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# Analysis of rehabilitation therapies for sports injuries

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**Abstract.** Sports injuries are a problem that often occurs in the sports environment, and its rehabilitation research is mostly theoretical or empirical research on a certain therapy, and lacks systematic research. In this study, the literature method and logical analysis method are used to search relevant literature in various databases, and summarize the rehabilitation therapies for sports injuries, the principles, contents and treatment sequence of rehabilitation plans, in order to conduct a systematic analysis of rehabilitation research on sports injuries. It finds that the rehabilitation for sports injuries took physical and mental rehabilitation, including physical rehabilitation and psychological rehabilitation. Rehabilitation programs should be based on principles of avoidance of injury deterioration, timing of treatment, adherence, individualization, specificity assessment, intensity of recovery plans, and overall health; cover muscle strength and endurance, range of motion and flexibility of joints, proprioceptive and neurological function, cardiorespiratory endurance rehabilitation content; follow the sequence of diagnosis, identify treatment goals, primary care, intermediate care, functional rehabilitation, and circulation assessment and maintenance therapy.

**Keywords:** Sports Injury, Rehabilitation Therapy, Rehabilitation Programs, Rehabilitation Content, Rehabilitation Sequence.

## 1. Introduction

Sports injuries are common problems in exercise and can occur in almost every part of the body and organ system. Sports injuries include two categories: "acute injury" and "overuse injury", and the mechanism of the two types of injury is different. Acute injuries are caused by contact or non-contact forces, which can cause the damaged structure to bend and deform, or even tear and break, such as fractures, strains, sprains, etc. Overuse injury is the result of the cumulative effect of submaximal force, and the mechanism of injury is more likely to be related to the history of activity over time. At present, the rehabilitation therapy for sports injuries is diverse, including acupuncture, massage, manual medicine [1], etc., but most studies are theoretical or empirical studies on one of these methods, and systematic research on rehabilitation therapy for sports injuries is limited. And in the course of the study, few studies explain how to develop a rehabilitation plan or how to arrange rehabilitation treatment, as well as psychological rehabilitation. Therefore, this study adopts the literature method and logical analysis method to collect and analyze data, and systematically summarizes the rehabilitation therapy for sports injuries, the principles and content of rehabilitation plans, and the sequence of rehabilitation treatment, which not only provides a variety of rehabilitation therapy options for sports injuries, but also

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helps people to clearly and deeply understand the principles and treatment sequence of rehabilitation plans, which is conducive to the development of sports injury rehabilitation research.

## 2. Rehabilitation therapies for sports injuries

### *2.1. Massage therapy*

Massage therapy can relieve muscle tension and stiffness, reduce muscle pain, swelling and spasm, reduce nerve excitability, and is one of the common techniques used by athletes to restore and improve athletic performance. Massage therapy includes erasing, rubbing, massage, and vibration, but the specific massage timing and technique used are also related to the type of sports injury, etc. Studies [2] have suggested that shorter massage times (5-12 minutes) tend to have greater results than longer massage times (> 12 minutes); short-term recovery periods of less than 10 minutes work better than recovery periods of more than 20 minutes. However, the effects of massage on injury recovery and athletic performance are currently unclear, and the mechanisms of each massage technique have not been extensively studied.

### *2.2. Acupuncture therapy*

Acupuncture originated in China and is currently used to treat pain and musculoskeletal disorders [3]. Acupuncture is achieved by stimulating acupuncture points (meridian or non-meridian acupoints), including traditional Chinese acupuncture, ear acupuncture, scalp acupuncture, etc., in addition to electroacupuncture can be used to stimulate acupuncture needles with a small current to enhance the treatment. Acupuncture has a good therapeutic effect on acute injuries and overuse injuries, and can be used for the treatment of a variety of sports injuries, such as acute and chronic back pain, arthritis, Achilles tendonitis, etc [1]. However, the current research on acupuncture is not comprehensive and profound, often the experiment poorly controls the study, there is a lack of placebo or control group [3,4], and more in-depth research is needed in the follow-up.

### *2.3. Manual therapy*

Manual therapy includes orthopedics, chiropractic and physiotherapy [5], and treatment techniques include active release techniques, strain-response techniques, myofascial release techniques, etc [6]. Although manual therapy has been widely promoted and used, the test for therapists in the process of rehabilitation is excellent, not only requires exquisite technology, but also needs to provide personalized and ideal treatment plans under existing medical conditions, so different therapists operate the same technique or the same therapist uses the same maneuver to treat different sports injury patients, and the effect of treatment may be somewhat different.

### *2.4. Spa therapy*

Water physiotherapy has been used to treat common sports injuries, and the key factors in designing effective exercises for the treatment of sports injuries are buoyancy and resistance [7]. The buoyancy of water reduces an individual's effective weight in proportion to the degree of immersion, and the ability to control joint compression through varying degrees of immersion has major benefits in the design and prescription of treatment exercises. The resistance of water strengthens the muscles, it can adjust the resistance to match the force or effort exerted by the patient, it is an adaptive and variable resistance. At the same time, strength exercises in water are limited only by the range of motion of the joints used, not by the direction [8]. As such, hydrotherapy provides a unique environment that promotes normal movement patterns and early healing processes of strength, often accompanied by a reduction in pain and perceived discomfort.

### *2.5. Cryotherapy*

Cold therapy has become a generally accepted treatment in the rehabilitation of acute sports injuries and injured athletes. Cold therapy refers to the cooling of the injured area, which can use ice packs, ice

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towels, ice massage, cryogel packs, chloroethane and other vapor coolants, etc., which have a positive effect on the reduction of pain and the recovery of various injuries [9]. However, in the specific implementation process, it is necessary to pay attention to the issue of duration, because a long time at extremely low temperatures may produce harmful effects on the body. For example, athletic performance is affected by temperature, the critical temperature is about 18°C, above and below that temperature, muscle performance decreases, below 15°C, increases muscle inflammation and edema.

### *2.6. Extracorporeal shockwave therapy*

Extracorporeal shock waves are a form of energy that creates pressure [10]. There are two main forms of extracorporeal shock waves used in clinical treatment: focused shock waves and radial shock waves. At present, extracorporeal shockwave therapy [11] has been used to treat musculoskeletal diseases, such as tendinopathy, patellar tendinopathy, Achilles tendinopathy, bone stress injury, etc. Treatment regimens (number of pulses, type of shock wave, number of treatments/frequency/duration, application area, and postoperative treatment plan) can be adjusted in the specific implementation environment, and the treatment time is relatively short. However, due to the variability of extracorporeal shockwave therapy, it is not possible to determine the optimal regimen for most indications.

### *2.7. Psychological intervention*

In the rehabilitation for sports injuries, people focus on the physical aspect, but the psychology can also be affected or injured rehabilitation results, and even psychological problems will occur during sports injuries. In order to achieve better rehabilitation results and to reduce psychological stress, it is recommended to include psychological rehabilitation elements such as imagery, self-talk and self-confidence training in rehabilitation programs, as well as peer support groups, which will allow patients to receive emotional and practical support in the process of sharing experiences or information. Regular conversations with patients can also improve the effectiveness of communication and emotional support, making them ideal for overall recovery [12].

In summary, rehabilitation programs should be comprehensive, should not focus only on specific body part injuries or diseases, and should better promote faster recovery from injuries by taking a holistic approach.

## 3. Principles and contents of rehabilitation program development

### *3.1. Principles for the development of rehabilitation programs*

While rehabilitation programs are individual, key (overarching) principles remain unchanged when developing rehabilitation programs. These include the following: avoidance of injury progression, timing of treatment, adherence, individualization, specificity assessment, strength of recovery plan, and overall health. These principles form the basis of the rehabilitation program.

Timing of treatment means that rehabilitation should be started as soon as the healing tissue tolerates to avoid worsening of injury. Adherence refers to helping patients understand the content and process of a rehabilitation program, so that they adhere to the prescribed exercises and complete the exercises correctly [13]. Individualization refers to the individualization of the rehabilitation program, taking into account the severity of the sports injury and the size of the patient's response, as well as the patient's previous injury history and treatment history. Specific assessment is based on the severity of the sports injury, the physiologic process of the injury site at each stage of rehabilitation, and the response. The strength of the rehabilitation program refers to ensuring that the healing tissue of the injury does not disrupt the healing process or negatively affect the patient when undergoing therapeutic training. Overall health means that a rehabilitation program that targets specific damaged tissues or sites should have less impact on the patient's overall health.

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### *3.2. Contents of rehabilitation plan development*

The content of the rehabilitation program should take into account the pathology of the sports injury and the needs of the individual, but the overall should include the following: muscle strength and endurance, range of motion and flexibility of joints, proprioceptive and neurological function, cardiorespiratory endurance. This is not only the rehabilitation content that the general public needs after injury, but also the basic quality of athletes who want to return to the field after injury.

The unrestricted range of motion and flexibility of the joints is the basis for the realization of body walking and motor functions, which are affected by pain, swelling, adhesions, etc., requiring early exercise and weight-bearing exercises. Flexibility also has an impact on the range of motion of the joint, which can be restored by stretching techniques, such as static and dynamic stretching and proprioceptive neuromuscular facilitation (PNF) [13] etc. Among them, PNF technology [14] is mainly the application of proprioceptive stimulation to promote muscle contraction, enhance muscle strength, expand the joint range of motion, increase functional activities, emphasize the overall movement of multi-joint, multi-muscle group participation rather than single muscle activity, enhance joint mobility, stability, control ability and how to complete compound action skills, while using kinesthesia, posture sensation and other stimuli to enhance the neuromuscular response and promote the corresponding muscle contraction exercise method. The basic principle is to stimulate it in activities according to the physiological characteristics of neuromuscular, stimulate as many receptors as possible, thereby enhancing muscle activity and promoting the realization of functional movement. PNF drafting techniques are part of PNF techniques and there are two main types: hold-to-relax techniques and contraction-relaxation techniques. Muscle strength and endurance provide support and stability to the limbs, and movement requires resistance to the muscles; Proprioceptive and neuromuscular control refers to restoring balance, coordination, and agility, which need to be carried out throughout the rehabilitation program; Cardiorespiratory endurance is necessary for daily life and work, and can be maintained at a fitness level throughout the rehabilitation process [13], which will help the injured site return to full mobility.

## 4. Sequencing of rehabilitation

### *4.1. Diagnosis*

Effective treatment is based on the precision of the diagnosis, which directly affects the subsequent treatment effect. Diagnosis requires a medical history, including past medical history, treatment history, comprehensive medical history, physical examination, and imaging if necessary, and then clarify the source of the symptoms, that is, the site of injury, and determine whether abnormalities in physical fitness (such as flexibility, strength, etc.) or neurological function are affected by the site of injury, the cause of the injury, or are not related to the injury, which is a deep understanding and diagnosis of the cause of injury.

### *4.2. Targeting treatment*

The definition of treatment goals is the structure of the treatment plan that helps to sequence the selected treatment interventions. Each rehabilitation program should have different stages of goals, which is also a benchmark for evaluating the effectiveness of treatment. And the goal should be functional, including objective criteria that can be measured and repeated, including "audience, behavior, condition, degree and time frame", in the case of rehabilitation for sports injuries, the patient, the purpose, how it is evaluated, the standard and time required to achieve the goal.

### *4.3. Primary treatment*

Primary treatment addresses the effects of injury and can also be understood as "first aid", depending on the type of injury. Treatment of acute injury includes, but is not limited to, immobilization of the injury site with wraps or splints to avoid further exposure of the patient. Overuse of injury focuses on identifying and reducing the activity that caused the injury, allowing the injury site to rest, i.e., protecting the injury area, using medications and/or treatments to control pain and swelling. Primary treatment

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should also include stabilizing the injury while transporting the critically ill to an emergency medical facility [15].

### *4.4. Intermediate treatment*

At this stage, patients begin therapeutic training, the purpose of which is to restore complete movement and strength in the injured part and maintain flexibility, strength and health in the uninjured part. Since the patient's joint mobility is currently limited, in addition to active activities, passive activities can be carried out with the help of therapists, etc. In terms of flexibility, manual stretching, elastic band stretching, proprioceptive neuromuscular facilitation (PNF) or contraction-relaxation techniques can be assisted by stretching; flexibility can be restored with the help of massage therapy or manual therapy; for strength quality, injured or moving the muscles of injured joints, strength training can start with isometric exercises, and low-resistance training can begin after improvement in mobility, and then slowly increase the resistance intensity and the number of exercise repetitions. In addition to strength exercises on land, adaptable, variable resistance training can also be provided in water environments.

### *4.5. Functional rehabilitation*

The need for movement determines the requirements of function, and once flexibility, joint movement, and strength are restored, patients need to regain the higher levels of function necessary for a successful return to physical activity, so the functional rehabilitation phase is actually the stage of restoring motor skills. What's more, the time required for athletes in different sports is different, and it varies from sport to sport.

### *4.6. Circulation assessment and maintenance therapy*

Repeated evaluations are required on an ongoing basis throughout the rehabilitation process in order to understand the effectiveness of the treatment and advance the treatment plan. The assessment site includes previously identified problems and phased goals. Evaluation should be based on patient-specific, region-specific, and disease-specific [16]. The circulation assessment process should be performed periodically until all goals have been completed and the patient has returned to their pre-injury state.

Maintenance therapy should be continued when rehabilitation from a sports injury has returned to its pre-injury state, or this rehabilitation phase, the athlete may be ready to return to the field, and rehabilitation needs to continue. Maintenance therapy is flexible, and therapy exercises can be flexibly performed according to the season, the athlete's time, and the athlete's environment.

## 5. Conclusion

Sports injuries are unavoidable or common problems during exercise, which can occur in every part of the body and organ system, and are broadly divided into "acute injury" and "overuse injury". Acute injuries can be caused by force, resulting in bending and deformation of the damaged part, or even tearing and breaking, while overuse injuries are caused by the cumulative effect of this maximum force over time. Although the principles and mechanisms of the two types of injuries are different, the therapy, principles, contents, and order of rehabilitation plans are consistent. Rehabilitation for sports injuries includes not only physical rehabilitation - acupuncture, massage, manual therapy, spa therapy, cryotherapy, extracorporeal shockwave therapy, etc. It should also cover psychological rehabilitation - imagery, self-talk and self-confidence training, etc. Therefore, the rehabilitation for sports injuries should take the body and mind as the starting point and carry out comprehensive rehabilitation treatment. The content of the rehabilitation program should vary according to the pathology of the injury and the needs of the individual patient, but it should also be holistic - it should cover muscle strength and endurance, range of motion and flexibility of joints, proprioceptive and neurological function, cardiorespiratory endurance. Rehabilitation treatment should be carried out in a reasonable and scientific order, accurate diagnosis is the premise, the goal of treatment is the benchmark, the primary treatment is "first aid" or solving the impact of injury, intermediate treatment is the treatment training to restore

physical fitness, functional rehabilitation varies from person to person, and circulation assessment and maintenance therapy are the effective guarantee of rehabilitation programs.

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