

Advantages and Disadvantages between Allograft versus Autograft in Anterior Cruciate Ligament Replacement

P. Vang and D. Day

Department of Physicians Assistant, College of Health Professions

Introduction

The number of Anterior Cruciate Ligament (ACL) injuries keeps rising year after year. The rise has a lot to do with the number of women and youth involved in sports. With the rise in ACL injuries, so many people are trying to identify the options available for ACL reconstruction. There are a few options available to these people, one being an allograft reconstruction, and the other an autograft reconstruction. In an allograft reconstruction the surgeon uses a harvested cadaver tendon that has been frozen to maintain its freshness. The other option for a reconstruction graft is the autograft. In an autograft reconstruction the graft is taken from the patient themselves and used as the new ACL. In this procedure, the tendon is harvested from the patient prior to the ACL reconstruction. As both surgeries have their pros and cons, this review will identify the most up-to-date advantages and disadvantages for both allograft and autograft procedures in ACL replacement.

Experiments, Results, Discussion, and Significance

Since its initial description, the central third of the patella tendon with bone on either end of the graft (BPTB) has become the “gold standard” for primary ACL reconstruction. Bone-to-bone healing in the femoral and tibial tunnels is more predictable and reliable than the healing of soft tissue to bone with other graft sources. In addition, soft tissue healing to bone with fibrous tissue or scar may take up to 12 weeks, whereas bone to bone healing should be accomplished in 6-8 weeks.¹ Since the patella tendon is considered the gold standard for ACL reconstruction we will focus our attention on this graft site. Once the right graft site has been chosen, then the decision needs to be made to use an autograft or an allograft. There are advantages and disadvantages to either choice. The questions that need to be asked are:

- What are the pros and cons involved with an allograft?
- What are the pros and cons involved with an autograft?
- Do both grafts hold up equally over time?

Allograft:

When an allograft is chosen the patient avoids having a graft taken from somewhere else on their body, but there are other concerns involved. The specific concerns related to allograft are tissue availability, sterilization, graft cost, delayed graft incorporation, disease transmission, and long term graft strength.² Tissue availability and graft cost should be concerns but are not high on the list.

Disease transmission is definitely a concern with allograft tissue. The two diseases most feared with allograft tissue are human immunodeficiency virus (HIV), and hepatitis, though the risk of obtaining these is small, it still exists.¹ A detailed medical, social, and sexual history questionnaire is completed by tissue bank personnel for any potential cadaveric donor. A physical examination then is done. Unfortunately, there still is a window of vulnerability between infection and the production of detectable antibodies by the donor. Techniques of secondary sterilization have not solved the problem.

The concern over long term graft strength has been around for a long time; however research has not proven either way whether an allograft will lose strength over time. In part, some of the blame for tissue strength has to do with the sterilization process. Both gamma radiation and ethyl oxide have been the cause of graft failure. Ethyl oxide is effective for nonbiologic substances but can cause graft failure when used to sterilize allografts.¹

Consequently this form of sterilization is no longer used. Gamma radiation is now used, and is safer and more effective. The only concern with gamma is that the Mrad level. Irradiation with doses >3 Mrads has been shown to affect the material properties of the graft.³ The other reason for graft ruptures in allograft transplants is delayed graft incorporation. Delayed graft incorporation occurs because the body fails to accept the foreign tissue that it is presented. Because of this the graft will not take and once the patient returns to activity the graft will give way. In a few studies there have been reports of traumatic graft ruptures in late follow up.⁴ Due to these ruptures, late allograft failure has been a concern for many surgeons considering their use in ACL reconstruction.⁴

The advantages for allograft are pretty simple. Using an allograft tendon will allow the patient to avoid donor site morbidity, reduces surgical time, smaller incisions, availability of larger grafts and no weakening of the extensor or flexor apparatuses.⁵ The most common candidates for allograft tendons are those over 45 years of age, those requiring revision, and skeletally immature athletes.² Allograft reconstruction also provides a safer alternative to those patients who are at higher risk of complications under anesthesia. Considering that the surgeon would not have to take time to harvest and prepare the autograft, he would be able to complete the reconstruction faster thus avoid having the patient under for longer periods of time.

Taking all the data into consideration and looking at the advantages and disadvantages of allograft, theoretically the BPTB allograft provides an excellent alternative to the BPTB autograft.
Autograft:

The standard with which all other grafts used in ACL reconstructions are compared is autograft BPTB. Its major disadvantages are donor site morbidity, patellar fractures, patella tendonitis, scar formation, alteration of quadriceps function, and numbness caused by the division of the infrapatellar branch of the saphenous nerve.¹ The reason for these possible problems is the fact that autograft allows the patient to use their own tendons. Since the gold standard is the BPTB an incision has to be made over the top of the central third of the patella tendon and a graft with a bone plug on either end has to be taken. The bone plugs come from the patella and the tibia. Considering a portion of the patella with bone on either end is surgically removed, there will be risks for patella fractures, patella tendonitis, a patch of numbness lateral to the incision from cutting the saphenous nerve, and a tender residual scar. Fortunately, these conditions usually improve, if not resolve completely, over time, and rarely cause functional impairment. Patients who choose autograft tendons also need to be aware of the increased surgery time and the number of scars on the knee.

The advantages of autograft ACL reconstruction is no risk of disease transmission, the human body tends to accept its own tendons better than tendons from a donor, and that autograft BPTB is the “gold standard” for ACL reconstruction. The fact that there is no risk of disease transmission is a very big positive for autograft. The patient has the understanding that they do not have to worry about the risk of HIV and Hepatitis disease transmission.

Conclusion

In conclusion, we found that there are pros and cons of both allograft and autograft. We hope that the information that was presented will give patients the information they are looking for when choosing a graft for ACL reconstruction. Ultimately the graft choice is up to the patient. Once that patient has decided on the graft that they want, they need to present that choice to their surgeon.

- [1.] Miller SL, Gladstone JN. Graft selection in anterior cruciate ligament reconstruction. *The Orthopedic clinics of North America*. Oct 2002;33(4):675-683.
- [2.] Sabrina M Strickland M, John D. MacGillivray, MD, Russell F. Warren, MD. Anterior cruciate ligament reconstruction with allograft tendons. *Orthopedic clinics of North America*. 2003;34:41-47.
- [3.] Harner CD, Olson E, Irrgang JJ, Silverstein S, et al. Allograft versus autograft anterior cruciate ligament reconstruction: 3- to 5-year outcome. *Clin Orthop Relat Res (Clinical orthopaedics and related research)* 1996 Mar(324): 134-44.
- [4.] Peterson RK, Shelton WR, Bomboy AL. Allograft versus autograft patellar tendon anterior cruciate ligament reconstruction: A 5-year follow-up. *Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association*. Jan 2001;17(1):9-13.
- [5.] Shelton WR, Papendick L, Dukes AD. Autograft versus allograft anterior cruciate ligament reconstruction. *Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association*. Aug 1997;13(4):446-449.