KNEE JOINT REHABILITATION IN BADMINTON ATHLETES

REABILITAÇÃO NAS ARTICULAÇÕES DO JOELHO EM ATLETAS DE BADMINTON

REHABILITACIÓN DE LAS ARTICULACIONES DE LA RODILLA EN ATLETAS DE BÁDMINTON

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ABSTRACT

Introduction: Athletic injuries are common in badminton, and the knee joint is the most affected. This type of injury can reduce the athlete's career, and poor treatment can cause secondary injuries during the rehabilitation period, requiring a thorough study of the causes and treatment methods. Objective: Study the causes and rehabilitation methods of knee joint injuries in badminton players. Methods: Junior badminton students and professional players from a university volunteered for a study on the causes of their knee joint injuries and the various types of rehabilitation training they were allocated to. The control group was treated with traditional physical therapy, and the experimental group was treated with slow recovery training under the guidance of doctors and teachers. The experiment lasted 6 weeks, and pain recovery and joint stability index were the main indicators. Results: Knee joint injuries in athletes often occur when performing intense or unfamiliar movements. The scores of the experimental group evolved rapidly during the 6 weeks of rehabilitation. The total stability index before training was 6.3432 ± 0.4647 versus 5.7190 ± 0.3747 after the experiment. Conclusion: Training in the physical rehabilitation of knee joint injuries in athletes has a good effect on pain relief and gain in joint stability, proving to be superior to acupuncture and traditional physiotherapy. Therefore, adding this restorative training protocol to knee joint rehabilitation in athletes is recommended. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Athletic Injuries; Knee Joint; Rehabilitation; Exercise Therapy.

RESUMO

Introdução: As lesões atléticas são comuns na prática de badminton, sendo a articulação do joelho a mais afetada. Esse tipo de lesão pode reduzir a carreira do atleta e um tratamento precário pode ocasionar lesões secundárias durante o período de reabilitação, exigindo um estudo minucioso das causas e métodos de tratamento. Objetivo: Estudar as causas e os métodos de reabilitação sobre as lesões articulares do joelho em jogadores de badminton. Métodos: Estudantes de badminton júnior e profissionais de badminton de uma universidade foram voluntários de um estudo sobre as causas de suas lesões articulares do joelho e os diversos tipos de treinamento de reabilitação a que foram alocados. O grupo de controle foi tratado com fisioterapia tradicional, e o experimental foi tratado com treinamento de recuperação lenta sob a orientação de médicos e professores. O experimento durou 6 semanas, a recuperação da dor e o índice de estabilidade articular foram os indicadores principais. Resultados: As lesões articulares no joelho dos atletas ocorrem frequentemente ao realizar movimentos intensos ou não familiares. A pontuação do grupo experimental evoluiu rapidamente durante as 6 semanas de reabilitação. O índice de estabilidade total antes do treinamento foi de 6,3432 ± 0,4647 contra 5,7190 ± 0,3747, após o experimento. Conclusão: O treinamento na reabilitação física das lesões articulares nos joelhos dos atletas tem um bom efeito no alívio da dor e ganho na estabilidade articular, revelando-se superior à acupuntura e à fisioterapia tradicional. Portanto, é recomendada a adição deste protocolo de treinamento restaurador à reabilitação na articulação do joelho em atletas. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

***Descritores*:** *Traumatismos em Atletas; Articulação do Joelho; Reabilitação; Terapia por Exercício.*

RESUMEN

Introducción: Las lesiones atléticas son frecuentes en la práctica del bádminton, siendo la articulación de la rodilla la más afectada. Este tipo de lesión puede reducir la carrera del deportista y un tratamiento deficiente puede provocar lesiones secundarias durante el periodo de rehabilitación, lo que exige un estudio exhaustivo de las causas y de los métodos de tratamiento. Objetivo: Estudiar las causas y los métodos de rehabilitación de las lesiones de la articulación de la rodilla en jugadores de bádminton. Métodos: Estudiantes de bádminton junior y profesional de una universidad se ofrecieron como voluntarios para un estudio sobre las causas de sus lesiones articulares de rodilla y los distintos tipos de entrenamiento de rehabilitación a los que fueron asignados. El grupo de control fue tratado con fisioterapia tradicional, y el grupo experimental fue tratado con entrenamiento de recuperación lenta bajo la dirección de médicos y profesores. El experimento duró 6 semanas, y los principales indicadores fueron la recuperación del dolor y el índice de estabilidad articular. Resultados: Las lesiones de la articulación de la rodilla en los deportistas suelen producirse al realizar movimientos intensos o desconocidos. Las puntuaciones del grupo experimental evolucionaron rápidamente durante las 6 semanas de rehabilitación. El índice de estabilidad total antes del entrenamiento era de 6,3432 ± 0,4647 frente a 5,7190 ± 0,3747 después del experimento. Conclusión: El entrenamiento en la rehabilitación

física de lesiones articulares de rodilla en atletas tiene un buen efecto en el alivio del dolor y la ganancia de estabilidad articular, demostrando ser superior a la acupuntura y la fisioterapia tradicional. Por lo tanto, se recomienda añadir este protocolo de entrenamiento restaurativo a la rehabilitación de la articulación de la rodilla en atletas.
Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.

Descriptores: *Traumatismos en Atletas; Articulación de la Rodilla; Rehabilitación; Terapia por Ejercicio.*

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INTRODUCTION

In the development of modern sports, the competitiveness of sports becomes stronger and the competition becomes more fierce, which greatly increases the probability of sports injuries.[1] In the actual combat of badminton, due to frequent lower limb exertion, it is likely to cause knee joint sports injuries. And among the types of injuries of badminton players, knee joint sports injuries are also more common.[2] The knee joint movement has brought not small influence to many badminton players. In addition, it is also very common to suffer from secondary knee injuries during the rehabilitation period.[3] Therefore, a thorough study of the causes of badminton players' knee injuries can provide sufficient theoretical support for athletes, effectively reduce the probability of sports accidents, and provide a certain degree of security for athletes' career.[4] In this paper, the junior and above badminton students in a university are taken as the research object to study the causes of knee joint injuries of these badminton players, and carry out some rehabilitation training to explore their recovery effects.

METHOD

Investigation on injury of badminton players' knee joint

The article first used the interview method and questionnaire survey method to interview the junior, senior and graduate students of badminton specialty in a university sports college, and contacted some athletes with knee joint injuries to conduct a questionnaire survey.[5] The problems mainly focus on the specific injury situation of the current knee joint injury, as well as the movement that the athletes are carrying out when this knee joint injury problem occurs.[6] Therefore, the specific situation of the knee joint injury of badminton professional players is analyzed, and the current research status and the necessity of research are clarified.[7] Through interviews, 64 athletes who had knee joint injuries and were willing to accept the questionnaire survey, distributed and recovered 64 questionnaires, and used Excel software to sort out and analyze the questionnaire results and draw relevant charts.

Test objects

After completing the questionnaire survey and having a certain understanding of the knee joint injuries, we consulted the current students who have knee joint injuries and have not recovered. The study and all the participants were reviewed and approved by Ethics Committee of Henan University of Economics and Law(NO.2020HNUEL-S179). After fully informing the precautions of this experiment, we asked them whether they would like to participate in rehabilitation training as volunteers. Finally, we obtained 16 athletes as the subjects of this experiment. According to the form of random sampling, 16 athletes were divided into experimental group and control group, with 8 members in each group. Their age, height, weight and training years were inquired and sorted out. The specific results are shown in Table 1.

Experimental design and implementation

The article adopts the method of controlled experiment. The control group used traditional physical therapy to recover the knee joint through acupuncture and massage, while the experimental group conducted slow recovery training under the guidance of doctors and teachers. The whole experiment lasts for 6 weeks. If athletes feel discomfort in their knee joints, they should seek help from doctors in a timely manner. If there is a change that affects athletes' recovery and endangers their career, the experiment should be terminated immediately. In the six week experiment, the members of the experimental group and the control group were able to complete their own physiotherapy training and recovery training without discomfort.

Data test

During the observation of the rehabilitation effect, the recovery of pain and the stability index of knee joint were selected as the judgment indicators. The recovery of pain is the analysis of athletes' subjective feelings, and the knee stability index is the judgment of athletes' recovery. The combination of the two can comprehensively study the effect of knee rehabilitation.

RESULTS

Analysis on injury of badminton players' knee joint

In the questionnaire survey, the specific injuries of the athletes' knee joint injuries and the training actions of the athletes when this problem occurs were analyzed, as shown in Figure 1 and Figure 2.

It can be seen from the data results in Figure 1 that the problems of 64 subjects are different. Although they are all knee injuries, the specific corresponding injuries are different. Among 64 athletes, 21 athletes suffered from muscle strain, accounting for 32.81%; There were 20 athletes with joint sprain, accounting for 31.25%; There were 8 athletes with meniscus injury, accounting for 12.50%; There were 8 athletes with patellar strain, accounting for 12.50%; There were 6 athletes with fatigue periostitis, accounting for 9.38%; There was one athlete with other conditions, accounting for 1.56%.

Table 1. Basic information of the experimental group and the control group.

Essential information	Experience group	Control group
Age	23.8242±1.0875	24.4198±0.8898
Height (cm)	171.9681±4.5570	180.2973±3.0463
Weight (kg)	66.1424±6.1546	63.9721±3.9707
Training years	8.6204±1.2152	8.4490±1.1139

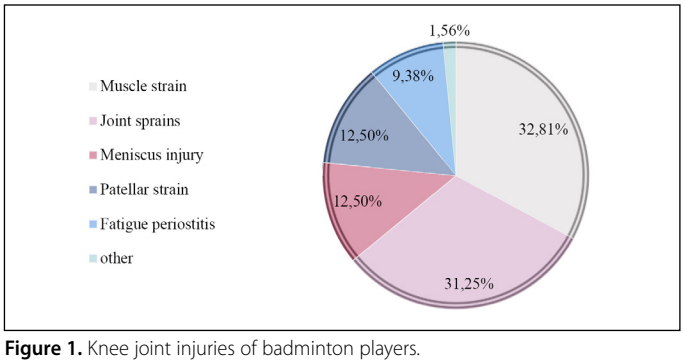

Figure 1. Knee joint injuries of badminton players.

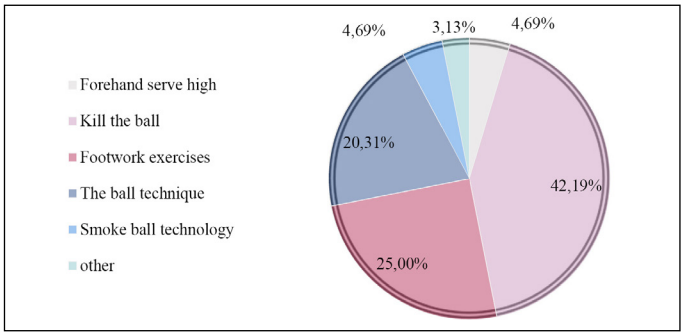

Figure 2. Technical reasons of badminton players' knee joint injuries.

As shown in Figure 2, when the athletes have knee joint injuries, they are in the action. It can be seen from the data that among the 64 players, 3 players were injured during forehand serve, accounting for 4.69%; 27 athletes were injured in the killing process, accounting for 42.19%; 16 athletes were injured during footwork practice, accounting for 25.00%; 13 athletes were injured in the process of catching skill practice, accounting for 20.31%; There were 3 players injured in the process of drawing skill practice, accounting for 4.69%; In other cases, 2 athletes were injured, accounting for 3.13%. This shows that the knee joint injuries of athletes often occur when they perform some more intense or unfamiliar movements. Through the interview with these athletes, it can be found that when the competition or training is in a more intense stage, many athletes tend to be too excited and neglect their own safety protection, which is easy to cause some strains and sprains. There are also some athletes who are eager for success if they do not master footwork fluently in the learning and training of footwork, which leads to knee joint injuries. This shows that when playing badminton, we should pay attention to laying a good foundation and playing steadily. We should always pay attention to our own situation on the court to prevent sports injuries.

Pain recovery of badminton players during rehabilitation of knee joint injury

The impact of knee injury on life of athletes, on the one hand, focuses on the impact of pain on daily life. Therefore, the recovery of pain can be regarded as a judgment index of knee injury recovery. In terms of pain judgment, a three-point system is selected, in which athletes score their pain according to their own state. The higher the score, the stronger the pain. Before the start of the experiment and every Wednesday during the experiment, the athletes will score according to their own state, collect the data, sort out and draw the relevant trend chart, as shown in Figure 3.

It can be seen from Figure 3 that the scores of the experimental group in the 6-week rehabilitation process changed from 2.56 points → 2.36 points → 2.16 points → 1.96 points → 1.56 points → 1.06 points → 0.76 points. The scores of the control group in the 6-week rehabilitation process were 2.42 points → 2.32 points → 2.22 points → 2.02 points → 1.92 points → 1.62 points → 1.42 points. In general, both the restorative training and the traditional physical therapy, massage and acupuncture methods have promoted the recovery of the athletes' knee joints, and the pain index of the athletes has shown a downward trend in 6 weeks. Through the specific analysis of the time period, it can be seen that the experimental group showed a downward trend of fluctuations in the whole process, and the overall decline rate showed a state of shrinking first and then increasing, indicating that the athletes had a good effect on pain treatment in the whole recovery process. It can be seen from this that both the traditional acupuncture and physiotherapy and the restorative training in this paper can promote the pain relief of knee joint injured athletes, but the restorative training proposed in this paper is more effective than the traditional physiotherapy.

Stability index of injured knees of badminton players before and after rehabilitation training

Stability index refers to the ability of athletes to control balance in different directions. The lower the value, the better the ability to control dynamic balance, and the more stable the knee joint.

Table 2 shows the stability index of injured knees of badminton players before and after rehabilitation training. The total stability index of the experimental group before training was 6.3432 ± 0.4647, the front and back stability index was 4.6382 ± 0.3139, and the left and right stability index was 4.2612 ± 0.4368. After six weeks of training, the total stability index of the experimental group was 5.7190 ± 0.3747, the front and back stability index was 4.2784 ± 0.3341, and the left and right stability index was 3.7975 ± 0.4152. This shows that the rehabilitation training proposed in this paper can greatly optimize the stability index of the athletes' knee joint, thereby enhancing the athletes' control of the knee joint. The total stability index of the control group before training was 6.4623 ± 0.3361, the stability index before and after training was 4.9181 ± 0.1965, and the left and right stability indexes were 4.4220 ± 0.3673. After six weeks of training, the total stability index of the control group was 6.3473 ± 0.3848, the front and back stability index was 4.8305 ± 0.1745, and the left and right stability index was 4.5862 ± 0.2680. This shows that the traditional acupuncture and physiotherapy can also optimize the stability index of the athletes' knee joint, but compared with the experimental group, the optimization range of the control group is significantly lower, which shows that for athletes, the effect of using restorative training is better than passive massage physiotherapy.

DISCUSSION

Knee joint injuries can be divided into two categories: chronic knee joint injuries and acute knee joint injuries. Generally, acute knee joint injury is more serious. Most acute knee injuries are caused by instant impact or sudden distortion of the knee. Due to the technical movements of badminton, there are often sudden stops and changes in equality.

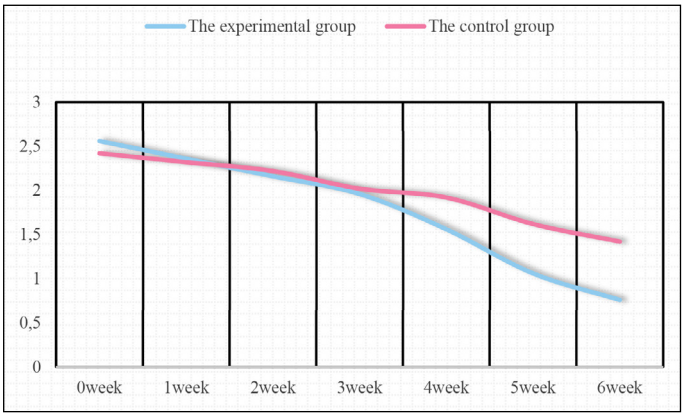

Figure 3. Pain recovery of badminton players during rehabilitation of knee joint injuries.

Table 2. Stability index of injured knees of badminton players before and after rehabilitation training.

Time	Option	Experience group	Control group
Before training	Total stability index	6.3432±0.4647	6.4623±0.3361
	Front and rear stability index	4.6382±0.3139	4.9181±0.1965
	Left right stability index	4.2612±0.4368	4.4220±0.3673
After training	Total stability index	5.7190±0.3747	6.3473±0.3848
	Front and rear stability index	4.2784±0.3341	4.8305±0.1745
	Left right stability index	3.7975±0.4152	4.5862±0.2680

These technical movements will bring potential safety hazards to the knee joint. Secondly, the athletes did not land their feet properly after the jump, and the knee joint was subjected to great stress. Causes the knee joint to twist. The above two points are the main reasons for the acute injury of the knee joint during the actual combat. The reason of chronic knee joint injury is mostly due to accumulated sports wear and tear, which has an irreversible impact on the knee joint. It is common that the meniscus is seriously worn, resulting in insufficient cushioning at the joint of the thigh and calf. Chronic knee joint injury is mainly related to the consumption of knee joint. The more serious chronic knee joint injury requires the replacement of artificial tissues by medical means. There are also many objective factors affecting knee joint sports injury. First of all, there is a lack of necessary warm-up links before the start of sports. When the preparatory activities before sports are insufficient, the flexibility of their own joints does not meet the needs of sports, which may greatly cause sports injuries at joints in the process of sports. When self warm-up activities are fully guaranteed, even if sports risks occur, the severity of sports risks can be effectively reduced. Secondly, too long exercise time and too much exercise frequency are also indirect causes of knee joint injury. When a sport is over, all parts of the body tissues, joints and muscles are in a state of fatigue. If you don't get enough rest, continue to exercise. The body will be overloaded. It greatly increases the risk of sports injury. In addition, the knee joint bears all the gravity above the knee of the body. Under fatigue, the knee joint cannot bear the movement with this gravity intensity. Once the risk occurs in the fatigue state, the severity of the risk is relatively high. Lack of adequate self-protection awareness is also an indirect cause of knee joint sports injury. In the process of sports, we should develop the habit of wearing sports protective equipment for our vulnerable tissues. Professional sports protective equipment can provide a relatively safe sports environment for oneself. Provide adequate protection for joints when accidents occur. Moreover, due to lack of self-protection awareness. When injured, it is easy to miss the best period of treatment because the injured cannot be dealt with immediately, resulting in slow recovery. It is very likely that acute injury will change into irreversible chronic injury. The nonstandard technical movements are also a part of the causes of knee joint sports injuries. If you use the wrong technical movements, you may cause the movement burden of the knee joint, which will have a certain consumption impact on the knee joint. Finally, it is also a part of the reason that their physical quality cannot meet the project requirements. In badminton, many technical movements require a certain basis for physical attributes. In the process of training and actual combat, athletes should avoid blind sports and should not use technical actions beyond their own capabilities. Through daily training, improve their physical fitness, can effectively avoid knee injury.

CONCLUSION

In the sport process of badminton, players need to constantly change their positions according to the actual situation of the game to complete various combat actions, which brings a certain pressure to the athletes' knee joints, and it is easy to cause knee joint injuries. Therefore, this paper puts forward relevant recovery strategies for badminton players' knee injuries. The research results show that active restorative training has a good effect on the relief of knee joint pain and the improvement of stability of athletes, which is better than passive acupuncture and physiotherapy. Therefore, some targeted restorative training should be purposefully added to the knee joint rehabilitation of athletes, so that athletes can better recover their knee joints and return to the competition field.

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AUTHORS' CONTRIBUTIONS: The author has completed the writing of the article or the critical review of its knowledge content. This paper can be used as the final draft of the manuscript. Every author has made an important contribution to this manuscript. Tiejun Zhang: writing and execution.

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