



**SANDHILLS  
CENTER**



# Arthroscopic anterior cruciate ligament surgery — skeletally immature

Clinical Policy ID: CCP.1301

Recent review date: 3/2022

Next review date: 7/2023

Policy contains: Adolescent; anterior cruciate ligament; arthroscopic surgery; child.

*This policy is a Sandhills Center Clinical Coverage Policy adopted from AmeriHealth Caritas of North Carolina. These clinical policies are used to assist with making coverage determinations. Sandhills Center's clinical policies are based on guidelines from established industry sources, such as the Centers for Medicare & Medicaid Services (CMS), state regulatory agencies, the American Medical Association (AMA), medical specialty professional societies, and peer-reviewed professional literature. These clinical policies along with other sources, such as plan benefits and state and federal laws and regulatory requirements, including any state- or plan-specific definition of "medically necessary," and the specific facts of the particular situation are considered by Sandhills Center when making coverage determinations. In the event of conflict between this clinical policy and plan benefits and/or state or federal laws and/or regulatory requirements, the plan benefits and/or state and federal laws and/or regulatory requirements shall control. Sandhills Center clinical policies are for informational purposes only and not intended as medical advice or to direct treatment. Physicians and other health care providers are solely responsible for the treatment decisions for their patients. Sandhills Center's clinical policies are reflective of evidence-based medicine at the time of review. As medical science evolves, Sandhills Center will update its clinical policies as necessary. Sandhills Center clinical policies are not guarantees of payment.*

## Coverage policy

Arthroscopic anterior cruciate ligament reconstruction in skeletally immature members is clinically proven and, therefore, medically necessary when all of the following criteria are met (American Academy of Orthopaedic Surgeons, 2014b; LaBella, 2014):

- Skeletally immaturity confirmed with both:
  - Anterior-posterior left hand and wrist radiography.
  - Tanner stage II or III.
- Documentation of:
  - Anterior cruciate ligament injury or associated knee injury on clinical examination and imaging; magnetic resonance imaging is preferred.
  - Knee laxity via a positive anterior drawer sign or Lachman test.
  - Functional impairment (e.g., Lysholm Knee Scoring scale).
  - Activity level (e.g., Tegner activity level scale).
- One of the following clinical indications:
  - Unresponsive to at least six weeks of conservative therapy (See Alternative covered services).
  - Concomitant repairable meniscal tear.
  - Significant or recurring knee instability.

## Limitations

All other uses of arthroscopic anterior cruciate ligament reconstruction in skeletally immature members are not medically necessary.

Diagnostic arthroscopy for diagnostic purposes only is not medically necessary. It may be medically necessary to assess for associated intra-articular injuries (such as meniscal tears and chondral surface injuries) during surgical intervention for a correctable anterior cruciate ligament lesion.

## Alternative covered services

- Activity modification.
- Functional bracing.
- Non-steroidal anti-inflammatory drug therapy.
- Instruction in self-directed exercises to strengthen the quadriceps and hamstring muscles.
- Range-of-motion exercises.
- Proprioceptive exercises.

## **Background**

The incidence of anterior cruciate ligament tears has acutely risen in the skeletally immature population over the last 20 years. It's now known that conservative therapy of a ruptured anterior cruciate ligament and thus an unstable knee joint in childhood and adolescence can lead to poor subjective and objective consequences (Zimmerer 2021). Optimal treatment is based individually on location of the tear, type and quality of it, skeletal development, lifestyle regarding activity, and parental perception to make the decision (Turati, 2021).

Knees that are unstable as a result of anterior cruciate ligament tears have a high chance of meniscus tears and cartilage injury that could result in permanent damage if not fixed (Accadbled, 2010). Treatment for an anterior cruciate ligament injury depends upon the patient's individual needs and injury severity. According to Turati and colleagues the injury is graded on a severity scale from Tanner stages I - V. Types I and II tears have remaining good quality tissue and a primary repair is recommended. It's considered more like a strain or sprain with mild ligament stretching and the knee joint is still stable (Turati 2021).

Types III and IV (a more severe injury) requires the recommendation of a physeal-sparing reconstruction with an iliotibial band graft since there is a complete tear. In the case of a type V anterior cruciate ligament tear repair; a Meyers-McKeever classification approach is recommended as best treatment (Turati 2021). A grade 3 sprain is the most common and a complete tear of the ligament (American Academy of Orthopaedic Surgeons, 2014a).

Nonsurgical treatment (e.g., bracing, physical therapy, and self-directed exercises) may be effective for patients with a stable knee or a very low activity level. Surgically, anterior cruciate ligament tears must be replaced with a tissue graft to restore stability to the knee joint. A patellar tendon, hamstring tendon, cadaver graft, or, sometimes, quadriceps tendon can be used. Grafts are held in place with a fixation device (often a screw) by tunneling a hole in the femur and one in the tibia. Reconstruction can be performed arthroscopically or via open arthrotomy (American Academy of Orthopaedic Surgeons, 2014a).

Historically, anterior cruciate ligament reconstruction was limited to skeletally mature individuals, because early growth plate closure or alignment deformities could result from surgical repair in a child who has not reached skeletal maturity. New reconstruction techniques eliminate the need to drill tunnels across the growth plate (physeal-sparing) or keep the primary fixation away from the growth plate (e.g., transphyseal), and can be customized to the growing child's age (Accadbled, 2010; Leathers, 2015; Mall, 2014).

## Findings

We identified five systematic reviews and meta-analyses (Dunn, 2016; Frosch, 2010; Kaeding, 2010; Ramski, 2014; Vavken, 2011), two evidence-based guidelines (American Academy of Orthopaedic Surgeons, 2014b; LaBella, 2014), and no economic studies for this policy. Current evidence consists of surgical case series and a limited number of cohort studies comparing early anterior cruciate ligament surgery (open physes) to either delayed surgery (closed physes) or conservative treatment.

According to the systematic reviews, while there is no universally accepted measure of knee ligament integrity, studies integrated subjective examination techniques, objective instrumented devices, and advanced imaging in orthopedic examination. Examples included objective measurement of knee stability (e.g., the Lachman test), subjective knee function scores, and Tegner activity scores. Studies defined skeletal immaturity by Tanner stages, hand and wrist radiographs, and other parameters, in addition to chronological age, which reflects the lack of consensus in the literature and further complicates direct comparisons across studies. In general, studies included physically active children with sustained knee laxity that limited activity participation or activities of daily living. Potential harms of early anterior cruciate ligament surgery were rare and included physeal injury, graft failure, and surgical complications.

**The evidence is sufficient to recommend early anterior cruciate ligament reconstruction in skeletally immature patients (e.g., Tanner stage II or III) with complete anterior cruciate ligament tears and knee instability that restricts function and activity levels.** The strongest evidence from direct comparisons suggests that, compared to conservative or delayed treatment, early anterior cruciate ligament reconstruction in skeletally immature patients with complete tears will result in improved knee stability, knee function, activity levels, and prevention of secondary injury without affecting the growth plates or causing growth disturbances. Indirect comparisons among case series derived similar findings. Many patients initially selected for conservative treatment suffered from secondary damage and crossed over to surgical stabilization.

Guidelines from the American Academy of Orthopaedic Surgeons (2014b) and the American Academy of Pediatrics (LaBella, 2014) support anterior cruciate ligament reconstruction for skeletally immature patients with high activity demands, who do not respond to medical treatment, with a concomitant repairable meniscal tear, or with significant or recurring instability. Reconstructive surgery should be performed within five months following an isolated anterior cruciate ligament injury to avoid further knee damage, but earlier intervention may be needed for concomitant injury to multiple ligaments or the menisci. Conservative or delayed surgical treatment should be reserved for very compliant patients with joint stability, low demands, and no other pathologies. Rehabilitation should focus on returning motion to the joint and surrounding muscles, strengthening the surrounding muscles to protect the new ligament, and returning function tailored to the patient's needs.

**The evidence is insufficient to assess the relative effectiveness of various surgical techniques or types of grafts.** Three types of surgical procedures are presented in the current literature: intra-articular, transphyseal, transosseous reconstruction; intra-articular, physeal-sparing, transosseous reconstruction; and combined intra- and extra-articular, physeal-sparing, extraosseous stabilization (Vavken, 2011). Evidence from direct and indirect comparisons suggest no differences in patient-reported outcomes, anterior-posterior laxity, leg-length discrepancy, or angular deformities between physeal-sparing and transphyseal reconstruction.

A study by Zimmerer and colleagues on 22 members 17 years after receiving the transepiphyseal anterior cruciate ligament reconstruction was done to record long term results and concluded that it should be the method of choice for functionality and stability of the knee joint over the long term (Zimmerer 2021).

In 2018, we added two systematic reviews comparing transphyseal and physeal-sparing techniques in the skeletally immature (Longo, 2017; Pierce, 2017). Their findings are consistent with previous findings, and no policy changes are warranted.

In 2019, we added two systematic reviews (Kay, 2018a; Tovar-Cuellar, 2018) to the policy. The results are consistent with previous findings, and no policy changes are warranted.

In 2020, we added three systematic reviews and meta-analyses (Kay, 2018b; Shanmugaraj, 2019; Wong, 2019) to the policy. No policy changes are warranted.

In 2021, we added a systematic review of 17 nonrandomized studies (n = 545 total participants) that supported the clinical utility of all-epiphyseal anterior cruciate ligament reconstruction in pediatric patients (mean age 12.0 ± 1.2 years, range 8 to 19 years) with at least two years of skeletal growth remaining based on radiographic bone age (Gupta, 2020). Postoperative subjective International Knee Documentation Committee scores were above 90 points (out of 100 points). The rate of return-to-sport after the procedure was 93.2% (n = 219/235), and 77.9% (n = 142/183) of patients returned to sport at pre-injury level. Time of return-to-sport ranged from eight to 22 months. The overall complication rate was 9.8% (n = 53/545). The most common complication was anterior cruciate ligament re-rupture (5.0%; n = 27/545), and 1.5% (n = 8/545) of patients demonstrated growth disturbances. No policy changes are warranted.

In 2022 we added the proposed algorithm used for the decision making process regarding type of repair best suited for skeletally immature anterior cruciate ligament injury based on Tanner stages and individual considerations. No policy changes are warranted.

## References

On January 4, 2022, we searched PubMed and the databases of the Cochrane Library, the U.K. National Health Services Centre for Reviews and Dissemination, the Agency for Healthcare Research and Quality, and the Centers for Medicare & Medicaid Services. Search terms were “anterior cruciate ligament reconstruction” (MeSH), “adolescent” (MeSH), “child” (MeSH), “anterior cruciate ligament” (MeSH), “anterior cruciate ligament injuries” (MeSH), and “arthroscopy” (MeSH). We included the best available evidence according to established evidence hierarchies (typically systematic reviews, meta-analyses, and full economic analyses, where available) and professional guidelines based on such evidence and clinical expertise.

Accadbled F. Arthroscopic surgery in children. *Orthop Traumatol Surg Res.* 2010;96(4):447-455. Doi: 10.1016/j.otsr.2010.04.002.

American Academy of Orthopaedic Surgeons. Anterior cruciate ligament (ACL) injuries. <http://orthoinfo.aaos.org/topic.cfm?topic=a00549>. Last reviewed March 2014. Accessed January 4, 2021.(a)

American Academy of Orthopaedic Surgeons. Management of anterior cruciate ligament injuries. Evidence-based clinical practice guideline. <https://www.aaos.org/globalassets/quality-and-practice-resources/anterior-cruciate-ligament-injuries/anterior-cruciate-ligament-injuries-clinical-practice-guideline-4-24-19.pdf>. Published September 5, 2014. Accessed January 4, 2022.(b)

Dunn KL, Lam KC, Valovich McLeod TC. Early operative versus delayed or nonoperative treatment of anterior cruciate ligament injuries in pediatric patients. *J Athl Train.* 2016;51(5):425-427. Doi: 10.4085/1062-6050.51.5.11.

Frosch KH, Stengel D, Brodhun T, et al. Outcomes and risks of operative treatment of rupture of the anterior cruciate ligament in children and adolescents. *Arthroscopy.* 2010;26(11):1539-1550. Doi: 10.1016/j.arthro.2010.04.077.

Gupta A, Tejpal T, Shanmugaraj A, et al. All-epiphyseal anterior cruciate ligament reconstruction produces good functional outcomes and low complication rates in pediatric patients: A systematic review. *Knee Surg Sports Traumatol Arthrosc.* 2020;28(8):2444-2452. Doi: 10.1007/s00167-020-06085-3.

- Kaeding CC, Flanigan D, Donaldson C. Surgical techniques and outcomes after anterior cruciate ligament reconstruction in preadolescent patients. *Arthroscopy*. 2010;26(11):1530-1538. Doi: 10.1016/j.arthro.2010.04.065.
- Kay J, Memon M, Marx RG, et al. Over 90% of children and adolescents return to sport after anterior cruciate ligament reconstruction: A systematic review and meta-analysis. *Knee Surg Sports Traumatol Arthrosc*. 2018;26(4):1019-1036. Doi: 10.1007/s00167-018-4830-9.(a)
- Kay J, Memon M, Shah A, et al. Earlier anterior cruciate ligament reconstruction is associated with a decreased risk of medial meniscal and articular cartilage damage in children and adolescents: A systematic review and meta-analysis. *Knee Surg Sports Traumatol Arthrosc*. 2018;26(12):3738-3753. Doi: 10.1007/s00167-018-5012-5.
- LaBella CR, Hennrikus W, Hewett TE, et al. Anterior cruciate ligament injuries: diagnosis, treatment, and prevention. *Pediatrics*. 2014;133(5):e1437-e1450. Doi: 10.1542/peds.2014-0623.
- Leathers MP, Merz A, Wong J, et al. Trends and demographics in anterior cruciate ligament reconstruction in the United States. *J Knee Surg*. 2015;28(5):390-394. Doi: 10.1055/s-0035-1544193.
- Longo UG, Ciuffreda M, Casciaro C, et al. Anterior cruciate ligament reconstruction in skeletally immature patients : A systematic review. *Bone Joint J*. 2017;99-b(8):1053-1060. Doi: 10.1302/0301-620x.99b8.bjj-2016-1150.r1.
- Mall NA, Chalmers PN, Moric M, et al. Incidence and trends of anterior cruciate ligament reconstruction in the United States. *Am J Sports Med*. 2014;42(10):2363-2370. Doi: 10.1177/0363546514542796.
- Pierce TP, Issa K, Festa A, Scillia AJ, McInerney VK. Pediatric anterior cruciate ligament reconstruction: A systematic review of transphyseal versus physeal-sparing techniques. *Am J Sports Med*. 2017;45(2):488-494. Doi: 10.1177/0363546516638079.
- Ramski DE, Kanj WW, Franklin CC, Baldwin KD, Ganley TJ. Anterior cruciate ligament tears in children and adolescents: A meta-analysis of nonoperative versus operative treatment. *Am J Sports Med*. 2014;42(11):2769-2776. Doi: 10.1177/0363546513510889.
- Shanmugaraj A, de Sa D, Skelly MM, et al. Primary allograft ACL reconstruction in skeletally immature patients-a systematic review of surgical techniques, outcomes, and complications. *J Knee Surg*. 2019;32(7):673-685. Doi: 10.1055/s-0038-1666833.
- Tovar-Cuellar W, Galvan-Villamarin F, Ortiz-Morales J. Complications associated with the techniques for anterior cruciate ligament reconstruction in patients under 18 years old: A systematic review. *Rev Esp Cir Ortop Traumatol*. 2018;62(1):55-64. Doi: 10.1016/j.recot.2017.09.001.
- Turati M, Rigamonti L, Giulivi A, et al. Management of anterior cruciate ligament tears in Tanner stage 1 and 2 children: a narrative review and treatment algorithm guided by ACL tear location. *J Sports Med Phys Fitness*. 2021 Oct 5. Doi: 10.23736/S0022-4707.21.12783-5.
- Vavken P, Murray MM. Treating anterior cruciate ligament tears in skeletally immature patients. *Arthroscopy*. 2011;27(5):704-716. Doi: 10.1016/j.arthro.2010.11.062.
- Wong SE, Feeley BT, Pandya NK. Complications after pediatric ACL reconstruction: A meta-analysis. *J Pediatr Orthop*. 2019;39(8):e566-e571. Doi: 10.1097/bpo.0000000000001075.
- Zimmerer A, Schneider MM, Semann C, et al. 17-Year results following transepiphyseal anterior cruciate ligament reconstruction in children and adolescents. *Z Orthop Unfall*. 2021 Feb 18. English, German. Doi: 10.1055/a-1352-5541.

## Policy updates

3/2017: initial review date and clinical policy effective date: 5/2017

3/2018: Policy references updated.

3/2019: Policy references updated.

3/2020: Policy references updated.

3/2021: Policy references updated.

3/2022: Policy references updated.