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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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Abstract

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 (0–11 to 50) for Symptoms, 16 (3–37) for Function in daily living, 23 (10–45) for Function in sport and recreation, and 9 (6–31) 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 month 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.
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 (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: 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 discussed between researchers and physical therapists before the exercise program the patient was included. Before the exercise program the patient consulted a physical therapist, who set goals for the patient and had a discussion with the therapists about the treatment plan. 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 (Holden-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 sideways 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 therapists 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...
having treatment?” with six response options ranging from “less than 2 weeks” to “more than 24 months”, “How did the knee pain/problems for which you are now having treatment develop?” with three response options “The pain/problems have slowly developed over time”, “As a result of a less severe incident (i.e. kneeling, sliding, and/or twisting of the knee or the like)”, and “As a result of a severe incident (i.e. during sports, a crash, or a collision or the like)”.  

2.4.2. Mechanical symptoms

At baseline and follow-up, the patients reported the presence and frequency of mechanical knee symptoms (i.e. the sensation of catching and locking): “How often have you experienced catching or locking of the knee that is about to undergo treatment?” with five response options ranging from “never” to “daily”.  

2.4.3. Knee injury and osteoarthritis outcome score (KOOS)

At baseline and follow-up, patients completed the Knee injury and Osteoarthritis Outcome Score (KOOS) with scores ranging from 0 (worst) to 100 (best) for each subscale. KOOS contains the subscales Pain, Symptoms, Function in daily living (ADL), Function in sport and recreation (Sport/Rec) and Quality of life (QOL) (Roos et al., 1998). KOOS is a valid, reliable and responsive patient-reported outcome measure in young and old adults with knee injuries and/or OA (Collins et al., 2016).  

2.4.4. Knee-related adverse events

After the 12-week program, the patients were emailed and asked about worsening of symptoms or new symptoms during the 12-week exercise program. If they reported worsening or new symptoms, they were asked to state which symptom and whether it occurred during a specific exercise.  

2.4.5. Number of exercise sessions

After the 12-week program, the patients were emailed and asked how many of the 24 exercise therapy sessions they participated in.  

2.4.6. Surgery of the knee

Six months after the last patient was enrolled in the feasibility study an email was sent to all patients asking them to report whether they had undergone surgery of their knee or if they were on a waiting list for knee surgery.  

2.5. Patient interviews

The semi-structured interviews with patients were conducted online at the end of the 12-week exercise program using Adobe Connect (Adobe Systems, San Jose, CA, USA) including both video and audio of the patient and interviewer. Each interview lasted between 30 and 60 min and was conducted by the first author. An interview topic guide with open-ended questions was developed in collaboration with experienced qualitative researchers. Examples of questions were: “Tell me about your knee problem?” “You have now exercised for 12 weeks, can you please tell me what you have experienced?” “How were the physical therapists?” “What did the physical therapist tell you about your knee problem?” Themes that the patient brought up during the interview were followed by probing questions and, if needed, the interviewer made the open-ended question more focused, e.g. “How did the exercise affect your symptoms?” and “How was the level of difficulty of the exercises?” Finally, they were asked whether they would like to undergo surgery now, after participating in the exercise therapy program. All interviews were conducted in Danish and recorded in Adobe Connect.  

2.6. Statistical analysis

Due to the small sample size of this feasibility study, the change in mechanical symptoms and KOOS subscale scores was analyzed using non-parametric statistics. As the distribution of differences between baseline and 3 months scores was not symmetrical for any of the variables paired-samples sign test was used to assess for change in the outcome.

The significance level was set at p < 0.05 and all analyses were carried out in IBM SPSS Statistics 24 (IBM, Armonk, NY, USA).

3. Results

3.1. Outcomes

Baseline characteristics and the number of exercise sessions that the patients participated in are presented in Table 1.  

3.1.1. Mechanical symptoms

At baseline, three patients (50%, patient 1–3) reported having mechanical symptoms (i.e. the sensation of catching or locking of the knee), while only one (17%, patient 5) had self-reported mechanical symptoms at the 3 months follow-up (Table 2).  

3.1.2. Knee injury and osteoarthritis outcome score (KOOS)

Significant improvements from baseline to 3 months were found for the KOOS subscales ADL (21% improvement) and Sport/Rec (43% improvement) (Table 2 and Fig. 1).  

3.1.3. Knee-related adverse events

During the exercise therapy program, patient 2 started running and playing soccer. At one point he had to reduce the number of repetitions and weight applied in the individual exercises for a couple of sessions and to take a short break from running and soccer. Before starting the exercise program, patient 3 performed the exercises to improve range of motion at home as instructed by the physical therapists. During the exercise to improve knee flexion he felt that his knee locked, which resulted in that he had to perform the exercise with caution in the following weeks. Patient 4 had joint line pain during knee flexion in the exercise machine, but the pain decreased after reducing the resistance and number of repetitions for a couple of exercise sessions. Patient 6 experienced soreness in his knee after playing beach volley after approx. eight weeks in the exercise therapy program. The symptoms decreased after one week. Due to the short-lasting nature, neither of the adverse events was considered severe enough to require medical attention.  

3.1.4. Surgery of the knee

Six months after the last patient was enrolled none of the patients had undergone surgery in the study knee or were on waiting list for knee surgery.  

3.2. Semi-structured interviews

3.2.1. The exercise therapy program

12 weeks of exercise therapy two times a week were considered appropriate by most of the patients. One of the patients felt that three sessions per week would have been too much, while another patient stated that he would like to have had a couple of weeks more with supervised exercise. The duration of the individual sessions were between one and two hours with most patients exercising for one to one and a half hour per session. One patient felt that the first couple of exercise sessions were a bit too long. Some of the patients expressed that the timing of the individual
exercise sessions in relation to their daily life was important to ensure that they were able to participate.

The individual exercises were considered feasible, relevant and effective by the patients. Some patients highlighted the neuromuscular exercises, especially the sideways slide exercise, as particularly effective for their knee problem. One patient had joint pain that improved significantly.

Table 1
Baseline characteristics and treatment compliance of the patients (n – 6)*.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pt. 1</th>
<th>Pt. 2</th>
<th>Pt. 3</th>
<th>Pt. 4</th>
<th>Pt. 5</th>
<th>Pt. 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Male</td>
<td>Male</td>
<td>Male</td>
<td>Male</td>
<td>Male</td>
</tr>
<tr>
<td>Age, y</td>
<td>30</td>
<td>23</td>
<td>39</td>
<td>22</td>
<td>22</td>
<td>23</td>
</tr>
<tr>
<td>Body mass index, kg/m²</td>
<td>25.8</td>
<td>24.4</td>
<td>20.9</td>
<td>20.6</td>
<td>28.3</td>
<td>24.7</td>
</tr>
<tr>
<td>Duration of symptoms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between 2 weeks and 3 mo.</td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>4–6 mo.</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>7–12 mo.</td>
<td></td>
<td></td>
<td>+</td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>13–24 mo.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>More than 24 mo.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Onset of symptoms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developed slowly over time</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>As a result of a less severe incident</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>As a result of a severe incident</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior surgery of index knee</td>
<td>No</td>
<td>No</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Supervised exercise sessions that the patient self-reported to participate in (out of 24 sessions)</td>
<td>14</td>
<td>17</td>
<td>20</td>
<td>24</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

* Pt. = Patient; A less severe incident could be kneeling, sliding, or twisting of knee; A severe incident could be during sports, a crash, or a collision.

Table 2
Improvements in outcomes from baseline to 3 months (n – 6)*.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline</th>
<th>3 months</th>
<th>Improvements</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catching or locking of knee, n (%)</td>
<td></td>
<td></td>
<td></td>
<td>0.63</td>
</tr>
<tr>
<td>Never</td>
<td>3 (50)</td>
<td>5 (83)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Once a month</td>
<td>2 (33)</td>
<td>1 (17)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Once a week</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Several times/wk</td>
<td>1 (17)</td>
<td>0 (0)</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Daily</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KOOS, median (mean; range)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain</td>
<td>68.1 (69.9; 61.1 to 88.9)</td>
<td>86.1 (87.0; 80.6 to 94.4)</td>
<td>15.3 (17.1; 0.0 to 33.3)</td>
<td>0.06</td>
</tr>
<tr>
<td>Symptoms</td>
<td>66.1 (67.9; 50 to 92.9)</td>
<td>83.9 (83.3; 64.3 to 100.0)</td>
<td>10.7 (15.5; –10.7 to 50.0)</td>
<td>0.60</td>
</tr>
<tr>
<td>ADL</td>
<td>76.5 (77.0; 63.2 to 89.7)</td>
<td>95.6 (95.3; 88.2 to 100.0)</td>
<td>16.2 (18.4; 2.9 to 36.8)</td>
<td>0.03</td>
</tr>
<tr>
<td>Sport/Rec</td>
<td>52.5 (52.5; 45.0 to 60.0)</td>
<td>77.5 (79.2; 60.0 to 95.0)</td>
<td>22.5 (26.7; 10.0 to 45.0)</td>
<td>0.03</td>
</tr>
<tr>
<td>QOL</td>
<td>43.8 (46.9; 43.8 to 56.3)</td>
<td>56.3 (58.3; 60.0 to 75.0)</td>
<td>9.4 (11.5; –6.3 to 31.3)</td>
<td>0.22</td>
</tr>
</tbody>
</table>

* KOOS = Knee injury and Osteoarthritis Outcome Score with scores ranging from 0 (worst) to 100 (best); Function in daily living (ADL), Function in sport and recreation (Sport/Rec) and Quality of life (QOL). Wk = Week. Paired-samples sign test was used to assess for change in outcome. Mean values were only presented to be able to compare with previous studies and were not used in the statistical analysis due to the limited sample size.

Fig. 1. Change in Knee injury and Osteoarthritis Outcome Score (KOOS) from baseline to three months for each of the six patients. KOOS has five subscales all with scores ranging from 0 (worst) to 100 (best): Pain (A), Symptoms (B) Function in daily living (C; ADL), Function in sport and recreation (D; Sport/Rec) and Quality of life (E; QOL).
line pain during knee flexion in the exercise machine, but was able to decrease the pain by reducing the resistance and number of repetitions for a couple of exercise sessions.

As the program was considered feasible, relevant and effective by the patients, no changes were made to the program tested in the feasibility study.

3.2.2. The physical therapists

The patients described, that the physical therapists were supportive and ensured that the exercise therapy program was practical and regressed to adapt to individual patient symptoms and were available for questions and feedback when needed. It was important for patients, that the physical therapists gave a thorough introduction and instruction on how to perform the exercises. Furthermore, the supervision was found important to ensure that physical therapists were available to adjust the exercises if performed incorrectly.

3.2.3. Symptom flares and improvements in symptoms

In the first two to four weeks, some of the patients experienced minor symptom flares during and after exercise and physical activity, which decreased and disappeared as the exercise therapy program progressed. Improvements in symptoms were gradual, but important improvements were experienced after four weeks in some patients and eight to ten weeks in others. All patients stated that they did not want to undergo surgery of their knee after finishing the exercise therapy program.

3.2.4. Exercising with others

Some of the patients experienced that there were too many patients at some of the exercise sessions (10–15), which reduced the ability of the physical therapist to give feedback and supervise the individual patient and waiting time for some of the individual exercises. However, exercising with others was considered beneficial by some of the patients as it gave the possibility to interact with other people with similar knee problems and get help with improving the performance of specific exercises.

4. Discussion

This study provided a detailed description of a 12-week exercise therapy program designed for young adults with a meniscal tear. The program was found to be feasible in patients eligible for meniscal surgery with important improvements in symptoms. Neither of the patients wanted surgery after completing the program and there were only a few short-lasting knee-related adverse events.

The median baseline KOOS Sport/Rec (53 points, mean: 53 points) and KOOS Pain (68 points, mean: 70 points) scores from our study are relatively similar to the mean scores in patients of 36–60 years of age with a degenerative meniscal tear randomized to surgery or exercise therapy (44–48 and 63–68 points, respectively) (Kise et al., 2016). However, it is considerable better than baseline values of patients with anterior cruciate ligament injury randomized to surgery or exercise therapy (14–15 and 57 points, respectively) (Frobell et al., 2010). This is consistent with the general perception that an anterior cruciate ligament injury has larger patient impact than meniscal injury.

The median improvement for the five subscales of KOOS ranged from 9 to 23 points (mean improvements of 12–27 points) with the largest effect for the subscale Sport/Rec with questions on running, jumping and twisting of the injured knee etc. and the smallest effect for the subscale QOL with questions on awareness of knee problem, modification of activities and lack of knee confidence etc. The improvements in pain, symptoms, function in daily living and function in sport and recreation were all larger than the clinically relevant differences found in an RCT comparing surgery and exercise therapy for patients with degenerative meniscal tears, while the improvement in quality of life was not (Kise et al., 2016). In the present study, patients had a median improvement of 23 points (mean improvement of 27 points) in KOOS Sport/Rec and 16 points (mean improvement of 18 points) in KOOS ADL at 3 months while the mean improvement in the same subscales was approx. 20 and 10 points at 3 months in the exercise therapy group and 17 and 9 points in the arthroscopic partial meniscectomy (APM) of the trial in degenerative meniscal tears (Kise et al., 2016). This suggests that exercise therapy is a viable treatment option also for younger individuals with a meniscal tear, as the median age of our study was 23. The described exercise therapy program only requires equipment that is available in most physical therapy clinics. Furthermore, a relatively short training period is needed for physical therapists. This suggests that implementation of the program in a clinical setting is realistic, if the program proves to be effective in larger clinical trials.

Three patients had mechanical symptoms at baseline before starting the exercise therapy program. Only one patient reported mechanical symptoms at the 12-week follow-up after finishing the program and with a low frequency of symptoms (i.e. monthly). Presence of mechanical symptoms (i.e. the sensation of catching or locking) is typically considered an important indication for meniscal surgery (Mezhov et al., 2014). However, a recent secondary analysis from a RCT comparing APM to sham surgery in patients aged 35–65 years with degenerative meniscal tears did not find a larger effect of APM for improving mechanical symptoms than sham surgery (Sihvonen et al., 2016). Based on before-and-after studies, APM in non-degenerative meniscal tears seems more effective in relieving mechanical symptoms than APM in degenerative tears (Sihvonen et al., 2016). Therefore, future high-quality comparisons of the effect of exercise therapy to that of meniscal surgery for patients with a non-degenerative meniscal tear with or without mechanical symptoms are warranted to support clinical decision-making.

Albeit the qualitative interviews did not result in any specific changes to the exercise therapy program, they contributed with important information about the patients’ perspective on the program and the feasibility of exercise in this population in general. Firstly, individual exercises were found feasible, relevant and effective. Secondly, the supervision from physical therapists was considered important. From RCTs of exercise therapy as treatment for patients with knee osteoarthritis it has been shown that supervised exercise sessions improves the efficacy of exercise therapy (Juhl et al., 2014). It is unknown whether this is also true for young adults with a meniscal tear, but our study provides qualitative support that patients consider ongoing supervision important to help adapt and adjust exercises during the program. Furthermore, the interviews highlighted that symptom flares are frequent, but decrease during the first four weeks, and that patients can expect gradual improvement over time with clinically relevant improvements after two to three months. These findings are similar to recent data from adults aged 35 years or older with knee or hip pain demonstrating pain flares to decrease with increasing number of exercise therapy sessions performed (Sandal et al., 2016). This is important information for young adults with a meniscal tear that consult their physician or physical therapist. Patients should not abandon exercise therapy until after two to three months of supervised exercise even though they have pain flares in the beginning.

The study has some limitations. First of all, this study was a feasibility study with a small sample size and the uncontrolled design precludes any conclusions on the effect from the exercise program.
therapy program on self-reported outcomes. Secondly, only men were included in the feasibility study. Men and women might respond differently to a specific treatment, and as such it is important to include both men and women when assessing the effectiveness of exercise. Lastly, information on number of exercise sessions attended were collected through self-report and not by the physical therapist potentially affecting the validity of this measure. However to the authors’ knowledge, this is the first study thoroughly describing the development and application of a specific exercise program in young adults of 18–40 years of age with a meniscal tear, thereby serving as an important stepping stone towards better treatment of this patient population in the future.

5. Conclusions

The present neuromuscular and strengthening exercise therapy program was found to be feasible in adults aged 40 years or younger with a meniscal tear. While patients were considered eligible for meniscal surgery before undergoing the exercise program, neither of the patients wanted surgery after the treatment. Albeit, based on a small, uncontrolled study the observed improvements in symptoms and the few short-lasting knee-related adverse events are encouraging and support the application of the exercise therapy program in a future RCT comparing exercise to meniscal surgery.

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Declaration of interest

STS is one of the founders of Good Life with osteoArthritis in Denmark (GLA:D). GLA:D is a non-profit initiative hosted at University of Southern Denmark.

Conflicts of interest

The authors report no other conflicts of interest.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.jbmt.2017.07.010.

References


