Cartilage Surgery
The Knee

www.sportssurgeryclinic.com
CARTILAGE INJURY

Treatment of cartilage injury remains one of the most significant challenges faced in Orthopaedics and Sports medicine.

Research programmes and surgical options for repair and regeneration of cartilage and meniscus are continuously evolving. The SSC Cartilage Repair Programme is committed to providing patients with the most advanced and effective treatments available.

Both patient and defect specific variables, as well as a commitment to post-operative rehabilitation are crucial when considering clinical interventions for cartilage injury. The appropriate surgical procedure depends on limb alignment, knee stability, and the extent of damage to the articular cartilage and / or the meniscus.

Surgical options include:

- Articular Cartilage Repair, Replacement and / or Regeneration
- Meniscus Surgery
- Alignment / Osteotomy Surgery
- ACL / Ligament Surgery

Successful outcomes post cartilage repair depends not only on the surgery, but also a commitment to a specific post-operative, criteria based, rehabilitation programme.
ARTICULAR CARTILAGE INJURY

Articular cartilage lines the ends of our joint surfaces and is composed of cells called chondrocytes, along with a matrix of proteins and collagen. In healthy joints, this durable material allows bones to glide on one another with minimal friction, as well as acting as a shock absorber, by facilitating the transmission of loads to the underlying (subchondral) bone.

Areas of cartilage loss often interfere with normal joint and limb mechanics, and can result in pain and a reduction in daily and sporting functional capabilities.

When areas of cartilage are worn away, exposing the subchondral bone, treatment is designed to assist in filling in the defect with healthy articular cartilage and provide new protection for the joint surface.

Treatment options for articular cartilage injury are based on a variety of factors, including:

- age
- activity level
- overall joint condition
- the size and location of the lesion
- commitment to rehabilitation, and
- desire to return to sporting activity.

ARTICULAR CARTILAGE SURGERY

Surgery is considered when a patient remains symptomatic and functionally incapacitated, despite an adequate trial of conservative treatment.

There are various surgical methods available for treatment of articular cartilage defects, which include:

- Chondroplasty
- Marrow Stimulation
- Osteochondral transplantation
- Cellular Treatments
- Synthetic Scaffold Implantation

CHONDROPLASTY

Chondroplasty refers to an arthroscopic procedure which aims to smooth down articular surface areas of degenerative cartilage, and treat chondral lesions. Rough and unstable cartilage lesions are treated with the use of an oscillating shaver and other debridement tools. Decreasing the roughness of the surface aims to decrease pain and improve joint function.
MARROW STIMULATION

Marrow stimulation is a technique to create tiny holes in the underlying subchondral bone of the damaged area. Bone marrow cells and blood from the holes allow clots to form, completely covering the damaged area. These marrow-rich clots are the basis for the new tissue formation, as it gradually matures into firm, smooth and durable tissue, acting as protection for the joint surface.

This procedure is also referred to as the microfracture procedure, and is usually carried out arthroscopically. In some cases, the option of adding a scaffold or external cellular treatment to your marrow stimulation procedure may be discussed with you.

OSTEOCHONDRAL TRANSPLANTATION (OATS)

OATS (Osteochondral Autograft / Allograft Transplantation Surgery) is a method of cartilage transfer, which involves moving healthy cartilage and bone units from an area of the knee that is non weight bearing to an area of damaged cartilage.

A mosaicplasty is a form of OATS, that utilises many plugs of healthy cartilage and bone, which once embedded, resemble a mosaic.

The OATS procedure may also be performed using allograft bone and cartilage units obtained from a donor.

CELLULAR AND SYNTHETIC SCAFFOLD OPTIONS

For large lesions that are unsuitable for marrow stimulation and/or OATS, there are a number of other internationally validated as well as experimental treatments that use a patient’s own cells or implantable synthetic or natural scaffold to grow new, healthy cartilage.

We are involved in a number of clinical trials in this regard through our Cartilage Repair Programme which is linked to research at Trinity College Dublin, Royal College of Surgeons in Ireland, and other partner institutes nationally and internationally. These options may be discussed with you by your surgeon if appropriate for your condition.
THE MENISCUS: REPAIR & REPLACEMENT

The Meniscus

The meniscus contributes to the stability and smooth movement of the knee. It plays a role in
- Joint Congruency
- Load distribution
- Enhanced stability

Each knee has two menisci, one located medially on the inside of the knee, and the other, laterally, on the outside of the knee.

MENISCAL SURGERY

Meniscal tears are often treated by partial meniscectomy. This involves removal of damaged or unhealthy tissue which has no possibility of healing or repair.

Where possible, preservation of meniscal tissue and function is preferred, as it is believed to enhance long-term joint function.

MENISCAL REPAIR

Some meniscal injuries can be repaired arthroscopically, depending on the type of tear, as well as the overall status of the damaged meniscus.

The torn pieces of the meniscus are sutured / stitched back together.

Not all meniscal tears are suitable for meniscal repair, but the appropriate options will be discussed with you by your surgeon.

There is now potential for biological augmentation and tissue engineering strategies to enhance options for meniscal repair and replacement in symptomatic patients.

MENISCAL REPLACEMENT

Meniscal replacement surgery uses natural or synthetic scaffolds to guide tissue repair or regeneration, while providing a temporary construct for mechanical function, while also potentially reducing progression of degenerative change.

At present, these options are used in patients who are symptomatic following loss of meniscal tissue. As of yet, they are not advocated for use in the absence of symptoms.
Meniscal Allograft Transplantation represents a solution to a symptomatic, meniscal deficient knee, which has not reached an advance stage of osteoarthritis.

The ligaments cross each other to form an “X” with the anterior cruciate ligament in front and the posterior cruciate ligament in behind.

Articular cartilage and/or meniscal injuries frequently occur in conjunction with ACL injury, in which case combined, or staged surgery, may be carried out. Appropriate management of cartilage injuries occurring with ACL injury has been shown to have a significant impact on outcomes.

**KNEE STABILITY**

Management of cartilage and meniscal injuries are based on a number of patient and lesion related factors, as well as the presence of any comorbidities.

Such comorbidities, such as malalignment of the limb axis and/or ligamentous injury may need to be addressed, either simultaneously or separately. Where articular cartilage is being treated, specific attention must also be given to the meniscus.

**CRUCIATE LIGAMENTS**

The anterior cruciate ligament (ACL) is one of four major ligaments stabilising the knee joint, which connects the femur (thigh bone) to the tibia (shin bone).

The ACL prevents the tibia from sliding forward too much, and contributes to the rotational stability of the knee. The posterior cruciate ligament (PCL) prevents the tibia from sliding backwards.

The collateral ligaments are located at the inner side and outer side of the knee joint. The medial collateral ligament (MCL) connects the femur to the tibia and provides stability to the inner side of the knee.

The lateral collateral ligament (LCL) connects the femur to the fibula and stabilizes the outer side. The collateral ligaments contribute to lateral stability by controlling the sideways motion of the knee.

**Anterior view of the right knee**
KNEE ALIGNMENT & OSTEOTOMY SURGERY

MALALIGNMENT

Proper alignment of the knee is essential for normal function and balance of the joint.

Where uneven forces pass through the knee, this can cause excess stress to both the articular cartilage and ligaments. Dealing with the surfaces of a joint without assessing limb alignment and mechanics has been shown to be associated with a higher failure rate.

There are two types of malalignment in the knee, which can contribute to knee pathology

- Knee Varus
- Knee Valgus

With a varus knee, the weight passes through the medial compartment of the joint. Due to increased force going through the inside of the joint, degeneration of the medial compartment of the knee is common.

With a valgus knee, the forces pass more through the lateral aspect of the knee, predisposing the outside of the knee to degenerative changes.

OSTEOTOMY

A corrective osteotomy redistributes the weight bearing forces on the knee, by cutting a wedge of bone from either the tibia or femur, to reposition and realign the knee.

A successful osteotomy

- transfers weight from the painful area of the knee
- corrects poor knee alignment
- helps prolong the lifespan of the knee joint
BRACING

Offloading braces are a form of non-invasive treatment for uni-compartmental degeneration. They are often also used to evaluate the possible benefits of osteotomy surgery in a non-invasive way.

They are designed to improve tibiofemoral alignment by re-distributing the mechanical forces away from the degenerative compartment of the knee, via an external varus or valgus force applied to the knee. This decreases the load on the symptomatic compartment, reduces pain, and reduces the potential of increasing the provocative mechanical stresses.

The braces incorporate load adjustment mechanisms which allow the brace to be modified according to the patient comfort levels.

REHABILITATION

Commitment to a progressive rehabilitation programme represents a critical component for successful recovery after cartilage repair surgeries.

At SSC, we have designed Rehabilitation Guidelines specific to the surgical technique carried out. You will be seen by a physiotherapist prior to discharge from SSC, who will advise you on gentle range of motion and early strengthening exercises. You should continue these until you follow up with a chartered physiotherapist 7-10 days post discharge.

As everyone progresses at different rates, the rehabilitation programme focuses on criteria based progression, rather than timeline based progression.

Progress is based on Key Performance Indicators, with consistent sequential progressions. Once you are proficient with the execution of a particular exercise, this can be increased in complexity, with emphasis all the time on technique efficiency.
CARTILAGE REPAIR AND ORTHOBIOLIGICS PATHWAY

A National Cartilage and Orthobiologics Centre has been established in partnership with Sports Surgery Clinic, Trinity College Dublin, Royal College of Surgeons, Ireland and Cappagh National Orthopaedic Hospital.

The Cartilage Repair and Orthobiologics Centre links specialists in cartilage, orthobiologics, and related research across Ireland, and internationally, in an effort to facilitate the best possible clinical care following an injury and/or early arthritis.

CARTILAGE REGISTRY

After your initial consultation with your orthopaedic surgeon, you will be invited to be a participant in our Cartilage Repair Programme. This programme focuses on all aspects of care, including articular cartilage, meniscus, alignment / osteotomy surgery. It links pre-operative imaging and clinical evaluation with surgery and our carefully designed rehabilitation programme.

Participation in this research is not compulsory, however, we would greatly appreciate your participation, which involves completing a number of questionnaires, at various time points before and after the surgery, regarding the history of your injury, and your symptoms, such as pain and dysfunction, along with some functional strength and control tests.

If you decide not to participate, this will not affect your care pathway in any way, and should you agree to participate, your identity will remain completely anonymous.

You are also free to withdraw yourself from the research at any stage.

OUR PATHWAY

At Sports Surgery Clinic, we have developed a Cartilage Repair Pathway, designed to optimise your journey through from your consultation to your return to daily functional tasks or your chosen sport.

At various time points, as outlined below, you will undergo some objective tests, to monitor your progress through the various stages of your rehabilitation. This will provide real-time feedback and a clear indication of your progress and readiness to return to your optimum level of activity.

STAGE 1
Pre Op Testing & Prehabilitation

STAGE 2
Post Operative Rehabilitation

STAGE 3
6, 9, 12 Month Functional Testing

STAGE 4
Return to Activity
PRE OP TESTING & PREHABILITATION

After your initial consultation with your Orthopaedic Surgeon, you will see one of our physiotherapists, who will educate you on your surgery and the rehabilitation process. You will undergo an Isokinetic strength test in our 3D Biomechanics Lab here in SSC. This will give you a baseline measure of strength, which you will be working to improve on both before and after your surgery.

You will also commence a pre-operative rehabilitation programme (prehabilitation) to ensure your knee is in optimal condition prior to the surgery. Prehabilitation involves both physical and mental preparation prior to surgery, in order to restore optimal knee function, as well as education regarding the surgery, rehabilitation and goal setting. Prehabilitation also benefits in accelerating the initial post-operative rehabilitation phase.

POST-OPERATIVE REHABILITATION

The post surgery rehabilitation programme is crucial to optimize the success of your surgery, and begins the morning after your surgery.

You will be given your discharge instructions, along with a copy of specific Rehabilitation Guidelines prior to your discharge. It is essential to your recovery that you and your physiotherapist adhere to the specifics of the Rehabilitation Guidelines.

As everyone progresses at different rates, the rehabilitation programme focuses on criteria based progressions, rather than time based progressions.

For each exercise, it is imperative to have consistent sequential progressions. Once you are proficient with the execution of a particular exercise, it can be increased in complexity, with emphasis all the time on technique efficiency.

FUNCTIONAL TESTING

At various stages post surgery, you will undergo repeat objective strength tests and movement analysis in our 3D Biomechanics Lab. Your Isokinetic strength results will be monitored from pre-operatively, through to return to sport and beyond, giving you an objective, quantifiable measure of your progress.

You will also undergo some power testing and 3D Motion Analysis, which will allow us to investigate your movement patterns with a high degree of accuracy. Your results will be explained to you in detail, and your rehabilitation programme can be tailored appropriately based on these, in order for you to return to sport in a safe and timely manner.
PREHABILITATION

EXERCISE PROGRAMME

Carry out these exercises on a daily basis prior to your surgery. Emphasis on good technique is essential. While you may have some mild discomfort while doing the exercises it is essential to get the knee moving to have it in the best condition post operatively.

Knee extension

Lying, towel under ankle, extending the knee in pain free range. 8 reps x 4 sets.

Knee Flexion

Bend the knee gently and hold for 5 seconds. You may use a towel anchored around the thigh to aid the movement. Repeat 10 times.

Straight Leg Raise

Bend your un-operated leg. Push the back of the operated knee down into the bed and contract the quadriceps (thigh) muscles. Keeping the knee straight, lift the whole leg about 6 inches off the bed as demonstrated. Aim to hold for 5 seconds. Repeat 10 times.

Single Leg Chair Squat

- Stand on one leg with arms straight out in front looking straight ahead
- Squeeze €100 note between gluts and drive heel into ground
- Sit back hips first softly touching the chair and come back up
- 8 reps x 4 sets.
• Keep knee in line with middle of foot
• Push with flat foot with emphasis on weight through the heel
• Push out as quickly as possible
• Slowly control return to bent position
• 8 reps x 4 sets.

• Keep low back flat at all times
• Bend knee all the way through range
• Pull up as quickly as possible
• Slowly control return to straight position
• Repeat 10 times.

• Standing on one leg
• Slowly lift one knee so that thigh is parallel to floor, pause x 2 seconds, from this position extend the knee and step forward
• Repeat on opposite side

• Standing on one leg
• When steady, close eyes and maintain balance for 10 seconds
• Increase time as able
• 2 minutes