CLINICAL DIAGNOSIS AND TRAINING OPTIMIZATION ON KNEE SPORTS INJURIES

DIAGNÓSTICO CLÍNICO E OTIMIZAÇÃO NO TREINAMENTO PARA LESÕES ESPORTIVAS NO JOELHO

DIAGNÓSTICO CLÍNICO Y OPTIMIZACIÓN DEL ENTRENAMIENTO DE LAS LESIONES DEPORTIVAS DE LA RODILLA

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ABSTRACT

Introduction: The knee joint is one of the sites of greatest mechanical stress in the lower limbs. The overload generated by impacts, blows from falls, and torsions in collisions can generate disabling tissue damage that is difficult to recover from. Although lacking clinical diagnosis, some studies have pointed out that implementing functional training in rehabilitation can reduce the period of disability and the harmful effects of immobilization. Objective: Study the clinical diagnosis and the optimization of training for knee sports injuries. Methods: This experiment uses the intra-group comparison method. The method used in the experiment is a rehabilitation training protocol for the knee joint, focusing on quadriceps muscle strength and balance. The training cycle is six times per week for one month. Results: The optimization in exercise training evidenced a good improvement in functional ability and pain condition, reflected in the athletes' balance ability. After training optimization, 9 out of 12 athletes recovered completely, and three improved significantly. Conclusion: Trainers should follow the physical rehabilitation orders and match them with the athletes' actual situation, sport types, etc., designing the appropriate sports mode for the athletes to promote training optimization and reduce sports joint injuries. ***Level of Evidence II; Therapeutic Studies - Outcome Investigation.***

Keywords: Knee Injuries; Sports Injuries; Clinical Diagnosis.

RESUMO

Introdução: A articulação do joelho é um dos locais com maior estresse mecânico nos membros inferiores. A sobrecarga gerada por impactos, os golpes por quedas e torções em colisão podem gerar danos teciduais incapacitantes e de difícil recuperação. Embora careça de diagnósticos clínicos, alguns estudos têm apontado que a implementação do treinamento funcional na reabilitação pode reduzir o período de incapacitação e os efeitos deletérios da imobilização. Objetivo: Estudar o diagnóstico clínico e a otimização no treinamento para lesões esportiva do joelho. Métodos: Este experimento utiliza o método de comparação intragrupo. O método utilizado no experimento é o protocolo de um treinamento de reabilitação direcionado a articulação do joelho, com foco na força e equilíbrio muscular do quadríceps. O ciclo de treinamento é de 6 vezes por semana, durante 1 mês. Resultados: A otimização no treinamento do exercício evidenciou uma boa melhora na capacidade de funcional e condição de dor, refletindo na melhoria da capacidade de equilíbrio dos atletas. Após a otimização do treinamento, 9 dos 12 atletas se recuperaram completamente, e 3 atletas melhoraram significativamente. Conclusão: Os treinadores devem acatar as ordens de reabilitação física e combiná-las com a situação real dos atletas, tipos esportivos, entre outros fatores, projetando o modo esportivo adequado aos atletas, visando promover a otimização do treinamento e reduzir as lesões esportivas nas articulações. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Traumatismos do Joelho; Lesões Esportivas; Diagnóstico Clínico.*

RESUMEN

Introducción: La articulación de la rodilla es uno de los lugares de mayor tensión mecánica en los miembros inferiores. La sobrecarga generada por los impactos, los golpes de las caídas y las torsiones en colisión pueden generar daños tisulares incapacitantes y de difícil recuperación. Aunque carecen de diagnóstico clínico, algunos estudios han señalado que la aplicación del entrenamiento funcional en la rehabilitación puede reducir el periodo de discapacidad y los efectos nocivos de la inmovilización. Objetivo: Estudiar el diagnóstico clínico y la optimización del entrenamiento de las lesiones deportivas de la rodilla. Métodos: Este experimento utiliza el método de comparación intragrupo. El método utilizado en el experimento es el protocolo de un entrenamiento de rehabilitación dirigido a la articulación de la rodilla, centrado en la fuerza muscular del cuádriceps y el equilibrio. El ciclo de entrenamiento es de 6 veces por semana durante 1 mes. Resultados: La optimización en el entrenamiento de ejercicios evidenció una mejora en la capacidad funcional y en el estado del dolor, lo que se refleja en la mejora de la capacidad de equilibrio de los atletas. Tras la optimización del entrenamiento, 9 de los 12 atletas se recuperaron por completo, y 3 atletas mejoraron significativamente. Conclusión: Los entrenadores deben seguir las órdenes de rehabilitación física y combinarlas con la situación real de los atletas, los tipos de deporte, etc., diseñando el modo de deporte adecuado para los atletas, con el objetivo de promover la optimización del entrenamiento y reducir las lesiones articulares deportivas. ***Nivel de evidencia II; Estudios terapéuticos - investigación de resultados.***

Descriptores: *Traumatismos de la Rodilla; Lesiones Deportivas; Diagnóstico Clínico.*

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INTRODUCTION

Joint is an important part of supporting human movement. As the largest and most complex joint of human body, knee joint plays an important role in people's daily life and movement. If knee joint is damaged, it will cause inconvenience in the process of action, and it will have a certain impact on walking and even standing upright.[1] However, compared with the complex functions, the vulnerability of the knee joint is. For people, especially athletes, many sports are against the principles of human mechanics and anatomy, resulting in excessive load on their own body. As a part under great pressure, if there is a collision or bump between the bodies during the movement, the exercise intensity is too high If you don't pass the sports skills, it is very easy to have problems with the knee joint, such as ligament injury, articular cartilage injury, meniscus injury and so on. Due to the limitation of current medical technology, the damaged knee joint can not be completely restored, so it can only be treated and optimized as much as possible.[2]

For athletes, once knee joint injury occurs in the process of sports training, professional rehabilitation personnel should choose appropriate ways for targeted rehabilitation under the premise of complex structure of knee joint, and return to the field after a period of rest to reach the original sports level, but there are still some hidden dangers in knee joint at this time, If the training is not optimized in time, it will easily lead to the recurrence of the problem. Therefore, in the process of sports training, athletes should pay attention to optimizing training methods, protecting knee joints and improving their sports performance.[3]

METHOD

Selection of subjects

Arthroscopy is a common examination method after joint injury, which has the characteristics of high accuracy and small trauma. However, for athletes, minor injuries may have an adverse impact on their sports career. Therefore, the application of non-invasive MRI technology is very necessary. To explore the diagnostic effect of MRI technology, we need to have enough samples for comparison. However, for athletes, although knee joint sports injury is more common, its overall proportion is small. If only athletes with knee joint injury are taken as the research object, there will be a way of insufficient sample number and error. The study and all the participants were reviewed and approved by Ethics Committee of Northeastern University at Qinhuangdao (NO. NUQIN-ZD19024). Therefore, in determining the diagnostic effect of MRI technology, Through the way of volunteer recruitment, some knee injury patients who have experienced arthroscopic diagnosis and obtained the diagnostic results were recruited for MRI detection, and the results were compared with the results of knee arthroscopy, so as to analyze their effectiveness.

In the research of knee training optimization, this paper selects 13 athletes with knee sports injury as the research object. In order to eliminate the interference of human factors as much as possible, when selecting athletes, according to the principle of full voluntariness, fully explain and inform the information to be provided by the experiment, the operation to be carried out, and the rules to be observed. After obtaining the recognition and consent of athletes, they will be included in the research object and tested.

Optimal experimental design of knee joint training

After the athletes warm-up to a certain extent, first keep the knee joint about 70 degrees in the form of knee bending and squatting, with both feet the same width as the shoulder. The knee joint is located behind the toes, and the upper body leans back with force. Keep the state of continuous force for three minutes and hold three groups every day. Then maintain the sitting position, tie the elastic belt at the ankle joint, the lower leg will sag naturally, and complete the knee extension through the force of both legs. At this time, the elastic belt belongs to the stress state, the legs are completely straight and the force is maintained for 3 ~ 5 seconds, and then take a certain rest, 20 times in each group, and hold three groups every day. Maintain the bending range of the injured knee joint at the angle of 45 degrees in a standing position, bend the other leg back, and carry out balance training and rehabilitation training with both hands behind the body. Maintain this position for two minutes and adhere to 5 groups every day. In the whole exercise process, we should pay attention to the protection of athletes' knee joints so that they do not feel hard during the exercise. However, in order to ensure a single variable of the experiment, we need to carry out the same protection as all athletes. In addition, athletes should reasonably arrange the training load according to their own actual situation. If they feel discomfort of knee joints during training Pain and so on, we should report to professionals in time and ask for help in time to prevent knee injury caused by blind training. During the training process, one of the 13 athletes had knee discomfort, so the experiment was terminated. After removing the falling samples, a total of 12 athletes were compared with the relevant data.

RESULTS

Clinical diagnostic criteria and result analysis of knee sports injury

As a medical image, MRI technology has both the advantages of image diagnosis and the disadvantages of image diagnosis. In terms of advantages, compared with arthroscopy or other imaging technologies, MRI is a real non-invasive technology and will not cause damage to the detector. In addition, there is no need to inject contrast agent, so as to reduce the interference to the detector's body as much as possible. Compared with the current more mature CT detection technology, it can directly detect the images of cross-section, sagittal plane and various inclined body layers without artifacts and other interference. Therefore, it is favored by the medical academic community and has become a mainstream trend of current development. However, MRI technology is not mature and there are still many problems. For example, compared with arthroscopy, Mr. technology can only be diagnosed by experienced doctors through images, and cannot have a certain understanding of regional images and pathology at the same time as arthroscopy. In addition, MRI technology has high requirements for patients. If patients have metal objects in their bodies, cardiac pacemakers, severe claustrophobia or more than three months of pregnancy, relevant tests cannot be carried out. Therefore, its development needs to be further improved.

When analyzing the clinical diagnosis of knee sports injury, some patients who have been diagnosed by arthroscopy are examined, and the results are compared to explore the characteristics and diagnostic effectiveness of knee sports injury, as follows.

As shown in Figure 1, the MRI and arthroscopic grading diagnosis results of knee cartilage injury are shown. From Figure 1, it can be seen that most

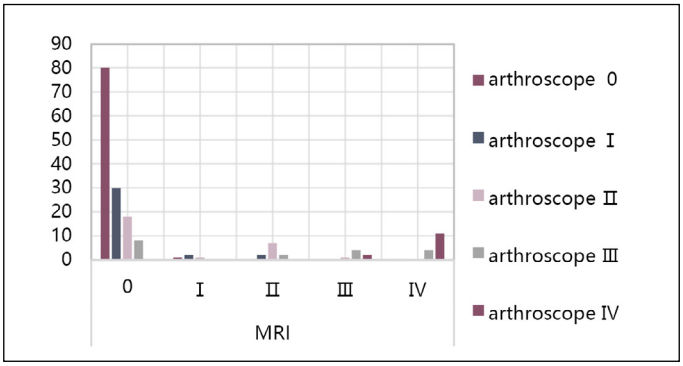

Figure 1. Comparison of MRI and arthroscopic grading diagnosis of knee cartilage injury.

of the people who are judged as grade 0 by arthroscopy are also judged as grade 0 in MRI, while most of the people who are judged as grade 1 by arthroscopy are also judged as grade 0. Most of the people who are judged as the heaviest grade IV by arthroscopy are judged as grade IV, However, for patients who are judged as grade II and III by arthroscopy, the MRI grade is relatively vague, and there are grades I to IV. therefore, due to the lack of experience in MRI image diagnosis, compared with arthroscopy, there can only be a clear judgment on some mild or severe symptoms, and the judgment on the intermediate grade is not clear enough.

As shown in Figure 2, the MRI and arthroscopic grading diagnosis results of the medial and lateral meniscus are shown. From Figure 2, it can be seen that the grade assessed by arthroscopy is not different from that determined by MRI technology. Only a small number of individuals have chaotic state, and all grades appear, which shows that compared with the articular cartilage mentioned above, the damage state of meniscus is relatively obvious, and its observation accuracy is stronger. For some chaotic states, the analysis may be related to the actual situation of the individual case, which also reflects that the accuracy of MRI is closely related to the level of doctors, and there are still some differences compared with arthroscopy.

As shown in Figure 3, the MRI and arthroscopic grading diagnosis results of ligament injury are shown. From Figure 3, it can be seen that there is little difference between the grade assessed by arthroscopy and the grade determined by MRI technology. Only a few individuals have chaotic state, and all grades appear, but there are still some differences compared with the meniscus and articular cartilage mentioned above, For example, in the selection of cases, the number of people with ligament injury is relatively small, and most of them are in grade 0 or grade III state, showing very obvious polarization. Therefore, there are undoubtedly many fewer obstacles in the process of diagnosis. Therefore, the author believes that in the MRI judgment of ligament, a large number of cases still need to be continuously collected for integration and processing.

From the comparison of the diagnostic results of articular cartilage meniscus and ligament injury, it can be seen that compared with more accurate arthroscopy, MRI diagnostic technology still has some defects in knee injury. The key performance is that the diagnosis of mild and most severe patients is relatively clear, while for patients with moderate injury, it is prone to confusion. This may be related to the lack of experience of current diagnostic personnel and the lack of more comprehensive diagnostic samples, which need to be further optimized.

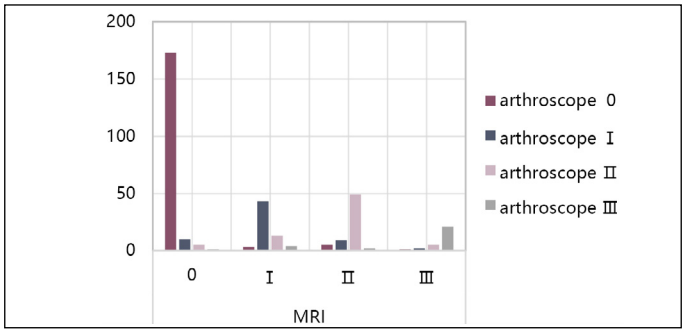

Figure 2. Comparison of MRI and arthroscopic grading diagnosis results of medial and lateral meniscus.

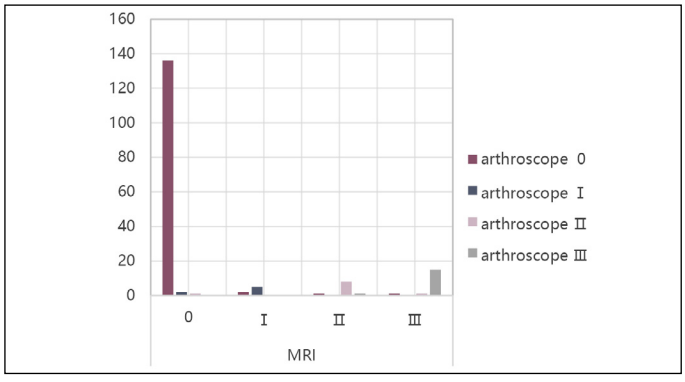

Figure 3. Comparison of MRI and arthroscopic grading diagnosis of ligament injury.

Analysis of training optimization effect of knee sports injury

As shown in Figure 4, the optimization index of knee joint sports injury is shown. From Figure 4, it can be seen that the pain index is significantly reduced from (2.732 ± 0.678) before training optimization to (0.506 ± 0.536) after training optimization, indicating that the pain is reduced. $P < 0.01$ indicates that there is a very significant difference. Lysholm score increased from (69.391 ± 6.620) before training optimization to (87.038 ± 5.181) after training optimization, indicating that the knee function was improved, $P < 0.01$, indicating that there was a very significant difference. The range of motion of knee joint was increased from (104.705 ± 1.103) degree before training optimization to (112.581 ± 0.299) degree after training optimization, which showed that the flexibility of knee joint was increased, $P < 0.01$, indicating that there was a very significant difference. The thigh circumference of 10cm above the patella was increased from (53.737 ± 5.005) cm before training optimization to (56.470 ± 4.357) cm after training optimization, which showed that the muscle volume and strength near the knee joint were enhanced and had a better protective effect on the knee joint, $P < 0.01$, indicating that there was a very significant difference. This shows that the optimization of knee motion training has a good improvement on knee motion ability and pain, $P < 0.01$, indicating that there is a very significant difference.

As shown in Figure 5, it shows the impact of training optimization of knee sports injury on balance ability, where OSI is the overall stability index, that is, the overall stability index; API is the anterior posterior

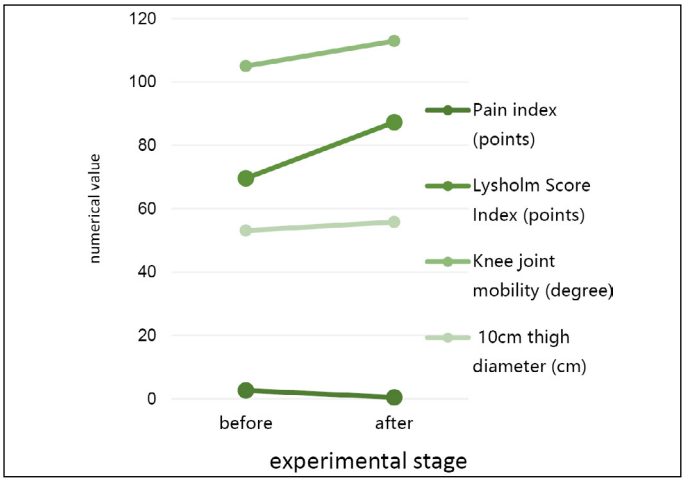

Figure 4. Training optimization index of knee joint sports injury.

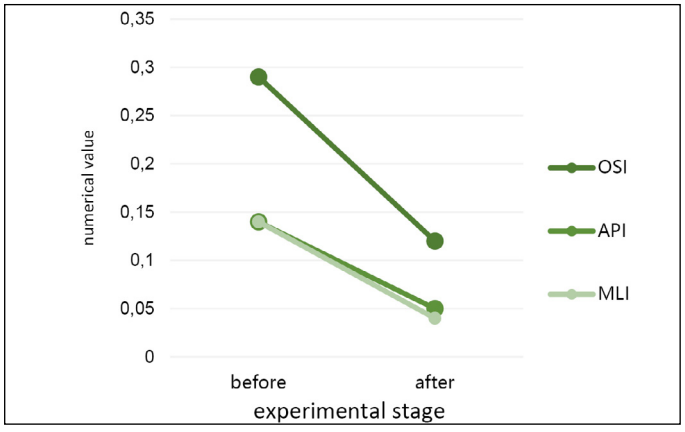

Figure 5. Effect of training optimization of knee sports injury on balance ability.

index; MLI is the internal and external index, i.e. the medical later index. As can be seen from Fig. 5, the OSI index decreased significantly from (0.2935 ± 0.0101) before training optimization to (0.1214 ± 0.0202) after training optimization, $P < 0.01$, indicating that there is a very significant difference; API index decreased significantly from (0.1397 ± 0.0304) before training optimization to (0.0506 ± 0.0299) after training optimization, $P < 0.01$, indicating that there was a very significant difference; The MLI index decreased significantly from (0.1417 ± 0.0299) before training optimization to (0.0399 ± 0.0202) after training optimization, $P < 0.01$, indicating that there was a very significant difference. This shows that the optimization of knee exercise training has a good improvement on the balance ability of athletes, $P < 0.01$, indicating that there is a very significant difference.

DISCUSSION

For athletes with knee injury, only by restoring the normal angle of the joint can we avoid the rapid decline of muscle strength around the knee joint due to the failure of the knee joint to function normally. Knee medial collateral ligament (MCL) injury is the most common type of knee injury in sports. MCL injury brace shall be used for fixation for 4 weeks, and active and passive rehabilitation training shall be carried out. Generally, it will gradually return to the normal joint angle within 2-3 weeks; After the anterior cruciate ligament (ACL) injury of the knee joint, the brace shall be used for fixation within 8 weeks. Generally speaking, it can be normal two weeks after operation without affecting the normal angle of the joint.[4] The scope of knee joint exercise mainly includes flexion training and extension training. Among them, the flexion training mainly adopts skateboarding, while the extension movement mainly adopts knee hyperextension.[5]

Clinical research shows that knee injury will lead to the weakening of muscle strength around the joint. Quadriceps femoris atrophy is very common in injured athletes, and it is also accompanied by the loss of strength during knee extension. This phenomenon often occurs during knee injury and lasts for a long time, which further leads to the loss of stability. Obviously, the muscle strength of extensor and flexor muscles around the knee joint has an important relationship with the normal function of the knee joint. At present, sports training experts and rehabilitation experts at home and abroad have jointly recognized the first quadriceps exercise. Among many training methods, isometric contraction training is considered to be the most commonly used training method for athletes' knee injury or early postoperative rehabilitation, and it is also considered to be the most suitable and effective recovery method.[6]

CONCLUSIONS

It can be seen from this study that the current MRI technology can reduce the damage to the body as much as possible, and its interference is the least for athletes. Therefore, it can be used as a way to detect the health of athletes' knee joints. However, if an athlete has a certain injury to his knee joint, he should further use arthroscopic technology for diagnosis on the basis of MRI technology, so as to have a clearer understanding of his own joint injury. Coaches should collect the doctor's advice and combine it with the actual situation and sports types of athletes to design their own sports methods for athletes, so as to promote the optimization of athletes' training and reduce knee sports injury as much as possible.

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AUTHORS' CONTRIBUTIONS: Every author has made an important contribution to this manuscript. TY: writing; CJ and YM: execution.

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