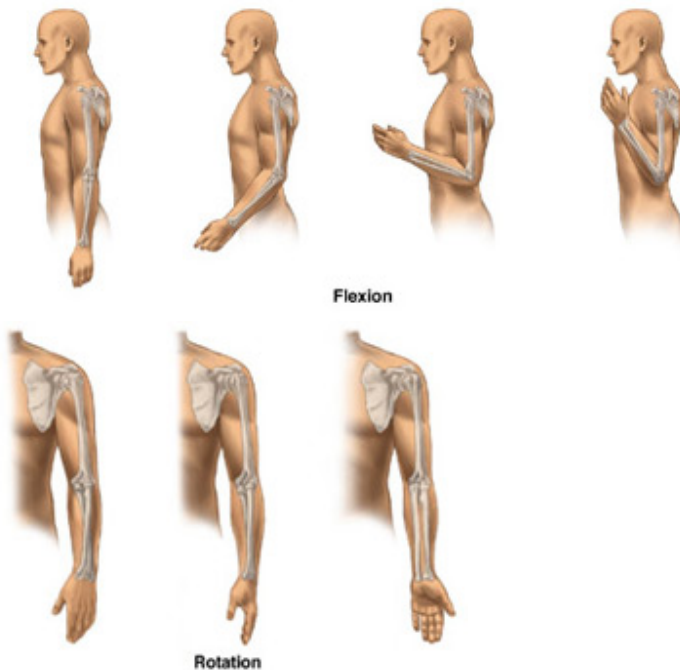


## Elbow Anatomy

The elbow is a hinge joint consisting of three bones. The upper portion of the hinge is at the end of the upper arm bone (humerus), and the lower portion is the top of the two forearm bones (radius and ulna) which are side by side. All three of these bones are in contact with each other. The joint is surrounded and lined by cartilage, muscles, and tendons that provide support, stability, and ease of movement.



The elbow joint allows for the extension, flexion, and rotation of the arm. The range of motion is dependent upon the proper articulation of the elbow joint.

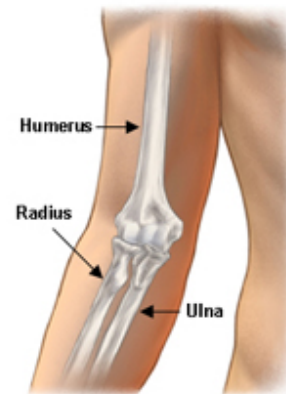


## Your Elbow Surgery

The elbow is a hinge joint consisting of three bones. The upper part of the hinge is at the end of the upper arm bone (humerus), and the lower part of the hinge is at the top of the two forearm bones (radius and ulna) which are side by side. When the elbow is bent, the ends of the two forearm bones rub against the end of the humerus.

## ***Bones of Elbow Joint***

In a healthy elbow joint, the surfaces of these bones are very smooth and covered with a tough protective tissue called cartilage. Arthritis causes damage to the bone surfaces and cartilage where the three bones rub together. These damaged surfaces eventually become painful.



## ***Arthritic Elbow Joint Surfaces***

There are many ways to treat the pain caused by arthritis. One way is total elbow replacement surgery. The decision to have total elbow replacement surgery should be made very carefully after consulting your doctor and learning as much as you can about the elbow joint, arthritis, and the surgery.

In total elbow replacement surgery, an artificial hinge made of metal and a very durable plastic material is inserted into the joint so that the elbow can move without allowing the two forearm bones to contact the humerus. We call this artificial hinge an "implant."



## ***Getting to the Joint***

The patient is first taken into the operating room and given anesthesia. After the anesthesia has taken effect, the skin around the elbow is thoroughly scrubbed and sterilized with an antiseptic liquid. A tourniquet is then applied to the upper portion of the arm to help slow the flow of blood.

An incision about six inches long is then made over the elbow joint. The incision is gradually made deeper through muscle and other tissue until the bones of the elbow joint are exposed.

### ***Preparing the Bones***

One of the forearm bones, the ulna, has a projection at the end, which extends up and behind the end of the humerus. A special power saw is used to remove part of this projection.

This allows the two forearm bones to be rotated out of the way so parts of the humerus can be removed with the saw. Precision guides are used to help make sure that the cuts are made so the bones will align properly after the implant is inserted.

The middle portion at the end of the humerus is removed first.

The arm bones have relatively soft, porous bone tissue in the center. This part of the bone is called the "canal." Special instruments are used to clear some of this soft bone from the canal of the humerus. These instruments also help shape the canal to fit the shape of the implant.

Then, similar instruments are used to clear some of the soft bone and shape the canal of the ulna.

### ***Attaching the Implants***

The elbow implant consists of two metal stems that are connected by a metal locking pin. This pin passes through the ends of both stems, which are lined with a strong plastic material, serving as a bearing that allows the elbow to bend. The stems are inserted into each of the two prepared canals. A special kind of cement for bones is first injected into the canals to help hold the stems in place.

When the cement is hard, the two implant parts are brought together and the pin is inserted to connect them.

## ***Stems Locked Together to Create Hinge***



## ***Closing the Wound***

If necessary, the surgeon may adjust the ligaments that surround the elbow to achieve the best possible elbow function.

When all of the implants are in place and the ligaments are properly adjusted, the surgeon sews the layers of tissue back into their proper position. A plastic tube may be inserted into the wound to allow liquids to drain from the site during the first few hours after surgery. The edges of the skin are then sewn together, and the elbow is wrapped in a sterile bandage. Finally, the patient is taken to the recovery room.

## **Preparing for Joint Replacement Surgery**

### ***Three Weeks Before Surgery***

*This information is intended to be an overview of activities that you may experience during joint replacement surgery. It is not intended to replace any instructions provided by your physician, and we would encourage you to discuss this information with your physician.*



- **Store frequently used items in easy to reach cabinets, such as cleaning supplies and canned foods.** Avoid very high or very low shelves as these may require you to use a step stool or kneel.

- **Make and freeze meals or stock up on frozen dinners before surgery so that meal preparation is easier and requires less effort.** You may want to make a list of items you will need to prepare meals and go to the supermarket. You should plan on making enough meals for one week or so.
- **Contact friends/family for support.** Friends/family may be needed to assist with activities such as driving and moving items in your home for safety. The Arthritis Foundation also has a support network that can provide emotional support. You can contact your local chapter or go to the [Arthritis Foundation](#) web site for more information.
- **Check the safety of your home to prevent falls or tripping .** Move long electrical and telephone cords against the wall, remove rugs, and place a non-skid mat in your bathtub. You may want to prepare a bed in the downstairs level of you home to reduce climbing stairs. Have an elevated chair or high seated chair with arms in every room if possible.

### ***Two Weeks Before Surgery***

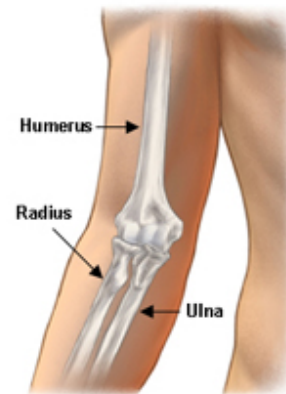
- **Anti-inflammatory medications** Your physician may not want you to take any aspirin or non-steroidal anti-inflammatory medications (Advil, Ibuprofen, Motrin, etc.) for the 14 days before surgery. You may be able to take Tylenol or medicines with acetaminophen. Be sure to discuss this with your physician.
- **Purchase or borrow the special equipment your physician recommends .** This may include an elevated commode and small devices such as a grabber. You can find these items at most hospital supply sections of large drug stores or in mail order catalogs from department stores. Practice using the items at home.

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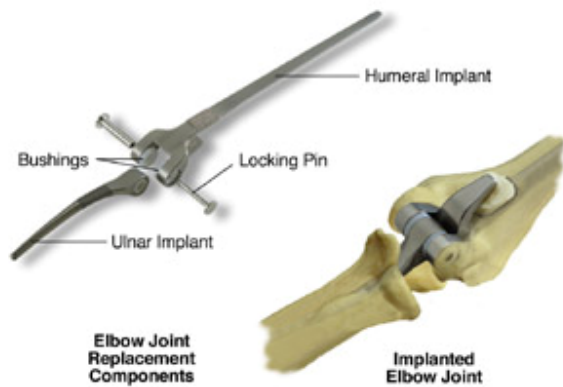
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## **Elbow Replacement - Frequently Asked Questions**

This following provides a brief introduction to elbow replacement. It can help you make a list of questions to ask your doctor, but it is not meant to provide complete information. Check with your surgeon's office about more comprehensive resources and patient education materials.

### **What is elbow replacement?**

In elbow replacement surgery, the painful surfaces of the damaged elbow are replaced with artificial elbow parts. One part fits into the humerus (upper arm), and the other part fits into the ulna (forearm). The two parts are then connected and held together by a pin. The resulting hinge allows the elbow to bend.



### **How do I prepare for elbow replacement surgery?**

If you and your surgeon decide that total elbow replacement is right for you, a date will be scheduled for your surgery. Several things may be necessary to prepare for surgery. For example, your surgeon might ask you to have a physical examination by your primary care physician. This will ensure that other health problems you may have, such as diabetes or high blood pressure, will be treated before surgery. Your doctor, or a staff member, will advise you about the things you can do to prepare for your hospital stay, and your rehabilitation after surgery.

### **What happens during elbow replacement surgery?**

On the day of surgery, an intravenous tube will be inserted into your unaffected arm to administer necessary medications and fluids during surgery. You will then be taken to the operating room and given anesthesia. After the anesthesia takes effect, your elbow will be scrubbed and sterilized with special solution.

The procedure is performed through an incision over the elbow that will expose the joint. Special, precision guides and instruments will be used to cut the ends of the humerus (upper arm bone) and ulna (forearm bone), and prepare the bone to accept the implant. The implants are then inserted and fixated in place with a special kind of epoxy cement for bones. The two parts of the hinge are then brought together and secured with a pin. When the surgeon is satisfied with the fit and function, the incision will be closed and covered with dressings. The surgery usually takes one to three hours, although this depends on the severity of the arthritis in your elbow.

A sterile bandage will be placed over the wound, and you will be sent to the recovery room where you will be carefully monitored. As the anesthesia wears off you will slowly

regain consciousness. A nurse will be with you, and may encourage you to cough or breathe deeply to help clear your lungs. Your arm will be in a splint, and it may be wrapped in an ice pack to help control pain and swelling. You will also be given pain medication. When you are fully conscious, you will be taken back to your hospital room.

### **What can I expect after surgery?**

When you are back in your hospital room, you will begin a gentle rehabilitation program to help relax the muscles around your new elbow. On the day of surgery you may be encouraged to get out of bed and take a few steps. You will continue to receive pain medication as needed, and your bandage will be removed about two days after surgery.

Depending on your specific situation, you will probably remain in the hospital from one to three days. Your elbow area may be warm and tender for several weeks. Before you are dismissed from the hospital, your physical therapist will show you how to perform the rehabilitation exercises that are important for your recovery.

### **How soon can I return to normal activities after surgery?**

Successful joint replacement surgery may relieve your pain and stiffness, and allow you to resume some of your normal daily activities as instructed by your doctor. While you are recovering, you should not lift more than one pound with the operated arm. Even after you have fully recovered from your surgery, you will still have some restrictions. Normal daily activities for elbow replacement patients do not include contact sports, "jamming" activities such as hammering, heavy or repetitive lifting, or activities that put excessive strain on your elbow. Your doctor may advise you not to lift anything that weighs more than five pounds. Although your artificial joint can be replaced, a second implant is seldom as successful as the first.

### **How long will an elbow replacement last?**

Longevity of the prosthetic elbow varies from patient to patient. It depends on many factors, such as a patient's physical condition and activity level, as well as the accuracy of implant placement during surgery. It is useful to keep in mind that prosthetic joints are not as strong or durable as a natural, healthy joint, and there is no guarantee that a prosthetic joint will last the rest of a patient's life.

Today, total elbow replacement is becoming a common and predictable procedure. Many patients enjoy relief from pain and improved function, compared to their status before surgery. As a result, some patients may have unrealistic expectations about what

the prosthetic elbow can do and how much activity it can withstand. As with any mechanical joint, the components move against each other. Natural fluid in the joint space, called synovial fluid, helps to lubricate the implants just as it lubricates the bones and cartilage in a natural joint. Still, the prosthetic components do wear as they roll and slide against each other during movement. As with car tires or brake pads, the rate of wear depends partly on how the elbow joint is used. Activities that place a lot of stress on the joint implants, as may be the case with more active patients, may reduce the service life of the prosthesis. Implant loosening and wear on the components can lead to the necessity for revision surgery to replace the worn parts, or all of the parts. Your doctor will be in the best position to discuss these issues with you, taking into account your particular clinical circumstances, the type of implants used, and your post-surgical lifestyle.

Talk with your doctor about the following points, and how they might affect the longevity and success of your elbow replacement:

- Avoiding repetitive lifting; avoiding lifting anything heavier than one pound during recovery; and avoiding lifting anything heavier than five pounds after recovery.
- Avoiding "jamming" activities such as hammering
- Staying healthy and active
- Avoiding "impact loading" sports such as boxing
- Consulting your surgeon before beginning any new sport or activity, to find out what type and intensity of sport or activity is appropriate for you
- Thinking before you move
- Avoiding any physical activities involving quick stop-start motion, twisting or impact stresses on the operated elbow
- Not pushing heavy objects

## **Materials**

Orthopaedic implants can be quite complex, and the materials used to make them, called biomaterials, are highly developed. In the United States, the FDA requires extensive testing before a new material may be used in an orthopaedic implant. The materials most commonly used have a long history of clinical use with great success.

There are many different biomaterials, but there is no single biomaterial that is best for all implants and all patients. The specific requirements of an implant material vary depending on how the implant is designed to be used

An orthopaedic implant has a challenging job. As you go about your daily activities, an implant may encounter mechanical forces that tend to push on it, pull on it, bend it, scrape it, or wear against it. These forces can cause the implant to break or wear out over time. It is also subjected to the many natural chemicals inside the human body. Some of these chemicals may tend to corrode some materials. In order for an implant to perform under these conditions, it must be made from materials that can withstand these forces and chemical environment in the patient.

Whether an implant is designed to replace a joint, or help repair a fracture, several physical and biological characteristics are important when selecting the material for the implant. For example, an implant must be sufficiently strong, flexible, and resistant to wear. But that doesn't mean the strongest material, or the most flexible material, is the best material.

The ideal implant material should have physical characteristics that match those of the bone it is replacing or reinforcing. After all, orthopaedic implants are attached to your bones, and they must work with your bones to restore function. This usually requires a balance of physical characteristics. Your bones, for example, are strong but flexible. This combination helps them withstand forces as high as several times your weight without breaking.

Obviously, physical characteristics are important to orthopaedic materials; but biological characteristics are just as important. When we talk about biological characteristics, we mean the biological effect the material has on the body, as well as the effect the body has on the material

## **Types of Materials**

Generally, the most common materials used in orthopaedic implants are metals and a type of plastic called polyethylene. These two material types are combined in most joint implants, that is, one component is made from metal, and one from polyethylene. When properly designed and implanted, the two components can rub together smoothly while minimizing wear.

While some pure metals have excellent characteristics for use as implants, most metal implants are made from a mixture of two or more metals. These mixed metals are called alloys. By combining metals, a new material can be created that has a good balance of the desired characteristics. The most common metal alloys used in

orthopaedic implants are stainless steel, cobalt-chromium alloys, and titanium alloys.

### ***Stainless Steel***

Stainless steel is most often used in implants that are intended to help repair fractures, such as bone plates, bone screws, pins, and rods. Stainless steel is made mostly of iron, with other metals such as chromium or molybdenum added to make it more resistant to corrosion. There are many different types of stainless steel. The types of stainless steel used in orthopaedic implants are designed to resist the normal chemicals found in the human body.

### ***Cobalt-chromium Alloys***

These alloys are used in a variety of joint replacement implants, as well as some fracture repair implants. While cobalt-chromium alloys contain mostly cobalt and chromium, they also include other metals, such as molybdenum, to increase their strength and corrosion resistance.

### ***Titanium Alloys***

Titanium alloys are the most flexible of all orthopaedic alloys. They are also lighter weight than most other orthopaedic alloys. Consisting mostly of titanium, they also contain varying degrees of other metals, such as aluminum and vanadium.

### ***Commercially Pure (CP) Titanium***

CP titanium may also be used in some implants. It is used, for example, to make fiber metal, which is a layer of metal fibers bonded to the surface of an implant to allow the bone to grow into the implant, or cement to flow into the implant, for a better grip.

### ***Tantalum***

Tantalum is a pure metal with excellent physical and biological characteristics. It is flexible, corrosion resistant, and biocompatible.

### ***Ultra High Molecular Weight Polyethylene (UHMWPE)***

UHMWPE is a type of plastic commonly used on the surface of one implant that is designed to come in contact with another implant, as in a joint replacement. Although other types of polyethylene have many familiar household uses, the polyethylene used in

orthopaedic implants is a much higher grade. In fact, a special type of medical-grade polyethylene was developed specifically for use in orthopaedic implants.

Polyethylene is very durable when it comes into contact with other materials. When a metal implant moves on a polyethylene surface, as it does in most joint replacements, the contact is very smooth and the amount of wear is usually minimal.

Polyethylene can be made even more resistance to wear. This can be accomplished through a process called crosslinking, which creates stronger bonds between the molecular chains that make up the polyethylene. The appropriate amount of crosslinking depends on the type of implant. For example, the surface of a hip implant may require a different degree of crosslinking than the surface of a knee implant.

### ***Ceramics***

Ceramic materials are usually made by pressing and heating certain metal oxides (typically aluminum oxide and zirconium oxide) until they become hard and dense.

These ceramic materials are strong, resistant to wear, and biocompatible. They are used mostly to make implant articulating surfaces that do not require flexibility, as in the surfaces of a hip joint.

### ***Composite Materials***

Composite materials are made by mixing two or more separate materials without creating a chemical bond between the materials. Metal alloys and ceramics are not considered to be composite materials because their ingredients are chemically bonded to create a new material.

On a larger scale, two layers of different materials can be combined to create a composite material with the desired characteristics. The stem of a hip implant, for example, may consist of layers of two different materials that together provide the desired combination of strength and flexibility.

### ***Trabecular Metal***

*Trabecular Metal*<sup>™</sup> material is made from tantalum over carbon. It is strong, flexible, and biocompatible. The structure of *Trabecular Metal* material is similar to the structure of bone. It is very porous, which means it has small spaces or pores. New tissue can grow into these pores and help hold the implant in place.

## ***Bioabsorbable Materials***

Bioabsorbable materials are designed to be absorbed by the body when their job is complete. They are made from a biocompatible plastic that can be dissolved by normal body fluids. Many sutures used today in all types of surgery are bioabsorbable. These bioabsorbable materials may also be used in implants that reattach soft tissue to bone.

## ***Silicone***

Silicone is a rubbery material that is very flexible. In orthopaedics, it is most commonly used in implants that replace the joints of the toes.