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Prevention and Rehabilitation of Ankle Injuries in Basketball

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Abstract. The popularity of national fitness has led to an increasing number of people engaging in physical exercise, and basketball, as a popular sport, has a large number of participants. Basketball is prone to injuries because of its high confrontations, fast pace and intense intensity. And because the lateral ankle is longer and taller than the medial ankle and the lateral ligament is weaker than the medial ligament, the ankle is often the most vulnerable part of the body in basketball, and most of the injuries are ankle varus. This article aims to provide effective rehabilitation strategies and ankle reinforcement training methods to help athletes quickly return to their best athletic condition after an injury, return to the court faster, and reduce the risk of re-injury. This article delves into the effects, mechanisms, and types of ankle injuries, analyzes the causes of the injuries, and offers recommendations for targeted reinforcement training. The relevant literature review provides detailed methods for athletes' prevention and rehabilitation of ankle injuries. Ultimately, it enables athletes to fully recover after injury and quickly regain their athletic form after recovery.

Keywords: Ankle Injuries, Injuries Prevention, Sports Rehabilitation

1. Introduction

With the progress of The Times and the improvement of the economy, more and more people are beginning to engage in physical exercise. Basketball, as a sport that demands a high level of physical fitness, can not only affect an athlete's career but also make the daily life of the injured person difficult. Ankle injuries are the most common problem in basketball. According to statistics, lateral sprains of the ankle account for about 25% to 30% of all sports injuries and are a common musculoskeletal disorder. Ankle sprains typically occur in cases of excessive inversion, eversion, or dorsiflexion of the foot, and 85% of these cases result from eversion trauma [1]. In basketball games, the ankle is vulnerable to self-impact and external force due to frequent stops, starts and rhythm changes by the athlete, which can lead to injury. After an injury, the stability of the ankle decreases and the risk of re-injury increases. Therefore, in order to prevent sports injuries more effectively, it is necessary to study the related factors of ankle injuries in depth. In recent years, although experts at home and abroad have conducted extensive research in the field of ankle injuries and achieved many results in biomechanical mechanisms, diagnostic techniques and treatment methods, these studies have shown fragmented characteristics [2]. At present, prevention of ankle injuries mainly focuses on the direct causes, while exercise therapy has become the preferred

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method for ankle injury rehabilitation. Traditional Chinese rehabilitation techniques, such as kinesiology patches, can be used as adjunctive treatments. It is necessary to explore in detail how to improve ankle stability through the proper use of braces. As of now, there is an incomplete mechanism for assessing athlete risk in the country, and there is a lack of clear standards for the diagnosis and follow-up monitoring of functional rehabilitation training [3]. These issues may present new opportunities for exploration in the field of sports rehabilitation. Therefore, in basketball games, it is necessary to pay attention and take appropriate measures to provide players with scientific and reasonable ankle injury prevention strategies to ensure their physical safety and the continuous development of their careers. It is crucial for athletes, coaches and medical personnel to understand these prevention strategies. Therefore, systematically collating research progress on the prevention and rehabilitation of ankle injuries is of great theoretical value and practical significance for promoting standardized research and clinical application in this field [4]. The purpose of this review is to collate common studies on the ankle, explore the association between different injury types and biomechanical factors, and provide strategic recommendations for athletes and sports enthusiasts to prevent ankle injuries.

2. Physiological structure of the ankle joint

The ankle joint is formed by the articular surfaces at the base of the tibia and fibula joining the talus pulley, also known as the talus calf joint [5]. The lower articular surface of the tibia, combined with the inner and outer ankle articular surfaces, forms a '⌈⌋' -shaped joint socket that accommodates the talus pulley as the joint head. Because the articular surface of the pulley is wider at the front and narrower at the back, when the foot is dorsiflexed, the wider front part slides into the joint cavity, making the joint more stable. However, when the sole of the foot bends downward, such as when walking downhill, the narrower rear part of the pulley enters the ankle fossa, causing the ankle to loosen and allowing lateral movement [6].

3. Causes of ankle injuries

3.1. Insufficient warm-up

Adequate warm-up is an important foundation for reducing the risk of sports injuries. If basketball enthusiasts do not warm up adequately before training, their bodies may not be fully activated, which can lead to injuries. Human muscle tissue is resilient, elastic and extensible. If proper warm-up is not done before training, the elasticity and extensibility of the muscle may be limited, and its toughness may significantly affect the flexibility of the muscle. High-intensity and intense exercise can lead to ligament damage.

3.2. Lack of awareness of self-protection or protecting others

Footstepping is very common in basketball. This often occurs because defenders lack awareness of protecting others. In addition, in professional basketball training, there are often problems such as non-compliance with defensive rules, reckless behavior, lack of tactical strategies, and rough and simplistic movements. Young basketball players, in particular, often lack formal training and rely on their physical superiority to cope with the highly competitive sport. There is a general lack of overall vision, and they tend to rely on individual breakthroughs to score by charging towards the basket with the ball. There is less technical element and more reliance on the confrontation and competition of strength and physical ability. Once inside the penalty area, the foot may bump into other players,

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which can easily lead to a fall or an ankle sprain. Fast collisions occur when defenders notice an opponent dribbling through and they jump up to fight for the rebound. When both sides lack awareness of self-protection and caring for others, they may be too close to each other, especially when moving around in a tight space, the movement may not go smoothly. There is a high possibility of stepping on each other's feet while moving or landing, resulting in an ankle sprain.

3.3. Site factors

In addition to an athlete's physical fitness and skills, the field conditions are also a key cause of ankle sprains. In daily life, amateur basketball training often takes place on asphalt or concrete courts. Such courts are often seen and widely used. The ground in this training area is very hard.

Training in such a place for a long time may put too much pressure on the legs and can easily cause chronic ankle injuries.

3.4. Physical causes

Nowadays, many people have become accustomed to staying up late, a behavior that leads to insufficient sleep and may increase the risk of injury. Long-term training can cause extreme physical fatigue, which in turn leads to muscle stiffness, poor response, reduced limb coordination and increased foot pressure, all of which can easily cause ankle injuries.

4. Types of ankle injuries in basketball and preventive measures

4.1. Injury types

4.1.1. Acute injury

Basketball, due to its high intensity and intensity, often leads to ligament injuries or ruptures, and sometimes even fractures. These are acute injuries [7]. Acute ankle injuries account for about 60 percent of all ankle injuries and usually manifest as pain on the outer side of the ankle, often accompanied by swelling and sometimes bruising on both sides of the foot [8]. Severe injuries can cause a tear in the lateral ankle capsule, ankle fractures, and separation of the inferior tibiofibular syndesmosis. Inversion sprains are the most common type of ankle sprain. This is because the lateral malleolus is longer and taller than the medial malleolus, which limits excessive valgus of the talus. The most frequently injured ligaments are the lateral collateral ligaments, including the anterior talofibular ligament, the calcaneofibular ligament, and the posterior talofibular ligament. Among them, the anterior talofibular ligament is the most vulnerable to injury because of the important role it plays in function.

4.1.2. Chronic injury

Chronic injuries do not result from occasional, sudden basketball moves, but from chronic strain that accumulates over long periods of training [9]. While a prolonged injury may not cause serious consequences in the short term, it directly hinders an athlete's technical improvement and training progress. Extra caution is needed for those who have chronic injuries during training. Irregular movements or overly forceful movements, such as sudden pauses or intense defense

and offense, can exacerbate chronic injuries and may eventually result in serious ankle injuries. Ankle sprains are one of the most common sports injuries, with up to 50% of patients with acute

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ankle sprains not seeking formal medical treatment, resulting in repeated sprains for months or even years after the initial injury. Even with subsequent systematic rehabilitation, up to 70 percent of patients develop various functional impairments within six months and progress to functional ankle instability (FAI). FAI severely limits a patient's physical function and may even lead to post-traumatic ankle arthritis [10].

4.2. Preventive measures

The specific technical aspects of prevention involve specialized techniques such as massage relaxation and mechanical therapy, as well as the application of non-specialized techniques. Support and proprioceptive training are the most effective interventions. Mechelen et al. demonstrated that when athletes used semi-rigid ankle braces during training and competition, recurrent sprains were reduced by 69%. Zech et al. showed that three balanced training sessions per week for eight weeks reduced primary sprains by 42%, and the effect was better when combined with external support [11]. Adequate warm-up exercises before the start of exercise to enhance joint flexibility and reduce the likelihood of injury and gradually increase the intensity of exercise to avoid overloading and increase the likelihood of injury. According to research, a specific warm-up program can reduce acute injuries by 21% [12]. So, combining specialized warm-up with traditional warm-up can effectively prevent acute sports injuries. After exercising, you should do some soothing exercises to relax tense muscles and help with recovery. According to research, ankle injuries are a common cause of RRIs because of the role of the feet and ankles throughout the running gait cycle. Most ankle Rris are caused by overuse. Damage is caused by an imbalance in tissue homeostasis [13]. Basketball is also a running-based sport, so attention should be paid to the frequency of use of the ankle to avoid ankle injuries caused by overexertion and to improve ankle stability and reduce the risk of injury by strengthening the muscles of the ankle. Such methods can be used for the treatment and prevention of RRI in the foot and ankle. In a randomized trial in 2020, Taddei demonstrated that core training of the foot is gradually becoming an effective rehabilitation approach. Core training exercises the intrinsic, extrinsic and neuromuscular functions of the foot and ankle joints. Runners who receive core foot training are 2.42 times less likely to have RRIs (including ankle Rris) than those who do not [14].

5. Rehabilitation principles

From a Western perspective, the treatment of patients mainly relies on the application of biomechanical analysis and inductive reasoning. However, in the view of the Far East, movement is not just physical; it also contains "subtle energy elements" [15]. It is generally believed that Western and Far Eastern approaches are complementary when analyzing traditional and non-traditional sports techniques. Currently, a hot topic is reexamining traditional therapies through technological innovations or scientific advancements. Solutions that boost efficiency are often seen as the best solution. According to one study, people who participated in the treatment showed significantly better performance than those who did not participate in the treatment in areas such as pain, tenderness, temperature, swelling, joint range of motion, and manual muscle strength tests, both within and between groups. Conclusion: The study showed that in dealing with ankle sprains, a combination of physical therapy was more effective than the traditional approach of relying solely on rest [16].

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5.1. Police principles

In China, due to the prevalence of various indoor and outdoor sports, thousands of people suffer from acute ankle sprains every day. Fortunately, the POLICE principle provides the internationally recommended five-step approach to this type of injury, helping patients to relieve symptoms to the greatest extent and promote early recovery. p stands for protect, ol stands for optimal loading, i stands for ice, and e stands for elevation. This approach focuses not only on the acute phase of pain but also on appropriate exercise and strength training. It offers a more dynamic and personalized rehabilitation strategy. It helps athletes recover from ankle injuries more comprehensively, restore joint and muscle function, and return to the field faster.

5.2. The principle of gradual progress

During the rehabilitation process, proceed step by step and avoid the pursuit of quick results. The rehabilitation training program should specify the duration and intensity of the exercise, as well as the physiological load. At the same time, pay attention to gradually increasing the training volume and record the physical responses of the trainees in order to adjust the plan. This will enable athletes to recover better within a reasonable range, and help them better complete the rehabilitation content based on reasonable load planning to achieve the goal of returning to the field.

5.3. The principle of targeting rehabilitation training

Targeting rehabilitation training after an ankle injury is a complex process. Customized rehabilitation programs are of great significance, emphasizing the professional and personalized aspects. Therefore, each patient's rehabilitation plan should be tailored to avoid a one-size-fits-all approach. Because each basketball player with an ankle injury is injured in different situations and to different degrees, rehabilitation methods should be tailored to the actual situation of the player and should not be generalized with the same rehabilitation method.

5.4. Principles of psychological care

Many people fail to recover to their pre-injury state, and the majority are unable to return to their training level after an injury [17]. Not only is the ankle often one of the most vulnerable parts of the body when engaging in physical activity. And the recovery process after an ankle injury is very complicated. So it is crucial to understand and manage an athlete's expectations effectively. Because many athletes develop a fear of using the injured area after an injury, they are reluctant to exert force, which affects their competitive form and increases their risk of getting injured again. So it is also very important to provide psychological care to athletes during the rehabilitation process.

6. Rehabilitation methods

Exercise therapy, also known as exercise rehabilitation, is a form of rehabilitation treatment that uses equipment, manual techniques, or the patient's own strength to promote the recovery of overall and local motor and sensory functions. There is evidence that exercise therapy is a first-line option for many chronic diseases. Compared with traditional care, exercise rehabilitation can reduce the risk of recurrent ankle sprains. So for basketball players, exercise therapy can better help with recovery and return to the court.

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6.1. Routine rehabilitation combined with joint movement

Routine rehabilitation includes balance and stability exercises and rehabilitation muscle strength training, while joint movement involves sliding the subtalar joint forward and backward, and sliding the subtalar joint medial and lateral.

Under the guidance of a physiotherapist. According to a study, participants were randomly assigned to either the experimental group (EG) or the control group (CG) in a 1:1 ratio, with 17 people in each group divided into two groups: (1) Conventional rehabilitation training combined with joint movement; (2) Regular rehabilitation training. In the study, patients with FAI (limited ankle mobility) showed more significant improvement in torque after 4 weeks of joint mobilization intervention than CG. After temporal ball joint mobilization using the Maitland III technique, the range of motion of ankle dorsiflexion (DFROM) increased significantly by 0.42 cm [18]. The results showed that FAI patients who combined joint relaxation with strength training performed better than strength training alone in terms of ankle muscle strength. These results suggest a synergistic effect between joint mobilization and traditional training, which can more effectively enhance ankle muscle strength, and also improve the dorsiflexion Angle of the foot, indicating that conventional rehabilitation combined with joint movement can have a better effect.

6.2. Psychological counseling

After suffering a sports injury, basketball players not only experience physical changes but also psychological adjustments and need time to recover gradually. Physical recovery is usually quick after an athlete's injury, but psychological recovery is relatively slow and complex. According to research, only a quarter of athletes return to their pre-injury state after an injury, nearly half of them show a significant decline in condition, and a quarter of athletes leave the field either directly or quickly [17]. Therefore, regular psychological counseling and team support can help athletes adjust their mindset and better cope with various difficulties and obstacles during the rehabilitation process. Therefore, it is extremely important to understand and manage the expectations of athletes. Studies have found that athletes experience a range of emotions, including frustration, anxiety and depression, after an injury and during recovery. Negative emotions typically emerge after an injury and are often exacerbated while waiting for a formal diagnosis. Social support is a significant factor in the injury experience, including co-health professionals (particularly sports trainers and physical therapists), teammates, and family members [19]. Because athletes worry about whether their muscles or joints can return to their previous functional state after an injury, which can lead to psychological disorders, these studies found that social support not only enhances athletes' performance, self-confidence and motivation, but also serves as a buffer against stress and burnout. It plays a very important role in injury recovery.

7. Conclusion

Basketball is a sport that demands a high level of physical strength and physicality. While athletes strive for excellent performance, they also bear a high risk of sports injuries. Therefore, the high intensity of basketball can put a lot of pressure on the ankle. This article provides effective prevention and rehabilitation methods for basketball players by analyzing sports ankle injuries, through adequate preventive measures to help them improve competitive performance in a safe environment, and through scientific rehabilitation methods to help athletes recover in a timely manner after injury and constantly give athletes psychological cues during the rehabilitation process,

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While the body recovers, the mind is also helped, and ultimately the physical skill state is fully utilized to return to the sports field and extend athletic life. However, there are still limitations in current research. Most studies are limited to specific groups, such as professional basketball players, and preventive and rehabilitation methods are relatively scarce. In the future, the scope of research needs to be expanded to promote the development of rehabilitation programs, and the mechanism of multi-factor interaction needs to be explored in depth to develop personalized injury prediction and monitoring models and promote the application of evidence-based rehabilitation programs. And integrate wearable devices with motion capture technology to achieve real-time monitoring and feedback of training load. Provide more scientifically grounded theoretical support for ankle prevention and rehabilitation. To help more basketball players and amateurs of the sport get rid of injuries and compete and play basketball in better condition.

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