


Effectiveness of modeling videos on psychological responses of patients following anterior cruciate ligament reconstruction

A pilot randomized trial

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Abstract

Background: To date, much of the rehabilitation following anterior cruciate ligament reconstruction (ACLR) has centered on physical components. However, clinical outcomes including return to sport after ACLR depends on not only physical recovery but also psychological components. This study was performed to assess the feasibility of 6-month modeling video intervention on psychological responses following ACLR.

Methods: Following the baseline assessment of psychological measures through Knee Self Efficacy Scale (K-SES), ACL-Return to Sport after Injury (ACL-RSI), and Tampa Scale of Kinesiophobia-11 (TSK-11), 32 patients scheduled for ACLR were randomly assigned to intervention (n = 10), placebo (n = 11), or control (n = 11) group. Six modeling videos and placebo videos were developed by the investigators. Intervention and placebo groups watched their respective videos during their follow-up visits while control group did not. All groups completed psychological assessments during hospitalization, at 2 weeks, at 6 weeks, at 3 months, and at 6 months following ACLR. Also, Knee Injury and Osteoarthritis Outcome Score (KOOS) was used to evaluate symptoms and function of the knee at 3 and 6 months after surgery.

Results: No significant changes in K-SES, ACL-RSI, and TSK-11 scores over 6-month period were observed among groups ($P = .808$, $P = .574$, $P = .888$, respectively). Compared with baseline, only the scores of K-SES improved with statistical significance in the intervention, placebo, and control groups ($P = .05$, $.01$, $.00$) at 6 months after ACLR. The KOOS subscale scores were not significantly different among the intervention, placebo, and control groups at 3 and 6 months.

Conclusion: A modeling video intervention, although feasible, was not effective in addressing the psychological risk factors in patients undergoing ACLR.

Abbreviations: ACLR = anterior cruciate ligament reconstruction, ACL-RSI = ACL-Return to Sport after Injury, ANOVA = analysis of variance, KOOS = Knee Injury and Osteoarthritis Outcome Score, K-SES = Knee Self Efficacy Scale, RCT = randomized controlled trials, TSK-11 = Tampa Scale of Kinesiophobia-11.

Keywords: anterior cruciate ligament rehabilitation, modeling, psychosocial interventions, return to sport

1. Introduction

Anterior cruciate ligament (ACL) injury is one of the common sports-related injuries which is often treated with anterior

cruciate ligament reconstruction (ACLR) surgery to restore knee stability.^[1] Following ACLR, postoperative rehabilitation focuses on the restoration of neuromuscular control to enable patients to return to their preinjury level of physical activities.^[2] With

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ACLR and proper rehabilitation, athletes are expected to resume sports within 12 months.^[3] Despite the advancement in postoperative rehabilitation programs over the decades,^[4] two-thirds of patients could not return to their preinjury level of sports.^[1] This low rate of return to sport has prompted the investigation of other factors that may affect the outcomes following ACLR.

A previous systematic review identified self-confidence, optimism, self-motivation, stress, social support, and athletic self-identity as the psychosocial predictors that may influence ACLR outcomes.^[5] In particular, self-efficacy, fear of reinjury, and fear of reinjury/movement were reported to be the primary reasons for inability to return to sports.^[6] These studies suggest that integrative interventions should not only address functional ability but also psychological risk factors that are necessary to elicit better clinical outcomes following ACLR. To date, 5 randomized controlled trials (RCTs) have examined guided imagery and relaxation, coping modeling, visual imagery, and web-support intervention as potential psychosocial interventions.^[7,8] However, there is limited evidence on the efficacy of these interventions in providing additional benefits.^[7] Given the limited number of studies, further research should be conducted to explore the efficacy of these psychosocial interventions.

Modeling or observational learning is one of the psychological interventions that can be used in the rehabilitation settings based on the previous theoretical and empirical support. Modeling has been found to be an useful instructional tool for gaining motor skills, psychological responses, and behavioral modification in physical activity contexts.^[9,10] Furthermore, watching modeling videos was found to be effective in increasing early rehabilitation self-efficacy and decreasing postoperative perception of pain in patients following ACLR.^[11] It involved patients watching 2 videos in which the models discuss their injury, experiences, expectations, problems, strategies, and recovery and perform postoperative time-matched tasks. These interventions were provided during the first 6 weeks of rehabilitation.^[11] However, muscle strength and proprioception are usually regained after 6 weeks,^[2] and returning to sport takes at least 6 months.^[12] Therefore, psychosocial interventions such as watching modeling videos may need to match the course of functional rehabilitation and last up to 6 months.

This pilot randomized trial aimed to examine the feasibility of a 6-month modeling video intervention in modifying psychological risk factors following ACLR. The secondary aim was to compare the functional outcomes among the control, placebo, and intervention groups at 3 and 6 months after surgery.

2. Materials and methods

2.1. Study design

This pilot randomized trial with pre- and post-intervention design (outcome assessments at baseline, during hospitalization, at 2 weeks, at 6 weeks, at 3 months, and at 6 months following ACLR) aimed to compare the following 3 groups: a control group (standard physical therapy), a placebo group (watching a placebo video in addition to receiving the standard physical therapy), and an intervention group (watching a modeling video in addition to receiving the standard physical therapy). This study aimed to investigate the feasibility of a 6-month intervention using modeling and placebo videos in preparation for a potential larger, fully powered randomized trial. The study was approved

by the institutional review board of the author-affiliated institute (No. 2018AN0159).

2.2. Participants

The participants who were scheduled for ACLR and postoperative rehabilitation care at our institution from June 2018 to October 2019 were screened for eligibility. Participants aged 15 to 60 years at the time of surgery, who could speak Korean and provided an informed consent, and who received rehabilitation care at our institution were included in our study. Because the videos were developed in Korean, patients fluent in Korean could be eligible for inclusion. Furthermore, because different physical therapy protocols and interactions with other physical therapists could potentially affect the outcomes, only patients who underwent rehabilitation through our institution could be included.

In contrast, participants with previous knee surgeries, with concomitant psychiatric disorder, who did not have Internet access to receive online link for intervention or placebo videos, who received other psychosocial interventions, who could not understand Korean, and who had visual impairment were excluded. Patients with previous knee surgeries and concomitant psychiatric disorders were excluded because they might not have the same response from our intervention as the patients without the psychiatric disorders who undergo the surgery for the first time. Moreover, because patients received online links for their videos after they watched under the supervision of the physical therapist, patients were excluded if they did not have regular internet access. Since we wanted to test for the effect of modeling, patients planned to receive other psychosocial interventions were not eligible. Lastly, patients with visual impairments were excluded because they could not watch the videos.

Participants who agreed to participate were assessed at baseline before ACLR, during hospitalization, at 2 weeks, at 6 weeks, at 3 months, and at 6 months after surgery. Questionnaires were used to assess self-efficacy, psychological readiness to return to sports, and fear of reinjury/movement. Functional outcomes were measured at 3 and 6 months after surgery. For this pilot trial, we aimed to recruit at least 30 participants (10 participants in each group). The sample size was determined based on the possible number of patients undergoing ACLR during the duration of the pilot study.

2.3. Randomization and masking

Eligible participants were randomized by draw lots. All participants were informed that they would be allocated to either the video group or control group, but they could not differentiate whether the videos they received were intervention or placebo videos. The randomization was performed by a physical therapist not involved in this trial.

2.4. Control group

The control group underwent standard postoperative rehabilitation, which was composed of 3 phases.^[2] During the initial phase, which lasted for 6 weeks, the patients focused on controlling pain, regaining full functional range of motion, and attaining normal gait. The second phase was intended to restore muscle strength and proprioception and lasted up to 12 weeks. The final phase began after 12 weeks and focused on improving functional

performance. Rehabilitation exercises performed by models in the intervention videos or described in the placebo videos were taught to the patients in the control group by physical therapists.

2.5. Intervention group

Six intervention videos were made based on the previous study^[11] and semi-structured interviews on 10 patients who underwent different phases of rehabilitation. All patients reported that the modeling video may be a useful intervention for future patients. The common themes of interviews were extracted and used in developing videos. Six videos were similar in length (5 minutes) and reflected 6 different time points: preoperative period, from hospitalization to 2 weeks, 2 to 6 weeks, 6 weeks to 3 months, 3 to 6 months, and 6 months and beyond following ACLR. In the videos, the models discussed their injury experience, expectations, and recovery and performed postoperative time-matched tasks and rehabilitation exercises. For example, in the first video that reflected the preoperative period, models discussed how they sustained their original injuries, what expectations they had before surgery, and what kind of emotions they went through. Furthermore, the models performed few exercises that can help prevent muscle atrophy before and immediately after surgery. The second video described the period between hospitalization and 2 weeks, and the models discussed how their surgeries went and what kinds of difficulties they faced after discharge. In terms of rehabilitation, the models performed stretching and exercises to maintain range of motion. In the third video which reflected the period between 2 and 6 weeks, the models discussed their general conditions, ability to walk, and importance of rehabilitation exercises which included straight leg raise, heel raise, knee extension, and wall squats. In the fourth video, the models described the challenges and difficulties they faced during rehabilitation between 6 weeks and 3 months following ACLR. They performed balance exercise, lunge, mini squat, and leg press that could restore proprioception and muscle strength. In the fifth video, the models described their original expectations and their actual progress regarding functional outcomes. They performed exercises such as jump squat, bound, single hop plyometric, and running to increase functional performance. In the last video, the models reflected on their 6-month rehabilitation process and described what went smoothly and what did not.

Consistent with social learning theory and previous study,^[11] the models were around the age of 30, and each male and female version was developed for all 6 videos. This was intended for participants to identify with at least 1 model in terms of age and sex.

The videos were watched at least once under the supervision of a physical therapist during the follow-up visits; afterward, online links to the videos were provided. The participants were encouraged to watch the videos until the next follow-up, but additional reminder was not provided since this interaction could influence their psychological responses during the subsequent visits.

Patients in the control group underwent the same exercise protocols supervised by the same physical therapists.

2.6. Placebo group

Considering that providing video may become an intervention itself, rather than the effect of modeling, this study incorporated a placebo video. Six placebo videos were developed and consisted

of PowerPoint slides that explained the process of ACL rehabilitation. For example, the first placebo video displayed epidemiology of ACL injuries, anatomy of ACL, and mechanisms of ACL injury. Although the intervention video showed models performing time-matched rehabilitation exercises, the placebo video described such exercises with words. The placebo videos were viewed by the participants in a manner similar to that of the intervention group, and the online link was provided as well. The control group underwent the same exercise protocols supervised by the same physical therapists.

2.7. Psychological outcome measures

At each visit (baseline, during hospitalization, 2 weeks, 6 weeks, 3 months, and 6 months), self-efficacy, psychological readiness to return to sport, and fear of reinjury/movement were assessed using the Knee Self Efficacy Scale (K-SES), Anterior Cruciate Ligament Return to Sport After Injury (ACL-RSI) scale, and Tampa Scale for Kinesiophobia (TSK-11), respectively.

K-SES is composed of 4 parts: 7 items on daily activities, 5 items on sports and leisure activities, 6 items on physical activities, and 4 items on knee function in the future. Each item was graded on an 11-grade Likert scale ranging from 0 (not at all certain) to 10 (very certain). The sum of these scores was divided by the number of items, and a higher score indicated greater self-efficacy in physical performance.^[13] Preoperative self-efficacy was shown to predict return to acceptable level of physical activity, symptoms, and muscle function 1 year after ACLR.^[14]

The ACL-RSI scale consists of 12 items, which fall into 3 categories: emotions, confidence in performance, and risk appraisal. For each item, values were assigned in increments of 10 ranging from 0 to 100 and presented as a visual analog scale in which patients choose a certain value. A value of 0 indicated an extremely negative response, while a value of 100 indicated no negative psychological response.^[15,16] The average score of all 12 items is calculated to measure the psychological readiness, and this score is used as one of the predictors for return to sport after ACLR.^[17,18]

The shortened version of TSK (TSK-11) is composed of 11 questions; total scores range from 11 to 44, with higher scores indicating greater fear of movement.^[19] A change of >10% or a reduction of 3 points was considered clinically meaningful and indicated decreased fear of movement.^[19] The TSK-11 has been used to evaluate fear of reinjury and movement in patients who underwent ACLR in previous studies.^[20–22]

At each visit, the participants filled out the above questionnaires prior to watching the next modeling or placebo videos so that the videos will not influence their psychological responses. Furthermore, the videos were intended to reflect the time period from the point when participants started watching videos to the next follow-up period; the questionnaires were intended to evaluate their psychological states from the last follow-up visit to the point when the participants started watching the subsequent video. For example, the participants completed questionnaires at baseline before watching the first video so that watching the first video will not affect their baseline responses to questionnaires. Then, on the first day of hospitalization before ACLR, the participants in the intervention group completed the second questionnaires to evaluate their psychological status during the preoperative period, which would be hypothetically modified by watching modeling videos.

2.8. Functional outcome measures

The Knee Injury and Osteoarthritis Outcome Score (KOOS) was used to evaluate symptoms and function of the knee at 3 and 6 months after surgery. The subscales of KOOS included pain, symptoms, daily living function, knee-related sports and recreational activities (sport), and knee-related quality of life. The scores ranged from 0 to 100, and a higher score indicated a better outcome.^[2,3]

2.9. Surgical Procedure

All operations were performed using the same technique (anatomical single-bundle ACLR using auto-hamstring tendon graft) under a spinal or general anesthesia by an arthroscopic specialist who had the technical knowledge and experience to carry out this procedure.

2.10. Statistical analysis

The number of follow-up loss (attrition rate) was recorded in each group. Descriptive statistics (means and standard deviations) were provided for all psychological and functional measures. Repeated measures analysis of variance (ANOVA) was conducted to investigate the time group effect and group differences in K-SES, ACL-RSI, and TSK over 6 different time points. Since the items in the ACL-RSI scale ranged from 0 to 100 with increments of 10 points, the scale was converted to 0 to 10 during data input. In addition, a paired *t* test was used to compare the psychological measures between groups at baseline and 6 months after surgery. This test was performed to determine whether the change in psychological response in each group was statistically significant even if no significant difference was observed among the 3 groups. Lastly, one-way ANOVA was used to compare the differences in the subscales of KOOS at 3 and 6 months among the 3 groups. All analyses were conducted using the SPSS software version 21.0 (SPSS Inc., Chicago, IL). A *P* value of <.05 was considered significant.

3. Results

During the predefined pilot study period, 38 patients were assessed for eligibility; after excluding 3 patients for not meeting the inclusion criteria, 35 patients were recruited. Ten patients were assigned to the intervention group, 12 to the placebo group, and 13 to the control group. During follow-up, 2 patients from the control group and 1 from the placebo group withdrew from the study due to poor compliance and unwillingness to participate. Hence, only 32 patients (intervention=10, mean age: 27.1±9.5, 1 woman; placebo=11, mean age: 32.2±12.5, 3 women; control=11, mean age: 26.8±7.9, 1 woman) completed the study until 6 months after surgery (Fig. 1).

3.1. K-SES

Compared with baseline, the scores of K-SES improved with statistical significance in the intervention, placebo, and control groups (*P*=.05, .01, .00) at 6 months after ACLR. However, no significant time × group effect (*P*=.686) over 6 different time points and group differences (*P*=.808) were observed (Fig. 2).

3.2. ACL-RSI

The scores of ACL-RSI were not significantly different between baseline and 6 months in the intervention, placebo, and control groups (*P*=.113, .152, .067). Moreover, no significant time × group effect (*P*=.709) over 6 different time points and group differences (*P*=.574) were found (Fig. 3).

3.3. TSK-11

The TSK-11 scores were not significantly different between baseline and 6 months in the intervention, placebo, and control groups (*P*=.235, .059, .095). Moreover, no significant time × group effect over 6 different time points (*P*=.220) or group differences (*P*=.888) were found (Fig. 4).

3.4. KOOS

The KOOS subscale scores were not significantly different among the intervention, placebo, and control groups at 3 and 6 months. Descriptive statistics and *P*-values are summarized in Table 1.

3.5. Adverse event

No adverse event associated with this trial was reported from the participants.

4. Discussion

This pilot randomized trial investigated the feasibility of a 6-month modeling video intervention in improving self-efficacy and psychological readiness to return to sport and in reducing fear of reinjury/movement in patients undergoing ACLR. Although modeling videos did not show a significant benefit in addressing psychological risk factors, this pilot study provides several insights and challenges that require further research.

4.1. Currently available psychosocial interventions

Five RCTs^[8,11,24–26] and 1 open pilot study have investigated the efficacy of psychosocial interventions. Guided imagery and relaxation were effective in reducing reinjury anxiety^[26] but did not increase self-efficacy.^[24] Visual imagery was found to decrease fear of movement/reinjury,^[25] while modeling video interventions increased the early rehabilitation self-efficacy.^[11] Internet-based intervention^[8] and cognitive behavioral-based physical therapy^[6] were evaluated for their effectiveness in increasing self-efficacy and decreasing fear of reinjury/movement. Despite this effort, the small sample size, short study duration, and heterogeneity in types of interventions and outcome scales have limited their use as additive therapy. Of the 6 studies, 3 were pilot studies, which were underpowered.^[6,8,24] The modeling video intervention showed few positive results, but lasted for 6 weeks.^[11] Two studies lasted for 3 months,^[8,25] while 3 studies^[6,24,26] lasted for 6 months; these studies showed conflicting results. Considering that postoperative rehabilitation can last up to 6 months, psychosocial interventions need to match the course of physical rehabilitation. Hence, our study extended the previous study^[11] by adding 4 more intervention periods and following up until 6 months.

In the previous studies that evaluated psychosocial interventions, K-SES and TSK were used to assess self-efficacy and fear of reinjury/movement, respectively. Both self-efficacy and fear of

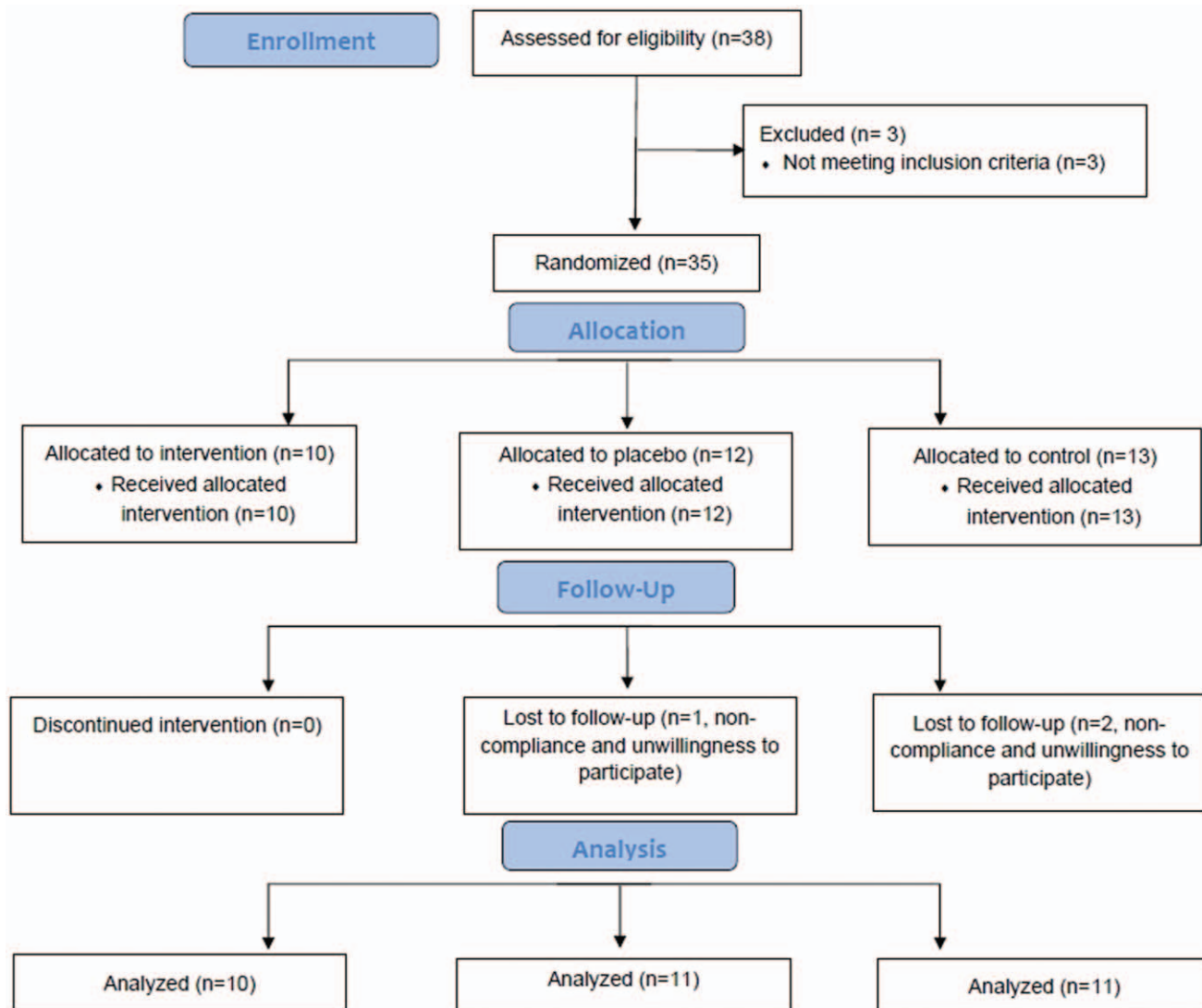


Figure 1. Flowchart of the patient recruitment.

reinjury/movement were reported to be predictors of clinical outcomes at 12 months following ACLR.^[1,14,21] Thus, psychosocial interventions targeting these 2 psychological risk factors are reasonable. However, psychological readiness to return to sport is another significant predictor of clinical outcomes 1 year after ACLR.^[1,18] Interestingly, none of the interventions up to date used ACL-RSI as their outcome measure even though return to sport may be the primary interest of patients with ACL injury. Whether a psychosocial intervention can impact ACL-RSI may be worth exploring, and our study is unique in that it assessed whether a modeling video intervention would improve a patient's psychological readiness to return to sport.

4.2. Insights from the current study

Although the results of studies with a small sample size warrant a cautious interpretation, the preliminary results of this study suggest that a modeling video intervention does not affect both psychological and functional outcomes. In addition, only self-

efficacy significantly improved at 6 months, but not psychological readiness to return to sport and fear of movement/reinjury.

In a previous study, modeling video intervention seemed to increase early rehabilitation self-efficacy, but it was not effective in later self-efficacy (2- and 6-week walking self-efficacy).^[11] Consistent with this finding, our study showed that modeling intervention did not improve self-efficacy at 6 months. Guided imagery and internet-based intervention were other interventions aimed to increase self-efficacy, but they remained ineffective.^[8,24] Therefore, if a patient's confidence to perform tasks is low or high at baseline, further increases through interventions maybe difficult to achieve. In our study, the self-efficacy of each group significantly improved 6 months after ACLR compared with that at baseline. This result suggests that confidence may increase with the improvement of function, which could be attributed to physical therapy that all patients underwent after ACLR.

Both ACL-RSI and TSK-11 did not show significant change in each group between baseline and at 6 months. Given that all patients underwent ACLR without developing complications and

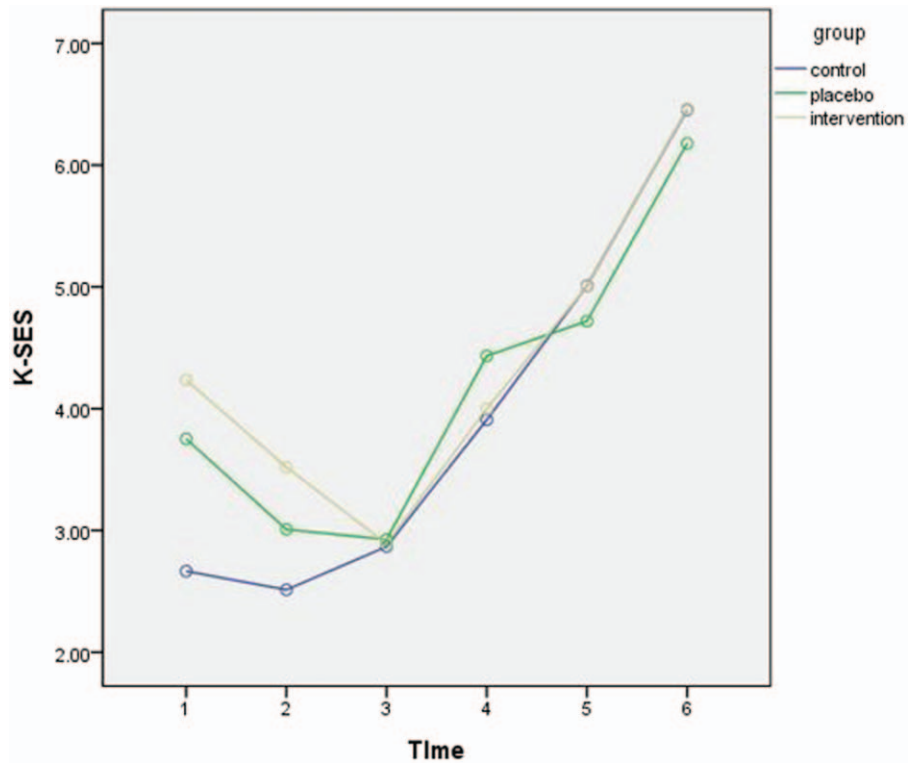


Figure 2. Repeat measures analysis for K-SES. K-SES=Knee Self Efficacy Scale.

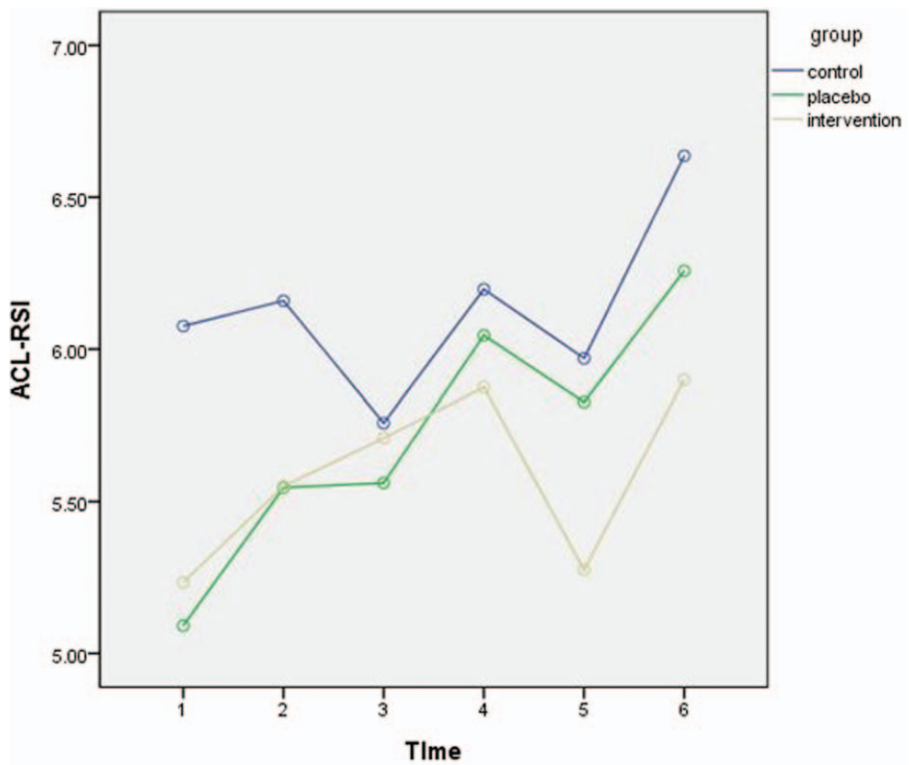


Figure 3. Repeat measures analysis for ACL-RSI. ACL-RSI=anterior cruciate ligament-return to sport after injury.

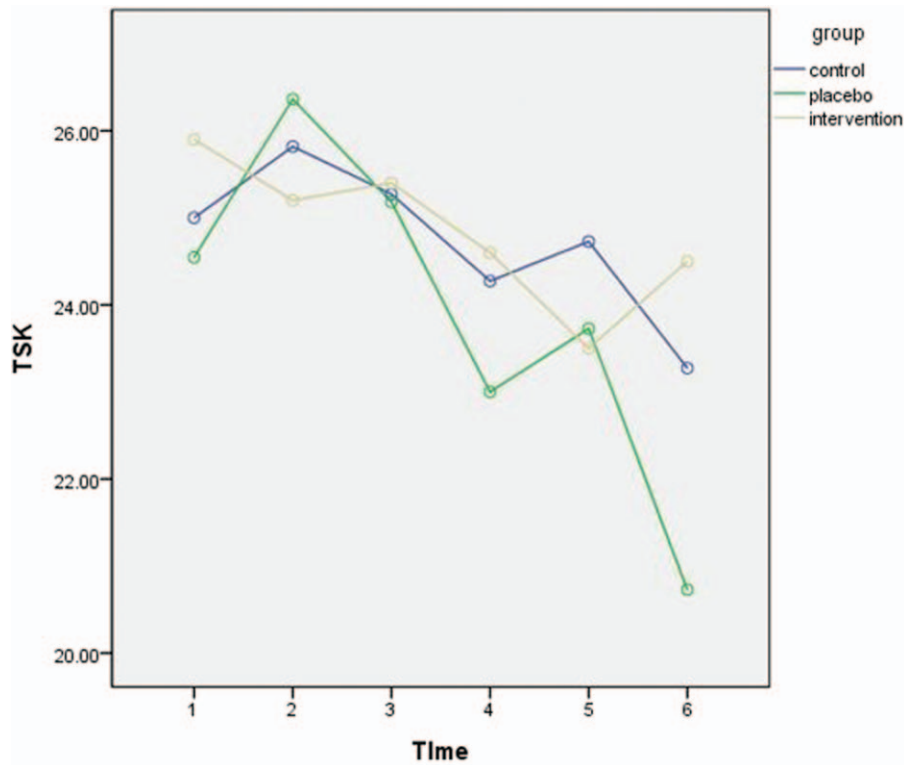


Figure 4. Repeat measures analysis for TSK-11. ACL-RSI = anterior cruciate ligament-return to sport after injury, K-SES = Knee Self Efficacy Scale, TSK-11 = Tampa Scale of Kinesiophobia-11.

received appropriate postoperative rehabilitation care, functional improvement itself is not enough to address psychological readiness to return to sport and fear of reinjury/movement. In particular, the mean score of TSK-11 in each group at baseline (Table 2) indicated that most patients fall into the high-fear group (>17) according to previous studies.^[20,21] Patients presented with high fear at baseline and maintained a high level of fear over the course of 6 months. This result is concerning because patients with greater fear were associated with less activity, low single-leg hop performance, low isometric quadriceps strength, and increased risk of obtaining a second ACL injury.^[21] Currently, there is no available psychosocial intervention aimed at

increasing psychological readiness to return to sport, and only one study that used the visual imagery showed possible reduction of fear of reinjury/movement at 3 months.^[25] Thus, further studies are required to address these 2 psychological risk factors to elicit additional benefit in clinical outcomes following ACLR.

4.3. Considerations for future research

Conducting a research investigating the psychosocial interventions in patients undergoing ACLR is practically challenging. The patients experience a long course of rehabilitation; during this course, multiple confounding factors come into play, and follow-

Table 1
Descriptive statistics of functional measures.

Variable	Intervention (n=10)		Placebo (n=11)		Control (n=11)		P-value
	M	SD	M	SD	M	SD	
KOOS-pain at 3 months	81.25	6.82	77.23	18.4	82.57	9.94	.866
KOOS-symptom at 3 months	81.25	6.82	77.23	18.4	80.16	14.47	.84
KOOS-ADL at 3 months	88.81	10.74	87.98	9.25	86.76	11.6	.916
KOOS-sport at 3 months	48.13	17.3	52.19	32.66	45.45	28.4	.868
KOOS-QOL at 3 months	43.75	10.02	55.94	28.79	51.14	14.74	.445
KOOS-pain at 6 months	90.47	7.15	85.4	12.21	88.63	8.19	.572
KOOS-symptom at 6 months	90.82	8.71	79.46	19.54	85.06	13.91	.351
KOOS-ADL at 6 months	96.01	6.34	91.36	9.01	92.91	6.89	.486
KOOS-sport at 6 months	72.14	13.8	58.13	22.98	70.09	14.29	.236
KOOS-QOL at 6 months	54.46	16.02	57.03	26.82	64.77	15.63	.517

ADL=activities of daily living; KOOS=Knee Injury and Osteoarthritis Outcome Score; QOL=quality of life.

Table 2
Descriptive statistics of psychological measures.

Variable	Intervention (n = 10)		Placebo (n = 11)		Control (n = 11)	
	M	SD	M	SD	M	SD
K-SES baseline	4.2	2.8	3.75	2.7	2.67	1.79
K-SES during hospitalisation	3.52	2.15	3.01	2.56	2.51	1.29
K-SES at 2 weeks	2.89	1.46	2.93	2.15	2.87	1.5
K-SES at 6 weeks	4	2.27	4.43	2.28	3.9	1.77
K-SES at 3 months	5	1.3	4.72	2.45	5	1.97
K-SES at 6 months	6.46	1.79	6.18	2.47	6.45	2.17
ACL-RSI baseline	5.23	1.17	5.09	2.32	6.08	1.6
ACL-RSI during hospitalisation	5.55	1.01	5.45	1.95	6.16	1.28
ACL-RSI at 2 weeks	5.71	1.24	5.56	2.03	5.76	1.41
ACL-RSI at 6 weeks	5.88	0.77	6.05	1.61	6.2	1.34
ACL-RSI at 3 months	5.28	1.16	5.83	1.11	5.97	1.32
ACL-RSI at 6 months	5.9	1.36	6.26	1.78	6.63	1.16
TSK baseline	25.9	3.28	24.55	7.2	25	4.49
TSK during hospitalisation	25.2	3.33	26.36	6.76	25.81	4.51
TSK at 2 weeks	25.4	3.03	25.18	7.3	25.27	5.2
TSK at 6 weeks	24.27	4.47	23	7.28	24.6	3.8
TSK at 3 months	23.5	4.14	23.7	5.53	24.73	5.14
TSK at 6 months	24.5	3.87	20.7	6.33	23.27	5.46

ACL-RSI = anterior cruciate ligament-return to sport after injury; K-SES = Knee-Self Efficacy Scale, M = mean; SD = standard deviation, TSK = Tampa Scale or Kinesiophobia.

up loss may occur. At each visit, patients may go through several physical evaluations and questionnaire surveys to assess their knee functions, which altogether consume a significant amount of time. These challenges may explain the limited number of studies on psychosocial interventions despite their needs.

When designing the current study, one of the main debates among the authors was whether to include the placebo group. The authors reasoned that in order to determine the true effect of modeling, the effect of receiving video should be adequately controlled. Subsequently, if the study were to add a placebo group, determining what kind of contents would be appropriate was another concern because watching art videos was found to be effective in reducing fear of reinjury/movement.^[25] Due to the small sample size, placebo videos were developed for this pilot trial; however, if the goal of future study is to capture adequate power with limited resources, placebo group may not be necessary.

Moreover, other psychosocial factors such as personality, motivation, recovery expectations, satisfaction, negative emotional responses interplay with one another and could be different across the individuals.^[27] Since these factors could not be adequately controlled and were not measured at baseline, differing degrees of these factors among the patients could have influenced our results. Accordingly, the patients might have had different degrees of self-efficacy, psychological readiness to return to sport, and fear of reinjury/movement despite our effort to develop modeling videos in such a way that the patients could identify themselves to the models. Thus, individual needs could not be met just by viewing the common modeling videos. After all, a one-size-fits-all approach using video interventions may not be appropriate psychosocial interventions despite their limited efficacy in the short-term.^[11] It may be important to identify individuals who might benefit from psychosocial interventions through thorough baseline assessments and target those specific individuals.

Recently, a pilot study investigated the feasibility of cognitive behavior therapy over the telephone.^[6] The strategies of

cognitive behavioral therapy included controlled breathing, grounding, setting activity goals, monitoring self-talk, setting daily intentions, present-mindedness, managing setbacks, and guided imagery. Also, the patient and therapist worked together and organized an action plan tailored to the patient's goals. Such type of comprehensive and individual-based therapy may provide more benefits than one-way communication through videos and could be a future direction for developing psychosocial interventions to address psychological risk factors.

4.4. Limitations

This study has several limitations. First, due to the small sample size, the statistical approach and results should be interpreted with caution. However, as a pilot study, this trial was intended to explore the feasibility of the current study design and decide whether a further trial will be appropriate, rather than to detect significant differences. Second, compliance to rehabilitation protocols was not monitored; therefore, the varying degrees of compliance among patients might have influenced the results. Lastly, online links for modeling and placebo videos were offered for further views, but constant reminder for watching videos was not provided. However, in the previous study, despite frequent reminders, the patients had low adherence to Internet-based interventions.^[8] Thus, the absence of reminders per se might not have affected how many times the patients watched the videos, but the different numbers of views among patients might have affected the outcomes. Lastly, none of the RCTs, including our study, performed a follow up beyond 6 months and included return to sport as an outcome measure. Considering the fact that the psychosocial factors are implicated in outcomes including return to sport at 12 months and beyond,^[1,14,17,18,21] there seems to be disparity between currently available interventions and their actual clinical use. Therefore, future research following patients for at least 1 year and assessing return to sport as an outcome measure is needed.

5. Conclusion

A modeling video intervention, although feasible, was not effective in addressing the psychological risk factors in patients undergoing ACLR. Further studies are needed to increase the psychological readiness to return to sport and decrease the fear of reinjury/movement. A study design with a longer follow-up and return to sport as an outcome measure may provide a more useful clinical implication.

Author contributions

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