Frequently Asked Questions: Anterior Cruciate Ligament Injury and Surgery

1) **Surgery vs No Surgery:**
   a) What happens if I decide to against surgery for the treatment of my ACL tear? What happens if it is managed with only physical therapy? Over the next several months to years there is a high likelihood of recurrent instability, pain, and further damage to the cartilage of the knee in ~80% of patients who select this type of non-conservative treatment. (Sanders, Pareek et al. 2017)

   b) What happens when I injure my ACL, but I want to **only repair the meniscus?**? There would be a high chance of failure of the repair in an ACL deficient knee as the stress on the repair would be higher. It is important to recognize that the stability of the knee is dependent on many ligaments, with the ACL being a very important stabilizer. Without proper stability of the knee, there is a high likelihood of further damage over time of additional structures within the knee. (Deledda, Rosso et al. 2015)

2) **Pre-Op/ "Prehabilitation":**
   a) What is "prehabilitation"? Is "prehabilitation" necessary? Prehabilitation is commonly utilized in order to increase a patient's range of motion after surgery. In patients who injure their ACL, it's very possible that they develop stiffness before surgery due to immobility. After their ACL reconstruction, there may be even more stiffness due to the post-operative **immobilization** of the knee. With prehabilitation, patients can increase their range of motion and decrease their post-operative stiffness.

   b) What is the schedule for pre-operative physical therapy or "prehabilitation"? How many times per week? Prehabilitation starts as two to three sessions per week for the beginning 3 to 4 months, then the frequency will decrease to 1 to 2 times a week for the remainder of the total amount of therapy. The total time in prehabilitation ranges from 6 to 9 months depending on the rate of improvement. Research has shown that patients with good range of motion before surgery have better outcomes after surgery compared with patients with poor range of motion. (Shaarani, O'Hare et al. 2013)

   c) Is it possible to bear weight on the leg before surgery? Does weight bearing cause further damage? If you have had an isolated ACL injury without a meniscus injury, then you may bear weight on that leg. If you have an additional meniscus injury, then it is recommended to be partial weight bearing at most with crutches until surgery, if the surgery is planned in the next several weeks.

   d) Are knee braces necessary, and if so, when should they be worn? Knee braces are not necessary all the time but can be helpful. There are various types of braces including over the counter knee braces, range of motion braces, and

functional ligament braces that require a prescription. It is recommended that they be worn around crowds of children, while at school, and should be careful at home. (Lobb, Tumilty et al. 2012)

3) **Grafts:**
   a) What are the different types of grafts? There are many types of grafts used for ACL reconstruction. An autograft means that the graft is harvested from the patient's own tissue, which would include Bone-Tendon-Bone (BTB) grafts, quadricep tendon autografts, and hamstring autografts. Other types would include cadaver hamstring allograft (meaning a graft harvested from donated tissue).

   b) What are the advantages and disadvantages of the different types of grafts used for ACL reconstruction? What criteria should be used to decide? The **B**one-patella **T**endon-**B**one (**BTB**) tends to have a higher rate of prolonged anterior knee pain after surgery and carries a slight risk of patella fracture during and after surgery. The risk of fracture is mitigated by bone grafting the donor site which I do with bone harvested during creation of the new location for the graft. Generally, the BTB graft has been shown to have lower rates of failure. (Maletis, Inacio et al. 2013)

   c) What are the success rates of each graft type? Current research shows a 90-95% success rate for both, but it is difficult for studies to prove one is superior to the other. (Maletis, Inacio et al. 2013)

   d) Typical issues of each graft type? General complications of all graft types show a possible chance of re-rupture ranging from 5 to 10%. Other issues include cramping in the posterior thigh, an area of numbness near the incision on the upper leg/shin outer and or inner side, anterior knee pain especially with kneeling for BTB grafting. (Wright, Magnussen et al. 2011)

   e) How many ACL Reconstructions do you perform? Each year I perform a total of ~75-100 ACL reconstructions.

   f) Do you have a preference in general for the graft types? I perform ACL reconstructions in a variety of ways using all graft types and try to fit the appropriate graft to each patient's uniqueness. (Engelman, Carry et al. 2014) (Maletis, Inacio et al. 2013)

   g) Among the people who received a hamstring grafting procedure, what was the percentage that was a cadaver graft? Among my patients who received a hamstring graft, only 5-10% was a cadaveric graft used as an augmentation.

h) What would be a reason for additional surgery? Approximately 20 % of patients may return to the operating room following an ACL reconstruction. There can be many reasons for additional surgery: reinjury to the knee that had surgery, injury to the opposite knee, tears in the graft, non-healing meniscus tears following repair, new meniscus or cartilage injuries, stiffness, or scar tissue in the knee joint following surgery.

i) When would you know if a cadaver hamstring is needed to augment the primary graft? Can it be determined before the surgery or only once you visualize the internal structures of the knee during surgery? *Once I have harvested the primary graft, that is the best time to most accurately assess the size of the graft and if there is a need for augmentation with a cadaver graft which occurs in 5-10 % of cases.*

j) What issues may be associated with using a cadaver graft? The complications associated with using a cadaver hamstring graft does not change the complications associated with the procedure. ACL reconstruction issues may include cramping in the posterior thigh, very mild weakness, small area of numbness near the incision for the hamstrings grafting procedure, anterior knee pain in BTB grafts.

k) What are the complications with using a hamstring graft and now having “less hamstrings” in the leg? *There is almost no discernable, functional impact, but there may have cramping in the posterior thigh, very mild weakness, and a small area of numbness near the incision used for the hamstrings graft procedure.*

4) Meniscus:

a) What is the risk in repairing the meniscus? What if the meniscus is irreparable? *Main risk in the surgery to repair the meniscus is that it may not heal. Depending on the type and severity of the tear, it may not be repairable, therefore some material will need to be removed which will be determined at the time of surgery.*

b) What are typical complications associated with meniscus repair/recovery? *Typical complications include possible non-healing and need for revision surgery in 15-20% or less of cases. (Deledda, Rosso et al. 2015)*

5) **Surgery:**

a) Any tests needed before surgery? *After getting an X-ray and MRI, healthy young adolescents usually will not require additional tests. Everything will be covered during your visit in the clinic.*

b) Do patients see an anesthesiologist before surgery day? Healthy adolescents usually are not required to see an anesthesiologist. *Some patients may need to before surgery, but the plan will be explained and reviewed before the surgery.*

c) What is given for pain after surgery? *Pain management after surgery includes Acetaminophen (Tylenol) alternating with Ibuprofen as needed, then aspirin for 3 weeks for blood clot prevention. Narcotics are rarely utilized.*

d) How long is the surgery itself? *This procedure is an outpatient surgery and is usually 2-3 hours in length.*

6) Recovery:

a) Are people homebound after surgery due to pain medications? *No, but you should not attend school or drive until off of narcotics.*

b) Is it true that you should not put any weight on the leg? *Partially true, most young healthy patients can stand immediately and may bear partial weight on the affected leg. These issues will be discussed before and after surgery.*

c) Do I need crutches? And if so, can any weight be put on that leg? *If you have undergone an isolated ACL reconstruction, crutches may be used for 1-2 weeks depending on comfort level. If you have undergone a meniscus repair, crutches may be needed for 4-6 weeks, as you will need to be partial weight bearing for a minimum of 4 weeks.*

d) What kind of activities are allowed during the postoperative period? *3-4 months of no running. 6-9 months of no sports. 6-9 months of physical therapy.*

e) How long will I have to wear the full leg brace? *4 to 6 weeks*

f) How long do I wait to start physical therapy? *Physical therapy starts immediately for a total of 6-9 months, 2-3 times per week.*

g) What is a continuous passive motion (CPM) machine? How long can I use it for? *It is used at home to help increase range of motion of the knee and some studies have shown it may be associated with decreased rates of pain. (Wright, Magnussen et al. 2011)*

h) What is a Cryo/Cuff icing device? *This is a device that helps prevent swelling of the knee after surgery by essentially icing your knee.*

i) What is the most common recovery problem? *The most common problem is stiffness, which may occur in 5% of cases, otherwise patients do extremely well.*

j) What is the recovery required for the leg that 'donated' the hamstrings? *The leg that will be undergoing the ACL reconstruction will also be the same leg that donates the hamstring. This prevents additional surgical incisions and complications by having only one leg that needs to recover and heal from surgery. This allows for a more efficient and effective recovery. The hamstring graft procedure typically does not affect the recovery period significantly. (Corry, Webb et al. 1999)*

k) Is recovery different or more difficult for one graft type over another? *Simply put, no. The recovery is similar for all types of grafts.*

l) Is full ROM recovery possible? *Yes, full range of motion is absolutely possible.*

m) How long until I can wear the shoes I am used to wearing, such as high heels. *Shoes that may alter your gait pattern and put stress or pressure on your knee in unpredictable ways should be avoided for at least 4-6 months. This will all be discussed before surgery. (Noehren, Wilson et al. 2013)*

n) Are there any long-term consequences of getting an ACL reconstruction surgery? *A possible long-term consequence can be osteoarthritis in the affected knee, but patients generally tolerate this procedure very well and outcomes are good. (Barenius, Ponzer et al. 2014)*

References

Barenius, B., et al. (2014). "Increased risk of osteoarthritis after anterior cruciate ligament reconstruction: a 14-year follow-up study of a randomized controlled trial." Am J Sports Med **42**(5): 1049-1057.

BACKGROUND: The reported prevalence of radiological osteoarthritis (OA) after anterior cruciate ligament (ACL) reconstruction varies from 10% to 90%. Purpose/ HYPOTHESIS: To report the prevalence of OA after ACL reconstruction and to compare the OA prevalence between quadrupled semitendinosus tendon (ST) and bone-patellar tendon-bone (BPTB) grafts. The hypothesis was that there would be no difference in OA prevalence between the graft types. The secondary aim was to study whether patient characteristics and additional injuries were associated with long-term outcomes. STUDY DESIGN: Randomized controlled trial; Level of evidence, 1. METHODS: Radiological examination results, Tegner activity levels, and Knee injury and Osteoarthritis Outcome Score (KOOS) values were determined in 135 (82%) of 164 patients at a mean of 14 years after ACL reconstruction randomized to an ST or a BPTB graft. Osteoarthritis was defined according to a consensus by at least 2 of 3 radiologists of Kellgren-Lawrence grade >/=2. Using regression analysis, graft

type, sex, age, overweight, time between injury and reconstruction, additional meniscus injury, and a number of other variables were assessed as risk factors for OA 14 years after ACL reconstruction. RESULTS: Osteoarthritis of the medial compartment was most frequent, with 57% of OA cases in the ACL-reconstructed knee and 18% of OA cases in the contralateral knee (P < .001). There was no difference between the graft types: 49% of OA of the medial compartment for BPTB grafts and 65% for ST grafts (P = .073). The KOOS results were lower for patients with OA in all subscales, indicating that OA was symptomatic. No difference in the KOOS between the graft types was found. Meniscus resection was a strong risk factor for OA of the medial compartment (odds ratio, 3.6; 95% CI, 1.4-9.3) in the multivariable logistic regression analysis. CONCLUSION: A 3-fold increased prevalence of OA was found after an ACL injury treated with reconstruction compared with the contralateral healthy knee. No differences in the prevalence of OA between the BPTB and quadrupled ST reconstructions were found. An initial meniscus resection was a strong risk factor for OA; the time between injury and reconstruction was not.

Corry, I. S., et al. (1999). "Arthroscopic reconstruction of the anterior cruciate ligament. A comparison of patellar tendon autograft and four-strand hamstring tendon autograft." Am J Sports Med **27**(4): 444-454.

We compared the outcome of anterior cruciate ligament reconstruction using hamstring tendon autograft with outcome using patellar tendon autograft at 2 years after surgery. Patients had an isolated anterior cruciate ligament injury and, apart from the grafts, the arthroscopic surgical technique was identical. Prospective assessment was performed on 90 patients with isolated anterior cruciate ligament injury undergoing reconstruction with a patellar tendon autograft; 82 were available for follow-up. The hamstring tendon autograft group consisted of the next 90 consecutive patients fulfilling the same criteria; 85 were available for follow-up. Clinical review included the Lysholm and International Knee Documentation Committee scores, instrumented testing, thigh atrophy, and kneeling pain. These methods revealed no difference between the groups in terms of ligament stability, range of motion, and general symptoms. Thigh atrophy was significantly less in the hamstring tendon group at 1 year after surgery, a difference that had disappeared by 2 years. The KT-1000 arthrometer testing showed a slightly increased mean laxity in the female patients in the hamstring tendon graft group. Kneeling pain after reconstruction with the hamstring tendon autograft was significantly less common than with the patellar tendon autograft, suggesting lower donor-site morbidity with hamstring tendon harvest.

Deledda, D., et al. (2015). "Results of meniscectomy and meniscal repair in anterior cruciate ligament reconstruction." Joints **3**(3): 151-157.

Meniscal tears are commonly associated with anterior cruciate ligament (ACL) injuries. A deficient medial meniscus results in knee instability and could lead to

higher stress forces on the ACL reconstruction. Comparison of results in meniscectomy and meniscal repairs revealed worse clinical outcomes in meniscectomy, but higher re-operation rates in meniscal repairs. Our aim was to review the results of ACL reconstruction associated with meniscectomy or meniscal repair.

Engelman, G. H., et al. (2014). "Comparison of allograft versus autograft anterior cruciate ligament reconstruction graft survival in an active adolescent cohort." Am J Sports Med **42**(10): 2311-2318.

BACKGROUND: Graft selection for anterior cruciate ligament (ACL) reconstructive surgery is a controversial topic. Few studies have compared graft outcomes in adolescents. PURPOSE: To identify factors related to ACL graft failure in an adolescent cohort. STUDY DESIGN: Case-control study; Level of evidence, 3. METHODS: After institutional review board approval was obtained, adolescent subjects (age range, 11-18 years) who underwent primary ACL reconstruction surgery at a large tertiary pediatric hospital between July 2005 and July 2009 were identified through a query of International Classification of Diseases, 9th Revision, diagnostic and Current Procedural Terminology codes. Subject data were obtained by means of a retrospective chart review, phone survey, and the administration of functional knee outcome instruments. A multivariate Cox proportional hazards regression analysis was used to analyze factors related to graft survival. RESULTS: The average ages at surgery in the allograft (n = 38) and autograft (n = 35) groups were 15.29 +/- 2.24 and 15.60 +/- 1.57 years, respectively. There were 11 graft failures (28.95%) in the allograft group compared with 4 graft failures (11.43%) in the autograft group. In the multivariate model, graft type (P = .0352) and postoperative knee laxity according to the Lachman test (P = .0217) were the only variables significantly related to graft survival. The hazard of graft failure was 4.4 (95% CI, 1.23-18.89) times greater in the allograft group compared with the autograft group. The hazard of graft failure was 5.28 times (95% CI, 1.1-12.72; P = .0217) greater for a subject who demonstrated increased postoperative knee laxity relative to the contralateral knee. The risk for autograft failure tended to remain constant 24 to 48 months after initial surgery, whereas the risk for allograft failure continued to increase during postoperative months 24 to 48. There were no differences (P > .05) between the allograft and autograft groups with respect to International Knee Documentation Committee score, Lysholm score, and the rate of return to previous activity level. CONCLUSION: Graft type and postoperative knee laxity were identified as significant predictors of graft survival. On the basis of this large retrospective cohort, we recommend the use of autogenous grafts in children and adolescents undergoing primary, transphyseal ACL reconstruction. Patients who demonstrate increased translation during a postoperative Lachman test should be carefully followed because of concerns for subsequent graft failure.

Lobb, R., et al. (2012). "A review of systematic reviews on anterior cruciate ligament reconstruction rehabilitation." Phys Ther Sport **13**(4): 270-278.

The aim of this systematic review of systematic reviews was to critically appraise systematic reviews on Anterior Cruciate Ligament (ACL) reconstruction rehabilitation to determine which interventions are supported by the highest quality evidence. Electronic searches were undertaken, of MEDLINE, AMED, EMBASE, EBM reviews, PEDro, Scopus, and Web of Science to identify systematic reviews of ACL rehabilitation. Two reviewers independently selected the studies, extracted data, and applied quality criteria. Study quality was assessed using PRISMA and a best evidence synthesis was performed. Five systematic reviews were included assessing eight rehabilitation components. There was strong evidence (consistent evidence from multiple high quality randomised controlled trials (RCTs)) of no added benefit of bracing (0-6 weeks post-surgery) compared to standard treatment in the short term. Moderate evidence (consistent evidence from multiple low quality RCTs and/or one high quality RCT) supported no added benefit of continuous passive motion to standard treatment for increasing range of motion. There was moderate evidence of equal effectiveness of closed versus open kinetic chain exercise and home versus clinic based rehabilitation, on a range of short term outcomes. There was inconsistent or limited evidence for some interventions. Recommendations for clinical practice are made at specific time points for specific outcomes.

Maletis, G. B., et al. (2013). "Reconstruction of the anterior cruciate ligament: association of graft choice with increased risk of early revision." Bone Joint J **95-B**(5): 623-628.

We examined the association of graft type with the risk of early revision of primary anterior cruciate ligament reconstruction (ACLR) in a community-based sample. A retrospective analysis of a cohort of 9817 ACLRs recorded in an ACLR Registry was performed. Patients were included if they underwent primary ACLR with bone-patellar tendon-bone autograft, hamstring tendon autograft or allograft tissue. Aseptic failure was the main endpoint of the study. After adjusting for age, gender, ethnicity, and body mass index, allografts had a 3.02 times (95% confidence interval (CI) 1.93 to 4.72) higher risk of aseptic revision than bone-patellar tendon-bone autografts ($p < 0.001$). Hamstring tendon autografts had a 1.82 times (95% CI 1.10 to 3.00) higher risk of revision compared with bone-patellar tendon-bone autografts ($p = 0.019$). For each year increase in age, the risk of revision decreased by 7% (95% CI 5 to 9). In gender-specific analyses a 2.26 times (95% CI 1.15 to 4.44) increased risk of hamstring tendon autograft revision in females was observed compared with bone-patellar tendon-bone autograft. We conclude that allograft tissue, hamstring tendon autografts, and younger age may all increase the risk of early revision surgery after ACLR.

Noehren, B., et al. (2013). "Long-term gait deviations in anterior cruciate ligament-reconstructed females." Med Sci Sports Exerc **45**(7): 1340-1347.

PURPOSE: Little is known of the potential long-term gait alterations that occur after an anterior cruciate ligament (ACL) reconstruction. In particular, variables,

such as impact loading, which have been previously associated with joint deterioration, have not been studied in walking and running after an ACL reconstruction. The purpose of this study was to define the alterations in impact forces, loading rates, and the accompanying sagittal plane kinematic and kinetic mechanics at the time of impact between the ACL-reconstructed group and a healthy control group. METHODS: Forty females (20 with ACL reconstruction and 20 controls) participated in the study. An instrumented gait analysis was performed on all subjects. Between-group and between-limb comparisons were made for the initial vertical impact force, loading rate, and sagittal plane knee and hip angles as well as moments. RESULTS: During walking and running, the ACL cohort had significantly greater initial vertical impact force (P = 0.002 and P = 0.001, respectively) and loading rates (P = 0.03 and P = 0.01, respectively), as well as a smaller knee extensor moment and hip angle during walking (P = 0.000 and P = 0.01, respectively). There was a trend toward a smaller knee moment and hip angle during running (P = 0.08 and P = 0.06, respectively) as well as a larger hip extensor moment during walking (P = 0.06) in the ACL group. No differences were found for hip extensor moment during running and for knee angles between groups during walking or running. Lastly, no between-limb differences were found for any variable. CONCLUSIONS: Gait deviations such as elevated impact loading and loading rates do not resolve long term after an individual has resumed previous activity levels and these may contribute to the greater risk of early joint degeneration in this population.

Sanders, T. L., et al. (2017). "Long-term follow-up of isolated ACL tears treated without ligament reconstruction." Knee Surg Sports Traumatol Arthrosc **25**(2): 493-500.

PURPOSE: The incidence of subsequent meniscal tears and arthritis among patients with isolated ACL tears treated without ligament reconstruction has not been clearly established. The purpose of this study was to (1) compare the risk of subsequent meniscal tears and osteoarthritis (OA) between patients with isolated ACL tears treated without ligament reconstruction and a matched cohort of individuals without ACL tears and (2) examine factors predictive of long-term sequelae after non-operative treatment of isolated ACL tears. METHODS: This study compared a population-based incidence cohort of 364 patients with new-onset, isolated ACL tears between 1990 and 2000, to an age and sex-matched cohort of 364 individuals without ACL tears. A chart review was performed to collect information related to the initial injury, treatment, and outcomes. Subjects were retrospectively followed for mean follow-up of 14.3 years (+/-7.4 years) to determine the development of subsequent meniscal injury, arthritis, or total knee arthroplasty (TKA). RESULTS: Patients treated without ligament reconstruction after ACL tears had a significantly higher risk of secondary meniscal tears (HR 18.0, 95 % CI 9.7, 33.3), arthritis (HR 14.2, 95 % CI 8.0, 25.2), and need of TKA (HR 5.0, 95 % CI 2.1, 12.2) than individuals without ACL tears. Lateral meniscal tear at diagnosis was associated with a higher risk of arthritis (HR 2.7, 95 % CI 1.4, 5.7) and TKA (HR 4.3, 95 % CI 1.3, 13.7). Treatment with meniscectomy was associated with an increased risk of additional meniscal tears (HR 51.5, 95

% CI 10.3, 936.8). CONCLUSIONS: Patients treated non-operatively after isolated ACL tears are at a significantly higher risk of secondary meniscal tears, arthritis, and TKA when compared to age and sex-matched subjects without ACL tears. Additionally, baseline lateral meniscal tears were significantly associated with an increased probability of developing arthritis and the need for TKA. This information may be helpful when counselling patients about the natural history of ACL tears treated without ligament reconstruction. LEVEL OF EVIDENCE: III.

Shaarani, S. R., et al. (2013). "Effect of prehabilitation on the outcome of anterior cruciate ligament reconstruction." Am J Sports Med **41**(9): 2117-2127.

BACKGROUND: Prehabilitation is defined as preparing an individual to withstand a stressful event through enhancement of functional capacity. HYPOTHESIS: We hypothesized that a preoperative exercise program would enhance postoperative outcomes after anterior cruciate ligament reconstruction (ACLR). STUDY DESIGN: Randomized controlled clinical trial; Level of evidence, 1. METHODS: Twenty volunteers awaiting ACLR were randomly assigned to a control or exercise intervention group. The exercise group completed a 6-week gym- and home-based exercise program. Assessments include single-legged hop test; quadriceps and hamstring peak torque and magnetic resonance imaging cross-sectional area (CSA); Modified Cincinnati Knee Rating System score; and muscle biopsy of the vastus lateralis muscle completed at baseline, preoperatively, and 12 weeks postoperatively. Myosin heavy chain (MHC) isoforms protein and messenger RNA (mRNA) expression were determined with SDS-PAGE (sodium dodecyl sulfate polyacrylamide gel electrophoresis) and RT-PCR (real-time polymerase chain reaction), respectively; IGF-1 (insulin-like growth factor 1), MuRF-1 (muscle RING-finger protein-1), and MAFbx (muscle atrophy f-box) mRNA expression were determined with quantitative RT-PCR. RESULTS: Following 6 weeks of exercise intervention, the single-legged hop test results improved significantly in the exercise-injured limb compared with baseline (P = .001). Quadriceps peak torque in the injured limb improved with similar gains in CSA compared with baseline (P = .001). However, this was not significantly increased compared with the control group. Quadriceps and vastus medialis CSA were also larger in the exercise group than in controls (P = .0024 and P = .015, respectively). The modified Cincinnati score was better in the exercise-injured limb compared with baseline. At 12 weeks postoperatively, the rate of decline in the single-legged hop test was reduced in the exercise group compared with controls (P = .001). Similar trends were not seen for quadriceps peak torque and CSA. The vastus medialis CSA had regressed to similar levels as the control group (P = .008). The modified Cincinnati score continued to increase in the exercise group compared with controls (P = .004). The expression of the hypertrophic IGF-1 gene was significantly increased after the exercise intervention (P = .028), with a decrease back to baseline 12 weeks postoperatively (P = .012). Atrophic MuRF-1 gene expression was decreased after intervention compared with baseline (P = .05) but increased again at 12 weeks postoperatively (P = .03). The MAFbx levels did not change significantly in

either group and within each time point. On the mRNA level, there was a shift from MHC-IIx isoform to MHC-IIa after exercise, with significant changes compared with control preoperatively (P = .028). Protein testing was able to reproduce this increase for MHC-IIa isoform expression only. CONCLUSION: The 6-week progressive prehabilitation program for subjects undergoing ACLR led to improved knee function based on the single-legged hop test and self-reported assessment using the modified Cincinnati score. These effects were sustained at 12 weeks postoperatively. This study supports prehabilitation as a consideration for patients awaiting ACLR; however, further studies are warranted.

Wright, R. W., et al. (2011). "Ipsilateral graft and contralateral ACL rupture at five years or more following ACL reconstruction: a systematic review." J Bone Joint Surg Am **93**(12): 1159-1165.

BACKGROUND: Injury to the ipsilateral graft used for reconstruction of the anterior cruciate ligament (ACL) or a new injury to the contralateral ACL is a devastating outcome following successful ACL reconstruction, rehabilitation, and return to sport. Little evidence exists regarding the intermediate to long-term risk of these events. METHODS: The present study is a systematic review of Level-I and II prospective studies that evaluated the rate of rupture of the ACL graft and the ACL in the contralateral knee following a primary ACL reconstruction with use of a mini-open or arthroscopic bone-tendon-bone or hamstring autograft after a minimum duration of follow-up of five years. RESULTS: Six studies met the inclusion and exclusion criteria. The ipsilateral ACL graft rupture rate ranged from 1.8% to 10.4%, with a pooled percentage of 5.8%. The contralateral injury rate ranged from 8.2% to 16.0%, with a pooled percentage of 11.8%. CONCLUSIONS: This systematic review demonstrates that the risk of ACL tear in the contralateral knee (11.8%) is double the risk of ACL graft rupture in the ipsilateral knee (5.8%). Additional studies must be performed to determine predictors for these injuries and to improve our ability to avoid this devastating outcome.