Implants used in total knee replacement

Generalities

This type of surgery has greatly benefited from continuous advances in science, engineering, metallurgy, and bio-mechanics. This has generated the development of better and longer lasting implants.

At present, knee replacement is considered a highly successful procedure that has helped alleviate pain and better the quality of life for millions of people throughout the world.

Even though there are many manufacturers, types of implants, different materials and different designs, the basic knee components are:

- Femoral component.
- Tibial component.
- Patellar component.
- Tibial Insert.

Implant features

All implants used in knee replacement share four basic features:

- **Biocompatibility.** All implants are made out of special materials that are "host friendly" and have little or no bodily reaction thus preventing inflammation and rejection.
- **Mechanical stress resistant.** All implants are strong enough to sustain body weight and movement without breaking.
- **Friction resistant.** All implants are strong enough to resist wear due to friction between contact surfaces.
- **Corrosion resistant.** All implants resist biochemical corrosion and oxidation while in a liquid environment.

Materials

Implants are made out of different materials that have been proven through research, development and time to have all four of the previously described characteristics. These materials are termed biomaterials because they are considered "host friendly".

- **High molecular weight and cross-linked polyethylene.** This is a group of plastics that is very strong and highly resistant to friction. Tibial and patellar components are made out of these special plastics.

- **Medical grade steel.** They are strong metal alloys that are flexible and are highly biocompatible. Cemented femoral and tibial components are made out of these kind of alloys.

- **Titanium alloy.** One of the most “host friendly” materials in use, with excellent strength, flexibility and durability. Most of the non-cemented tibial components are made out of this alloy.
- **Polymethilmetacrilate.** This is a highly specialized plastic designed to create a suitable interface between implant and host bone. It creates a strong fibrous anchor between them and is commonly known as bone cement.

Different designs and surface combinations

When performing a knee replacement, your surgeon will choose the best implant for your specific needs. There are many different types of implants and materials that he/she can choose from, and he/she will select the implant according to bone geometry, bone health, patient health and personal experience. The main purpose of placing the best implant in each patient is to increase its durability.

According to this criteria, there are three basic implant fixation techniques:

- **Cemented implants:** bone cement is used to fix patellar, femoral and tibial implants to the patient’s bone. This is the most popular technique in the world used by orthopaedic surgeons.
- **Non-cemented implants:** implants are fixated to the patient’s bone though a press-fit technique which permits a primary mechanical fixation. Implants are made out of titanium alloy that permit bone growth resulting in a secondary biological fixation. This kind of fixation is indicated in younger patients or elderly patients with adequate bone health, but its general use in knee replacement is still not widely accepted because of poor results.
- **Hybrid implants:** one component is fixated with cement and the other is fixated with a press-fit technique.

There are also two different types of surface contact between components:

- Hard – Soft contact surface: the tibial insert is made out of polyethylene and the femoral component is made out of iron alloy, chromium cobalt alloy or ceramic. This is universally the most widely used implant selection used by orthopaedic surgeons.
- Hard - Hard contact surface: here we combine different designs, either metal - metal or ceramic - ceramic components. Its general use in knee replacement is still not widely accepted because of poor results.

Depending on the need to preserve the posterior cruciate ligament or the sufficiency of collateral ligaments , knee implants are also divided into:

- **Non restricted knee implants:** these implants leave the patient’s posterior cruciate ligament intact, thus allowing the patient to climb and go down stairs easier.

- **Semi – Restricted knee implants:** these implants sacrifice a patient's posterior cruciate ligament. This ligament is artificially substituted by a "box" stop that blocks the knee in extension creating stability. In theory it allows for more knee flexion than non- restricted implants.
- **Restricted implants:** this is a hinged knee implant used mainly in some revision knee surgeries in patients with unstable collateral ligaments.

As you can see, there are many different types of implants your surgeon can choose from for your knee replacement depending on different implant design and biomaterials. Your doctor will select the best implant for your needs depending on gender, age, physical activity, general health, bone health, and bone geometry. This is done with the purpose of improving the longevity of your knee replacement.

Long-term results

Knee replacement surgery has a variable lifetime that depends on many factors such as weight, bone health, general health and activity level. Taking these factors into account, it is universally accepted that more than 80% of all knee replacements will last between 10 and 15 years.

As always, if there are further questions, please let us know, and with pleasure we'll contact you to dispel your worries.

Remember we are here to help you.

Dr. Stefan Martínez & Dr. Isaac Cervantes.

NOTE: The main reason for the above information is to aid patients. We are not responsible for the decisions made by patients without previously consulting their attending physician.