ACL Injuries in High Schoolers - An Athlete's Worst Nightmare

Lin, Lichi[1]*
[1]Leland High School, San Jose, CA, 95120
*Lichi Lin; lichilin2010@gmail.com

Abstract
The Anterior Cruciate Ligament tear is one of the most common and well known injuries throughout the sporting community. For high school athletes, it's one of the worst things that can happen. This review paper explores the details of the mechanisms, diagnostic techniques, and much more. It strongly emphasizes the management and recovery process for athletes, guiding one through this tough process of coming back even stronger than before. It discusses the importance of early and accurate diagnosis through clinical exams and MRI, outlines both conservative and surgical management strategies, and provides a stage-by-stage overview of the recovery timeline, through a well constructed, specific plan considering many aspects of recovery. From initial inflammation control and limited motion to full rehabilitation and return to sport, this paper's main goal is to guide athletes and their families through a complex but conquerable journey. With the right knowledge and individualized care, high school athletes can make a full and confident return to their sport following an ACL tear.

Key Words:
ACL tear, Anterior cruciate ligament, Athlete injury,

Introduction

Anterior cruciate ligament (ACL) tears are a devastating reality for thousands of young athletes each year, particularly in high-impact sports like soccer, where they account for almost half of all knee injuries(1). This injury's potential to eliminate a team's best athlete in a single unfortunate

moment has made it one of the most notorious incidents in sports. Yet, how do ACL injuries occur, how are they managed, and what does the recovery process look like?

Accurately diagnosing, managing, and ensuring a full recovery from ACL tears in high school players is a complex challenge. This article aims to provide an overview of ACL tears for high school athletes and their families, condensing the wide array of information available on the internet into a concise summary. A torn ACL in high school athletes can be identified by tests and confirmed by medical imaging. It can be effectively managed with surgical intervention or physical rehabilitation and successfully overcome with an appropriate recovery period.

Diagnosis

Identification and diagnosis are essential for understanding the ACL tear. Some ways to do this are to know the risk factors, understand injury mechanisms, and perform tests and imaging. There are many risk factors for ACL injuries. The most obvious risk factor is participating in sports and other athletic activities, as the movements required put significant strain on the joints. Paradoxically, however, studies report that as many as 76.4% of ACL tears are non-contact injuries (3). These injuries typically occur when an athlete plants their foot in an awkward position or makes a sharp, abnormal movement that stresses the ACL (2). One final risk factor is having torn the ligament before. In fact, after one tear, the risk of tearing an ACL again increases to between 10% and 20%. (3)

Sudden pivoting, cutting, and other sharp movements are the main mechanisms for an ACL tear. (4) Often, these injuries happen when a sudden force occurs within the knee while the leg is planted. (5) Primarily, the knee must be slightly flexed, which loosens the medial and lateral collateral ligaments. Next, the femur rotates internally, which puts the ACL in a more vulnerable position. In this position, a strong valgus force - potentially caused by another person but more frequently a non-contact incident - can cause the ACL to rupture. A valgus force is when the knee bends inward toward the center of the body. (6)

The gold standard for imaging an ACL tear is Magnetic Resonance Imaging (MRI). MRI uses radio waves and a strong magnetic field to create images of both hard and soft tissues in the body. (7) It can show the extent of an ACL injury (whether partial or complete, etc.) while identifying signs of damage to other tissues in the knee, such as cartilage and tendon. In addition to imaging, several physical manipulation tests exist to help diagnose an ACL injury. For example, the Lachman test is a well-known test of the ACL's integrity to see if a significant tear exists. This test is performed by stabilizing the femur with one hand and applying an anterior translational force to the tibia with the other. If the ACL is unstable, the test will be positive, and the tibia will move anteriorly on the femur. After diagnosing the injury, the next step is to learn how to manage it.

Management

Management of the ACL tear ranges from conservative techniques such as the RICE method to invasive procedures like reconstructive surgery (ACLR). RICE stands for a conservative treatment protocol of rest, ice, compression, and elevation.' Often, this is most helpful in managing the early stages of an ACL tear. RICE is mostly employed for the first 2-3 days after

the injury. (9) The resting stage involves avoiding all physical activity that would stress the knee. Icing should be performed for 15 minutes at a time, several times a day. Compression involves wrapping the knee to help reduce swelling. Finally, elevation involves propping the leg above the level of the heart for approximately 2-3 hours per day. (10-11)

ACL reconstruction (ACLR) involves surgical repair of an ACL injury. It is the most common treatment for an ACL tear, accounting for ~98% of repairs in injured athletes aged 14-18. (19) ACLR involves constructing a new ACL from a graft of replacement tissue from one of two sources. The first option is an autograft, which involves removing a portion of the patient's iliotibial band, hamstring, quadriceps, or patellar tendon. The second is an allograft, which involves a human tissue donor. This allograft tissue typically comes from a cadaver. (13) Physical rehabilitation is also crucial to managing and recovering from an ACL tear. This recovery process can be seen as a period involving several stages, as we discuss in the following section.

Recovery Process

Splitting the recovery process into several parts can be a helpful approach. This article discusses the recovery stages in sections: 1-3 weeks, 4-6 weeks, and 7-24 weeks after injury.

Weeks 1-3: Various factors are emphasized in the first stage of recovery. First of all, any inflammation of the injured area must be controlled using methods like RICE or anti-inflammatory medications. Secondly, a notable point of emphasis in this period includes the education of the patient about the recovery process. During this time, it is important to encourage a limited range of motion with extension and 90-degree knee flexion. 90-degree knee flexion can be achieved by various exercises that should not be rigorous. (14) If the athlete wants to return to their sport anywhere between 9-12 months after the injury, a knee brace can also be helpful by supporting the knee and allowing it to rest in a stable position. (15) Overall, an athlete can expect to have pain and swelling in the knee over this 1-3 week period. After 2-3 weeks, walking on crutches is typically permitted. Crutches may be a big part of these first few weeks of recovery and are normally used for 7-10 days.

Weeks 4-6: The next few weeks after an ACL injury involve a new emphasis on the complete range of motion. At this time, it is also important to begin rebuilding muscle, tendon, and joint strength by using light weights, elastic bands, or other equipment. Improvement in endurance and stamina during this period is also key. This can be done using a treadmill, step machine, elliptical, or stationary bike and is typically recommended for 20-30 minutes (17). This helps the athlete begin to recuperate their cardiovascular stamina. Bodyweight exercises can also be incorporated during this second stage of recovery.

Weeks 7-24: The final major stage of recovery from an ACL injury occurs over many weeks, with a full return to the sport often taking 8-9 months. This stage is focused on improving the athlete's confidence in the knee. Physical rehabilitation should focus on increasing strength and power while gradually returning to practice. Jogging and straight-ahead running are also typically allowed after 3 months. (18) During this time, staying away from contact activities and practicing one's landing form is advised. This helps to reinforce safe landing techniques and

prevent future injuries. Between 3 and 6 months, most residual pain is typically gone. The focus continues to center on strengthening the leg, improving agility, and increasing balance. (21)

Discussion

In conclusion, this review demonstrates that ACL tears in high school soccer players can be managed with a comprehensive approach. Accurate diagnosis is achieved through clinical tests and confirmed by advanced imaging techniques. Management strategies range from RICE and conservative physical rehabilitation to surgical reconstruction, tailored to the individual athlete's needs. By following evidence-based guidelines and a personalized recovery plan, these young athletes can successfully overcome ACL injuries and return to the sport they love. As for the recovery timeline, controlling inflammation and using crutches are most important. For the next few weeks, focus on emphasizing a full range of motion while slowly incorporating lightweight, treadmill, or bodyweight exercises. For the final stretch, improving confidence in high-impact movements is important while gradually returning to sport. The ACL tear is important to understand and treat, as it is one of the most common injuries in sports. Current studies include several up-and-coming surgical techniques, including bridge-enhanced ACL repair (BEAR). The BEAR method is a new way to treat ACL injuries. It uses a special scaffold and the patient's blood to help the ligament heal instead of completely replacing it with a graft. With the right diagnosis, treatment, and rehabilitation, athletes who successfully overcome an ACL tear can return stronger mentally, technically, and psychologically than ever before.

References:

1. "Anterior Cruciate Ligament (ACL) Injury or Tear." Johns Hopkins Medicine, 9 Sept. 2024, www.hopkinsmedicine.org/health/conditions-and-diseases/acl-injury-or-tear.
2. Dai, B., et al. "Anterior Cruciate Ligament Injuries in Soccer: Loading Mechanisms, Risk Factors, and Prevention Programs." Journal of Sport and Health Science, vol. 3, no. 4, 2014, pp. 299-306.
3. Schilaty, N. D., et al. "Incidence of Second Anterior Cruciate Ligament Tears and Identification of Associated Risk Factors From 2001 to 2010 Using a Geographic Database." Orthopaedic Journal of Sports Medicine, vol. 5, no. 8, 2017.
4. Collings, T. J., et al. "Strength and Biomechanical Risk Factors for Noncontact ACL Injury in Elite Female Footballers: A Prospective Study." Medicine & Science in Sports & Exercise, vol. 54, no. 8, 2022, p. 1242.
5. "Anterior Cruciate Ligament (ACL) Injury or Tear." Johns Hopkins Medicine, 9 Sept. 2024, www.hopkinsmedicine.org/health/conditions-and-diseases/acl-injury-or-tear.
6. Schilaty, N. D., and N. A. Bates. "Commentary on 'The Deterministic Condition for the Ground Reaction Force Acting Point on the Combined Knee Valgus and Tibial Internal Rotation Moments in the Early Phase of Cutting Maneuvers in Female Athletes.'" Journal of Sport and Health Science, vol. 13, no. 3, 2024, pp. 373-375.
7. "ACL Injury—Diagnosis and Treatment—Mayo Clinic." Mayo Clinic, www.mayoclinic.org/diseases-conditions/acl-injury/diagnosis-treatment/drc-20350744. Accessed 30 Nov. 2024.
8. "Lachman Test." Physiopedia, www.physio-pedia.com/Lachman_Test. Accessed 30 Nov. 2024.

9. Butler, K., et al. "Anterior Cruciate Ligament Injury in Young Athletes." Journal of Pediatric Surgical Nursing, vol. 13, no. 2, 2024, pp. 51-57.
10. "ACL Tear & Injury: Symptoms & Recovery." Cleveland Clinic, my.clevelandclinic.org/health/diseases/16576-acl-tear. Accessed 2 Mar. 2025.
11. "Rest, Ice, Compression, and Elevation (RICE): Method and How It Works." Medical News Today, 11 Apr. 2018, www.medicalnewstoday.com/articles/321469.
12. Paterno, M. V. "Incidence and Predictors of Second Anterior Cruciate Ligament Injury After Primary Reconstruction and Return to Sport." Journal of Athletic Training, vol. 50, no. 10, 2015, pp. 1097-1099.
13. "ACL Reconstruction Surgery: Procedure and Recovery | HSS." Hospital for Special Surgery, www.hss.edu/condition-list_acl-surgery.asp. Accessed 2 Mar. 2025.
14. "Phase I - Weeks 1-3." Emory Healthcare, www.emoryhealthcare.org/centers-programs/acl-program/recovery/post-op-weeks-1-3. Accessed 2 Mar. 2025.
15. Doctors, The Basketball. "Knee Brace After an ACL Injury: Do I Need It?" The Basketball Doctors, 16 Apr. 2024, thebasketballdoctors.com/knee-brace-after-an-acl-injury-do-i-need-it/.
16. "Phase II - Weeks 4-6." Emory Healthcare, www.emoryhealthcare.org/centers-programs/acl-program/recovery/post-op-weeks-4-6. Accessed 2 Mar. 2025.
17. "ACL Reconstruction Rehabilitation Raleigh | Dr. Matthew Boes." MATTHEW T.BOES, M.D., www.matthewboesmd.com/acl-reconstruction-rehabilitation/. Accessed 15 Mar. 2025.
18. "Phase III - Weeks 7-12." Emory Healthcare, www.emoryhealthcare.org/centers-programs/acl-program/recovery/post-op-weeks-7-12. Accessed 2 Mar. 2025.
19. Monk, A. P., et al. "Surgical Versus Conservative Interventions for Treating Anterior Cruciate Ligament Injuries." Cochrane Library, www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD011166.pub2/full. Accessed 2 Mar. 2025.
20. Sanders, T. L., et al. "Incidence of Anterior Cruciate Ligament Tears and Reconstruction: A 21-Year Population-Based Study." The American Journal of Sports Medicine, vol. 44, no. 6, 2016, pp. 1502-1507.
21. "Information for 3-6 Months—ACL Reconstruction Communications with Dr. Tony Levenda." Healthy-txt.com, healthy-txt.com/levendaacl/information-for-3-6-months/. Accessed 2 Mar. 2025.