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Human Kinetics
CRITICALLY APPRAISED TOPIC

Reducing Fear of Reinjury and Pain Perception in Athletes With First-Time Anterior Cruciate Ligament Reconstructions by Implementing Imagery Training

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Clinical Scenario: The anterior cruciate ligament is one of the major stabilizing ligaments of the knee joint by preventing anterior translation of the femur in the closed kinetic chain. A ruptured anterior cruciate ligament may require reconstructive surgery for patients who wish to return to physical activity. For the most part, surgeries are successful at repairing the ruptured ligament and restoring ligamentous function; the percentage of athletes that return to a competitive level of physical activity is only 44%, and 24% of patients report a main factor of preventing their return is fear of reinjury and pain. Most physiotherapy and rehabilitation research has focused on the physical treatment and is limited on the psychological aspects of recovery. Imagery has been suggested to be effective at reducing anxiety, tension, and pain, while promoting and encouraging healing after an injury. Imagery is defined as a process of performing a skill in one's mind using the senses (touch, feel, smell, vision, etc) without any overt actions. ***Clinical Question:*** In athletes who are first-time anterior cruciate ligament reconstruction patients, does imagery training in combination with standard physical therapy reduce the fear of reinjury and pain perception? ***Summary of Key Findings:*** Previous research has primarily looked at the physical treatment aspect, and few studies have focused on the psychological factors affecting recovery. Researchers concluded that fear of reinjury was the unique predictor of return to sport even in a sample of participants that reported very little or almost no pain at all. Imagery as a therapy is an effective intervention in reducing fear of reinjury and confidence building. Furthermore, mental imagery is suggested to assist with a reduction in anxiety, pain, and tension, while promoting healing. ***Clinical Bottom Line:*** Based on the strength of recommendation taxonomy, there is a combination of level A and B evidence proposing that imagery, in combination with traditional physical therapy, can be effective at reducing psychological distress such as fear of reinjury and pain perception in first-time anterior cruciate ligament reconstruction patients.

Keywords: knee joint, psychology, rehabilitation, sport psychology

Clinical Scenario

Injuries are an inevitable part of competitive sports as well as recreational activities. Research shows that one of the most common musculoskeletal complaints that accounts for approximately 48 out of 1000 patients is knee-related injury.[1] As noted, approximately 9% of these knee complaints are related to anterior cruciate ligament (ACL) injuries.[2,3] The ACL is commonly injured in contact sports by a noncontact action, such as planting, cutting, landing on a hyperextended knee, or pivoting and sudden deceleration.[4] Typically, athletes report feeling immediate pain and hearing a pop, resulting in progressive knee swelling and difficulty ambulating. The ACL is one of the major ligaments that provides stability to the knee joint by preventing anterior translation of the femur in the closed kinetic chain.[5] Therefore, most of the time, a ruptured ACL results in reconstructive surgery aimed at repairing the ligament. Athletes will often choose reconstructive surgery in an effort to return to physical activity. A major outcome measure that assesses the success of an ACL reconstructive surgery is the ability to return to sports or recreational activity.[6] Although surgery is effective at repairing the ruptured ligament and restoring ligamentous function, for the most part, the percentage of athletes that return to a competitive level of physical activity is only 44%.[4] Of these, 44% report not returning to preinjury activity and 24% report that the main factor preventing their return is fear of reinjury and pain.[4,7] The inability to return to the previous level of activity can be stressful and mentally frustrating for athletes. Taking into consideration how the psychological aspects of the injury affect an athlete's sports performance, it is crucial to address psychological factors during physical rehabilitation for an athlete to rebuild confidence and overcome fear of reinjury. Currently, most physiotherapy and rehabilitation research has primarily focused on the physical treatment without focusing on the psychological aspects of recovery following an injury.[5,7] The use of imagery as a psychological intervention has been suggested to be effective at reducing anxiety, tension, and pain, while promoting and encouraging healing after an injury. Imagery is defined as a process of performing a skill in one's mind using the senses (touch, feel, smell, vision, etc) without any overt actions.[8] Incorporating a therapeutic intervention that targets the psychological effects on an athletes' ability to return to sport is necessary to assure that the patient is both physically and mentally prepared to return to activity. Therefore, the purpose of the critically appraised topic was to determine if imagery training in combination with standard physical therapy is a suitable option to reduce the fear of reinjury and pain perception among first-time anterior cruciate ligament reconstruction (ACLR) patients.

Focused Clinical Question

In athletes who are first-time ACLR patients, does imagery training in combination with standard physical therapy reduce fear of reinjury and pain perception?

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Summary of Search, Best Evidence Appraised, and Key Findings

- Previous research has primarily looked at the physical treatment aspect, and few studies have focused on the psychological factors affecting recovery.[5]
- Researchers have concluded that fear of reinjury was the unique predictor of return to sport even in a sample of participants that reported very little or almost no pain at all.[9]
- A critical appraisal of the literature revealed that imagery as a therapy is an effective intervention in reducing the fear of reinjury and confidence building. Furthermore, mental imagery is suggested to assist with a reduction in anxiety, pain, and tension, while promoting healing.[7]

Clinical Bottom Line

There is moderate to strong evidence indicating that many patients with ACLRs experience psychological factors that impede their ability to return to preinjury level of activity. Evidence also suggests that this patient population would benefit from interventions that target both the physical and psychological aspects of rehabilitation. These interventions may aid the efforts of reducing the percentage of patients with ACLRs that do not return to preinjury activity due to fear and pain perception.

Strength of Recommendation

Based on the strength of recommendation taxonomy, there is a combination of level A and B evidence proposing that psychological factors are expressed as an important aspect that affects rehabilitation and return to preinjury activity in this patient population during the course of 6- to 12-months postoperative.

Search Strategy

Terms Used to Guide Search Strategy

- **P**atient group: ACLR patients
- **I**ntervention: Imagery in combination with standard physical therapy
- **C**omparison: Only standard physical therapy
- **O**utcomes: Reduce fear of reinjury and pain perception when returning to preinjury level of activity

Sources of Evidence Searched

- PubMed
- EBSCOhost
- The Cochrane Library via EBSCOhost
- Google Scholar

Inclusion and Exclusion Criteria (Include Search Limits)

Inclusion Criteria

- Studies investigating ACL surgery outcomes
- Subjects with history of minimum of 1 surgery
- Studies using imagery as an intervention
- Studies investigating psychological factors affecting rehabilitation
- Studies with at least 2B level of evidence and minimum of 5 on the PEDro scale
- Studies within the last 15 years
- Restricted to the English language

Exclusion Criteria

- Studies using subjects with a history of bilateral knee surgeries
- Studies that include participants with more than 1 reported ACLR
- Studies investigating other interventions other than a type of imagery as a form of intervention

Table 1 Summary of Study Designs of Articles Retrieved

Level of evidence	Study design/methodology of articles retrieved	Author
1B	RCT	Maddison et al[8]
1B	RCT	Cupal and Brewer[5]
1A	RCT	Lebon et al[10]
2B	RCT	Wilczynska et al[11]

Abbreviation: RCT, randomized controlled trials.

Results of Search

Four relevant studies[5,8,10,11] were located and categorized, as shown in Table 1 (based on Levels of Evidence, Centre for Evidence Based Medicine, 2011).

Best Evidence

The studies shown in Table 1 were identified as the best evidence. These studies were graded a level of evidence of 1A, 1B, and 2B. They investigated imagery as an intervention to address physical and psychological factors affecting patients with ACLRs.

Summary of Best Evidence

Characteristics of included studies are shown in Table 2.

Implications for Practice, Education, and Future Research

Surgical reconstruction is aimed at restoring mechanical knee stability, which, in turn, is supposed to promote optimal function. It is noted that surgical recovery is mainly focused on improving motion and strength of the knee joint, while reducing psychological distress has not been stressed as an important aspect in postoperative ACLR rehabilitation.[12] In efforts to address psychological factors affecting this population, the studies appraised have suggested that the fear of reinjury may play a significant role

Table 2 Characteristics of Included Studies

	Study 1	Study 2	Study 3	Study 5
	Maddison et al[8]	**Lebon et al[10]**	**Cupal and Brewer[5]**	**Wilczynska et al[11]**
Study design	RCT	RCT	RCT	RCT
Participants	21 eligible participants, $M_{age} = 34.86$ y, primarily male (62%) and first-time ACLR	12 competitive or recreational athletes (10 men and 2 women) ages 18–40. Right ACLR, with no other lower extremity traumas	30 participants ages 18–50, ACL surgery, no other lower extremity trauma, and expected to engage in postsurgery physical therapy	10 outpatient clinic patients, arthroscopy of the knee, 3 meniscus repair, 5 ACL, 2 patellar luxation and diagnosis
Intervention investigated	Main aim of the study was to evaluate the effectiveness of guided imagery and relaxation (visual and kinesthetic modalities) delivered over 9 individual sessions in addition to 6 mo of standard physical therapy in postoperative patients with ACLR.	Intervention consisted of MI training over 5 wk; 15-min sessions for every 2 d in combination with standard physical therapy. Subjects were instructed to perceive muscle activation and joint tension, while imagining maximal isometric contraction of a full knee extension during 10 s, without overt movement.	The intervention group received 10 sessions of relaxation and imagery every 2 wk over for 6 mo. Each session was approximately 10–15 min (visual, kinesthetic, motivational, and healing imagery). A placebo group received attention, encouragement, and support.	Participants were divided into 2 groups. Group I (control) performed traditional rehabilitation activities. Group II (experiment) received additional activities pertaining to visualization techniques (functional recovery and full efficiency) in addition to traditional exercises. Evaluated over 15 sessions.
Outcome measure(s)	(1) Cybex 6000 isokinetic dynamometer (knee strength) (2) KT1000 arthrometer (knee laxity) (3) 24-h urine sample (neurobiological factors) (4) Athletic Injury Self-Efficacy Questionnaire (self-efficacy) (5) Athletic Injury Imagery Questionnaire-2 (rehabilitation imagery)	(1) The Visual Analog Scale (pain perception) (2) Maximal isometric electromyogram activity of vastus medalis at full knee extension (ACLR vs noninjured limb) (3) Lower-Extremity Functional Scale (ability to perform daily activities with the injured limb) (4) Measures to assess magnitude of effusion from surgery and atrophy ○ Knee circumference—measured just above the patella ○ Thigh circumference—15 cm from superior edge of patella ○ ROM—assessed with goniometer	(1) Reinjury Anxiety 11-point Scale—ranging 0 (absence of concern) to 10 (extreme concern) (2) Perception of Pain 11-point Scale—ranging 0 (no pain) to 10 (extreme pain) (3) Cybex 6000 isokinetic dynamometer—knee strength	(1) Postoperative and nonoperated limb circumference (6 and 10 cm from patella base) (2) Laitinen Pain Scale (4—unbearable pain, and 0—no pain) (3) Postoperative and nonoperated limb-flexion ROM
Main findings	No significant difference was found in knee strength. Knee laxity was significantly lower in the intervention group (5.25–0.15 mm) compared with control (3.73–0.50 mm) after 6 mo. Urine samples reflected significantly lower levels of noradrenaline and dopamine at wk 2, 6, and 12 in the intervention group. Imagery usage was also favored in the intervention group.	The results showed that pain perception, effusion, atrophy, and the Lower-Extremity Functional Scale scores were not different between patients receiving MI training to those who did not. Vastus medialis electromyogram was significantly greater during the last session in the MI group compared with the group without MI (85.36% vs 51.56% compared with the healthy limb).	Main findings demonstrated that knee strength was greater in the intervention group (0.83) compared with both placebo (0.63) and control groups (0.66). Reinjury anxiety was significantly less in intervention group (1.10) compared with both placebo (4.00) and control groups (3.40). Pain also showed decreased in the intervention (0.70) group in comparison with both the control (2.70) and placebo (2.70) groups.	Group I vs Group II: Both groups showed significant pain reduction from day 1 (3.6 vs 2.8) to day 15 (0.8 vs 0.6). However, regardless of time after surgery the experimental group reported less pain compared with control group. Similar results were found for flexion ROM and limb circumference of postoperative limb. ROM day 1 (79 vs 83) to day 15 (118 vs 119). Limb circumference day 1 (417.5 vs 419.9) and day 15 (417.2 vs 425.5).
Levels of evidence	1B	1B	1A	2B
Validity of score PEDro	7	7	8	6

(continued)

Table 2 *(continued)*

	Study 1	Study 2	Study 3	Study 5
	Maddison et al[8]	**Lebon et al[10]**	**Cupal and Brewer[5]**	**Wilczynska et al[11]**
Conclusion	Imagery is associated with a reduction in stress levels (measured by levels of noradrenaline and dopamine) as well as improved healing (KT100 scores). Guided imagery may have a positive effect on the autonomic system, reducing stress hormones that can potentially delay healing process. Although the self-efficacy scale did not reach significance, the intervention group showed a more stable score when rating their perceived level of knee function.	MI showed to be effective at facilitating greater muscle activation when compared with just standard physical therapy alone. These finding support previous findings indicating the MI can limit the force loss after immobilization. It has reported that patients who undergo arthroscopic surgery experience a profound impairment of quadriceps group strength approximately 30 d after surgery.[3] This suggests that MI can reduce the degree of impairment when administered in combination with physical therapy.	Combining relaxation and imagery can potentially benefit patients those are undergoing rehabilitation for ACL. Specifically, it showed that relaxation and imagery can potentially increase muscle strength and reduce pain and anxiety related factors after an ACL reconstructive surgery.	The study concluded that adding a visualization aspect to therapy during the initial stages of rehabilitation can help increase pain control, lower effusion, swelling, and inflammation. Although their sample size is small and the study was only applied during the initial stage of rehabilitation, it showed improvement in all 3 outcome measures. The authors concluded with suggesting replication of the research in the different stages of recovery.

Abbreviations: ACL, anterior cruciate ligament; ACLR, anterior cruciate ligament reconstruction; MI, motor imagery; RCT, randomized controlled trials; ROM, range of motion.

in the patient's ability to return to the same level of activity after surgery.[5] Taking into consideration that patients report fear and confidence in their ability to reengage in competitive and recreational sports, implementing imagery techniques in physical therapy may help to alleviate these factors.[9] The results of this critically appraised topic support the evidence that imagery can potentially reduce the fear of reinjury and pain in the ACLR population. Addressing the psychological component during the early stages of recovery has shown to be effective in reducing pain and increasing range of motion, while suggesting that the use of imagery is equally or more so important during the final stages of rehabilitation.[11] Therefore, patients who report not being able to return to their preinjury activity or sport due to fear and pain can potentially benefit from imagery to ameliorate their distress.[4] Imagery, in combination with physical therapy, can potentially promote greater activation of the quadriceps muscles and reduce ligamentous laxity, which can promote greater knee function.[10] Reduction of neurobiological factors associated with anxiety and stress (noradrenaline and dopamine) is associated with utilizing imagery; this is significant due to the fact that stress hormones delay the healing process through pro-inflammatory cytokine activity.[6] Considering the effectiveness of reinjury, pain questionnaires, and rating scales, clinicians should consider utilizing a tool (ie, Athletic Injury Self-Efficacy Questionnaire, 11-point pain/reinjury scale) to evaluate their patients during rehabilitation to identify those who would benefit from addressing psychological factors. Although the results support that imagery is an effective intervention, there are a couple of limitations to the selected studies. All 4 studies had a sample size of 30 or less, which is not necessarily a limitation, but there should be a focus on reproducing larger scale randomized controlled trials with a larger sample size to minimize the likelihood of reproducing false-positive results. Also, more research involving longer follow-up time and single imagery modality should be explored. Finally, future research studies would benefit from including different study designs (cohort and prospective) in an effort to increase generalizability to the ACLR population. Another component to consider is the feasibility of implementing such an intervention in a clinical setting, addressing the barrier of insurance coverage as well as time allocation for the personnel leading the intervention. In conclusion, the results of the critically appraised topic support the effectiveness of imagery as a psychological intervention to reduce postpsychological consequences, while improving both functional and mental outcomes of patients with ACLR. Specifically, guided imagery has been shown to be associated with reduction of reinjury anxiety, lowered stress levels, increased muscle activation, and decreased pain perception. Therefore, ongoing research efforts are needed to examine the benefits of addressing psychological factors affecting injured athletes.

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