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## ACL Surgery: General Principles

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### 1 General Principles of ACL surgery

The **Anterior Cruciate Ligament** (ACL) is the main stabilizer in the knee. It prevents anterior movement of the tibia during twisting of the knee or landing from a jump. The injury is usually associated with immediate pain and swelling in the knee associated with instability or giving way. The initial pain and swelling may settle over a number of weeks but often a degree of instability on twisting or recurrent swelling is present. The ligament does not heal or repair itself and the symptoms are usually prolonged unless the patient wishes to restrict their activities and/or to use an immobilizing knee brace. If appropriate treatment is not undertaken then continuing symptoms, limitations in sports and progressive degenerative changes often result. Therefore surgical reconstruction of the ligament is often necessary and commonly recommended in order to allow patients to resume their pre-injury level of activities.

There are several ways to surgically repair or reconstruct the ACL. A surgical reconstruction using a **hamstring tendon technique** can be undertaken using a double or quadruple graft or by a double tunnel anatomical technique. The gold standard to which the success is compared remains a reconstruction using a **patellar tendon technique (BPTB)**. Rehabilitation following a BPTB technique is generally more rapid than following reconstruction using the hamstring tendons during the first 6 weeks due to the fact that early fixation of the BPTB graft using a screw is more secure and in a hamstring technique. However the BPTB technique may result in more discomfort over the first few days. Use of a BPTB graft may result in more discomfort whilst kneeling and so is not preferred for roofers and plumbers. The use of a hamstring graft results in a degree of hamstring weakness and a slightly higher failure rate and so is often not preferred for active young soccer, rugby or hockey players.

The ACL study group has driven advances in the development of the surgical techniques over the last 20 years. This group of the top ACL surgeons around the world meet bi-annually and may invite new members based on the quality of their research into ACL injury.

## **2 Types of graft for ACL reconstruction**

The technique of ACL reconstruction using the BPTB technique has changed little over the last ten years other than for the introduction of third and fourth generation bio-absorbable screws. The results have been uniformly successful in delivering a return to active twisting sports. The results remain the “Gold Standard” to which other techniques are compared. The technique of ACL reconstruction using a hamstring reconstruction technique has undergone dramatic changes over the past decade, due to extensive clinical experience, improved surgical technique and better understanding of rehabilitation. The initial technique was of a doubled semitendinosus graft with subsequent use of tripled and quadrupled grafts. Subsequently longer grafts using semitendinosus and gracilis tendons were used. More recently attempts to provide a more anatomical reconstruction have incorporated a double tunnel and an “anatomical” reconstruction technique. The early results of these techniques have all been promising although some of the published results have not proven as reliable in young active twisting sports. Over several years this has prompted and stimulated evolution of the hamstring tendon technique.

The objective of ACL reconstruction is to restore normal stability in the knee and through proper rehabilitation achieve active and dynamic stability without instability, weakness, pain, swelling or stiffness. The goal is to achieve full; function, strength and a return to normal daily, recreation and sporting activities. With a successful surgical technique patients can generally return to office work by 1 – 4 weeks, driving at 4 weeks, pool exercises at 2-3 weeks and manual work after 6-8 weeks. It is very important that the patient takes an active part in the rehabilitation, both before and after the operation. Our goal is to guide our patients through the rehabilitation without unnecessary restrictions or delay. Adherence to the protocol is important as insufficient rehabilitation may result in unnecessary discomfort, stiffness and swelling whilst excessive activities before adequate healing may result in stretching or laxity of the reconstruction.

Pre and post-operative rehabilitation is a major factor in the success of ACL reconstruction. Early restoration within the first few days of knee extension, control of the swelling and protective muscle strength helps achieve an early return to the normal activities of daily life such as walking, stairs, office work and driving. Restoration of the full range of motion, pain relief and a normal walking gait allows a return to more manual work, gym and pool exercises after 4-6 weeks. Whilst later rehabilitation to improve strength, balance (proprioception) and sports specific functional activities allow a return to recreational activities, jogging and gently non twisting sports by 3 months and to soccer, rugby, hockey training at 6 months and to skiing by 9-12 months.

An important aspect of this is an understanding of the basic principles of the ACL reconstruction and the rehabilitation by patients and to mentally and physically prepare the patient for the operation and accelerated rehabilitation program. This program is based on accelerated rehabilitation principles and extensive experience. The initial protocol for early active rehabilitation was championed by Dr. K. Don Shelbourne of the Shelbourne Knee Centre at the Methodist Hospital Indianapolis, USA. Like David Johnson, Dr. Shelbourne is a longstanding member of the ACL study group.

## **3 Anatomy and bio-mechanics of the ACL**

The knee is a complex joint, which has the ability to bend and rotate slightly. Knee ligaments help control motion by connecting bones and bracing the joint against abnormal types of motion. The ACL links the back of the **femur** (thighbone) to the centre of **tibia** (shinbone), stabilising the knee, mainly in the forwards and backwards direction.

In addition to its mechanical restraining function, the ACL provides important neurological feedback that directly affects perception of joint position, and reflex muscular stabilisation of the joint (**proprioception**). Conscious and subconscious proprioception is essential for normal joint function in daily activities, occupational tasks and sports. Proprioception diminishes following capsuloligamentous injury of the knee, but is significantly restored following successful surgical ACL reconstruction and rehabilitation. A typical mechanism of an ACL injury is a non-contact twisting movement, usually due to stopping and/or changing direction. Side-stepping (cutting), pivoting and landing from a jump are examples of events that may cause an ACL tear. An audible pop or crack, pain

and the knee giving way are typical initial signs, followed by almost immediate swelling, due to bleeding inside the joint. Associated damage to other important joint structures, such as **menisci**, **collateral ligaments** and **articular cartilage** (Joint lining) is very frequent.

Some patients achieve satisfactory stability and function with non-operative treatment (rehabilitation and adjustments to daily activities and sports). However, chronic ACL deficiency results in gradual damage to the menisci and articular cartilage and consequent early joint wear.

**ACL reconstruction is not an emergency operation.** Delaying surgery until a full range of motion is obtained significantly reduces the chance of having problems post-operatively. Delaying acute surgery also allows the patient to be mentally better prepared for surgery and gives the patient time to learn, fully understand and practise adequate exercises.

A complete tear of the ACL has minimal ability to heal and often requires surgical reconstruction. This involves replacing the torn ligament, either with a graft from the hamstrings muscles (**semitendinosus-gracili autograft**) or sometimes with the middle third of the patella tendon (**bone-patella tendon-bone autograft**). Fastening the graft to tunnels drilled in the bone with interference screws provides secure fixation which enables early accelerated progressive rehabilitation to take place. Surgery is usually followed by an overnight stay in hospital (maximum of 2 days) and by several months of intensive rehabilitation to restore normal range of motion, strength, flexibility and proprioception.

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