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A 12-week supervised exercise therapy program for young adults with a meniscal tear: Program development and feasibility study

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A B S T R A C T

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Objective: To describe the development and feasibility of an exercise therapy program for treatment of young adults (18–40 years of age) with a meniscal tear.

Methods: Researchers and experienced physical therapists developed a 12-week supervised neuromuscular and strengthening exercise therapy program based on clinical expertise and available evidence. Six patients (age range 22–39 years) considered eligible for meniscal surgery by an orthopedic surgeon underwent the program. Patients completed the Knee Injury and Osteoarthritis Outcome Score (KOOS) and evaluated the program during a semi-structured qualitative interview. Feedback from patients was included to finalize the exercise therapy program.

Results: Median improvements (Range) in KOOS subscales were 15 (0–33) for Pain, 11 (–11 to 50) for Symptoms, 16 (3–37) for Function in daily living, 23 (10–45) for Function in sport and recreation, and 9 (–6 to 31) for Quality of life. The patients found the program relevant and effective with only a few short-lasting adverse events and important clinical improvements after four to ten weeks. Physical therapist supervision was considered important. No patients wanted surgery up to 6 months after the exercise therapy program.

Conclusion: A neuromuscular and strengthening exercise therapy program was feasible and showed important improvement in a small group of young adults with meniscal tears.

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1. Introduction

Meniscal tears are a common knee injury in adults aged 40 years or younger with an annual incidence of isolated meniscal tears of at least 112 to 172 injuries per 100,000 persons between 15 and 40 years of age (Peat et al., 2014). A meniscal tear can be associated with pain and functional limitations for the individual (Englund et al., 2012) and knee injury is associated with a nearly three-fold risk of later knee osteoarthritis (Silverwood et al., 2015), highlighting the need for effective treatment strategies. However, high-quality evidence on proper treatment of meniscal tears in younger adults is sparse (Thorlund et al., 2015). Currently, surgery is often the treatment of choice for these patients.

Exercise therapy has previously been proven feasible and effective in young adults with severe knee injuries (i.e. anterior cruciate ligament injury) (Frobell et al., 2010) and in middle-aged or older patients with a meniscal tear (Thorlund et al., 2015; Kise et al., 2016) and knee osteoarthritis (Fransen et al., 2015). Thus, exercise therapy may also be a feasible and effective treatment option for younger adults with a meniscal tear, potentially postponing or even preventing surgery.

The purpose of this study was to describe the development and feasibility of a 12-week exercise therapy program in young adults (18–40 years of age) eligible for meniscal surgery. We considered the exercise therapy program to be feasible if patients had important improvements in symptoms following the program, if few knee-related adverse events were observed, and if most patients did not want to undergo surgery after completing the exercise program.

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2. Materials and methods

2.1. Design

This was a feasibility study with follow-up immediately after ending the exercise therapy program (3 months follow-up). The feasibility study adhered to the Declaration of Helsinki and informed consent was obtained from all patients. The feasibility study was designed to inform a future RCT comparing meniscal surgery (resection or repair) to 12-weeks of exercise therapy and education in young adults, which has been approved by the Regional Committees on Health Research Ethics for Southern Denmark (S-20160151), and is registered at [ClinicalTrials.gov](https://clinicaltrials.gov/ct2/show/study/NCT02995551) (NCT02995551).

2.2. Participants

Patients consulting one orthopedic surgeon at the Department of Orthopedic Surgery, Aalborg University Hospital with knee problems were screened for eligibility for the study by the surgeon.

From June 6 and through July 4, 2016 six consecutive patients aged 18–40 years with a meniscal injury confirmed on magnetic resonance imaging (MRI) and considered eligible for meniscal surgery by the surgeon were included. Major exclusion criteria were a previous knee injury in the same knee, clinical suspicion of displaced bucket-handle tear confirmed on MRI and complete rupture of one or more knee ligaments. For complete eligibility criteria please refer to the eligibility criteria for the future RCT: [ClinicalTrials.gov](https://clinicaltrials.gov/ct2/show/study/NCT02995551): NCT02995551.

2.3. Exercise therapy program development

The description of the exercise therapy program adheres to the Consensus on Exercise Reporting Template (CERT) ([Slade et al., 2016](#)).

The exercise therapy program was developed in close collaboration between the authors and three clinical physical therapists with 7, 10 and 20 years of experience with exercise treatment for joint injury and musculoskeletal disorders. The authors presented an initial version of the program to the three physical therapists based on available evidence describing successful exercise therapy for patients with other types of knee injuries and osteoarthritis ([Frobell et al., 2010](#); [Ageberg and Roos, 2015](#); [Skou et al., 2015a,b](#); [Kise et al., 2016](#)). The relevance of the individual exercises was then discussed between researchers and the clinical physical therapists before the first patient in the feasibility study started. Based on these discussions the plank exercise, side plank exercise, slide-exercise sideways and sideway lunge and the inner thigh exercise was added to the program together with some additional levels of difficulty for some of the exercises, while lunges from side to side with a medicine ball and the jumping cross exercises were removed from the initial version of the program (see [appendix A](#) for a detailed description of the final exercise therapy program). The changes to the initial program were mainly based on the extensive clinical experience of the physical therapist, but still adhering to the existing evidence ([Frobell et al., 2010](#); [Ageberg and Roos, 2015](#); [Skou et al., 2015a,b](#); [Kise et al., 2016](#)). After completing the program, patients were interviewed using a semi-structured approach assisted by an interview guide to evaluate the exercise therapy program. Comments from patients were included in a discussion between researchers and physical therapists after the feasibility study to be able to make any final changes to the exercise therapy program.

2.3.1. The final exercise therapy program

The exercise therapy program was a 12-week group-based, supervised, exercise therapy program (2 exercise sessions per week of approx. 60–90 min. each). Each exercise session of the program included a warm up (5 min on stationary bike) and eight neuromuscular and four strengthening exercises focusing on the lower extremities. In addition, two exercises focusing on reducing swelling and increasing range of motion were included to be used in the first weeks if needed. The combination of both neuromuscular and strengthening exercises had the purpose of addressing different issues related to a meniscal tear and other knee injuries and to match the age and activity level of the patient group. Knee injuries often lead to functional instability, reduced muscle strength and impaired neuromuscular function ([Holder-Powell and Rutherford, 1999](#); [Ageberg, 2002](#); [Thorlund et al., 2012](#); [Hall et al., 2015](#)). Neuromuscular exercise focus on improving sensorimotor control and functional joint stability through functional exercises, evaluated by the quality of the performance. Strengthening exercise focus on increasing muscle strength and mass using free weights and/or resistance training machines ([Ageberg and Roos, 2015](#)). The neuromuscular exercises (knee bends, pelvic lift, plank, side plank, stair climbing, outer thigh and inner thigh exercises using an exercise band, slide-exercise sideways and sideway lunge) were individually fitted to each patient based on two to six levels of difficulty and performed in two to three sets of 10–15 repetitions. The starting level and progression of the neuromuscular exercises was based on visual inspection of the quality of the movement and sensorimotor control (evaluated by the physical therapist) and minimal exertion, pain during the exercise and a feeling of control over the movement (evaluated by the patient) ([Ageberg and Roos, 2015](#)). The strengthening exercises (one-legged leg press, one-legged knee extension, one-legged knee flexion and kettlebell swings) were initially performed in two sets of 15 repetitions, progressing to three sets of 12, three sets of 10 and finally three sets of 8 repetitions. Progression of the strengthening exercises followed the +2 principle, i.e. when the patient was able to perform two additional repetitions in the last set more weight was added and fewer repetitions per set were performed (see [appendix A](#) for a detailed description of the final exercise therapy program) ([Ageberg and Roos, 2015](#)).

The feasibility study patients all underwent the 12-week exercise therapy program. The exercise therapy program was supervised by one of three experienced physical therapist in groups of 8–15 patients with similar lower extremity problems and took place at a private physical therapy clinic close to the hospital, where the patients were included. Before the exercise program the patient had a consultation with the physical therapist, where they discussed the treatment plan and set goals for the patient, and had a thorough instruction in the exercise program. During the individual sessions the physical therapist gave the patients feedback to ensure proper performance of the exercises and to maintain their motivation (see [appendix A](#) for a detailed description of the final exercise therapy program).

2.4. Outcomes

At baseline prior to starting the exercise therapy program and after the exercise therapy program (3 months follow-up) all patients completed an online questionnaire.

2.4.1. Baseline characteristics

At baseline, patients self-reported their height, weight, gender, age and prior surgery of the injured knee and answered the following questions regarding duration and symptom onset: “How long have you had your knee pain/problems for which you are now

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