Rehabilitation following ACL reconstruction has changed dramatically over the past two decades. This protocol is an accelerated rehabilitation which emphasizes early extension, unrestricted weight bearing and a more expedient return to athletic activity. The accelerated rehabilitation program is based on the following three factors: (1) early terminal knee extension equal to the contralateral side; (2) early weight bearing; and (3) closed and open kinetic chain strengthening exercises.

Early knee extension is critical when using an accelerated protocol. The incidence of flexion contracture with associated quadriceps weakness and extensor mechanism dysfunction following ACL reconstruction has significantly decreased with accelerated knee extension immediately after surgery. Quadriceps strength is enhanced with early extension and early weight bearing. Closed kinetic lower extremity strengthening facilitates improved patellar tracking and has been determined to be a functional mode of exercise. The combination of early knee extension, early weight bearing, and closed kinetic quadriceps strengthening allows the patient to progress through the post-operative rehabilitation period at a rather rapid pace without compromising ligamentous stability.

The following ACL rehabilitation program is based on limited but purposeful clinic visits. Making the patient responsible for their rehabilitation through a structured program of patient education and clinical treatment is key to obtaining effective and efficient therapy. Clinical goals and expectations are established before surgery so that the patient is aware of what needs to be accomplished during
each phase of the rehabilitation program. Instead of having the patient perform the entire exercise program at the clinic, they are educated on how to perform each exercise effectively and how to progress each exercise independently based on clinical expectations. Goals are established for the patient at each visit with a detailed timetable as to when these goals should be attained. If the patient experiences difficulty in achieving the goals set forth, they will be scheduled for more routine physical therapy visits. Through appropriate pre- and post-operative visits we are able to avoid complications rather than treat them once they occur.

Throughout the 5 phases described below, it is possible to overlap phases depending on the individual progress of the patient.

**Phase I**  
*(Post-Injury / Pre-operative)*

*(Physical, Mental and Emotional Preparation and Planning)*

The objectives with the pre-operative visits include physically preparing the knee for surgery as well as mental and emotional preparation of the patient and their support group to deal with surgery and the post-operative rehabilitation course. Patients with acute ACL tears will be placed on appropriate rehabilitation to decrease swelling and restore range of motion and strength to near normal levels. Both acute and chronic ACL patients will undergo pre-operative testing: KT 1000, CYBEX isokinetic strength, and isometric leg press strength evaluation.

**Clinical Goals**

♦ Restore full ROM and normal strength prior to ACL reconstruction  
♦ Control swelling prior to ACL reconstruction  
♦ Ensure complete understanding of the basic principles of accelerated rehabilitation including  
  - Full terminal knee extension  
  - Early weight bearing  
  - Closed and open chain strengthening  

**Testing**

♦ Bilateral ROM including full terminal knee extension  
♦ KT-1000  
♦ *Cybex isokinetic evaluation at 180°/sec*  
♦ Isometric leg press test  
♦ Single leg hop on non-involved leg  

**Exercises**

♦ Prone hangs,
Heel slides
- Closed kinetic chain strengthening
  - Leg press
  - ¼ squats
  - Knee extensions
  - Step downs
  - Bike
  - StairMaster
  - ___ trainer

**Phase II**
(Recover and Restore to normal ADLs)
(Week 1)

**Clinical Goals**
- Full passive knee extension and 90° flexion
- Independent straight leg raise
- Weight bearing as tolerated

**Testing**
- Bilateral ROM

**Exercises**
- The patient begins using CPM the day of surgery, set from 0° to 40° flexion. The CPM machine is to be used as much as possible in the first 2 weeks, with a minimum of 6 hours per day.
- A CryoCuff or GameReady is placed on the patient’s knee immediately after surgery. This provides compression and cold to minimize pain and swelling. The CryoCuff/GameReady also remains on the knee at all times, except when performing motion exercises.
- Extension range of motion exercises hourly during the day:
  - The knee is allowed to fully extend to terminal extension in a heel prop position for 10 minutes during each exercise bout. Quadriceps sets are performed during the heel prop to facilitate quadriceps function at the end range of knee extension
- Knee flexion
  - Sitting knee flexion is performed with assistance into flexion with opposite foot
- Leg control
  - Sitting knee extensions are performed in a pain free arc
- Gait
  - During the first week the patient is to remain lying down with the knee elevated in the CPM/using cold therapy as much as possible. The patient is encouraged to be full weight bearing as tolerated with crutches.
  - While walking, extension is emphasized during the stance phase of the gait cycle. This not only encourages terminal extension in weight bearing, but also facilitates quadriceps function during the stance phase of gait
Clinical Follow-up
♦ Patient will report to physical therapy one week after surgery and should have:
  - Full terminal extension and flexion to 90°
  - Minimal swelling and soft tissue healing
  - Normal gait and ability to lift leg

**Phase II**
(Week 2)

Clinical Goals
♦ Full terminal extension and flexion to 120°
♦ Minimal swelling and soft tissue healing
♦ Normal gait without assistive devices
♦ Demonstrate ability to lock knee with weight shifted to ACL leg

Testing
♦ Bilateral ROM

Exercises
♦ Regaining full extension range of motion is the most critical factor in this phase. Early terminal extension has been demonstrated through many clinical research studies to be the key to a successful result. The patient is encouraged to push extension by performing the following exercises:
  - Towel extensions
  - Prone hangs
  - Flexion is regained by the following exercises:
  - Wall slides
  - Heel slides
♦ Patient is encouraged to lock out their knee by standing with weight shifted to ACL leg so that extension is full and knee is fully locked (single leg stance)
♦ It is very important to emphasize leg control early in the rehabilitation program. Through early extension and normal gait the patient is able to regain good quadriceps tone and leg control. This combination of clinical variables will set the pace for the entire rehabilitation program and a successful outcome.
♦ Once the patient has regained full knee extension and is ambulating normally, it will be possible to implement further leg control exercises:
  - Quarter squats
  - Knee extensions off side of bed with no additional weight
  - It is felt that this type of exercise facilitates return of lower extremity strength with minimal stress to the joint.
♦ Patient continues to increase flexion (DC use of CPM after week #1)
  - Heel slides
  - Wall slides
  - Supine flexion hangs

Clinical Follow-up
♦ The patient will return 2 weeks following surgery
The patient should have full terminal extension, full flexion to 120°, and good quadriceps control to demonstrate an independent straight leg raise and near-normal gait mechanics.

Phase III
(2-4 Weeks)

Clinical Goals
♦ Full terminal extension and 135° flexion
♦ Consistent weight room strengthening

Testing
♦ Bilateral ROM

Exercises
♦ If the patient does not have full passive terminal extension or full flexion:
  - An extension board or other extension device will be given to the patient for home use in addition to routine clinic visits to restore full extension.
  - Supine flexion hangs are the most common means of regaining terminal flexion, however kneeling down and sitting back on one’s heels should be practiced as it is the goal for full, functional flexion. It is also used as the guideline for the patient, so the patients knows if he/she is overdoing it – losing the ability to sit on ones heels is an indicator that rest is needed until full, easy flexion returns.
♦ Weight room activities (once the patient has sufficient leg control to perform a unilateral knee bend without difficulty):
  - ¼ squats
  - Unilateral leg press
  - Unilateral calf raises
  - StairMaster 4000 progressing to greater intensity levels
  - Unilateral step-downs
  - Unilateral leg extensions
  - Bicycling workouts are started. Initially the bike is used as a mechanical means of attaining flexion. Once the patient has gained 120° flexion they can use the bike for moderate speed strengthening workouts.
  - Swimming and other hydrotherapy exercises can be started once the incisions have healed.

Clinical Follow-up
♦ At the 4-week follow-up visit the patient will work on:
  - Full terminal extension and full flexion to
  - Improved quadriceps tone
  - Increased unilateral strength
  - Improved cardiovascular status with low impact exercise
    • Stair master
    • Bike
    • ___ trainer

Phase IV
(4-8 Weeks)
Clinical Goals
♦ Full knee terminal extension and flexion
♦ Return to low impact sport specific goals
♦ Quadriceps tone continues to improve with noticeable quadriceps definition returning by this time
♦ Quadriceps and hamstring strength 75% to non-involved leg
♦ Proprioceptive/agility specific program as appropriate

Testing
♦ KT-1000 at 8 weeks
♦ Cybex at 8 weeks
♦ Single leg hop at 8 weeks

Exercises
♦ Weight room activities are continued including leg press, knee extensions, lunges, and squats
♦ Continue low impact cardiovascular exercises
♦ Low impact sport specific drills

Agility
♦ Factors influencing the patient’s return to controlled agility training and sport specific activity includes patient subjective rating, as well as isokinetic and isometric test scores.
♦ Agility training and limited sports participation not only help the patient to regain fast speed strength but also help to restore confidence in getting back to aggressive athletic activities as tolerated in the program.
  - Form running (short distance)
  - Backward running
  - Lateral slides and crossovers
  - Practicing single leg hopping
  - Shooting baskets, dribbling soccer ball and/or other sport specific drills

Clinical Follow-up
♦ Follow-up visits after the 4 week visit are determined by the patient meeting the initial postoperative goals of full knee ROM and good knee control in weight bearing.

Phase V
(8 Weeks On)

Clinical Goals
♦ Maintain full ROM
♦ Advance total leg strengthening
♦ Quadriceps and hamstring strength 85% compared to non-involved leg
♦ Increase sporting activities as appropriate
♦ Return to sport and/or exercise routine
Testing
♦ Subjective questionnaire
♦ Bilateral ROM
♦ KT-1000 ligamentous stability testing (done at 8wks, 3 months, 6 mo, 1 yr)
♦ Isokinetic testing (Cybex) at 180/ sec and 60/ sec (done at 8wks, 3 mo, 6 mo, 1 yr)
♦ Isometric leg press (done at 8wks, 3 months, 6 mo, 1 yr)
♦ Single Leg Hop

Exercises
♦ Continued unilateral weight room/home strengthening exercises
♦ Sport specific drills progressing to full sports participation
♦ Progression to running and higher impact cardiovascular exercise

Return to Sport
♦ Return to full, non-restricted practice and competitive activities
♦ Patient, parents, coach, and ATC must be educated to know when and how to modify situation according to subjective and objective findings of the knee.

Clinical Follow-up
♦ Patient will return for the above testing visits to address any problems that the patient encounters with ADL's, exercise, or sport
♦ Patient returns for reassessment/strength testing at 3, 4 and 6 months postop with progression of sport activities based on strength testing results and physician exam.