

Exploration of prevention and rehabilitation strategies for adolescent athletic injuries

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ABSTRACT

With the popularization of sports activities and the improvement of training intensity, the incidence of athletic injuries in adolescents continues to grow. Due to the immature musculoskeletal system, weak sports safety awareness and insufficient protective measures, many avoidable injuries occur frequently. Therefore, this paper focuses on the causes, prevention strategies and scientific rehabilitation paths of adolescent athletic injuries, aiming to help adolescents fully enjoy the benefits of sports in a safe and healthy environment and promote the scientific and standardized development of adolescent sports health-managed care.

KEYWORDS

adolescent; athletic injuries; rehabilitation training; health managed care

In recent years, with the campus physical education curriculum reform and the vigorous development of socialized sports training, adolescent enthusiasm for participating in sports activities continues to rise. However, with the improvement of athletic ability, the problem of athletic injuries has gradually become a challenge that can not be ignored. Acute injuries such as sprain and muscular pull, as well as chronic problems such as joint strain and abnormal spinal column posture caused by long-term improper load, not only affect their short-term sports performance but also pose a potential threat to bone development and mental health. Adolescents are in a stage of strong curiosity and weak risk judgment and are prone to ignore safety details in sports. The rehabilitation after athletic injuries is also mainly "Rest and recuperation." Some injuries occur repeatedly. These problems reflect the disconnection between the traditional sports medicine model and the actual needs of adolescents, and they also expose the lack of sports health knowledge. In this context, this paper will deeply analyze the deep causes and evolution rules of adolescent athletic injuries and explore prevention and rehabilitation strategies in order to help adolescents participate in sports safely under the guidance of science to maximize the release of sports potential to lay a solid foundation for their lifelong health.

1 Types and causes of Adolescent athletic injuries

1.1 Types of Athletic Injuries

The sites of athletic injuries in adolescents include the knee joint, shoulder joint, ankle joint and waist joint. Common injuries include sprain, muscular pull, abrasions, contusions, joint dislocation and fractures. Rare but serious adolescent athletic injuries include athletic sudden death, etc.. Athletic injuries not only threaten the physical health of adolescents but also affect their mental state and studies and even endanger their lives. The sprains are mainly in the ankles and wrists, where the ligament around the joint is overstretched, causing pain and swelling; a muscular pull is an injury to a muscle fiber caused by a sudden, forceful stretch, commonly in the back of the thigh and lower leg^[1]. An abrasion is a superficial injury to the skin caused by friction, while a contusion is a deeper tissue injury resulting in bruising and swelling after a blow. A joint dislocation is when a bone in a joint breaks away from its normal position, making the joint unable to move. A fracture is a partial or complete fracture of a bone, such as a lower leg fracture. This serious type of injury requires medical attention to avoid interfering with normal bone growth. After an injury, adolescents will feel depressed and even self-doubt because they can not continue to participate in their favorite sports. The long-term recovery process can also affect their daily learning and social activities, resulting in physical decline, further affecting self-confidence.

1.2 Analysis of the main causes of athletic injuries

There are two main reasons for adolescent athletic injuries: one is the athletic injuries caused by the influence of physical development; the other is the injuries caused by improper exercise. The growth rates of bones, muscles, and joints are inconsistent during adolescence. Bones tend to grow faster than muscles and ligaments, resulting in the inability of muscles and ligaments to fully adapt to the changes in bones, which may lead to the development of new

muscles and ligaments, insufficient support around the joint, resulting in running, jumping prone to sprains. The bones of adolescents are not fully hardened, bone mineral density is low, and they are more likely to have crack and fracture problems in violent collisions or falls. Moreover, adolescents' coordination and balance abilities are also in a developmental stage, with movement in the need for rapid response, and they are prone to movement errors or body out of balance, resulting in ankle sprains or falls. On the issue of exercise mode, many adolescents lack scientific guidance in sports and blindly increase exercise intensity and training time in order to pursue short-term effects, resulting in physical fatigue; the muscles in the state of fatigue can not effectively protect the joint, and it is easy to cause strain and sprain. Lack of preparation and neglect of recovery after exercise can also increase the risk of injury. When the warm-up is insufficient, the muscles and joints become rigid and sudden high-intensity exercise can easily cause acute strain. A lack of stretching after exercise can keep your muscles tight for a long time, resulting in less flexibility and an increased risk of injury the next time you exercise.

2 Prevention strategies of athletic injuries in adolescents

2.1 Scientific warm-up and post-exercise relaxation

A good warm-up before exercise can help your body slowly get into the exercise state. A warm-up can make your heart beat faster and blood flow more smoothly. This will gradually make your muscles and joints more flexible; simple activities such as stepping in place and gently swinging your arms and legs will open up your body's joint muscles and reduce the stress of sudden movements. Warm-ups also allow your brain and body to work more closely together, making running more stable and less likely to leave you flat on your feet or fall over. At the same time, warm-ups should not be too short. You need to get all the muscles in your body moving, especially in the follow-up exercise, to use the parts, and you should do more activities. Relaxation and stretching after exercise are equally important. During exercise, the muscles are continuously contracting, and after finishing, stretching is necessary to restore them to their original length. Proper stretching requires each movement to be held for a while; you can bend down to touch your toes or raise your hands to stretch your shoulders for relaxation. Such activities can help the heart rate gradually return to normal, allow blood to continue flowing, and remove waste produced during exercise, thereby reducing muscle soreness the next day^[2]. If there is direct rest after exercise, the body very easily does not adapt to dizziness and cramps; therefore, developing the habit of relaxing after exercise is essential.

2.2 Standard movement technology and action guidance

An effective way to prevent adolescent athletic injuries is to standardize their athletic skills and correct their mistakes in time. Each sport has its own set of standard movement requirements, which are based on the characteristics of the human body. In running, for example, the body should be slightly forward, and the ball of the foot should land near the midline of the body in order to reduce the impact on the knee. If you do not run properly, you will increase the stress on your joints and muscles, causing chronic joint damage. Therefore, coaches should guide adolescents to practice correctly, understand the details of each step, and develop muscle memory through repeated practice; during this process, coaches should observe whether the adolescents' movements are accurate and promptly point out any issues, thereby laying a solid foundation for their development in sports. There are differences in adolescents' flexibility and strength levels, and the forced unification of movement standards will easily lead to injuries. Based on this, coaches need to adjust the training objectives according to each person's ability and prioritize ensuring the movement's stability and safety. Standardized techniques can reduce the risk of injury and improve sports efficiency. Adolescents should plan and promote in stages of sports skill practice, master the basic movements first, and then learn the difficult movement skills. The essence of technical norms is to keep the body in a state of natural coordination in sports and avoid accidental injuries caused by unbalanced movements.

2.3 Reasonable training intensity and rest

The physical fitness foundation of adolescents varies, so the exercise plan must start with low intensity to allow the body to adapt gradually. To effectively prevent athletic injuries, it is necessary to reasonably arrange the intensity of training and rest time. When adolescents are in a period of growth and development, the endurance of bones and muscles is limited. A sudden increase in exercise will put too much pressure on the joints, which is not conducive to developing their motor skills and physical health. Coaches should fully consider this and set progressive training content. For example, in the first week, running 15 minutes a day; in the second week, it increased to 20 minutes; in the third week, it extended to 25 minutes; gradually, the muscles and ligaments get enough exercise to avoid tearing and inflammation. Training intensity should be strictly controlled; excessive training will destroy the rhythm of the body recovery, increase

the risk of injury, and the movement of fatigue easily deformed, strained muscles^[3]. Therefore, it is necessary to integrate low-intensity exercise into the exercise training plan of adolescents to give the body buffer time and maintain the consistency of exercise habits. Rest after exercise training is essential for the body's repair and growth. Adolescents need to ensure 8 to 10 hours of sleep each day. During deep sleep, the secretion of growth hormones is vigorous, which helps accelerate the recovery of bones and muscles. During this time, engaging in light activities can also aid recovery; walking, slow cycling, and simple stretching are all effective methods. This can relieve psychological stress and prevent feelings of fatigue from excessive tiredness, which could affect long-term motivation for exercise.

3 The rehabilitation methods of adolescent athletic injuries

3.1 Alternating hot and cold therapy and local nursing

In the early stages of athletic injuries, swelling and inflammation often occur, and cold compresses are needed. Low temperatures can constrict blood vessels, reduce tissue fluid leakage, and relieve local hyperemia and pain. Adolescents should cover the swelling with a cloth to prevent frostbite. Use an ice pack and a cold-water-soaked towel to cover the swelling for about 15 minutes, then re-apply the cold compress at two-hour intervals and repeat the procedure several times. After 48 hours, when the inflammation is under control, apply a hot compress instead. The hot compress promotes vasodilation, speeds up the excretion of waste products, and softens stiff muscles to help restore joint mobility. Adolescents can use a warm towel or hot water bottle to cover the affected area for 10 to 20 minutes, two or three times a day. Alternating hot and cold can help reduce discomfort and speed recovery from an injury. For areas with abrasions or cuts, rinse and disinfect with saline solution, then cover with a sterile dressing to prevent infection. Activity should be reduced after a muscle or joint injury, and elastic bandages should be used for support and fixation. If adolescents experience significant pain, topical analgesic ointments can be applied. During the recovery period, monitoring changes in skin color and temperature is important. If persistent bruising or numbness occurs, the care plan should be adjusted promptly to avoid symptom deterioration and promote effective repair of the injured tissue^[4].

3.2 Progressive Functional Rehabilitation Training

In the first two weeks after acute injury, the focus is to restore the basic range of motion of the joint, which can be performed three times a day with passive activity training, and the injured joint can be slowly bent with the assistance of others. In the initial stage of knee joint rehabilitation, the lower leg should swing in a sitting position to prevent adhesion. Independent anti-gravity training can be carried out when the muscle strength recovers to about 40%. Maintain steady breathing throughout the training, repeat each movement eight to twelve times, and rest for two minutes between sets. In the mid-term recovery stage, single-leg standing exercise with eyes closed can improve the proprioception of the ankle joint, and the lateral movement of the elastic band can enhance the stability of the hip joint. In strength training, the knee joint rehabilitation should first do the leg lifting without weight; after the adaptation to the ankle-bound 500 grams of sandbags to continue training, action speed has always been controlled within 30 degrees per second angle. Applying ice for ten minutes after each training session. If there is an increase in skin temperature or soreness, reduce the training the next day. In the late stage of recovery, the real sports scene is simulated, and the slow direction change stepping training is added to the joint rehabilitation to improve the flexibility and coordination of the joint and enhance the dynamic stability, laying the foundation for re-engaging in specific sports.

3.3 Psychological reconstruction and exercise habit adjustment

Psychological reconstruction requires eliminating the fear and memories associated with the injury. Ankle sprain patients attempt to shift their center of gravity under protective braces, while shoulder strain patients gradually restore their rotational function by lifting their hands to touch their ears. They should set small, achievable goals each week, and accomplishing these goals helps them gradually regain their confidence in movement. The rehabilitation team should adjust the program based on the rehabilitation results. At the same time, the bad exercise habits of adolescents should be adjusted. The coach should rearrange the training process for them, add twenty minutes of dynamic stretching during the warm-up phase, and focus on activating the peripheral muscle groups at the injury site. To maintain daily joint stability, perform ten minutes of hip abduction activation with an elastic band before running and stand on a balance pad for fifteen minutes after basketball training^[5]. Additionally, nutritional supplementation can be enhanced by increasing adolescents' daily intake of twenty grams of whey protein and supplementing with vitamin C before bedtime to promote collagen synthesis. For three months post-rehabilitation, follow the principle of 'decreasing intensity every other day' to ensure that the repaired tissues fully adapt to changes in load, allowing for continuous exercise training.

4 Conclusion

In summary, to prevent adolescent athletic injuries, attention should be paid to risk screening and targeted protection before sports, optimize training load distribution, and reduce the probability of injuries from the source. In terms of rehabilitation, alternating hot and cold therapy combined with functional training can effectively restore the function of damaged tissues, and psychological reconstruction can help adolescents overcome sports fear and rebuild sports confidence. In the future, with the progress of intelligent wearable devices and biomechanical analysis technology, the precise repair of injury parts can be realized, and the sports and health-managed care for adolescents will gradually become more precise and intelligent; finally, the ideal goal of "Zero injuries in scientific sports" will be achieved.

About the Author

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