

Master thesis project proposal:

Towards the world's first well-functioning knee brace

Injuries to the cruciate and collateral ligaments are common in sports. Besides being devastating for the individual, the treatment and rehabilitation of knee ligament injuries is also associated with a large cost for society. Still, however, the treatment and rehabilitation process has recently been the subject of much debate, with the efficacy of knee bracing being particularly controversial.

Functional knee braces are most often prescribed to patients with knee ligament injury, both to prevent further damage to the knee joint prior to a potential surgery, but also as protection after ligament reconstruction via surgery. However, so far such braces have not been objectively proven to be useful for rehabilitation or for protecting healing structures. Thus, more research is crucial to objectively quantify the capabilities of existing knee braces, and also to improve their design for improved protective capability.

The current master thesis project aims to support an ongoing research project between the Division of Material and Computational Mechanics at Chalmers and Sahlgrenska Academy at Gothenburg University, with the ultimate goal to develop a new, principal concept design for a knee brace system that will protect the knee from additional injury and aid ligament injury.

To be more precise, the task of the master thesis project team will be to:

- Together with the researchers in the project, analyse existing knee brace systems to identify improvement capabilities in their design.
- In discussion with the researchers, develop design improvement concepts that will improve the protective capabilities of knee braces today.
- Perform structural analysis simulations (FE simulations) to verify the improved protective capability.
- Propose ways for how these design improvements can be integrated in existing knee braces for a first proof-of-concept verification study on patients.
- If there is time, help to manufacture and integrate the new design improvements in existing knee braces.

The project is a collaboration between researchers at Chalmers and Sahlgrenska Academy, where expertise in solid and material mechanics and design will be provided from Chalmers, and where the expert knowledge in knee ligament injury comes from Sahlgrenska. The majority of the work will be conducted at Chalmers, but throughout there will be close interaction with the Sahlgrenska researchers (which are also surgeons and physiotherapists by profession).

We are now looking for talented students who together have documented knowledge in solid and material mechanics, computed aided design (CAD) and engineering (CAE) and an interest in sports medicine. You need to be motivated and self-propelled and to be able to take own responsibility for the progress of the project. Please come and join a very exciting project!

Interested, please contact **Martin Fagerström**, martin.fagerstrom@chalmers.se (Chalmers supervisor and thesis examiner) or **Kristian Samuelsson**, kristian@samuelsson.cc (Professor and chief physician in Orthopaedics at Sahlgrenska)



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