INJURIES IN AEROBIC EXERCISE: CAUSES AND PREVENTIONS

LESÕES NO EXERCÍCIO AERÓBICO: CAUSAS E PREVENÇÃO

LESIONES EN EL EJERCICIO AERÓBICO: CAUSAS Y PREVENCIÓN

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ABSTRACT

Introduction: Professional aerobic exercises require high performance from exercisers. Injuries are common during their execution. Understanding the causal reasons is essential for prevention methods to reduce athletes' injuries. Objective: Investigate the influential factors of ligament injuries caused by aerobic exercise. Methods: This paper analyzes the injuries caused by aerobic exercise through mathematical statistics. Time, course, degree of injury, location of the injury, cause, early treatment time, primary approach, treatment methods, recovery conditions, and speed in recovery time of sports injuries were investigated. Results: Injuries are mainly concentrated at the hip, knee, and ankle joint level; sprains are the first injuries, followed by muscle strains, lower back muscle contractures, kneecap deformities, and joint ligament injuries. The leading causes of injuries were poor warm-up, excessive load, technical errors, and fatigue. Conclusion: Various physiotherapy methods can improve the recovery rate from ligament injuries. This method can also improve sports ligament injuries' prevention and treatment effects. ***Evidence Level II; Therapeutic Studies - Investigating the result.***

Keywords: Gymnastics; Exercise; Anterior Cruciate Ligament Injuries; Sports.

RESUMO

Introdução: Exercícios aeróbicos profissionais exigem alto rendimento dos praticantes e as lesões são comuns durante suas execuções. É essencial compreender as razões causais para fornecer métodos de prevenção no intuito de reduzir as lesões nos atletas. Objetivo: Analisar os fatores que influenciam as lesões ligamentares causadas pelo exercício aeróbico. Métodos: O artigo analisa os fatores das lesões esportivas causadas por exercícios de aeróbica através de estatísticas matemáticas. Foram investigados o tempo, curso, grau de lesão, localização da lesão, causa, tempo de tratamento precoce, abordagem primária, métodos de tratamento, condições de recuperação e velocidade no tempo de recuperação das lesões esportivas. Resultados: As lesões concentram-se principalmente a nível de quadril, articulações do joelho e tornozelo; entorses são as primeiras lesões, seguidas por estiramentos musculares, contraturas da musculatura lombar, deformações da rótula e lesões nos ligamentos articulares. As principais causas das lesões foram aquecimento precário, carga excessiva, erros técnicos e fadiga. Conclusão: Vários métodos de fisioterapia podem melhorar a taxa de recuperação das lesões ligamentares. Esse método também pode melhorar os efeitos de prevenção e tratamento das lesões ligamentares esportivas. ***Nível de evidência II; Estudos Terapêuticos - Investigação de Resultados.***

Descritores: *Ginástica; Exercício Físico; Lesões do Ligamento Cruzado Anterior; Esportes.*

RESUMEN

Introducción: Los ejercicios aeróbicos profesionales exigen un alto rendimiento de los practicantes y las lesiones son frecuentes durante sus ejecuciones. Es esencial comprender las razones causales para proporcionar métodos de prevención con el fin de reducir las lesiones en los deportistas. Objetivo: Analizar los factores que influyen en las lesiones de ligamentos causadas por el ejercicio aeróbico. Métodos: El artículo analiza los factores de las lesiones deportivas causadas por el ejercicio aeróbico mediante la estadística matemática. Se investigó el tiempo, la evolución, el grado de la lesión, la localización de la misma, la causa, el tiempo de tratamiento temprano, el enfoque primario, los métodos de tratamiento, las condiciones de recuperación y la velocidad en el tiempo de recuperación de las lesiones deportivas. Resultados: Las lesiones se concentran principalmente a nivel de las articulaciones de la cadera, la rodilla y el tobillo; los esguinces son las primeras lesiones, seguidas de las distensiones musculares, las contracturas de los músculos lumbares, las deformidades de la rótula y las lesiones de los ligamentos articulares. Las principales causas de las lesiones fueron el mal calentamiento, la carga excesiva, los errores técnicos y la fatiga. Conclusión: Varios métodos de fisioterapia pueden mejorar la tasa de recuperación de las lesiones de ligamentos. Este método también puede mejorar los efectos de la prevención y el tratamiento de las lesiones de los ligamentos deportivos. ***Nivel de evidencia II; Estudios terapéuticos - Investigación de resultados.***

Descriptores: *Gimnasia; Ejercicio Físico; Lesiones del Ligamento Cruzado Anterior; Deportes.*

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INTRODUCTION

Skeletal muscles are important joints for human movement and activities. Skeletal muscles ensure that the human body can bend over, stretch legs, sit down and walk upright. However, the human skeletal muscle detaches from the acetabulum and pushes towards the lower part of the joint capsule.[1] If the external force acts on the knee joint from the front and then travels along the femur to the femoral head, it is very easy to cause skeletal muscle dislocation and injury. Studying the force characteristics of skeletal muscle in aerobics exercise and analyzing its influence on ligament injury can guide the treatment of aerobics exercise muscle and ligament injury. We apply computer perception technology to analyze human aerobics sports behaviors to realize accurate analysis and recognition of human aerobics sports behaviors, especially through the force decomposition and feature extraction of human body aerobics exercise behavior.

The positioning of the arc trajectory of the aerobics arm movement is based on the image feature extraction and edge feature analysis of the aerobics arm movement. Most scholars build aerobics arm motion image collection and information processing models. Combining edge feature decomposition and information fusion method for image feature analysis and optimization extraction of aerobics arm action.[2] We use corner information detection and ambiguity noise reduction analysis methods to achieve optimal detection and recognition of aerobics arm motion images. In the traditional method, the trajectory positioning method of the moving image of the aerobics arm mainly includes the Harris corner tracking and recognition method, the video tracking video method, and so on. Combine feature point positioning and recognition to realize the aerobics arm movement trajectory positioning. However, the traditional method for aerobics arm movement trajectory positioning is not well-adapted, and the feature recognition ability is weak.

We use miniature low-power sensors for feature extraction in human body aerobics exercises, extracting relevant information from the data.[3] In this way, accurate quantitative analysis and simulation of aerobics exercises and force-generating patterns of different body parts in the process of human aerobics exercises are realized. Finally, it can improve the effectiveness and pertinence in the training of aerobics athletes and the treatment of aerobics sports injuries.

METHOD

Research object

In this paper, there are 13 cases of ligament injury caused by skeletal muscle exercises in aerobics. There were 3 females and 10 males, with an average age of (28±9.5) years. The admission period is from September 2019 to January 2020. We use computer simulation and medical clinical tracking methods to analyze the force characteristics of skeletal muscles in aerobics exercises.[4] We analyze the therapeutic effect of this method on ligament injury.

Construction and mathematical analysis of aerobics skeletal muscle force characteristic analysis model

Aerobics exercise fatigue refers to the phenomenon that the body's functions are unbalanced or impaired due to excessive use of body resources during aerobics exercises. Therefore, fatigue is caused by the corresponding attenuation or weakening of the functions of the tissues and organs. Fatigue can affect the various systems of the body.[5] Aerobics exercise-induced muscle fatigue is a physiological phenomenon in which the muscle contraction caused by exercise produces the maximum active contraction force or the maximum output power temporarily decreases. This paper constructs an analysis model of the skeletal muscle force characteristics of aerobics. According to the accelerometer worn by the aerobics, the mechanical characteristics of the force exerted and the muscle force is quantitatively analyzed and judged for the patients with ligament strain in the aerobics exercise. At the same time, it can also identify the force and action characteristics of the skeletal muscles in aerobics exercises.

We use the acceleration sensor worn on the crotch to collect the raw data of the motion characteristics of the human body under several actions such as running, standing still, walking, and jumping.[6] Two acceleration sensors are selected, and the missing data functional algorithm based on RFID is used to analyze the force characteristics and behavior decomposition of skeletal muscles. First, the feature extraction of human motion behavior is required. The most important step in designing the decomposition model of human motion force behavior based on the probability function of RFID missing data is to extract the characteristics of human motion behavior. In the force analysis of human motion behavior, the association relationship between multi-sensor information requires joint feature extraction. There is a $N \times N$ size characteristic component of the arc trajectory of the aerobics arm motion image in the radian trajectory information sampling model of the aerobics arm motion image. Let R_t be the local gray-scale feature value of the image at time t. R_0 is the contour offset component. Perform aerobics arm motion arc trajectory tracking detection in the *Ridgelet* domain to get the aerobics arm motion arc trajectory detection output as:

$$m_i = c_i + \int_t^i u + (R_t + R_0) \tag{1}$$

c_i The multi-scale wavelet decomposition method is used to filter and analyze the collected aerobics arm motion images. u means to construct the sub-block area [7]. According to the contour characteristics of the aerobics arm, the regularized equation of the image fusion of the arc trajectory of the aerobics arm is obtained:

$$K_\psi = \sum_y^o Ki + d + \psi < \infty \tag{2}$$

ki represents the arc trajectory positioning method of aerobics. It is said that ψ is the similarity information of images in d dimensional space.[8] We use the corner detection method to obtain the edge contour feature quantity of the arc trajectory of the aerobics arm movement as:

$$N_i = \left\{ i'[\sin^{-1}\theta]^2 \le \left(\frac{\pi}{d=2} - \theta \right) r \right\} \tag{3}$$

Here, the Euclidean distance between the corner points of the arc trajectory of the aerobics arm movement of $d = 2$, we use $[\sin^{-1}\Theta]^2$ to describe. r is a constant. The Euclidean distance is used to realize the point positioning and recognition of the arc trajectory of the aerobics arm movement.[9] In this way, the edge contour feature set of the arc trajectory of the aerobics arm action is obtained as:

$$R_i = \frac{1}{\gamma_i} \sum_{j \in \Omega} g_j d(A_1 + A_g + A_b) \tag{4}$$

We reconstruct the edge contour feature of aerobics arm movement arc trajectory sequence component A_r, A_g, A_b. In this way, the feature analysis model of the arc trajectory tracking and recognition of the aerobics arm movement is obtained:

$$A = \lim_{\delta x \to 0} + \sum_b k, t = Ag \tag{5}$$

According to the multi-scale contour edge feature extraction results. $\lim_{\delta x \to 0}$ uses the scale decomposition method.[10] We use k, t to represent the arc trajectory tracking and positioning recognition of the arm movement in aerobics.

RESULTS

Ligament injury is one of the important diseases of aerobics sports injury. The leading factor is usually due to the unbalanced force of the skeletal muscles in the aerobics exercise. Therefore, it is necessary to analyze the force characteristics of skeletal exercise muscles.[11] Assume that m data are missing in the acceleration sensor and RFID channel in collecting human motion characteristics. Therefore, we need to modify the original forward variable. We adopt anti-aerobics kinematics transformation to obtain the trajectory matching mode of Wiener space and force state space. Use Θ_i $(i = 1,2,\cdots, 6)$ to represent the multi-information feature fusion value of the force behavior of the skeletal muscle in aerobics exercise.[12] Figure 1 shows the characteristic tension model of the skeletal muscle force of different patients' aerobics exercises through the school model construction.

It can be seen from Figure 1 that the muscles have not recovered in the tonic contraction curve of the skeletal muscles in aerobics exercises. At this time, a new record will be generated and cyclically become a continuous muscle response. According to the above research on the characteristics of skeletal muscle stress in aerobics exercise and analyze its influence on ligament injury, guide the aerobics exercise muscle and ligament injury treatment.[13] In this way, the clinical treatment guidance analysis results for the still-pending injury are shown in Table 1.

DISCUSSION

The analysis of the above results shows that if the model in this paper is used, it can effectively realize the analysis of the force characteristics of the skeletal muscle in aerobics exercise. At the same time, this method

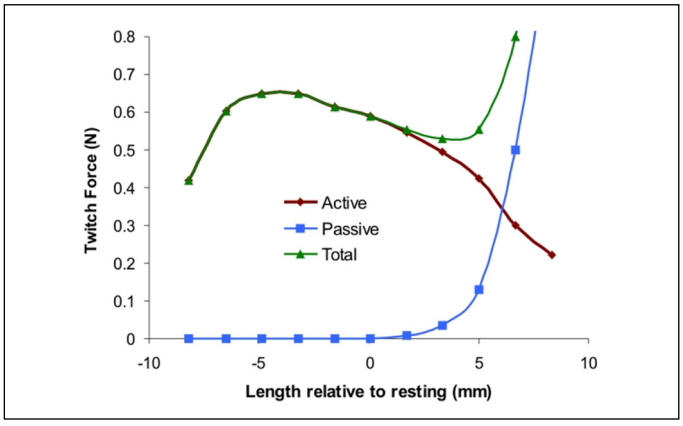

Figure 1. The skeletal muscle force characteristic tension model of aerobics exercise.

Table 1. Analysis of skeletal muscle force characteristics and treatment results of different patients' aerobics exercises.

Patient serial number	gender	Skeletal muscle stress time/h	Ligament strain rate/%	Ligament injury recovery rate/%
1	male	19	37.9	53.3
2	male	17	27	8.09
3	male	25	26.54	2.3
4	male	28	38.96	38.75
5	male	30	46.7	40.87
6	male	11	6.5	43.43
7	male	27	28.44	4.22
8	male	26	23.47	19.99
9	male	6	6	12.99
10	male	4	16.86	40
11	Female	19	8.11	21.57
12	Female	38	39.71	45.53
13	Female	8	8.28	72.8

can realize effective treatment guidance for ligament injuries.[14] Analyzing the results in Table 1 and the above simulation results, it can be seen that the use of this model to analyze the skeletal muscle force characteristics of aerobics exercise can effectively decompose the muscle force model of the patient's aerobics exercise injury. At the same time, the method can guide ligament injury treatment and improve the recovery rate of ligament injury.

In this paper, the force decomposition and feature extraction of human body aerobics sports behavior.[15] At the same time, we use miniature low-power sensors for feature extraction, reasoning, or recognition in the process of human body aerobics exercise. In this way, human body aerobics' action types and behavior patterns can be quantitatively analyzed from the perspective of data information processing and information perception. At this time, the relevant information is extracted and expressed. This method realizes the accurate quantitative analysis and simulation of the aerobics exercise and force generation mode of different body parts in the process of human aerobics exercise. This method improves the effectiveness and pertinence in the training of aerobics athletes and the treatment of aerobics sports injuries.

CONCLUSION

Using this method to analyze the skeletal muscle force characteristics of aerobics exercise can effectively decompose the muscle force model of the patient's aerobics exercise injury. This method guides ligament injury treatment, improves the recovery rate of ligament injury, and improves the prevention and treatment effect of a ligament injury in aerobics sports.

The author declare no potential conflict of interest related to this article

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