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Allograft ligament reconstruction for the ACL deficient knee

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Introduction

Anterior cruciate ligament (ACL) deficiency of the knee is a common complaint commonly resulting in knee instability, pain, swelling and meniscal or cartilage damage to the knee. Various techniques to reconstruct the ruptured ACL have been used over time. The most successful is the use of a Patella tendon graft from the anterior aspect of the injured knee. Alternately the hamstring tendons from the same knee may be used. However in some circumstances these graft materials may not be available or may already be damaged. In these circumstances it is common to utilise the tendon grafts from the uninjured leg. However occasionally circumstances may prevail were no patellar tendon or hamstring graft is available or appropriate from the patient and another graft is needed.

Artificial graft of Dacron, Polyethylene, Gore-Tex or carbon fibre were used historically in the 1970's and 1980's. However poor experiences with artificial ACL substitutes resulted in a decline in their use. Tissues from tissue donors or allograft tissue was therefore used in many cases. This may be of particular use if there are multiple ligament injuries in a knee so that several ligaments need reconstructing.

Allograft tissue

Allografts have the advantage of having the same tissue histological makeup of the area to be replaced. As a result they have all the necessary bioactive materials for replacement such as: proteins, regeneration materials and cells providing a support matrix. Other advantages include being available in numbers so that several grafts may be used. No harvesting from the patient is required so there is no associated scar, pain or deficiency. A large variety of tissues are available for use as replacement grafts such as; the anterior and posterior cruciate ligaments, patellar tendon grafts, hamstring grafts, anterior and posterior tibialis tendons and the Achilles tendon. These have the added advantage of having their bony attachments in situ thus making fixation easier. These grafts once harvested are stored ready for use in Tissue banks following a strict preservation and storage processes.

Preservation and storage

The grafts may be stored cryopreserved by the technique of fresh frozen or freeze drying, It is thought that the hydration status of the graft after freeze-drying is a major factor in the subsequent success of the use of the graft. Preservation of the strength by protecting the collagen within the graft from denaturisation is a primary concern. Although the graft may be histologically the same as the original it may not demonstrate the same degree of strength or stability especially after being subjected to the preservation processes. Some surgeons advocate protection from early aggressive rehabilitation regimes and limitation of weight-bearing stresses across the grafted area following the use of allograft tissue. Certainly the published success of allograft use in ACL reconstruction shows that it is not as successful as the use of the patients own tissue in an autograft.

Side effects of allograft use

There are three factors of importance in the provision and use of Allografts: The potential disease transmission, ultimate graft strength and the cost of the graft.

There is significant risk of disease transmission. The sterility of the graft depends upon the technique utilised for harvesting and storage. If the grafts are harvested poorly they may be contaminated with bacteria particularly clostridium. These may cause severe infections when they are later used. There is also the problem of the small risk of viral transmission. Whilst this may include hepatitis the principle concern is of transmission of the HIV virus. This is commonly quoted as being a chance of 1 in 1,000,000. However it depends to a large degree on the social-economic and geographical area in which the graft was harvested. Cryopreservation itself does not sterilise the graft against viral transmission. The only secure method is to irradiate the graft. However the problems arise as the dose of radiation needed to ensure complete sterility of the graft also has an effect to denature and weaken the structure of the collagen in the graft. This has the effect of making the graft weaker and more prone to fail when used.

The second problem is the strength of the graft when used. Although as stated the process of cryopreservation does not significantly weaken the graft sterilisation against viruses and irradiation does have a significant effect in weakening the graft tissue. This may obviate the use oif the graft as a routine for primary surgery but where previous autograft stabilisation has failed then allograft tissue may be the most appropriate graft substitute to use.

The third problem is the cost and availability. In the USA there are several commercial tissue banks from which such grafts may be secured. The cost of the graft is a significant amount usually in excess of $1,000. In the UK largely because of the difficulty in tissue banks complying with the legislation, and quality standards necessary allografts are not readily available.

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