ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION REHABILITATION GUIDELINES

While there is no consensus on the best accelerated rehabilitation program or which specific surgical techniques result in the most favorable outcomes, our patients do well, thanks to the skill of our surgeons and the evidence based approach to our rehabilitation. The ultimate goal of the surgery is to restore the anterior stability of the knee and the ultimate goal of rehabilitation is to achieve the maximum safe level of function possible without compromising the stability achieved by surgery.

For many, that maximum safe level of function is sports participation. Patients who undergo ACL reconstruction need to understand that while their ultimate goal is to return to athletic activities, many small goals need to be accomplished after surgery, such as:

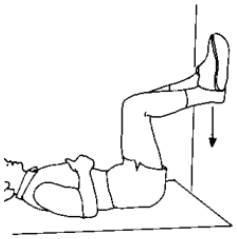
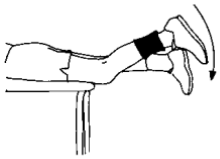
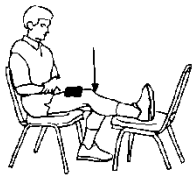
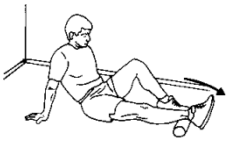
1. Maintain the integrity of the graft
2. Full knee active and passive Range of Motion
3. Restoration of lower extremity strength
4. Normal walking
5. Pain-free activities (steps, squatting, lunging, running)
6. Ability to perform functional movements safely
7. Ability to perform sports specific skills with good technique safely

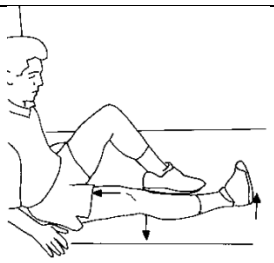
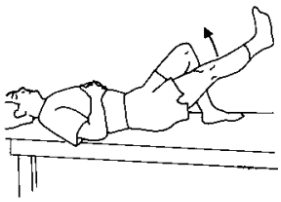
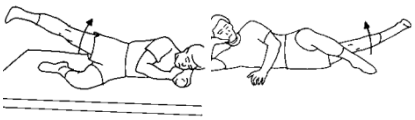
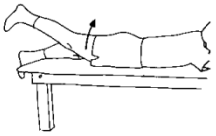
Returning to sports safely requires a dedication in part of the patient to follow the guidelines established by the surgeon and his team of therapist and athletic trainers. Our guidelines are a multidisciplinary approach, which includes criterion-based gradual progressions between the protective phase (week 1 to approximately week 8) and the intermediate/strengthening phase (week 9 to week 16) and also between the intermediate phase and the return to sports phase (week 16 to 24+).

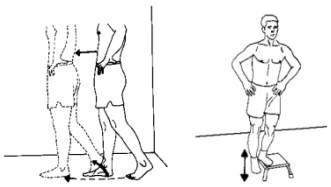
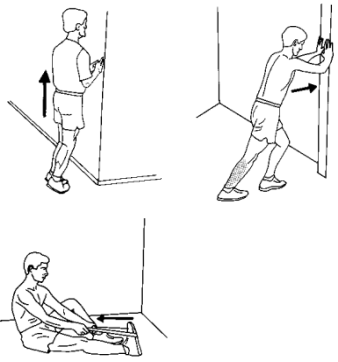
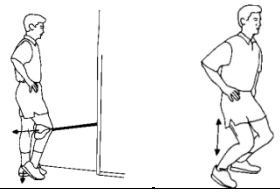
Pressure to return to sports as soon as possible should not be the only motivating factor for the athlete to follow the rehabilitation guidelines. Athletes should think about returning to their sport safely and feeling/performing close to 100%. However, patients, parents, coaches also tend to feel that athletes could play when there is no pain or swelling and “feels normal”. The reality is that many patients have reported that the knee does not feel “completely normal” until 12 to 18 months after surgery.

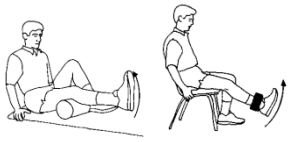
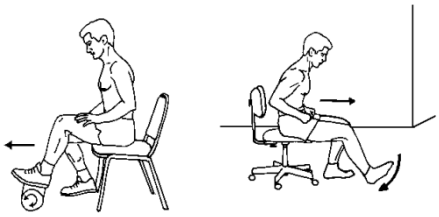
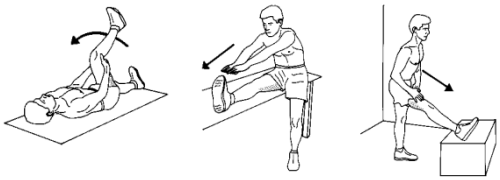
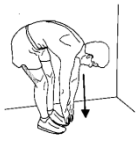
Ultimately the decision to return to sport is made by the surgeon with input from the Physical Therapist, Athletic trainer, coaches, parents and obviously the patient. We utilized a Functional Evaluation that includes a battery of functional tests. The results could give us objective measurements that serve as criteria to advance the level of exercises on each phase, and help us determine if the surgical knee is functioning normally when compared to the contra-lateral knee. Depending on the type of sport the player participates in, and assuming a normal comprehensive

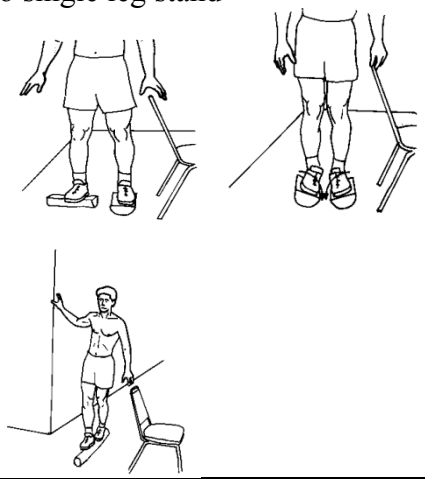
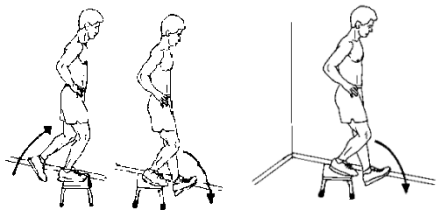
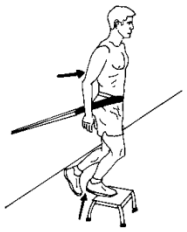
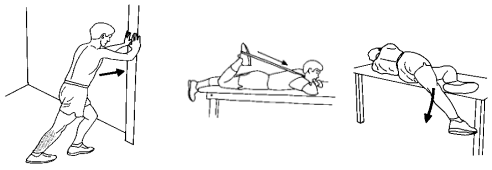
rehabilitation, as well as 90% or higher objective functional measurements, Athletes tend to return to sports safely between 5 to 9 months after surgery.

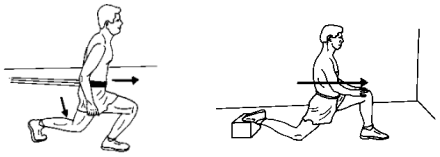
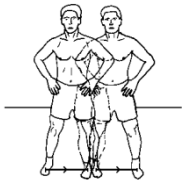
Time	Goals /Milestones	Activities/Exercises
Week 1	Full extension (0 degrees) At least 90 degrees flexion Active Quadriceps contraction Controlled Straight leg raise in all planes (brace on) Walk weight bearing as tolerated with crutches Minimal swelling (less than 5% comparative girth measurements) WOUND CARE: Therapist will change 1st dressing. If dressing is sealed, it should stay in place until MD appointment. Home dressing change should be made following universal precautions. Wound should not be wet. Showering normally allowed after 3rd day, however, wound should be covered with Press-N-Seal.	CPM machine 2 hours 3-5x per day Start 0-45 degrees, increase 10 degrees everyday Heel slide on the wall Assisted by other leg. Hold 10 seconds; repeat 10 to 20 times 3 times a day.  Heel Prop or Prone Hang (5 to 10 minutes 3-5 times per day) May combine with ankle pumps 20 times 3-5 sets    Quad Sets (5 sets of 20; 3-5 times per day)

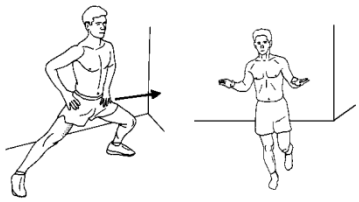
		 Face up SLR; Start day 3 and use brace if necessary 5 sets of 10 reps 3-5 times per day 
Time	Goals /Milestones	Activities/Exercises
Week 2	Full Knee Extension Quadriceps control while single leg standing (able to stand up in one leg with good control) Knee flexion 110 degrees or more Walking without crutches and full extension, minimal or no limp. Able to go around on a stationary bicycle. Reciprocal Stair Climbing	**Continue with previous exercises at home, especially extension exercises** Straight leg raises 4 ways. Attempt without brace. 3 sets of 10 reps   Patellar Mobilizations (start earlier if swelling is down). Hold 5 to 10 seconds. 10 reps Also could be performed by oscillating up and down or side to side as instructed by Therapist

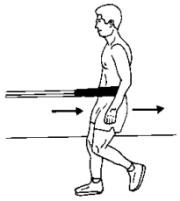
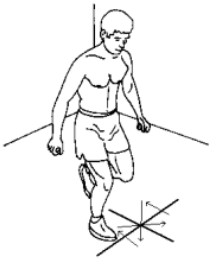
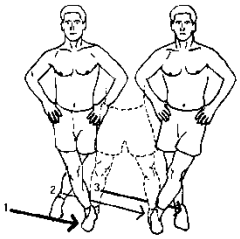
		 Stationary Bicycle 10 to 20 minutes a day Single leg stand weight shifting, progressing to Step climbing. Single leg step up. Start with 2 inches and move 2 inches every other day until reaching 12" step.  Calf raises (10 reps x 3 sets) followed by calf stretches (hold 10 seconds per 3 times)  Terminal knee extension with T-band (above knee and protecting donor site with a towel). Progress to ¼ bilateral squats or mini squats (20 reps x 3 sets). 
Time	Goals /Milestones	Activities/Exercises
Week 3 to 5	Flexion within 10 degrees of contra lateral Normal gait pattern	**Continue with previous activities, adding resistance to SLR exercises.** Stairmaster, Stationary Bike, Elliptical short stride (20 to 30 minutes of Cardio 3

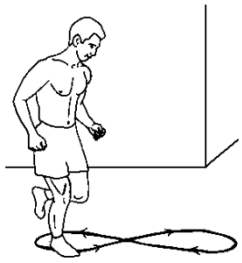
	Quadriceps strength 60% Increased cardiovascular endurance Hamstrings Strengthening and Flexibility. Until now, The harvested tendon had to be protected. While light stretching could be initiated along with Knee extension in the first 2 weeks, aggressive stretching, and Soft tissue mobilization, and Strengthening should wait until week 4 or 5.	times per week). Leg press. Bilateral and unilateral with low resistance. Progress resistance according to Therapist instructions. Goal is to obtain at least 100% of body weight bilaterally and 50% of body weight Unilaterally by week 8 if preoperative testing was not performed. Quadriceps sets in short arch and 90-45  degrees quad sets Introduce Hamstrings Strengthening and Stretching. Hamstrings strengthening progression: heel slides with ball or roll, Stool scoots, Hamstring curls   Hamstring stretching progression: Face up SLR; sitting reaching toes and standing reaching toes on a step or to the floor.  

		Perturbation training exercises Level 1 (bilateral rocker board, Mini trampoline, BOSU or Pillow) Even and tandem add ball toss when balance is good. Advance to single leg stand 
Time	**Goals/Milestones**	**Activities/Exercises**
Week 6 to 8	Full Range of Motion Controlled step up and down on 6 inch step Controlled Lunges Controlled squat up to 60 degrees Quadriceps strength 70% 1st Functional Test performed at the end of week 8(only straight ahead tests, no lateral test). See Functional Testing Scoring Sheet. If scores are below 60% or FMS below 14 delay functional exercises and concentrate on deficits.	**Continue with previous cardiovascular activities, Leg press quadriceps and Hamstring strengthening. Increase loads as tolerated** Step up and down 20 reps x 3. Progressing to resistive step ups/downs.   General Flexibility Exercises as Instructed by Physical Therapist 

		 Perturbation training exercises Level 2 (Single leg on rocker board, Mini trampoline, BOSU or Pillow adding ball toss when balance is good)  Week 8 Mini-trampoline marching and fast walking in short bouts (20-30 secs) Lunges straight ahead. Advance to resistive lunges and lunges into a step  Resistive lateral walking 

Time	Goals/Milestones	Activities/Exercises
Weeks 9 to 12	Maintaining or Gaining quadriceps strength (> 80%) Single leg hop test (>70%) Knee Outcome Survey > 70% (IKDC) Controlled running pattern in treadmill starting at week 12 Single leg balance and reach tests in Anterior, Posterior medial and posterior lateral within 75%. 2nd Functional test performed at week 12 and includes some lateral testing (see Functional testing sheet) If scores are below 75% or FMS below 14 delay functional exercises and concentrate on deficits.	**Continue with previous cardiovascular activities, Leg press quadriceps and Hamstring strengthening. Increase loads as tolerated.** Weight Room activities (Could be performed independently at a health club o school gym, but a strength and conditioning specialist or athletic trainer is highly recommended) **Running Progression** Depending on patient's progress in previous stages, body mass, strength, first functional evaluation results and any other applicable factors, patient could initiate a gradual running progression around week 9. The following guidelines are an example of such progression: Week 9-10 Mini-Trampoline running 30-second bouts of **light stationary jogging** followed by 30 seconds of stationary walking. Week 10 to 12 initiate treadmill running program at clinic (week 1-2 of running/Level1) 0.1 miles jog followed by 0.1 miles walk. Complete 5 times and gradually increase up to 10 times. Do NOT run back-to-back days. **Perturbation Techniques level 3** (Single leg stand eyes closed on non compliant surface) Also add ball toss on mini-trampoline or "kicking" a soccer ball. Introduce a sport gesture without twisting. Add rolling board. Initiate lateral lunges and single leg balance and reach activities in all planes  Initiate backward walking with resistance. Advance to light running at week 12

		
Time	Goals /Milestones	Activities/Exercises
Weeks 13-15	Increase running progression Able to tolerate lateral and diagonal movements without difficulty Able to perform higher balance activities without difficulty	**Initiate early agility drills** (floor ladder) Walking, then light jog  **Running** Week 3 of running (Level 2) Alternate 0.1 miles walk and 0.2 miles jog (2 miles total) Week 4 of running (Level 3) Alternate 0.1 miles walk and 0.3 miles jog (2 miles total) Week 5 of running (Level 4) Alternate 0.1 miles walk and 0.4 miles jog (2 miles total) Perturbation techniques with sport gestures (board, BOSU plus batting, dribbling a basket, pushing a ball held at different heights) . Use all movement planes (diagonal, rotation) Initiate crossover step ups or BOSU/ dynadisc  crossovers **Initiate figure 8 walking** progress to light jogging

		 **Mini trampoline hops** and Total Gym bilateral "jumps".
Time	Goals/Milestones	Activities/Exercises
Weeks 16 to 20	3rd Functional Test performed at week 16. **80-90 % on Following tests:** 1. Comparative 10 rep max for Quad, Hamstring and Leg press 2. IKDC or KOS 3. Single leg hop for distance 4. Single leg crossover for distance 5. Double leg Jump and tuck in test 6. Modified Agility T-run Test 7. Isokinetic test (90/180) 8. Any other functional test (step down, Functional movement screening) If scores are below 90% or FMS below 14 delay Plyometric exercises and concentrate on deficits.	**Increase Intensity and duration of all previous exercises.** **Running.** Week 6 of running level 5-6 (jog 2 full miles) **Track** or **Treadmill**, Do not run 2 days in a row. Progress to level 6 (jog 2.5 miles) Week 7 of running level 7 (Increase workout to 3 miles) Week 8 of running level 8 (alternate between running and jogging every 0.25 miles). On a track increase speed straight ahead and jog curves (one level a week) Week 9 and up full run. **Advanced Neuromuscular Training** Dynamic warm up: Straight leg march, forward, backward lunge, leg cradle, hand walks, "spider-man" crawl; "Frankenstein" walk (kicking hands at shoulder height). Dog and bush walk. Agility drills: Floor ladder full speed, add complex patterns and crossing legs. Add resistance. Skipping, Lateral shuffle, Backward running, T run jogging. **Initiate Plyometric Work with a safe sequence**: 1. Hoping (bouncing up and down on toes) 2. Vertical Jumps (hip and knee flexion acceleration) 3. Lateral jumps (side to side) 4. Diagonal Jumps (Direction of feet land at an angle) 5. Broad Jumps (Distance jumps) 6. Scissors jump (split landing alternating legs) 7. Single leg hopping 8. Single leg vertical Jump 9. Single leg lateral jump 10. Single leg diagonal jump

		11. Bounding **Field Therapy session/Controlled practice:** Schedule a conference involving parent/athlete/coach /athletic trainer/ strength and conditioning specialist /physical therapist. Discuss the possibility of uneventful and modified practices. Level II sports that have lateral movements, less jumping and pivoting than level I (baseball, softball, tennis), may initiate training under controlled environments and skill training/technique should be the focus of training.

Time	Goals/Milestones	Activities/Exercises
Weeks 20 +	4th Functional Test performed at week 20. 5th at weeks 24 Return to Sport Training. Controlled contact practices Follow Return to sport criteria: **90-100 % on Following tests:** 1. Comparative 10 rep max for Quad, Hamstring and Leg press 2. IKDC or KOS 3. Single leg hop for distance 4. Single leg crossover for distance 5. Double leg Jump and tuck in test 6. Modified Agility T-run Test 7. Isokinetic test (90/180) 8. Any other functional test (step down, Functional movement screening) 9. Vertical Drop Test If scores are below 90% or FMS below 14 delay return to sport exercises and concentrate on deficits.	**Advanced Plyometrics allowed:** 1. Barrier Jump forward-back 2. Barrier Jump side to side 3. 180 jump bilaterally 4. Barrier hop or single leg jump front and back 5. Barrier hop or single leg jump side to side 6. Scissors jump 7. Single leg hop diagonally 8. Single leg jump and turn 90 degrees, 180 degrees. **Field Therapy session/Controlled practice:** Schedule a conference involving Parent/Athlete /coach /Athletic trainer/ Strength and conditioning specialist /Physical Therapist With Surgeons approval, return to sport activities need to be tailored and have a multidisciplinary approach. Cutting, figure 8 and Contact should only be introduced if testing reveals >90% of strength in all tests. Physical Therapy Evaluation/testing 20 and 24 and 28 if necessary. Surgeon will consider testing results for release as well as type of sports played. Level II sports that have lateral movements, less jumping and pivoting than level I (Baseball, Softball, tennis), may return to sport under controlled environments. Level I sports with Jumping, Cutting, Pivoting (e.g. Basketball, Soccer, Football) can initiate practice in a controlled environment, but with the surface and equipment that the athlete normally wears, It would be ideal to perform a therapy session involving all movements natural to the sport, including skill training at low speeds. PT, ATC or Certified Strength and conditioning specialist along with coach could tailored a program to involve the athlete in practice without contact, However, Cutting and Pivoting are restricted until surgeons release. Uneventful practices for about 4 weeks, followed by contact/full speed practices for 4 weeks recommended before competition.