



Stockholm Sports Trauma Research Center



**Karolinska
Institutet**

SPORTS MEDICINE is the specific field of knowledge dealing with the injuries and diseases afflicting athletes. Each sport has its own typical injuries, depending on such factors as level of expertise (amateur or professional), gender and age.

THE STOCKHOLM SPORTS TRAUMA RESEARCH CENTER
is a collaboration between Karolinska Institutet and Capio Artro Clinic.
Karolinska Institutet is the principal.



Research
Postgraduate training
University courses

Treatment
Rehabilitation
In-service training



**Karolinska
Institutet**



Capio Artro Clinic



KI's newest campus is now taking shape in the park at Sophiahemmet (Queen Sophia Hospital) in Stockholm. Researchers, clinicians, teachers, postgraduates and undergraduates come here to collaborate on new advances in the field of sports medicine.

Illustration: FL Arkitekter AB

A campus for sports medicine

Sweden and Stockholm, with Karolinska Institutet (KI) and the former Karolinska Hospital, have a long history of leading research on sports injuries. Ivar Palmer published his famous book about knee ligament injuries, particularly anterior cruciate ligament injuries, in the 1930s and defended his dissertation at Karolinska Institute in 1938. In it he presented his biomedical research regarding the function of the knee joint. The word "biomechanics" had not yet been invented at this time. Ivar Palmer therefore entitled a chapter in the book *The light thrown on injuries to the ligaments by laws of mechanics and by experiments*. In the 1950s and '60s, Rolf Ljungqvist, Sten-Otto Liljedahl and Lennart Broström, all at KI, made great contributions to our knowledge of tendon and ligament injuries. In the 1970s and '80s, Ejnar Eriksson and Jan Gillquist, also at KI, and their many postgraduate students, continued to study other types of sports injuries. They also carried out numerous new studies of ligament injuries.

The dream of a sports medicine center

In the early 1990s, Ejnar Eriksson hatched the idea of a sports medicine center that would house both clinical activities and research. He made repeated attempts to persuade Karolinska Institutet to start

such a center. The then president of Karolinska Institutet was very positive, but not until today has Ejnar Eriksson's dream come true.

Now the center is the result of a collaboration between Karolinska Institutet and Capio Arthro Clinic and has been given the name of the *Stockholm Sports Trauma Research Center*. Treatment, clinical research and education soon will be housed in a new building between Sophiahemmet and the Olympic Stadion in Stockholm.

Sports is medicine

Physical activity and sports are vital in order to stay fit and healthy. Today some two million people in Sweden are engaged in some form of physical activity. The saying "sports is medicine" was coined many years ago. But like other medical treatments, sports and physical activity can lead to complications in the form of injuries, which we refer to as sports injuries.

The main goals of the Stockholm Sports Trauma Research Center are to:

- Offer treatment, rehabilitation and education at the highest international level in the field of sports medicine.
- Perform both basic and clinical research and prevent sports injuries through better information.

**High risk:
Anterior cruciate
ligament injuries**



Photo: Scanpix

To predict and prevent

Sports and exercise reduce the risk of a variety of diseases and injuries that can afflict people later in life. It has been clearly demonstrated that people who do not exercise or engage in sports run a greater risk of contracting cardiovascular disease, diabetes, osteoporosis and certain types of cancer. Prevention of fractures due to osteoporosis starts during childhood with physical training leading to increased bone density. The first 30 years of life are crucial here.

The body adapts to stress

Physical training also has a strengthening effect on various tissues in the body, such as muscles, tendons and ligaments. But there is an individual limit to what the tissues can take. If that limit is exceeded, the result can be what we call "overuse injuries". However, the body has an ability to adapt to some overuse, called trainability, which is influenced by such factors as heredity, gender, age, training status, amount of training, recovery and diet.

This adaptation is the tissue's response to the demands made on it and involves the formation of local growth factors in the loaded structures. There is an interaction between loading and adaptation. Muscles are quick to adapt, while tendons and ligament need more time.

Risk factors must be identified

Sports injuries are a problem, not just for the individual athlete, but also economically for society. Measures aimed at preventing sports-related injuries are therefore by far the best "treatment". How, then, should one prevent sports injuries? First the risk factors for sports injuries must be identified. We talk about two types of risk factors here: *individual-related* and *environment-related*. Examples of individual-related risk factors are:

- Knee position.**
- Muscle weakness.**
- Recovery.**
- Insufficient post-injury rehabilitation.**

The knowledge required to prevent sports injuries must be based on knowledge of both individual-related and environment-related risk factors.

Examples of environment-related risk factors are:

- Equipment.
- Surface.
- Weather and wind.
- Duration of exposure to the sport.

Different sports have different risk profiles, and they vary during the year. These include training camps, change of training surface, increased training intensity, start of competitive season and end of competitive season.

It is also important for the athlete to be aware of and understand how a sports injury can occur. In team sports such as football and ice hockey, the individual player's knowledge of the risks involved in different playing situations is of great importance.

In other words, knowledge of the particular sport is required in order to prevent injuries. Here we talk about the sport's specific demand profiles – physiological and mental. Each sport has its own unique demand profiles. Part of the center's work is to determine these demand profiles, which entails analyzing the demands on the athlete in a given sport. These demand profiles then serve as a basis for how the athlete should prepare and train.

Physiological demand profiles include:

- Aerobic demands.
- Anaerobic demands.
- Demands on muscle strength.
- Demands on speed.
- Mobility demands.
- Technical demands.

Mental demand profiles include:

- Demands on pain tolerance.
- Demands on tactics.



Photo: Scanpix

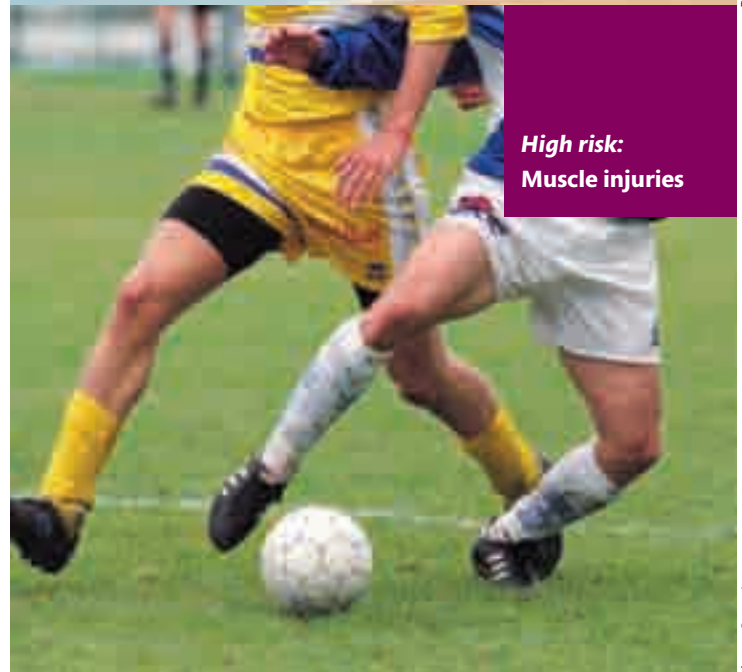


Photo: Scanpix



Photo: Mattson

When the damage is done ...

Getting a quick and correct diagnosis is vital in reducing the extent of an injury and thereby permitting a speedy recovery and return to physical activity and sports. With today's effective clinical methods, it is often possible to make a correct diagnosis on the spot.

Correct diagnosis requires knowledge

But today's physician training in Sweden often includes only a few hours of instruction in sports medicine. Physiotherapists should also be taught more about the treatment and rehabilitation of sport injury victims in their education. The center will therefore try to arrange for medical students at Karolinska Institutet to receive more hours of instruction in this subject.

In order to fill the knowledge gap among today's active medical professionals, we will hold regular courses for doctors, physiotherapists and other sports medicine practitioners. The courses will offer instruction in what each professional category should know in order to be able to

provide optimal care and treatment of sports injury victims.

For physicians, courses will be held in such subjects as arthroscopic surgery, ligament surgery and the latest findings in the treatment of overuse injuries. For physiotherapists, naprapaths etc., regular courses will be held regarding new findings in the rehabilitation of sports injury victims.

Therapy and science at an international level

The center has already established contact with some leading international sports medicine centers for co-operation and an exchange of experience.

We welcome foreign colleagues to come work with us, and they welcome us. Such exchanges spread knowledge of the latest international advances in the treatment and rehabilitation of sports injuries – knowledge that can be integrated into clinical activities as well as research and education. Similarly, our co-opera-

tion partners are allowed to share in the findings made at the center. The goal is that all treatment should be evidence-based, putting it on a sound scientific footing.

Advanced courses

In the United States there is a special professional group called "athletic trainers" who act as a link between healthcare and sports. A similar category could be trained in Sweden by having physiotherapists and trainers participate in the center's upcoming advanced courses, all to facilitate the return of the athletes to their sporting activities.

- Physiotherapists should mainly be taught more about the demands made by different sports on the body's different systems.
- The courses for sports trainers emphasize the importance of a gradual return to sports and physical activity after an injury.

The goal is 100–110% restored muscle strength

Insufficient rehabilitation leads to a high frequency of new injuries. The center will therefore further improve the capacity of the individual patient prior to a resumption of sporting activities.

Today the general consensus is that the patient should build up a muscle strength in the injured limb that is 90% of the strength of the healthy limb. But the evidence suggests that this figure is too low and that the goal should be 100–110% to prevent a recurrence of the injury. The center will therefore review today's recommendations for rehabilitation so that new information in this regard can be given to the country's physiotherapists.

Each patient gets his/her own team

Some countries use special teams to treat each injured athlete. These teams can include a physician, a physiotherapist, a trainer and, in some cases, a psychologist. This has worked very well abroad, and our goal is therefore to start a similar program. The patient can then meet his/her "own" team each time they visit the center.



Running on a treadmill to restore a normal pattern of movement and get back into shape after an injury.

Photo: Christina Mikkelsen



Optimal care – cost effective

Our goal is to give our patients the best possible treatment. This means not only keeping up with new developments in surgical and treatment methods, but also providing efficient healthcare when it comes to flows and costs.

We want to be a highly specialized clinic employing the latest treatment methods where we can offer our patients optimal care.

- The surgeons have long experience of the procedures they perform.
- The most experienced physiotherapists are in charge of rehabilitation.
- Our methods are based on research and proven science.
- Five new operating rooms with the latest technology.
- A rehabilitation department of about 1,200 sq.m.

SEK 60 million a year can be saved

Healthcare costs are rising steadily all over the world, and it is our responsibility to try to find methods that are more cost effective and can hasten the patient's recovery and rehabilitation. An example of this is the research on arthroscopy with a local anesthetic. We have published a number of research reports that show that arthroscopy with a local anesthetic is just as

effective as arthroscopy with a general anesthetic and permits a cost saving of up to SEK 2,000 per operation.

If all knee arthroscopies in Sweden were performed with a local anesthetic, this would save the taxpayers SEK 60 million a year. It is important that this type of research performs and initiates at the center. Another example is a study on 160 patients who have been randomly assigned to different treatment methods with fast or slow rehabilitation after anterior cruciate ligament surgery. The purpose of this study is to determine the most effective treatment method without jeopardizing the stability of the knee joint.

Follow-up of results

It is important that we can evaluate different surgical methods. The clinic has therefore developed its own computerized follow-up system where the results of surgery, rehabilitation and different surgical methods are compared to each other. Everyone on the care team at the clinic has access to the system and can, when faced with similar cases, quickly determine via their computers WHAT should be done, WHEN it should be done and HOW the patient feels after a specific operation.

Research close to treatment

The goal of the center's research group is to produce high-quality clinical and basic research in the field of sports medicine.

Spin-off for "ordinary" people

Sports medicine research has benefited Swedish healthcare in many ways over the years. Athletes are a patient group who make great demands on treatment and rehabilitation resources. The results obtained from the center's research are naturally shared with other fields in healthcare as well. This is one of the basic tenets of the program. In this way the latest scientific findings regarding the often complicated injuries suffered by elite athletes benefit everyone, regardless of whether they are physically active or not.

Professors Ejnar Eriksson and Per Renström of Karolinska Institutet, both also heads of the Section of Sports Medicine at Karolinska Hospital, have since the 1980s devoted a great deal of interest to research on improving treatment methods for sports injuries. They are now both helping to build up the new center's research activities, which includes not only researchers from KI but also physicians, physiotherapists and biomechanists, lending great breadth to the center's research, which is further bolstered by visiting researchers from abroad. The focus of the research is on new and improved methods for the treatment of injuries in shoulder, knee and ankle joints, muscles and tendons.

Basic research

The center's basic research is pursued at the *Department of Molecular Medicine and Surgery*, KI, but in very close collaboration with the other activities. Examples of current (2007) basic research are cellular and molecular studies of growing and transplantation of cartilage, as well as a project investigating the possibility of using micro dialysis on injured tendons.

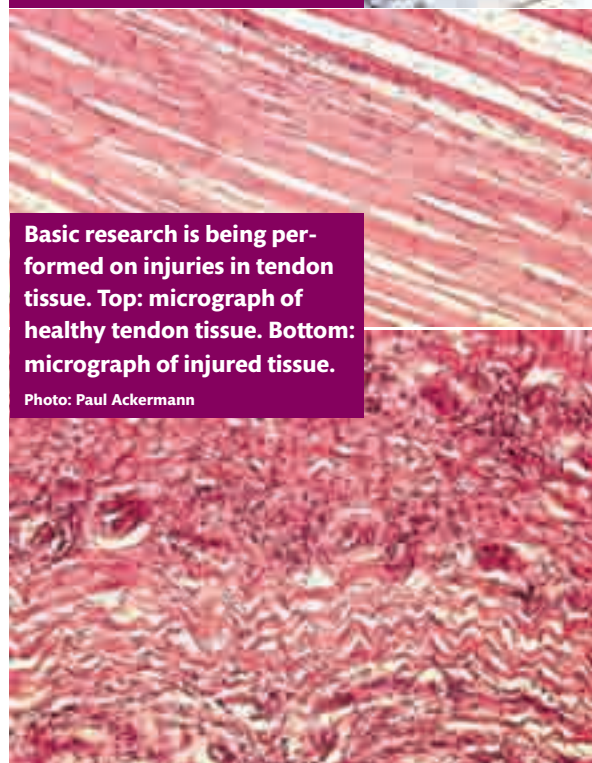
The research being done at many KI departments has also a bearing on sports medicine and therefore contributes to the center's body of knowledge.

Each new research project is reviewed and approved by a research ethics committee before it is started. The center's research results are published in leading scientific journals, but also in popular scientific and sports publications to disseminate new findings. Many of the staff members are editors or members of the editorial staff of some of the world's leading sports medicine journals.



Continuous measurements of muscle strength during rehabilitation are important for both the patient and the clinical research.

Photo: Alexander Ruas



Basic research is being performed on injuries in tendon tissue. Top: micrograph of healthy tendon tissue. Bottom: micrograph of injured tissue.

Photo: Paul Ackermann



Photo: Alexander Ruas

We welcome postgraduate and undergraduate students

Why is research so important? In our clinical work we are constantly striving to further improve the care and treatment of injured and/or sick people. To achieve this we continuously gather clinical experience, which provides us with ongoing quality control. The center's clinical research group has focused on improved treatment and rehabilitation of injuries in shoulder, knee and ankle joints as well as injuries and discomfort in muscles and tendons.

Research aimed at a deeper understanding of what mechanisms and factors can interact in sports injuries, whether the injury is acute or has been triggered by overuse, is vital in preventing sports injuries.

Doctoral dissertations

The research and scientific production at the center has resulted in a number of doctoral dissertations. The dissertations mainly consist of studies of different treatment forms, rehabilitation models, biomechanics, and risk factors for and prevention of sports injuries. Other dissertation subjects in our group include the epidemiological aspects and health economics of sports injuries.

New research areas

There are many unsolved problems in sports medicine that will be explored in future research.

The group photo on the left shows some of the center's staff on 6 December 2006.

Front row center: the center's clinical director Magnus Forssblad, Capio Arthro Clinic, and the head of the center Suzanne Werner.

At right: two postgraduate students performing an ultrasound examination on a patient.

Photo: Alexander Ruas

They include the following questions:

- How soon can an injured area be activated (and loaded) without jeopardizing the healing process or risking a "new" injury?
- What is the optimal rehabilitation dosage?
- What is the optimal stimulus for utilizing the "material properties" of a muscle, a tendon or a ligament when it comes to strength, power and endurance as well as healing capacity after an injury?
- What risk factors can be identified in different sports?



Photo: Einar Eriksson

A random selection of doctoral dissertations.

Postgraduate and undergraduate students

The center plans to admit more postgraduate and undergraduate students, primarily from Karolinska Institutet, but also active professionals such as physicians, physiotherapists and physical education teachers.

The research laboratory in the new building will house most of the measurement equipment required by a modern sports medicine center. Special offices for postgraduate students and guest researchers are also being built here.

Anyone interested in sports medicine research at the center will be offered expert supervision by individuals with both PhDs and clinical specialist expertise in the field of sports medicine.

Would you like to do research in sports medicine?



Don't hesitate to get in touch if you want to do your postgraduate studies with us.

If you are admitted you will be registered as a postgraduate student at Karolinska Institutet.

See the contact information on the back page.

Professional football player Kim Källström trains on the center's building site.



KAROLINSKA INSTITUTET (KI)

is Sweden's only university exclusively for medical studies. It is also Sweden's largest center for medical research and education. Research at KI spans the whole human being, from the body's molecules to psychosocial factors. It is performed in some 600 research groups, each with its own specializations. These research groups also take an active part in the university's 20 undergraduate programs and other educational activities.

Under the terms of Alfred Nobel's will, Karolinska Institutet chooses the *Nobel Prize winner in physiology or medicine*.

CAPIO ARTRO CLINIC

is one of Sweden's leading clinics for arthroscopic surgery, sports injuries and rehabilitation. The clinic offers highly specialized care by experienced orthopedic surgeons and physiotherapists. Every year the clinic sees 25,000 patients and performs about 4,000 operations. The Stockholm County Council is our principal client, but we also work for other county councils, insurance companies, sports associations and private paying patients.

The Swedish sports movement has chosen the Capio Arthro Clinic as its co-operation partner. The clinic is responsible for providing medical services to a number of sports clubs and national teams, including the national teams in football, basketball, alpine skiing, snowboard, golf, diving and motor sport. Our Olympic athletes receive medical support via a close collaboration with the Swedish Olympic Committee.

THE STOCKHOLM SPORTS TRAUMA RESEARCH CENTER

is a new concept where clinical treatment, research and education will be combined in a single building to achieve and sustain cutting-edge expertise at all levels of sports medicine.

In August 2007, when the new building is ready for occupation, some 80 or so persons will be active at the center, including:

- 20 researchers,
- 15 orthopedic specialists with long experience of arthroscopic surgery and sports injuries,
- 10 operating room nurses/enrolled nurses with a special interest in arthroscopic surgery,
- 15 physiotherapists specially trained to rehabilitate patients with sports injuries,
- 10 registered nurses/enrolled nurses in charge of reception, scheduling of operations and "customer service",
- an administrative staff for accounting and IT.

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