

# **Shoulder Impingement**

## **Shoulder Impingement Syndrome**

Shoulder impingement syndrome is caused by compression of the tendons of the rotator cuff between a part of the shoulder blade and the head of the humerus. This can become a chronic inflammatory condition that may lead to a weakening of the tendons of the rotator cuff, a situation that may result in a torn rotator cuff. Initial treatment for an impinged shoulder includes rest, ice, and anti-inflammatory medications (sometimes including steroid injections).

## **What is Shoulder Impingement Syndrome?**

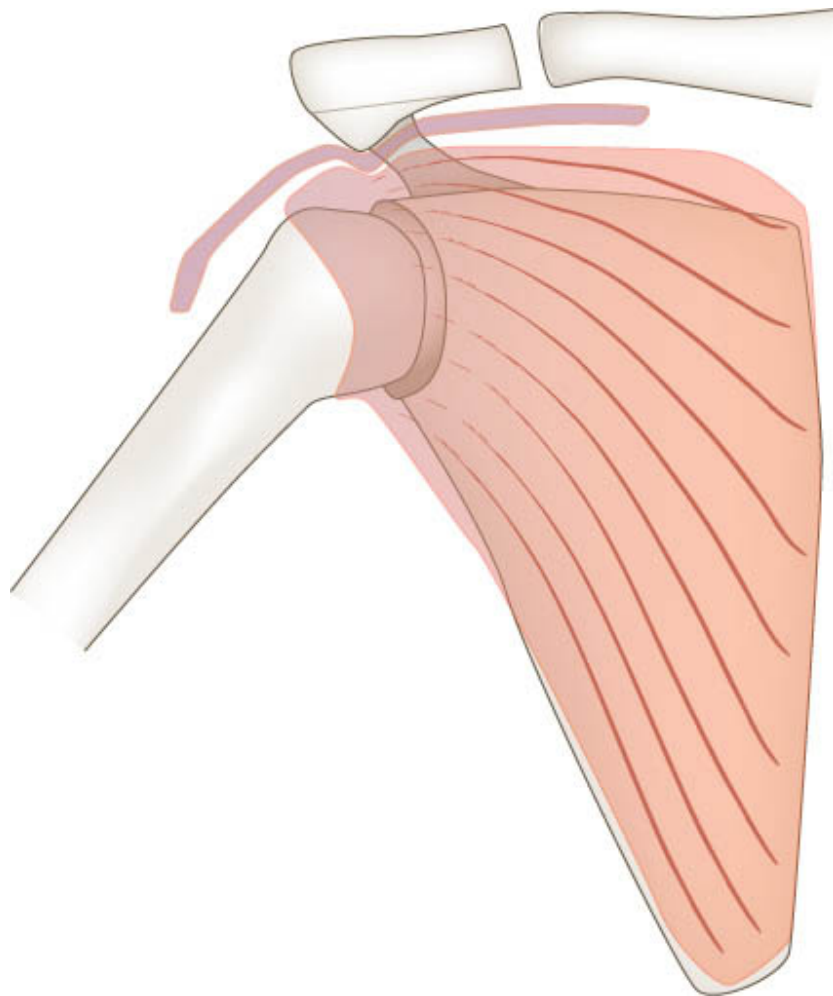
The dictionary defines impingement as "a sharp collision," but in the shoulder this is usually a gradual process that can cause a lot of shoulder pain, especially when using the hands above the level of the head. Shoulder impingement syndrome occurs when the supraspinatus tendon rubs against a part of the scapula called the acromion. This process is similar to the way that a rope frays and unravels as it travels through a rough pulley. The mechanical impingement of the tendon on the undersurface of the acromion causes a chemical inflammation in the tendon that is felt as shoulder pain by the patient. The inflammation of the tendon results in tendinitis (AKA tendonitis) of the rotator cuff.

The lubricating sack between the rotator cuff and the acromion, known as the bursa, is a special structure that helps to reduce the amount of friction as the tendon slides back and forth. Bursal sacks are found in several other places in the body where a tendon runs over a bone. The bursa in the shoulder is called the "subacromial bursa". Shoulder impingement can cause the inflammation and irritation of the bursa in the shoulder or "bursitis".

As with tendinitis, many people (especially athletes, construction workers, and laborers) who perform a lot of overhead activities suffer from shoulder pain caused by shoulder impingement syndrome. The tendons of the rotator cuff rub between the head of the humerus and the shoulder blade when you use your hands above the level of your head or when your arm is held out to the side of the body.

***Symptoms of shoulder impingement often involve one or all of the following:***

- The tendons of the rotator cuff either are being pinched or are rubbing on a bone spur
- There is inflammation of a lubricating sac (bursa) located just over the rotator cuff, a condition called bursitis
- There is inflammation of the rotator cuff tendons, called tendonitis or tendinitis



**Bone spurs on the undersurface of the acromion can create inflammation and bursitis.**

## ***How is shoulder impingement syndrome treated?***

The initial treatment of tendinitis or bursitis of the shoulder is designed to quiet the inflammation down and allow the body to heal itself. The basic principles of this form of treatment are the following:

Rest the shoulder. Your body is trying to tell you something, and the message is having a hard time getting through. Slowing down or stopping the activity that caused the shoulder pain in the first place will often relieve most of the symptoms. This usually means modifying your training regime, waiting a few months before hanging the rest of the wallpaper or painting the ceilings or changing to a lighter duty at work for a while. Unfortunately, this can be difficult to do if you depend upon overhead activities for a living, as do construction workers or baseball pitchers.

Quiet down the inflammation. Ice and anti-inflammatory medications can do wonders. Cooling your shoulder with ice packs helps to reduce swelling and inflammation as well as relieve pain. Most people also obtain a significant amount of relief from a course of anti-inflammatory medications such as aspirin, ibuprofen (which is sold as Advil® or Motrin®), Tylenol®, Naproxen, Clinoril®, or Feldene® (to name just a few). These medications, which are called NSAIDs (Non-Steroidal Anti-Inflammatory Drugs) by doctors, act by stopping the body from making certain chemicals that are part of the inflammatory process. In order to have the most effect they have to be taken regularly, according to the recommended schedule for each medication.

Occasionally, people suffer from stomach upset, heartburn, and irritation of the lining of the stomach (all of which are referred to as "gastritis" by doctors) when they take NSAIDs. Individuals who are particularly vulnerable may develop gastric ulcers, which are very serious and can be quite severe. It is very important to tell your doctor if you are suffering from an upset stomach while taking anti-inflammatory medications. Health food supplements, such as chondroitin sulfate and glucosamines, are currently very popular with people who suffer from arthritis and inflammation of their joints. This is also true with patients who have shoulder problems. These medications have not been studied enough that doctors fully understand their advantages and disadvantages, but in general, they appear to have anti-inflammatory-like effects and are very well tolerated by most patients.

## ***What happens if this doesn't work?***

Shoulder impingement syndrome that does not go away with several months of rest, ice, and anti-inflammatory medications may require more treatment. The next thing that can be tried is an injection with a local anesthetic like the Xylocaine® that the dentist uses and a powerful anti-inflammatory steroid. These medicines are injected into the subacromial space. This is a very safe procedure. It is not terribly painful and sometimes a single shot can take care of the shoulder pain and swelling forever.

The reason that an injection is more effective than oral medications is that it allows doctors to deliver a higher concentration of a more powerful anti-inflammatory medication to the inflamed tissues than would be possible orally. Unfortunately, it is impossible to predict how long the effects of the medication will last. Some people find that the relief that they receive doesn't last quite long enough, or that the shoulder pain returns after a short period of time. Most doctors don't like to give more than two or three injections in the same joint. There isn't anything particularly harmful about having more than two or three injections, but in general, doctors believe that this is a sign that shoulder surgery will be required to take away the pain properly.

## ***What kind of shoulder surgery is done for impingement syndrome?***

The primary aim of the surgical treatment of shoulder impingement is to make more space available for the tendons of the rotator cuff. Enlarging, or "decompressing" the space between the acromion and the head of the humerus can relieve the symptoms of impingement. Removing a part of the acromion can stop the tendons of the rotator cuff from rubbing on the bone. This type of surgery is called an acromioplasty. Because inflammation in the subacromial bursa contributes to the pain of impingement syndrome, this lubricating sack is often removed. This part of the procedure is called a bursectomy or a debridement. These two procedures together are called a sub-acromial decompression.

Acromioplasty surgery can be performed with an arthroscope or with an open technique and a larger incision. The primary advantage of arthroscopic subacromial decompression is a shorter recovery time. This is the case because the incisions that are required in order to be able to see the subacromial space are smaller when an arthroscope is used. However, there are some instances in which the anatomy of the patient's shoulder makes it difficult to see well enough to perform safely an adequate sub-acromial decompression. In these instances, a larger incision has to be made.

In general, the recovery from this surgery is usually quite quick. Motion is started very soon after surgery in order to speed up the rehabilitation process.

Many patients who have shoulder impingement syndrome also have a painful acromio-clavicular joint that can be a partial cause of their shoulder pain. A/C joint arthritis and shoulder impingement syndrome often occur together, in the same shoulder. When the patient has shoulder pain that seems to be related to the A/C joint, a distal clavicle resection is often performed at the same time as a subacromial decompression. This procedure removes that last four or five millimeters of the clavicle and increases the amount of space in the acromio-clavicular joint. It has very few disadvantages and can be very effective in treating painful arthritis of the shoulder joint

## Shoulder Instability

[See Shoulder Instability Surgery Video](#)

### ***The loose shoulder or shoulder instability -- causes and treatment***

The capsule that surrounds the shoulder joint is a very strong ligament that helps to keep the shoulder in the joint and functioning normally. In most people it is very difficult to tear the ligaments of the capsule or pull the shoulder out of joint. These injuries usually occur only when a lot of force has been applied to the shoulder or the arm -- like in a tackle football game. There are some people who have a capsule that is a little bit too loose. If the shoulder slips partially out of joint, this is called "subluxation". A dislocated shoulder occurs when the shoulder comes completely out of joint. Use the link at the bottom of this page to read more about the causes of shoulder instability:

If the shoulder slips in and out of joint more than once or twice, or frequently slips partially out of joint and then returns on its own, then the joint is said to be "unstable". This condition can create a lot of problems for patients because they may not be able to do certain activities because they are afraid their shoulder will slip out of joint if they move their arm into certain positions. This is a particularly big problem for people who work with their hands above their heads or are "overhead athletes", like baseball pitchers and tennis players, who depend upon their shoulder to play certain sports. There is also a concern that the surface cartilage of the shoulder can be damaged if it slips in and out of joint frequently.

Shoulder instability is one of the more challenging disorders that orthopaedic surgeons treat. The incredible range of motion that the shoulder is capable of is

achieved by balancing the structures that permit motion (the shallow ball and socket joint of the shoulder) with the structures that stabilize and move the shoulder: the muscles, tendons, and capsule of the shoulder joint. Once this balance is upset, it can be challenging to correct it without causing excessive tightness or leaving the patient with too much looseness. The treatment options for shoulder instability are discussed further in the following sections:

## ***How is shoulder instability treated?***

The first step in any treatment plan for shoulder instability is to try to identify what is causing the joint to be unstable. A complete physical examination must be performed in order to determine in which direction the shoulder slips out of joint, and how loose the injured shoulder is in comparison to the other one. X-rays and MRI scans can be used to look for areas where the ligaments of the capsule have been torn or damaged.

The results of these tests often reveal the cause of the shoulder instability as well as the direction of the instability. Shoulders that slip out of joint in one direction only because the ligaments have been pulled away from the bone are much easier to treat than shoulders that slip out of joint in several directions because the ligaments are often just too loose.

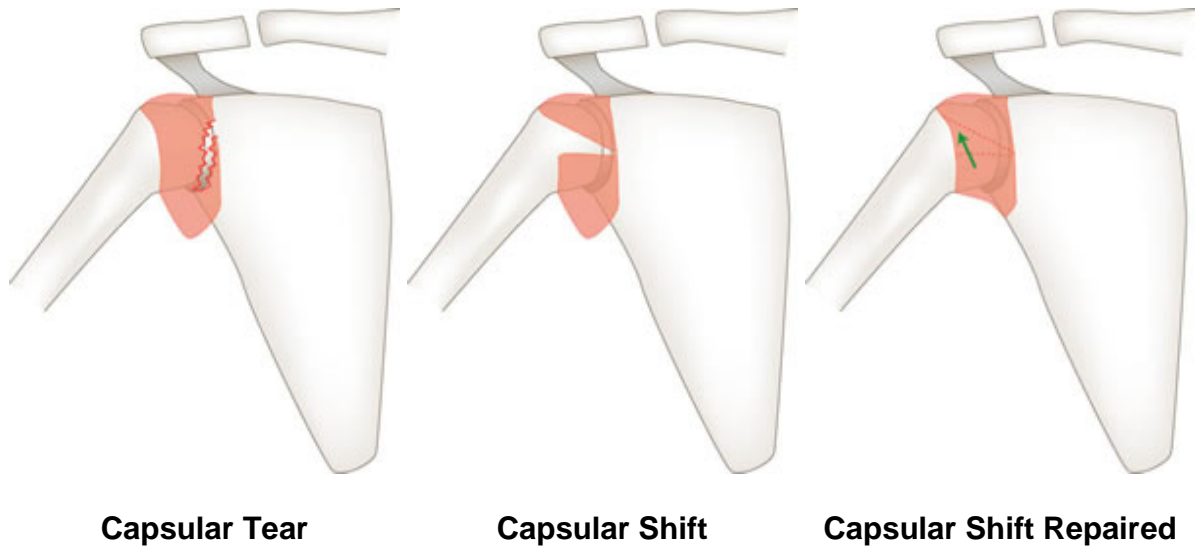
## ***What is the treatment for post-traumatic instability?***

Post-traumatic shoulder instability can be corrected with surgical procedures that are designed to repair and strengthen the ligaments that keep the shoulder in the joint normally. These operations have been developed over the years as doctors have recognized that many unstable shoulders have a particular type of an injury called a "Bankhart lesion". The Bankhart lesion specifically refers to an injury where part of the capsule of the shoulder joint is pulled away from the bone.

Surgical techniques are aimed at fixing this problem and also tightening up the ligaments of the shoulder that have been stretched or torn by the dislocation. Without an operation, physical therapy is of limited use as a treatment plan for preventing post-traumatic instability. This is because the cause of the shoulder instability is a torn or stretched ligament, which can not be fixed or improved with physical therapy.

Repairing the torn capsule and ligament back to the bone is called a Bankhart repair, and tightening the capsule of the shoulder is called a "capsular shift". Both of these procedures can be done with both open and arthroscopic techniques. Open techniques are tried and true and they are very reliable in preventing future episodes of instability. Arthroscopic techniques have recently been developed in order to decrease the size of the surgical scar and the amount of pain after the

operation, and also speed up the rehabilitation after the operation. Your doctor will be able to discuss the advantages and disadvantages of the different types of surgery that are designed to correct shoulder instability.



## ***How is multi-directional shoulder instability treated?***

In contrast to the treatment for post-traumatic instability, physical therapy plays a much larger role in the treatment of multi-directional shoulder instability. Many patients who have loose joints and a shoulder that slips out of the joint in several directions will benefit from a course of physical therapy that is designed to strengthen the rotator cuff muscles. The rotator cuff muscles play an important role in shoulder stability, and strengthening them by doing certain exercises can stop the shoulder from slipping out of joint as easily as it did before. Many people with multi-directional instability will need to maintain the strength in their rotator cuff muscles by performing their exercises regularly, and for an extended period of time.

# Rotator Cuff Repair

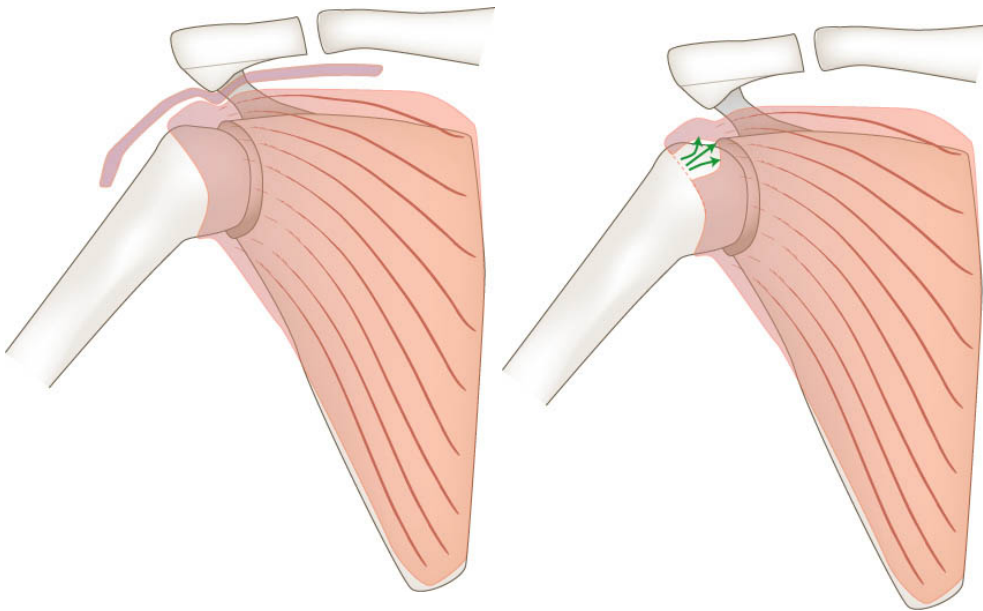
[Watch Rotator Cuff Repair Video](#)

## ***Rotator Cuff Tears***

A torn rotator cuff is a common cause of pain and weakness in the shoulder. There are several different causes of rotator cuff tears and many different treatment options. In this section, the information on rotator cuff tears is divided into the following topics:

### ***Why does a torn rotator cuff happen, and how are they treated?***

The movement of the arm and the shoulder is controlled by a group of four muscles called the rotator cuff. This group of muscles is attached to the shoulder blade and then inserted to the upper part of the humerus. They control the way in which the arm is internally and externally rotated and how it is lifted up and down. At the end of each muscle is a tendon that attaches to the bone. Tears in these tendons are called rotator cuff tears, and they are a common cause of shoulder pain and weakness.



**Bone Spurs that rub on the tendons of the rotator cuff can weaken the tendons.**

**When the tendon tears, it pulls away from the bone of the arm.**

## ***The rotator cuff is frequently injured in several common ways:***

- Frequent use of the hands in the overhead position can weaken the rotator cuff and eventually lead to tears in the tendons. Certain athletes, like baseball pitchers, and overhead workers like painters and sheet-rock workers frequently develop tendinitis. This causes inflammation, pain, and tenderness in the cuff. Over time, the wear and tear on the rotator cuff can lead to a tear in one of the tendons.
- A direct blow to the shoulder, a fall onto an outstretched hand, or a dislocated shoulder joint can also result in a tear of one of the rotator cuff tendons. This type of tear would be called a "traumatic tear."
- As we age, so does the rotator cuff. A process of natural wear and tear breaks down the strength and flexibility of the rotator cuff tendons, which can lead to a complete rupture of one of the tendons. This type of a tear would be called a "degenerative tear."

A torn rotator cuff can be treated very successfully by a combination of physical therapy, exercises and shoulder surgery (if necessary). Each of these options has a very important role in the treatment of a torn rotator cuff, but before we discuss them, we will first discuss the shoulder anatomy of the rotator cuff, and why some tendons are more easily injured than others are.

## ***Surgical options for a rotator cuff repair***

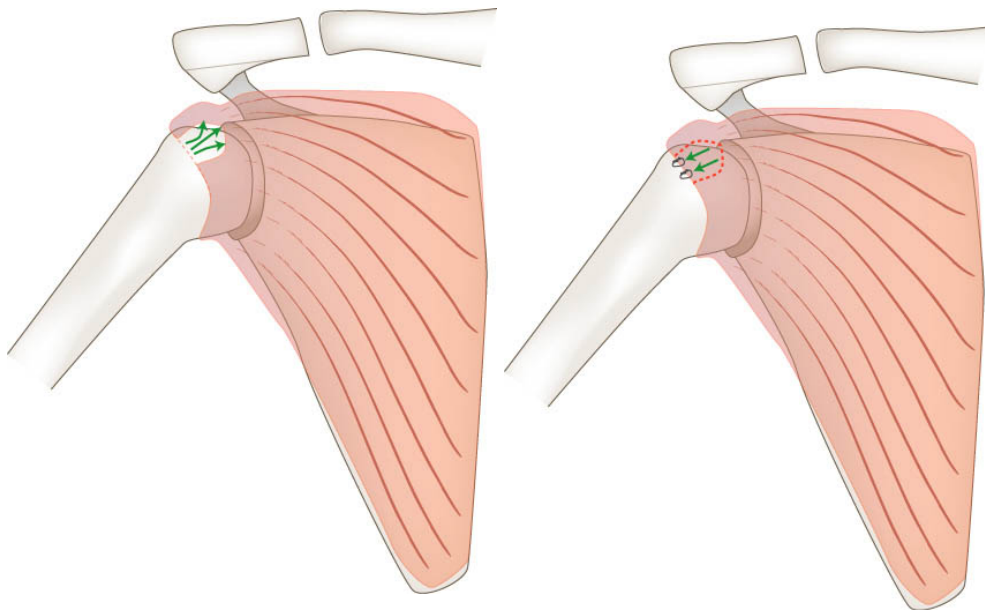
Not every rotator cuff tear need to be fixed with shoulder surgery. There are people who have large tears of the rotator cuff but still have reasonably good function and relatively little shoulder pain. However, there are also some people who have a torn rotator cuff that causes a lot of shoulder pain and very little use of the shoulder. Everyone is different and the role of surgery in the treatment of a torn rotator cuff is different for each patient. The main goals of rotator cuff surgery include relieving the shoulder pain, improving the strength and increasing the function of the shoulder. You and your doctor will be able to decide how much this type of surgery may improve your shoulder pain and function, and each decision is made on an individual basis.

## ***The types of shoulder surgery that can be done for a torn rotator cuff include:***

- Repair of the torn rotator cuff and removal of the excess bone from the acromion through a typical surgical incision.

- Removal of the excess bone from the acromion by first using an arthroscopic technique and then performing a rotator cuff repair through a small surgical incision.
- Removal of the excess bone from the acromion and also performing a rotator cuff repair with the arthroscope.

There are advantages and disadvantages to each of these surgical techniques. Surgeries that are done with arthroscopic techniques leave smaller scars, but they can be more technically demanding and take longer to conduct than other types of shoulder surgery. There are also some patients and some rotator cuff tears that can not be fixed by using only arthroscopic techniques. In this situation, a regular incision needs to be made in order to complete the repair safely.



**The tendons that have pulled away from the bone are immobilized by the surgeon...**

**...and then fixed back in their original position**

Although surgeons can fix most rotator cuff tears, there are some tears that are so large that they can not be fixed. In these situations, the tendon that is torn is usually scarred down and has retracted so that it cannot be pulled out to its original length very easily. Unfortunately, surgeons are usually unable to determine if a rotator cuff tear is not repairable before the shoulder surgery. An attempt is usually made to repair the torn rotator cuff, only to find that either the tissues do not have enough strength left to hold surgical sutures, or they are scarred and shrunken. When this happens, the ends of the rotator cuff tendons are trimmed of any loose fibers and the excess bone from the underneath of the acromion is removed.

## ***Rotator cuff surgery options for tears that usually cannot be fixed include:***

- Trimming of the torn rotator cuff tendons, which are called "debridement" by doctors.
- Replacement of the shoulder joint

Removing the excess bone from the acromion and trimming the edges of the torn rotator cuff tendons can relieve a lot of shoulder pain and help restore a lot of motion in many patients with an irreparable cuff tear. If a patient continues to have a lot of pain and stiffness in the shoulder joint, then a shoulder replacement may be considered as an option for relieving shoulder pain.

## ***How well does rotator cuff surgery work?***

The overall success rate for rotator cuff surgery is difficult to determine precisely because there is a lot of variability in the age of the patients, the size of the tear, and the type of surgery. However, studies show that 85% or more of patients are improved to the point where they feel that their surgery was very worthwhile and their shoulder function is much better after surgery. In the situation where the torn rotator cuff cannot be fixed, many people still get very good pain relief and function from decompression of the shoulder without a rotator cuff repair.

## ***Will the rotator cuff tear again after surgery?***

There has been a lot of research on what happens to people after rotator cuff surgery. These studies have shown that some people have evidence of new "re-tears" in the rotator cuff many years after surgery. Although this doesn't happen very often, it is more likely after repairs of large tears, complicated tears, and in people who are older at the time of their surgery.

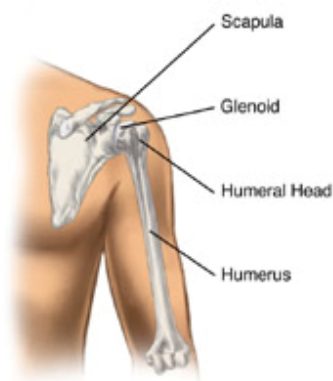
This does not mean that the surgery has failed, and in fact, most people do not have any increased pain or loss of strength and motion with a re-tearing of the cuff. This is because the repair very rarely breaks down completely, and because the original surgery also enlarged the subacromial space so that the shoulder is not irritated and inflamed as easily as before surgery. Studies on people who have had their repair breakdown still report very high rates of satisfaction with the results of surgery. More than 85% of patients with a small re-tear of their cuff

repair report that their pain and function is still significantly better than before the surgery.

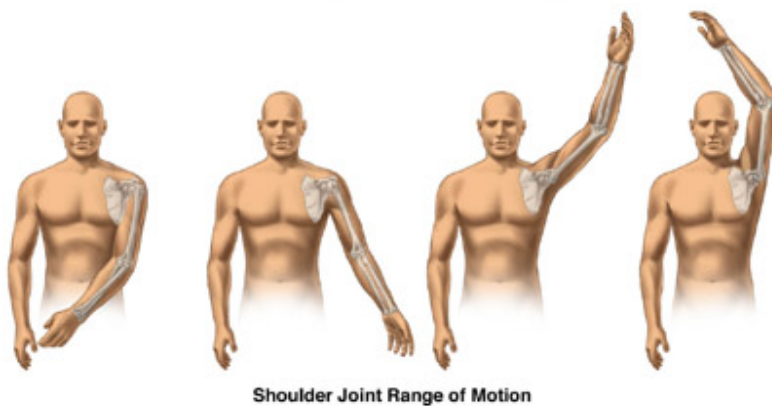
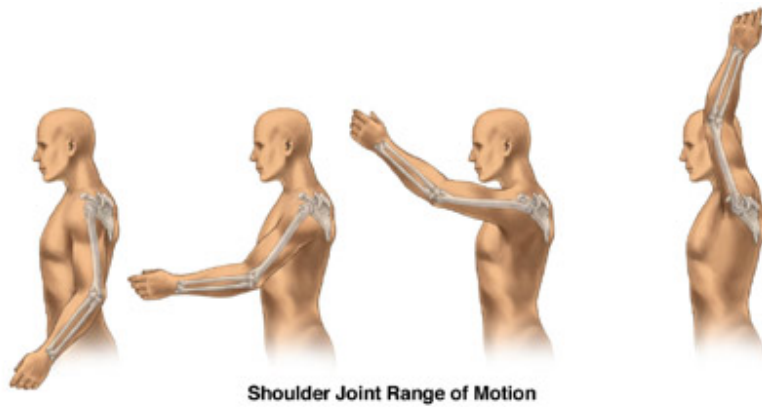
# Shoulder Replacement

## Shoulder Anatomy

The shoulder is a ball and socket joint. The ball portion of the joint consists of the rounded head of the upper arm bone (humerus), and the socket portion is made up of a depression (glenoid) in the shoulder blade. The humeral head (ball) fits into the glenoid (socket) creating the joint that allows you to move your shoulder. The joint is surrounded and lined by cartilage, muscles, and tendons that provide support, stability, and ease of movement.



The shoulder allows for the rotation of the arm in all directions. The range of motion is dependent on the proper articulation of the humeral head upon the glenoid (shoulder socket).



## Your Shoulder Surgery

The shoulder is a ball and socket joint. The ball portion of the joint is called the humeral head, and is part of the humerus (upper arm bone). The socket portion is called the glenoid, and is part of the scapula (shoulder blade). The humeral head (ball) fits into the glenoid (socket) and the two bones rub together as the shoulder moves.

### Ball and Socket Of Healthy Shoulder Joint Surfaces

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

## Arthritic Shoulder Joint Surfaces

There are many ways to treat the pain caused by arthritis. One way is total shoulder replacement surgery. The decision to have total shoulder replacement surgery should be made very carefully after consulting your doctor and learning as much as you can about the shoulder joint, arthritis, and the surgery. In total shoulder replacement surgery, the ball and socket that have been damaged by arthritis are removed and replaced with artificial parts made of metal and a very durable plastic material. We call these artificial parts "implants." These implants are shaped so that the shoulder joint will move in a way that is very similar to the way the joint moved when it was healthy.

## 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.

- **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 your 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.

## What to Bring to the Hospital

Below is a list of things you may want to bring with you to the hospital in preparation for your surgery. Talk with your physician as he/she may have additional information about preparing for your hospital stay.

- Your personal belongings should be left in the car until after surgery. Tell your family that your room will be assigned when you are in surgery or in recovery, at which point they can bring your personal items to your room.
- Personal grooming items that you may want to pack include a toothbrush, toothpaste, hairbrush, eyeglasses/contacts, comb, deodorant, shaving cream/electric razor, shampoo, lotion, undergarments, and a robe.
- Bring slippers or flat rubber-soled shoes for walking in the hallways.
- Bring loose fitting clothing for your trip home.
- Bring any medications you are currently taking. You should also write down your medication information to be given to the hospital staff. Be sure to include the name, strength, and how often you take the medications. Please communicate any allergies you might have to your doctors and the nursing staff.

- If you use a breathing exerciser (IBE), be sure to bring it with you from home, as you will probably need this right after surgery. Leave jewelry, credit cards, car and house keys, checkbooks, and items of personal value at home. Bring only enough pocket money for items such as newspapers, magazines, etc.

## **Getting to the Joint**

The patient is first taken into the operating room and positioned on a special operating table as though lounging in a beach chair. The arm is placed on a board that will allow the surgeon to move it up or down as necessary during the surgery. Anesthesia is given and, when it has taken effect, the skin around the shoulder and upper arm is thoroughly scrubbed and sterilized with an antiseptic liquid.

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

## **Shoulder Joint Exposed**



## **Replacing the Socket Portion of the Joint**

The implant that replaces the socket consists of a durable plastic insert with a very smooth, cupped surface.

### **Implant to Replace Socket in Shoulder Blade**



### **Removing the Surface of the Socket**

The arm is maneuvered until the humeral head is dislocated from the socket.

Special precision instruments are then used to remove the damaged cartilage and bone surface from the glenoid, and to shape the socket so it will match the shape of the implant that will be inserted. Holes are then drilled into the socket to accommodate the fixation pegs on the implant. These pegs help stabilize the implant.

### **Socket Prepared for Implant**



## **Inserting the Implant**

The socket implant is attached by using a special kind of cement for bones. The cement is pressed into the holes. The implant is then inserted.

### **Glenoid Implant**



## **Replacing the Ball Portion of the Joint**

The implant that replaces the ball consists of a long metal stem that fits down into the humerus. A metal head in the shape of a partial sphere is mounted on top of this stem. This head contacts the socket implant in the shoulder blade.

### **Metal implant to replace ball portion of shoulder joint**



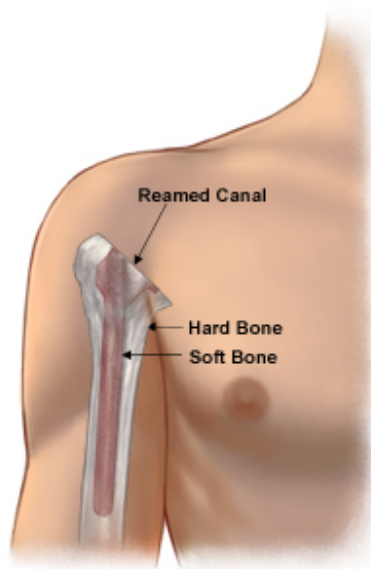
## Preparing the Humeral Canal

The upper arm bone has 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.

Using a precision guide and saw, the damaged rounded portion (ball) of the humerus is removed.

## Humeral Head (Ball) is Removed



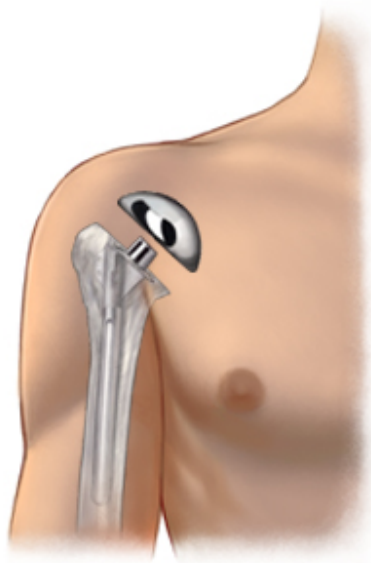
## Inserting the Implant

The metal stem implant may be held in place by either using the special bone cement, or by making it fit very tightly in the canal. The surgeon will choose the best method, depending on the patient's age and expected activity level.

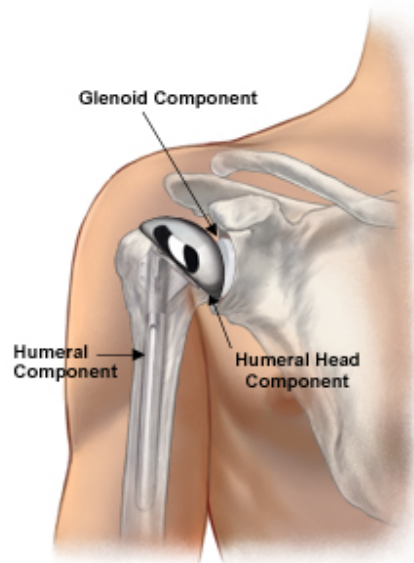
If cement is used, it is injected into the canal first, and then the implant is inserted into the canal. If cement is not used, the implant is simply inserted into the canal.

On some implants, the stem and partial sphere are one piece. On others, they may be two separate pieces. If the partial sphere is a separate piece, it is usually secured to the top of the stem after the stem has been inserted.

## Stem Implant with Partial Sphere (Head)



## Shoulder Implants after Insertion



## Closing the Wound

When all the implants are in place, the surgeon places the new ball that is now part of

the upper arm bone into the new socket that is part of the shoulder blade. If necessary, the surgeon may adjust the ligaments that surround the shoulder to achieve the best possible shoulder function.

When 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. After the tube is inserted,

the edges of the skin are sewn together, and a sterile bandage is applied to the shoulder. Then, the patient is taken to the recovery room.

## **After Shoulder Replacement Surgery**

The following are some ways to promote healing and incorporate movement after you have had shoulder replacement surgery. Discuss these techniques with your physicians and orthopedist before attempting them. Your physical therapist may modify some of these techniques depending upon your situation (i.e., age, weight, and procedure). Only do the techniques that are recommended by your physician and/or therapist.

### **Once You Are At Home**

It is very important that you follow your surgeon's instructions. Any questions should always be discussed with your surgeon before your hospital discharge:

- Do not use your surgery arm to get up out of bed or from a chair position. Use the opposite arm.
- You may be advised not to pull anything to you, such as pulling up pants and opening doors, for six weeks after surgery.
- Your doctor will likely give you a list of exercises to do once you're home. Be certain to follow your doctor's instructions, but typically you will be asked to do these four or five times a day for a month or so.
- Be certain not to exceed the range of motion restrictions given by your physician.
- Be careful to avoid falls.
- You may experience less pain after surgery, which may make you believe you can do more. Be certain to follow your doctor's instructions so that you don't overdo it.
- The amount of weight you can lift using your surgery arm will be limited. Your doctor may recommend that you don't lift anything heavier than a cup of coffee for the first four to six weeks.
- Sling use will vary depending upon the situation, but your doctor may request that you wear the sling every night for at least the first month.
- You will likely need to avoid contact sports after surgery. Your doctor will discuss these restrictions with you.
- Remember that you will probably tire more easily than usual. You may want to plan a rest period of 30 to 60 minutes mid-morning and mid-afternoon.

- Avoid many household chores such as, raking, sweeping, mopping, and running the vacuum cleaner using your surgery arm. Use long-handled feather dusters for dusting high and low items. Your doctor will tell you when it is okay to do these activities.
- Constipation is a common problem for patients following surgery. This is usually due to your limited activity and any pain medications you may be taking. Discuss your diet with your doctor. It should include fresh fruits and vegetables as well as eight full glasses of liquid each day, unless your doctor tells you otherwise.
- Your doctor will probably give you a prescription for pain pills. Please follow your doctor's instructions concerning these medications.
- Some swelling around the incision is normal. You will find it more comfortable to wear loose clothing to avoid pressure on the incision. Ask your doctor or other qualified health professional about appropriate wound care.
- You may want to place a pillow behind your elbow when seated or lying down to keep the surgery area forward to help decrease pain.
- Your doctor may recommend that you apply ice to your shoulder to help decrease pain. A two-pound bag of frozen peas or other small vegetables works surprisingly well as an ice pack.

## **Materials Used in Orthopaedic Implants**

### **Overview**

As you would expect, orthopaedic implants are very “high tech.” Their designs can be quite complex, and the materials used to make them, called biomaterials, are highly developed. Examples of biomaterials include Titanium, cobalt-chrome, polyethylene, and *Trabecular Metal*™ Material.

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. Also, like medicine, biomaterials can produce side effects like microscopic debris, increased ion levels in the blood or urine, or inflammation. These are rare, but

you should be aware of the possibility. For these reasons, your doctor will evaluate you individually and carefully consider the material that is used to manufacture your implant, along with its design.

The content on biomaterials is intended to answer some of the most common questions about the biomaterials used in orthopaedic implants, but it cannot tell you what material is best for your implant. Only your doctor can tell you that, so be sure to discuss your specific questions with him. If you have more questions for your surgeon about the biomaterials in your implant, be sure to ask during your visits.

## **Materials Used in Orthopaedic Implants**

### **Physical Characteristics—Strength and Flexibility**

#### **Strength**

Certainly, an orthopaedic implant should be designed to be as strong as possible. Even in everyday activities, you will place high levels of mechanical stress on your bones and joints. An implant must be able to withstand these stresses day to day without breaking or permanently changing its shape. It should also be designed to withstand the accumulated effect of repeating these stresses.

#### **Flexibility**

While strength characteristics of implants are important, they must also be somewhat flexible to avoid shielding of bones from stress (what doctors call “stress shielding”). To understand stress shielding, you have to understand that the human body may tend to reduce or eliminate its own parts when they are not used. Your muscles, for example, can be built up by lifting weights. But when you stop lifting weights, you will eventually begin to lose the extra muscle that you have built up.

Similarly, your bones can remain strong only if they are regularly placed under a reasonable stress. And if they are never stressed, your body will actually begin to lose bone tissue, causing the remaining bone to become weak.

When stress is applied to an orthopaedic implant that is very stiff, the implant absorbs most of the stress. But when stress is applied to a more flexible implant, some of the

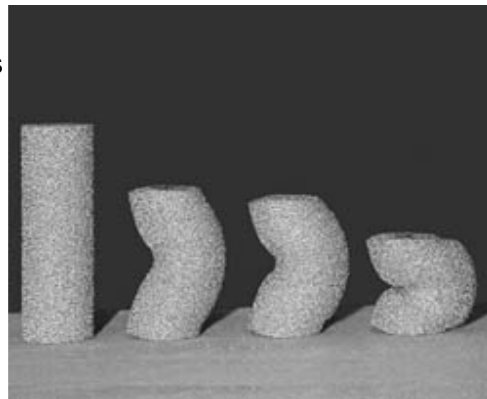
stress passes through the implant so it can be shared with the surrounding bone. That's good because your bones need to be stressed. That's why flexibility is important.

## Materials Used in Orthopaedic Implants

### Importance of Materials

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 cause its parts to rub together. These forces can cause the implant to break or wear out over time.

It is also subjected to the many natural chemicals inside your body. Although normal, 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 chemicals.



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 would 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.

# **Materials Used in Orthopaedic Implants**

## **Common Materials Used in Orthopaedic Implants**

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 steels, cobalt-chromium alloys, and titanium alloys.

### **Stainless Steel**

Stainless steel is a very strong alloy, and 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 stainless steels used in orthopaedic implants are designed to resist the normal chemicals found in the human body.

### **Cobalt-chromium Alloys**

Cobalt-chromium alloys are also strong, hard, biocompatible, and corrosion resistant. These alloys are used in a variety of joint replacement implants, as well as some fracture repair implants, that require a long service life. While cobalt-chromium alloys contain mostly cobalt and chromium, they also include other metals, such as molybdenum, to increase their strength.

### **Titanium Alloys**

Titanium alloys are considered to be biocompatible. They 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.

## **Titanium**

Pure titanium may also be used in some implants where high strength is not required. 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.

## **Polyethylene**

Polyethylene is a type of plastic commonly used on the surface of one implant that is designed to contact another implant, as in a joint replacement. You may recognize polyethylene as the material used to make milk cartons. But don't worry; your implant is not made from recycled milk cartons. 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 minimal.

Patients who are younger or more active may benefit from polyethylene with even more resistance to wear. This can be accomplished through a process called crosslinking, which creates stronger bonds between the elements 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.

# **Materials Used in Orthopaedic Implants**

## **Other Materials**

### **Ceramics**

Ceramic materials are usually made by pressing and heating metal oxides (typically aluminum oxide and zirconium oxide) until they become very hard. These ceramic materials are strong, resistant to wear, and biocompatible. They are used mostly to make implant surfaces that rub together but 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. For example, carbon fibers may be added to another material to provide additional strength, but the two materials do not combine in a way that creates a new material. 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™ Material**

*Trabecular Metal* 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**

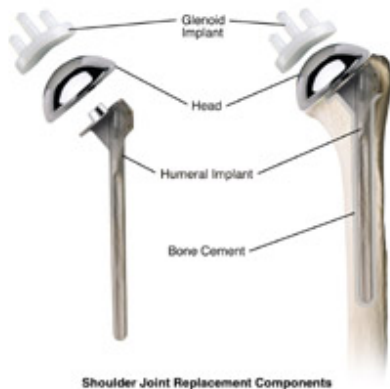
Silicone is a rubbery material that is very flexible. In orthopaedics, it is most commonly used in implants that replace the joints of the toes.

## Shoulder Replacement - Frequently Asked Questions

This following provides a brief introduction to shoulder 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 shoulder replacement?

In shoulder replacement surgery, the painful surfaces of the damaged shoulder are resurfaced with artificial shoulder parts. The part that replaces the ball consists of a stem with a rounded metal head. The part that replaces the socket consists of a smooth plastic concave shell that matches the round head of the ball. When both sides of the joint are resurfaced, we call it a total shoulder replacement. However, your doctor may determine that only the humeral side of the joint (ball) should be resurfaced. We call this a partial shoulder replacement.



### How do I prepare for shoulder replacement surgery?

If you and your surgeon decide that total shoulder 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 shoulder replacement surgery?**

On the day of surgery, an intravenous tube will be inserted into your arm to administer necessary medications and fluid during surgery. You will then be taken to the operating room and given anesthesia. After the anesthesia takes effect, your shoulder will be scrubbed and sterilized with a special solution that removes bacteria from your skin.

The procedure is performed through an incision over the shoulder that will expose the joint. Special, precision guides and instruments will be used to cut the humeral head (ball) and prepare the bone to accept the implant. The new metal ball and stem are then inserted. If the socket is to be resurfaced, its damaged surface is smoothed and the new plastic surface is inserted. The ball and socket are then joined. When the surgeon is satisfied with the fit and function, the incision will be closed and covered with dressings. A special drain may be inserted into the wound to drain the fluids that naturally develop at the surgical site. The surgery usually takes one to three hours, although this depends on the severity of the arthritis in your shoulder.

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 our lungs. Your arm will be in a sling or brace, 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 shoulder. 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 shoulder 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 recover.

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

Successful joint replacement surgery may relieve your pain and stiffness, and may allow you to resume some of your normal daily activities as instructed by your doctor. But even after you have fully recovered from your surgery, you may still have some restrictions. Normal daily activities for shoulder replacement patients do not include contact sports "jamming" activities such as hammering, repetitive heavy lifting, or activities that put excessive strain on your shoulder. Although your artificial joint can be replaced, a second implant is seldom as successful as the first.

### **How long will a shoulder replacement last?**

Longevity of the prosthetic shoulder 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 shoulder 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 shoulder can do and how much activity it can withstand. As with any mechanical joint, the ball and socket 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 shoulder 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 plastic portions of the implant can lead to the necessity for revision surgery to replace the worn components, or all of the components. 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 shoulder replacement:

- Avoiding repetitive heavy lifting
- 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 discuss what type and intensity of sport or activity is appropriate for you
- Thinking before you move
- Not lifting or pushing heavy objects