

American Academy of Orthopaedic Surgeons Clinical Practice Guideline Summary: Management of Anterior Cruciate Ligament Injuries

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This clinical practice guideline was approved by the American Academy of Orthopaedic Surgeons Board of Directors on August 22, 2022.

The complete document, *Management of Anterior Cruciate Ligament Injuries: Evidence-based Clinical Practice Guideline*, includes all tables and figures and is available at www.aaos.org/aclcpg.

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ABSTRACT

Management of Anterior Cruciate Ligament Injuries: Evidence-based Clinical Practice Guideline is based on a systematic review of published studies for the treatment of anterior cruciate ligament injuries in both skeletally mature and immature patients. This guideline contains eight recommendations and seven options to assist orthopaedic surgeons and all qualified physicians managing patients with ACL injuries based on the best current available evidence. It is also intended to serve as an information resource for professional healthcare practitioners and developers of practice guidelines and recommendations. In addition to providing pragmatic practice recommendations, this guideline also highlights gaps in the literature and informs areas for future research and quality measure development.

Overview and Rationale

The American Academy of Orthopaedic Surgeons (AAOS) with input from representatives from the American Orthopaedic Society for Sports Medicine, the Pediatric Orthopaedic Society of North America, the American Academy of Physical Medicine and Rehabilitation, and the American College of Emergency Physicians recently published their clinical practice guideline (CPG), *Management of Anterior Cruciate Ligament Injuries*.¹ This CPG was approved by the AAOS Board of Directors in August 2022.

The anterior cruciate ligament (ACL) of the knee is commonly injured, often during sports, although it can occur during a wide variety of activities of daily living. Although this injury may be contact or noncontact, the majority result from a noncontact mechanism.^{2,3} The rate of noncontact ACL injuries is reported to occur at a twofold to eightfold greater rate in female patients than male patients participating in similar sports and activities.⁴ An estimated 200,000 patients present annually with ACL injuries in the United States alone.⁵ Although the mean patient age for ACL reconstruction remained constant (29 years) from 1990 to 2006, the incidence of ACL reconstruction in patients older than 40 years increased >200%, second in growth only to the incidence of reconstructions in patients younger than 14 years.^{4,6}

These injuries can have a notable effect on knee function, particularly for activities involving cutting, pivoting, and landing. Younger and more active patients tend to be most affected by these injuries, although some patients with ACL tears can have instability with very mundane tasks. Treatment of these injuries is important to optimize joint function, sports activity, work, and activities of daily living.

Most treatments are associated with some known risks. Nonsurgical management may put patients at risk for persistent or recurrent instability and additional meniscal and/or cartilage injury. Complications of surgical treatment include recurrent instability including graft re-tear, postoperative loss of motion or arthrofibrosis, neurovascular injury, kneeling pain, and routine postoperative concerns, such as infection, deep vein thrombosis (DVT), and anesthesia complications. In addition, patients who have suffered an ACL tear are at increased risk of contralateral ACL tear. The choice of treatment may depend on a variety of factors which can include associated injuries and patient-specific characteristics, such as comorbidities, skeletal maturity, and especially future desired activity such as but not limited to sports participation and work needs.

Therefore, the AAOS developed this CPG to aid practitioners in the management of patients with ACL injuries.¹ Furthermore, the CPG represents a resource demonstrating areas that need additional investigation to provide improved evidence-based guidelines for the management of ACL injuries.

In summary, the ACL injuries guideline involved reviewing over 5,500 abstracts and more than 1,100 full-text articles to develop eight recommendations supported by 324 research articles meeting stringent inclusion criteria. Each recommendation is based on a systematic review of the research-related topic which resulted in five recommendations classified as high and three recommendations classified as moderate for both skeletally mature and immature patients who have been diagnosed with an ACL injury. The strength of recommendation also takes into account the quality, quantity, and the trade-offs between the benefits and harms of a treatment, the magnitude of a treatment's effect, and whether there are data on critical outcomes. Strength of recommendation is assigned based on the quality of the supporting evidence. In addition, seven options were formulated. Options are formed when there is little or no evidence on a topic. These included a consensus option on knee aspiration and limited strength options on ACL surgical reconstruction, meniscal repair, treatment for patients with a combined ACL/medial collateral ligament (MCL) tear, the use of prophylactic knee bracing treatment

to prevent an ACL injury, return to sport after ACL reconstruction, and functional knee bracing treatment when returning to activity after ACL reconstruction.

Guideline Summary

The developed recommendations are meant to aid in the clinical decision-making process for the treatment of patients who have been diagnosed with an ACL injury of the knee. The use of this guideline helps in treating physicians to determine the appropriate intervention/s that are likely to provide the greatest predictable benefit. This CPG set offers a substantially updated perspective from the published 2013 iteration, which previously offered 20 statements, 5 of which were supported by strong evidence, 6 by moderate, the rest of which were limited evidence, or consensus-based. New research, of improved quality, has allowed for more decisive CPG statements. The updated 2022 CPG consisted of 15 statements, 5 of which provide strong evidence and 3 of which provide moderate evidence. Three recommendations are substantively different from the recommendations of the previous CPG, and three recommendations are new and were not part of the previous CPG.

Previously, the 2013 ACL CPG recommended that the practitioner should use either autograft or appropriately processed allograft tissue because the measured outcomes are similar based on strong evidence. This has been revised in the current CPG to recommend that surgeons should consider autograft over allograft to improve patient outcomes and decrease ACL graft failure rate, particularly in young and/or active patients, based on strong evidence. Autograft has potential benefits for graft ruptures/revision and functional scores based on 2 high, 2 moderate, and 11 low-level studies.⁷⁻¹²

In another shift, the current CPG states that surgeons may favor bone-tendon-bone (BTB) to reduce the risk of graft failure or infection or hamstring to reduce the risk of anterior or kneeling pain when using autograft to perform ACL reconstruction in skeletally mature patients, citing moderate evidence.¹³⁻²⁴ This recommendation, detailing the relative advantages of these autograft choices, is a clarification of the previous CPG which recommended that the practitioner should use bone-patellar tendon-bone or hamstring tendon grafts because the measured outcomes are similar based on strong evidence.

The previous CPG recommended that when indicated, reconstruction should occur within 5 months of ACL injury to protect articular cartilage and menisci, citing

moderate evidence. The current CPG recommends reconstruction as soon as possible when indicated as the risk of additional cartilage and meniscal injury starts to increase within 3 months, citing strong evidence.²⁵⁻³⁰ As mentioned previously, treatment is highly dependent on patient characteristics, so while this recommendation applies to younger and more active patients who should be treated as expeditiously as possible, it is less applicable to older and less active patients who may do well with nonsurgical treatment and are not necessarily indicated initially for surgical intervention.

The current CPG added a new recommendation that ACL tears indicated for surgery should be treated with ACL reconstruction rather than repair because of lower risk of revision surgery based on strong evidence.³¹⁻³³ The previous CPG did not contain any recommendations regarding repair versus reconstruction. Although ACL reconstruction is currently the standard of care for surgical treatment of primary ACL injury, there is much to be learned from ongoing and future research on innovations in biologic intervention and/or surgical technique which may optimize the results of ACL repairs.

Another new recommendation was that anterior lateral ligament (ALL) reconstruction or lateral extra-articular tenodesis (LET) could be considered when performing hamstring autograft reconstruction in select patients to reduce graft failure and improve short-term function, although long-term outcomes are yet unclear based on moderate evidence.³⁴⁻³⁹ The previous CPG did not make any recommendation regarding augmentation of hamstring autograft reconstruction with ALL reconstruction or LET.

Finally, the current CPG recommends that functional evaluation, such as the hop test, may be considered as one factor to determine return to sport after ACL reconstruction based on limited evidence for better functional outcomes.^{40,41} The previous CPG did not support waiting a specific time from surgery/injury or achieving a specific functional goal before return to sports participation after ACL injury or reconstruction also based on limited evidence. More research is clearly needed in this area.

Recommendations

This Summary of Recommendations of the AAOS *Management of Anterior Cruciate Ligament Injuries: Evidence-based Clinical Practice Guideline* contains a list of evidence-based prognostic and treatment recommendations (Table 1). Discussions of how each recommendation was developed and the complete evidence report are contained in the full guideline at www.aaos.org/

acclpg. Readers are urged to consult the full guideline for the comprehensive evaluation of the available scientific studies. The recommendations were established using methods of evidence-based medicine that rigorously control for bias, enhance transparency, and promote reproducibility. An exhaustive literature search was conducted resulting initially in more than 1,100 papers for full review. The papers were then graded for quality and aligned with the work group's patients, interventions, and outcomes of concern. For CPG PICO (ie, population, intervention, comparison, and outcome) questions that returned no evidence from the systematic literature review, the work group used the established AAOS CPG methodology to generate one companion consensus statement that physicians may consider aspirating painful, tense effusions after knee injury with likely or confirmed ACL tear.

The Summary of Recommendations is not intended to stand alone. Medical care should be based on evidence, a physician's expert judgement, and the patient's circumstances, values, preferences, and rights. A patient-centered discussion understanding an individual patient's values and preferences can inform appropriate decision-making. The recommendations regarding the treatment of ACL tears are primarily focused on younger, more active individuals. Recommendations regarding surgical treatment are principally based on literature studying ACL tears as an isolated ligamentous injury rather than a multi-ligamentous injury (except for isolated ACL and MCL injury). A variety of mitigating circumstances, particularly related to patient age, preinjury activity, symptoms, and desired level of postinjury activity, may also be factors in the shared decision-making process.

A Strong recommendation means that the quality of the supporting evidence is high. A Moderate recommendation means that the benefits exceed the potential harm (or that the potential harm clearly exceeds the benefits in the case of a negative recommendation), but the quality/applicability of the supporting evidence is not as strong. A Limited option means that there is a lack of compelling evidence that has resulted in an unclear balance between benefits and potential harm. A Consensus option means that expert opinion supports the guideline recommendation, although there is no available realistic evidence that meets the inclusion criteria of the guideline's systematic review.

History and Physical

A relevant history should be obtained, and a focused musculoskeletal examination of the lower extremities should be done when assessing for an ACL injury.

Table 1. Strength of Recommendation Descriptions

Strength of Recommendation	Overall Strength of Evidence	Description of Evidence quality	Strength Visual
Strong	Strong	Evidence from two or more “High” quality studies with consistent findings for recommending for or against the intervention. Or Rec is upgraded from Moderate using the EtD framework.	★★★★
Moderate	Strong, moderate, or limited	Evidence from two or more “Moderate” quality studies with consistent findings or evidence from a single “High” quality study for recommending for or against the intervention. Or Rec is upgraded or downgraded from Limited or Strong using the EtD framework.	★★★☆☆
Limited	Limited or moderate	Evidence from one or more “Low” quality studies with consistent findings or evidence from a single “Moderate” quality study recommending for or against the intervention. Or Rec is downgraded from Strong or Moderate using the EtD framework.	★★★☆☆
Consensus	No reliable evidence	There is no supporting evidence, or higher quality evidence was downgraded due to major concerns addressed in the EtD framework. In the absence of reliable evidence, the guideline work group is making a recommendation based on their clinical opinion.	★☆☆☆☆

Strength of recommendation: Strong. ★★★★★

Implication: Practitioners should follow a Strong recommendation unless a clear and compelling rationale for an alternative approach is present.

Surgical Timing

When surgical treatment is indicated for an acute isolated ACL tear, early reconstruction is preferred because the risk of additional cartilage and meniscal injury starts to increase within 3 months.

Strength of recommendation: Strong. ★★★★★

Implication: Practitioners should follow a Strong recommendation unless a clear and compelling rationale for an alternative approach is present.

Single-bundle or Double-bundle Anterior Cruciate Ligament Reconstruction

In patients undergoing intra-articular ACL reconstruction single-bundle or double-bundle techniques can be considered because outcomes are similar.

Strength of recommendation: Strong. ★★★★★

Implication: Practitioners should follow a Strong recommendation unless a clear and compelling rationale for an alternative approach is present.

Autograft Versus Allograft

When performing an ACL reconstruction, surgeons should consider autograft over allograft to improve

patient outcomes and decrease ACL graft failure rate, particularly in young and/or active patients.

Strength of recommendation: Strong. ★★★★★

Implication: Practitioners should follow a Strong recommendation unless a clear and compelling rationale for an alternative approach is present.

Autograft Source

When performing an ACL reconstruction with autograft for skeletally mature patients, surgeons may favor BTB to reduce the risk of graft failure or infection, or hamstring to reduce the risk of anterior or kneeling pain.

Strength of recommendation: Moderate. ★★★★★ (downgraded)

Implication: Practitioners should generally follow a Moderate recommendation but remain alert to new information and be sensitive to patient preferences.

Anterior Cruciate Ligament Training Programs

Training programs designed to prevent injury can be used to reduce the risk of primary ACL injuries in athletes participating in high-risk sports.

Strength of recommendation: Moderate. ★★★★★

Implication: Practitioners should generally follow a Moderate recommendation but remain alert to new information and be sensitive to patient preferences.

Anterolateral Ligament/Lateral Extra-articular Tenodesis

ALL reconstruction/LET could be considered when performing hamstring autograft reconstruction in select patients to reduce graft failure and improve short-term function, although long-term outcomes are yet unclear.

Strength of recommendation: Moderate. ★★★★★ (downgraded)

Implication: Practitioners should generally follow a Moderate recommendation but remain alert to new information and be sensitive to patient preferences.

Repair Versus Reconstruction

ACL tears indicated for surgery should be treated with ACL reconstruction rather than repair because of lower risk of revision surgery.

Strength of recommendation: Strong. ★★★★★

Implication: Practitioners should follow a Strong recommendation unless a clear and compelling rationale for an alternative approach is present.

Options

Low-quality evidence, no evidence, or conflicting support evidence has resulted in the following statements for patient interventions to be listed as options for the specified condition. Future research may eventually cause these statements to be upgraded to Strong or Moderate recommendations for treatment.

Aspiration of the Knee

In the absence of reliable evidence, it is the opinion of the workgroup that physicians may consider aspirating painful, tense effusions after knee injury.

Strength of recommendation: Consensus. ★★★★★

Implication: In the absence of reliable evidence, practitioners should remain alert to new information because emerging studies may change this recommendation. Practitioners should weigh this recommendation with their clinical expertise and be sensitive to patient preferences.

Anterior Cruciate Ligament Surgical Reconstruction


ACL reconstruction can be considered to lower the risk of future meniscus pathology or procedures, particularly in younger and/or more active patients. ACL reconstruction may be considered to improve long-term pain and function.

Strength of recommendation: Limited. ★★★★★

Implication: Practitioners should feel little constraint in after a recommendation labeled Limited, exercise clinical judgment, and be alert for emerging evidence that clarifies or helps to determine the balance between benefits and potential harm. Patient preference should have a substantial influencing role.

Meniscal Repair


In patients with ACL tear and meniscal tear, meniscal preservation should be considered to optimize joint health and function.

Strength of recommendation: Limited.


Implication: Practitioners should feel little constraint in after a recommendation labeled Limited, exercise clinical judgment, and be alert for emerging evidence that clarifies or helps to determine the balance between benefits and potential harm. Patient preference should have a substantial influencing role.

Combined Anterior Cruciate Ligament/MCL Tear

In patients with combined ACL and MCL tears, non-surgical treatment of the MCL injury results in good patient outcomes, although surgical treatment of the MCL may be considered in select cases.

Strength of recommendation: Limited.
 (downgrade)

Implication: Practitioners should feel little constraint in after a recommendation labeled Limited, exercise clinical judgment, and be alert for emerging evidence that clarifies or helps to determine the balance between benefits and potential harm. Patient preference should have a substantial influencing role.

Prophylactic Knee Bracing Treatment

Prophylactic bracing treatment is not a preferred option to prevent ACL injury.

Strength of recommendation: Limited.


Implication: Practitioners should feel little constraint in after a recommendation labeled Limited, exercise clinical judgment, and be alert for emerging evidence that clarifies or helps to determine the balance between benefits and potential harm. Patient preference should have a substantial influencing role.

Return to Sport

Functional evaluation, such as the hop test, may be considered as one factor to determine return to sport after ACL reconstruction.


Strength of recommendation: Limited.


Implication: Practitioners should feel little constraint in after a recommendation labeled Limited, exercise clinical judgment, and be alert for emerging evidence that clarifies or helps to determine the balance between ben-

efits and potential harm. Patient preference should have a substantial influencing role.

Return to Activity Functional Bracing Treatment

Functional knee braces are not recommended for routine use in patients who have received isolated primary ACL reconstruction because they confer no clinical benefit.

Strength of recommendation: Limited.
 (downgrade)

Implication: Practitioners should feel little constraint in after a recommendation labeled Limited, exercise clinical judgment, and be alert for emerging evidence that clarifies or helps to determine the balance between benefits and potential harm. Patient preference should have a substantial influencing role.

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