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ORIGINAL RESEARCH ARTICLE

Video-based education is non-inferior to in-person education in patients undergoing arthroscopic partial meniscectomy: a non-inferiority randomized controlled trial

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ABSTRACT

Introduction: Reduced self-efficacy and high kinesiophobia levels affect recovery after arthroscopic partial meniscectomy. Video-based patient education represents an alternative approach to in-person education to support postoperative management and home-based rehabilitation in these patients. The study investigated whether preoperative video-based patient education was non-inferior to postoperative in-person education on pain-related self-efficacy and assessed the effects of such an approach on disability and fear of movement in patients undergoing arthroscopic partial meniscectomy.
Methods: One hundred sixty-six patients undergoing arthroscopic partial meniscectomy were randomized into a video-based (n = 83) or control group (n = 83). The video-based group received a video clip including educational content and home-based exercises within 5 days before surgery, while the control group received in-person education and instructions for home-based exercises a few hours after surgery. Participants were assessed for self-efficacy (Pain Self-Efficacy Questionnaire - PSEQ), knee function (Western Ontario and McMaster Universities Osteoarthritis Index - WOMAC), and kinesiophobia (Tampa Scale of Kinesiophobia - TSK) 5 days before surgery (T0), after the 2-week training (T1), and 6 weeks after surgery (T2).
Results: Video-based education was non-inferior to in-person education for PSEQ scores at T1 (MD: -0.6, 1-sided 95% lower bound: -3.8) and T2 (MD: -0.5, 1-sided 95% lower bound: -3.5). Moreover, the video-based group revealed a better TSK score than the control group at T2, while no between-group differences over time were found for WOMAC.
Conclusions: Preoperative video-based education was not inferior to postoperative in-person education on pain-related self-efficacy and revealed reduced fear of movement in patients undergoing arthroscopic partial meniscectomy.

Keywords: Arthroscopy, Functional recovery, Joint recovery, Knee joint, Meniscectomy, Patient education

What is already known about this topic?

- *Patient education can modulate psychosocial factors in surgical populations, and video-based education represents a feasible intervention included in the perioperative care pathway.*

What does the study add?

- *Preoperative video-based patient education was non-inferior to in-person education in patients undergoing arthroscopic partial meniscectomy and led to a higher reduction in fear of movement.*

Introduction

Meniscal tears cause pain, swelling, reduced range of motion, and instability, which have been reported to contribute to knee joint degeneration (1). Despite meniscal tissue playing a pivotal role in knee biomechanics, the limited regenerative capacity of the meniscus has led to the adoption of arthroscopic partial meniscectomy as a common surgical treatment for meniscal tears (2). Such a surgical procedure frequently induces pain, joint effusion, and quadriceps activation failure in the early postoperative phase, which negatively impacts physical and psychosocial outcomes (2,3). In this context, early rehabilitative programs based on home-based exercises have been reported as effective strategies to speed up the achievement of postoperative outcomes (2-4). In particular, in-person educational sessions are usually adopted for delivering postoperative information on home-based exercise training to patients undergoing arthroscopic partial meniscectomy (3).

Video-based education has been developed in addition to conventional rehabilitative programs to support postoperative

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management and provide adequate instructions in the acute phase after orthopedic surgery and during the performance of home-based exercises (5-7). Such intervention has been reported to effectively contribute to pain reduction and achievement of functional and psychosocial outcomes in patients with musculoskeletal conditions such as chronic low back pain, rotator cuff tears, and knee arthroplasty (5-7). However, the effects of video-based education in patients with arthroscopic partial meniscectomy have been poorly explored.

When considering patients undergoing arthroscopic partial meniscectomy, higher levels of preoperative anxiety, fear of movement, depressive symptoms, sleep disturbances, and pain have been described as associated with poorer postoperative functional recovery and health-related quality of life (8,9). In this scenario, video-based educational interventions delivered at patients' homes may contribute to improvements in postoperative recovery and enhance psychosocial factors in subjects undergoing arthroscopic partial meniscectomy. In particular, this approach may be as effective as in-person education, resulting in an easier and cost-effective modality of administration. Moreover, the opportunity to ensure availability of educational content to patients at any time through video clips may further enhance psychosocial outcomes. To date, a single study has investigated the effects of a web-based video clip added to standard in-person teaching counseling in patients undergoing knee arthroscopy for meniscal tears, revealing higher knowledge and satisfaction compared to counseling alone (9). However, video-clip contents consisted of an overview of surgical procedures, and education on pain management or exercise instructions was not included. Furthermore, patients' knowledge and satisfaction were only assessed, without investigating functional or psychosocial outcomes (9).

Against this background, the primary aim of this study was to investigate whether preoperative video-based education was non-inferior to postoperative in-person education on pain-related self-efficacy in patients undergoing arthroscopic partial meniscectomy. The secondary aims were to explore the effects of video-based patient education compared to in-person education on disability and fear of movement in these patients.

Methods

Participants

One hundred sixty-six patients scheduled to undergo arthroscopic partial meniscectomy were enrolled between January 2024 and December 2025. Inclusion criteria were age ≥18 years, surgery for arthroscopic partial meniscectomy at the level of the medial or lateral meniscus for traumatic or degenerative meniscal tear, and proficiency in the Italian language. Surgical procedures were performed by 3 orthopedic surgeons of the same unit using standard anteromedial or anterolateral portals, based on the involved meniscus. Patients underwent surgery in supine posture with the knee in a flexed position during surgery, and unstable meniscal tissue was selectively resected, preserving healthy meniscal tissue as much as possible. Subsequently, portals were closed following standard practice (10). Exclusion criteria were previous knee surgery in the last 5 years, locked knee or trauma requiring acute surgery associated with ligament injuries or severe knee osteoarthritis (grade 4 on the Kellgren-Lawrence Grading Scale), postoperative hematomas requiring aspiration, infections, and neurological, musculoskeletal, rheumatologic, or oncological conditions able to influence postoperative recovery (11). Patients with diagnoses of cognitive or psychiatric disorders were also excluded (12). The study was carried out at the Hip and Knee Orthopedic Surgery Department and Physiotherapy Unit of the IRCCS Humanitas Research Hospital of Milan, Italy. The study protocol was approved by the Ethical Committee of the IRCCS Humanitas Research Hospital (n. CLF23/03), written informed consent was obtained from all participants, and the study protocol was registered on ClinicalTrials.gov (NCT07358325).

Study design and interventions

The study was a two-armed, single-blind, non-inferiority, randomized controlled trial. An independent researcher blinded to the randomization list assessed participants' eligibility 5 days before surgery to ensure allocation concealment. Subsequently, participants were randomized into a video-based group (n = 83) or a control group (n = 83) using a computer-generated random sequence. In particular, participants allocated to the video-based group received a pre-recorded video clip including educational content and home-based exercises within 5 days before surgery. Participants allocated to the control group received in-person education and instructions on home-based exercises from a physiotherapist a few hours after surgery. A leaflet including written educational content and a graphical representation of home-based exercises was also delivered to the control group.

Video-based and control groups received identical educational content consisting of advice for postoperative management and instructions on the exercises to be performed at home. Specifically, participants were instructed to keep the involved limb elevated 3 times per day for 30 minutes, maintain knee extension several times during the day by positioning a support under the heel in supine posture, apply local cryotherapy at least 3 times per day for 15 minutes, and perform active ankle dorsiflexion and plantar flexion movements for 3 minutes every 2 hours in supine posture. Participants were asked to walk with full weight-bearing since the first postoperative day, and the use of crutches was recommended for 3-5 days until gait pattern normalization. Moreover, all participants were asked to perform home-based exercises consisting of knee active mobilization, muscle stretching, and neuromuscular recruitment. Stretching of posterior thigh and calf muscles was performed in seated and standing postures (30 seconds of posture maintenance for 5 times), while knee active mobilization and neuromuscular recruitment exercises included active knee flexion movements in supine posture (2 sets of 10 repetitions), isometric quadriceps contractions (10 repetitions per limb with a 6-second isometric hold), and straight leg raise tasks (10 repetitions with a 6-second isometric hold). Home-based exercises were performed 2 times per day for 2 weeks with no supervision. Participants were asked to fill in a diary to monitor treatment adherence during the training period.

Assessment

Participants were assessed at 5 days before surgery (T0), after the 2-week training (T1), and at 6 weeks after surgery (T2) using self-administered questionnaires distributed via email and collected through an ad hoc Google Forms spreadsheet. Questionnaire responses were managed by a physiotherapist blinded to group allocation. The primary outcome was the Pain Self-Efficacy Questionnaire (PSEQ) for pain-related self-efficacy. The PSEQ is a 10-item questionnaire ranging from 0 to 60 to assess the confidence of individuals with ongoing pain in performing activities (13). Secondary outcomes included the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and Tampa Scale of Kinesiophobia (TSK). The WOMAC assesses pain, stiffness, and physical function in subjects with knee musculoskeletal conditions (14,15). The TSK investigates pain-related beliefs and fear of movement or reinjury in individuals with musculoskeletal conditions (16).

Statistical analysis

Sample size was calculated a priori based on the PSEQ as the primary outcome and the non-inferiority assumption of the study. A minimal clinically important difference (MCID) ranging between 5.5 and 8.5 points in terms of PSEQ has been reported in populations with musculoskeletal disorders (13). Therefore, a conservative non-inferiority margin of 5 points was adopted to avoid overestimation of treatment effects (17,18). In this context, assuming a standard deviation (SD) of 12.9 points, one-sided alpha error (α) of 5%, and statistical power of 80%, 83 participants per group were required.

Normality of data distribution was assessed using the Shapiro–Wilk test. Between-group differences in terms of baseline characteristics were investigated using the Mann–Whitney tests for continuous variables (age, body mass index, and symptom duration before surgery), while the Chi-square tests were adopted for categorical variables (gender, mechanism of injury, side of injury, and site of tear). Mean adherence percentages derived from patients' exercise diaries were compared between video-based and control groups using an unpaired t-test.

Participants' age and symptom duration were included as covariates in intervention effect analyses, as they were significantly different between video-based and control groups at baseline.

Non-inferiority of video-based education compared to control intervention in terms of the primary outcome was conducted according to the intention-to-treat principle, including all available data. A linear mixed model with maximum likelihood estimation with time, group, and group by time interaction as fixed effects and participants as a random effect was applied. Mean differences (MD) between the two groups (MD = video-based − control) and lower bound (LB) of one-sided 95% confidence interval (1-sided 95% LB) were computed for PSEQ at T1 and T2. This approach provides valid inference under the missing-at-random assumption (19). The non-inferiority hypothesis was satisfied if the 1-sided 95% LB of the MD did not cross the non-inferiority margin ($\Delta = -5$ points). Sensitivity analysis included a per-protocol analysis for the primary outcome, including participants who completed all the assessments, as recommended by the CONSORT extension for non-inferiority trials (18).

Subsequently, superiority analyses were carried out for primary and secondary outcomes using a linear mixed model with time as a within-subject factor and group as a between-subject factor to investigate between-group differences over time in terms of PSEQ, WOMAC and TSK. When a significant group by time interaction occurred, Bonferroni post hoc tests were carried out. The effect size between the two groups was also computed and expressed as MD with two-sided 95% confidence intervals (2-sided 95% CI). Statistical analysis was performed using SPSS 29.0 for Windows, and the level of statistical significance was set at $\alpha = 0.05$.

Results

A total of 258 patients were assessed for eligibility. Ninety-two patients were excluded: 57 patients did not meet inclusion criteria, while 35 patients declined to participate. The remaining 166 participants were enrolled and randomized into a video-based or control group. In the control group, 3 participants were lost to treatment-end assessment, and an additional 5 participants were lost to follow-up. In the video-based group, 2 participants were lost to follow-up. Participants' flow throughout the study and loss to follow-up reasons are shown in Figure 1.

Control group participants revealed higher median age and longer symptom duration before surgery when compared with the video-based group. Participants' baseline characteristics are reported in Table 1. Moreover, no between-group differences in terms of adherence to the home-based exercise program were reported, with mean adherence percentages of 77.6% (SD 9.6%) in the video-based group and 74.7% (SD 17.4%) in the control group ($p = 0.13$).

No between-group differences were found for the PSEQ at T1 and T2. Non-inferiority for the primary outcome was confirmed, with the 1-sided 95% LB of the between-group MD at both T1 and T2 above than the non-inferiority margin ($\Delta = -5$) in both intention-to-treat and per-protocol analyses ($p = 0.760$ at T1, $p = 0.774$ at T2 for intention-to-treat analysis; $p = 0.825$ at T1, $p = 0.797$ for per-protocol analysis). Between-group comparisons for the primary outcome at T1 and T2 are shown in Figure 2.

Linear mixed model analysis revealed a significant time effect for PSEQ and WOMAC, while no significant time by group interaction or group effect was found. A significant group by time interaction was found for TSK. Between-group post-hoc analysis revealed significantly lower TSK scores in favor of the video-based group compared to the control group at T2 ($p = 0.015$). Within-group post hoc analyses revealed that TSK significantly decreased in the video-based group from T0 to T1 and T2 ($p = 0.036$ and $p = 0.012$, respectively). No within-group differences were found for the control group. Between-group analysis over time for the primary and secondary outcomes is reported in Table 2.

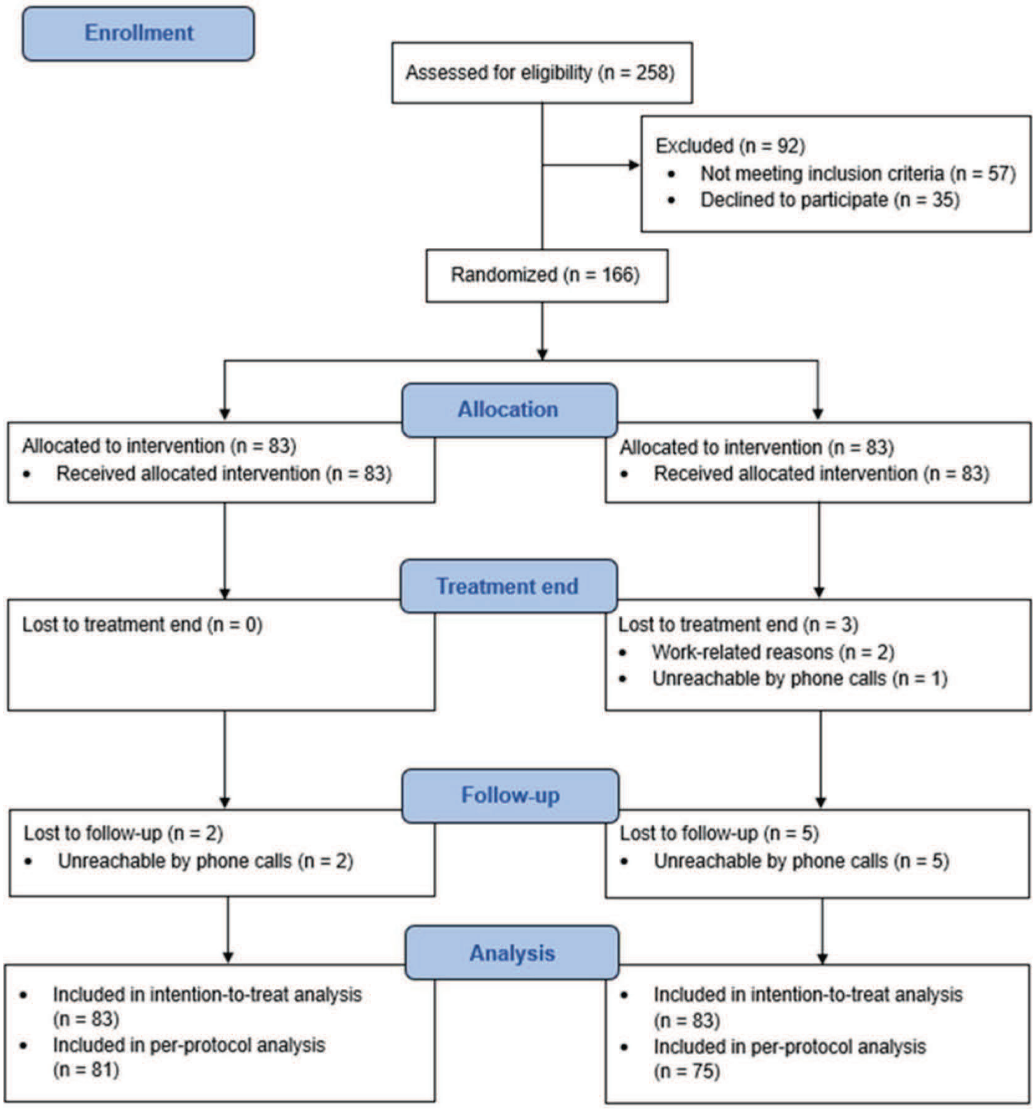

FIGURE 1 - Participants' flow diagram.

TABLE 1 - Characteristics of study participants (Mann–Whitney and Chi-Square tests). Data are shown as median and interquartile range [25th-75th percentile] or proportion.

	Video-based group (n = 83)	Control group (n = 83)	p-value
Age (years)	44 [34 – 54]	50 [38 – 58]	**0.046**
Gender (M/F)	59/24	54/29	0.405
BMI (kg/m²)	24.9 [23.2 – 27.4]	25.3 [22.8 – 27.7]	0.846
Symptoms duration (months)	4 [2 – 9]	5 [3 – 15]	**0.034**
Traumatic injury (yes/no)	53/30	42/41	0.084
Side of injury (R/L)	41/42	47/36	0.351
Site of tear (MM/LM)	71/12	70/13	0.828

Abbreviations: M: Male, F: Female, BMI: Body Mass Index, R: Right, L: Left, MM: Medial Meniscus, LM: Lateral Meniscus.

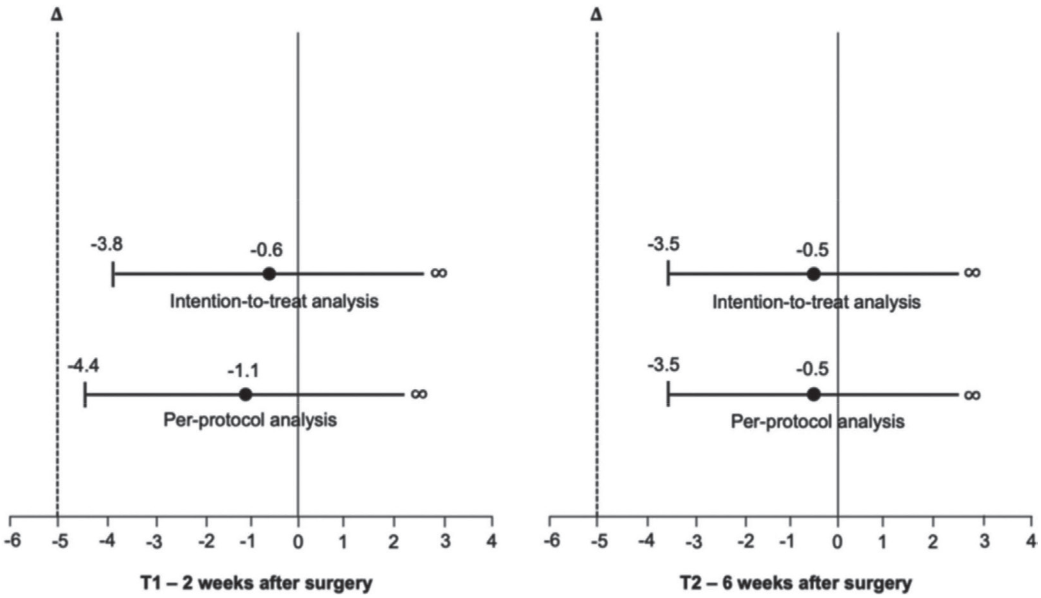

FIGURE 2 - Non-inferiority and sensitivity analysis of pain-related self-efficacy (PSEQ) at 2 weeks (T1) and 6 weeks after surgery (T2) from a linear mixed model. Data are presented as mean difference (MD) and 1-sided lower bound of the 95% confidence interval (1-sided 95% LB). Dotted lines represent the non-inferiority margin (Δ = −5 points).

TABLE 2 - Superiority analysis of pain-related self-efficacy (PSEQ), disability (WOMAC) and fear of movement (TSK) at 2 weeks (T1) and 6 weeks (T2) after surgery from a linear mixed model. Data are shown as mean and standard deviation (SD) and mean difference (MD) with 2-sided 95% confidence intervals (2-sided 95% CI) between groups.

	Video-based group (n = 83)			Control group (n = 83)			p-value Time	p-value Group	p-value Group x Time	MD T1 (2-sided 95% CI)	MD T2 (2-sided 95% CI)
	T0	T1	T2	T0	T1	T2					
PSEQ	36 (12.9)	43.9 (11.6)	52.2 (11)	36.6 (14.9)	44.5 (13.3)	52.7 (11.6)	**< 0.001**	0.712	0.989	-0.6 (-4.5; 3.3)	-0.5 (-4.1; 3.1)
WOMAC	33.9 (16.7)	28.5 (14.9)	18.5 (14.9)	33.4 (18.3)	28.2 (16.9)	19.8 (18,4)	**< 0.001**	0.916	0.698	0.3 (-4.6; 5.2)	-1.3 (-6.6; 4)
TSK	33.3 (7.5)	30.9 (7.6) §	29.5 (8.6) * §	32.2 (7.7)	32.5 (8)	33.1 (9.4)	0.220	0.171	**0.035**	-1.6 (-4; 0.8)	-3.6 (-6.4; -0.7)

Abbreviations: MD: Mean Difference, CI: Confidence Interval, PSEQ: Pain Self-Efficacy Questionnaire, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index, TSK: Tampa Scale of Kinesiophobia.
Symbols: * p < 0.05 compared to Control at the same time-point, § p < 0.05 compared to T0 of the same group.

Discussion

The current study proved that preoperative video-based education was non-inferior to postoperative in-person education on pain-related self-efficacy in patients after arthroscopic partial meniscectomy. Non-inferiority was confirmed, since 1-sided 95% LB of the mean difference between the video-based group and the control group did not cross the non-inferiority margin established for the primary outcome (PSEQ) at treatment end and follow-up. Furthermore, no between-group differences were detected for pain-related self-efficacy (PSEQ) and knee function (WOMAC).

In the current study, participants received the same postoperative educational content and followed a standardized home-based exercise program for 2 weeks after surgery, and the only difference consisted of the timing and modality of education and exercise delivery. Such a methodology allowed for the interpretation that non-inferiority of video-based patient education on psychosocial outcomes may be attributed to preoperative video-based educational intervention rather than potential differences in exercise execution. The current study results agree with the findings of Yin and co-workers, demonstrating the ability of web-based educational interventions to achieve benefits comparable to those obtained through in-person counseling after meniscectomy (9). Notably, this trial assessed psychosocial outcomes using valid and reliable measurement tools such as the PSEQ and TSK, unlike previous studies that primarily focused on patients' knowledge or satisfaction after the educational intervention (9). More broadly, these findings are also consistent with evidence deriving from musculoskeletal populations, including chronic knee pain and degenerative meniscal tears, showing that structured telerehabilitation programs are non-inferior to face-to-face rehabilitation on clinical outcomes (20,21). In this context, the current study extends the aforementioned findings, suggesting that even a preoperative video-based education may positively influence postoperative psychosocial outcomes similarly to an in-person approach.

When considering the clinical relevance, these findings may have pivotal implications for the care pathway of patients undergoing arthroscopic partial meniscectomy. In fact, standard postoperative management typically requires physiotherapists to deliver individualized, in-person education and exercise instructions immediately after surgery, which is time-consuming and resource-intensive. Video-based education delivered preoperatively may reduce clinicians' workload and healthcare costs while preserving clinical effectiveness (22,23).

Besides non-inferiority findings, preoperative video-based patient education revealed lower fear of movement at 6 weeks after arthroscopic partial meniscectomy. This result may be explained by both timing and modality of the educational intervention. In particular, the administration of educational content before surgery might have facilitated early cognitive and emotional processing of surgery-related fears, mitigating fear of movement during the postoperative phase (8,24). This finding is consistent with previous literature data highlighting the role of preoperative education in improving postoperative pain management and reducing anxiety across surgical populations, including subjects undergoing orthopedic surgery (24). In addition, educational content and exercise instructions delivered using a video-based approach have been reported to allow patients to review information at their own pace, potentially enhancing understanding and reassurance during the perioperative period (9). However, the current study cannot determine whether reduction in fear of movement in participants undergoing preoperative video-based intervention was primarily attributable to preoperative timing of the intervention administration or video-based delivery modality of the treatment.

Some limitations of the current study deserve to be highlighted. First, the control group showed higher median age and longer symptom duration than the video-based group. In fact, longer duration of symptoms may negatively affect postoperative perceived knee functionality and psychosocial outcomes in these patients, leading to maladaptive coping strategies (25). However, mean baseline values of outcome measures did not differ between groups, and age and symptom duration were included in the model as potential confounders using covariate-adjusted analyses. Nevertheless, baseline differences in demographic and clinical characteristics may limit the generalizability of the current findings to a broader population. Second, some participants withdrew from the study. However, the dropout rate was low, and both intention-to-treat and per-protocol analyses were carried out to limit any potential influence of missing data on the results. Third, the home-based exercise program was unsupervised, leading to potential heterogeneity in terms of adherence. However, participants were asked to fill in a diary, and no differences were found in terms of self-reported adherence. Finally, no physical performance outcome measures were collected, hindering the opportunity to draw conclusions on motor recovery beyond self-reported outcomes.

Conclusion

Preoperative video-based education was not inferior to postoperative in-person education on pain-related self-efficacy and led to less fear of movement in patients undergoing arthroscopic partial meniscectomy. These findings supported the adoption of video-based patient education as an alternative approach to guarantee an adequate postoperative care pathway when an in-person intervention is not possible and as an effective strategy to decrease fear of movement in patients undergoing arthroscopic partial meniscectomy.

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Disclosures

Conflict of interest: all authors disclose any financial and personal relationship with other people or organizations that could inappropriately influence their work.

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Author's contributor role: AB - data curation, formal analysis, and writing. DC - data curation. EP - data curation. NC - data curation. PA - conceptualization and supervision. RG - conceptualization, supervision, project administration and writing. FT - conceptualization, data curation, formal analysis and writing.

Data availability statement: The datasets of this study are available from the corresponding author upon reasonable request.

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