RANGE OF MOTION EXERCISE:

A BASIC TRAINING IN SPORT REHABILITATION

Lucky Angkawidjaja Roring

School of Sport Education and Health Education

Indonesia University of Education

Abstract

Sport rehabilitation program is focused in controlling pain and inflammation, regain the normal joint movement (ROM), flexibility, muscle strength and muscle endurance and cardiovasclular endurance. These steps of program should be matched with the healing stages after injury. Healing process has three phases; acute inflammation phase, proliferative phase, remodeling phase. Based on the phases of healing process, rehabilitation program is divided into three phases; reduction phase, restorative phase, re-integrated phase.

Range Of Motion exercise is a basic technique used to evaluate movement and initial activity in a therapeutic intervention. There are two major techniques in ROM exercise; Passive ROM and Active ROM.

ROM techniques are used to maintain joint and soft tissue mobility and to minimize loss of flexibility and contracture formation in injured tissues.

Key words: Sports Rehabilitation, Range of Motion

INTRODUCTION

Sport and recreation (SR) - related injuries are an important cause of morbidity. These injuries account for nearly one third of all injuries in a rural population in United States and over 20% in a Dutch trauma centre study. Because of the high incidence the need for hospital treatment as out-patient or in-patient resources is considerable.

Sports injury management is needed to be known by the people involved in sports, in order to prevent and better sports injury treatment to avoid a decrement of quality of life caused by injury. Sports injury management includes sports injury prevention, treatments and rehabilitation.

Injury is damage or trauma suffered or experienced by someone. Sports injury is injury that occurred at when someone doing sport activities such as fitness, exercise or sports games. Sports injury can occur at any part of the body, but the most often is muscle and skeletal (the musculoskeletal system).

DISCUSSION

Classification of Sports Injury

Sporting injuries can be classified by their cause (Williams & Sperryn, 1976) or by the tissue which is injured. An understanding of both is needed if the sports physician is to give the patient optimal care during the recovery period.

Mechanisms of Injury

Mechanisms of injury can divided into primary and secondary injury. There are three types of primary injury.

1. Direct or Extrinsic Injury
   This type of injury may result from external causes such as collision with another athlete or being struck by a piece of equipment, falling etc. Examples, head injury, bone or joint injury, muscle contusion or skin abrasions.
2. Indirect or Intrinsic Injury
   These injuries are caused by the individual athlete and are commonly seen with muscle tears following inadequate pre-season and in-season stretching, where muscle length is not adequate to perform a particular skilled manoeuvre. The muscle-tendon unit is overloaded, often under eccentric loading conditions, with the inevitable consequences of a partial tear or even a complete rupture of that muscle-tendon unit.
3. Overuse injury
   Acute repetitive friction
   This may occur if continually apposed structures are in constant contact, such as in the iliotibial band syndrome.
   Chronic repetitive microfatigue
   This failure can result in such injuries as Achilles tendinitis or Osgood-Schlatter's disease.

Secondary injuries divided into two types:

Short Term injuries

These injuries often follow one which has been previously mismanaged. It is common with muscle-tendon unit tears when the pain of acute inflammatory phase has settled down in the second or third week of treatment. At this time the athlete believes that an adequate load-bearing scar has formed and commences the rehabilitation exercise at full power or speed, which may cause a re-tear at the previously injured site.

Long term injuries

This occurs in situations where a long-term injury can lead to other degenerative problems. For example: degenerative knee osteoarthritis as a result of cruciate ligament rupture or meniscal damage.

Tissue-Based Classification of Injury

Soft tissue injuries:

- Skin and deep fascia
- Muscle-tendon unit an tendoperiosteal attachments to the skeleton
- Muscle compartment of the leg
- Joints and their associated structures including dislocation, subluxation, fracture dislocation with ligamentous an ligament-bone junction
- Intervertebral disc annulus fibrosus disruption

Hard tissue injuries:

- Acute bone fractures including osteochondral fractures and avulsion fractures
- Periostitis,
- Stress fractures due to repetitive cyclical loading on normal bone
- Hyaline articular and epiphyseal cartilage injuries

Healing/Repair Process

There are three phases of healing or repair process as described by Alvarez et al (1987).

1. Acute Inflammatory Response (0 – 72 h after injury)
   This phase occurs immediately after the tissue is injured. There are several occurrence in this phase such as:
   - In the early stage of this phase, chemotactic agents are released from mast cell and platelet and stimulating the migration of PMN and monocyt
   - Degradative enzymes released
   - Vasodilatation and capillary permeability improvement intervened by prostaglandins
   - Interstitial swelling and internal hemorrhage at injured site
   - Chemotactic factors released from the macrophage cell granules that will stimulate the development of undifferentiated tissue cells become fibroblast, endothel and other matured cells.

2. Matrix and Cellular Proliferation Phase (72 h – 6 weeks after injury)
   This phase is characterized by the proliferation of capillaries and fibroblasts which synthesize a collagen/proteoglycan matrix and both together form the granulation tissue. In this phase wound becomes contracted that caused by the formation of collagen.

3. Remodelling and Maturation Phase (approximately 6 weeks to several months after injury)
   During this phase, the special cells called myofibroblasts which contain the contractile actin proteins, interact with the newly laid down collagen fibrils and continue contraction of the collagen fibril framework established during the repair phase.
   Early motion of ligaments as opposed to immobilization appears to translate mechanical signals to the fibroblasts at this stage to assist in the remodeling process of removal of early poorly orientated collagen fibrils and the deposition of new collagen fibers in the direction of loading.

Effects of Immobilization on Ligaments and Synovial Joints

There is articular cartilage atrophy with proteoglycan loss and an associated fibro-fatty connective tissue that is synovial-derived, which adheres to the articular cartilage. Ligaments insertion sites are weakened and the ligament itself has increased compliance with reduce load to failure. This is due to loss of collagen mass which may occur with only 8 – 12 weeks of immobilization and may take up to 1 year to recover after mobilization. Capsular changes include loss of water due to loss of glycosaminoglycans, including hyaluronic acid which leads to joint stiffness (Akeson et al, 1987). Clearly joint immobilization is to be avoided if possible to prevent the above changes from occurring as they may take many months to recover.

Objectives of Treatment and Rehabilitation

The initial aims of treatments are to assist healing, to regain length and strength of damaged tissues and to regain function. The final functional result of treatment must include cardiovascular fitness, endurance, speed and psychomotor skills. One of many rehabilitation methods used to achieve functional result of treatment as mentioned above is therapeutic exercise.

Therapeutic exercise is the systematic and planned performance of bodily movements, postures, or physical activities intended to provide a patient or client with means to:

- Remediate or prevent impairments
- Improve, restore, or enhance physical function
- Prevent or reduce health-related risk factors
- Optimize overall health status, fitness, or sense of well-being

A basic technique of therapeutic exercise is Range of Motion Techniques

Range of Motion

Range of Motion is a basic technique used for examination of movement and for initiating movement into a program of therapeutic intervention. Movement that is necessary to accomplish functional activities can be viewed as muscles or external forces moving bones in various patterns or ranges of motions. Bones move at the connecting joints. The structure of the joints, as well the integrity and flexibility of the soft tissues that pass over the joints affects the amount of motion that can occur between any two bones. The full motion possible is called the Range of Motion (ROM). When moving a segment through its ROM, all structures in the region are affected: muscle, joint surfaces, capsules, ligaments, fasciae, vessels and nerves. Therapeutically, ROM activities are administered to maintain joint and soft tissue mobility, in order to minimize loss tissue flexibility and contracture formation. ROM exercises do not encompass stretching techniques that intended to increase range.

Types of Range of Motion (ROM) Exercises

- Passive ROM (PROM). PROM movement is within the unrestricted ROM for a segment that is produced entirely by an external force. There is little or no voluntary muscle contraction. The external force may be from gravity, a machine, another individual, or another part of individuals own body.
- Active ROM (AROM). AROM is movement within the unrestricted ROM for a segment that is produce by an active contraction of the muscles crossing joints.
- Active-Assistive ROM (A-AROM). A-AROM is a type of AROM in which assistance is provided by an outside force, either manually or mechanically, because the prime mover muscles need assistance to complete the motion.

Indications and Goals for Range of Motion

Passive Range of Motion

Indications for PROM

- In the region where there is acute, inflamed tissue, passive motion is beneficial; active motion would be detrimental to the healing process.
- When a patient is not able to or not supposed to actively move a segment or segments of the body as when comatose, paralyzed or on complete bed rest.

Goals for PROM

The primary goal for PROM is to decrease the complications that would occur with immobilization such as cartilage degeneration, adhesion and contracture formation and sluggish circulation.

Specific goals are follows:

- To maintain joint and connective tissue mobility
- To minimize the effect of the formation of contractures
- To maintain mechanical elasticity of muscle

- To assist circulation and vascular dynamics
- Enhance synovial movement for cartilage nutrition and diffusion of materials in the joint
- To decrease or inhibit pain
- To assist with the healing process after injury or surgery
- To help maintain the patient's awareness of movement

Other uses for PROM

- When therapist is examining inert structures, PROM is used to determine limitations of motion, to determine joint stability, and to determine muscle and other soft tissue elasticity.
- When a therapist is teaching an active exercise program, PROM is used to demonstrate the desired motion.
- When a therapist is preparing a patient for stretching, PROM is often used preceding the passive stretching techniques.

Active and Active-Assistive ROM

Indications for AROM

- Whenever a patient is able to actively contract the muscles and move a segment either with or without assistance, AROM is used.
- When a patient has weak musculature and is unable to move joint through the desired range (usually against gravity), A-AROM is used to provide enough assistance to the muscle in a carefully controlled manner so that the muscle can function at its maximum level and progressively be strengthened.
- AROM can be used for aerobic conditioning program.
- When a segment of the body is immobilized for a period of time, AROM is used on the regions above and below the immobilized segment to maintain the areas in as normal a condition as possible and to prepare for new activities, such as walking with crutches.

Goals for AROM

If there is no inflammation or contraindication to active motion, the same goals for PROM can be met with AROM. In addition, there are physiological benefits that result from an active muscle contraction and motor learning from voluntary muscle control. The specific goals include:

- Maintain physiologic elasticity and contractility of the participating muscles.
- Provide sensory feedback from the contracting muscles.
- Provide a stimulus for bone and joint tissue integrity.
- Increase circulation and prevent thrombus formation.

- Develop coordination and motor skills for functional activities.

There are several limitations for doing Range of Motion exercises include

True passive, relaxed ROM may be difficult to obtain when muscle is innervated and the patient is conscious.

Passive motion will not

- Prevent muscle atrophy
- Increase strength or endurance
- Assist circulation to the extent that active, voluntary muscle contraction does.

And the limitations of Active ROM are as follows:

- For strong muscles, it will not maintain or increase strength.
- It will not develop skill or coordination except in the movement patterns used.

There are some precautions and contraindications for doing ROM exercise as follows:

- ROM exercises should not be given if the motion is disruptive to the healing process of injuries .
    - Carefullly controlled motion within the limit of pain-free motion during phases of healing have been shown to benefit of healing and early recovery
    - Signs of too much or the wrong motion, include increased pain and inflammation
- ROM should not be done when patient response or the condition is life-threatening

CONCLUSION

The conclusion of this presentation are as follows:

- Sport and recreation (SR) - related injuries are an important cause of morbidity.
- Sports injury management is needed to be known by the people involved in sports, in order to prevent and better sports injury treatment to avoid a decrement the quality of life caused by injury.
- Healing process has three phases:
    - Acute Inflammatory Response (0 – 72 h after injury)
    - Matrix and Cellular Proliferation Phase (72 h – 6 weeks after injury)

    - Remodelling and Maturation Phase (approximately 6 weeks to several months after injury)

- Treatments and rehabilitation should match the healing phases
- Early mobilization after injury such as ROM exercise should be administered :
    - To assist healing process.
    - To avoid the effect of prolonged immobilization
- ROM exercise is a basic technique in Sports Rehabilitation that provide early mobilization program for injured patients.
- ROM exercise is not intended to increase range of motion, unlike the stretching exercise.