

Rehabilitation of the Injured Athlete

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Abstract. An increase in the rate of injuries has accompanied the boom in sports participation among children and adolescents. Accurate diagnosis, prompt treatment, and comprehensive rehabilitation are keys to the safe return of the young athlete to sports. Reacquisition of flexibility, strength, and endurance forms the basis of reconditioning. A graded reacclimatization to the demands of the sport allows the athlete to attain the preinjury level of skill. Psychological ramifications of injury such as fear, anger, and depression are to be expected and must be dealt with appropriately.

Introduction

Youth participation in sports on both a recreational and competitive level has increased dramatically over the past 30 years. This has done much to enhance the general health and well-being of children. Unfortunately, along with this rise in participation has come an increase in sports-related injuries. Although children have an enormous capacity for healing, appropriate rehabilitation of sports-related injuries must be undertaken with the same vigor as with their adult counterparts. Factors unique to the immature athlete must be considered during the course of rehabilitation.

Team Approach

A team approach is essential to comprehensive sports injury rehabilitation. No one health professional can effectively provide all services needed by the recovering athlete. The physician, physical therapist, trainer, and coach should work closely together in the rehabilitation process. The rehabilitation plan must be prescribed and coordinated by the physician. The progress of the athlete should be frequently monitored, as alterations in the program may be necessary.

Linkage

In the rehabilitation of any athletic injury the concept of linkage must be kept in mind [1]. A significant injury to any component of the musculoskeletal system will invariably have an impact on structures proximal and distal to the site of injury. Secondary effects also occur in the cardiovascular, neurological, and other organ systems. If attention is focused solely on the site of injury, complete recovery is compromised. Further, the demands of the chosen sport may not be met because of residual deficits in the musculoskeletal system away from the site of injury. With 'total body linkage' as a basis, a rational and comprehensive approach to rehabilitation may be taken.

Components of Athletic Rehabilitation

Rehabilitation ideally begins immediately after injury and ends when the athlete returns to full activity without limitations imposed by the injury [2]. Treatment of the injury and some degree of healing must precede reconditioning. Therefore, treatment and healing become integral parts of the rehabilitation process. Following injury, anatomical restoration of damaged structures becomes

the primary goal. This may be accomplished by nonoperative or operative methods. Rest and immobilization are often required to facilitate the healing process. Muscle atrophy is a consequence of limb immobilization. Maintaining muscle in the lengthened position, isometric muscle contractions, and electrical muscle stimulation are useful ways to decrease muscle atrophy during immobilization [3]. During the early healing phase the athlete should be encouraged to perform strengthening and endurance exercises using body parts not affected by the injury. These measures will shorten recovery.

Pain is a natural sequela of injury and is usually present to some degree during the early phases of healing. Pain activates neural mechanisms which initiate muscle function, making it difficult for the injured athlete to perform exercises that are essential for a speedy recovery. Judicious use of analgesics and therapeutic modalities such as cryotherapy and heat help provide necessary pain relief.

The essential components of any athletic reconditioning program will include measures to restore flexibility, strength, and cardiovascular endurance. Kegerreis [4] has used 'functional progressions' in the augmentation of traditional athletic rehabilitation to achieve complete restoration of athletic abilities. Functional progression is defined as an ordered sequence of activities enabling the acquisition or reacquisition of skills required for the safe, effective performance of the chosen sport. If this important component of rehabilitation is omitted, the athlete may be physically fit but may lack the confidence to return to full sports participation.

Flexibility

Flexibility is the ability to move unresisted through a full range of motion and is as important to an athlete as strength, cardiovascular conditioning or timing [3]. Joints and muscles may lose flexibility in response to injury and immobilization. Flexibility has primary importance in rehabilitation in that the fullest muscle-tendon-length-gives-a-more-efficient contraction [5]. Efforts should be made to begin early motion in injured joints as soon after injury or surgery as is safely possible [6].

When immobilization is discontinued or when restrictions on range of motion are removed, stretching exercises may be initiated. Stretching exercises use forced motion applied actively by the individual contracting the antagonist muscle group or passively by an external force stretching the muscle [7]. There are three

types of stretching: static, ballistic and proprioceptive neuromuscular facilitation.

Static stretching is the most commonly used method. It is performed by holding the muscle in a lengthened position for a period of time, followed by relaxation. Several repetitions are done, with the idea of increasing excursion with each successive effort.

In ballistic stretching the position of stretch is assumed and a bouncing motion is utilized. This method is often more painful and even may result in muscle tears if the tolerance of the muscle being stretched is exceeded [8].

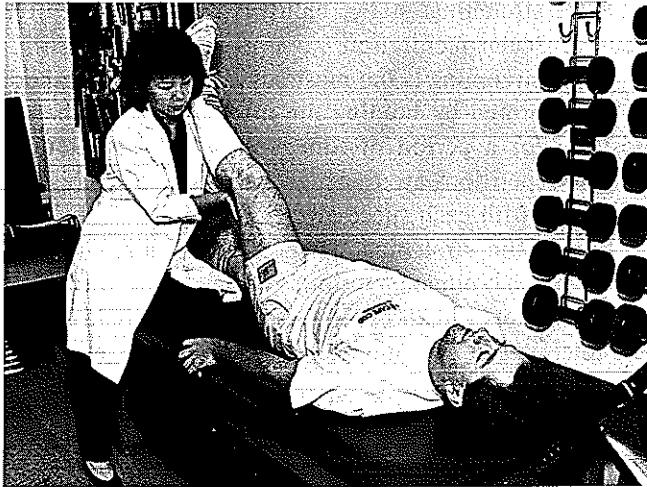
Proprioceptive neuromuscular facilitation techniques require a partner. Increased flexibility is gained by first fatiguing the muscle by requiring it to contract isometrically for a period of time against a fixed resistance (fig. 1a). The muscle is then relaxed, and the antagonist contracts along with assisted movement from the partner [8] (fig. 1b). This technique is not only useful in rehabilitation but may also be used in injury prevention and warm-up [9].

Strength

Delorme [10] popularized the use of heavy resistance exercises to restore muscle power after injury during the 1940s. Since that time, numerous strength programs and types of exercise equipment have been developed that have revolutionized sports injury rehabilitation. Although strength training in children remains a controversial issue, there is a growing body of evidence that supports its safety and efficacy [11]. There are three types of strength training modalities: isometric, isotonic, and isokinetic. A working understanding of each will allow for its proper use in prescribing a rehabilitation program.

Isometric exercise involves contraction of a muscle against a fixed resistance such that no joint motion occurs. The muscle unit may be loaded maximally; however, since the muscle is only loaded at one point in the range of motion of the joint, there is little effect on motor performance [12]. Therefore, isometrics have limited use as a singular strength modality in athletic rehabilitation. Isometric exercise may be useful in the early stages of rehabilitation when the limb is immobilized or in the treatment of knee injuries when the lack of patellar loading is desirable [13].

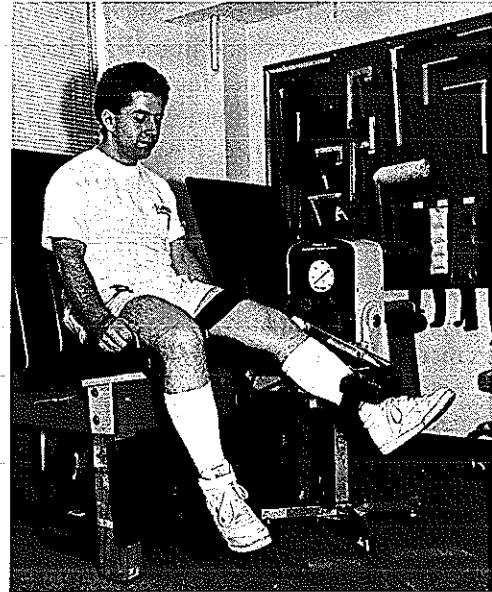
Isotonic exercise is done through a full range of motion with a fixed resistance. An isotonic muscle contraction may be concentric, in which the muscle shortens



1a



1b



2

Fig. 1. Technique of proprioceptive neuromuscular facilitation stretching. a Contract phase – athlete contracts hamstring with physical therapist applying resistance. b Relax/stretch phase – therapist stretches hamstring passively.

Fig. 2. Isokinetic strength work is performed on Cybex dynamometer. Both hamstring and quadriceps strengthening is performed by sequential contraction of knee flexors and extensors.

against resistance, or eccentric, in which the muscle lengthens. Equipment for isotonic exercises is simple and readily available. The most common example is free weights. A disadvantage of free weights is that the force on the muscle is not constant through a full range of motion. The muscle is loaded maximally only at its weakest point, and the rest of the system is operating at less than capacity [12]. A variation of isotonic exercise called variable resistance (Nautilus[®], Eagle[®]) attempts to provide maximum resistance throughout the range of motion by employing cams and pulleys.

Isokinetic exercise is performed at a fixed speed with resistance that is accommodating throughout a range of motion (fig. 2). Isokinetics have proven to be a useful therapeutic tool because of three unique features [14].

(1) Maximal dynamic loading of a muscle may be achieved throughout a range of motion. (2) Resistance is accommodating; therefore, a patient may use less effort through a painful arc in the range of motion, yet still have high resistance in other areas in the range of motion. (3) Exercises may be performed at fast, functional contractile velocities.

The development of isokinetic resistance exercise has allowed the use of lower resistances and higher repetitions, resulting in better strength development and less joint trauma when high loads are avoided [15]. On the negative side, availability of isokinetic equipment is limited in some situations because of cost. Also, its use can become a time-consuming endeavor when multiple muscle groups must be exercised.

Cardiovascular Endurance

During the early phases of rehabilitation, an effort should be made to limit the loss of cardiovascular endurance. Since cardiovascular endurance is lost rapidly with cessation of training, any form of exercise that the athlete can engage in without further aggravating the injury should be encouraged [16].

Selection of a cardiovascular conditioning program for the latter stages of rehabilitation should be sports-specific; however, activities for the earlier stages should accommodate the injury. Stationary cycling is an excellent form of cardiovascular exercise. The unique advantage of this modality is that it may be used even when one leg is immobilized. Some models will allow for variation in workload and speed to provide a good anaerobic and aerobic workout.

Pool running allows for aerobic conditioning while providing a relatively weightless environment [16]. This is accomplished by having the athlete run in chest-high water. Pool running is particularly useful in lower extremity injuries in which impact loading should be minimized.

Psychological Aspects of Rehabilitation

A comprehensive rehabilitation program promotes a positive state of mind which will facilitate the physical reconditioning process. Rehabilitation is 75% psychological and 25% physiological. These are important considerations when dealing with the delicate psyche of the young athlete.

The athlete's physical condition and ability to perform in his/her chosen sport are intimately tied to a sense of well-being [17]. An injury that prevents the athlete from competing may be a devastating problem. Rehabilitation should be expedited to return the athlete to the sport as soon as is safely possible.

Faris [17] has proposed a format for addressing the psychological aspects of athletic rehabilitation. Phase I—Information is gathered about the patient and the injury, and rapport is established. In doing so, trust is earned and anxiety is reduced. Phase II—The nature of the injury and the rehabilitation process is explained to the patient. The stage is set for the patient to have a proper frame of mind about the rehabilitation process. Phase III—The patient's emotional reactions to the injury and treatment are addressed. Fear, anger and depression are normal responses. Phase IV—The patient is trained to

perform rehabilitation exercises properly to maximize benefits.

Pressure and anxiety may mount in the athlete attempting to recover from injury. Much of it may arise from uncertainty and fear of failure. Nideffer [18] has pointed out how increasing pressure and anxiety may incite certain physiological responses (increased heart rate, blood pressure and muscle tension) and psychological responses (loss of concentration) that may interact to complicate the process of recovery. These problems, if recognized early, often respond to reassurance. However, in some cases referral to a psychological specialist may be necessary. Techniques such as biofeedback, progressive relaxation and attention control may be effective in alleviating these problems [18].

Conclusion

Comprehensive sports injury rehabilitation requires a team approach. An understanding of how musculoskeletal injury impacts on other organ systems is necessary. Traditional rehabilitation techniques to restore strength, flexibility and endurance should be augmented with a graded program to reacclimate the athlete to the demands of the sport. The psychological aspects of rehabilitation should not be ignored, as they often impact on recovery.

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