

**Theodore B. Shybut, MD FAANA FAAOS**  
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Knee, Shoulder, Elbow Arthroscopy &  
Reconstructive Surgery  
Burbank, Valencia / Santa Clarita, Van Nuys  
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## ACL Recon + High Tibial Osteotomy (HTO) Protocol

### Tips for Successful Recovery

1. **Surgical pre-cautions:** Do not change bandages unless instructed by physician. Wear compression hoses on operative limb until crutches are discharged. If you suspect a DVT, contact Dr. Shybut's office immediately at 661-290-5473 or refer to ED immediately. If patient has reactive effusion that does not improve with rest, ice, and compression, contact Dr. Shybut's office.

2. Begin stretching extension ROM on day one. Achieve full extension ROM by week 2. If not achieved by end of week 4, notify the physician's office.

3. Address quad activation early and focus on isolation of quadriceps activation. Use surface emg, NMES, and tactile cueing to isolate quadriceps. Be aware of co-contracting from hamstrings, and ensure proper form. Do not progress to standing activities if patient is unable to achieve isolated quad set in long seated position. Goal is to achieve heel lift with a quad set.

\*Dosing quad sets: 10 minutes of 10 second squeeze/10 second rest, x5 times a day.

4. Straight leg raises: Ensure quadriceps is activated and is maintaining contraction throughout the SLR range to eliminate extensor lag. Aim for a calf tap and elimination of extensor lag by week 6. Calf tap: the calf taps/skims the table while the heel stays elevated as the leg descends to starting position. Ankle weights may be added after 6 weeks, progress slowly.

5. Do not force flexion ROM, but encourage steady progression. Patellar mobility is imperative. Use gentle soft tissue techniques for areas such as anterior interval/fat pad, quadriceps, hamstrings, and scar management. If 90° of flexion is not achieved by week 4, notify physician's office.

6. Start double leg (DL) mini squats and leg press from 0° to 60° initially, then progress to 90° as tolerated. Single leg (SL) activities may be initiated at week 10 with SL leg press and step-ups, then advancing to SL activities as tolerated. Loaded leg extensions are prohibited.

\*Squat progressions example: DL leg press, DL mini squats, DL chair squats, DL body weight squats, SL leg press, SL step ups, Static lunge split squat, SL step downs, SL squats, SL split squat with elevated back leg, walking lunges, SL sit to stands, SL slide outs.

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7. Pre-run/pre-jump program includes tempo-based activities with focus on the deceleration phase such as DL speed squats, DL drop squats, DL “bounce bounce bounce squat”, then progress to alternating SL drop squats. Also, intermittently increase the tempo of regular strengthening exercises to align with the timing requirements of jogging and jumping.

8. Walk/Jog program: MD approval required. Begin on treadmill with 2- 3 days per week. Begin with 1:1 or 2:1 walk to jog ratios, (ie. 1 min walk to 1 min jog or 2 min walk to 1 min jog). Then progress each week by 1 min jog until 12-15 min of jogging is achieved.

9. Plyometric program: MD approval required. Begin with small DL jumps, jump rope, and small depth jump landings& box jumps. Progress box height as skill is mastered. Ensure equal weighted DL take-off and landing before progressing to SL plyometrics. Initiate SL plyometrics with alternating L and R landings in place and then advance to SL hops. Begin a sportsmetric based plyometric program when released by surgeon.

10. Isokinetic protocol: After 36 weeks and with MD approval, may begin training and testing with 300°/sec and progress to 180°/sec. Do not proceed if patient has history of anterior knee pain.

11. Return to Play Progression: a graded re-exposure is essential. Return to non-contact practice, return to contact practice, return to scrimmage, return to interval play, return to full time play.

12. **Prevention of future ACL injury** requires ongoing dedication to correcting functional movement deficits identified during rehabilitation. **FIFA 11+** is an injury prevention program that has demonstrated efficacy. Dr. Shybut recommends athletes, therapists, and trainers utilize this program and incorporate the exercises into their ongoing conditioning.

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## **PHASE 1 - ACUTE (0-6 Weeks)**

### **PHASE GOALS: PROTECT GRAFT, RESTORE RANGE OF MOTION RANGE OF MOTION**

0-1 Week – Full extension and progress flexion to 60°

1- 4 Weeks – Maintain full extension and progress to 90°

4+ Weeks – Gradually progress flexion to 120°

### **WEIGHT BEARING**

0-2 Weeks – Toe Touch Weight Bearing

2-6 Weeks – Partial Weight Bearing

### **BRACE & CRUTCH USE**

0-1 Week -- Brace locked in 0° extension

1-2 Weeks -- Unlock brace 0° to 60° (unless prohibited by MD)

2-4 Weeks – Unlock brace 0° to 90°

4-6 Weeks -- Brace unlocked to full if good quad control and full extension

### **STRENGTHENING**

0-3 Weeks: Quad sets and patellar, scar, and soft tissue mobilizations

2+ Weeks: Pre-gait, TKEs, calf raises

3+ Weeks: Straight leg raises **with MD approval and imaging**

No ankle weights with SLRs until >6 weeks

**SAQs and LAQs are prohibited, Quad stretching is prohibited**

### **CRITERIA FOR FULL AMBULATION**

- **> 0 DEG KNEE EXTENSION & 90 DEG KNEE FLEXION**
- **> 30 STRAIGHT LEG RAISES WITHOUT LAG**
- **MINIMAL EFFUSION/PAIN, & SYMMETRICAL GAIT WITHOUT A LIMP**
- **MD OR PT APPROVAL**

## **PHASE 2 – STRENGTH (6-16 Weeks)**

### **PHASE GOALS: IMPROVE STRENGTH AND PROTECT THE GRAFT RANGE OF MOTION:**

6+ Weeks – Maintain full extension and progress to full flexion

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### **WEIGHT BEARING AND CRUTCH USE:**

6+ Weeks – Weight bearing as tolerated → FWB with symmetrical gait

8+ Weeks -- D/C crutches when gait is normal; D/C brace for home ambulation; continue for community ambulation until MD approval to D/C

### **STRENGTHENING**

6+ Weeks: gait training, static balance, mini squats, SLR with wts or for time

8+ Weeks: methodical progression of exercises below

Leg press, step ups, step downs, RDLs, lunges, Bulgarian squats, wall sits

Squat progression: bodyweight squats → single leg squats **Avoid depth >90°**

Advance hip abduction & glut strength: band walks, lateral lunge, reverse lunge, bridges, hip thrusters

Core exercises: planks, side planks, v-ups, Russian twist, superman

Balance training: foam pad, balance board, BOSU

### **CONDITIONING**

6+ Weeks: Stationary biking: **must be > 110° knee flexion**

8+ Weeks: Encourage daily biking, may begin interval training if non-reactive

12+ Weeks: Elliptical

12+ Weeks: Swimming: Progress kicking gradually and pain-free, no flip turns

### **CRITERIA FOR PHASE 2**

**PAIN LESS THAN 3/10 (WORST)**

**WITHIN 2 DEG NORMAL KNEE EXTENSION & 120 DEG KNEE FLEXION**

**SYMMETRICAL BODY WEIGHT SQUAT**

**MINIMAL EFFUSION, PAIN, & SYMMETRICAL GAIT WITHOUT A LIMP**

### **PHASE 3 – INITIATE JOGGING (16-24 Weeks)**

**PHASE GOALS: IMPROVE STRENGTH AND INITIATE JOGGING PROGRAM**

**RANGE OF MOTION**

16+ Weeks – Promote and maintain symmetry

### **STRENGTHENING**

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Gym strengthening: squats, deadlifts, initiate olympic lifting

SL strengthening: SL squats, sit to stands, ball slams, step ups/downs

Dynamic core exercises: mountain climbers, planks, pikes, pale off press

Integrate interval strength circuits & work/rest timed intervals

### **CONDITIONING**

Stationary bike, elliptical, swimming, & rowing machine

Initiate dynamic warm-up: frankenstein kicks, leg swings, knee hugs, heel sweeps, heel/toe walks, oil rigs, lateral lunge, hip rotation, inch worm, speed squats

16- 24 Weeks – **With MD Approval**, may begin Alter-G treadmill walk/jog progressions: begin with 30"-1' W/J intervals, advance jog time as tolerated, no more than by 1 min each week

22+ Weeks – May advance to treadmill after AlterG progression to 90%

### **CRITERIA FOR JOGGING**

- **PAIN LESS THAN 3 / 10 (WORST)**
- **WITHIN 2 DEG NORMAL KNEE EXTENSION & 120 DEG KNEE FLEXION**
- **QUADRICEPS & HAMSTRING STRENGTH > 60% NORMAL**
- **LESS THAN 4cm DEFICIT ON SINGLE-LEG SQUAT (ANTERIOR REACH)**
- **AT LEAST 1 MINUTE OF SINGLE LEG SQUATS**
- **MD APPROVAL**

## **PHASE 3 – STRENGTH, AGILITY, AND DOUBLE LEG PLYOMETRICS (24-32 Weeks)**

**PHASE GOALS: INTRODUCE DYNAMIC MOVEMENTS**

**RANGE OF MOTION**

24+ Weeks – Promote and maintain symmetry

### **STRENGTHENING**

Gym strengthening: squats, deadlifts, initiate olympic lifting

SL strengthening: SL squats, sit to stands, ball slams, step ups/downs

Dynamic core exercises: mountain climbers, planks, pikes, pale off press

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Integrate interval strength circuits & work/rest timed intervals



## **CONDITIONING**

Dynamic warm-up

Biking, elliptical, swimming & rowing

24+ Weeks -- Treadmill walk/jog progressions: begin with 30"-1' W/J intervals, advance jog time as tolerated

Advance to track progressions once 15 min on treadmill is achieved: initially jog straights & walk curves, then progress to full laps and linear speed

## **PLYOMETRICS & AGILITY:**

Ladder drills, footwork agility drills

Double leg plyos: shuttle jumps, jump rope, line jumps, depth jumps, box jumps

## **CRITERIA FOR DL PLYOMETRICS AND AGILITY PAIN LESS THAN 2 / 10 (WORST)**

- **QUAD & HAM STRENGTH > 80% NORMAL; > 50% H/Q RATIO FOR FEMALES**
- **AT LEAST 3 MINUTES OF SINGLE LEG SQUATS (RESISTED)**
- **JOGGING >15 MINUTES ON TREADMILL**
- **< 5 ON LANDING ERROR SCORING SYSTEM (LESS)**
- **MD OR PT APPROVAL**

## **PHASE 4 – ADVANCED STRENGTH, AGILITY, AND PLYOMETRIC (32-40 Weeks)**

### **PHASE GOALS: INTRODUCE POWER MOVEMENTS RANGE OF MOTION**

32+ Weeks - Promote and maintain symmetry

## **STRENGTHENING**

Gym strengthening: squats, deadlifts, olympic lifting

Interval strength circuits & work/rest timed intervals

Dynamic eccentric loading: double & single leg

Dynamic core: rotational and anti-rotational drills

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36+ Weeks -- Isokinetic training protocols: begin with 300°/sec, progress to 180°/sec



## **CONDITIONING**

Dynamic warm-up

Biking, elliptical, jogging, swimming & rowing

Advance track workouts: progress time and linear speed

## **PLYOMETRICS & AGILITY: DOUBLE & SINGLE LEG**

Tuck jumps, squat jumps, bounding, SL hop, SL triple hop, SL cross over hop

Cone drills and change of direction drills: begin with < 90°, progress to 90° and greater

High intensity predictable patterned movements

## **CRITERIA FOR SL PLYOMETRICS AND ADVANCED AGILITY**

- **PAIN LESS THAN 2 / 10 (WORST)**
- **QUAD & HAM STRENGTH > 80% NORMAL; > 50% H/Q RATIO FOR FEMALES**
- **AT LEAST 3 MINUTES OF SINGLE LEG SQUATS (RESISTED)**
- **JOGGING >15 MINUTES ON TRACK OR PAVED SURFACE**
- **MD OR PT APPROVAL**

## **PHASE 5 - RETURN TO PLAY (40+ Weeks)**

### **PHASE GOALS: INITIATE SPORTS SPECIFIC MOVEMENTS & RETURN TO PLAY STRENGTHENING**

Gym strengthening: squats, deadlifts, and olympic lifting

Interval strength circuits & work/rest timed intervals

Dynamic strength and core exercises

Complex movement patterns

Isokinetic protocols: 300°, 180°, and 60°/sec

## **CONDITIONING**

Jogging, biking, swimming, rowing, & interval sprint workouts

## **PLYOMETRICS & AGILITY (2-3 DAYS/WEEK)**

Max effort DL and SL jumps → progress with rotation

Lateral & rotational agility drills

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Unpredictable cutting agility



Non contract drills → contact drills with MD approval

**Return to practice → return to contact practice → return to scrimmage → return to interval play → return to full play**

#### **CRITERIA FOR RETURN TO PLAY**

- **PAIN LESS THAN 2 / 10 (WORST)**
- **> 75/100 ON ACL-RSI SURVEY**
- **QUAD & HAM STRENGTH > 90% NORMAL; > 60% H/Q RATIO FOR FEMALES**
- **90% NORMAL ON SINGLE-LEG HOP TESTS**
- **95% NORMAL FIGURE OF 8, 5-10-5 PRO-AGILITY, & SL VERTICAL JUMP**
- **MD APPROVAL**