ATHLETE TEARING AND REHABILITATION CHARACTERISTICS

AS CARACTERÍSTICAS DE RUPTURAS EM ATLETAS E SUA REABILITAÇÃO

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Dandan Zhao[1]
(Physical Education Professional)
Hua Zhang[2]
(Physical Education Professional)
Hongseol Kim[3]
(Physical Education Professional)
Yiming Shu[4]
(Physical Education Professional)

1. Paichai University, Daejeon Korea.
2. Anhui Normal University, Anhui, China.
3. Paichai University, Daejeon Korea.
4. Anhui Polytechnic University, Anhui, China.

Correspondence
Yiming Shu
Anhui, China, 241000.
shuyiming9@163.com

ABSTRACT

Introduction: The speed and quality of functional recovery after knee cruciate ligament reconstruction directly affect the training effect and competition results of athletes. Objective: To evaluate the effect of early systematic rehabilitation after reconstruction of ligament tears in outdoor sports athletes. Methods: In this study, Liu Mou, an outstanding player of the national men's rugby team, was selected as the experimental object. A rehabilitation training program was adopted, and rehabilitation began from 2 to 5 weeks after reconstruction. Results: After the recovery of the first stage for 4 weeks, the knee extension Angle of the injured limb in Liu's sitting position reached 180 degrees. In the second stage of rehabilitation physical training, the body composition test showed that body fat decreased from 20.8% before rehabilitation to 16.3%. At the end of the third stage of physical training, he could complete the high flip. Conclusions: Through different stages of postoperative rehabilitation physical training, Liu's physical condition fully recovered to a higher level. He could then participate in normal football training and return to the game, indicating that Liu's rehabilitation training after anterior cruciate ligament reconstruction is effective. ***Level of evidence II; Therapeutic studies - investigation of treatment results.***

Keywords: Athletes; Anterior cruciate ligament injuries; Rehabilitation.

RESUMO

Introdução: A velocidade e qualidade da recuperação funcional após a reconstrução de ligamentos cruzados do joelho diretamente afetam o efeito do treinamento e resultados de competição de atletas. Objetivo: Avaliar o efeito da reabilitação sistemática precoce após a reconstrução de rupturas dos ligamentos em atletas de esportes ao ar livre. Métodos: Neste estudo, Liu Mou, um excepcional jogador do time masculino nacional de rúgbi, foi escolhido como objeto do experimento. Um programa de treino de reabilitação foi adotado e a reabilitação começou de 2 a 5 semanas após a reconstrução. Resultados: Após a recuperação da primeira fase por 4 semanas, o ângulo de extensão do joelho do membro lesado na posição sentada alcançou 180 graus. Na segunda fase de reabilitação por treino físico, o teste de composição corporal mostrou que a gordura corporal havia diminuído de 20,8% antes da reabilitação para 16,3%. Ao final da terceira fase de treino físico, Liu pode completar um high flip. Conclusões: Através das diferentes fases de treinamento físico de reabilitação pós-operatório, a condição física de Liu foi completamente recuperada a um nível elevado. Ele pode então participar de treinos normais no rúgbi e voltar a jogar, o que indica que o treino de reabilitação de Liu após a reconstrução ligamentar cruzada foi eficaz. ***Nível de evidência II; Estudos terapêuticos – investigação de resultados de tratamento.***

Descritores: *Atletas; Lesões do ligamento cruzado anterior; Reabilitação.*

RESUMEN

Introducción: La velocidad y calidad de la recuperación funcional tras la reconstrucción de ligamentos cruzados de la rodilla derecha afectan el efecto del entrenamiento y resultados de competición de atletas. Objetivo: Evaluar el efecto de la rehabilitación sistemática temprana tras la reconstrucción de roturas de los ligamentos en atletas de deportes al aire libre. Métodos: En este estudio, Liu Mou, un excepcional jugador del equipo masculino nacional de rugby, fue elegido como objeto del experimento. Un programa de entrenamiento de rehabilitación se adoptó y la rehabilitación empezó de 2 a 5 semanas tras la reconstrucción. Resultados: Tras la recuperación de la primera fase por 4 semanas, el ángulo de extensión de la rodilla del miembro lesionado en la posición sentada alcanzó 180 grados. En la segunda fase de rehabilitación por entrenamiento físico, el test de composición corporal mostró que la grasa corporal había disminuido de 20,8% antes de la rehabilitación para 16,3%. Al fin de la tercera fase de entrenamiento físico, Liu ha podido completar un high flip. Conclusiones: Por medio de las diferentes fases de entrenamiento físico de rehabilitación postoperatorio, la condición física de Liu fue completamente recuperada a un nivel elevado. Él pudo, entonces, participar de entrenamientos normales en el rugby y volver a jugar, lo que indica que el entrenamiento de rehabilitación de Liu tras la reconstrucción del ligamento cruzado fue eficaz. ***Nivel de evidencia II; Estudios terapéuticos – investigación de resultados de tratamiento.***

Descriptores: *Atletas; Lesiones do ligamento cruzado anterior; Rehabilitación.*

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INTRODUCTION

The anterior cruciate ligament of the knee joint of athletes (anterior cruciate ligaments, ACL) enhanced functional training after reconstruction is very different from postoperative rehabilitation in the general population, it is required to restore the athletes' special competitive ability to the highest level.[1] At present, there are some controversies in the rehabilitation training of athletes after ACL reconstruction of knee joint, such as how to arrange different training methods, means and training loads in different stages for special sports. Although the conventional rehabilitation training treatment plan takes into account the postoperative knee inflammatory reaction period, graft loosening and other clinical problems, however, the implementation of comprehensive physical training and progressive special sports strengthening functional training plan starting early after surgery is often insufficient, which leads to improper methods of lower limb functional training and improper arrangement of exercise load, affecting athletes' recovery of competitive level and timely return to the competition.[2,3]

Rugby is a high-intensity, intense competition, sports injury is inevitable, attacking players in the high-speed change movement, the hip, knee and ankle joints are always in extreme torsion state, which makes the lower limb joints vulnerable to injury, especially the anterior cruciate ligament of the knee joint (anteri-or cruciate ligament,ACL) damage. The injury of ACL will directly affect the training and competition. Whether the rehabilitation training after ACL reconstruction is reasonable and effective, whether it can restore the normal function of the knee joint and help athletes to return to the competition as soon as possible is very important. Taking rugby players as an example, the characteristics of ligament tear injury and the post-reconstruction health were studied.[4,5]

METHOD

Subjects

Liu, an excellent player of the National Men's Rugby Team, stepped on an uneven place on his right foot during the training before a certain match and suffered severe pain in his right knee joint. He was positive for Lachman test and Pivot shift test, after NMR examination, non-contact anterior cruciate ligament rupture of the right leg was confirmed. Therefore, ACL reconstruction of the right knee and meniscus suture were performed in a certain hospital. Three days later, the patient was discharged.

Rehabilitation training program

The rehabilitation training is divided into three stages. The first stage is the second to the fifth week after the operation. The main purpose is to control the swelling of the joints, increase range of motion, prevent quadriceps atrophy, and early gait training, as shown in Table 1. Liu then rested from the 6th to 10th week and stopped rehabilitation training. The second stage is the 11th to 16th week after the operation. The main purpose of the second stage is to improve scar adhesion, enhance relevant muscle strength, stabilize the knee joint and restore the basic functional activities of the right lower limb, improve upper limb muscle strength, cardiopulmonary function, muscle group strength in other key areas and overall physical quality, as shown in Table 2. During the 17-20 weeks after surgery, the patients exercised at home according to the training content of Stage 2. At the 21st week after surgery, he returned to the team and started the third stage of physical training. During the 21-40 weeks after surgery, sensitivity, balance and stability training were mainly carried out on the basis of the second stage of rehabilitation physical training, strengthen collision, avoidance, self-protection and other skills, strengthen rugby specific physical fitness, including Perturbation training, Trampoline balance and proprioception training, Treadmill training. Double line distance five mark around the mark running, kneeling before throwing medicine ball, elastic with push-ups turn over and turn, diving column squat after throwing, etc, the physical training program can be adjusted at any time according to the individual's ability. The training methods include step-by-step training, cycle training and pyramid training.

RESULTS

Rehabilitation effect of stage 1

The examination results of Liu on the second week after the operation, that is, before the first stage of recovery, showed that: Right patella mobility is obviously insufficient; The skin temperature of the right knee joint was high and the swelling was obvious. Both active and

Table 1. Stage 1 rehabilitation training plan.

Rehabilitation action	Number (PCS)	Number of groups (group)	Intermittent (seconds)	Note
Ankle pump for advanced resistance to ankle flexion and extension	20	2	0	8~10 Time/day
Activity of patella	4 directions per group, 15 in each direction	1	0	4 Time/day
The fourth week of passive knee extension was advanced to active knee extension	The brace was removed every 2~3 hours, the heel pad was raised, the knee joint was suspended, and the knee joint was passively depressed and fully extended for 10~15 minutes. With the assistance of the healthy leg, the affected limb is raised and the quadriceps femoris of the affected limb is actively contracted to straighten the knee joint.			
The fourth week of supine closed chain knee flexion was advanced to suspension open chain active knee flexion	50	2	120	2 Time/day
Quadriceps isometric contraction	60, each contraction should be maintained for 6 s	1	0	3 Time/day
Lie on the back straight leg lift the 4th week step up to the sitting position straight leg lift	10~20, lift 20 cm and hold for 6 seconds	3	60	3 Time/day
Side lying on the inside straight leg lift	10, lift 5 cm and hold for 6 seconds	3	60	2 Time/day
Lie on the lateral side of the leg straight	10, lift 5 cm and hold for 6 seconds	3	60	2 Time/day
Lie on your stomach and lift your legs	10, lift 5 cm and hold for 6 seconds	3	60	2 Time/day
Leg lifts on the bridge	20~30	3	60	3 Time/day
Squatting (from the 3rd week after surgery)	Every 20 s	1		Start at 120 degrees

Table 2. Stage 2 rehabilitation physical training plan.

Rehabilitation action	Number (PCS)	Number of groups (group)	Intermittent (seconds)	Note
Bend your legs with weights	The injured side was loaded with 5 kg for 5 times, and then advanced to 25 kg for 14 times	3~4	60	Rehabilitation progresses in steps and cycles according to the individual's ability.
	The healthy side load 5 kg, 50 times, advanced to 25 kg, 19 times	3~4	60	
Leg flexion and extension with weight	The injured side was loaded with 15 kg, 3 times, and advanced to 40 kg, 16 times	3~4	60	
	The healthy side load 15 kg, 30 times, advanced to 40 kg, 16 times	3~4	60	
Upgrade the Octavia Lunge Squat	8 to 15 times on each leg	3~4	60	
Squat with heavy weights	Loading 2.5kg, 20 steps	3~4	30	
The bench press	80 kg, 10 times, up to 150 kg, 1 time	1	0	
Pull-ups	From 15 unloaded, advanced to 32 kg chain loaded, 6 + flexor arm support super group	3	30	
High turn over	40 kg, 6 times, up to 55 kg, 10 times	6	45	
A hard pull	80 kg, 6 times, advance to 100 kg, 10 times	3	60	
Bottom plate curls	10 kg, 30 times, up to 20 kg, 20 times	6	60	
The Roman chair straightened	5 kg, 10 times, up to 10 kg, 20 times	6	60	

passive flexion were poor, the right knee joint could not be locked, and the muscle strength of the medial quadriceps femoris was insufficient. After the first stage of rehabilitation, knee flexion and bilateral thigh circumference changed as follows.

Changes in knee flexion and bilateral thigh circumference

After 4 weeks of rehabilitation, Liu's knee extension Angle of the injured limb in the sitting position reached 180 degrees, and the passive and active flexion of the injured knee joint in the prone position were both greatly improved, as shown in Figure 1.

Effect of Stage 2 Rehabilitation Physical Training

Pre-convalescence examination results of stage 2 showed: Slight inactivity of the right patella; Postoperative scar adhesion; Slight swelling of the right knee joint; The stability of the right knee joint was insufficient, and the muscle strength of the medial quadriceps femoris was insufficient; Right iliopsoas muscle, quadriceps femoris, triceps calf muscle tension; The right gluteus maximus, gluteus medius, quadriceps femoris, hamstring, triceps crus and tibialis anterior muscle have insufficient active resistance muscle force. After the second stage of rehabilitation, the knee function, body shape and quality changes are as follows.

Changes in knee flexion

12 weeks after the operation, the active flexion of the affected limb was close to the healthy side, and both the healthy side and the affected side were in the normal range and close to the maximum Angle. Thirteen weeks after the operation, the flexion examination results were still stable, and the normal joint mobility of the injured knee joint was basically restored. (Table 3)

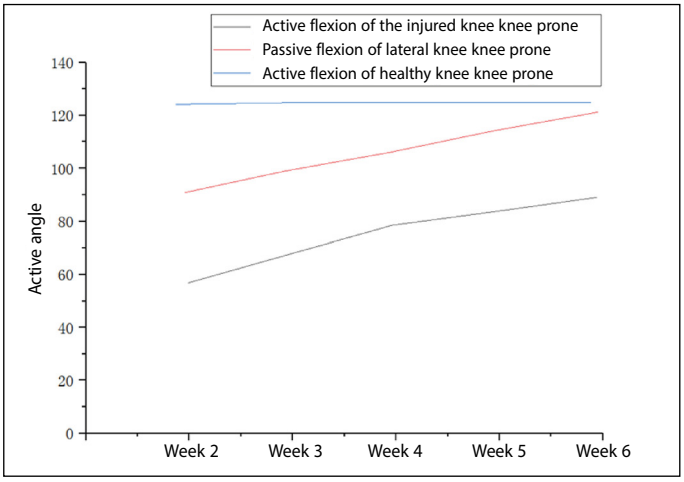

Figure 1. Changes in knee flexion of the injured side.

Table 3. Passive and active flexion of bilateral knee joints in prone position at stage 2.

Time	Active flexion of prone knee of injured side	Active flexion of supine knee on the healthy side	Prone passive flexion of the injured knee joint	Prone passive flexion of the knee on the opposite side
The 11th week after surgery	98°	124°	114°	The buckling degree
The 12th week after surgery	126°	124°	The buckling degree	The buckling degree
Thirteen weeks after surgery	126°	124°	The buckling degree	The buckling degree

DISCUSSION

At the end of the second stage of rehabilitation physical training, Liu's overall strength quality was significantly improved.[6] The bench press score was improved to the personal all-time best score of 140 kg at the 14th week after surgery, and finally reached 150 kg; 8 super groups of pull-ups (6 for each group) and flexor arm support (8 for each group) with 32kg weight; Complete 10 times with 55 kg high turn. Hard 160 kg, nearly 2 times the weight; Box squat weight 100 kg, each group of 4, can be completed in two consecutive groups; Rome chair lifting 10 kg, complete 20, a total of 6 groups; Shoulder on the bench load hip sprint, can be in fast circumstances, load 80 kg, 12, 6 groups; Under the condition of timing, 25 barbell pieces can be completed, a total of 6 groups. Squatting and lunging with weight on both hands, 15.75kg on each side, 24 steps in each group, a total of 6 groups; In the core training super group (4 movements), the completion time of each group was increased from 3 minutes and 39 seconds to 2 minutes and 25 seconds, and the number of groups that could be completed was also increased from 5 to 6 groups under the condition of increasing load.[7] In order to understand whether Liu has the possibility to return to the team for training after recovery, the physical function test results after the second stage of rehabilitation physical training were compared with the data before injury.[8,9]

CONCLUSION

Through this experiment, we should grasp the golden time for ligament tear injury and postoperative rehabilitation. Rehabilitation training mode can promote the recovery of muscle function after knee cruciate ligament injury to a certain extent, and can effectively restore muscle strength in a short time.

All authors declare no potential conflict of interest related to this article

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