To begin, can you outline the main objectives of your research?

The overall goal of our research is to optimise exercise as treatment for people with musculoskeletal injury or disease. We use the injured knee as model to: 1) elucidate the effects of the injury on sensorimotor function; 2) study the effects of exercise therapy; 3) develop and validate clinical methods of assessing sensorimotor function; and 4) test the hypothesis that good sensorimotor function prevents or delays future problems related to the injury.

What existing knowledge are you building on as part of your research? Are there any particular questions that you are seeking to answer?

Physical activity is an important modifiable factor with beneficial effects on overall health, including the musculoskeletal system. For example, physical activity improves muscle strength, a measure of sensorimotor function. General exercise, such as aerobic exercise and strength training, is usually recommended. However, physical training that targets the specific needs related to the injury or disease may have an important role in the treatment.

We aim to determine the effect of a joint injury and exercise therapy on sensorimotor mechanisms. This will help in designing and improving training methods. Current training programmes appear to demonstrate insufficient effects; more effective training methods are therefore needed.

Why are musculoskeletal diseases and disorders such a prevalent cause of disability in developed countries?

Musculoskeletal conditions are the leading cause of disability among adults in developed countries, comprising 2 per cent of the global disease burden. The cost of this public health burden is expected to increase with physical inactivity, obesity and an ageing population in both developed and developing countries. Osteoarthritis is the most common problem; accounting for more than 50 per cent of the total burden of musculoskeletal conditions. History of knee joint injury is the major risk factor for knee osteoarthritis in the young and middle-aged.

As part of the project, you have developed a neuromuscular training programme named NEuroMuscular EXercise (NEMEX). How central is the development of novel treatments and exercises to your research?

Development of novel programmes is entirely central to this work, as the overall goal of our research is to optimise exercise as treatment for people with musculoskeletal injury or disease. Developing and evaluating training programmes will be given increased attention now that I have started building my own research group.

For much of your research the injured knee is used as a model. How can the findings be applied to other joints?

Because the principles of training focus on sensorimotor re-learning, and the exercises aim to resemble conditions of daily life and more demanding activities, the principles for training and exercises can be applied to other joints and musculoskeletal conditions.

Musculoskeletal injury and disease can severely lower the quality of life for sufferers. Dr Eva Ageberg explains how her work on the knee joint will eventually lead to a better understanding of sensorimotor function in these patients so current treatments may be improved.

Mending musculoskeletal disorders

Musculoskeletal injury and disease can severely lower the quality of life for sufferers. Dr Eva Ageberg explains how her work on the knee joint will eventually lead to a better understanding of sensorimotor function in these patients so current treatments may be improved.
The goal of training is to reduce symptoms (such as pain and instability) and improve functional ability, irrespective of injury or disease.

In what ways does successful treatment of joint injuries impact on the disease burden for the individual, the healthcare system and society?

Successful treatment is achieved when the individual has fewer symptoms, and improved function and quality of life. This will likely mean that the individual no longer requires healthcare, at least for that specific injury, leading to reduced costs for the healthcare system and society.

How will these research findings contribute to clinical research excellence on the role of physical activity for achieving and maintaining musculoskeletal health?

By optimising exercise therapy as treatment, we can reduce an individual’s symptoms and improve their function, allowing for a much swifter return to general physical activity. Furthermore, if we can determine that good sensorimotor function is a preventative factor for further injury-related problems, treatment to improve function will be recommended. Exercise therapy is feasible and safe, and may be the most effective and inexpensive treatment available to achieve optimal outcomes.

Through what channels will you be disseminating your findings and how will you ensure the full potential of this work is exploited?

We publish our work in international scientific journals, and present our data at national and international scientific conferences. Other channels include providing our results in plain language in, for example, non-scientific journals and the Lund University website. We give courses and lectures for healthcare staff, university students and the public.

In order to achieve the project’s scientific objectives, Ageberg’s research focuses on understanding how sensorimotor function is affected in patients with musculoskeletal conditions. Sensorimotor is a term used to combine both the sensory and motor function of a biological system and although her research is carried out on the knee, the findings can be applied to other joints. The research group uses a number of approaches to assess sensorimotor function such as position-movement sensation, muscle strength, performance-based tasks and cortical brain activation.

The strategy for understanding musculoskeletal conditions and developing preventative and curative training schemes can be divided into the four main areas of investigation.

INVESTIGATING THE EFFECTS OF JOINT INJURY ON SENSORIMOTOR FUNCTION

Joint injury is known to cause disturbance in the sensory nervous system through the loss of mechanoreceptors leading to sensory deficiency. It is also suspected that injury can affect activation patterns in the central nervous system (CNS) and motor function. In order to further understand this, Ageberg has carried out experiments to assess activation in the cortex of the brain whilst subjects suffering from knee injury carry out a number of sensorimotor tasks. Although still in the initial stages of research, the aim of this...
INTELLIGENCE

SENSORIMOTOR FUNCTION IN JOINT INJURY – MECHANISMS, OUTCOMES, EXERCISE AND PREDICTORS

OBJECTIVES

To optimise exercise as treatment for people with musculoskeletal disorder, using the injured knee as a model, through investigation into sensorimotor mechanisms and the role of sensorimotor function in predicting joint-related problems.

KEY COLLABORATORS

Jochen Baumeister, Paderborn University, Germany
Kim L Bennell, University of Melbourne, Melbourne, Australia
Mark Creaby, Australian Catholic University, Brisbane, Australia
Kay M Crossley, University of Queensland, Brisbane, Australia
Richard Frobell, Lund University, Lund, Sweden
Stefan Lohmander, Lund University, Lund, Sweden, and University of Southern Denmark, Odense, Denmark
Ewa Roos, University of Southern Denmark, Odense, Denmark

FUNDING

Swedish Research Council
Crafoord Foundation
Skåne Regional Council
Faculty of Medicine, Lund University
Swedish Rheumatism Association

CONTACT

Dr Eva Ageberg
Associate Professor
Department of Health Sciences
Lund University
PO BOX 157
Baråvågen 3
Lund SE-22100
Sweden
T +46 46 2224943
E eva.ageberg@med.lu.se

EVA AGEBERG received her PhD from Lund University in 2003. She has been a full-time junior researcher, funded by the Swedish Research Council, since 2010 and established her own research group on ‘Sensorimotor function in joint injury’ at Lund University in 2012.

Ageberg aims to develop and validate clinical tests for assessing sensorimotor function. In order to do this she is focusing on muscle function asymmetry and the movement quality in patients with knee injuries. Following injury, there is often a difference in the muscle function of the patient’s two legs, termed asymmetry. A greater difference, or greater asymmetry, and patients experience increasingly reduced functional ability. An appreciable amount of muscle function asymmetry can be a precursor to conditions such as osteoarthritis. Ageberg aims to determine what degree of asymmetry acts as a clinical ‘cut-off’ in the hope that this will enable the identification of those at risk of developing musculoskeletal conditions who may be candidates for preventative treatment through training.

In order to develop clinical tests for movement quality, Ageberg has been assessing individuals as they carry out day-to-day and more strenuous tasks. Here the individual’s postural orientation is monitored by visual analysis. This method is in keeping with Ageberg’s aim to develop clinical techniques that are easy to administer and inexpensive. “Little equipment is required thus the assessment can easily be employed in different settings,” she reflects.

INVESTIGATION INTO THE EFFECTS OF EXERCISE THERAPY

NEuroMuscular Exercise (NEMEX) is a neuromuscular training programme which has been developed by Ageberg as part of the project. Training methods vary depending on the condition they are required to treat and are given a suffix to indicate the group of patients to which that programme applies. For example NEMEX-TJR refers to the programme developed for older patients suffering from osteoarthritis who require total joint replacement (TJR). This programme is based on the same principles as similar training programmes successfully applied in younger patients with knee injury. Results from testing NEMEX-TJR showed that this training programme is feasible for patients with severe hip or knee osteoarthritis; individuals undertaking the programme experienced few joint specific adverse effects and were able to progress to higher training levels.

NEMEX-ATR has been developed to treat patients suffering from Achilles tendon rupture. Ageberg is currently carrying out a randomised pilot study to investigate the feasibility of early neuromuscular training on those with non-surgically treated Achilles tendon rupture (ATR). The production and implementation of effective NEMEX training programmes is the major long term goal of Ageberg’s research. The outcomes from the investigation into the role of sensorimotor function in joint injury will be used to develop these programmes, providing more effective treatments for musculoskeletal conditions. She believes that the key to effective treatment lies in early and targeted treatment.

INVESTIGATING THE ROLE OF SENSORIMOTOR FUNCTION TO PREDICT JOINT-RELATED PROBLEMS

Following on from the idea that early treatment of musculoskeletal conditions is required to maximise the reduction of symptoms and prevent further joint-related problems, if such conditions can be predicted, then techniques could be adopted to treat conditions in their early stages or even to prevent development. Investigation into sensorimotor function could prove key to predicting joint-related problems. Ageberg is in the process of studying the role that poor sensorimotor function has in predicting joint-related problems. She hypothesises that good sensorimotor function can act to prevent or delay joint-related problems, such as osteoarthritis development after knee injury. Through her investigations, Ageberg is also attempting to determine whether some sensorimotor function tests are more effective at predicting problems than others.

Although Ageberg has stated that one of the major hurdles encountered has been acquiring funding, now that her research group is up and running more results are soon to follow. She collaborates with research institutes in Sweden and internationally and she also works with researchers in various disciplines, such as orthopaedics, physical therapy, exercise and sports science, and brain research: “Relevant and important research questions are raised within the interface between different fields,” she emphasises.

FINDINGS AND THE FUTURE

Through the four main investigative approaches, Ageberg aims to investigate the role of that sensorimotor function has on predicting, preventing and treating musculoskeletal conditions and to use this knowledge to develop effective training programmes to reduce the impact of these conditions. Work to date has been successful, but Ageberg is clear that gaps in knowledge remain and this continues to drive their work: “Although improvements are achieved by training interventions, impairment often persists. The achieved improvements are evident in measures of motor function (eg., muscle strength, functional performance), but the possible influence of training on sensory function (eg., position-movement sensation) remains uncertain,” she concludes. Breakthroughs in this area may lead to treatment in the early or preventative stages of condition development, offering hope for a better quality of life for millions worldwide.