

- When flexion of greater than 110 degrees is achieved, the patient is able to progress to full stationary cycling to assist with edema.
- The patient may begin active exercise in closed and open chain with the possible addition of neuromuscular electrical stimulation (NMES) to assist in the improvement of quadriceps strength when they present with full and active ROM, no knee joint effusion, and can perform a straight leg raise without lag.
- Squats, lunges, leg press, and stepping down may be introduced when ROM improves to 0-125 degrees and there is good patellar mobility present (Cavanaugh and Powers, 2017). A KT1000 should be performed at around 3 months post-surgery.
- When the patient has control of terminal knee extension in weight-bearing positions, 80% of the **quadriceps index**, and 80% symmetry on the hop test with good movement quality, they can begin on plyometrics, agility drills, and more extensive standing balance activities. Focus should be on achieving sound movement patterns while characteristics such as speed, distance, duration, and repetition should be changed to increase the difficulty of the exercise. At this time, unstable surfaces and other external factors should be added to also increase difficulty. Exercises should begin with light loads and high repetitions and gradually progress to lower repetitions and heavier loads.
- The patient may begin jogging and running when the quadriceps index reaches 90%, slowly increasing the distance and speed as the patient tolerates. With a 90% hop test symmetry in addition to the 90% quadriceps index, the patient can be subjected to performance-based tests to determine the appropriateness of a return to sports activities. The patient, if returning to sports, should progress from non-contact, to unrestricted sports, and finally to unrestricted participation in competition.

Section 3 Summary

Non-surgical and surgical post-operative care follow similar avenues concerning exercise and protocols. Surgical reconstruction is the normal decision chosen for young people and children, especially athletes. It is important to follow the surgeon's recommendations concerning weight-bearing, assistive devices, and general therapy progression. It normally takes at least six months for a patient to begin to return to full function and consider a total return to sports activities. Exercise should progress from open to closed chain, with no resistance to resistance. Exercises should also progress from double leg to single leg, and static to dynamic exercises. Gym equipment should be added gradually to increase strength and improve ROM. Therapy should not only focus

on strength, but on gait quality and safety, flexibility and ROM, proprioception, agility, and speed. Protocols such as the commonly used Wilks Protocol can be used as a basis for rehabilitation, however it is important to create an individualized and criterion-based plan for each patient.

Section 3 Key Concepts

- Criterion based-a type of guideline that relies upon the evidence gathered from the patient's progress to maximize the patient's response to exercise at the current level of function, while minimizing the risk of injury to the healing tissue.
- Plyometric exercise-exercises also known as jump training, are used to increase strength. They involve changing directions quickly and jumping.
- Quadriceps index-a measure of the relative strength of the involved quadriceps compared to the uninvolved quadriceps.

Summary

The ACL is one of the four major ligaments that stabilize the knee. Although ACL injury is more common in adults, this injury is becoming more common in children due to an increase in sports related activities. Symptoms of ACL injury include an immediate sharp pain in the center of the knee, swelling, a sudden popping noise in the knee at the time of injury, a decline in knee ROM and mobility, a deep aching pain, and knee instability. Physicians may use tests such as the Lachman's Sign Test, Anterior Drawer Test, Pivot Shift Test, Reverse Pivot Shift Test, and the Clunk Test to ascertain the presence of ACL injury. An x-ray, MRI, ultrasound, or arthroscopy may be used to determine the severity of the injury to the ACL and surrounding structures. Treatment includes immediate utilization of the POLICE method, while continuing ice, compression, and elevation throughout the treatment period to decrease swelling and pain. Patients and physicians will collaborate to determine the best treatment option, which will either be a conservative non-operative treatment or surgical reconstruction. For people under 25 who are active, including children in sports, a surgical reconstruction is recommended to return to full function. There are many grafts and types of surgeries available. Considerations must be allowed for children who are still growing as a reconstruction surgery may intersect the growth plate, resulting in damage that can result in leg length discrepancies or angular deformities. For this reason, the surgeon will most likely choose to drill sockets instead of tunnels to minimize the risk. Surgery is typically performed on

an outpatient basis, and the patient will be released with an assistive device and possibly a cold compression device. Physical therapy plays a vital role in recovery whether a conservative or reconstruction option is chosen. Therapy will help to restore muscle strength, agility, speed, and balance, and will help the patient to return to a prior level of activity.

The Therapist will include open chain exercises progressing to closed chain, and free activities that will progress to resistance. Gym equipment will be utilized to restore ROM and eventually to strengthen the extremity. As the rehabilitation continues, the patient will begin sports specific drills to assist in returning to the prior level of activity. A full return to sports and regular activities could take 6-12 months, depending on the patient and level of injury. During this time, the physical therapist will be a vital team member to monitor and progress the plan of care as the recovery process is a time-consuming and difficult journey.

References

- Abu-El-Rub, E., Allouh, M., Khasawneh, R. (2019, June 19). "Measurement of the Quadriceps (Q) Angle with Respect to Various Body Parameters in Young Arab Population". Retrieved June 20, 2020 from, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6564690/>
- Beck, N., DeFor, T., et al. (2017, February). "ACL Tears in School-Aged Children and Adolescents Over 20 Years". Retrieved June 5, 2020 from, <https://pediatrics.aappublications.org/content/early/2017/02/20/peds.2016-1877>
- Bruder, S., Hube, R., et al. (2018, September). "Single-Bundle Versus Double-Bundle Anterior Cruciate Ligament Reconstruction—5-Year Results". Retrieved June 9, 2020 from, [https://www.arthroscopyjournal.org/article/S0749-8063\(18\)30279-2/fulltext](https://www.arthroscopyjournal.org/article/S0749-8063(18)30279-2/fulltext)
- Cavanaugh, J., Powers, M. (2017, August 8). "ACL Rehabilitation Progression: Where Are We Now?" NCBI. Retrieved August 22, 2020 from, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5577427/>
- Connaughton, A., Geeslin, A., Uggem, C. (2017, March 19). "All-inside ACL Reconstruction: How Does it Compare to Standard ACL Reconstruction Techniques?" Retrieved June 15, 2020 from, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5360217/>
- FIFA Medical. (2018, December 13). "ACL Avulsion Fracture". Retrieved June 22, 2020 from, <https://www.fifamedicalnetwork.com/acl-avulsion-fracture/>

Filbay, S., Grindem, H. (2019, January 18). "Evidence Based Recommendations for the Management of Anterior Cruciate Ligament Rupture". Science Direct. Retrieved August 21, 2020 from, <https://www.sciencedirect.com/science/article/pii/S1521694219300191#tbl3>

Finch, S., Shaw, L. (2017, June 5). "Trends in Pediatric and Adolescent Anterior Cruciate Ligament Injuries". Retrieved June 17, 2020 from, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5486285/>

Frederics, M., Khadavi, M. (2019, June 12). "ACL Tear Diagnosis". Retrieved June 30, 2020 from, <https://www.sports-health.com/sports-injuries/knee-injuries/acl-tear-diagnosis>

Massachusetts General Hospital. (2018, January 15). "Rehabilitation Protocol for ACL Reconstruction". Retrieved June 28, 2020 from, <https://www.massgeneral.org/assets/MGH/pdf/orthopaedics/sports-medicine/physical-therapy/rehabilitation-protocol-for-ACL.pdf>

Mayo Clinic. (2019, March 30). "ACL Injury". Retrieved June 22, 2020 from, <https://www.mayoclinic.org/diseases-conditions/acl-injury/symptoms-causes/syc-20350738>

Med Star Health. (2016, November). "Knee Outcome Survey Activities of Daily Living Scale". Retrieved June 11, 2020 from, <https://ct1.medstarhealth.org/content/uploads/sites/108/2016/11/KOS-2014.pdf>

Miller, A. (2020, March 4). "A Review of Open and Closed Kinetic Chain Exercise Following Anterior Cruciate Ligament Reconstruction". Retrieved June 21, 2020 from, <https://www.brianmac.co.uk/kneeinj.htm>

Mirabile, B. (2019, March 5). "Female Athletes Compete Against Higher Risk of ACL Injuries Than Males". Retrieved June 27, 2020 from, <http://sites.nd.edu/biomechanics-in-the-wild/2019/03/05/female-athletes-compete-against-higher-risk-of-acl-injuries-than-males/>

Pandya, N. (2016, December 25). "Risk Factors for ACL Injuries in Young Athletes". Retrieved June 15, 2020 from, <https://www.childrenshospitaloakland.org/main/can-we-prevent-acl-injuries-in-our-young-athletes.aspx>

Paterno, M. (2017, July 29). "Non-Operative Care of the Patient with an ACL Deficient Knee". Retrieved June 17, 2020 from, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5577432/>

Sears, B. (2020, April 28). "The P.O.L.I.C.E. Principle Emergency Treatment for Acute Injuries". Retrieved June 13, 2020 from, <https://www.verywellhealth.com/the-police-principle-for-acute-sprains-and-strains-2696549>

South Shore Hospital. (2016, December). "ACL Non-operative Protocol". Retrieved June 30, 2020 from, http://southshoreorthopedics.com/wp-content/uploads/2016/12/ACL_non-operative_managment.pdf

South Shore Hospital. (2016, December). "ACL Reconstruction Protocol". Retrieved June 16, 2020 from, <http://www.ptsaadat.ir/images/pdf/3.pdf>

Swan, K. (2015, June 2). "ACL Injury: What Are the Risk Factors?" Retrieved June 25, 2020 from, <https://www.uoanji.com/wp-content/uploads/2015/05/ACL-Risk-Factors-KG-Swan.pdf>

UC San Diego Health. (2020). "Treatment and Surgery for ACL Tears". Retrieved June 19, 2020 from, <https://health.ucsd.edu/specialties/surgery/ortho/knee/Pages/acl-tear.aspx>

Wheless, C. (2017, March 4). "Pivot Shift Test". Retrieved June 20, 2020 from, http://www.whelessonline.com/ortho/pivot_shift_test

Wolf, S. (2019, March 3). "ACL Injuries in Young Athletes". Retrieved June 3, 2020 from, <https://www.healthychildren.org/English/health-issues/injuries-emergencies/sports-injuries/Pages/ACL-Injuries.aspx>

Women's Sports Foundation. (2016, September 2). "Title IX and the Rise of Female Athletes in America". <https://www.womenssportsfoundation.org/education/title-ix-and-the-rise-of-female-athletes-in-america/>



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