

Cover Page

**The Official Title: Effects of Preoperative Rehabilitation on Tendon
Healing, Bone Mineral Density, and Cartilage After ACLR and
Patellar Dislocation**

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Exercise Rehabilitation Training Methods

1 Knee Range of Motion (ROM) (about 4min)

1.1 Knee Extension: With the healthy leg standing, extend the affected leg's knee and flex the hip joint to 90 degrees, allowing the foot to lightly touch the edge of the bed. The stretch can be enhanced by increasing ankle dorsiflexion, by increasing the trunk flexion angle, and by increasing the hip flexion angle. Repeat once for 60 seconds. (each side for 1 min, totaling 2 min, weeks 1-6) (Fig. 1)



Fig. 1 Knee Extension

1.2 Knee Flexion: With the leg on the healthy side supporting itself against the wall while standing, flex the knee joint of the affected leg, while the hand on the same side holds the ankle to provide additional force. Perform once for 60 seconds. (each side for 1 min, totaling 2 min, weeks 1-6) (Fig. 2)

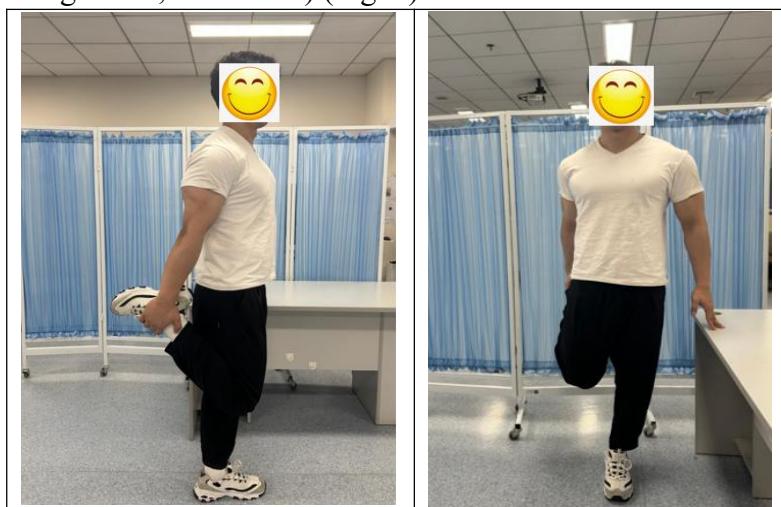


Fig.2 Knee Flexion

2 Muscle Strength Exercises (about 25-30min)

2.1 Wall Squats: Start in a standing position with your feet shoulder-width apart and toes pointing forward. Lean your back against a wall and begin to bend your knees into a squat. Begin at a 30° angle in the first week, gradually progress to a 60° angle

in the second week, and increase to a 90° angle by the third week. Ensure that your knees do not extend beyond your toes to avoid painful angles. Hold the squat for 2 to 4 minutes each time, with a 30-second rest between sets. Complete 2 sets. (totaling 4-6 min, weeks 1-3) (Fig. 3)



Fig.3 Wall Squats

2.2 Deep Squat: Stand with your feet shoulder-width apart and your hands clasped into fists at your sides. Keep your shoulders relaxed. Slowly squat down until your thighs are parallel to the horizontal surface, holding this position for 2 seconds. Then, slowly stand up, ensuring that your knees point towards your toes without extending beyond them. Complete 15 repetitions for each set, with 2 sets in total, and take a 30-second rest between sets. (totaling 4-6 min Weeks 4-6) (Fig. 4)

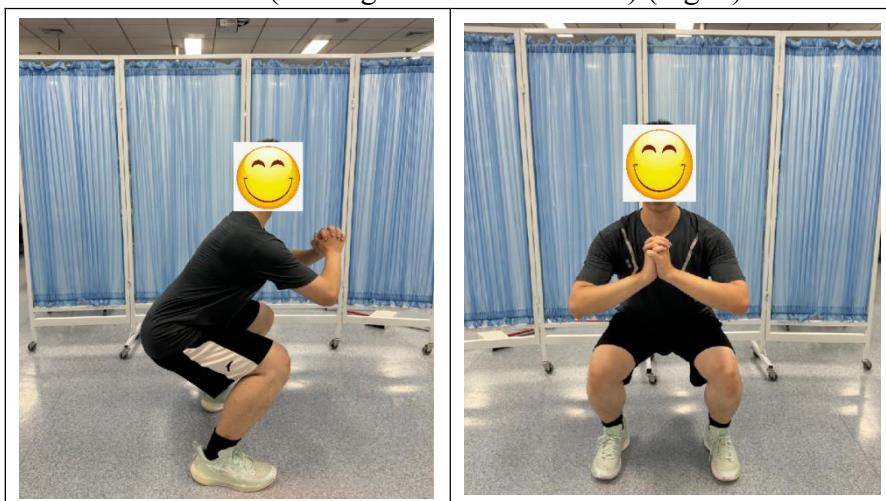


Fig.4 Deep Squat

2.3 Lunge: Stand upright with weights in your hands. Take a step backward with your healthy leg and simultaneously flex both knees to 90° . The healthy foot should exert force in a backward and downward direction, while the affected leg stirs upward before resuming the standing position. Ensure that your shoulders remain level, your chest is lifted, and your core is engaged. Maintain a straight spine, allowing the upper body to lean slightly forward if necessary. In the lunge position, squat with your knees

pointing straight up towards your toes. Slowly rise from the squat. Complete 15 repetitions per set, with a total of 2 sets, and take a 30-second rest between sets. (totaling 4-6 min, Weeks 4-6) (Fig. 5)



Fig.5 Lunge

2.4 Seated Knee Extension Resistance Exercise: Sit down and flex your hip and knee joints to 90° angles. Secure a sandbag to your ankle (gradually increase the weight as you progress). Slowly extend your knee, then return to the starting position. Complete 15 repetitions per group, with 2 groups in total, and take a 30-second rest between groups. (totaling 5-6 min, Weeks 1-6) (Fig. 6)



Fig.6 Seated Knee Extension Resistance Exercise

2.5 Prone Position Knee Flexion Resistance Exercise: Lie in a prone position with sandbags tied to your ankles (gradually increase the weight as you progress). Slowly flex your knees, keeping your hips in contact with the ground. Complete 15 repetitions per set, with a total of 2 sets, and take a 30-second rest between sets. (totaling 5-6 min, weeks 1-6) (Fig. 7)

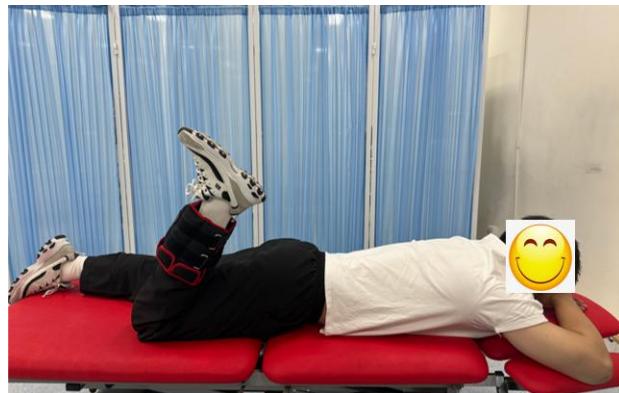


Fig.7 Prone Position Knee Flexion Resistance Exercise

3 Balance Training (about 4-6 min)

3.1 Catch and throw with legs standing under the balance Cushion: Stand with both feet on the balance mat. The healthcare worker should perform catch and throw movements with the patient from various angles, as quickly as possible. Aim for multiple angles to increase the challenge. Complete the exercise for 2 minutes per group, with 2 to 3 groups in total. Rest for 1 minute between groups. (totaling 4-6 min, Weeks 1-3) (Fig. 8)



Fig.8 Catch and throw with legs standing under the balance Cushion

3.2 Catch and throw with Single-leg standing under the balance Cushion: Stand on the balance cushion with one leg, keeping the other leg elevated 20 cm above the ground. The healthcare worker should engage in catch and throw movements with the patient from various angles, moving as quickly as possible. The goal is to practice from multiple angles to enhance balance and coordination. Complete the exercise for 2 minutes per group, with 2 to 3 groups in total. Rest for 1 minute between groups. (totaling 4-6 min, Week 4-6) (Fig. 9)



Fig.9 Catch and throw with Single-leg standing under the balance Cushion

4 Sclerotin Training (about 5-10min)

4.1 Low Leg Raise: Straighten your back, keep your gaze straight ahead, and quickly lift your legs alternately, with your forefoot briefly touching the ground and your knee raised to the mid-thigh position. Maintain body stability and swing your arms in rhythm with the leg lifts. Aim to move at 60-80% of your fastest speed. Complete 20 repetitions per set, with a total of 3 sets, and take a 30-second rest between sets. (totaling 2-3 min, Week 1-2) (Fig. 10)

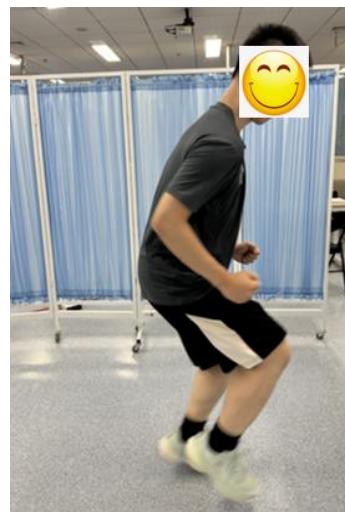


Fig.10 Low Leg Raise

4.2 Leg Lift: Straighten your back, look ahead, and quickly alternate leg raises, landing on the ball of your forefoot. Keep your body steady and swing your arms vigorously in rhythm with your leg lifts. Maintain a speed of 60-80% of your fastest pace. Complete 20 repetitions per group, with a total of 3 groups, and take a 30-second rest between groups. (totaling 2-3 min, Weeks 3-6) (Fig. 11)



Fig.11 Leg Lift

4.3 Skipping Rope: When skipping rope with both feet on the ground, exert a force that is 60%-80% of your individual maximum strength. Perform the exercise for 2 to 4 minutes. (1-3 weeks: 2-4min, 4-6 weeks: 4-8min). (Fig. 12)



Fig.12 Skipping Rope

Table Progressive Exercise Rehabilitation Program

Exercise Movement		1 st week	2 nd week	3 rd week	4 th week	5 th week	6 th week
		week	week	week	week	week	week
ROM	Knee Extension	✓	✓	✓	✓	✓	✓
	Knee Flexion	✓	✓	✓	✓	✓	✓
	Wall Squats	✓	✓	✓			
Muscle Strength	Deep Squat				✓	✓	✓
	Lunge				✓	✓	✓
	Seated Knee Extension Resistance Exercise	✓	✓	✓	✓	✓	✓
	Prone Position Knee Flexion Resistance Exercise	✓	✓	✓	✓	✓	✓
Balance	Catch and throw with legs standing under the balance	✓	✓	✓			
	Cushion						
Training	Catch and throw with Single-leg standing under the balance Cushion				✓	✓	✓
Sclerotin Training	Low Leg Raise	✓	✓				
	Leg Lift			✓	✓	✓	✓
	Skipping Rope	✓	✓	✓	✓	✓	✓

ROM: Range of Motion