MENISCUS INJURIES UNDER HIGH-INTENSITY TRAINING IN CYCLING ATHLETES

LESÕES NO MENISCO SOB TREINAMENTO DE ALTA INTENSIDADE EM ATLETAS DE CICLISMO

LESIONES DE MENISCO BAJO ENTRENAMIENTO DE ALTA INTENSIDAD EN ATLETAS DE CICLISMO

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Bo Zhang[1]
(Physical Education Professional)
Bowei Ma[2]
(Physical Education Professional)

1. Shangqiu University, School of Physical Education, Shangqiu, Henan, China.
2. Soochow University, School of Physical Education, Soochow, Jiangsu, China.

Correspondence:
Bowei Ma, Soochow, Jiangsu, China. 215000.
chenzhi2018@yeah.net

ABSTRACT

Introduction: Due to the high intensity and speed of cycling, a high technical and tactical level, physical quality, and psychological quality are required of athletes. Meniscal injuries are common in cyclists. In particular, chronic meniscal injuries are usually caused by an accumulation of fatigue or untimely and incomplete treatment of acute sports injuries. Objective: Analyze the protective factors and methods for meniscal injuries in cyclists. Methods: Volunteer male cyclists were selected for a questionnaire that investigated the athletes' meniscal injuries. The data collected were statistically analyzed. Results: There were 6 cases of right knee meniscus injury in athletes; these data accounted for 75% of the injuries. Left meniscus injuries accounted for 2 cases. There was one case of medial injury in both knees. The corresponding preventive measures are presented according to the cause of the injury. Conclusion: Causes of meniscal injuries in cyclists include insufficient knee strength, inadequate training methods, physical fatigue, and long-term localized effort. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Athletes; Tibial Meniscus Injuries; Knee Joint; Sports Injuries.

RESUMO

Introdução: Devido à alta intensidade e velocidade do ciclismo, é exigido um alto nível técnico e tático, qualidade física e qualidade psicológica dos atletas. Lesões meniscais são comuns em ciclistas. Em particular, as lesões meniscais crônicas são geralmente causadas por um acúmulo de fadiga ou tratamento inoportuno e incompleto de lesões esportivas agudas. Objetivo: Analisar os fatores e métodos de proteção para lesões meniscais em ciclistas. Métodos: Ciclistas do sexo masculino voluntários foram selecionados para um questionário que investigou as lesões meniscais dos atletas. Os dados coletados foram analisados estatisticamente. Resultados: Houve 6 casos de lesão meniscal do joelho direito em atleta, esses dados são responsáveis por 75% dos danos. Lesões no menisco esquerdo representaram 2 casos. Houve um caso de lesão medial em ambos os joelhos. As medidas preventivas correspondentes são apresentadas de acordo com a causa da lesão. Conclusão: As causas das lesões meniscais em ciclistas incluem força insuficiente no joelho, métodos de treinamento inadequados, fadiga física e esforço localizado a longo prazo. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Atletas; Lesões do Menisco Tibial; Articulação do Joelho; Lesões Esportivas.*

RESUMEN

Introducción: Debido a la alta intensidad y velocidad del ciclismo, se exige a los deportistas un alto nivel técnico y táctico, calidad física y calidad psicológica. Las lesiones de menisco son comunes en los ciclistas. En particular, las lesiones crónicas de menisco suelen ser causadas por una acumulación de fatiga o por un tratamiento inoportuno e incompleto de las lesiones deportivas agudas. Objetivo: Analizar los factores y métodos de protección de las lesiones meniscales en ciclistas. Métodos: Se seleccionaron ciclistas masculinos voluntarios para un cuestionario que investigaba las lesiones meniscales de los atletas. Los datos recogidos se analizaron estadísticamente. Resultados: Hubo 6 casos de lesiones de menisco de la rodilla derecha en atletas, estos datos representaron el 75% de las lesiones. Las lesiones del menisco izquierdo representaron 2 casos. Hubo un caso de lesión medial en ambas rodillas. Las medidas preventivas correspondientes se presentan según la causa de la lesión. Conclusión: Las causas de las lesiones de menisco en los ciclistas incluyen una fuerza insuficiente de la rodilla, métodos de entrenamiento inadecuados, fatiga física y esfuerzos localizados a largo plazo. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Atletas; Lesiones de Menisco Tibial; Articulación de la Rodilla; Lesiones en Deportes*

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INTRODUCTION

Cycling is intense and fast. This has higher requirements on athletes' technical and tactical level, physical quality, and psychological quality. When the athlete is riding, the bicycle limits the working state within a fixed range. The athlete's torso is less likely to move freely, and the legs work for regional stability. The training and competition venues for road cyclists are open roads. The terrain of the competition is varied, and the road conditions are not one. The track surface covering material, roughness, and inclination angle also differ when the cycling race uses different racing tracks.[1] At the same time, athletes work in the open air.

They are affected by weather conditions such as climate, wind direction, temperature and humidity, air pressure, etc., which impact the piece.

The use of specific techniques and tactics in sports also increases the risk of injury. These factors increase the likelihood of crashes in cycling. This leaves athletes vulnerable to acute injuries. Chronic motor impairment Injuries are generally caused by the accumulation of fatigue or untimely and incomplete treatment of acute sports injuries. The meniscus is composed of fibrocartilage. It is an integral part of the knee joint. It has essential functions such as absorbing shock, lubricating, increasing joint contact area, and maintaining joint stability. Because the meniscus has its complex structural features and unique living environment, it is easy to damage and difficult to recover after injury. This article investigates meniscal injuries in cyclists who have been trained for many years. We analyze and try to determine the reason and mechanism for meniscus injury.[2] At the same time, we propose scientific and reasonable prevention and treatment measures.

METHOD

Research objects

We selected 8 cases of cyclists with meniscus injuries caused by sports between November 2019 and May 2020. Six cases of right knee meniscus injury in cyclists. Data accounts for 75% of damage—left knee meniscus injury in 2 cases. Data accounts for 25% of damage—1 case of medial injury of left and right knees. Data accounted for 12.5% of the damage: Left and right knee lateral injury in 7 cases. Data accounted for 87.5% of the damage. Among them, 6 cases were on the lateral side of the right knee.[3] Data accounts for 75% of damage. Meniscus damage is 1-3 years old. The training period is 3-12 years.

Research methods

All eight athletes were followed for this article. We investigated meniscal injuries utilizing a questionnaire.[4] We organize the data promptly. The main contents of the questionnaire include basic personal information, injury time, cause and training content, clinical examination, treatment methods, rehabilitation training, etc. At the same time, we also ask the athletes about their history of sports injuries after engaging in special training and conducting injury inspections. In addition, this article registers, examines, diagnoses, and treats sports injuries that occur during athletes' training and records the details.

Predictive modeling and simulation of the meniscus of a cyclist

In constructing the prediction model of the meniscus that is prone to injury during strenuous exercise, we first obtained the intrinsic relationship between the attributes of sports injury and the range of meniscus movement.[5] We calculated variables between strenuous exercise injury attributes and the range of motion of the vulnerable meniscus. This article abstracts the strenuous exercise data:

$$A = \langle W, Q, V, f \rangle \tag{1}$$

The domain of discourse of strenuous exercise data attributes is expressed as

$$W = \{x_1, x_2, \cdots, x_n\} \tag{2}$$

$Q = S \cup D$ represents a finite set of strenuous exercise data attributes. The attribute set representing the condition of strenuous exercise data is

$$S = \{s_1, s_2, \cdots, s_m\} \tag{3}$$

$D = \{d\}$ represents the strenuous exercise data decision attribute set $V = \{v_1, v_2, \cdots v_m\}$ represents the value range set of strenuous exercise data attributes. v_i represents the range of the strenuous exercise data attribute c_i. $f: W \times S \rightarrow V$ represents the motion data information function.[6] It embodies the mapping of the entire universe W and the conditional attribute set S to the value domain set V. It is assumed that a single decision attribute corresponds to a decision table. it satisfies

$$\{f(x_i, s_j) = u_{j,i}, f(x_i, d) = v_i\} \tag{4}$$

$u_{j,i}$ represents the corresponding value of the risk amount x_i of the site where sports injury occurs and the condition attribute s_j of the strenuous exercise data. v_i represents the corresponding value of the risk amount of the site of sports injury and the decision attribute d. Q contains any data attribute subset B of strenuous sports injury attribute data, then the equivalence relation of W corresponding to on I satisfies

$$I(B) = \{(x, y) \in W \times W : f(x, a) = f(y, a), \forall a \in B\} \tag{5}$$

When $(x, y) \in I(B)$ is satisfied, it means that x, y is indistinguishable from B. We let R be the relationship set of the easily injured meniscus motion range, then it satisfies

$$I(R) = I(R - \{r\}) \tag{6}$$

r is the strenuous motion data attribute in R that can be reduced. Assuming that $P = R - \{r\}$ is independent, then P is a reduction in R. All relations in R that cannot be reduced are called kernels. The set consisting of it is called the core set of R.

There is no need for a code of ethics for this type of study.

RESULTS

Analysis of the location of meniscus injury and its causes

The meniscus injury caused by insufficient preparation and excessive movement accounts for many.[7] In addition, injuries caused by fatigue, psychological quality, technology, and other reasons also accounted for a certain proportion. (Table 1) Excessive and incorrect technical movements will lead to weak knee muscles and less functional movement. Cyclists are prone to meniscus damage during exercise. The meniscus is injured due to the rapid transition of technical movements and many changes in direction during training. Insufficient preparation

Table 1. List of locations of meniscal injuries and their causes.

Reason	Part				
	Left knee	Right knee	Knees	Total	Injury cause ratio (%)
Too much action	6	4	1	11	16.2
Technical problem	2	2	1	5	7.4
Fatigue	3	0	0	3	4.4
Poor mental quality	3	0	0	3	4.4
Insufficient preparation activities	4	6	4	14	20.6
Venue equipment	2	2	1	5	7.4
Insufficient level of training	2	4	2	8	11.8
Unscientific training	5	6	1	12	17.6
Human Factors	1	0	0	1	1.5
Objective factors	1	2	1	4	5.9
Other	0	1	1	2	2.9

and long-term high-volume training can cause chronic knee joint strain. In particular sports, the long-term repeated flexion and extension of the knee joint and friction cause the wear of the articular surface and the degeneration of the ligaments, which can cause meniscus damage. Poor psychological quality and unsatisfactory site and facility conditions will affect the performance of sports skills. It has a direct or indirect impact on knee joint injuries in athletes. Insufficient training and obstetric training will cause the body to produce a series of disordered physiological and biochemical reactions. The athlete's performance is a deformation of technical movements, unresponsiveness, and a corresponding decrease in willpower and alertness. Athletes cannot effectively protect the knee joint. Other factors mainly include human subjective factors and objective factors.

Sports situations and meniscal injuries

Different training forms and sports occasions have different proportions of meniscus injuries. Among them, the probability of meniscus injury in special confrontation training was the highest (75.00%). They were followed by special quality training (62.50%). (Table 2) This may be because, in the extraordinary confrontation and quality training, the exercise intensity and load are the same as the actual combat, so the proportion of meniscus damage is relatively large. The proportion of meniscus injury in special preparation activities and ordinary practice was 12.5% and 37.5%, respectively. The author analyzes that this is mainly related to the sufficiency of preparation activities and the technical movements and functional states during usual practice. Inadequate preparation or reduced function can adversely affect the meniscus.[8] This is mainly related to proper preparation before the game, good skill status, and suitable competition venue and equipment.

Types and analysis of meniscus injury

Different causes and locations of injuries result in different types of injuries. Among the types of meniscal injury, longitudinal tear and transverse tear accounted for the immense proportions (87.50% and 75.00%). This is followed by edge tearing and horizontal tearing. Front and rear corner tear ratios are minimal.[9] Since the meniscus itself has no vascular transport, a ruptured meniscus loses its role in helping to stabilize the joint and interferes with the normal movement of the knee joint. (Table 3)

Table 2. Analysis list of meniscal injuries.

Injury occasion	Damage times	Damage rate (%)
Special preparation activities	4	50.00
Special confrontation training	6	75.00
Special quality training	5	62.50
Usual practice	3	37.50
Official game	1	12.50

Table 3. List of meniscus injury types and injury rates.

Damage type	Damage times	Damage rate (%)
Torn edges	3	37.50%
longitudinal tear	7	87.50%
Torn sideways	6	75.00%
Horizontal tear	2	25.00%
Front and rear corner tear	1	12.50%

DISCUSSION

In cycling training and competition, the technical movements of athletes are unreasonable, incorrect, or due to external environment, machine Mechanical and other factors are prone to meniscus damage. Meniscal injury can be diagnosed based on trauma history and clinical manifestations. In the past, meniscus injury treatment was mainly based on excision.[10] However, from the long-term follow-up results, it was observed that the incidence of late postoperative osteoarthritis was extremely high. The removal of the meniscus severely disrupts the law of standard load transmission. Athletes should be diagnosed early and treated early to achieve the goal of preserving the meniscus as much as possible. Arthroscopy can be used to treat meniscal injuries. Meniscal edge tear can be repaired with a suture. Doctors usually partially remove the meniscus and leave the undamaged part. Doctors may perform emergency arthroscopy in patients with early suspicion of meniscal injury.

The meniscus is the main component of the knee joint. Recovery from injury is slow. Athletes should focus on prevention in their daily training and competition.[11] The specific preventive measures are as follows:

Be fully prepared before exercising. The content includes a variety of stretching and running exercises. Increase the range of motion of the joints through each stretch, reduce the viscosity of the muscles and ligaments and increase the elasticity of the muscles to prevent sports injuries effectively. Strengthen lower limb muscle strength and knee ligament additional training. In particular, it is necessary to strengthen the endurance training of the quadriceps femoral muscle and the training of the tension and tension of the patellar ligament to improve the stability and agility of the knee joint. Ensure post-match recovery. Athletes should use active recovery methods based on scientific principles to improve recovery speed from fatigue. Athletes formulate scientific training plans. The coaches reasonably arrange the training intensity and load.

CONCLUSION

This article analyzes and discusses the meniscal injury factors of cyclists. At the same time, we put forward suggestions for injury prevention and reduction suitable for Chinese cycling practice.

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