion	Power range of motion
Group 1	61.65	68.32	77.14	92.17
Group 2	63.47	72.16	87.42	101.42
Group 3	69.21	75.85	98.18	110.26

knee joint before and after nursing was measured, and the active and passive angles of the knee joints in the two groups were evaluated.

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 was higher than that of the control group in all indicators. Therefore, it can be concluded that, compared with ordinary nursing care, the addition of specialized exercise therapy intervention after surgery can effectively speed up the recovery of knee joint function and not only improve the patient's quality of life during illness but also make the patient recover better and better. At the same time, from the perspective of the patient, the communication between the doctor and the patient is increased and the patient's satisfaction with the treatment is improved. The postoperative quality of life of the patients was assessed by observing various indicators.

3.4. Statistical Methods. SPSS statistical software can analyze the relationship between single variables and multiple variables. The chi-square test was used to compare the incidence of intraoperative and postoperative complications and the rate of stone clearance. The factors with statistical significance ($P < 0.05$) were used as independent variables and whether blood transfusion treatment was used as the dependent variable. The t-test was used for comparison between groups. When $P < 0.05$, it is considered statistically significant. The chi-square test formula is as follows:

$$\chi^2 = \sum_{i=1}^{k} \frac{(f_i - np_i)^2}{np_i}. \quad (1)$$

Among them, χ^2 is the test statistic, n is the number of experiments, and f_i is the group frequency.

3.5. Advantages of Sports Health Treatment. In the course of rehabilitation training after knee arthritis, the patient's confidence in recovery plays an important role in the recovery of the condition:

(1) Because of the stiffness of the knee, the patient's flexion and extension are restricted to a certain extent, which greatly affects the patient's quality of life. The caregiver and family members massage some of the patient's muscles. Massage can promote blood circulation and improve the osteoarthritis surgery site. Blood supply can reduce muscle swelling and pain and stiffness

(2) Normal nursing includes effective methods such as psychological counseling, pain nursing, massage, and adding exercise fixation belts. The observation group's nursing involves professional sports rehabilitation and rehabilitation projects. In the process, rehabilitation training is an important part of fracture recovery treatment and 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 mortality and disability rate of the patient

(3) During training, attention should be paid to alleviating the pain of the patient, such as early recovery training before the effect of anesthesia disappears. 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 knee joint function

Because the number of research subjects in this study is small, the results of the survey have certain flaws. If the number of researchers is expanded, I believe that more valuable research results can be obtained.

4. Survey Results and Analysis

In this study, 60 patients with knee stiffness after surgery were selected as the research objects, including 38 males and 22 females, with an average age of 47 years. According to the order of admission, the patients were divided into an observation group and two control groups. Among them, age, gender, and knee stiffness are the characteristics of this experiment, which are important factors that determine the degree of nanomaterials for knee injury repair.

Group 1 adopts common knee joint treatment clinical methods and routine medical care, group 2 adopts TiO_2 nanotubes to carry antibacterial drugs for knee arthritis treatment and routine medical care, and group 3 adopts TiO_2 nanotubes to carry antibacterial drugs for knee arthritis treatment and professional sports rehabilitation therapy, among which group 1 and group 2 are used as the control group, and group 3 is used as the observation group. Specific investigation and research found that among the three groups compared, the observation group had higher scores of physical pain, physical function, mental health, social function, and overall health compared with the control group. It can be seen that rehabilitation nursing intervention is more effective than conventional nursing. Promote the recovery of knee joint function, improve the quality of daily life, and help patients return to normal home and work life better and faster.

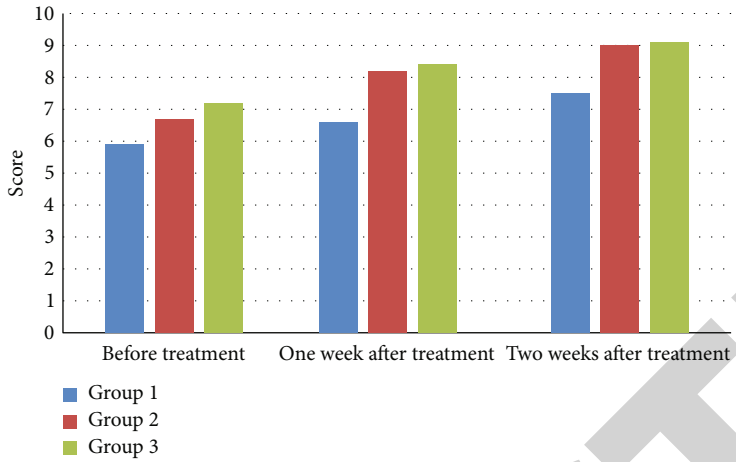

Figure 2: Comparison of knee joint activity scores before and after treatment in the three groups.

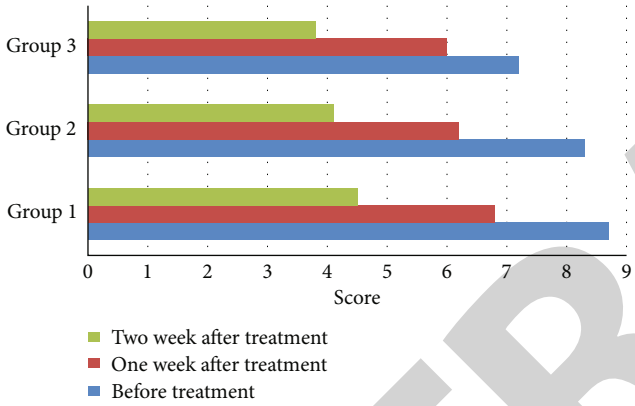

Figure 3: Comparison of pain scores before and after treatment in the three groups.

It can be seen in Figure 2 that the knee joint activity scores of the three groups before and after treatment are significantly different. The scores of the three groups of patients before treatment were relatively low, but the scores of the observation group were significantly higher than those of groups 1 and 2. The joint scores of the observation group gradually increased one week and two weeks after treatment. The functional score increased more significantly. For patients with a long medical history, carry out appropriate help exercises. Because the patient has not recovered well, he cannot carry out voluntary exercise training and needs to rely on others to carry out exercises within a certain range of strength. Therefore, the nurse or family member must provide some help to the patient, especially when lying down. Patients with stiff knees will experience pain after surgery, which is the main reason that affects the recovery of patients. Before the anesthesia effect disappears, advance recovery training is required. 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 the pain and accelerate the recovery of knee joint function, so the observation group can achieve a healthy recovery from the disease. Therefore, compared with patients without nanomaterials to heal knee joints and conventional treatment, patients after using nanotubes and exercise rehabilitation therapy are more effective for knee arthritis recovery.

It can be seen in Figure 3 that the pain scores of the three groups before and after treatment are significantly different. Before the treatment, the scores of the three groups of patients were relatively low but the scores of group 3 were significantly higher than those of groups 1 and 2. The pain scores of one week and two weeks after treatment were significantly reduced. Compared with the control group, the observation group's pain score decreased more obviously. The use of the sports fixation belt device is customized for patients with special conditions. The exercise fixation belt used for postoperative recovery can reduce the swelling of the patient's body, help restore the patient's muscle strength, accelerate the patient's nerve to touch recovery, and enhance the patient's ability to take care of themselves. Before the anesthesia effect disappears, advance recovery training is required. 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 the pain and accelerate the recovery of knee joint function.

It can be seen in Figure 4 that the scores of pains, mental health, social function, and swelling of the three groups before and after treatment have obvious differences. The scores of various indicators of the observation group are significantly higher than those of the control group. In the course of rehabilitation training after knee arthritis surgery, the patient's confidence in recovery plays an important role in the recovery of the disease. Because of the stiffness of the knee, the flexion and extension of the patient are restricted to a certain extent, which greatly affects the quality of life of the patient, and the patient often feels a decrease in inner happiness. Therefore, nurses should pay close attention to the patients actively and give them a certain degree of psychological counseling, so that the patients can control their emotions and have an optimistic and confident attitude towards recovery.

It can be seen in Figure 5 that all the study subjects are very satisfied with the preoperative and postoperative care.

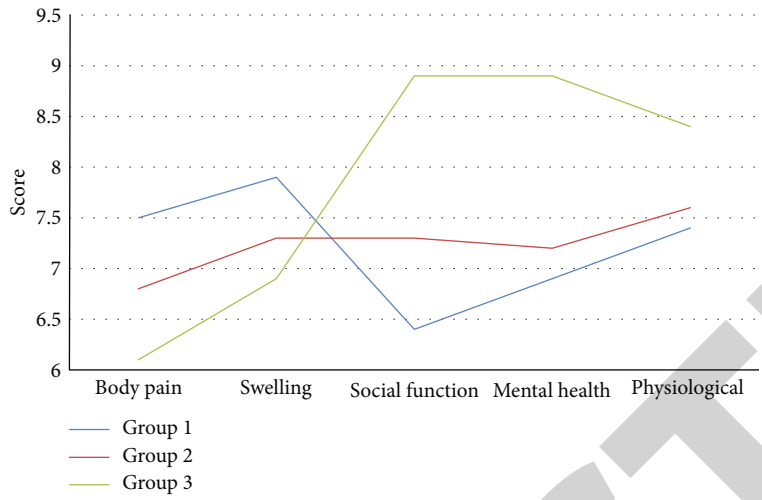

Figure 4: Comparison of quality of life scores before and after treatment in the three groups.

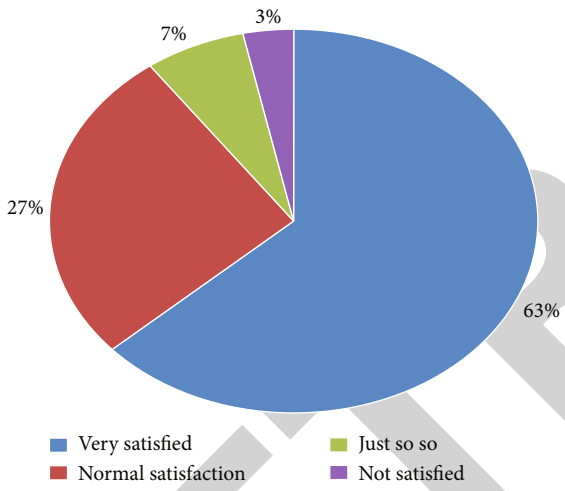

Figure 5: Patient satisfaction with surgery.

The patient's critical period is 24 hours after the operation. The nursing staff carefully observe the changes in the patient's physical signs. The patient will be tested every half an hour after the operation. If any abnormality is found, please inform the doctor for proper treatment in time. After the vital signs are stable, test once every 2 hours. When the patient was conscious, the nursing staff did the first time to tell the patient the news of the success of the operation and actively guided the family members to master some of the contents and methods of nursing, which greatly helped the patient to relieve the pressure and improve the family's understanding of nursing work. In addition, nurses observe the color and volume of the urinary tube and nephrostomy tube at regular intervals and make a record; for patients with knee stiffness, the nurse should actively tell the family to massage the patient's biological muscles, which can promote blood circulation. Increasing the blood supply to the osteoarthritis surgery site can reduce muscle swelling and pain and improve patient satisfaction with nursing care.

5. Conclusions

Osteoarthritis is a type of synovial arthritis, which is very common in clinical treatment, and knee osteoarthritis has the highest incidence. In recent years, TiO_2 nanotubes, as a newly developed material, have better human tissue compatibility and strong anti-infection performance than commonly used orthopedic materials such as stainless steel, titanium alloy, polyethylene, and ceramics. In addition, by adjusting the diameter and drug loading of the nanotubes, the damaged bone tissue can be targeted and the drug can be released and the internal implantation has a long-lasting antibacterial effect. Sports rehabilitation therapy combined with important nursing methods in orthopedic treatment can enable patients to speed up the recovery of various body functions. In this paper, the research of titanium dioxide nanotubes in orthopedic treatment is carried out and how the diameter and drug loading of TiO_2 nanotubes affect the recovery of damaged cells, as well as the tissue compatibility and safety of nanotubes to the human body. At the same time, a comprehensive analysis of the enhancement of exercise rehabilitation therapy to the patient's physical recovery ability is also carried out. Clinical investigation and analysis showed that according to the assessment of the simple life scale, the postoperative quality of life, social activities, mental health, and physical function of the observation group were higher than those of the control group. The movement of nanomaterials is of great importance in research in many fields of medicine, which are used as drug carriers, antibacterial drugs, anticancer drugs, and smart targeted drugs. In summary, in the clinical treatment of knee arthritis surgery, titanium dioxide nanotubes have good antibacterial properties as an endoplant and good histocompatibility with human bones. In the observation group combined with exercise therapy, various complications such as pain, swelling, and muscle atrophy were relatively small, allowing the patient to speed up the recovery of various body functions. At the same time, nurses should actively pay attention to patients and give patients a certain degree of

psychological counseling, so that patients can control their emotions and maintain an optimistic and confident attitude towards recovery.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The author(s) declare(s) that they have no conflicts of interest.

References

[1] M. B. Goldring and S. R. Goldring, "Osteoarthritis," *Journal of Cellular Physiology*, vol. 213, no. 3, pp. 626–634, 2007.

[2] S. T. Duncan, M. S. Khazzam, J. M. Burnham, K. P. Spindler, W. R. Dunn, and R. W. Wright, "Sensitivity of standing radiographs to detect knee arthritis: a systematic review of level I studies," *Arthroscopy The Journal of Arthroscopic and Related Surgery*, vol. 31, no. 2, pp. 321–328, 2015.

[3] A. Kumar, A. M. Bendele, R. C. Blanks, and N. Bodick, "Sustained efficacy of a single intra-articular dose of fx006 in a rat model of repeated localized knee arthritis," *Osteoarthritis and Cartilage*, vol. 23, no. 1, pp. 151–160, 2015.

[4] Y. A. Zhongxiong and S. H. Jun, "Comparison of clinical efficacy between immediate implant repair and delayed implant repair of maxillary single front teeth," *Chinese Journal of Oral Implantology*, vol. 23, no. 1, pp. 14–17, 2018.

[5] G. J. A. Ter Boo, D. W. Grijpma, T. F. Moriarty, R. G. Richards, and D. Eglin, "Antimicrobial delivery systems for local infection prophylaxis in orthopedic- and trauma surgery," *Biomaterials*, vol. 52, no. 3, pp. 113–125, 2015.

[6] N. O. Foni, F. A. R. Batista, L. H. Rossato et al., "Postoperative infection in patients undergoing inspection of orthopedic damage due to external fixation," *Revista Brasilra De Ortopedia*, vol. 50, no. 6, pp. 625–630, 2015.

[7] A. J. Barton, R. D. Sagers, and W. G. Pitt, "Bacterial adhesion to orthopedic implant polymers," *Journal of Biomedical Materials Research Part B Applied Biomaterials*, vol. 30, no. 3, pp. 403–410, 1996.

[8] J. Bucheńska, "Polyamide fibers (pa6) with antibacterial properties," *Journal of Applied Polymer Science*, vol. 61, no. 3, pp. 567–576, 1996.

[9] N. Maguire, P. Chesterton, and C. Ryan, "The effect of pain neuroscience education on sports therapy and rehabilitation students' knowledge, attitudes and clinical recommendations towards athletes with chronic pain," *Journal of Sport Rehabilitation*, vol. 39, no. 2, pp. 1–19, 2018.

[10] I. M. Punt, J. L. Ziltener, D. Monnin, and L. Allet, "Wii Fit™ exercise therapy for the rehabilitation of ankle sprains: its effect compared with physical therapy or no functional exercises at all," *Scandinavian Journal of Medicine & Science in Sports*, vol. 26, no. 7, pp. 816–823, 2016.

[11] D. L. Hoover, W. R. Vanwye, and L. W. Judge, "Periodization and physical therapy: bridging the gap between training and rehabilitation," *Physical Therapy in Sport*, vol. 18, no. 6, pp. 1–20, 2016.

[12] X. Gong, J. Liu, S. Baskaran, R. D. V. And, and J. S. Young, "Surfactant-assisted processing of carbon nanotube/polymer composites," *Chemistry of Materials*, vol. 12, no. 4, pp. 1049–1052, 2000.

[13] M. M. Momeni and Y. Ghayeb, "Photoelectrochemical water splitting on chromium-doped titanium dioxide nanotube photoanodes prepared by single-step anodizing," *Journal of Alloys and Compounds*, vol. 637, no. 1, pp. 393–400, 2015.

[14] L. Zaraska, A. Brudzisz, E. Wierzbicka, and G. D. Sulka, "The effect of electrolyte change on the morphology and degree of nanopore order of porous alumina formed by two-step anodization," *Electrochimica Acta*, vol. 198, no. 8, pp. 259–267, 2016.

[15] L. Ballarin, F. Cima, and A. Sabbadin, "Morula cells and histocompatibility in the colonial ascidian botryllus schlosseri," *Zoological Science*, vol. 12, no. 6, pp. 757–764, 1995.

[16] J. Venkatamuthukumar and N. Sivakumar, "Growth, structural, spectroscopic, optical, and mechanical studies of potassium hydrogen phthalate single crystals with glycine as additive," *Journal of Materials Science: Materials in Electronics*, vol. 32, no. 14, pp. 18978–18993, 2021.

[17] M. Sha, D. Zhang, R. Pan, P. Xing, and B. Jiang, "Synthesis and surface properties study of novel fluorine-containing homopolymer and copolymers for coating applications," *Applied Surface Science*, vol. 349, pp. 496–502, 2015.

[18] Y. Liu, J. Li, H. Chen, L. Sun, and C. Xu, "Enhanced broadband NIR emission of low Bi-doped borate glass by carbon reduction," *Materials Letters*, vol. 305, no. 1, article 130576, 2021.

[19] Y. Sano, K. Arima, and K. Yamauchi, "Planarization of SiC and GaN wafers using polishing technique utilizing catalyst surface reaction," *ECS Journal of Solid State Science and Technology*, vol. 10, no. 8, article 081106, 2013.

[20] H. Zhu, H. Wei, B. Li, X. Yuan, and N. Kehtarnavaz, "Real-time moving object detection in high-resolution video sensing," *Sensors*, vol. 20, no. 12, p. 3591, 2020.

[21] B. Gao, X. Ning, and P. Xing, "Shock wave induced nanocrystallization during the high current pulsed electron beam process and its effect on mechanical properties," *Materials Letters*, vol. 237, no. 15, pp. 180–184, 2019.

[22] H. Song and M. Brandt-Pearce, "Range of influence and impact of physical impairments in long-haul DWDM systems," *Journal of Lightwave Technology*, vol. 31, no. 6, pp. 846–854, 2013.