ValleyOrtho Rehabilitation Playbook Series

Physician: Dr. Ferdinand Liotta **Physician Assistant:** Amanda Hunter **MA:** Kara Morgan **ATC:** Maddy Prior & Dylan Frazier
Office Phone: 970-384-7140 **Office Fax:** 970-384-8133

Surgical Procedure: Vertical Longitudinal & Peripheral Meniscus Repair GREEN Playbook

The intent of this information is to inform the treating clinician on the evidence-based considerations to be used as a guideline regarding the surgery noted above. This is not a substitute for appropriate clinical decision making, but a supplement to that effect. If at any time a clinician feels uncertain about a given phase discrepancy or patient presentation they are strongly encouraged to discuss this with the referring physician and his/her team.
****It is the responsibility of the therapist to read the operative report before providing care to the patient to improve treatment communication***.*

Therapeutic Activity Progression Disclaimer: Progression to the next phase should be strongly based on meeting clinical criteria (not solely based on the post-operative timeframes) as appropriate and in collaboration with the referring surgeon. Exercise prescription should be clinically directed by pain and performance absent of detrimental movement patterns with respect to proper biomechanics of the spine, hip, knee and ankle.

Communication Recommendations from Therapist to Surgical Team: When a treating therapist feels the need to reach out to Dr. Liotta, or a member of his team, at any point for any reason they are strongly encouraged to do so. All concerns are not explicitly written and clinical judgement is paramount. Below is a handful of reasons and suggested methods of contact to promote communication:

Urgent Red Flag Communication: the patient is in clinic and an action is required as directed by referring staff office
- Uncontrollable and unremitting pain.
- Signs of infection at incision or treated limb.
- Severe palpation tenderness, swelling, tachycardia (UE or LE DVT).
- Labored breathing (PE).
- Drastic decline in ROM.
- After a fall/trauma, or near fall/trauma, resulting in a clinical change.

Preferred Contact Method: 1. Immediate call to MD or PA Cell. 2. Office phone call to request consult with MD/PA/MA/ATC until answer.

Administrative Needs
- Rehabilitation Prescription needed or prescription change requests.
- Appointment needed with the physician office, or medication refill.

Preferred Contact Method: Office phone call to MA/ATC.

Other Patient Concerns During Clinic Hours M-TH 9am-5pm F 9-3pm
- Abnormal pain, comorbidities or complications that may prevent attainment of established discharge criteria.
- Patient is noncompliant with rehabilitation process.
- Excessive muscle guarding/motion phobia after 1-2 outpatient visits.
- Adverse work or home practices negatively impacting recovery.
- Patient expresses discontent or concerns with the current POC established by PT and/or by MD/PA

Preferred Contact Method: Phone call to MD &/or PA

Preferred Updates before checkup visits with MD/PA
During Clinic Hours M-TH 9am-5pm F 9am-3pm
- Information regarding adherence/participation in rehabilitation process.
- Comments on progress and trends of the patient's rehab course.

Preferred Contact Method: Phone call MD and/or PA. Or Fax update.

Phase 1: Edema, Quadriceps & ROM Recovery (*wks 0 to 3*)

Goals:

- Minimize pain/swelling to decrease quad inhibition[13]
- Normalize quadriceps activation/control[13]
- Set baseline KOOS-pain/KOOS-Sport for RTS readiness[22] (Appendix A)

Precautions/Restrictions:

- WB/Gait:
  - ☐ WBAT in locked EXT brace[3, 7, 11] until week 5[6] to prevent any incidental WB pivoting[14]
- A/AA/PROM:
  - ☐ OKC ≠ brace and reduced BW CKC in brace per quad control from 0-90° until week 4[14], then progress as tolerated from 0-125° until week 6[11]
- Activity:
  - ☐ No isolated RROM HS for 6 weeks[1, 2]
  - ☐ No pivot/twisting training until week 10[2]

Phase 1 Therapeutic Activities:

- Gait:
  - ☐ Progression from bilateral crutches to single crutch within knee extension brace
  - ☐ D/C single crutch when patient can ambulate ≠ pain/swelling increase and without detrimental limp in knee extension brace
- ROM:
  - ☐ Manual & self-management for flexibility, swelling and full ext[2]
  - ☐ Scar mobilizations on healed incisions[1]
  - ☐ Stationary bike at <50% BW loading 0-90°[11]
- Strengthening:
  - ☐ Quad TKE focused activity[2, 13]
  - ☐ NMES to quad with volitional contraction as needed [2, 13]
  - ☐ Consider blood flow restriction to deter atrophy[2]
- Balance:
  - ☐Proprioception with TKE control within precautions[1]

Criteria for Progression to Phase 2:

- 0^0 EXT[2], ≈ 90^0 Flexion[14]
- 20 SLR ≠ Quad Lag[15]

Phase 2: ROM, Total LE Strengthening & Balance (*wks 3 to 6*)

Goals:

- Consistent swelling resolution despite activity increases
- Proper gait mechanics by end of phase

Precautions:

- WB/Gait:
  - ☐ WBAT wean from brace with quad control and from crutches ≠ limp after week 4
- A/AA/PROM:
  - ☐ OKC and reduced BW CKC as tolerated 0-125 until week 6[11]
- Activity:
  - ☐ No isolated RROM HS for 6 weeks[2]
  - ☐ No plyometrics in this phase [1, 2, 8, 13]
  - ☐ Avoid pivot/twisting training until week 10[2]

Phase 2 Therapeutic Activities with Respect to WB/ROM Status:

- Gait:
  - ☐ Ensure proper weight shifting over involved extremity with appropriate assistance based on repair type, pain and quad control
- ROM:
  - ☐ Manual & self-management for flexibility, swelling
  - ☐ Stationary bike as tolerated[12]
- Strengthening:
  - ☐ Total LE strengthening/activities aimed avoid valgus collapse and promote core strength/pelvis control[2]
  - ☐ Continue quad focused activity [2, 13]
  - ☐ Double leg Mini squats <90°[1]
- Balance:
  - ☐Proprioception training progressions within precautions[1]

Criteria for Progression to Phase 3:

- Normal gait mechanics without AD
- 0-125° AROM

Phase 3: Total LE Strengthening & Balance (*wks 6 to 12*)

Goals:

- Full flexion ROM between 6-10 weeks[2, 8]
- **In prepubescent patients:** focus primarily on form control and movement patterns instead of muscle hypertrophy as their bodies will not put on muscle growth as in more mature patients[16]

Precautions:

- Avoid pivot/twisting training until week 10[2]

Phase 3 Therapeutic Activities:

- ROM:
  - ☐ Manual & self-management for gains in ROM, flexibility & swelling
- Strengthening & Activity:
  - ☐ Progressions of Total LE CKC & OKC 0-90° strengthening aimed avoid valgus collapse and promote core strength/pelvis control[2]
  - ☐ Stationary bike as tolerated[12]
  - ☐ Elliptical OK
  - ☐ Plyometric initiation[1] with cautious progressions from double leg to single leg with good valgus control
- Balance:
  - ☐ Proprioception training progressions with variable surfaces and perturbations

Criteria for Phase 4 & Running Initiation at week 8[8]:

1. Full AROM and joint girth at 100% LSI[2, 3]
2. WB symmetry with squat form to 60º [2]
3. Stork test[2] at 75% LSI (Appendix B)
4. Isometric leg press at 60º of knee flexion LSI ≥ 75%[2, 3] (Appendix C)
5. Isometric quad and HS LSI ≥ 75% at 60º of flexion[2, 3] (Appendix D-E)
6. Anterior Reach ≤ 4cm difference Vs uninvolved LE[2, 3] (Appendix F)
7. Single leg hop test LSI ≥ 70%[17] (Appendix G)

Phase 4: Single Leg Strength & Plyometrics (*wks 12+*)

Goals:

- Increasing strength to support desired activity
- Optimize biomechanics at the hip, knee and ankle
- Address remaining barriers to RTS via KOOS-pain/KOOS-sport[22]
- Establish patient specific HEP relative to resources and goals.
- Post activity soreness resolves within 24 hours[12]

Precautions:

- Ensure proper limb biomechanics with activity progressions to optimize force distribution across tibiofemoral joint

Phase 4 Therapeutic Activities:

- Begin sport specific drills/patterns at 50% effort[15]
- Single leg plyometric progressions without valgus[15]
- Ladder drills and progressive agility at 50-75% effort as tolerated[15]
- High level balance training
- Slow progressions of cutting/pivot & decelerating intensity as tolerated
- Continue total lower extremity strengthening based on remaining deficits

Criteria for Progression to Return to Activity Testing:

- No complaints with functional or exercise tasks
- Reports confidence with all running and jumping tasks
- Return to activity timelines vary by repair type and are based on achieving clinical criteria with return to activity testing:
  - ☐ Typical return ≈ 12-16 weeks[3, 6]

Progression Note:

- Clinical outcomes were not affected by age, chronicity of injury, sex or concurrent ACL[10]
- If comorbidities create unattainable goals for discharge, discuss this with the treating physician group.

Criteria for Return to Recreational Activity:

General Ortho Patient:

- Patient meets all return to running criteria in phase 3.
- Max single leg press LSI ≥ 90%[6, 10, 11, 19]

Recreational Athlete Sequence (includes above):

- Max Isometric Quad and HS LSI ≥ 90% [18] OKC at 60^0 of knee flexion.
- Single leg hop test and Crossover hop test[21] for distance: LSI ≥ 90%[18]

Competitive Athlete (includes above):

- Max single leg press LSI ≥ 95%[18]
- Max Isometric Quad and HS LSI ≥ 95%[18] OKC at 60^0 of knee flexion
- Single Leg hop test for distance: LSI ≥ 95%[18]
- Side Hop test: LSI ≥ 90%[19] (Appendix H)
- Crossover hop test for distance ≥ 95% LSI[18, 21] (Appendix I)

Abbreviation List:

AAROM: Active assisted range of motion
ABD: Abduction
AD: Assistive device
ADL: Activity of daily Living
AROM: Active range of motion
BPTB: Bone patellar tendon bone
BW: Body Weight
CKC: Closed kinetic chain
DVT: Deep vein thrombosis
ER: External rotation
EXT: Extension
FWB: Full weight bearing
GHJ: Gleno-humeral joint
HEP: Home exercise program
HS: Hamstring
IR: Internal rotation
LCL: Lateral collateral ligament
LE: Lower extremity
MA: Medical assistant
LSI: Limb Symmetry Index = *(Average score of the involved leg divided by the score of the uninvolved leg for a specific test)*
MCL: Medial collateral ligament
MD: Medical doctor
NWB: Non weight bearing
OKC: Open kinetic chain
PA: Physician assistant
PCL: Posterior cruciate ligament
PE: Pulmonary embolism
PLC: Posterior lateral corner
PROM: Passive range of motion
ROM: Range of motion
RP: Resting position
RROM: Resisted range of motion
RTS: Return to sport/activity
SLR: Straight leg raise
UE: Upper extremity
TKE: Terminal knee extension
WB: Weight bearing
WBAT: Weight bearing as tolerated
#: Pounds
≠: Absent/Without
≈: Approximately
≤: Less than or equal to
≥: Greater than or equal to

Return to Activity Test Descriptions:

Stork Balance Test[20]: (Appendix B for diagram)

- Hands on hips. NWB foot: medial distal femur or medial proximal tibia.
- Timer starts when the patient lifts heel of the stance foot off the ground.
- Timer stops if/when the patient removes hands from hips, NWB foot from medial stance leg or the heel comes in contact with the ground.

Anterior Reach Test[2,3]: (Appendix F for diagram)

- Stand on one leg and slide a tissue box forward with the toes of the other foot by pushing on the side of the box. Goals is to push the box as far as possible and return back to the starting upright position.
- Once contact is lost between the toes and the box the slide is over.
- Perform 6 warm up attempts per leg to diminish learning effect.
- Failed attempt = the sliding foot touches down on the floor or on top of the slide box before returning back to the starting position. Cannot kick or flick box forwards.
- Distance is measured from toe of standing foot to back edge of the box. Take the best of 3 attempts for each leg.

Single Leg Hop Test for Distance[18]: (See Appendix G for diagram)

- Measure patient's standing height in cm for pass/fail.
- Hands on hips to prevent arm swing momentum.
  - □ Arms can release for landing assistance after leaving the ground.
- 4 progressive warm up jumps ≈ 25%, 50%, 75% and 100% intensity.
- Patient must "stick" the landing ≠ significant knee valgus.
- Use the best of 3 maximum effort jump tests.
- Distance is measured from toe of start line to shortest distanced heel.

Single Leg Timed Side Hop Test[19]: (See Appendix H for diagram)

- Set up: 2 parallel lines on floor, with outer edges of lines 40cm apart.
- Start position: standing on single test leg with hands on hips.
- Action: Patient hops from outside of one line to outside of the other.
- Record the total number of completed foot strikes in 30 seconds.
  - □ Completed foot strikes = foot lands completely outside the line, without touching the line, while maintaining hand position.

Crossover Hop Test[21]: (See Appendix I for diagram)

- Patient starts on one leg with center line just lateral to stance leg.
- Patient is instructed to maximally hop forwards 3 times on the same. stance leg, alternately crossing a ≈15cm wide line.
- Distance is measured from toe of start line to heel of 3rd landed hop.

Quick Reference Activity Timeline:

Activity	Vertical Longitudinal & Peripheral Repair Activity Restrictions
Weight Bearing / Gait	• Immediately WBAT in locked Extension brace until week 5
Knee ROM	• OKC and reduced BW CKC 0-90° until week 4 • OKC and reduced BW CKC 0-125° weeks 4-6
CKC Squats	• Reduced BW 0-90 until week 6 • Progressive load increase as tolerated for weeks 6+
OKC RROM	• **Flexion:** Avoid until week 6 • **Extension:** OK within ROM precautions per phase
Plyometrics	• Begin with cautious progressions from double leg to single leg with good valgus control at week 6
Running	• OK as soon as 8 weeks AND meeting return to run criteria
Pivoting / Twisting	• Avoid training until week 10
Return to Sport Cleared by MD	• Having met all return to activity testing criteria related to level of desired intensity on page 4 • Typical return ≈ 12-16 weeks

Appendix A:
KOOS-pain/KOOS-sport

KOOS-Pain & KOOS-Sport Knee Surveys

Scoring KOOS Tests:
Items are scored on a 0-4 scale. Compare scores from the time of surgery to the time of return to activity to determine if Minimal Clinically Important Difference (MCID) that shows significant positive trend of RTS has been met.

Scoring KOOS-Pain:
The MCID is 9.7 points improvement for KOOS-pain[22]

Scoring KOOS-Sport:
The MCID is 14.7 points improvement for KOOS-sport[22]

Today's date: _____/_____/_____ **Date of birth:** _____/_____/_____

Name: _____

INSTRUCTIONS: This survey asks for your view about your knee. Answer every question by ticking the appropriate box, only one box for each question. If you are unsure about how to answer a question, please give the best answer you can.

PAIN:

	Never	Monthly	Weekly	Daily	Always
1. How often do you experience pain?	☐	☐	☐	☐	☐
What amount of knee pain have you experienced the last week during the following activities?					
	None	**Mild**	**Moderate**	**Severe**	**Extreme**
2. Twisting/pivoting on your knee.	☐	☐	☐	☐	☐
3. Straightening knee fully.	☐	☐	☐	☐	☐
4. Bending knee fully.	☐	☐	☐	☐	☐
5. Walking on flat surface.	☐	☐	☐	☐	☐
6. Going up or down stairs.	☐	☐	☐	☐	☐
7. At night while in bed.	☐	☐	☐	☐	☐
8. Sitting or lying.	☐	☐	☐	☐	☐
9. Standing upright.	☐	☐	☐	☐	☐
	Total Score 1-9:				

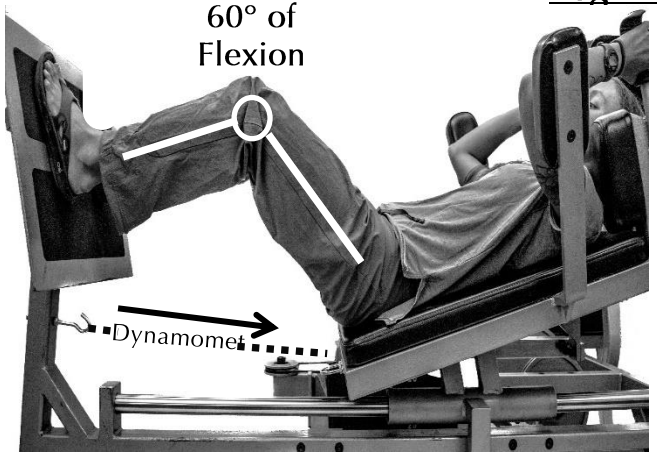
SPORT:

The following questions concern your physical function when being active on a higher level. The questions should be answered thinking of what degree of difficulty you have experienced during the **last week** due to your knee.

	None	Mild	Moderate	Severe	Extreme
1. Squatting.	☐	☐	☐	☐	☐
2. Running.	☐	☐	☐	☐	☐
3. Jumping.	☐	☐	☐	☐	☐
4. Twisting/Pivoting on your knee.	☐	☐	☐	☐	☐
5. Kneeling.	☐	☐	☐	☐	☐
	Total Score 1-5:				

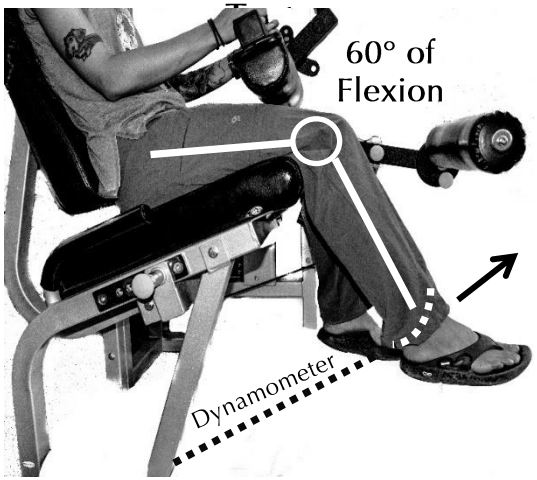
Appendix B: The Stork Test

Appendix C: Isometric Single Leg Leg Press



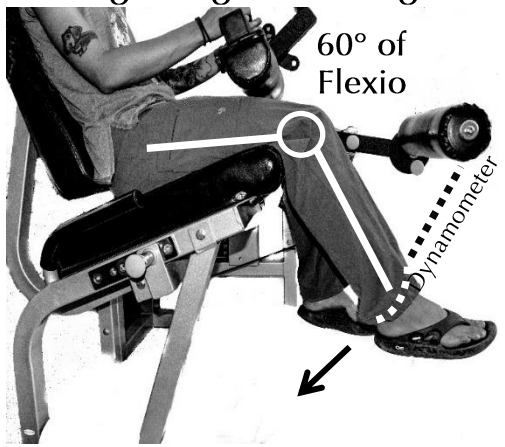
- Adjust foot and leg press position so that the knee is in 60 degrees of knee flexion when there is no slack in the dynamometer attachment.
- Perform maximal effort isometric tests per leg.
- Involved ÷ uninvolved x 100 = LSI

Appendix D: Isometric Single Leg Quadriceps



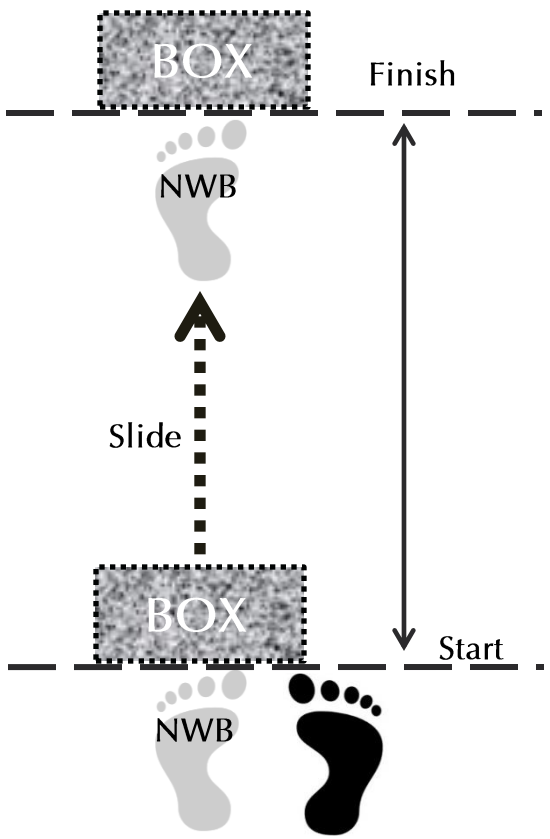
- Adjust seat position and dynamometer length so that there is no slack in the dynamometer attachment when the knee is in 60° knee flexion.
- Perform max effort isometric tests per leg.
- Involved ÷ uninvolved x 100 = LSI

Appendix E: Isometric Single Leg Hamstring

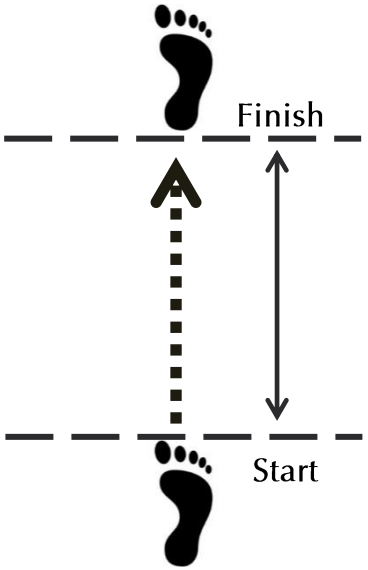


- Adjust seat position and dynamometer length so that there is no slack in the dynamometer attachment when the knee is in 60° knee flexion.
- Perform maximal effort isometric tests per leg.
- Involved ÷ uninvolved x 100 = LSI

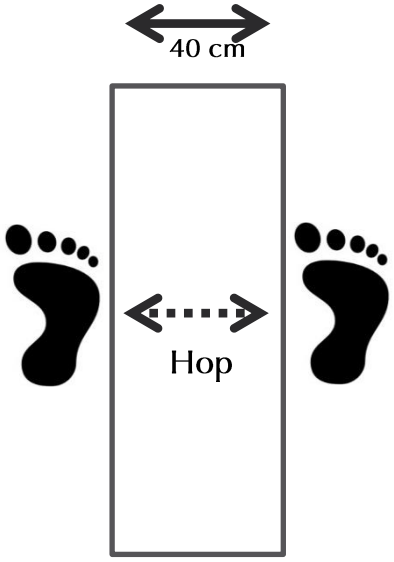
Appendix F: Anterior Reach Test (cm)



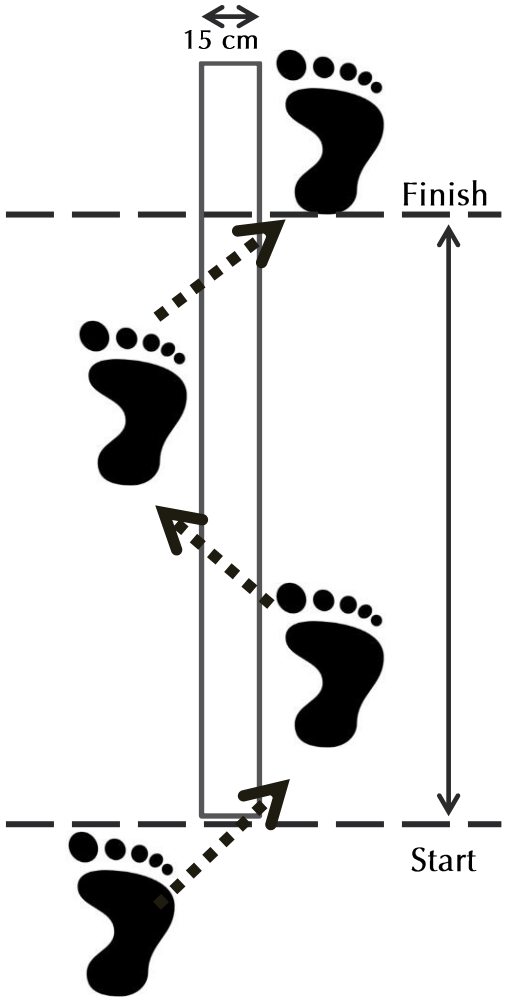
Appendix G: Single Leg Hop Test



Appendix H: Single Leg Timed Side Hop Test



Appendix I: Crossover Hop



Meniscus References:

1. Brigham and Women's Hospital, Inc. Department of Rehabilitation Services. Meniscal Repair. 2007. https://www.brighamandwomens.org/assets/bwh/patients-and-families/rehabilitation-services/pdfs/knee-meniscal-repair-protocol-bwh.pdf
2. Gunderson Health System. Meniscus Repair Rehabilitation Program. November 2019. https://www.gundersenhealth.org/app/files/public/1473/Sports-Medicine-Protocol-Meniscus-Repair.pdf
3. Harput, G. et al. Postoperative rehabilitation and outcomes following arthroscopic isolated meniscus repairs: A systematic review. *Physical Therapy in Sport.* 2020 Sep;45:76-85. doi: 10.1016/j.ptsp.2020.06.011. Epub 2020 Jul 13
4. Hupperich, A. et al. What are the factors to affect outcome and healing of meniscus bucket handle tears? *Archives of Orthopaedic and Trauma Surgery.* 2018 Oct;138(10):1365-1373. doi: 10.1007/s00402-018-2989-7. Epub 2018 Jun 29.
5. Kedgley, A. et al. Predicting meniscal tear stability across knee-joint flexion using finite-element analysis *Knee Surg Sports Traumatol Arthrosc.* 2019 Jan;27(1):206-214. doi: 10.1007/s00167-018-5090-4. Epub 2018 Aug 10.
6. Lucas, G. et al. Isolated meniscal injuries in paediatric patients: outcomes after arthroscopic repair. *Orthop Traumatol Surg Res.* 2015 Apr;101(2):173-7. doi: 10.1016/j.otsr.2014.12.006. Epub 2015 Feb 9.
7. McCulloch, P. et al. Does simulated walking cause gapping of meniscal repairs? *J Exp Orthop.* 2016 Dec;3(1):11. doi: 10.1186/s40634-016-0047-3. Epub 2016 Mar 15.
8. O'Donnell, K. et al. Rehabilitation Protocols After Isolated Meniscal Repair: A Systematic Review. *Am J Sports Med.* 2017 Jun;45(7):1687-1697. doi: 10.1177/0363546516667578. Epub 2016 Oct 7.
9. Perkins, B. et al. Similar failure rate in immediate post-operative weight bearing versus protected weight bearing following meniscal repair on peripheral, vertical meniscal tears. *Knee Surg Sports Traumatol Arthrosc.* 2018 Aug;26(8):2245-2250. doi: 10.1007/s00167-017-4665-9. Epub 2017 Aug 16.
10. Smoak, J. et al. An Up-to-Date Review of the Meniscus Literature: A Systematic Summary of Systematic Reviews and Meta-analyses *Orthop J Sports Med.* 2020 Sep 9; 8(9): 2325967120950306. doi: 10.1177/2325967120950306. eCollection 2020 Sep.
11. Spang, R. et al. Rehabilitation following meniscal repair: a systematic review *BMJ Open Sport Exerc Med.* 2018 Apr 9;4(1):e000212. doi: 10.1136/bmjsem-2016-000212. eCollection 2018.
12. University of Wisconsin Sports Medicine. Rehabilitation Guidelines for Meniscal Repair. November 2017. https://www.uwhealth.org/files/uwhealth/docs/pdf/SM14890_Meniscus_Repair8.pdf.
13. Wilk, K. et al. Rehabilitation principles of the anterior cruciate ligament reconstructed knee twelve steps for successful progression and return to play. *Clin Sports Med.* 36 (2017) 189-232.
14. Liotta, F. Expert Opinion and Consultation.
15. Wright, R et al. Anterior Cruciate Ligament Reconstruction Rehabilitation: MOON Guidelines. *Sports Health.* 2015 May;7(3):239-43. doi: 10.1177/1941738113517855.
16. Ardern, C.L et al. 2018 International Olympic Committee consensus statement on prevention, diagnosis and management of pediatric anterior cruciate ligament injuries. *Knee Surg Sports Traumatol Arthrosc.* 2018 Apr;26(4):989-1010. doi: 10.1007/s00167-018-4865-y. Epub 2018 Feb 17.

17. Rambaud, A et al. Criteria for return to running after anterior cruciate ligament reconstruction: a scoping review. *Br J Sports Med.* 2018 Nov;52(22):1437-1444. doi: 10.1136/bjsports-2017-098602. Epub 2018 May 2.
18. Davies G.J et al. Individualizing the Return to Sports After Anterior Cruciate Ligament Reconstruction. *Operative Techniques in Orthopaedics.* 2017 Mar 27:1 70-78.
19. Gustavsson, A. et al. A test battery for evaluating hop performance in patients with an ACL injury and patients who have undergone ACL reconstruction. *Knee Surg Sports Traumatol Arthrosc.* 2006; 14: 778-788. DOI 10.1007/s00167-006-0045-6.
20. Schell, J et al. *Physical Fitness Assessment in Exercise and Sports Science.* 1994 2nd Ed, Leelar Biomedisience Services, Matraville, NSW. p. 327
21. Munro, A et al. Between-Session Reliability of Four Hop Tests and the Agility T-Test. *Journal of strength and conditioning research.* May 2011; 25, (5): 1470-1477.
22. Agarwalla, A. et al. Predictive factors and duration to return to sport after isolated meniscectomy. *The Orthopaedic Journal of Sports Medicine. 2019: 7 (4).*