Rehabilitation Protocol for ACI Trochlea Patella

These guidelines are intended to assist clinicians in managing the post-operative course for Trochlea Patella Autologous Chondrocyte Implantation (ACI), a surgical procedure for treating full-thickness chondral lesions of the knee joint. The procedure begins with an arthroscopic harvest of healthy cartilage from a non-weight-bearing area of the knee joint. These cartilage cells are then preserved and cultivated onto a scaffolding tailored to the individual's defect. The second stage, performed openly 3-5 weeks later, involves implanting these cartilage cells/scaffolding into the defect and sealing them with fibrin glue. Over the next 24 months, the cells grow and mature to form hard cartilage tissue. The protocol is structured around the 4 stages of cartilage maturation: Proliferation, Transition, Remodeling, Maturation. The size and location of the defect guide the rehabilitation progression, potentially altering the duration of the phases. Treatment should be individualized based on the patient's needs, exam findings, and clinical judgment. Expected outcomes may vary based on the surgeon's preferences, additional procedures, and complications. Clinicians seeking guidance on patient progression should consult with the referring surgeon.

The interventions listed are not exhaustive and should be adapted based on the patient's progress and at the discretion of the clinician.

Considerations for Post-operative ACI Trochlea Patella Various factors, including the origin, size, and location of the defect, as well as concomitant injuries, can influence the outcomes of post-operative ACI Trochlea Patella rehabilitation. Additional procedures, such as a tibial tubercle osteotomy, may also impact the rehabilitation process.

PHASE I: IMMEDIATE POST-OP

(WEEKS 0-6 AFTER SURGERY)

Rehabilitation Goals	• Protect healing graft / tissue (joint surface & wound) • Decrease knee / lower extremity (LE) swelling • Enhance volitional control of quad • Achieve full knee extension • Gradually restore knee flexion range of motion (ROM) • Restore patellofemoral joint mobility
Weightbearing Status/ Brace / Things to Avoid	*Precautions:* • Weeks 0-2: passive range of motion (PROM) only, limited knee flexion 0-40 degrees • No active knee extension from 40-70 degrees • No repetitive closed chain knee flexion from 40-70 degrees • Avoid forceful motion into pain (some mild pain with passive extension is acceptable) *Weight Bearing:* • Tibial Tubercle Osteotomy: o Touch down weightbearing in locked brace • No Osteotomy: o Immediately post-op: 25% weightbearing in locked knee brace o Week 2: progress to 50% weightbearing in locked knee brace o Weeks 3-4: progress to 75% weightbearing in locked knee brace o Weeks 5-6: progress to weightbearing as tolerated in unlocked knee brace *Brace:* • Locked at 0 degrees for ambulation and at night • Removed for continuous passive motion / exercises • May lie in supine without brace in 0 degrees extension, if in safe protected position • Gradually open up brace with WB as quad control improves • Weeks 4-6: unlock to 20-30 degrees with ambulation if able to perform SLR without lag • Can discharge brace at 6 weeks if SLR without lag

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PHASE I: IMMEDIATE POST-OP
(WEEKS 0-6 AFTER SURGERY) CONTINUED

Interventions	*Pain/Effusion Management:* • Electrical stimulation for quadriceps • Ice, compression, elevation (check with MD: cold therapy) • Retrograde effleurage • Ankle pumps *Joint Mobilization:* • Grade III superior and inferior patellofemoral joint (PFJ) mobilization (should be painfree) *ROM:* • PROM by therapist o Weeks 0-2: 0-40 degrees only o Weeks 2-6: gradually increase per patient tolerance *Continuous Passive Motion (CPM):* • Limit 0-40 degrees for Weeks 0-2, then increase CPM range by 5-10 degrees per day based on tolerance • CPM 6-8 hours/day in 2 hour blocks • Start 1 cycle per minute at full extension to a knee flexion angle that is comfortable. Advance as tolerated *Therapeutic Exercise:* • Heel prop • Seated knee flexion AAROM (limit 0-40 degrees Weeks 0-2) • Heel slides • Supine knee flexion (limit 0-40 degrees Weeks 0-2) • Quad sets • Hamstring isometrics • Straight leg raise (SLR) • Sidelying hip abduction • Stationary bike with elevated seat height(start at Week 4 only if patient has 90 degrees knee flexion) *Additional Interventions:* • Biofeedback for quad/VMO control • Blood Flow Restriction Therapy (BFRT) with quad set and SLR • Pool walking – axilla/chest deep (begin at Week 4 if incision is fully healed) o Chest deep (25% body weight) o Waist deep (50% body weight)
Criteria to Progress	• SLR with no lag (without brace) • Full passive knee extension • Knee flexion – 90 degrees by Week 4, >120 degrees by Week 6 • Normal patellofemoral mobility • Controlled swelling

PHASE II: INTERMEDIATE POST-OP
(WEEKS 6 – 12 AFTER SURGERY)

Rehabilitation Goals	• Protect healing graft • Achieve full knee flexion • Return to full weightbearing with normalized gait pattern • Progress quad strength and lower extremity control
Weightbearing Status / Precautions	*Precautions:* • No active open chain knee extension from 40-70 degrees • Avoid repetitive closed chain knee flexion from 40-70 degrees • Avoid significant/persistent pain during or after exercise *Weight Bearing:* At 6 weeks, progress weight bearing as tolerated to full weight bearing by Weeks 8-9
Additional Intervention ***Continue with Phase I interventions as indicated**	*Therapeutic Exercise:* **ensure proper dynamic control with all exercises to avoid excessive shear on joint* **all exercises below should be limited to ROM from 0-40 degrees knee flexion* • Short arc knee extension (may begin at Week 9) • Standing heel raise • Bridging • Terminal knee extension • Mini squats • Wall slides • Step ups • Lateral step down • Resisted side stepping (band at thighs) *Balance/Proprioception Exercise:* • Single leg balance: begin at Week 8 o Static – shoes on / eyes open o Varied surface o Vision – eye / head movements, eyes closed o Task (throw and catch) • Single leg balance with lower extremity swings • Single leg balance with upper extremity reach: Begin at Week 10 *Aerobic Exercise:* • Stationary bike (no/minimal resistance for emphasis on range of motion) • Treadmill walking • Aquatic flutter or straight leg kicks with kickboard
Criteria to Progress	• Full knee ROM • Minimal/no swelling at baseline • Normal gait mechanics • Pain-free sit to stand

PHASE III: LATE POST-OP
(WEEKS 12-24 AFTER SURGERY)

Rehabilitation Goals	• Protect healing graft • Progress single leg strength, control, and load tolerance • Progress balance/proprioception work in all 3 planes of motion
Precautions	*Precautions:* • Significant pain during activity • Significant swelling after activity • Post activity soreness > 24 hours • No active knee extension from 40-70 degrees Avoid repetitive closed chain knee flexion from 40-70 degrees

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PHASE III: LATE POST-OP
(WEEKS 12-24 AFTER SURGERY) CONTINUED

Additional Intervention *Continue with Phase I-II Interventions as indicated	*Therapeutic Exercise:* • Single leg dead lift • Leg press <40 degrees flexion • Single leg squat <40 degrees flexion • Seated hamstring curl machine • Standing resisted knee flexion • Double leg mini squat • SLR with weight • Small step up with weight if appropriate *Balance/Proprioception Exercise:* • Progress single leg balance with lower extremity reaching and perturbations *Aerobic Exercise:* • Treadmill forward and retro walking • Aquatics: flutter kicking (no whip kicks) and aqua jogging
Criteria to Progress	• Bilateral squat to 40 degrees flexion with good mechanics without pain • Single leg squat depth to at least 40 degrees knee flexion with good control without pain • All activities of daily living (ADLs) performed without pain or swelling

PHASE IV: ADVANCED STRENGTHENING
(24+ WEEKS AFTER SURGERY)

Rehabilitation Goals	• Progress active knee flexion in full range of motion • Hamstring and calf strength within 80% of the contralateral limb • Ability to ambulate long distance (5-10 km) without pain • Ability to effectively negotiate uneven terrain • Return to pre-operative low-impact recreational activities
Additional Intervention	• Progression of phase II-III exercises incorporating increased knee flexion (now permitted to perform knee flexion 40-70 degrees)
Criteria to Progress	• No effusion/pain after exercise • Return to low-impact recreational activities without pain or swelling • Ability to perform bilateral and single leg squat in increased range of motion with good control without pain

PHASE V: EARLY RETURN TO SPORT
(9-12 MONTHS AFTER SURGERY)

Rehabilitation Goals	• Quadriceps strength within 90% of the contralateral limb • Ability to perform all activities of daily living pain free • Initiate return to running program

Additional Intervention	• Begin sub-maximal sport-specific training in the sagittal plane
	• Interval running Program
	    o Return to Running Program
	• Progress to plyometric and agility program
	    o Agility and Plyometric Program

Criteria to Progress	• Clearance from MD and ALL milestone criteria have been met
	• Completion of jog/run program without pain/effusion/swelling
	• Functional Assessment:
	    o Quadricep/hamstring/glute index >90% HHD mean or isokinetic testing at 60 degrees/second
	    o Hamstring/quad ratio >66%
	    o Hop testing >90% compared to contralateral side, demonstrating good landing mechanics

PHASE VI: UNRESTRICTED RETURN TO SPORT
(12 MONTHS AFTER SURGERY)

Rehabilitation Goals	• Continue strengthening and proprioceptive exercises • Symmetrical performance with sport-specific drills • Safely progress to full sport
Additional Intervention *Continue with Phase II-V	• Multi-plane sport-specific plyometrics program • Multi-plane sport-specific agility program • Include hard cutting and pivoting depending on the individuals' goals • Non-contact practice > full practice > full play
Criteria to Progress	• Full knee ROM • Minimal/no swelling at baseline • Normal gait mechanics • Pain-free sit to stand

For further assistance or to schedule an appointment, please contact **iOrtho - The Orthopedic Institute** at **833-464-6784** or visit our website at **iorthomd.com** to text/email us. Our team is dedicated to providing personalized care and guidance throughout your rehabilitation journey.