IX JORNADAS SOBRE
MEDICINA Y DEPORTE DE ALTO NIVEL

1ª Conferencia:

“Lesiones Musculares”

Ponente:

Dr. Markku Jarvinen

Curriculum Vitae

DR. MARKKU JUHANI JARVINEN

PROFESSIONAL APPOINTMENT

Professor of Surgery, University of Tampere June 1, 1997–

EDUCATION AND TRAINING

Doctor of Medical Science (MScD), University of Turku 1976
Specialist in Surgery1980

Specialist in Orthopaedics and Traumatology 1983

Docent in Surgery, University of Tampere 1984-97

PREVIOUS PROFESSIONAL APPOINTMENTS

Senior physician, Head of Section of Orthopaedics and Traumatology,
Department of Surgery, Tampere University Hospital (12years 9 months) 1984-1997

Visiting Professor, Department of Orthopaedics & Rehabilitation, College of Medicine,
University of Vermont, Burlington, Vermont, USA (12 months) 1986-87

MILITARY RANK

Medical Major 2002

HONOURS

Honorary member and the Faltin lecturer, The Finnish Surgical Society 2002
Honorary member and the Langenskiöld lecturer,
The Finnish Orthopaedic Association 2005
Honorary member, The Estonian Orthopaedic Society 2006

EDITORIAL BOARD MEMBERSHIPS

Italian Journal of Sports Traumatology.	
Member of Editorial advisory council	1978-86
Scandinavian Journal of Medicine and Science in Sports	1991–
Knee Surgery, Sports Traumatology; Arthroscopy	1993–
Scandinavian Journal of Surgery (Annales Chirurgie et Gynaecologiae)	
Guest editor, special issue: SPORTS INJURIES	1991
American Journal of Sports Medicine	1998–
International Journal of Sports Medicine	2002–
Baillière`s Clinical Orthopaedics; International Practice and Research	
Guest editor, special issue: SOFT TISSUE INJURIES IN SPORTS	1996

MEMBERSHIPS IN SCIENTIFIC SOCIETIES

Finnish Surgical Society	1976–
Member of the executive committee	1985-92
Honorary member	2002
Finnish Orthopaedic Association	1981–
President	1999-2001
Honorary member	2005
Finnish Society of Sports Medicine	1970–
Member of the executive committee	1973-88
European Society of Knee Surgery, Sports Traumatology and Artroscopy	1985–
Herodicus Society (USA)	1988–
Association of Closed treatment in Fractures (ARTOF)	1995–
Nordic Orthopaedic Federation	
Vice-president	2002-2004
President	2004-2006
ISAKOS	2004-
Member of Sports Medicine committee	2004-

SCIENTIFIC PUBLICATIONS

Has published 260 scientific papers in international per review –scientific journals on the field of sports medicine, experimental and clinical orthopaedics and traumatology.

Muscle Injuries – biology and treatment

Muscle injuries, one of the most common traumas occurring in sports, are classified according to their etiology as contusions, strains or lacerations (over 90% of all sports-related injuries are contusions or strains). Muscle contusion occurs as a muscle is subject to a sudden direct blow to the muscle in contact sports, while sprinting and jumping are the most common activities associated with muscle strains. In strains, an excessive tensile force subjected on the muscle leads to a rupture of the myofibers. Muscle strains typically concern the superficial muscles working across two joints, such as the rectus femoris, semitendinosus and gastrocnemius muscles in the lower extremity. Despite the apparent clinical importance, there are only few clinical studies on the treatment of muscle injuries. Accordingly, the current treatment principles of muscle injuries have been derived from experimental studies or tested empirically only.

Experimental studies have shown that the basic biological processes occurring in the healing muscle are identical irrespective of the primary etiology (injury mechanism). The understanding of the basic principles of muscle healing forms the basis for the treatment of muscle injury. The natural course of muscle injury healing can be summarized as follows:

After the initial trauma, the ruptured myofibers retract and a hematoma fills the gap between the myofiber stumps, while the injured tips of the myofibers undergo necrosis. Macrophages, having first invaded the injury site from the torn blood vessels, remove the cell debris and secrete growth factors that activate the satellite cells, the regenerative cells of the muscle tissue. The activated satellite cells first form myoblasts, then fuse into myotubes, and finally mature into myofibers. The ends of these matured myofibers attach to the extracellular matrix of the interposed scar via adhesion molecules at the newly formed myotendinous junctions.

Classification of muscle injuries: The clinical picture of a muscle injury - strain, contusion or laceration - depends on the severity of the injury and the nature of the haematoma. The intramuscular blood vessels are torn as a result of trauma, leading to either intra- or intermuscular haematoma. In case of the intramuscular haematoma, the extravasation of blood within the intact muscle fascia results in increased intramuscular pressure, which eventually limits the size of the haematoma. In contrast, an intermuscular hematoma develops if the fascia surrounding the muscle is torn and the extravasated blood has free access to spread into the interstitial and interfascial spaces.

The current classification of muscle injuries identifies mild, moderate, and severe injuries based on the clinical impairment they bring about. Mild (first degree) strain/contusion represents a tear of few muscle fibers with minor swelling and discomfort accompanied with no or minimal loss of strength and restriction of the movements. Moderate (second degree) strain/contusion, in turn, is a greater damage of the muscle with a clear loss in function (ability to contract), whereas a tear extending across the entire cross-section of the muscle, resulting in a virtually complete loss of muscle function, is termed severe (third degree) strain/contusion.

The diagnosis of muscle injuries: The diagnosis of a muscle injury begins with a careful history of the occurrence of the trauma, followed by clinical examination (inspection and palpation of the involved muscles), and testing of the function of the injured muscles without and with external resistance. The diagnosis is easy when a typical history of muscle contusion or strain is accompanied with an objective evidence of swelling and/or ecchymosis distal to the lesion. Haematomas that are small in size can be more difficult to diagnose clinically, but the imaging modalities (ultrasonography, CT or MRI) provide useful means to verify the injury. Ultrasonography has been considered the method of choice for diagnosis of muscle injuries, because it is inexpensive. The magnetic resonance imaging (MRI) has more recently replaced ultrasonography in the imaging of many musculoskeletal disorders. Concerning muscle injuries, the MRI can accurately confirm the existence of muscle injury and provides a detailed characterization of the lesion.

Treatment principles of muscle injuries: The current treatment principles of injured skeletal muscle lack firm scientific basis. Here we attempted to elucidate the theoretical basis on some of the basic principles in the treatment of injured skeletal muscle.

Early mobilization was first recommended as the acute treatment of muscle trauma by Dr. Woodard in 1953, largely based on his vast personal experience in treating injured athletes. Today, we have a considerable amount of scientific, experimental, evidence to support this treatment approach of muscle injuries. It has been shown that early mobilization induces more rapid and intensive capillary ingrowth into the injured area, better regeneration of muscle fibers, and more parallel orientation of the regenerating myofibers in comparison to immobilization, the previous preferred treatment for injured muscle. The positive effects of early mobilization on the regeneration of the injured muscle are not limited to morphological changes. It has been also shown that the mechanical strength of the injured muscle returns to the level of uninjured muscle more rapidly using active mobilization than if the muscle is immobilized.

Experimental studies have also shown that if active mobilization is began immediately after the injury, a larger connective tissue scar ensues and the initial penetration of muscle fibers through the scar appears to be impaired in comparison to immobilized muscle. In addition, reruptures at the site of the original muscle trauma are common if active mobilization is began immediately after the injury. Thus, a short immobilization after the trauma appears to provide the new granulation tissue and scar with the needed tensile strength to withstand the forces created by muscle contractions.

Although immobilization has been shown to result in beneficial effects in the early phase of muscle repair, it seems to have several clinically undesired effects. Inactivity has been shown to be associated with a significant atrophy of the healthy muscle fibers, excessive deposition of connective tissue within the muscle tissue, and a retarded recovery of the strength of the injured skeletal muscle throughout the immobilization period. If immobilization is continued past the acute phase (first few days) of muscle repair, the deleterious effects become particularly partparevident during the remodeling phase of the muscle healing. Thus, a short period of immobilization following muscle injury is beneficial, but it should be limited only to the first few days after the injury.

Clinically, the first aid of muscle injuries follows the RICE principle (Rest, Ice, Compression and Elevation). The objective of the RICE is to stop the injury-induced bleeding into the muscle tissue and limit the extent of injury to a minimum. Clinical examination should be carried out immediately after the injury and repeated frequently during 5-7 days after the initial trauma. If desired, a more detailed characterization of the injury can be made using the imaging diagnostic modalities (ultrasound or MRI).

Treatment after 3-5 days: If the acute phases after the injury have passed uneventfully and the recovery of the injured limb seems to be progressing favorably, the more active treatment should be started gradually using following specific exercises:

1. Isometric training first without a resisting/counter load and then later with increased loads. Special attention should be paid to ensure that all of these isometric exercises are performed only within the limits of pain.

2. Isotonic training can be started when isometric training can be performed pain-free with resisting loads. Similar to isometric training, isotonic exercises should also be first carried out without a resisting load and the loading should be progressively increased.

3. Isokinetic, dynamic training with minimal load should be started once the two above mentioned exercises can be performed pain-free.

The local application of heat or contrast treatment (cold and heat treatment in succession) may be of value, accompanied with a careful passive and active stretching of the affected muscle within the limits of pain. It is of particular importance to note that all rehabilitation activities should start with an adequate warming-up of the injured muscle, as it has been shown to reduce muscle viscosity. When warming up is combined with stretching, the elasticity of muscle is improved. The other purpose of stretching is to distend the maturing scar at a phase where it is still plastic.

Operative treatment: Surgical intervention might be beneficial in the cases, where the athlete has a large intramuscular hematoma(s), III degree (complete) strains or tears of muscles with few or no agonist muscles (muscles with the same function), and II degree strains if more than half of the muscle belly is torn. Operative intervention should also be considered, if the patient complains of persisting (4-6 months) extension pain, which seems to result in limited range of motion in the previously injured muscle. In such case, a deliberation of the scar adhesions restricting the movement of the muscle is warranted. In the special cases, e.g. avulsion of the insertion of hamstrings to tuber ischii, the operative reattachment of the insertion should be done, because of the neglect of this injury is followed by problems in many every day activities e.g. washing the faces.

Return to sport specific training: The decision regarding the timing of the return to sports-specific training can be based on two simple and inexpensive measures: 1) The ability to stretch the injured muscle as much as the healthy contralateral muscle. 2) The pain-free use of the injured muscle in basic movements. When the patient has reached this point in recovery, the permission to gradually start sports-specific training is granted. The final phase of the rehabilitation, the sport-specific training, should begin under the supervision of a coach or a trainer. There are few controlled studies on the use of non-steroidal anti-inflammatory drugs (NSAIDs) in the treatment of muscle injuries. The beneficial effects of NSAIDs have been well documented experimentally. A short-term use of NSAIDs in the early phase of healing has been shown to lead to a decrease in the inflammatory cell reaction with no adverse effects on tensile strength or ability of the injured muscle to contract. However, the use of NSAIDs should be restricted to the early phases of muscle repair as their long-term use seems to be detrimental to the regenerating skeletal muscle.

Reference:

Järvinen TAH, Järvinen TLN, Kääriäinen M, Kalimo H, Järvinen M: Muscle injuries, biology and treatment. Am J Sports Med 33:745-764,2005