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Recent Advances in Total Knee Replacement

Total knee replacement (TKR) is one of the most successful and life-enhancing surgical procedures available today. For 80% of patients who have the procedure, it relieves almost all pain, allowing them to regain much of their previous mobility, and enhancing their quality of life.

More than 90% of TKR implants currently last for up to ten years. However, there are a significant number of patients who continue to have problems with their joint. This can range from 20% to 30% of procedures in some centres.

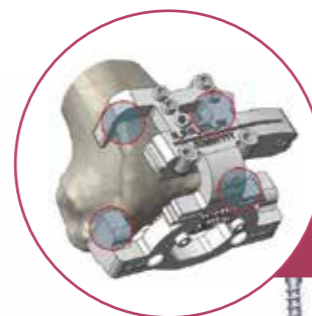
Knee replacement surgery has improved dramatically in the last few decades, due to better techniques, better materials and better understanding of knee physiology and function. The existence of a more successful and durable knee replacement has had a big impact on clinical practice; the recent advancements and changes in procedure has led to a need for changes in patient assessment and selection for surgery, as well as in post-operative care.

The aim of knee replacement is to replace the deficient joint surfaces (condyles of the femur and top surface of the tibia) with low-friction artificial surfaces, replacing the patella itself if necessary.

The artificial components are designed so that metal (titanium or cobalt/chromium-based alloys) articulates with plastic (ultra high-density polyethylene), and a complete prosthesis now weighs only about 500 to 600g.

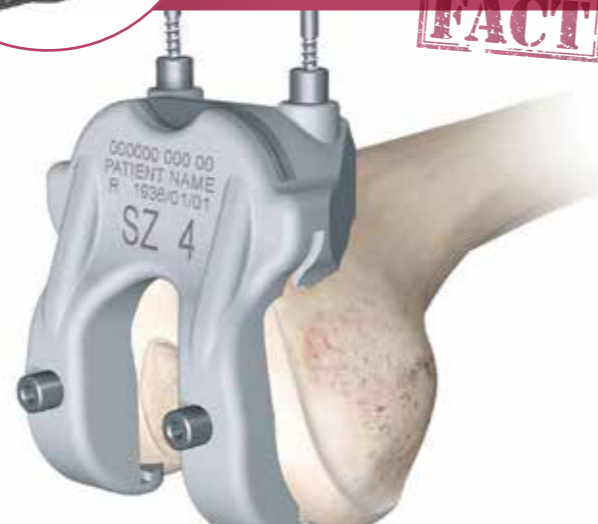
Good outcomes following TKR are collectively dependent on many factors. The most important of these are accurate

alignment of the prosthetic components, and appropriate soft tissue balancing. Poor alignment (i.e. greater than +/- three degrees with respect to mechanical axis of the lower limb) has been linked to poor long-term outcomes and instability due to poor soft tissue balancing leads to poor function and pain right from the outset. Though TKR has been successful, the prosthesis itself has a finite lifespan, making it unsuitable for younger patients.



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FACT



INDICATIONS FOR TKR

The primary indications and timing of TKR are important determinants of eventual outcome. A thorough discussion of patient characteristics and expectations is necessary.

The most common indications are as follows:

Osteoarthritis (OA)

The most common reason for knee joint replacement is OA. This may be:

- **Primary OA.** Some 40% of 40 year-olds will have radiographic evidence of OA, and half of these will have symptoms. There is thought to be a genetic risk for this condition, with siblings of joint replacement patients being up to five times more likely to need similar surgery themselves
- **Secondary OA.** This is secondary to mechanical derangement (for example, meniscal or cruciate ligament injuries), infection, instability, and fracture into the joint

Other causes of cartilage destruction

- Rheumatoid arthritis (RA)
- Haemophilia
- Seronegative arthritis
- Avascular necrosis, either idiopathic or steroid-induced.
- Gout and other crystal deposition diseases
- Rare causes, which include bone dysplasias and bone cancers (eg, osteosarcoma). The bone destruction involved usually requires the use of more unusual 'fixed-hinge' or constrained knee joint prostheses
- Obesity

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ADVANCES IN TOTAL KNEE REPLACEMENT

Over the past ten years there have been a number of improvements in prosthesis design, operating techniques and perioperative management.

These have not only helped to improve the longevity of the implant but the functional outcome as well right from the first postoperative day. The most significant of these are listed below.

Computer Navigation

Use of Computer Navigation to increase the accuracy of bony cuts has been a great success, with the added benefits of having every operative step and measurement recorded, and the ability to assess passive kinematics of the knee .



Software has been developed that enables surgeons to use computer navigation assistance to employ different techniques of knee replacement using the same prosthesis. Computer Navigation has resulted in improved consistency of accurate knee prostheses placement, which would enhance the longevity of the implant.

Patient Specific Instrumentation

It is now possible to produce instruments for TKRs that are entirely patient specific. These shift the bone landmark registration and implant positioning of computer navigation from intraoperative to the pre-operative setting. A preoperative MRI or CT scan is mandatory, as default implant sizing and alignment targets must be templated by the surgeon and mapped onto the virtual knee. The surgeon must also review and modify the preoperative computer plan to incorporate any clinical findings, such as flexion contracture or fixed deformity.

FACT!

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The finalised preoperative plan is sent back to the implant vendor for fabrication of patient-specific cutting blocks. The advantages of these instruments include more accurate coronal alignment, fewer outliers, no instrumentation of intramedullary canal, decreased operative time, and decreased hospital costs to clean-sterilise instruments.

Custom Made Implants

This is a recent development and a promising concept. The long term outcome is currently unknown but may have advantages in patients who have non-standard anatomy where an off the shelf implant may be difficult to fit. It is also possible that a more precise fit of implants may lead to better kinematics and ligament balance.



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Management of Pain

In some large joint replacement centres, the focus over the past 5 years has been on reducing functional disability in the perioperative period. The benefits of managing postoperative pain have significantly improved the functional outcome for patients. While the precise understanding of the pain pathway and appropriate intervention using systemic, regional and local anaesthesia in tandem, has resulted in 50% reduction in postoperative pain.

Management of Blood Loss

The management of blood loss has been a big factor in reducing swelling and stiffness in the post-operative period and improving limb function in the longer term. The use of Tranexamic acid and Transcollation technology has reduced the need for blood transfusion by 90%, which has significantly improved patient outcomes.

Knee replacement surgery is a success story and there are now numerous options available to a knee surgeon. All patients are different. Therefore, having the ability to take the various advances and devise a tailor made treatment plan, helps achieve the best outcome for each individual patient.

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