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Research Article

Repair Effect of Nanomaterials on Meniscus Injury Induced by Calisthenics Exercise

Wensuo Lian[1] and Jinling Wang[2]

[1]*Department of Leisure Sports, Jungwon University, Chungbuk 28024, Republic of Korea*
[2]*Graduate Department, Capital University of Physical Education and Sports, Beijing 100191, China*

Correspondence should be addressed to Jinling Wang; 20008001109@cupes.edu.cn

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With the development of aerobics, more and more college students participate in this sport, but more and more sports injuries of students. Sports injuries directly or indirectly affect the normal study and life of college students. Therefore, it is very important to study the sports injuries of college students and their causes for improving the sports level of college students and promoting their healthy growth. And it provides proper precautions. This paper presents the investigation of nanomaterials, deep learning, and MRI images of meniscal injuries and concludes that the injury rate of high-level competitive aerobics athletes is 100%, and the top 4 injured parts are the wrist, ankle, waist, and knee. It can be seen that the meniscus injury occurs more frequently.

1. Introduction

Physical exercise is the best way to enhance physical fitness and improve the quality of life. In particular, sports such as aerobics, which are full of passion and vitality, are more and more sought after by more and more people. Aerobics is a sport that integrates gymnastics, dance, and music; is based on aerobic exercise; and is characterized by health, strength, and beauty. It is not only a popular fitness method for body building and cultivating sentiment but also an item of competitive sports. However, the problem of sports injury caused by high-level aerobic exercise has become an important problem affecting the normal training of athletes. Therefore, it is very urgent to study the injury causes and preventive measures of high-level athletes.

With the improvement of the competitive level of competitive aerobics athletes, the functions and coordination of various organs and body systems have not only reached a high level but also approached the physiological limit. Although competitive aerobics is a non-Olympic event, the state's support is relatively weak and there is no dedicated team of doctors. Therefore, improving the injury prevention and control ability of high-level aerobics teams has important guiding significance.

The innovation of this paper lies in the application of nanomaterials to study the repairing effect of aerobics-induced meniscus injury, which has a certain clinical trial and innovation.

2. Related Work

The 21st century is an era of rapid progress in biological and medical research. Nanotechnology has a particularly obvious interdisciplinary nature. Many scholars have conducted research on nanotechnology. Yin et al. thoroughly characterized the Pt10 clusters through a combination of experimental techniques and theoretical analysis, showing the highest CO oxidation activity per platinum atom of CO oxidation catalysts, and this catalytic system presents a coherent interdisciplinary picture [1]. Shivakumar et al. verified by nearly unchanged PureB diode I–V characteristics and microscopic examination of the deposited layers. In order to obtain this result, it is required that the silicon surface must be cleaned before B deposition [2]. Here, Hu et al. introduced a new method based on two-dimensional electron resonance and thermal displacement measurements to measure the two-dimensional energy loss temperature of a sample by combining these measurements with first-principle modeling [3]. Zhao et al. used a new model to analyze the hydrogenation kinetics of Mg-Ce-Ni nanocomposites during the synthesis process and established a hydrogenation reaction rate control mechanism in the range of 300-680 k [4]. Ross and Yamaguchi described the effect of mechanical properties and polishing tool structure on tool-target surface contact during polishing. In addition to abrasive type and size, this also affects polishing characteristics, especially material removal at grain boundaries, grain enhancement, grain displacement, and nanoscale geometry of the polished surface [5]. Nanoimprint lithography (NIL) is an emerging high-resolution parallel patterning method that targets areas where e-beam and high-end lithography are expensive and cannot provide sufficient resolution at reasonable throughput. Currently, structures with feature sizes smaller than 5 nm have been achieved, and the resolution is limited by the ability to make reliefs. For historical reasons, the term nanoimprint lithography refers to a thermal imprint process. In ultraviolet (UV) NIL, photopolymerizable resins are used with UV clear stamps. In both of these processes, film squeeze flow and capillary action play a central role in understanding the NIL process. Kam and Torres provided an overview of NIL, focusing on general principles and concepts rather than specific process issues and state-of-the-art tools and processes. They also discussed the material aspects of printing and resists. Kam and Torres gave some specific applications where the imprint method had significant advantages over other construction methods. Finally, areas where further development in this field is needed are discussed [6]. Recently, large plastic deformations have been observed in compressive tests of biotemplated, anisotropic, and hierarchically structured silica monoliths. Based on the nanoscale structure of the material, Opdenbosch and Zollfrank fabricated a dynamic model in which parallel silica struts are compressed and sheared longitudinally. The resulting interfacial shear forces lead to continuous plastic deformation during cyclic loading with a gradual increase in force, matching the observations from mechanical tests. Opdenbosch and Zollfrank report physical parameter values obtained by fitting model curves to measured curves, their relationship to previous structural observations, and their utility in tailoring the complex mechanical behavior of this novel material [7]. However, the shortcomings of these studies are that the model construction is not scientific enough and the conditions are limited to adapt to more complex situations.

3. Nanomaterials and Related Methods

3.1. Nanomaterials

3.1.1. Definition of Nanomaterials. Generally speaking, nanomaterials refer to materials whose size is between 1 and 100 nm. Because nanomaterials have nanoscale dimensions, their properties, such as physical, electrical, optical, and magnetic properties, are significantly different from conventional materials. Many nanomaterials are catalytic, adsorptive, and highly reactive [8].

3.1.2. Application of Nanomaterials. In the past few decades, nanomaterials have been extensively researched and developed, and have been successfully applied in the fields of catalysis, medicine, sensors, and biology. In particular, it has also received extensive attention in water treatment and wastewater treatment. Due to their small size, nanomaterials have a relatively large specific surface area, so they have strong adsorption capacity and reactivity, and the flow properties of nanomaterials in solutions are very high. It has been reported that heavy metals, organic pollutants, inorganic anions, and bacteria can be successfully removed by many kinds of nanomaterials [9]. Due to the unique size-dependent properties of nanomaterials, they have a profound impact on various application fields such as the construction industry, products of daily life, and medical and healthcare. Figure 1 is an overview of nanomedicine.

Nano antibacterial materials have attracted much attention due to their stable performance, good antibacterial effect, and low price. For example, nanotitanium oxide material has photocatalytic effect, which can decompose toxic gases such as formaldehyde and benzene, and kill bacteria on its surface. Nanoscale self-cleaning materials have great development space [10]. Nanomaterials also have many applications in catalysis. Catalysts play an important role in chemistry because they can increase reaction rates and shorten reaction times. Most of the traditional catalysts have low catalytic efficiency and difficult preparation, resulting in waste of raw materials, reducing economic benefits, and polluting the environment. Nanomaterials have many active sites, which can greatly improve the reaction rate, control the progress of the reaction, and even make the chemical reaction that could not be carried out smoothly [11].

Nanoparticles used as catalysts are as follows: (1) metal nanoparticles; (2) nanoparticles are supported on porous supports, which can further increase the selectivity of catalysts; and (3) compound nanoparticles. Due to its small size, high voltage, and low self-discharge rate, lithium batteries are widely used in portable electronic devices such as mobile phones, notebook computers, power tools, and electric vehicles

Nanomaterials are used in lithium electric energy to improve cycle life and can take place in some reactions that cannot occur in other materials and increase the rate of charge and discharge. At present, nanomaterials can be well used as contrast agents in medical imaging. The mechanism of nanobiomaterials to promote the repair of damaged tissue is shown in Figure 2 [12]. Nanoparticles are widely used in biomedicine and can be used as biochips, bioprobes, etc. New medicines require new means of drug delivery so that side effects can be reduced and better efficacy can be achieved. Nanotechnology drug delivery can deliver drugs directly to cells and to targeted tissues [13].

3.1.3. Synthesis of Nanomaterials. The preparation methods of nanomaterials can be roughly divided into physical methods, chemical methods, and other methods. Among

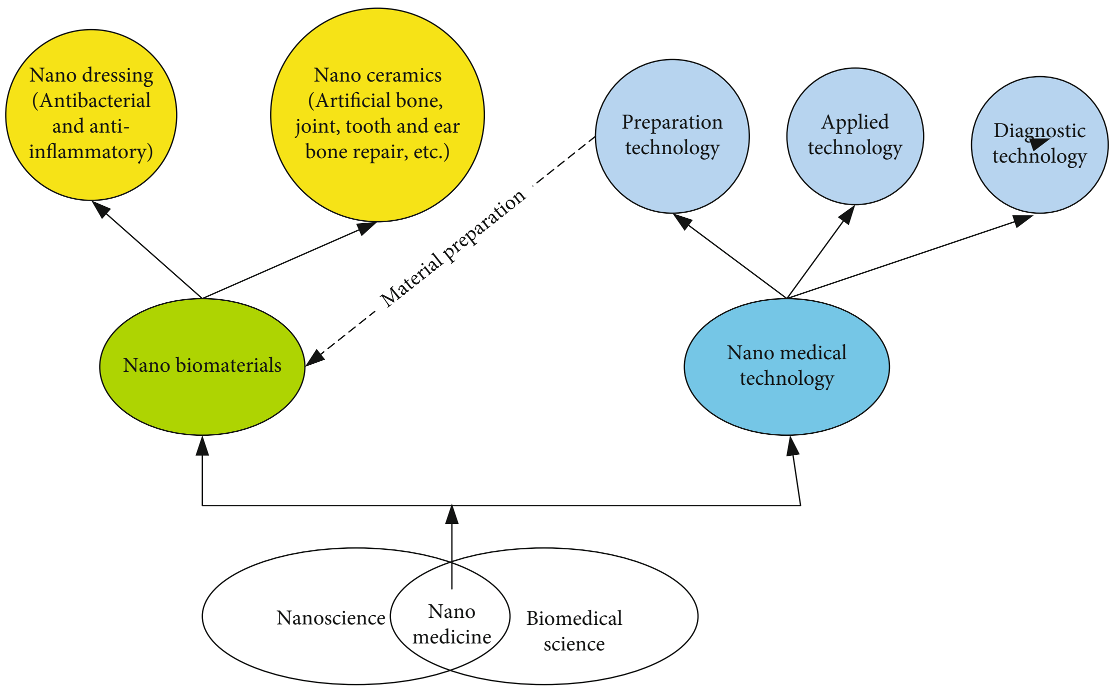


Figure 1: Overview of nanomedicine.

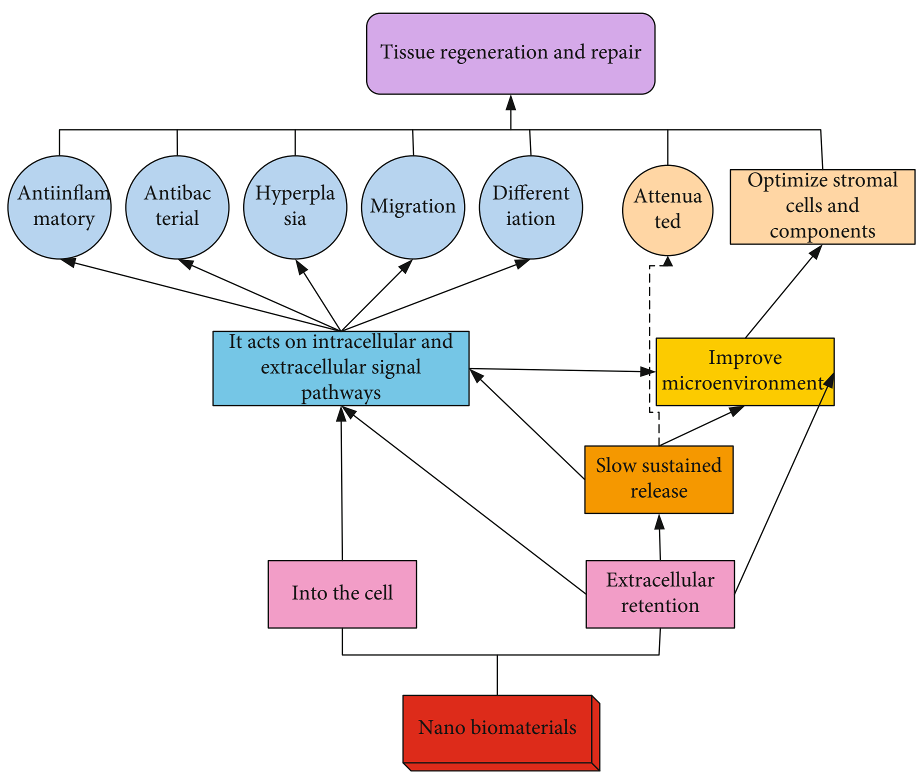


Figure 2: Mechanism of nanobiomaterials to promote the repair of damaged tissue.

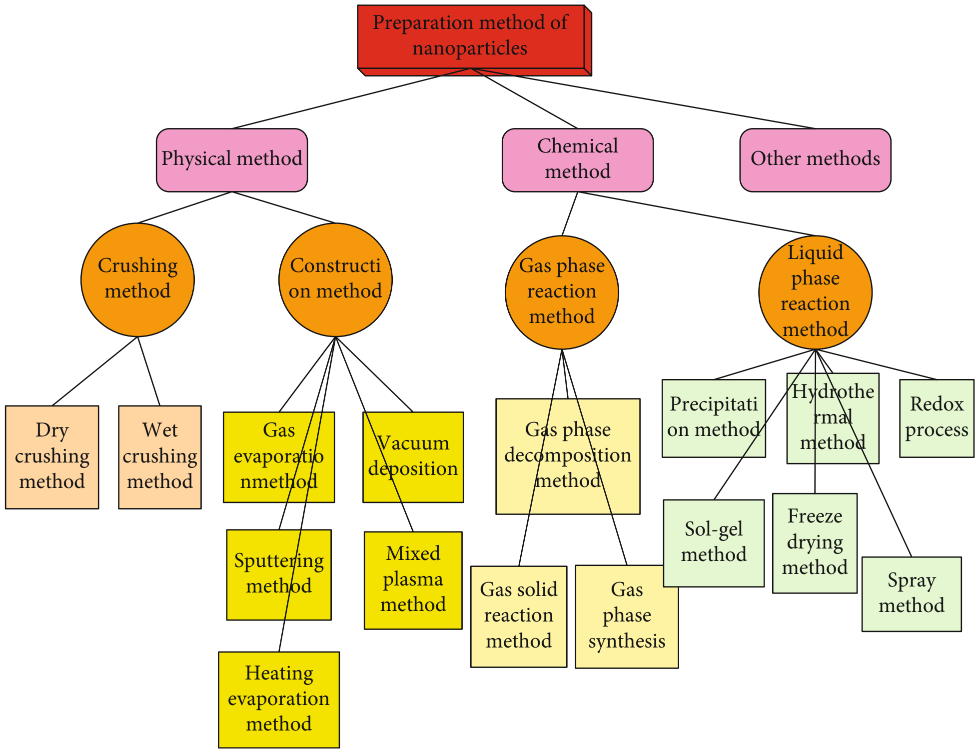


Figure 3: Nanoparticle preparation method.

them, physical methods include the pulverization method, deposition method, and sputtering method. Chemical methods include the sol-gel method, precipitation method, evaporative solvent pyrolysis method, redox method, and solvothermal method. Figure 3 shows the nanoparticle preparation method [14].

3.1.4. Characterization of Nanomaterials. In order to explore the mysteries of the nanoworld, the structure and properties of nanoparticles must be characterized. The characterization of nanomaterials is the modern analysis and detection technology and related theoretical knowledge about particle composition, structure, morphology, etc. Usually, we obtain the composition, particle size, morphology, structure, and interface of nanoparticles by inductively coupled plasma emission spectroscopy, scanning electron microscopy, transmission electron microscopy, atomic force microscopy, X-ray diffraction, and X-ray photoelectron spectroscopy. The average particle size, particle size distribution, composition, and interface of nanomaterials all affect their physicochemical properties. Figure 4 shows the commonly used characterization methods for nanomaterials [15].

3.2. Overview of the Development of Finite Element Analysis Based on MRI

3.2.1. Medical Imaging Technology. With computer assistance, in order to complete the construction of accurate physical and geometric models of anatomical organs, how to accurately extract the information contained in images (CT, MRI) is the key to current computer-assisted surgical guidance and treatment [16].

3.2.2. MRI Nuclear Magnetic Resonance Imaging Technology. With the development of imaging and the continuous improvement of surgical methods, the choice of surgical treatment of breast cancer has also changed. The range of surgical indications has also expanded, but it is limited to accurate diagnosis and surgery. It has a better therapeutic effect and therefore has a more prominent clinical significance in MRI examinations [17]. Figure 5 is a meniscus segmentation device based on a magnetic resonance image, and Figure 6 is a process of obtaining a meniscus segmentation result from an MRI image.

3.3. Introduction of Deep Learning Based on the Repairing Effect of Meniscus Damage. Deep learning is a very popular method in machine learning, covering a wide range of theoretical perspectives. In order to achieve more intelligent human-computer interaction, researchers imitate the human brain and thinking and establish various neural network models; deep learning is one of them. Deep learning is a multilevel representation learning method, learning data features by creating models, and finding a better data representation is the primary purpose of representation learning, as shown in Figure 7 [18].

The processing method of deep learning is nonlinear, and the processed data can be speech, images, text, etc., which can be learned from low-level to high-level abstract features [19].

3.4. Supervised Deep Learning Algorithms. In regression analysis, it is subdivided into various types according to the number of independent variables, dependent variables,

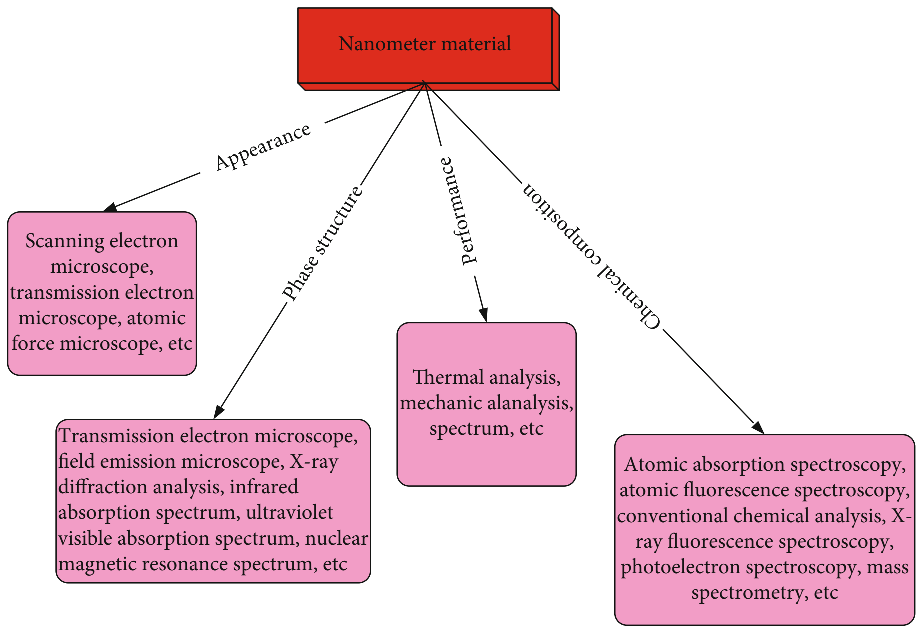


Figure 4: Nanomaterial characterization techniques.

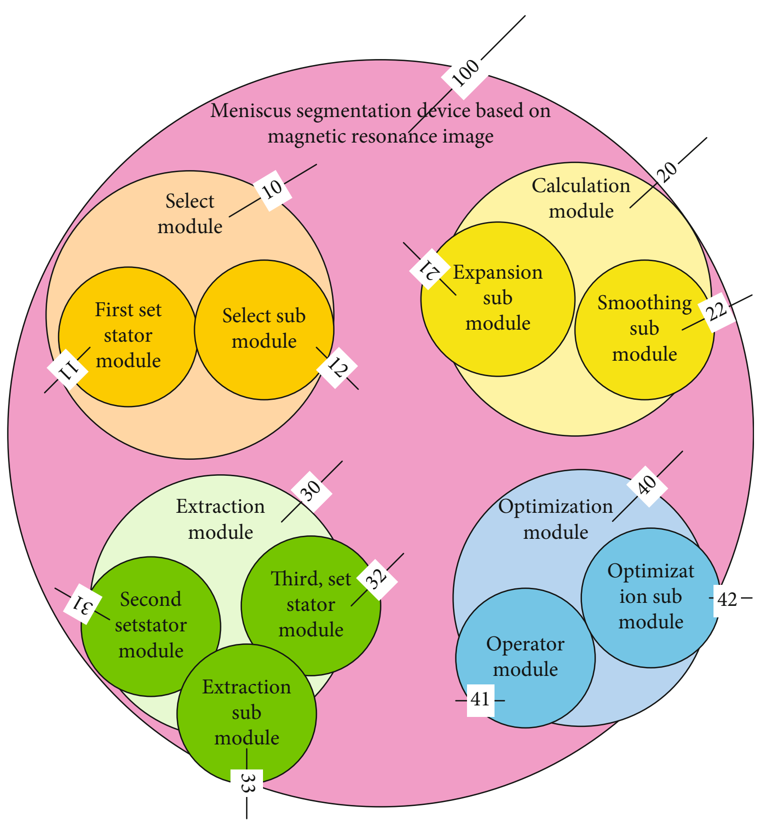


Figure 5: Meniscus segmentation device based on magnetic resonance images.

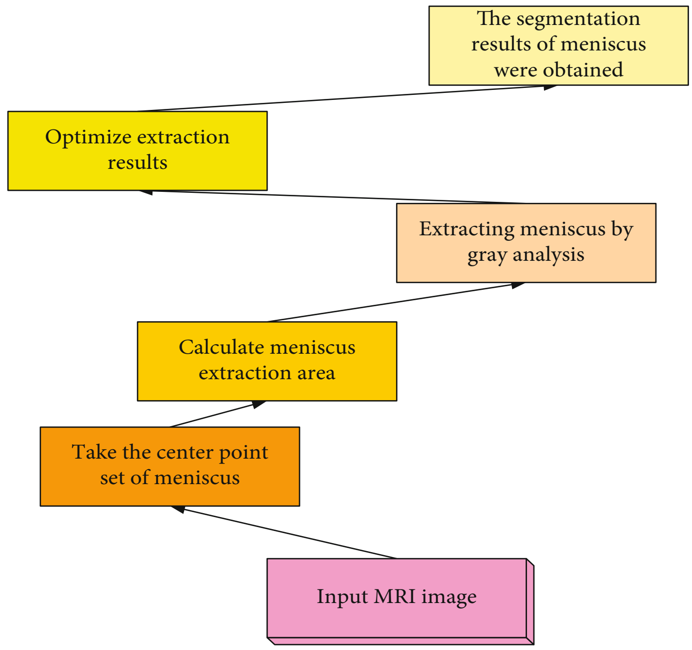


Figure 6: The process of obtaining meniscus segmentation results from MRI images.

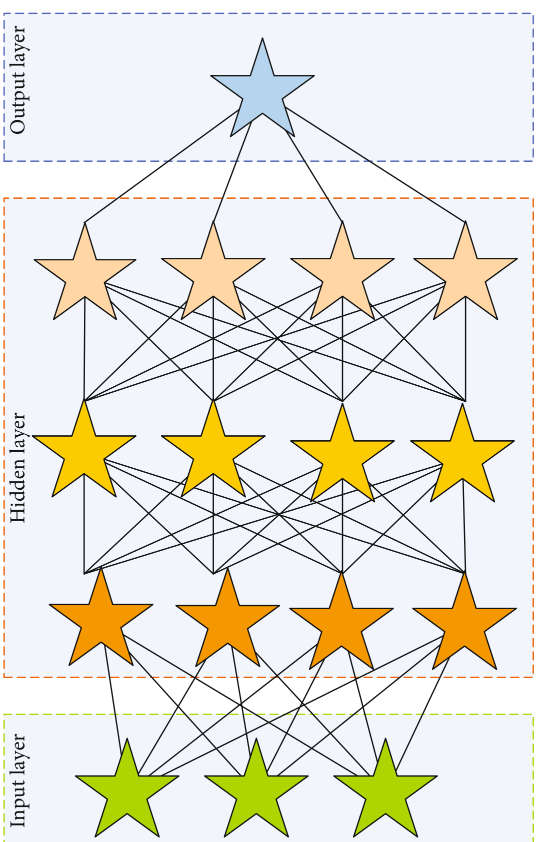


Figure 7: Deep neural network.

and the relationship between them. Regression methods in classification include logistic regression (LR), Softmax as an LR model is generalized on multiclassification problems, and Softmax regression is often used as the final classifier layer in supervised deep learning. The following is a detailed introduction from Softmax to convolutional neural networks [20].

3.4.1. Softmax Classifier. Before introducing Softmax regression, it is necessary to introduce logistic regression. Logistic regression is a simple binary classification algorithm that implements classification by fitting the classification boundaries of the data and uses optimization methods such as gradient descent to determine the best regression coefficients. One of the more important formulas in logistic regression is the step function: $Q(X) = 1/(1 + E^{-\theta^{Z} X})$; its waveform is as follows, the value range is $[0, 1]$ [21].

Its corresponding negative log-likelihood loss function is defined as

$$Q(\theta) = -\frac{1}{u}\left[\sum_{m=1}^{u} Y^{m} \log f_{\theta}(X^{m}) + (1 - Y^{m}) \log (1 - f_{\theta}(X^{m}))\right]. \tag{1}$$

LR is a special case of Softmax when dealing with binary problems. Two probabilities need to be solved in LR: $T(Y = 1|X;\theta)$ and $T(Y = 0|X;\theta)$. In Softmax regression, there are J probabilities, and its general function representation

$$T(i) = \frac{\exp\left(\theta_m^{Z} X\right)}{\sum_{J}^{J=1} \exp\left(\theta_m^{Z} X\right)}. \tag{2}$$

The negative log-likelihood loss function at this time is

$$Q(\theta) = -\frac{1}{u}\left[\sum_{m=1}^{u}\sum_{n=1}^{J} M\{Y^m = n\} \log \frac{E^{\theta_n^Z X^m}}{\sum_{l=1}^{J} E^{\theta_l^Z X^m}}\right], \quad (3)$$

where $M\{\bullet\}$ indicates that when its value is true and the result of the function is 1; otherwise, it is 0; then, the objective function is optimized by gradient descent [22].

3.4.2. Convolutional Neural Network. The convolutional neural network (CNN) is a kind of deep learning network structure, which is characterized by a large number of convolution operations in the network structure. In addition, activation functions and pooling layers are also its basic structures. These three basic structures make it have better local perception characteristics and feature abstraction ability than multilayer perceptron (MLP). At present, CNN has been widely used in many subdivisions of image processing and computer vision, such as image classification, image semantic segmentation, and visual object detection [23].

(1) Calculate the Output. For the l layer of the fully connected layer, the output is

$$\begin{cases} A^x = g(C^x), \\ C^x = T^x A^{x-1} + P. \end{cases} \quad (4)$$

Among them, T^x and P are the weights and biases, and $g(\bullet)$ is the sigmoid activation function, and the output range of this function is in $[0, 1]$. Assuming that d is the current sample number, the dth sample error is E^d:

$$E^d = \frac{1}{2}\sum_{k=1}^{l}\left(S_k^d - B_k^d\right)^2 = \frac{1}{2}\left\|S^d - B^d\right\|_2^2. \quad (5)$$

In the formula, S^d is the expected output value of the dth sample, and B^d is the actual output value of the dth sample after the network operation.

(2) Backpropagation. The data is calculated layer by layer through the network, and the error between the actual output and the expected output is obtained, which can be regarded as the sensitivity of the neuron base. The formula is

$$\frac{\partial E}{\partial P} = \frac{\partial E}{\partial C}\frac{\partial C}{\partial P}. \quad (6)$$

The formula for the sensitivity of layer x in the backpropagation stage is

$$\delta^s = \left(T^{x+1}\right)^S \delta^{x+1} \bullet g'(C^s). \quad (7)$$

The sensitivity of the output layer node is

$$\delta = g'(C^x) \bullet \left(B^d - S^d\right). \quad (8)$$

(3) Weight Update. The derivation of the error for the x layer weight of the fully connected layer is the cross product of the x layer input and its sensitivity. The weight update formula is

$$\frac{\partial E}{\partial T} = A^{x-1}(\delta^x)^S, \quad (9)$$

$$\Delta T^x = -\eta \frac{\partial E}{\partial T^x}. \quad (10)$$

The specific training process of the convolutional layer is as follows:

We input the data to the convolution layer for convolution calculation and get

$$A_n^x = g\left(\sum_{m \in W_n} A_m^{x-1} \bullet T_{mn}^x + P_n^x\right), \quad (11)$$

where T is the weight, P is the bias, and 1 is the set of input feature maps [24].

As shown in formula (17), it is shown that the computation is the gradient of the convolutional layer:

$$\delta_n^x = \beta_n^{x+1}\left(g'(C_n^x) \bullet \mathrm{up}\left(\delta_n^{x+1}\right)\right), \quad (12)$$

where up$(\bullet)$ is the upsampling calculation.

Through the above calculation, the gradient of the given feature map was gotten. The following equation shows the gradient of the bias basis obtained by summing the sensitivity of the feature map nodes in the x layer:

$$\frac{\partial E}{\partial P_n} = \sum_{i,j}(\delta_n^s)_{ij}. \quad (13)$$

The gradient of the convolution kernel weights is calculated as follows:

$$\frac{\partial E}{\partial K_{mn}^x} = \mathrm{rot180}\left(\mathrm{conv2}\left(A_m^{x-1}, \mathrm{rot180}(\delta_n^x), '\mathrm{valid}'\right)\right). \quad (14)$$

The same is true when updating the weights and biases with the above formula.

The pooling sampling layer training process is as follows:

$$A_n^x = g\left(\beta_n^x \mathrm{down}\left(A_n^{x-1}\right) + P_n^x\right). \quad (15)$$

Among them, down$(\bullet)$ is the pooling function and β and P represent the weight and bias, respectively.

The difficulty of the pooled sampling layer is also the calculation of the gradient. If the pooled sampling layer is followed by a fully connected layer, its sensitivity can be calculated by the BP algorithm; if the pooled sampling layer is followed by a convolutional layer, the sensitivity meter calculation formula is

$$\delta_n^x = g'(C_n^x) \bullet \mathrm{conv2}\left(\delta_n^{x+1}, \mathrm{rot180}\left(K_n^{x+1}\right), '\mathrm{full}'\right). \tag{16}$$

The calculation process of the bias in the pooled sampling layer is the same as that in the convolutional layer, but the calculation formula of the weight β is as follows:

$$\frac{\partial E}{\partial P_n} = \sum_{i,j} (\delta_n^x \bullet f_n^x)_{ij}. \tag{17}$$

In the formula,

$$f_n^x = \mathrm{down}\left(A_n^{x-1}\right). \tag{18}$$

Finally, the weights are updated by formulas (17) and (18).

3.5. Knee MRI and Meniscus Characteristics. In recent years, deep learning has made breakthroughs, and its application in the field of data analysis has grown rapidly. At present, deep learning has become the main application tool of machine learning in the field of image recognition and computer vision. In the biomedical field, deep learning is rapidly becoming the state-of-the-art in computer-aided diagnosis, resulting in increasing diagnostic accuracy. In the field of medical images, deep learning methods are applied everywhere from lesion detection, image segmentation, image registration to classification.

The meniscus is an important part of the knee joint and is a soft tissue structure, as shown in Figure 8. It consists of two crescent-shaped structures, which are located between the femur and the tibia and play a role in joint cushioning. The one near the inside of the knee joint in the leg is called the medial meniscus and has a larger opening that resembles a crescent; closer to the outside is the lateral meniscus, which has a smaller opening and is a crescent close to the full moon, which is wrapped in the middle by the medial meniscus. The sharp corners on the front side are called front corners, and the rear corners are called rear corners. At the knee joint, the femur, tibia, and meniscus are surrounded by peripheral ligament connections, one part is connected at the angle of the meniscus, and one end is on the leg bone. Its structure is relatively complex. If it is not presented in the form of a section, the meniscus is wrapped in it, making it difficult to observe.

4. Repair Experiment and Analysis of Nanomaterials on Meniscus Injury Caused by Calisthenics Exercise

4.1. Information on Meniscal Injury

4.1.1. Cause

(1) Traumatic injury: when the knee is in flexion, the medial and lateral menisci can move forward and backward with the femur due to rotation. When this paradoxical movement is outside the normal range, a tear of the meniscus can occur [25]

(2) Degenerative injury: due to age and exercise factors, such as excessive walking, it may cause frequent stimulation of the meniscus and frictional loads beyond the normal physiological range. As a result, the pathological changes such as tissue degeneration and minor damage of the meniscus are gradually aggravated to the degree of tearing

4.1.2. Clinical Manifestations

(1) Pain

Severe pain occurs immediately after trauma. The pain is worse with activity, but not as severe as before.

(2) Swelling

At the time of the injury or a few hours after the injury, the knee joint may swell and sometimes bruise under the skin.

(3) Sound

There is a sound in the knee joint during activities, which is mostly caused by the abnormal friction and bounce of the ruptured meniscus with the tibia and femur when the knee joint is active.

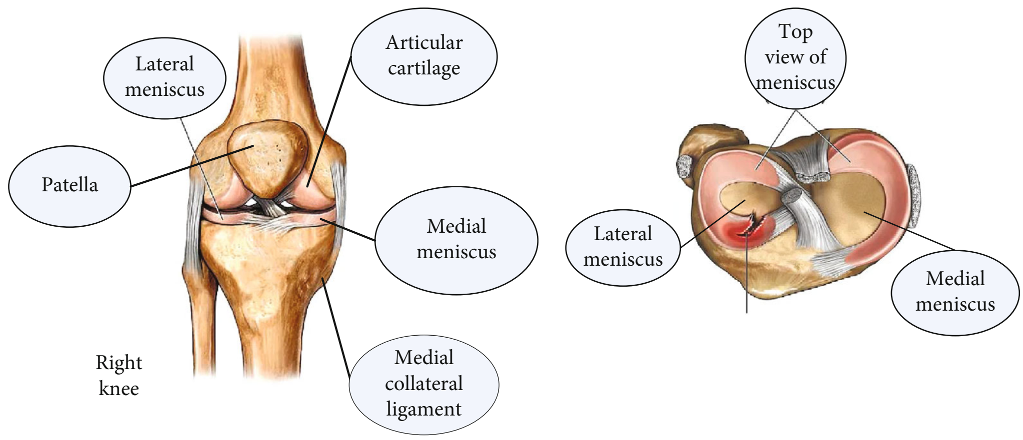
(4) Interlock phenomenon

During the extension and flexion activities of the knee joint, there is often a phenomenon of sudden "stuck" resulting in the inability to extend and flex the knee joint, which is called interlocking phenomenon.

4.1.3. Check

(1) MRI

MRI, the imaging method of choice for detection of meniscal injuries, also observes the condition of the collateral and cruciate ligaments. The nature of the pain can be



(a) Front view of the knee joint

(b) Top view of the meniscus

Figure 8: Schematic diagram of the structure of the knee joint and meniscus.

tugging, tearing, or colic-like persistent pain, and the pain range occurs on the side of the injury. Over time, the pain will gradually reduce and focus on the local area.

(2) McFarland's sign test

It has a high reference value for diagnosis. Subcutaneous congestion is the result of bleeding due to ligament damage.

(3) Extrusion test

When the knee is nearly straight, passively abduct or adduct the calf to squeeze the torn meniscus and cause pain.

(4) Arthroscopy

This is the basis for the final diagnosis. When the knee joint is actively or passively moved, this phenomenon can be relieved by itself, and the activity returns to normal. There are also cases where the interlock does not recover and the joint is permanently unable to straighten and flex.

4.2. Characteristics and Analysis of Injury Rate of High-Level Competitive Aerobics Athletes. In this survey, "a specific time" is the moment of filling out the survey form as the end of time and 12 months from this. In this paper, according to the research needs, the statistical number of sports injuries is limited to the frequency of injuries in the last year after the athlete achieved the corresponding level. Considering that the time continuity and cumulative effect of chronic injury will have a great impact on the statistical effect, therefore, the chronic injury is only counted once for the injury nature column in the questionnaire, and the sum of the actual numbers for acute injury is calculated. Statistics show that the injury rate of high-level competitive aerobics athletes is 100%. This shows that the investigators have suffered from sports injuries in the past year. Table 1 was prepared based on the frequency distribution data of the incidence frequency obtained by the questionnaire.

It can be seen from Table 1 that with the improvement of the level and the length of training years, the number of injuries will gradually increase. In the early stage of high level, there may be about 3 injuries, but in the later stage of high level, the number of injuries is mainly 6 or more. It can be seen that injuries are a common occurrence for high-level athletes and must be experienced all the time. Injuries seem to be an unavoidable problem associated with high-intensity training and daily high-intensity training as skill levels improve and develop.

It can be seen from Figure 9 that the most frequently treated parts of the national team are the waist, knee, and wrist, followed by the shoulder, hip, ankle, elbow, and back. Among them, most of the waist is lumbar muscle strain, and microwave or thermal magnetic therapy is often used for physiotherapy. Most of the back is fatigued after training. All athletes who perform back treatment use low-frequency electrical stimulation and relaxation instruments, which are equivalent to electrotherapy massage. Both the knee and the wrist belong to joints, and their injury prevention measures are very similar, so the knee joint is used as the representative to discuss. Actions of competitive aerobics jumps, body jumps, flexion and split jumps, twists, high kicks, Ilyushin, Kossack jumps, side split jumps, exchange jumps, scissor kicks, scissor jumps, etc. have a strong impact on the knees. This can easily cause knee pain, swelling, flexion and extension disorders, etc., and then atrophy of the quadriceps femoris and imbalance of the thigh and calf muscles. To prevent the disease from worsening in the case of uninterrupted training, it can be strengthened to prevent from the following aspects:

(1) The use of sports protective support belt can effectively prevent the aggravation of injury

(2) They should perform functional exercises, including strength, flexibility, motor sensory, and proprioceptive training. Flexibility has high requirements in competitive aerobics. Special functional exercises can not only prevent injuries but also improve sports performance, killing two birds with one stone. The common way is PNF exercises, specifically participating in primary prevention. The exercise of

Table 1: Incidence frequency of high-level competitive aerobics athletes in China in the past year.

Sport level frequency	1-2 times	3-5 times	≥6 times
National level	40%	37%	23%
National master	20%	38%	42%
International master	10%	12%	78%

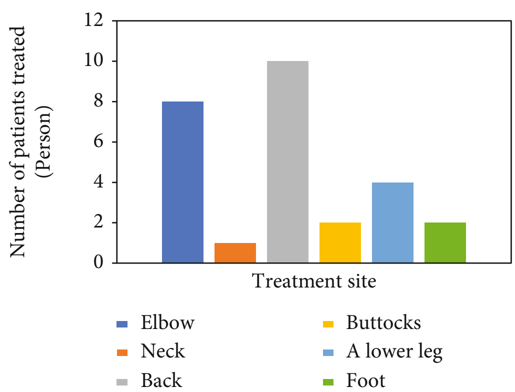


Figure 9: Distribution map of treatment sites for aerobics national training team during 2020\11-2021\11. Note: the statistics take one month as a small unit. If someone has performed multiple treatments on the same part within a month, it will be counted only once. However, the same parts of the same object in different months of the 12-month period are accumulated on the basis of the above. Such statistics not only reduce the interference of the injury healing process on the overall injury characteristics but also reduce the interference of the individual injury characteristics of the same subject with multiple treatments on the overall injury characteristics.

balance ability can greatly improve the neuromuscular control ability of the body and promote the coordination and stability of the body. The recovery of the athlete's balance ability and proprioceptive control ability is the key to reducing the risk of reinjury. Balance pads, active boards, and other balance exercise equipment can be used to enhance limb stability. The trampoline exercise used by the national aerobics training team is actually a functional exercise to enhance the sense of movement and proprioceptive training

(3) Physiotherapy. Any injury has the ability to repair itself, but research shows that the biochemical composition of tissue repaired by itself is different from that of uninjured tissue. Therefore, active stimulation by external means is helpful for the recovery of structure and function and also helps to improve the ability to respond to exercise and prevent the occurrence of injury. The commonly used physiotherapy methods for chronic knee injuries include microwave therapy, thermomagnetic therapy, ultrashort wave therapy, and ultrasonic therapy. Among them, ultrasound is mainly used for the removal of scar tissue and adhesions. The efficacy of microwave, thermomagnetic, and ultrashort mainly lies in the deep penetration of thermal effect, which can focus on promoting blood circulation in the affected area and promoting damage repair. During the treatment of the national team members, a total of 9 people have used the above methods, of which 7 people showed significant improvement, and continued to maintain a large amount of exercise training without any suspension of training. To sum up, the overall tertiary prevention of injuries for high-level athletes can enable athletes to fully and actively deal with sports injuries that accompany the improvement of competition, which is conducive to improving the body's ability to withstand high-intensity training, resulting in a good training adaptation

Table 2: Comparison of age, height, and weight between healthy group and patients.

Group	Health group	Patient group	Inspection value	*P* value
Number of cases	20	20		
Age	30.52 ± 5.33	32.52 ± 5.02	-1.592	0.110
Weight	74.38 ± 14.08	73.18 ± 11.69	0.422	0.680
Height	176.02 ± 5.84	174.89 ± 3.88	1.240	0.226

4.3. Comparison of Gender, Age, and Weight of Patients. Table 2 shows that the age comparison between the healthy group and the patient group was not statistically significant ($T = -1592$, $P = 0.110 > 0.05$); there was no statistical significance in height ($T = 1.240$, $P = 0.226 > 0.05$) and no statistical significance in weight ($T = 0.4226$, $P = 0.680 > 0.05$).

Table 3 shows the comprehensive score comparison made by the back-end algorithm layer of the Internet cloud of the foot space posture evaluation and analysis system based on all the gait data of the testee's feet within one minute. It is mainly assessed from four aspects: gait stability, bipedal symmetry, initiation ability, and deceleration ability. The results show that

(1) In patients with unilateral meniscus injury, the stability, symmetry, and starting ability of gait before surgery were significantly lower than those of the healthy group and the gait data obtained after surgery, which indicates that meniscus injury has a significant impact on gait stability, symmetry, and start-up ability. Factors such as uneven force on both lower extremities and the patient's own fear caused by factors such as knee instability, knee flexor muscle weakness, and pain in the affected limb after meniscus injury were considered

(2) There was no statistical difference in the stability, symmetry, and starting ability of the gait after surgery and the healthy group, indicating that the comprehensive evaluation of the gait after meniscus

Table 3: Comparison of gait comprehensive score between the healthy group and patient group.

Group	Health group	Patients before operation	Postoperative patients	F value	P value
Stability	98.67 ± 0.68	95.01 ± 1.56	98.70 ± 0.69	145.99	<0.01
Symmetry	95.60 ± 2.78	91.29 ± 3.61	95.29 ± 2.89	19.91	<0.01
Starting ability	89.05 ± 5.66	76.61 ± 4.41	88.11 ± 3.21	66.55	<0.01
Deceleration capacity	88.77 ± 5.78	84.99 ± 5.88	86.55 ± 5.01	1.24	0.28

surgery was close to the normal gait, the kinematic data was generally normal, and the surgical effect was more reliable

(3) There was no statistical difference in the deceleration ability between the patients before and after surgery and the healthy group, which may be related to the lower requirements of knee joint stability and muscle strength for gait deceleration exercise. It cannot be ruled out that the result error is caused by the small number of times of reentry and the large error of deceleration movement data collection in this experiment

5. Discussion

The research on sports injuries in advanced aerobics is a step that cannot be ignored in the scientific development of aerobics. At present, with the rapid development of science and technology, people are no longer satisfied with using "sports performance" as an index to evaluate the effect of training but pay more attention to evaluating the effect of training, that is, the relationship between the input and output of training.

Nanomedicine is also a promising drug, as it is not easily absorbed by the human body when prepared in nanopowder or suspension. Nanomedicine is pasted on the affected area and can be absorbed directly through the skin without injection. But in aerobics, strength quality is a very critical link, so it is necessary to have excellent strength quality.

During training, athletes continue to work hard to achieve better results and keep crossing borders. To break themselves, they cause multiple sports injuries. How to improve the effective prevention of aerobic injury has become a major problem faced by coaches and athletes. At present, the clinically preferred treatment for meniscal injury is arthroscopic surgery, which can well complete the trimming and shaping of the damaged meniscus. It can eliminate the pain, noose, joint instability, and other symptoms caused by meniscus injury and significantly improve the function of the knee joint.

6. Conclusions

This study found that the loss of postoperative muscle strength of the affected limb had a significant impact on postoperative gait. Postoperative muscle strength of the affected limb, especially the decrease of knee flexor muscle strength and postoperative pain are the two main causes of postoperative gait abnormalities in patients with meniscus injury. Another study has shown that muscle tension can be improved by exercising the muscle strength around the knee joint. The release of fascial adhesions has great benefits and is helpful for improving joint stability and internal circulation. Combined with the above data, patients with meniscus injury should be given appropriate lower extremity functional exercises after surgery to improve the muscle strength around the joints. It should be an equally important measure to eliminate postoperative pain, edema and other conventional treatments.

Data Availability

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

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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