

Implants used in total hip replacement

Generalities

Since the sixties, hip replacement has benefited greatly from continuous advances in research and development in the fields of engineering, metallurgy and biomechanics. Thanks to these advances newer hip implants have evolved into longer lasting implants.

At present, hip replacement is considered the “most successful surgical procedure of the twentieth century”. It has a high success rate and it has helped alleviate pain and better the quality of life of millions of people throughout the world.

Even though there are many manufacturers, types of implants, different materials and different designs, hip prosthesis is basically composed of three fundamental parts:

- Acetabular cup. (cemented or uncemented)
- Femoral stem. (cemented or uncemented)
- Femoral head

Implant features

All implants used in hip 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 over 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. Most acetabular components are made out of these special plastics.

- **Medical grade steel:** they are strong metal alloys that are flexible and are highly biocompatible. Most of cemented femoral stems are made out of this type of metals.
- **Titanium alloy:** one of the most “host friendly” materials in use, with excellent strength, flexibility and durability. Most of the noncemented components are made out of this alloy. (acetabular shells, acetabular rings, screws, femoral stems etc).
- **Chromium and cobalt alloys:** this is a very strong and resistant alloy used mainly in the fabrication of femoral heads and acetabular cups used in the metal on metal prosthesis.
- **Ceramics:** this is a group of non-organic, non-metallic elements. They are very resistant thanks to their ionic links, their purity, and the size of their particles. The most commonly used ceramic is alumina, and it is used in the fabrication of femoral heads.
- **Polymethylmetacrilate:** this a highly specialized plastic designed to create a suitable interface between implant and host bone. It creates a strong fibrous anchor between them and it is commonly known as bone cement.

Different designs and surface combinations:

When performing a hip 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 both acetabular and femoral implants to the patient’s bone. It’s used mainly in patients over 70.
- **Non-cemented implants:** implants are fixated to the patient’s bone through a press-fit technique which permits a primary mechanical fixation. Implants are made out of titanium alloy that permit bone in-growth resulting in a secondary biological fixation. This kind of fixation is indicated in younger patients or elderly patients with adequate bone health.
- **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 acetabular and femoral components:

Hard – Soft contact surface: the acetabular component is made out of polyethylene and the femoral head is made out of iron alloy, chromium cobalt alloy or ceramic.

Hard - Hard contact surface: here we combine different designs, either metal-metal or ceramic- ceramic acetabular components and femoral heads.

As you can see, there are many different types of implants your surgeon can choose from for your hip 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 hip replacement.

Long term results:

Hip 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 hip replacements will last between 15 and 20 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 van Gils & 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.