



ACL – REVIEW OF LATEST TRENDS AND RESEARCH

Presented by:
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APTA

■ MY PROFILE

- ❖ Licensed Physical Therapist in New York, Michigan and Indiana
- ❖ Completed my DPT from Andrews University.
- ❖ APTA certified Clinical Instructor
- ❖ Vice Chair- APTA Indiana Central district
- ❖ I work in a hospital associated Outpatient Rehab/Performance facility in Indiana
- ❖ I love teaching and helping people. I am also a super foodie, love cooking, adventures and sports is life.



- AGENDA

Introduction to ACL

Testing and diagnosis
with ACL

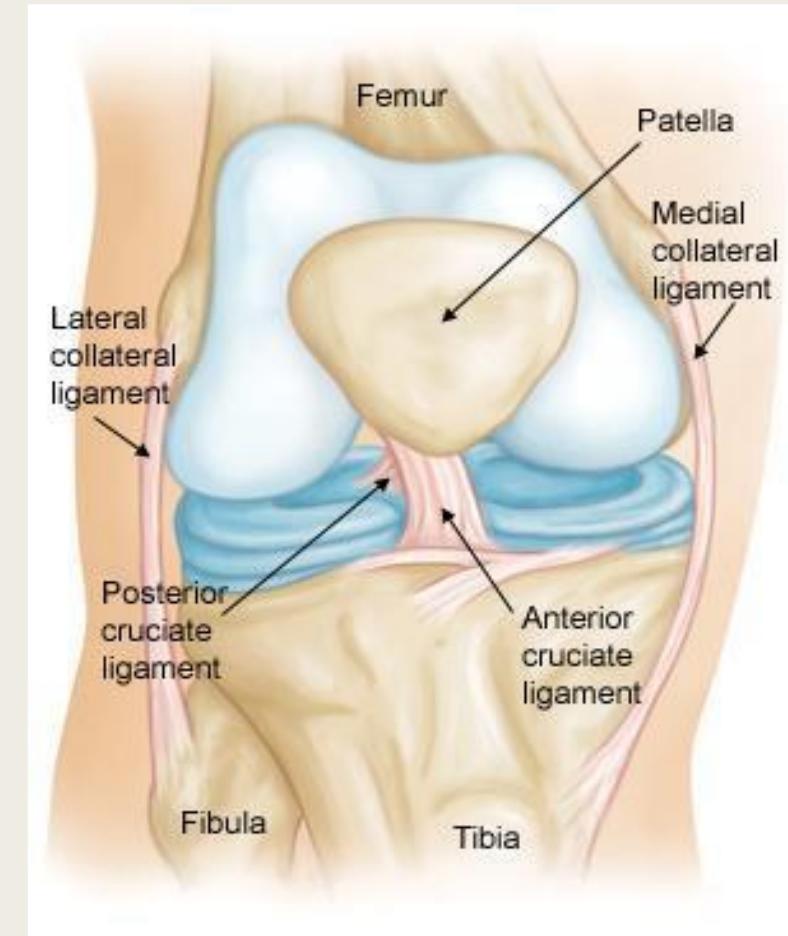
Prevalence and current
trends

Latest evidence on ACL

Conclusion

■ ANTERIOR CRUCIATE LIGAMENT

- It is a strong band made of connective tissue and collagenous fibers that originate from the anteromedial aspect of the intercondylar region of the tibial plateau and extends posteromedially to attach to the lateral femoral condyle. [1]
- The orientation of Anterior cruciate ligament is it runs oblique superior-laterally.
- The function of ACL is to prevent anterior translation of tibia and posterior translation of femur over tibia.
- The ACL additionally provides rotational stability to the knee with varus or valgus stress.

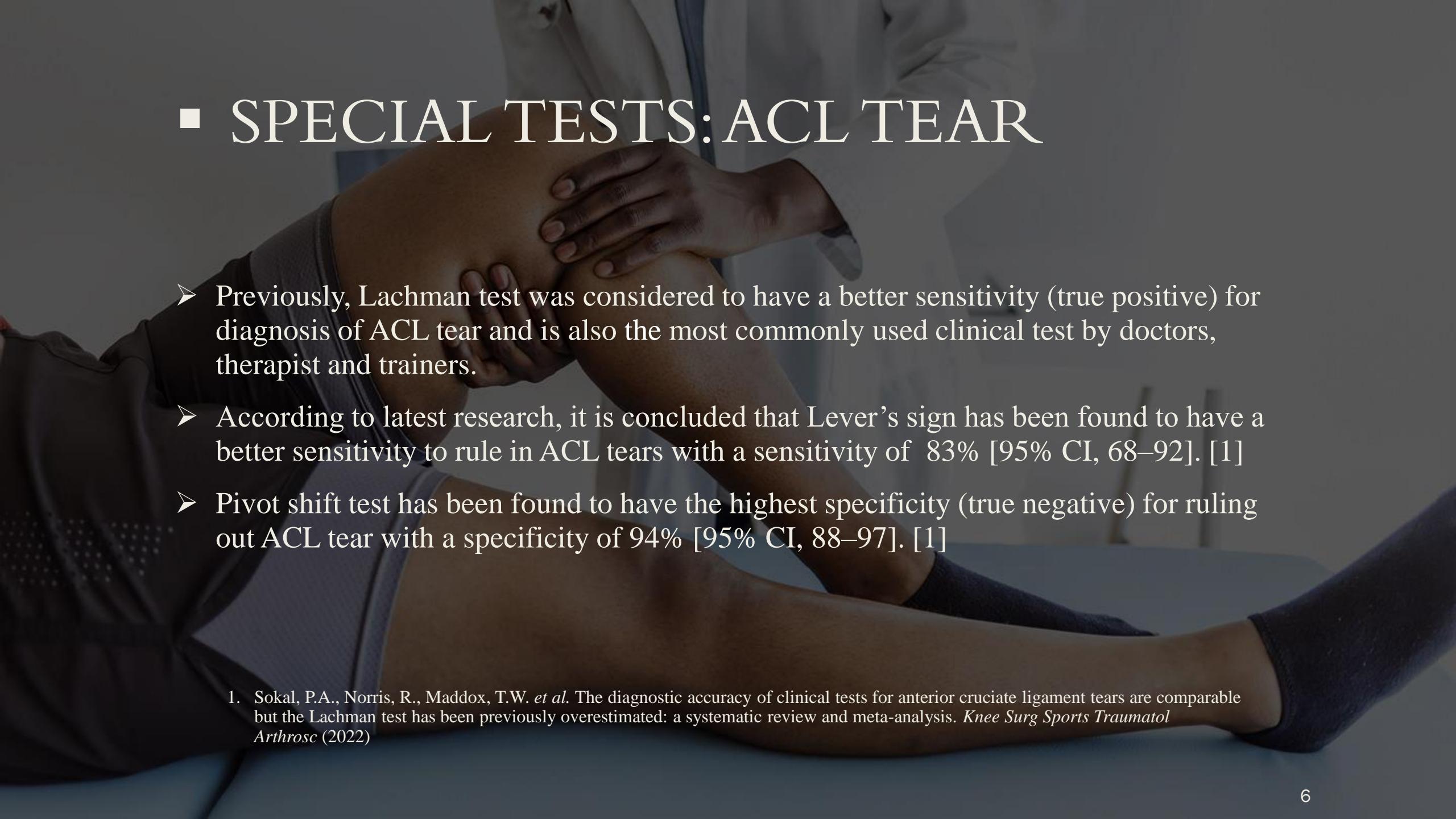


1. Gupta R, Malhotra A, Sood M, Masih GD. Is anterior cruciate ligament graft rupture (after successful anterior cruciate ligament reconstruction and return to sports) actually a graft failure or a re-injury? J Orthop Surg (Hong Kong). 2019 Jan-Apr;27(1):2309499019829625.

■ PREVALENCE

- According to CDC (Center for Disease Control and Prevention) Anterior cruciate ligament (ACL) injury affects as many as 250,000 individuals in the United States annually, resulting in an annual health care cost exceeding \$2 billion. This injury typically occurs in the physically active population, and while the incidence of ACL injury is greater in males due to greater exposure to physical activity.
- One of the most common knee injuries is an ACL sprain or tear. Typically, injury occurs during activity/sports play that includes sudden changes in the direction of movement, rapid stopping, jumping and landing abnormally, a direct blow to the lateral aspect of the knee, or slowing down while running.[1]
- Planted foot rotation is a common cause of ACL tears too [2]

1. Evans J, Nielson Jl. Anterior Cruciate Ligament Knee Injuries. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan
2. Lee J, Pathak P, Panday SB, Moon J. Effect of Foot-Planting Strategy on Anterior Cruciate Ligament Loading in Women During a Direction Diversion Maneuver: A Musculoskeletal Modeling Approach. Orthop J Sports Med. 2020 Nov 19;8(11):2325967120963180

A photograph showing a medical professional in a white lab coat and blue scrubs performing a physical examination on a patient's knee. The professional's hands are visible, one on the patient's knee and the other supporting the patient's leg. The patient is wearing a dark athletic shirt and shorts.

■ SPECIAL TESTS: ACL TEAR

- Previously, Lachman test was considered to have a better sensitivity (true positive) for diagnosis of ACL tear and is also the most commonly used clinical test by doctors, therapist and trainers.
- According to latest research, it is concluded that Lever's sign has been found to have a better sensitivity to rule in ACL tears with a sensitivity of 83% [95% CI, 68–92]. [1]
- Pivot shift test has been found to have the highest specificity (true negative) for ruling out ACL tear with a specificity of 94% [95% CI, 88–97]. [1]

1. Sokal, P.A., Norris, R., Maddox, T.W. *et al.* The diagnostic accuracy of clinical tests for anterior cruciate ligament tears are comparable but the Lachman test has been previously overestimated: a systematic review and meta-analysis. *Knee Surg Sports Traumatol Arthrosc* (2022)

■ DIAGNOSIS OF ACL TEAR



- MRI is the primary modality to diagnose ACL pathology with a sensitivity of 86% and specificity of 95%. [1]
- Examination with MRI offers high accuracy in the diagnosis of ACL injury, and has good consistency with arthroscopic diagnosis, which can provide reliable guidance for the selection and formulation of clinical surgery plans, and might be used as the first choice for the non-traumatic diagnosis of ACL injury.[2]
- Arthrography is considered the gold standard as it is 92% to 100% sensitive and 95% to 100% specific; however, it is rarely used as the initial step in diagnosis as it is invasive and requires anesthesia.[1]

1. Evans J, Nielson Jl. Anterior Cruciate Ligament Knee Injuries. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan
2. Zhao M, Zhou Y, Chang J, Hu J, Liu H, Wang S, Si D, Yuan Y, Li H. The accuracy of MRI in the diagnosis of anterior cruciate ligament injury. Ann Transl Med. 2020 Dec;8(24):1657. doi: 10.21037/atm-20-7391. PMID: 33490169; PMCID: PMC7812197.

So, what exactly are the current trends to treat the ACL?



■ CURRENT TRENDS OF TREATMENT:



- One of the first key criteria after ACL-R is achieving full passive and active knee extension.[1]
- Strategies to achieve full passive knee extension include prolonged stretching under low load and sleeping in a postoperative brace locked in full extension[2]
- Use of patellofemoral joint mobilization to restore normal superior translation of the patella is critical to achieving full active knee extension without a quadriceps lag. [1]
- Exercises to regain flexion, including wall slides and stationary bicycle, should begin shortly after ACL-R. [1]

1. Musahl V, Engler ID, Nazzal EM, Dalton JF, Lucidi GA, Hughes JD, Zaffagnini S, Della Villa F, Irrgang JJ, Fu FH, Karlsson J. Current trends in the anterior cruciate ligament part II: evaluation, surgical technique, prevention, and rehabilitation. *Knee Surg Sports Traumatol Arthrosc*. 2022 Jan;30(1):34-51.

2. Cavanaugh JT, Powers M (2017) ACL rehabilitation progression: where are we now? *Curr Rev Musculoskelet Med* 10(3):289–296

■ CURRENT TRENDS OF TREATMENT:

- Although controversy remains in terms of the precise timing of re-initiation of weight-bearing following isolated ACL-R, clinical practice guidelines recommend either early full weight-bearing exercises or immediate postoperative weight-bearing as tolerated. [1]
- Psychological factors such as motivation and self-efficacy have been shown to play an important role in outcomes following ACL-R . Psychological readiness to return to sport has shown the strongest association with return to preinjury activity level.[2]
- There is no significant data, which has assessed the quality or protocol of sports specific training post ACL-R, prior to return to sports.

1. Logerstedt DS, Scalzitti D, Risberg MA, Engebretsen L, Webster KE, Feller J et al (2017) Knee stability and movement coordination impairments: knee ligament sprain revision 2017. *J Orthop Sports Phys Ther* 47(11):A1-a47
2. Musahl V, Engler ID, Nazzal EM, Dalton JF, Lucidi GA, Hughes JD, Zaffagnini S, Della Villa F, Irrgang JJ, Fu FH, Karlsson J. Current trends in the anterior cruciate ligament part II: evaluation, surgical technique, prevention, and rehabilitation. *Knee Surg Sports Traumatol Arthrosc*. 2022 Jan;30(1):34-51.



What are the latest
evidences on ACL ?

■ LATEST EVIDENCES ON ACL:

- This article aims to compare the proportion of people following an ACL injury reporting an acceptable symptom state, between non-surgical and surgical treatment during a 10-year follow-up.
- It was concluded that patients treated with ACL reconstruction report acceptable knee function, including higher quality of life than patients treated non-surgically at cross-sectional follow-ups up to 10 years after the treatment of an ACL injury.

1. Persson K, Bergerson E, Svantesson E, *et al* Greater proportion of patients report an acceptable symptom state after ACL reconstruction compared with non-surgical treatment: a 10-year follow-up from the Swedish National Knee Ligament Registry. *British Journal of Sports Medicine* Published Online First: 08 April 2022

■ LATEST EVIDENCES ON ACL:

- The study is a systematic review of reviews to summarize the risk for development and prevalence of knee osteoarthritis (OA) after anterior cruciate ligament (ACL) injury and surgical treatment and compare prevalence rates between surgical and nonsurgical treatment of ACL injury.
- After combining all data from previous systematic reviews into a single source shows that ACL injury markedly increases the risk for development of knee OA, which is likely to be present in the long term in approximately a third of patients who have reconstruction surgery. Surgical treatment does not reduce OA prevalence in the longer term compared with nonsurgical treatment.[1]

1. Webster, Kate E. PhD*; Hewett, Timothy E. PhD† Anterior Cruciate Ligament Injury and Knee Osteoarthritis: An Umbrella Systematic Review and Meta-analysis, Clinical Journal of Sport Medicine: March 2022 - Volume 32 - Issue 2 - p 145-152

■ LATEST EVIDENCES ON ACL:

- In a cross-sectional survey study done on 201 young adult athletes, it was fund that there is a very high prevalence of kinesiophobia, which was reported to be (61.69%) post ACL-R in young adult athletes at 4-8 weeks post surgery.
- Females showed a are a higher risk of kinesiophobia at 67.44%. Whereas, 60.12% of males reported to have kinesiophobia. [1]

1. Rahul Chaitanya Shah, James Ghagare, Ashok Shyam, Parag Sancheti. PREVALENCE OF KINESIOPHOBIA IN YOUNG ADULTS POST ACL RECONSTRUCTION. Int J Physiother Res 2017;5(1):1798-1801

■ LATEST EVIDENCES ON ACL:

- In this RCT, the study compared readiness to return to sport based on completion of advanced training after ACLR. Patients with ACLR who self-selected participation in a 6-week group-format advanced training program (TRAINING) were compared to age- and sex-matched patients who did not participate (No TRAINING).
- It was concluded that Advanced training after ACLR facilitated readiness for sport participation by improving confidence and hop performance, but may not have a preferential effect on fear. [1]

1. Meierbachtol, A, Obermeier, M, Yungtum, W, et al. Advanced training enhances readiness to return to sport after anterior cruciate ligament reconstruction. *J Orthop Res.* 2022; 40: 191- 199.

■ LATEST EVIDENCES ON ACL:

- In this prospective cohort study, done to investigate the association between sustaining a second anterior cruciate ligament (ACL) injury and (1) time to return to sport, (2) symmetrical muscle function, and (3) symmetrical quadriceps strength at the time of return to sport in young athletes after primary ACL reconstruction.
- Returning to knee-strenuous sport before 9 months after ACL reconstruction was associated with an approximately 7-fold increased rate of sustaining a second ACL injury. Achieving symmetrical muscle function or quadriceps strength was not associated with new ACL injury in young athletes.[1]

1. Susanne Beischer, Linnéa Gustavsson, Eric Hamrin Senorski, Jón Karlsson, Christoffer Thomeé, Kristian Samuelsson, and Roland Thomeé. Young Athletes Who Return to Sport Before 9 Months After Anterior Cruciate Ligament Reconstruction Have a Rate of New Injury 7 Times That of Those Who Delay Return. Journal of Orthopaedic & Sports Physical Therapy 2020 50:2, 83-90

■ LATEST EVIDENCES ON ACL:

- In a latest review study, it was determined that patients who were about to undergo a primary ACLR had high expectations for return to their preinjury level of sport, with 88% expecting to achieve this outcome. In reality, only 65% of patients after ACLR return to their preinjury level of sport. [1]
- athlete (<20 years) who resumes activity after ACLR has a greater risk for a second ACL injury. Injury rates in this young cohort have been reported to be up to 23% to 29%

1. Webster KE, Feller JA. Expectations for Return to Preinjury Sport Before and After Anterior Cruciate Ligament Reconstruction. *The American Journal of Sports Medicine*. 2019;47(3):578-583.

■ LATEST EVIDENCES ON ACL:

- After ACLR, ligament (ACL), the proportion of athletes who successfully return to pre-injury level sport is low and disappointing, while the rate of second ACL injury in athletes under the age of 20 has been reported to be as high as 40% after RTS. Although in recent years, new insights pertaining RTS have been published, the lack of validity of RTS criteria after ACLR remains.

1.Gokeler A, Dingenen B, Hewett TE. Rehabilitation and Return to Sport Testing After Anterior Cruciate Ligament Reconstruction: Where Are We in 2022? Arthrosc Sports Med Rehabil. 2022 Jan 28;4(1):e77-e82.

■ LATEST EVIDENCES ON ACL:

- Blood flow restriction therapy uses a tourniquet or pressure cuff that is placed on the proximal part of the extremity while progressively increasing the internal pressure to the point of limiting arterial blood flow influx and the venous efflux.
- This systematic review, concluded that blood flow restriction training combined with low intensity resistance training may have a positive effect on remediating the loss the femoral muscle cross sectional area after an ACL reconstruction although further research is needed for clinical recommendation. [1]

1. Charles D, White R, Reyes C, Palmer D. A SYSTEMATIC REVIEW OF THE EFFECTS OF BLOOD FLOW RESTRICTION TRAINING ON QUADRICEPS MUSCLE ATROPHY AND CIRCUMFERENCE POST ACL RECONSTRUCTION. Int J Sports Phys Ther. 2020 Dec;15(6):882-891.

■ LATEST EVIDENCES ON ACL:

- This study showed an increasing trend in muscle activity of Biceps femoris in Stance phase and Rectus Femoris in Swing phase in individuals with ACL reconstruction(ACL-R) during aquatic treadmill (ATM) running at increased water depths. ATM running could be implemented as neuromuscular training in rehabilitation after ACL-R.
- In the ACL-R group, muscle activity of BF in the stance phase (BFSt) was significantly higher than the control group on land at all water depths. Muscle activity of RF in the swing phase (RFSw) in the ACL-R group significantly increased in all water depths immersion when compared to land, respectively.[1]

1. So BC, Kwok MY, Chan YL, Lam HK, Chang HH, Chan TK, Leung CK, Tse HT. Lower-Limb Muscle Activity During Aquatic Treadmill Running in Individuals With Anterior Cruciate Ligament Reconstruction. J Sport Rehabil. 2022 Apr 29:1-10

■ CLINICAL PRACTICE GUIDELINES: ACL

- Exercise-based knee injury prevention programs used for women should incorporate multiple components, proximal control exercises, and a combination of strength and plyometric exercises. (level 1)[1]
- Exercise-based knee injury prevention programs should involve training multiple times per week, training sessions that last longer than 20 minutes, and training volumes that are longer than 30 minutes per week. (level 1)[1]
- Higher volume of closed chain eccentric quadriceps training contributes to larger gains in quadriceps strength compared to concentric training. It can be initiated as early as 3 weeks post-op. (level 1)[2]

1. Arundale A, Bizzini M, Giordano A et al. Exercise-Based Knee and Anterior Cruciate Ligament Injury Prevention. *Journal of Orthopaedic & Sports Physical Therapy*. 2018;48(9):A1-A42. doi:10.2519/jospt.2018.0303
2. van Melick N, van Cingel R, Brooijmans F et al. Evidence-based clinical practice update: practice guidelines for anterior cruciate ligament rehabilitation based on a systematic review and multidisciplinary consensus. *Br J Sports Med*. 2016;50(24):1506-1515. doi:10.1136/bjsports-2015-095898

■ CLINICAL PRACTICE GUIDELINES : ACL

- Electrical stimulation in combination with isometric strength training can be used to facilitate voluntary contraction of the quadriceps for up to 2 months following ACLR (level1) [2]
- Neuromuscular training such as single leg tasks and plyometric training should be added to strength training to optimize self-reported outcomes (Level 1) [2]
- Use mobilization and strengthening techniques preoperatively to improve outcomes following surgery (level 2) [2]

2. van Melick N, van Cingel R, Brooijmans F et al. Evidence-based clinical practice update: practice guidelines for anterior cruciate ligament rehabilitation based on a systematic review and multidisciplinary consensus. *Br J Sports Med.* 2016;50(24):1506-1515. doi:10.1136/bjsports-2015-095898

■ CONCLUSION

- ACL is the most researched and talked about topic and hence has many prognostic ideas, but at the end the treatment should be very specific to the patient. So always analyze the patient's case and make appropriate decision based on which evidence is helpful to you.
- What you do need to be careful about is be mindful of your patient's prognosis and when is he or she ready to return to sports.
- Clinical Practice Guidelines can be helpful to guide with therapy,
- New researches to create more evidence is always going to be in need. So, keep researching !



QUESTIONS?

"Coming together is a beginning, staying together is progress, and working together is success."
— Henry Ford

I would love to thank APTA and APTA Delaware chapter of giving me this opportunity.

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