Knee Surg Sports Traumatol Arthrosc (2007) 15:393–401
DOI 10.1007/s00167-006-0243-2

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Arthroscopic or conservative treatment of degenerative medial meniscal tears: a prospective randomised trial

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Received: 24 August 2006 / Accepted: 9 November 2006 / Published online: 10 January 2007

Abstract In this prospective randomised study two treatments after non-traumatic medial meniscal tear diagnosed with radiological examination and magnetic resonance imaging were compared; arthroscopic partial meniscectomy followed by supervised exercise or supervised exercise alone. The aim was to evaluate knee function and physical activity. Ninety patients (mean age 56 years) were evaluated using the Knee Injury and Osteoarthritis Outcome Score, the Lysholm Knee Scoring Scale, the Tegner Activity Scale and a Visual Analogue Scale for knee pain prior to the intervention, after 8 weeks of exercise and after 6 months. According to the outcome scores arthroscopic partial medial meniscectomy combined with exercise did not lead to greater improvement than exercise alone. After the intervention both groups reported decreased knee pain, improved knee function and a high satisfaction ($P < 0.0001$). Forty-one per cent of the patients returned to their pre-injury activity level after 6 months. In conclusion, when evaluated with outcome scores, arthroscopic partial medial meniscectomy followed by supervised exercise was not superior to supervised exercise alone in terms of reduced knee pain, improved knee function and improved quality of life.

Keywords Arthroscopy · Knee Joint · Exercise · Physiotherapy · Questionnaires

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Introduction

Middle-aged men and women with degenerative meniscal tears constitute a large group of patients presenting with knee pain, swelling and loss of function [3]. Many meniscal tears occur without a trauma in physically active individuals as well as in older people and could be a part of early osteoarthritis [3, 14, 35, 36]. Battacharyya et al. [7] showed with magnetic resonance imaging (MRI) that medial or lateral meniscal tear was a common finding in older patients with or without symptomatic osteoarthritis and that 91% of the individuals with knee related problems had an abnormal meniscus defined as meniscus tear. This was however also found in 76% of the individuals in the asymptomatic control group. If an injured meniscus leads to poor knee function and knee instability, the risk of affecting the joint cartilage increases [1, 30].

Partial arthroscopic meniscectomy is a common surgical procedure in patients with meniscal tears. Many patients report improvement after arthroscopy referring especially to reduced knee pain, better knee function and improved quality of life [8, 40]. Chatain et al. [12] reported that 91% of the patients 11.5 years

after arthroscopic medial meniscectomy considered their knees normal or almost normal. In a retrospective follow-up study, 5–11 years after surgery, Matsusue and Thomson [26] reported that 64% of the patients older than 40 years of age had returned to normal activities and were satisfied with their knees. Despite reduced knee pain and improved knee function, Roos et al. [40] showed that 3 months after surgery a majority of the patients had decreased their physical activity and 38% were not physically active compared to 9% before surgery.

Exercise has been suggested to be an efficient treatment for patients with knee degeneration in order to improve knee function and to limit joint pain, acutely as well as chronically [9, 10, 27, 29, 41]. There is strong evidence that physical training plays an important role in order to reduce symptoms, improve muscle strength and physical ability and thereby quality of life in patients with osteoarthritis [32]. Physical exercise three times weekly during 4 months could lead to more than 35% improvement of knee function [23]. There are a number of reports showing that quadriceps weakens due to knee pain [e.g. 16]. However, it has also been reported that patients have regained the same quadriceps strength as before surgery but have remained weaker than the contralateral leg after arthroscopic partial meniscectomy followed by a period of 6 weeks of exercise [44].

The goal of rehabilitation is to regain good knee control, range of motion (ROM), flexibility as well as muscle strength and thereby improving knee function. The exercise programme should consist of both concentric and eccentric exercises to receive muscular hypertrophy as well as neuromuscular function [5].

There is a wide range of treatments after degenerative meniscus tears. However, there is still no consensus about the treatment of choice and to our knowledge no results have been reported when comparing arthroscopic partial meniscectomy and supervised exercise.

Therefore, the aim of the present investigation was to compare two treatments; arthroscopic partial meniscectomy followed by supervised exercise and supervised exercise alone, in terms of knee pain, knee function, physical activity and quality of life in patients with degenerative meniscal tears.

Materials and methods

Patients

Ninety-nine middle-aged patients (of 180), mean age 56 years with no traumatic knee pain, were included in this study between June 2003 and April 2005.

Inclusion criteria were: (a) age 45–64 years; (b) knee pain without a trauma, daily or almost daily pain experienced during the last 2–6 months; (c) knee osteoarthritis grade 0 or 1 on weight-bearing knee radiographs according to Ahlbäcks classification [2]; (d) medial meniscal tear on MRI; (e) understanding of the Swedish language.

Exclusion criteria were: (a) traumatic meniscal injury; (b) neurological and rheumatic inflammatory diseases; (c) loose bodies, ligament injuries, osteochondral defects and tumours (MRI); (d) earlier knee surgery, prosthetic replacements of the hip or knee and fractures to the lower extremities less than 1 year old; (e) contraindication to physical training.

The patients were referred to orthopaedic surgeons at the Capio Artro Clinic, Stockholm Sports Trauma Research Center for suspected meniscal tears. They were then contacted by telephone and informed about the study. After written informed consent they were randomly assigned to two different treatments; arthroscopic partial meniscectomy followed by supervised exercise or by supervised exercise alone. Patient characteristics are presented in Table 1.

Forty per cent of the patients did not want to participate mainly due to lack of time, reduced knee pain or own interest in choosing treatment method. After entering the study six patients chose to end their participation due to reduced knee pain and three patients wanted to be treated with arthroscopic surgery.

A clinical examination was carried out by two experienced physiotherapists (test leaders). Data on the patient's medical history was collected with

Table 1 Characteristics of the patients in the Arthroscopic Exercise group (*AE*) and the Exercise group (*E*) (both groups $n = 90$)

	Arthroscopic exercise group ($n = 47$)	Exercise group ($n = 43$)
Gender		
Men/women	28/19	27/16
Total	47	43
Age[a]		
Men/women	54/54 (4.6/5.6)	55/59 (5.5/3.8)
Total	54	57
BMI[a]		
Men/women	27/25 (3.9/3.9)	26/25 (3.3/6.5)
Total	26	26
Pain medication		
Men/women yes	5/5	3/3
Men/women no	23/12	24/13
Activity (Tegner)[b]		
Total	3 (0–6)	3 (0–7)

[a] Mean (standard deviation)

[b] Median (range)

information about body mass index (BMI) [49], number of days for sick leave, intake of medicine and degree of pain, type of work as well as possible physical activity.

The study was approved by the Ethical Committee at the Karolinska Institutet in Stockholm. All patients signed their informed consent.

Questionnaires

Before the start of the intervention and after 8 weeks all patients answered three questionnaires, Knee injury and Osteoarthritis Outcome Score (KOOS) [39], Lysholm Knee Scoring Scale [22] and Tegner Activity Scale [46]. Prior to the study these questionnaires were administered by the test leaders and after 8 weeks by administrative staff. After 6 months the three questionnaires were sent by ordinary mail to the patients for a third answer together with a formula with questions about intake of medicine, sick leave and degree of possible knee pain.

Knee injury and osteoarthritis outcome score

The KOOS consists of five patient-relevant subscales, which are scored separately: pain (nine items), symptoms (seven items), activity in daily living (17 items), sport and recreational function (five items) and quality of life (four items). All items have five possible answer options scored from zero (no problems) to four (heavy problems). The scores are transformed to a 0–100 scale, where 100 represent no knee-related problems. The KOOS has been shown to be a valid, reliable and responsive instrument with a test-retest reliability of 0.75–0.93 for the five individual sections and a responsiveness of 0.84 for pain to 1.65 for knee-related quality of life [42]. To detect an average difference between individuals as well as between groups, a minimal perceptible improvement was set to ten points [42].

Lysholm knee scoring scale

The Lysholm Knee Scoring Scale contains eight parts (pain, swelling, instability, locking, limping, stair-climbing, support and squatting). No knee problems mean a total score of 100. More than 91 points are suggested as an excellent knee function without symptoms during any activity [22]. The scale has been proven to be valid, reliable and responsive for knee ligament injuries [48]. Marx [24] reported face and content validation of the Lysholm Knee Scoring Scale and a reliability of $r = 0.95$ and a responsiveness of $r = 0.90$.

Tegner activity scale

The Tegner Activity Scale has ten different activity levels and covers activities in daily life as well as in sports. Levels 1–6 show recreational sports, levels seven to ten show competitive sports. Level 0 means sick leave due to knee problems. The patients were asked about their activity level before injury, at the start of the intervention, as well as after 8 weeks and 6 months. The main advantage of the Tegner Activity Scale is the possibility to evaluate changes in activity level over time for the same patient.

Exercise programme

Twice a week during a period of 8 weeks each patient followed a standardised exercise programme with possibility for individual adaptation. The goal of the exercise programme was to reduce pain, restore full ROM and improve knee function. It consisted of exercises for improving muscle strength and endurance, muscle flexibility as well as balance and proprioception. The patients were informed to exert the exercises with some strain but perform them almost pain free and without having any negative influence in the affected knee at the following day. If the patient could tolerate the exercises without any problems he/she performed the exercises with increasing weights and higher resistance (Table 2).

Table 2 The exercise programme for both groups performed during 8 weeks

Time (week)	Exercises	
0–8	Stationary bicycling	Gradual increase, 7–15 min
0–4	Calf raises on a leg press	3 × 10 repetitions
5–8	Calf raises standing on one leg	3 × 10 repetitions
1–4	Leg press	3 × 10 repetitions
5–8	Lunges with ≤ 80° of knee flexion with or without weight in the hands	3 × 10 repetitions
0–4	Knee flexions concentrically with two legs and eccentrically with one leg	3 × 10 repetitions
5–8	Knee flexions with one leg	3 × 10 repetitions
0–8	Knee extensions concentrically with two legs and eccentrically with one leg	3 × 10 repetitions
5–8	Knee extensions with one leg	3 × 10 repetitions
0–8	Stair walking and balance on wobble boards	3 min
0–8	Jogging, jumps, landing on a rebounder	5 min
0–8	Stretching of knee extensors and flexors	1 min/muscle group

A written home programme was also carried out twice a week. It consisted of one-leg standing during 1 min and a step down exercise each comprising 3 × 10 repetitions. Using a diary the patients noted both performances of home and supervised exercises as well as of other physical activities.

Visual analogue scale

The 10-point Visual Analogue Scale (VAS) was used to measure the amount of possible knee pain during the last week, at rest as well as during weight bearing [21]. Pain rating at zero means no pain, while ten mean maximal pain.

Arthroscopy

Arthroscopy was performed on 47 patients on an outpatient basis by two experienced surgeons. One arthroscopy was performed in general anaesthesia and the rest in local anaesthesia (Mepvakain 5 mg/ml + adrenalin 5 mg 7 ml; Carbocain adrenalin; AstraZeneca, Sweden AB) 20 + 20 ml extra and intraarticularly, respectively.

Two standard portals were used and no outflow cannula was needed. A 5.5 mm, 30°, arthroscope was used with a pressure controlled irrigation system.

A standard operation protocol was used to document possible findings in cartilage, ligaments, synovium and the medial and lateral meniscus. Meniscal lesions were registered and changes in the articular cartilage were classified according to the Outerbridge classification [11, 25, 31]; grade 0 = intact articular surfaces, grade I = softening of the surfaces, grade II = partial-thickness defects less than 1.5 cm, grade III = partial-thickness tears greater than 1.5 cm/fragmentation, grade IV = exposed bone.

Statistics

Results of ordinal data were presented as median and percentiles (P25 and P75), mean from interval and ratio data. The Mann–Whitney U-test was used to compare the KOOS and the Lysholm Knee Scoring Scale between the Arthroscopic-Exercise (AE) and the Exercise (E) groups. For comparisons over time, ANOVA and Friedman's ANOVA by ranks, followed by multiple comparisons between visits were performed. The Spearman Rank Order Correlation was used to measure the association between the KOOS and the Lysholm Knee Scoring Scale and the correlations between the single variables in the KOOS: sport/recreation and quality of life. A power analysis was performed and 40 patients per group were needed to detect an average difference of ten points in the KOOS with 80% power. P = 0.05 was considered to be statistically significant.

Results

KOOS

After 8 weeks of regular physical training twice a week, both groups showed significantly higher scores on all subscales as evaluated with the KOOS ($P < 0.001$). In sport and recreation the AE group scored 50 points higher and the E group 40 points higher than at the start of the study. In terms of quality of life the AE group scored 32 points higher and the E group 25 points higher than at the start of the study.

Significant improvements on all subscales of the KOOS from the start of the study to 8 weeks and to 6 months were found within groups, $P < 0.001$ (Table 3). There was a strong tendency that the E group scored lower after 6 months compared to the 8 weeks follow-up in terms of sport and recreation ($P = 0.052$) but not in terms of quality of life (Figs. 1, 2, 3).

The power to detect a ten points difference within groups for sport and recreation was estimated to 84% and quality of life to 98%. Correlations between sport and recreation and quality of life were good in both groups both at the start of the study $r = 0.69$ ($P < 0.001$) and 6 months later $r = 0.78$ ($P < 0.001$).

There were no statistical group differences in any of the subscales at the follow-ups (Table 3).

Lysholm knee scoring scale

The total Lysholm score at the start of the study was for the two groups in median 65 (range 24–95) of possible 100 points. Both groups scored significantly higher after 8 weeks than at the start of the study $P < 0.001$ (Table 4). Sixteen of 47 patients (34%) in the AE group and 18 of 43 patients (42%) in the E group scored ≥ 91, which is suggested to be a normal knee function without symptoms during activity [20, 22]. There were lower scores for the AE group at 6 months compared with 8 weeks follow-up, $P = 0.05$. Within groups there were no statistical differences at the follow-ups.

There was a high correlation between the total scores of the Lysholm Knee Scoring Scale and the KOOS subscales, at the start of the study ($r = 0.74$) and after 6 months ($r = 0.84$), $P < 0.001$.

Table 3 The result of the KOOS scores reported as median and range [lower quartile (P_{25})—upper quartile (P_{75})] at the start, after 8 weeks and 6 months after the intervention for the Arthroscopic Exercise group (*AE*) ($n = 47$) and the Exercise group (*E*) ($n = 43$)

	AE-group	E-group	*P*-values between groups
Start of the study			
Pain	56 (44–67)	62 (50–78)	0.08
Symptom	64 (50–75)	71 (57–82)	0.16
ADL	68 (54–81)	79 (54–87)	0.32
Sport/Rec	20 (5–40)	30 (10–50)	0.09
QOL	31 (25–50)	38 (25–50)	0.67
After 8 weeks			
Pain	89 (72–94)	86 (75–94)	0.90
Symptoms	86 (75–93)	89 (75–96)	0.48
ADL	93 (85–97)	96 (78–99)	0.53
Sport/Rec	70 (35–85)	70 (50–90)	0.12
QOL	63 (50–75)	63 (44–69)	0.59
After 6 months			*P*-values between groups, 8 weeks and 6 months
Pain	89 (75–97)	86 (72–94)	0.42
Symptoms	89 (79–96)	86 (79–96)	0.94
ADL	84 (81–100)	96 (76–99)	0.56
Sport/Rec	70 (30–90)	65 (35–85)	0.80
QOL	69 (44–88)	63 (44–75)	0.61

P-values are given for comparisons between groups. *P*-values within groups were < 0.001

Tegner activity scale

Of 90 patients, 34 patients (72%) in the AE group and 30 patients (70%) in the E group reported a decreased physical activity level when their knee problems started. Before injury the patients scored 4 (median) on the Tegner Activity Scale (Table 4). This means, for instance, jogging on even ground, gymnastics with jumps and cross-country skiing. After 8 weeks 18 of 47 patients (42%) in the AE group and 22 of 43 patients (51%) in the E group had reached their pre-injury activity level. This was the same after 6 months for the AE group, but not for the E group where 17 of 43 patients (40%) had reached their pre-injury activity level. Seventy per cent of all patients reported that they had reached level 3 or higher.

Visual analogue scale

Pain was reported significantly lower on the outcome scores as well as on the VAS scale after 8 weeks of regular exercise in both groups ($P < 0.001$). Pain ratings during physical activity using the VAS showed a median value of 5.5 at the start of the study for both groups. After two and 6 months they scored 1.0 (Table 4).

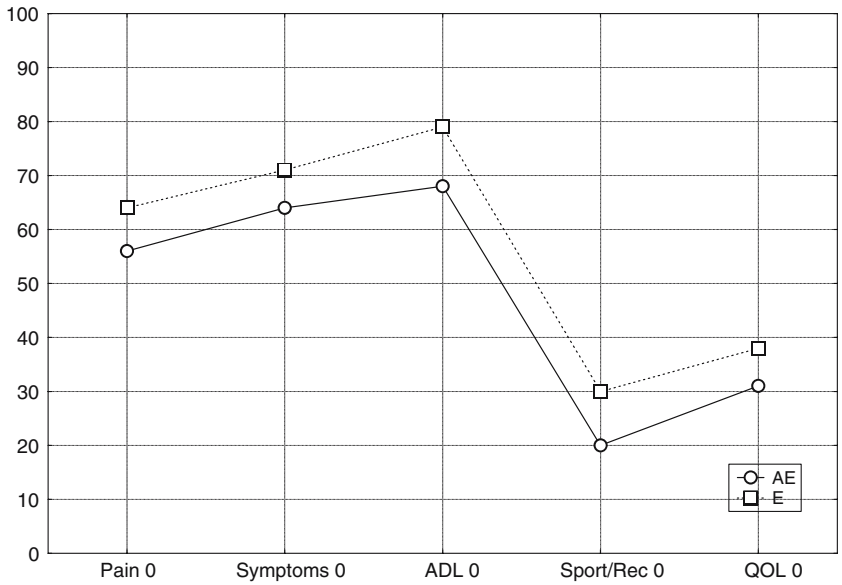

Fig. 1 KOOS scores (median); subscales Pain, Symptoms, ADL, Sport/Rec and QOL reported at the start as an outcome profile for the Arthroscopic Exercise group, AE = *open circle* ($n = 47$) and the Exercise group, E = *open square* ($n = 43$)

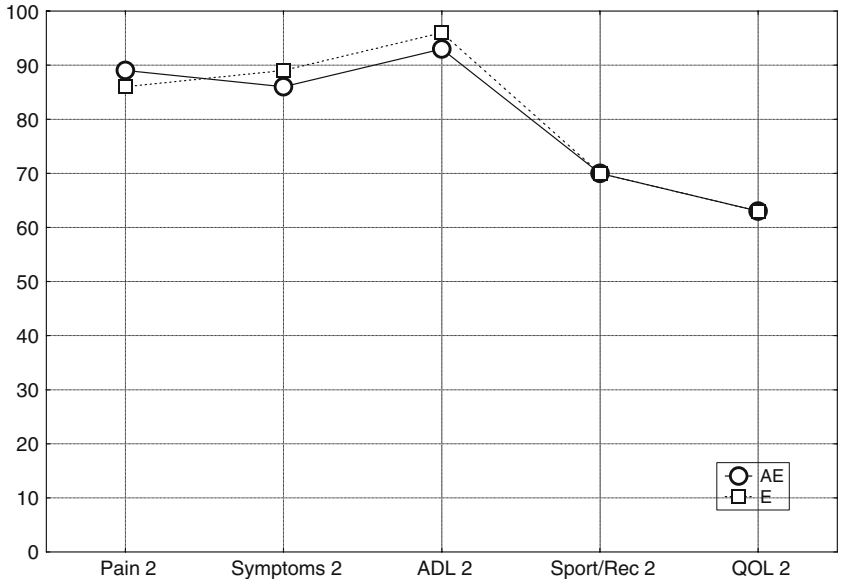

Fig. 2 KOOS scores (median); subscales Pain, Symptoms, ADL, Sport/Rec and QOL reported after 8 weeks as an outcome profile for the Arthroscopic Exercise group, AE = *open circle* (n = 47) and the Exercise group, E = *open square* (n = 43)

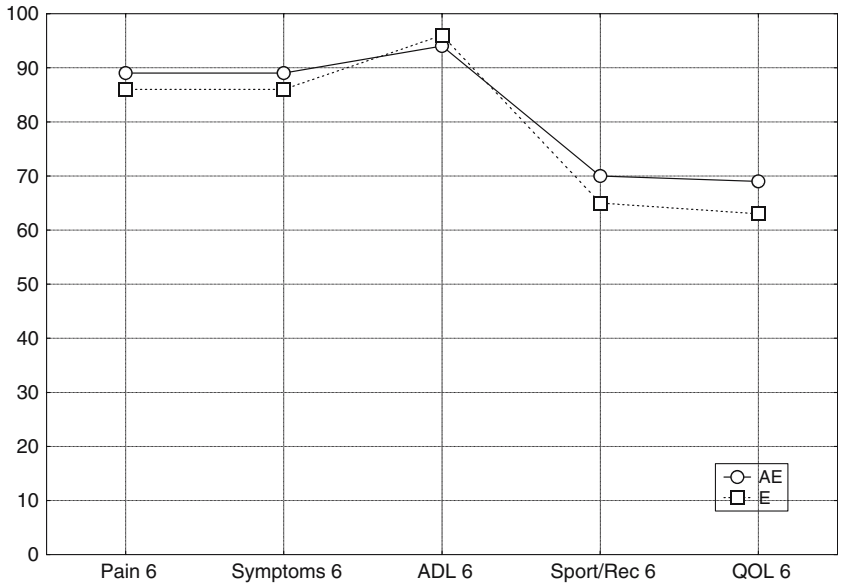

Fig. 3 KOOS scores (median); subscales Pain, Symptoms, ADL, Sport/Rec and QOL reported after 6 months as an outcome profile for the Arthroscopic Exercise group, AE = *open circle* (n = 47) and the Exercise group, E = *open square* (n = 43)

Table 4 The result of the Lysholm total score, Tegner Activity Scale and Vas scale reported as median and range lower quartile (P_{25})—upper quartile (P_{75}) at the start, 8 weeks and 6 months after the intervention for the Arthroscopic Exercise group (AE) (n = 47) and the Exercise group (E) (n = 43)

	Lysholm total score		VAS, movement		VAS, rest		Tegner activity level	
	AE-group	E-group	AE-group	E-group	AE-group	E-group	AE-group	E-group
Pre-injury							4 (3–5)	4 (3–5)
Start of the study	61 (49–70)	73 (56–83)	6 (3–8)	5 (2–7)	2 (0–4)	1 (0–5)	3 (2–3)	3 (2–3)
After 8 weeks	88 (79–93)	90 (78–95)	1 (0–3)	1 (0–3)	0 (0–1)	0 (0–2)	3 (3–4)	3 (3–4)
After 6 months	84 (70–94)	85 (71–94)	1 (1–3)	1 (1–4)	0 (0–2)	0 (0–2)	3 (2–4)	3 (2–4)

P-values within groups were < 0.001

Arthroscopy

Forty-two patients had medial meniscal tears and two patients had tears of both their medial and lateral menisci. Three patients had no meniscal tears. All meniscal tears were treated with partial resection. The location of the meniscal tears on pre-operative MRI was in agreement with the meniscal tears that were found and treated during surgery except for three patients where no meniscal tear was found.

Degenerative and/or other chondral lesions were found in 40 cases. According to the Outerbridge classification [11, 31] there were seven patients with grade I, six with grade II, nineteen with grade III and eight with grade IV. Thirty patients had cartilage changes grades II–IV of the medial joint compartment, 21 had grades II–IV in the patellofemoral joint and six in the lateral compartment.

Fourteen of the degenerative chondral lesions with unstable flaps were treated by debridement with a motorized shaver. Ten of these debridements concerned the medial aspect of the joint.

Discussion

The purpose of the present investigation was to compare two treatments for middle-aged patients with non-traumatic medial meniscal tear. Two groups of patients performed supervised exercise twice a week during 8 weeks, one after arthroscopic partial meniscectomy.

After a period of 8 weeks of exercise both groups showed great improvements when evaluated with different outcome questionnaires. The value of exercise as a treatment option after meniscal tears has not been sufficiently studied. Resistance training has been reported to be effective in rehabilitation of orthopaedic injuries [15]. Aichroth [3] recommends treating detected meniscal tears on MRI with mobility and strengthening exercises and gradually increased resistance training. We, like other authors [4, 15], would like to point out the importance of exercise programmes tailored for each individual in order to reach the best clinical outcome. Furthermore, our clinical impression of the present study suggested to start with supervised training sessions to optimise the performance of the exercises with core stability and control of the knee and to develop the exercises according to the patient's former experience.

The majority of scientific publications deals with rehabilitation after arthroscopy [18, 27, 29, 44, 45, 47]. In accordance with a few studies [29, 46] the patients in the AE group showed that supervised exercise after arthroscopy could contribute to a fast rehabilitation and to high-patient satisfaction. With critical reviews of clinical trials, Goodyear-Smith and Arroll [19] and Goodwin and Morrissey [17] have not found enough evidence for physical therapy following arthroscopy to lead to gains in functional improvements in patients below 40 years of age. They recommend a home exercise programme together with verbal instructions to patients after an uncomplicated arthroscopic partial meniscectomy. The referred clinical trials were however characterised by small sample sizes and short-term follow-ups. The discrepancy of results from earlier studies and the present study after training sessions can rely on lack of using standardised outcome scores especially comprising subscales of quality of life.

With arthroscopic partial meniscectomy as the only intervention Roos et al. [39] reported great improvement after 3 months in all subscales of the KOOS. This improvement was less than in the present study where the patients also received special knee training after surgery. Since not enough evidence points out the value of exercise after arthroscopy after medial meniscal resection (19, 17), a third group treated with arthroscopy alone might have improved the study.

In agreement with other authors we also found a reduction or cessation of sports after arthroscopic meniscectomy especially in patients with degenerative knee changes [13, 35]. The patients in our study have dropped their level of activity by 1 or more grades, which are in line with the mentioned studies. Fifty-nine per cent of the patients did not reach their pre-injury activity level after 6 months. There is a higher rate of patients nowadays not returning to sports than it was 20 years ago, when supervised rehabilitation after surgery was more common than today [38].

Arthroscopy can be an effective short as well as long-term treatment especially in those without articular cartilage damage [8, 20, 26]. Meniscal tears in the outer zones can be treated successfully [1]. Patients with non-degenerative meniscal tears are more satisfied with their knee function after arthroscopy than those patients with degenerative meniscal tears [3, 13, 14, 28]. Since there is an increased risk of developing radiographic tibiofemoral osteoarthritis for individuals older than 40 years of age after arthroscopic meniscectomy [12, 34, 43], exercise treatment during several weeks could be recommended as the first choice.

Our results are based on the formulas KOOS and the Lysholm Knee Scoring Scale and the Tegner Activity Scale. KOOS is validated for young and middle-aged patients with various knee disorders like meniscal pathology [42]. The high-rank correlation between KOOS and the Lysholm Knee Scoring Scale

could mean that the formulas were equal to show subjective evaluation of knee problems for patients with meniscal tears. The Lysholm Knee Scoring Scale, designed for the evaluation of knee ligament injuries, has been reported to be most sensitive for patients with meniscal tears [6]. However, the lower total Lysholm score for the AE-group after 6 months could mean that the scale might not be sensitive enough to changes over time [37]. The high reliability on face and content validation of the Lysholm Knee Scoring Scale, which was reported by Marx [24], was made on physically active young people with ligament injuries (≥ 4 in the Tegner Activity Scale). The patients in the present study had a mean age of 56 years. Most patients reported their activity level to be within the recreational range (≤ 4). If people reduce their activity, there might be a risk that they score higher on the Lysholm Knee Scoring Scale, since they are not performing knee demanding activities. Our results point in the opposite direction. After 8 weeks of knee demanding exercises the median value for both groups on the total Lysholm score was close to 90 (of 100), while after 6 months with reduced regular exercise the median value was somewhat lower, 85. Despite the high score on the Lysholm Knee Scoring Scale as well as great improvements in all subscales of the KOOS, after 6 months only 41% of the patients had returned to their pre-injury physical activity level. This could indicate that it takes more than 6 months after either arthroscopic partial meniscectomy and/or exercise therapy for a successful return to former physical activities or that these patients overestimate their regular physical activity before injury.

The patients were included after clinical examination, weight bearing radiographs with findings of no or low-arthritic sign and medial meniscal tears found on MRI. There are difficulties to reliably predict if the meniscal tears and not other structures in the knee joint can be associated with the patient's knee problems, since many meniscal tears without reported knee problems are found on the MRI [7, 13, 16]. The correlation between knee pain and osteoarthritis verified after radiological examination has been reported to be low [33, 41]. If clinical tests reveal suspect knee degeneration, a conservative treatment could be of value before considering other expensive investigations.

Despite randomisation we noticed that there were a few group differences at the start of the study. A power analysis was performed to detect an average KOOS difference of ten points between the groups. Preoperatively all the KOOS scores of the AE-group were numerically lower than the E-group. The differences were 11 and 10 points for ADL and Sport/Recreation, respectively. Despite this fact no statistical differences between the groups at the start in KOOS regarding ADL and Sport/Recreation were found. Postoperatively the scores of the two groups were of the same magnitude. This difference at the start could have influenced the results especially in those patients belonging to the AE group. This might give evidence to a subjectively evaluated slightly greater improvement by the patients in the arthroscopic exercise group compared to the exercise group. No statistical significant difference at the follow-ups was found between the groups in the subscales of KOOS but there was a strong tendency that the patients in the E group scored lower in the subscale sport and recreation after 6 months compared to 8 weeks when regular supervised training twice a week had ended.

Despite the power analysis with a power of at least 80%, our sample sizes might have been too small to be able to show possible differences between the groups. Since several authors report good long-term results after arthroscopy [3, 8, 12, 26], a longer follow-up time might also be needed to detect possible differences between the groups.

In conclusion, a combination of arthroscopic partial meniscectomy and supervised exercise does not necessarily lead to greater improvements of knee function compared to supervised exercise alone in middle-aged patients with non-traumatic medial meniscal tears. In light of our findings we recommend supervised exercise alone as the first choice of treatment.

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