PROTOCOL FOR KNEE REHABILITATION AFTER ARTHROSCOPIC RECONSTRUCTION OF THE ANTERIOR CRUCIATE LIGAMENT WITH SOFT TISSUE GRAFT

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Rehab following reconstruction of the knee for anterior cruciate ligament deficiency is a controlled and progressive process. The following protocol is based on scientific studies and clinical experience which have suggested necessary time frames for protection and appropriate exercise. The goal is to improve knee mobility, stability, and lower extremity muscle performance. The time schedule is dictated by the revascularization, remodeling of the graft and clinical experience. It is expected that the graft becomes living and viable tissue which will eventually develop adequate tensile strength, and provide necessary stability required for everyday functional tasks.

There are a few things to remember during rehabilitation following an ACL reconstruction. First, as always, each patient must be treated on an individual basis. It is the therapist’s responsibility to continuously assess whether or not the patient is ready to progress to the next stage of the rehabilitation. If not, the therapist must address what is causing the delay before progressing. Secondly the therapist should be fully aware of all appropriate stresses placed on the knee during exercise and design an appropriate exercise program. For example, closed chain terminal knee extension and leg presses are less stressful to the ACL than full range open chain flexion to extension exercises.

Lastly, maintenance of full extension during the rehabilitation process is mandatory. Aggressive correction of extension loss by bracing, institution of a hanging weight program, even casting, may be appropriate.

Post-Op Week 1
A. Brace Locked while walking and sleeping. Patients require an assistive device for seven to ten days. Then full weightbearing and gradual weaning from assistive devices begins as tolerated, if patient has achieved full extension.
B. May come out of brace for range of motion exercises (0-90 degrees)
C. Cryopump for cooling the knee
D. Quad sets, Hamstring sets, Glut sets, Straight leg raises

** Meniscal repair patients must weightbear in Full Extension Only for the first 6 wks. When non-weightbearing, the patient may remove the brace and bend the knee to a maximum of 60 degrees for the first 2 weeks, then advance to 90 degrees between week 2-4, and advance to 120 degrees from postop weeks 4-6. All closed chain motion activities must be delayed. Co-contraction exercises are encouraged.

Phase I - Week 1-6
A. Range of motion: 0-90 degrees as soon as possible, stressing the importance of full passive extension. The patient can perform self
range of motion (heel slides) as tolerated from day one. The patient can use hands to assist with range of motion. Restorator cycling or stationary bike riding may be used to assist in gaining range of motion. Manual patellofemoral and gentle tibiofemoral mobilization is performed. The patient should also be instructed in patellar mobilization. The therapist and patient should also emphasize soft tissue mobilization of peri-patellar tissue in longitudinal, diagonal, and transverse directions with special attention to the infrapatellar region.

B. Resistive Exercises: During this stage, emphasis is on high repetition low load rehabilitation program. This is also dictated by the patient’s signs and symptoms, i.e. pain and swelling.

1. Hip: The patient should perform co-contraction prior to lifting the leg. Straight leg raise exercises performed in supine, prone, and side lying on involved and uninvolved side. Co-contraction is mandatory during supine open chain quad contractions. Otherwise, bent leg raise is performed using quad/hamstring co-contraction with knee bent 45 degrees. Progress multi-hip machine with contact proximal to the knee.

2. Knee: Quadriceps and hamstring co-contraction 10 repetitions 5 times per day. Self-resisted isometric with uninvolved extremity for quadriceps at 45, 60, and 90 degrees. Co-contraction quad sets and full extension are encouraged. Hamstring exercises: Begin with manual resistance and progress to isokinetic and isotonic (progression may be overlapping). Quadriceps exercise- leg press type exercises to 0 degrees avoid hyperextension. Flexion to extension exercise from 90 to 45 degrees, using anti-shear apparatus and/or proximal tibial contact.

3. Ankle: Initially, ankle pumping to maintain range and eliminate swelling. Patient may also begin resisted exercise into plantar and dorsiflexion using any form of resistive equipment.

4. Isokinetic Parameters: Initially, concentric/ eccentric hamstrings through available range of 90 degrees – 0 degrees slow speeds. Controlled isokinetic extension and flexion exercise; Hamstrings at 0-90 degrees using slower speeds (more torque), quadriceps at 45 – 90 degrees at intermediate speeds (less torque), using anti-shear apparatus.

5. Neuromuscular Stimulation: Begin first week and progress through two months. Suggest dual channel electric stimulation unit activating hamstring muscle group first then quad muscle group second, (ie Steadman Protocol). Duration 30 minute session, frequency two times a day.

6. Closed chain exercises: Closed chain exercises may begin once the patient has adequate knee control. Avoid flexion
beyond 45 degrees for patellofemoral considerations. Closed chain exercises may consist of standing weight shift, Total Gym, lateral step up, BAPS, and stepper machines.

**DELAY IN PATIENTS WITH MENISCAL REPAIRS**

C. Patient may discontinue IROM brace once he/she has good quad and hamstring control.

D. If any extension deficit exits at 4 wks, return to the referring physician is mandatory.

Phase II (6 to 12 Weeks)

Range of motion is gradually increased to full flexion. Stationary bike strongly encouraged for endurance.

Resistance Exercise: Gradually increase resistance with closed chain exercises to patient tolerance (avoid cutting, jumping, and pivoting.) Maintain high repetition and low load extension exercises with open chain exercises still limited to -45 degrees of full extension. Swimming and Nordick Trak training may begin toward the end of this stage.

Phase III (12 to 18 weeks)

Begin to increase resistance of all exercises. Begin open chain extension to 45 degrees at moderate load/moderate repetitions. Swimming is encouraged (try to avoid open chain terminal knee extension. Retrain kicking from hip.) Pool running is allowed toward end of stage. Also increase rigor of isokinetics.

Phase IV (18 to 26 weeks)

Begin progressive loading with all exercises. Advance open chain extension exercise to -30 degrees of full extension. The therapist may begin using isokinetic velocity spectrum. Again consider individuality of each patient.

Closed chain progression: Lateral slide boards

A. Initiate running program
   1. Walk/jog intervals
   2. Jog half a mile at half speed progress by quarter mile increments on level surfaces.
   3. Increase to straight plane sprinting

B. Progress to cutting program
1. Figure 8 patterns over large displacement progressing to smaller displacement
2. Lateral shuffle
3. 45 degree cuts to 60 degree cuts to 90 degree cuts
4. Carioca drills
C. Jumping program
   1. Mini trampoline
   2. Jog in place
   3. Hop on involved leg
   4. Sport cord side to side hop
   5. Bilateral side to side hop

Phase V (26 to 36 weeks)

Continue exercise progression to include high load low repetition open chain extensions to – 30 degrees of full extension. The patient is progressed through controlled functional activities and sports.

Phase VI (36 to 40 weeks)

The patient may participate in activities if appropriate. Parameters used to measure patient’s return to functional tasks are functional testing and isokinetic testing 85% or better. Both of the above criteria must be achieved before returning to active participation in high demand situations. Maintenance exercise programs are outlined and strongly encouraged.

KT 1000 testing: every 8 wks if available to help assess passive knee stability.