Ankle injury treatment and rehabilitation training in basketball option class

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Abstract: Ankle injuries in basketball elective classes are one of the most critical sports injuries in basketball activities. This paper analyzes ankle injuries in basketball from the perspectives of biomechanics and human anatomy, investigates their specific causes, implements emergency treatment, and proposes scientific and effective methods for the rehabilitation training of ankle injuries, in order to better serve college students who are basketball enthusiasts.

Keywords: Basketball, Elective Course, Ankle, Sports Injury, Rehabilitation Training

1. Introduction

Influenced by the NBA star effect on Chinese youth, an increasing number of college students are willing to participate in basketball. In college physical education elective courses, the vast majority of students choose basketball. Due to the frequent physical contact inherent in the sport, sports injuries are inevitable. The reasons include not only whether the field is flat and whether the sports equipment meets the requirements but also that with the increase in exercise intensity, the body consumes a lot of energy, gradually produces physical fatigue. Once students use technical movements unreasonably and lose their body balance during the movement, it is quite easy to cause ankle injuries. Currently, colleges focus only on preventing sports injuries in students, but neglect the rehabilitation training methods after sports injuries occur; they only use traditional stagnant and X-ray methods [1]; rehabilitation training usually involves adaptive jogging with the affected limb, but there is no more detailed and systematic practice method and rehabilitation plan.

This paper, based on the characteristics of college basketball teaching content and the situation of ankle injuries among college students in Liaoning Province during practice, conducts a sampling survey and analysis. The ankle rehabilitation training is refined into six stages, and new, effective, and scientifically sound rehabilitation training methods are proposed in combination with the condition of the ankle at different stages, with detailed practice content and sets established.

2. Research subjects and methods

2.1. Research subjects

The focus of this study is on 684 students from the 2013 class of the basketball elective course at Liaoning University of Technology. To make this research more broadly applicable, a sampling survey was also conducted on a total of 6,176 students from the 2013 class at 10 undergraduate institutions in Liaoning Province, including Dalian University of Technology, Northeastern University, and Liaoning University.

2.2. Research methods

2.2.1. Fact-recording method

During basketball teaching and practice matches, basketball elective course teachers promptly record the condition of students' ankle injuries. Organizers and medical staff promptly record the occurrence of sports injuries among students in both organized and unorganized basketball activities.

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2.2.2. Comparative analysis method

Systematically analyze and compare the number of ankle injuries among students in the basketball elective courses at 10 universities in Liaoning Province, including Dalian University of Technology, Northeastern University, and Liaoning University, for the 2013 class.

2.2.3. Mathematical statistics method

Use the SPSS 10.0 statistical software for data processing of the original data.

3. Analysis of ankle injury factors

3.1. Causes of ankle injuries

College students have to endure a certain amount of exercise load when participating in sports activities. Although the intensity of each class varies, there will be some physical contact and confrontation. Especially when students are dribbling, grabbing rebounds, or landing after a layup, they are particularly prone to ankle injuries. Even with repeated urging and careful guidance from physical education teachers, the occurrence of ankle injuries cannot be prevented. In addition, due to seasonal factors, particularly in winter, the cold climate and slippery grounds; the reasons related to the equipment and conditions of the venue, such as uneven surfaces and debris; students' insufficient warm-up activities, increased exercise volume leading to a decline in physical performance, decreased attention, and unreasonable use of techniques during confrontation, as well as accidents that occur during intense scrambles, are all reasons for ankle injuries among college students in basketball activities.

3.2. Status of ankle injuries

According to the survey data from 6,176 basketball elective course students of the 2013 class in 10 universities including Dalian University of Technology, Northeastern University, Liaoning University, China Medical University, Shenyang Pharmaceutical University, Dong Bei University of Finance and Economics, Liaoning Normal University, Dalian Maritime University, Shenyang Agricultural University, and Shenyang University of Technology in Liaoning Province, the number of students participating in basketball is quite large, and the probability of ankle injuries is also high. Among these 6,176 students, there were 247 who suffered ankle injuries, accounting for 4.01% of the total population.

From the perspective of competitive sports, these figures are highly significant as they greatly affect students' athletic performance and the expression of their abilities. The recovery training from such injuries requires a considerable amount of time to promote the recovery of the affected limb's motor functions, often causing students to miss out on sports training.

From the perspective of sports biomechanics, students' ankle injuries prevent the affected limb from bearing the intensity and load of sports, and may even temporarily lose the ability to move and bear their own weight, which will also affect students' normal study and life.

Data proves that the emphasis on teaching sports injuries in some universities' basketball elective courses is not sufficient enough, and they are still only at the level of prevention and simple emergency treatment, neglecting the rehabilitation training of ankle injuries, which increases the incidence of ankle injuries. Therefore, paying attention to students' ankle injuries in basketball sports, especially the rehabilitation training after the injury, should become a topic worth studying by university physical education teachers.

When students in university physical education class basketball elective courses suffer ankle injuries, they often do not pay attention and do not carry out timely self-examination and emergency treatment, just doing simple stagnation of the affected limb. When the pain of the affected limb is slightly relieved, students will once again engage in basketball sports.

According to the survey of rehabilitation training for students with ankle injuries in basketball elective courses in 2013 among 10 universities in Liaoning Province, most students who have ankle injuries continue to participate in basketball sports, causing the affected limb to continue to bear the pressure of weight and causing the ankle to be injured again, ultimately leading to recurrent ankle injury. Some students, even if they choose the correct method for emergency treatment, the pain and swelling of the affected limb disappear, and they temporarily recover the ability to move, but they cannot participate in sports, the reason

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is that students have not done any rehabilitation training, do not have the concept of rehabilitation training for ankle injuries, and only stay at the level of simple prevention and treatment, ignoring the importance of recovery training for the affected limb [2]. Therefore, universities should set up sports injury rehabilitation training courses through compulsory physical education courses, teach methods and means of rehabilitation training, and provide professional and scientific guidance for rehabilitation training for ankles or other injuries, to strengthen students' self-protection awareness, and let students truly understand the importance of rehabilitation training after sports injuries.

4. Examination and emergency treatment

Teachers supervise students to prepare activities before participating in basketball, especially the ankle area, and check whether their sports equipment is suitable for basketball. During the basketball game, adjust the body's center of gravity, use techniques reasonably in confrontation, and prefer to land on both feet. When the body is tired, actively reduce the intensity of exercise and do not perform dangerous actions beyond one's ability. To replenish water in time (a little at a time) during exercise can restore the loss of body water. The prevention of ankle injuries ultimately requires students to develop good sports habits and to pay attention to preparatory activities before exercise fundamentally.

From the perspective of biomechanics, when a person is running, the front of the foot receives a downward force first and then transitions to the heel, indicating that the ankle joint is the core hub of the ankle, and its stability is crucial [3]. From an anatomical perspective, the skeletal structure of the ankle joint is composed of the distal fibula and the lateral malleolus, the tip of the distal tibia is the medial malleolus, and the distal tibia forms the tibial notch, which forms a joint with the talus through the balancing apparatus, and the tibial notch and the body of the talus together form a sturdy combination, forming the innate stability of the ankle joint [4]. In addition to this, there are three main accessory ligaments that stabilize the ankle joint: the lateral ligament, the deltoid ligament, and the connection between the tibia and fibula. In the case of ankle injuries, timely examination and emergency treatment are crucial.

4.1. Injury examination

The ultimate goal of examining an ankle injury is to quickly determine and assess the severity of the injured area and to take the correct emergency measures, preparing for a better and faster recovery of the ankle in the later stage. After an ankle sports injury occurs, it is necessary to promptly implement stagnation of the ankle (referred to as the affected limb for short); observe the location of the pain points on the affected limb, the degree of swelling, whether the ankle joint is dislocated or shows signs of fracture; and actively describe the cause of the injury (caused by inward or outward rotation of the ankle), etc.

4.2. Emergency treatment

After determining that the ankle injury is a general sports injury, emergency treatment can be carried out for the student.

Firstly, the student should be moved to a location with water facilities (the affected limb should not bear weight), and their shoes should be quickly removed to observe the affected limb while inquiring about the circumstances of the injury. In winter, rinse the painful area with cold water for 3 to 5 minutes, and then repeat once or twice after an interval of 2 to 3 minutes; in summer, the rinsing can be done more frequently, with an increased duration of about 2 minutes.

Secondly, apply the compression bandaging method. The patient should lie on their side to facilitate the operation. Use elastic bandages, squares of cloth, cotton, adhesive tape, etc., for local compression bandaging. Place a small square of cloth with a small amount of cotton inside, folded neatly, as a filler (for compression bandaging) and place it flat on the painful point of the ankle, then bandage it with an elastic bandage using a figure-eight method. During the bandaging process, ask the patient if the tightness is appropriate. After the bandaging is completed, let the patient lie down flat, and elevate the affected limb, preferably higher than their heart, trying not to let the affected limb bear any weight. Open the bandage after 20 to 30 minutes to check the condition of the injured area and promote local blood circulation. Re-apply compression bandaging after 5 to 10 minutes, and repeat the process. Before going to bed, the bandage can

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be looser, and if discomfort is felt, the bandage can be removed immediately, and simply elevating the affected limb will suffice.

4.3. Acute injury treatment

Generally speaking, in college basketball elective courses, the intensity and load of students' exercise are set, and teachers will actively control the students' exercise intensity and load when organizing exercise practices. Therefore, it is relatively rare to have severe ankle injuries (such as fractures) in basketball sports. However, joint injuries involving the lateral malleolus may occur from time to time and must be given sufficient attention and treatment to prevent pathological changes in the affected limb and complete loss of motor ability. Stagnation can be chosen for initial observation, and it is necessary to check whether there is obvious deformity in the ankle. If deformity, fracture, and other phenomena occur, teachers cannot handle it, and it is important to send the student to the hospital in time for an accurate X-ray of the ankle. For every case with local tender points in the ankle joint, or accompanied by persistent pain, loss of movement, and swelling that lasts more than 48 hours, repeated X-ray comparisons should be made, and a doctor should provide scientific advice and treatment methods.

5. Rehabilitation training

Diagnosing ankle joint injuries initially relies heavily on a comprehensive medical assessment, which includes the anterior drawer test and the inversion (supination) test of the ankle. The results of these tests are typically compared with the opposite side. The location of the injury and the degree of pain can provide a scientific basis for determining the specific structures involved and the severity of the injury. Physical examination can also promptly identify areas of tenderness, the range of motion of the affected limb, and the condition of effusion and joint stability. Effusive and hemorrhagic joint injuries can increase the pain response, reduce the range of motion of the affected limb, and limit the stability examination of the joint; local infiltration or injection of benzocaine can alleviate pain and facilitate further diagnostic tests and the initiation of physical therapy to enhance the mobility and muscle strength of the affected limb.

After students suffer an ankle injury, it is important to focus on the rehabilitation training of ankle joint motor function. A rehabilitation training plan can be formulated based on the recovery of the affected limb, and the daily practice and amount of exercise can be determined according to the degree of pain and swelling at the site of the injury. In the process of rehabilitation training, the six-stage theory of rehabilitation training after ankle injury summarized by the Oklahoma Sports Center can be referred to. According to the characteristics of each stage of the injured ankle, unique ankle training methods can be applied and implemented to assist in the rehabilitation training of students after ankle injury [5].

5.1. Acute phase of ankle injury stage

In the absence of pain in the ankle joint, passive ankle joint movement exercises can be performed with the aid of crutches for weight-bearing, doing small-range simple flexion and extension, inversion, and eversion movements, focusing attention on the ankle area to enhance blood circulation in the ankle joint.

Method: Perform 20 repetitions of small-range flexion and extension in both the anterior-posterior and medial-lateral directions for 1 set, completing 3 sets per day. For each additional day, one more set can be added to the practice according to one's own feeling.

Effect: Increases blood circulation and metabolism in the ankle, the swelling sensation disappears, and the ankle can perform small-range movements.

5.2. Late acute phase of ankle injury

If the pain subsides, crutches can gradually be discarded, and simple isometric and isotonic contraction exercises for the ankle can be performed, along with light-intensity stationary bicycle exercises appropriate to one's condition.

Method: Without crutches, the ankle is allowed to bear some weight and move slightly, performing simple isometric and isotonic contraction exercises of the ankle. Maintain the contraction for 1×10 seconds, complete 10 repetitions, and finish 2 sets per day. For bicycle exercises, start with a 10-minute set at a slow pace to gradually adapt to the exertion process.

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Effect: Complete independence from crutches is achieved, the ankle can bear a small amount of weight for exercises, and it can be moved slowly.

5.3. Pre-Motion phase of ankle injury

As pain and swelling subside, gradually increase the strength of the ankle. Elastic bands can be used around the ankle for strengthening stretching exercises, slowly adapting to walking slowly with the affected limb touching the ground, and performing single-leg balance exercises with or without eyes closed.

Method: Use elastic bands around the ankle for strengthening stretching exercises, do 10 to 15 repetitions for 2 sets; single-leg balance for 40 seconds, a total of 2 to 3 sets, and if the ankle feels good, you can appropriately increase by 5 to 10 seconds per set.

Effect: The ankle adapts to low-intensity strength exercises, can actively exert force, and balance support exercises can be increased, allowing the ankle to touch the ground and bear weight for slow walking.

5.4. Appropriate movement phase of ankle injury

When there is no discomfort during slow walking, gradually increase to light jogging, with a speed slightly faster than walking. The route can follow a figure-eight or zigzag pattern. Continue to enhance ankle strength exercises, and perform a moderate amount of box stepping exercises, completing movements forward, backward, and side to side, up and down. Practice can be done using the stairs of the campus track and field stands, but safety must be considered.

Method: Perform single-leg box stepping with heel raises, then alternate legs (one alternation counts as one repetition), 20 repetitions per set, complete 2 to 4 sets with a 30-second interval between sets. Additionally, choose slow-paced stair climbing exercises, with the affected limb exerting force for 3 rounds, followed by figure-eight and zigzag movement exercises.

Effect: The ankle has no issues with slow walking and can perform turning movements and light jogging exercises.

5.5. Ankle strengthening phase

Continue to strengthen resistance exercises for the ankle, and appropriately perform basketball footwork exercises, such as cross-stepping, backward running, and quick stops. Walking should basically return to normal, with an increase in various types of single and double leg jumps, running on slopes, and stair running exercises. Light jogging can be changed to short-distance sprints, and toe-lift exercises with weight-bearing on the ankles.

Method: With body weight-bearing equipment equal to half of one's body weight, perform semi-squat exercises, and do toe-lift exercises with weight-bearing on the ankles, 6 to 8 repetitions per set, for 5 to 8 sets. After each set, perform 5 double-leg jumps and 1 set of 50-meter sprints.

Effect: The ankle can withstand equipment exercises not exceeding its body weight, the ankle's motor function returns to normal, and it can perform technically challenging movements.

5.6. Ankle maintenance phase

Method: Maintain at least one session of ankle strength training per week. Continue to increase the strength of the ankle, restore ankle motor function, and enhance coordination training. Walk on uneven surfaces and perform toe-lift exercises with gradually increased weights, eventually being able to lift your own body weight. The number of sets for the practice can be appropriately increased. Do more stair running exercises to increase the strength and load-bearing capacity of the ankle.

Effect: The ankle's motor skills are fully restored and stronger than before, being able to adapt to intense competitive matches with high intensity.

Through the six stages of rehabilitation exercises mentioned above, the student's ankle injury can be basically healed, motor function will recover quickly, and strength will be enhanced. In the early stage of recovery of the affected limb, students can also use ankle guards and bandages for protection, and after adapting to a period of intensity, they can remove them on their own.

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6. Conclusion

The rehabilitation training for ankle injuries helps college students to correctly understand sports injuries, which is an important factor in determining or affecting whether college students can engage in sports activities for a long time. It is also a guarantee for the high-intensity running, attacking, and defending specialized qualities in modern basketball competitions. It is crucial to add emergency handling and recovery training for sports injuries to college basketball elective courses. Physical education teachers should make use of the limited time of physical education theory classes to provide detailed explanations on the emergency treatment methods and recovery training methods for ankle injuries, and reasonably arrange teaching practices. This helps college students to develop the good habit of preparing activities for each joint of the body before exercise and checking whether there is any discomfort and looseness in sports equipment. These are all conducive to college students developing self-protection awareness, eliminating students' previous misconceptions about ankle injuries, increasing their understanding of sports injury knowledge, and consciously accepting recovery training for ankle injuries.

7. References

[1] Lenn strand G. Clinical Practice in the Prevention and Treatment of Sports Injuries [M]. Translated by Wang Anli. Beijing: People's Sports Publishing House, 2004: 200-211, 234, 308-310.

[2] Qiu Shou Tao, Cui Di. The Impact of Different Intensities of Endurance Exercise on Skeletal Muscle Mass: Autophagy and Aging [J]. Journal of Shenyang Sport University, 2015, 34(1): 78-84.

[3] Feng Lian Shi, Li Ka gang. Common Physiological and Biochemical Indicators for Athlete Performance Assessment, Testing Methods, and Applications [M]. Beijing: People's Publishing House, 2002: 12-24.

[4] Lu Yi Jin, Yao Shi Shuo. Human Anatomy [M]. Beijing: Higher Education Press, 2001: 100-103.

[5] Chen KM, Ma Fu le. The Latest Views and Debates in Orthopedic Sports Medicine [J]. Foreign Medical Science: Health Science Edition, 2003, 21(5): 132-133.

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