KNEE ARTHROSCOPY (AKS)
CLINICAL PRACTICE GUIDELINE

Background

Knee arthroscopy is a minimally invasive surgical procedure that allows surgeons to clearly view the inside of the knee joint to diagnose and treat a variety of knee problems. During the procedure, the surgeon inserts a small high-definition camera, an arthroscope, into the knee joint through small incisions, called “portals.” Images of the inside of the knee are displayed on a video monitor, allowing your surgeon to guide small surgical instruments within the knee joint to perform surgical intervention.

Common arthroscopic procedures of the knee include:

- Removal of inflamed synovial tissue
- Trimming of damaged articular cartilage (chondroplasty)
- Removal of loose fragments of bone or cartilage
- Treatment of patellar (kneecap) impairments
- Treatment of knee sepsis (infection)

For more complex arthroscopic procedures including ACL reconstruction and meniscus repair, please refer to the surgeon’s operative note for clarification on post-operative rehabilitation plan and utilize appropriate rehab protocol found on the OSU Sports Medicine Rehabilitation Protocol website.

Disclaimer

The following rehabilitation guidelines are specific to patients who have undergone a knee arthroscopy surgical procedure.

Progression is criterion-based and dependent on soft tissue healing, patient demographics, and clinical evaluation. The time frames identified for each phase of rehabilitation are approximate times and are not recommended as guidelines for progression for the individual patient. It is recommended that progression is based upon the achievement of functional criteria demonstrating readiness for progression, noted at the end of each phase.

If you are working with an Ohio State Sports Medicine patient and questions arise, please contact the author by calling our office at (614) 293-2385.

Summary of Recommendations

General	• ***Please refer to the "post-op plan" section of the operative note for any specific post-operative recommendations*** • In general, there are no weight bearing or ROM restrictions; progress as tolerated by patient • RTS expectation: 8-16 weeks
Weight Bearing Guidelines	• WBAT immediately following surgery
Range of Motion Progression	• Full knee ROM allowed immediately following surgery
Outcome Tools	Collect the LEFS at each visit *You may choose to include IKDC, KOOS, ACL-RSI, Tegner or other questionnaires specific to your patient's needs*.
Criteria to Discharge Assistive Device	1. ROM: Full active knee extension; no pain on passive overpressure 2. Strength: Able to perform strong quad isometric with full tetany and superior patellar glide and able to perform 20 SLR without quad lag 3. Effusion: 1+ or less is preferred (2+ acceptable if all other criteria are met) 4. Weight Bearing: Demonstrates pain-free ambulation without visible gait deviation
Criteria to Discharge NMES	<20% quadriceps deficit on isometric or isokinetic testing (can use HHD for isometric testing) **OR- If testing equipment is not available:** 1. 20 SLR without quad lag 2. Normal gait 3. 10 heel taps to 60 degrees with good quality 4. 10 rep max on LP and similar effort bilaterally 5. Inability to break quad MMT
Strength Testing	Isokinetic testing: 4-8 weeks per therapist discretion
Criteria to Initiate Running and Jumping	1. ROM: full, pain-free knee ROM, symmetrical with the uninvolved limb 2. Strength: Isokinetic testing 80% or greater for hamstring and quad at 60º/sec and 300º/sec 3. Effusion: 1+ or less 4. Weight Bearing: normalized gait and jogging mechanics 5. Neuromuscular Control: Pain-free hopping in place without dynamic knee valgus
Criteria for Return to Sport	1. ROM: full, pain-free knee ROM, symmetrical with the uninvolved limb 2. Strength: Isokinetic testing 90% or greater for hamstring and quad at 60º/sec and 300º/sec 3. Effusion: No reactive effusion ≥ 1+ with sport-specific activity 4. Weight Bearing: normalized gait and jogging mechanics 5. Neuromuscular control: appropriate mechanics and force attenuation strategies with high level agility, plyometrics, and high impact movements 6. Functional Hop Testing: LSI 90% or greater for all tests 7. Physician Clearance

RED/YELLOW FLAGS

Red Flags
 	
Require immediate referral for re-evaluation
	• Signs of DVT→ *Refer directly to ED*
	  ○ Localized tenderness along the distribution of deep venous system
	  ○ Entire LE swelling
	  ○ Calf swelling >3cm compared to asymptomatic limb
	  ○ Pitting edema
	  ○ Collateral superficial veins
	• Lack of full knee extension by 3 weeks post-op→*Refer to surgeon for re-evaluation*
	• Mechanical block or clunk→*Refer to surgeon for re-evaluation*
	• Reported episode of instability→*Refer to surgeon for re-evaluation*

Yellow Flags *Require modifications to plan of care*	• Persistent reactive effusion or pain following therapy or ADLs ○ *Decrease intensity of rehab interventions, continue effusion management, educate patient regarding activity modifications until symptoms resolve*

Phase I: Protection (Post-Operative – 3 weeks)

Post-operative evaluation should be performed 3-5 days following surgery. Follow-up PT appointments 1-2x per week, depending on progression towards goals

Goals	Restore ROM, minimize effusion and pain, increase tolerance to WB, normalize gait pattern
Pain and Effusion	Goal is ≤ 2+ (using Modified Stroke Test) – Appendix C Cryotherapy and compression

ROM	• Recommend full ROM exercise as soon as possible following surgery to decrease articular swelling, scar tissue formation, and joint stiffness
	• Emphasis on patellar mobilizations (all directions) to regain full knee ROM
	• Suggested interventions:
	  ○ Extension ROM: seated knee extension towel stretch, prone hang, bag hang (appendix A)
	  ○ Flexion ROM: heel slides, wall slides, upright bike
	  ○ Patellar mobilization: superior, inferior, medial, lateral
	Contact surgeon by 3 weeks post-op with ROM concerns

Weight Bearing	• WBAT immediately following surgery

Suggested Interventions	• Effusion management strategies
	  ○ RICE, ankle pumps
	• Quad, hamstring, gluteal isometrics
	• SLR 4-way
	• SLR Progression (holds, pulses, ABCs)
	• Clamshells
	• DL Bridge
	• Prone/Standing TKE
	• Gait training
	• Open Chain Knee Extension
	  ○ SAQ
	  ○ LAQ (modified range → full range as tolerated)
	  ○ Knee extension machine
	  ▪ DL → eccentrics→ SL
	• Open Chain Hamstring Exercise
	  ○ Prone hamstring curls, hamstring curl machine (DL → eccentrics → SL)
	• Shuttle press
	• DL Squat (modified range → full range as tolerated)
	• Sidestepping
	• SL balance
	• Heel raises

Blood Flow Restriction Training *Appendix D*	• Blood Flow Restriction (BFR) training can be initiated as soon as sutures are removed • Ensure patient has no contraindications (Appendix D) and if patient has any listed precautions or are at risk for a DVT, clear with physician before initiating BFR • Use BFR twice weekly for up to 10 weeks; use for 2-3 exercises per session • Can be used with any exercise that is safe for patient to perform depending on time since surgery (ex. SLR 4-way, prone TKE). *BFR should never be performed during a plyometric exercise.* • Training Load: 20-40% 1 RM (Estimated, or use OMNI-RES, see Appendix D) • Limb Occlusion Pressure= 80% (see Appendix D if patient unable to tolerate) • 4 sets for each exercise with reps of 30-15-15-15 (75 total) with a 30 second rest break between sets, keeping cuff inflated the entire duration of each exercise. Deflate between exercises, or every 8 minutes.
NMES Parameters at 60º *Appendix B*	• NMES pads are placed on the proximal and distal quadriceps • Patient: Seated in long sitting (knees extended) until able to achieve 90° knee flexion. Progress to seated at 60° knee flexion once they are able to easily obtain 90° • The patient is instructed to relax while the e-stim generates at least 50% of their max volitional contraction against a fixed resistance OR maximal tolerable amperage without knee joint pain • 10-20 seconds on/ 50 seconds off x 15 min
Criteria to Discharge Assistive Device	1. ROM: Full active knee extension; no pain on passive overpressure 2. Strength: Able to perform strong quad isometric with full tetany and superior patellar glide and able to perform 20 SLR without quad lag 3. Effusion: 1+ or less is preferred (2+ acceptable if all other criteria are met) 4. Weight Bearing: Demonstrates pain-free ambulation without visible gait deviation
Criteria to Progress to Phase II Rehab	1. ROM: symmetrical knee ROM compared bilaterally ***Contact MD by 3 weeks post op if ROM concerns*** 2. Strength: Quadriceps set with normal superior patellar translation, 20x SLR without extensor lag 3. Effusion: 1+ or less with Modified stroke test

Phase II: Strengthening/Return to Function (4 – 8 weeks)

Goals	Improve quadriceps, hamstring, gluteal, and core strength, neuromuscular control, and proper joint mechanics for safe return to dynamic activities
Pain and Effusion	Cryotherapy/compression as needed for effusion – effusion should be 1+ or less
Suggested Interventions	• Continue phase 1 interventions • BFR (continue as in early phase, adding appropriate exercises) • Progress SL knee extension machine and SL leg press • SL RDL • SL Squat (modified range → full range as tolerated) • Heel taps • Step ups • Lunges • Rear foot elevated split squat • SL hamstring curl machine • Progress gluteal and lumbopelvic strength and stability • Progress single leg balance and proprioceptive exercises • Continue NMES (see discharge criteria below) • Continue effusion management strategies as needed
Strength Testing *Appendix E, F*	Isokinetic testing: 4-8 weeks per therapist discretion
Criteria to Discharge NMES	• <20% quadriceps deficit on isometric testing (can use HHD for isometric testing) **If testing equipment is not available:** 1. 20 SLR without quad lag 2. Normal gait 3. 10 heel taps to 60 degrees with good quality 4. 10 rep max on LP and similar effort bilaterally 5. Inability to break quad MMT
Criteria to Progress to Phase III of Rehab	1. ROM: Maintain full, pain-free AROM including patellofemoral mobility 2. Effusion: 1+ or less with Modified Stroke Test and no reactive effusion with progressions 3. Strength: Isometric quadriceps and hamstrings strength >/= 80% 4. Weight Bearing: Able to tolerate therapeutic exercise program, including PWB plyometrics, without increased pain or >1+ effusion 5. Neuromuscular Control: Demonstrates proper lower extremity mechanics with all therapeutic exercises (bilaterally)

Phase III: Return to Activity/Sport (weeks 8 – RTS)

Goals	Normalize symmetrical loading patterns, jumping, and landing mechanics to ensure safe RTS
Criteria to initiate Running and Jumping	1. ROM: full, pain-free knee ROM, symmetrical with the uninvolved limb 2. Strength: Isokinetic testing 80% or greater for hamstring and quad at 60º/sec and 300º/sec 3. Effusion: 1+ or less 4. Weight Bearing: normalized gait and jogging mechanics 5. Neuromuscular Control: Pain-free hopping in place
Pain and Effusion	Effusion may increase with increased activity, ensure ≤1+ and/or non-reactive effusion for progression of plyometrics
ROM	Full, symmetrical to contralateral limb, and pain-free with overpressure

Strength Testing *Appendix E, F, G*	• Isokinetic testing: 4-8 weeks per therapist discretion
	• Hop testing (Appendix E) *Appropriate after 80% symmetry achieved on isokinetic testing*
	  ○ SL hop for distance
	  ○ Triple hop
	  ○ Cross over hop
	  ○ Timed 6m hop
	
	Functional strength testing and hop testing should be reserved for patients returning to high level activity

Suggested Interventions	• Continue to progress quadriceps, hamstrings and core strength/stability
	• BFR (continue as in early phase, adding appropriate exercises) – NO PLYOS WITH BFR
	
	Once strength criteria have been met, perform the following progression:
	Refer to plyometric progressions document on shared drive for additional resources
	  • PWB jumping on the shuttle (DL → SL → alternating)
	  • Overground hop-holds
	  • Full body weight jumping progression
	  • DL squat jumps, DL broad jumps, SL squat jumps, bounding
	  • Initiate walk-jog program once 80% LSI is achieved on isokinetic test
	
	Agility drills
	  • Fwd/bwd shuffle, side shuffle, carioca, figure 8, zig-zags, resisted jogging (Sport Cord), backpedaling, ladder drills, cutting and pivoting drills
	  ○ Begin agility exercises between 50-75% effort (utilize visual feedback to improve mechanics as needed)
	Plyometrics
	  • Double → Single-leg hop downs from increasing height (up to 12” box)
	  • Double → Single-leg hopping onto unstable surface
	  • Double → single-leg jump-turns
	  • Box jumps
	  • Repeated tuck jumps
	  • Lunge jumps
	  ○ Advance plyometrics: Bilateral to single leg, progress by altering surfaces, adding ball toss/ball handling, 3D rotations, etc.

Criteria for Return to Sport	1. ROM: full, pain free knee ROM, symmetrical with the uninvolved limb 2. Strength: Isokinetic testing 90% or greater for hamstring and quad at 60º/sec and 300º/sec 3. Effusion: No reactive effusion and ≤ 1+ with sport-specific activity 4. Weight Bearing: normalized gait and jogging mechanics 5. Neuromuscular control: appropriate mechanics and force attenuation strategies with high level agility, plyometrics, and high impact movements 6. Functional Hop Testing: LSI 90% or greater for all tests 7. Physician Clearance

Appendix A: Bag Hang

Emphasis on low load, long duration stretching

- *Goal: 60 minutes of bag hang time total per day.*
- *Ideally: 4x15 minutes (or greater) per day*

Appendix B: NMES Set Up

2 or 4 pad set-up is appropriate

- NMES pads are placed on the proximal and distal quadriceps
- Patient: Seated with the knee in at least 60º flexion, shank secured with strap and back support with thigh strap preferred. The ankle pad/belt should be two finger widths superior to the lateral malleoli
- The patient is instructed to relax while the e-stim generates at least 50% of their max volitional contraction against a fixed resistance OR maximal tolerable amperage without knee joint pain
- 10-20 seconds on/ 50 seconds off x 15 min

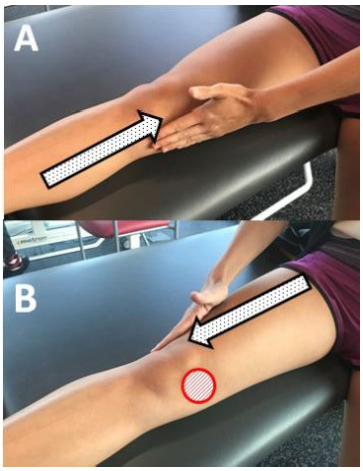
Appendix C: Stoke Test / Swelling Assessment

The Stroke Test

The stroke test is a great way to assess your swelling independently. The results of this assessment will help you decide what exercises are appropriate.

A. Using one hand, gently sweep the inside portion of your knee 2-3 times (pushing toward the hip joint).

B. On the outside portion of the knee, immediately sweep downward (toward the ankle). Watch the inside portion of the knee *(indicated by hashed circle in photo)* for a wave of fluid to appear during the downstroke.



Grading System

(Table adapted from Sturgill L et al, Journal of Orthopaedic & Sports Physical Therapy, 2009)

Test Result	Grade
No wave produced on downstroke	Zero
Small wave on inside aspect of knee with downstroke	Trace
Large bulge on inside aspect of knee with downstroke	1+
Swelling spontaneously returns to inside aspect of knee after upstroke (no downstroke necessary)	2+
So much fluid that it is not possible to move the swelling out of the inside aspect of the knee	3+

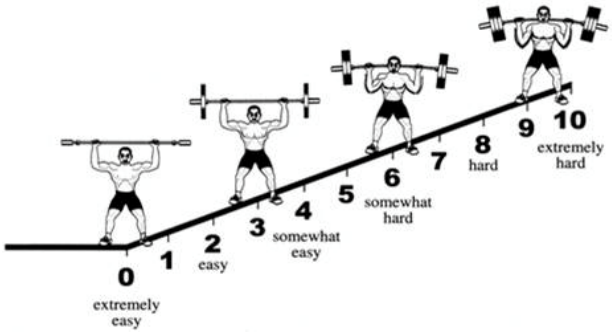
Indications for Activity

3+ or 2+	1+	Trace or Zero
Red Light	**Yellow Light**	**Green Light**
• No running, jumping or cutting or heavy lifting until swelling decreases to 1+ or less • Do not progress program until you speak with your therapist • Utilize swelling management strategies (ice, compression, elevation, NSAIDs)	• Proceed with caution • You may participate in running, jumping and normal lifting routine. • Check effusion before and after workouts • Utilize swelling management strategies (ice, compression, elevation, NSAIDs)	• May participate in running, jumping and normal lifting routine without restriction • Continue to monitor swelling after activity

Appendix D: Blood Flow Restriction Training

Precautions (must get permission from MD)	Contraindications
▪ Patients with poor circulatory systems (Indicators: shining or scaly skin, brittle dry nails, extremity hair loss, increased capillary filling time, and presence of varicose veins) ▪ Patients who are obese or with limb tissue that is loose ▪ Arterial claudification ▪ Abnormal clotting times ▪ Diabetes ▪ Sickle cell trait ▪ Tumor ▪ General infection ▪ Hypertension ▪ Cardiopulmonary conditions ▪ Renal compromise ▪ Clinically significant acid-base imbalance ▪ Atherosclerotic vessels ▪ Taking anti-hypertensive medications	▪ Venous thromboembolism ▪ Impaired circulation or peripheral vascular compromise ▪ Previous revascularization of the extremity ▪ Extremities with dialysis access ▪ Acidosis ▪ Sickle cell anemia ▪ Extremity infection ▪ Tumor distal to the tourniquet ▪ Medications/supplements known to ↑ clotting risk ▪ Open fracture ▪ Increased intracranial pressure ▪ Open soft tissue injuries ▪ Post-traumatic hand reconstructions ▪ Severe crushing injuries ▪ Severe hypertension ▪ Elbow surgery with excessive swelling ▪ Skin grafts in which all bleeding points distinguished ▪ Secondary or delayed procedures after immobilization ▪ Vascular grafting lymphectomies ▪ Cancer

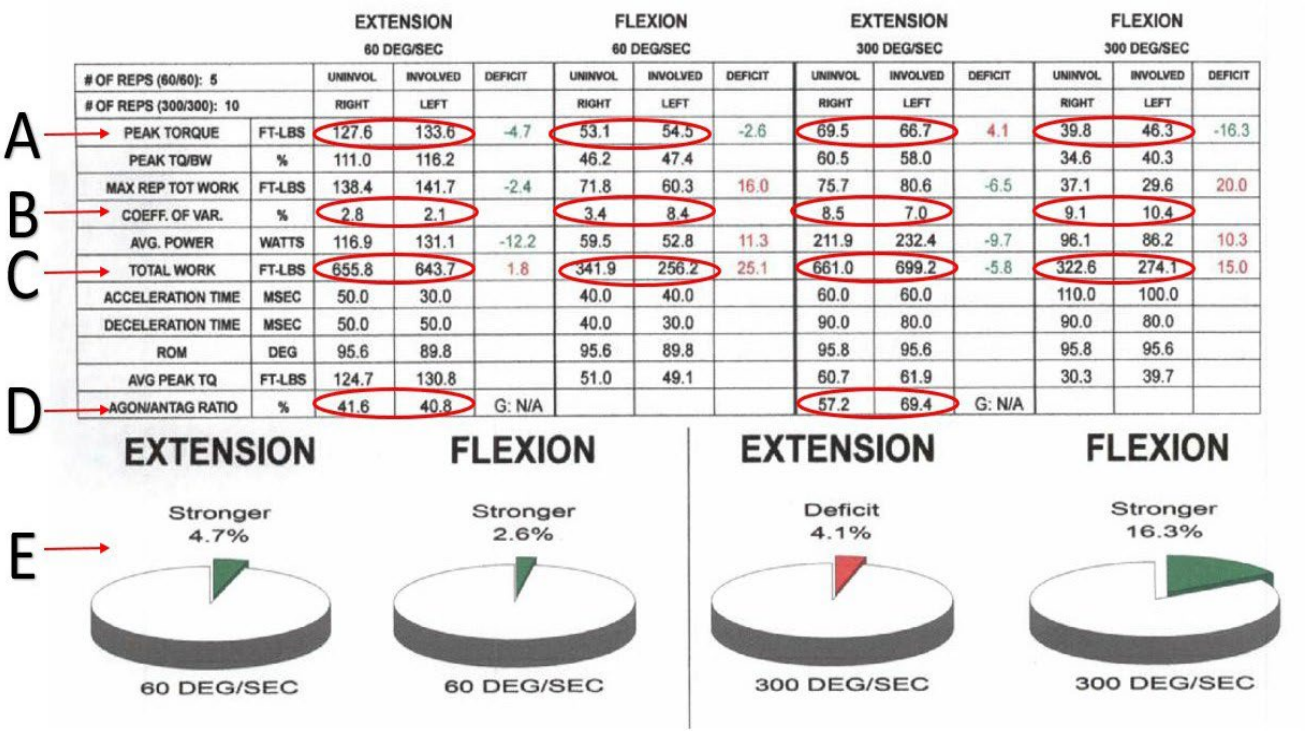
Training Intensity: 20-40% 1RM or use the Omnibus Resistance Exercise Scale (below). Patient chooses weight/resistance that corresponds to 2-3



Exercise Prescription:

- If Patient achieves:
  - 75 repetitions: continue with training, re-assess intensity within 1-3 sessions and change as strength improves
  - 60-74 repetitions: continue with training, but extend rest period between sets 3 and 4 to 45 seconds until 75 repetitions is completed
  - 45-59 repetitions: continue with training, but extend rest period between all sets to 45-60 seconds
  - <44 repetitions: reduce load by approximately 10% until repetitions are achieved
- If patient is forced to stop before 75 repetitions due to undue pain, soreness, or general uncomfortable feeling underneath the cuff→ reduce tourniquet pressure by 10mmHg at each training session until cuff tolerance is achieved. Ramp cuff pressure back up by 10 mmHg to target limb occlusion pressure if patient can tolerate.

Appendix E: Isokinetic Data Interpretation



	EXTENSION 60 DEG/SEC			FLEXION 60 DEG/SEC			EXTENSION 300 DEG/SEC			FLEXION 300 DEG/SEC		
# OF REPS (60/60): 5	UNINVOL	INVOLVED	DEFICIT	UNINVOL	INVOLVED	DEFICIT	UNINVOL	INVOLVED	DEFICIT	UNINVOL	INVOLVED	DEFICIT
# OF REPS (300/300): 10	RIGHT	LEFT		RIGHT	LEFT		RIGHT	LEFT		RIGHT	LEFT	
A → PEAK TORQUE FT-LBS	127.6	133.6	-4.7	53.1	54.5	-2.6	69.5	66.7	4.1	39.8	46.3	-16.3
PEAK TQ/BW %	111.0	116.2		46.2	47.4		60.5	58.0		34.6	40.3	
MAX REP TOT WORK FT-LBS	138.4	141.7	-2.4	71.8	60.3	16.0	75.7	80.6	-6.5	37.1	29.6	20.0
B → COEFF. OF VAR. %	2.8	2.1		3.4	8.4		8.5	7.0		9.1	10.4	
AVG. POWER WATTS	116.9	131.1	-12.2	59.5	52.8	11.3	211.9	232.4	-9.7	96.1	86.2	10.3
C → TOTAL WORK FT-LBS	655.8	643.7	1.8	341.9	256.2	25.1	661.0	699.2	-5.8	322.6	274.1	15.0
ACCELERATION TIME MSEC	50.0	30.0		40.0	40.0		60.0	60.0		110.0	100.0	
DECELERATION TIME MSEC	50.0	50.0		40.0	30.0		90.0	80.0		90.0	80.0	
ROM DEG	95.6	89.8		95.6	89.8		95.8	95.6		95.8	95.6	
AVG PEAK TQ FT-LBS	124.7	130.8		51.0	49.1		60.7	61.9		30.3	39.7	
D → AGON/ANTAG RATIO %	41.6	40.8	G: N/A				57.2	69.4	G: N/A			

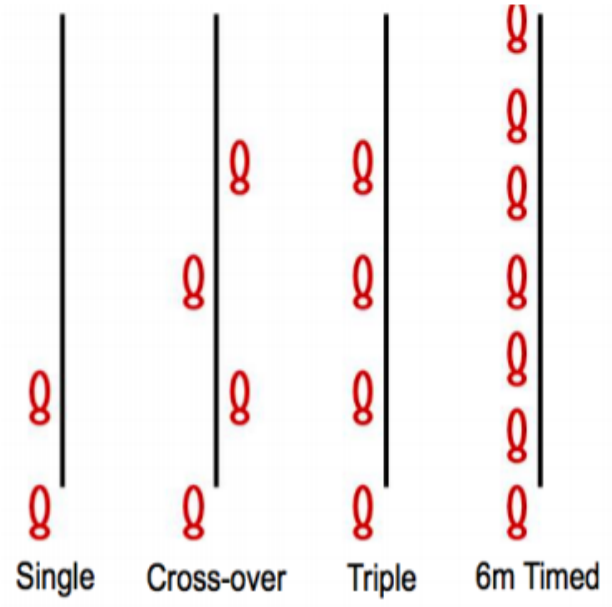
		Definition	Clinical Impact	What to do
A	Peak Torque (ft-lbs)	Peak torque during repetitions	Symmetry criteria (see 'E'- this is the data represented in pie charts)	If <80%; continue unilateral, high resistance strength training
B	Coefficient of Variance (%)	Between repetition variability	Goal: < 15%	If >15%, consider retest
C	Total Work (ft-lbs)	Torque over all repetitions	Possible indicator of fatigue	If >10%; consider high volume training
D	Agonist/Antagonist Ratio (%)	Hamstring/Quadriceps Ratio	Goal: >60%	<60%; ensure 1:1 quadriceps:hamstring exercise ratio
E	Limb Symmetry Pie Charts	Strength relative to involved limb	Goal: <10% asymmetry (either direction- deficit OR stronger on involved limb)	If <80%, continue NMES in addition to strength training If <90%, continue unilateral > bilateral strength training emphasis

Appendix F: Isokinetic Testing and Appropriate Alternatives

Isokinetic Dynamometry		• Considered the “gold standard” • 60°/sec for strength and power assessment • 300°/second for speed and endurance assessment
Hand Held Dynamometry with Static Fixation at 90°		• Appropriate alternative • Results may overestimate quadriceps strength symmetry: be cautious with data interpretation
SL 1RM Knee Extension Machine: 90°- 45°		• Appropriate alternative • Recommended to decrease stress on PF joint and limit strain on reconstructed ACL for up to 6 months • Results may overestimate quadriceps strength symmetry: be cautious with data interpretation
SL 1RM Leg Press		• Fair alternative • Results in significant overestimation of quadriceps strength symmetry due to compensation from other LE muscle groups
SL 1RM Knee Extension Machine: 90°- 0°		• Fair alternative • May be uncomfortable and/or inappropriate due to PF stress

Appendix G: Single Leg Hop Series

1) **Single hop for distance:** Have the subject line their heel up with the zero mark of the tape measure, wearing athletic shoes. The subject then hops as far as he/she can, landing on the same push off leg, for at least 3 seconds. The arms are allowed to move freely during the testing. Allow him/her to perform 2 practice hops on each leg. Then, have the subject perform 2 testing trial, recording each distance from the starting point to the back of the heel. Average the distanced hopped for each limb. The Limb Symmetry Index: Involved limb distance/Uninvolved limb distance X 100%.
2) **Cross-over hop for distance:** The subject lines their heel up with the zero mark of the tape measure and hops 3 times on one foot, crossing fully over the center line each time. Each subject should hop as far forward as he/she can on each hop, but only the total distance hopped is recorded. The arms are allowed to move freely during the testing. Allow him/her to perform 2 practice hops on each leg. Then, have the subject perform 2 testing trial, recording each distance from the starting point to the back of the heel. Average the distanced hopped for each limb. The Limb Symmetry Index: Involved limb distance/Uninvolved limb distance X 100%.
3) **Triple hop for distance:** The subject lines their heel up with the zero mark of the tape measure and hops 3 times on one foot. Each subject should hop as far forward as he/she can on each hop, but only the total distance hopped is recorded. The arms are allowed to move freely during the testing. Allow him/her to perform 2 practice hops on each leg. Then, have the subject perform 2 testing trial, recording each distance from the starting point to the back of the heel. Average the distanced hopped for each limb. The Limb Symmetry Index: Involved limb distance/Uninvolved limb distance X 100%.
4) **Timed 6-meter hop:** The subject lines their heel up at the zero mark of the tape measure and hops, on cue with the tester, as fast as they can the length of the 6-meter tape. The arms are allowed to move freely during the testing. Allow him/her to perform 2 practice hops on each leg. Then, have the subject perform 2 testing trial, recording each distance from the starting point to the back of the heel. Average the distanced hopped for each limb. The Limb Symmetry Index: Involved limb time/Uninvolved limb time X 100%.



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