

SpineFAQs

Cervical Disc Replacement

Artificial disc replacement (ADR) or disc arthroplasty is relatively new. In June 2004, the first ADR for the *lumbar spine* (low back) was approved by the FDA for use in the US. Making a replacement disc that works and that will last is not an easy task. Cervical artificial disc replacement devices have just been approved for use in the U.S. The goal is to replace the diseased or damaged disc while keeping your normal neck motion. The hope is that your spine will be protected from similar problems above and below the affected spinal level.

What does the surgeon hope to achieve?

Disc replacement surgery is done to stop the symptoms of degenerative disc disease. Discs wear out or *degenerate* as a natural part of aging and from stress and strain on the neck. Eventually, the problem disc collapses. This causes the vertebra above to sink toward the one below. This loss of disc height affects the nearby structures – especially the facet joints.

When the disc collapses, it no longer supports its share of the load in the cervical spine. The facet joints of the spine begin to support more of the force that is transmitted between each vertebra. This increases the wear and tear on the *articular cartilage* that covers the surface of the joints. The articular cartilage is the smooth, slippery surface that covers the surface of the bone in any joint in the body. Articular cartilage is tough, but it does not tolerate abnormal pressure well for long. When damaged, articular cartilage does not have the ability to heal. This wear and tear is what is commonly referred to as *arthritis*.

Shrinking disc height also reduces the size of the neural foramina, the openings between each vertebral pair where the nerve roots leave the spinal column. The arthritis also results in the development of bone spurs that may protrude into these openings, further narrowing the space that the nerves have to exit the spinal canal. The nerve roots can end up getting squeezed where they pass through the neural foramina.

The traditional way of treating severe neck pain caused by disc degeneration is a procedure called an *anterior cervical discectomy and fusion*. In this procedure, the surgeon makes an incision in the *anterior* (front) of the neck, performs a *discectomy* (removes the disc) and *fuses* the two vertebrae together. A fusion simply means that two bones grow together. Usually, when two vertebrae are fused together, a small piece of bone called a bone graft is inserted between the two vertebrae where the disc has been removed. This bone graft serves to both separate the vertebrae and to stimulate the two bones to grow together - or fuse.

The fusion procedure usually involves the use of hardware, such as screws, plates, or cages to keep the bones from moving. Fusion restricts movement in the problem area, but it creates greater strain on the healthy spinal segments above and below. The added strain may eventually cause these segments to wear out. This is called *adjacent-segment degeneration*.

Replacing the damaged disc with an artificial disc, called a *prosthesis* can restore the normal distance between the two vertebrae. The artificial disc sits between the two vertebrae and "jacks up" the upper vertebra. Enlarging the disc space relieves pressure on the facet joints. It also opens up the space around the spinal nerve roots where they pass through the neural foramina. Another benefit of the artificial disc replacement is that it mimics a healthy disc. Natural motion is preserved in the spine where the new disc is implanted. And it helps maintain stability in the spinal joints above and below it.

Who can benefit from disc replacement?

The indications for a cervical disc replacement are generally the same as for a cervical discectomy and fusion. A person must have symptoms from a cervical disc problem. Symptoms include neck and/or arm pain, arm weakness, or arm and hand numbness. These symptoms may be due to a herniated disc and/or bone spurs called *osteophytes* pressing on adjacent nerves or the spinal cord. This condition typically occurs at cervical spine levels C4-5, C5-6, or C6-7.

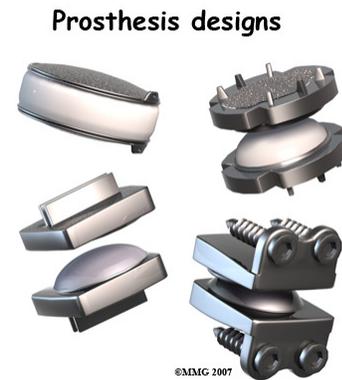
Cervical artificial disc replacement is indicated for the treatment of *radiculopathy* (pressure on the spinal nerve) and *myelopathy* (pressure on the spinal cord) at one or two levels. In the future, it may be used for the treatment of three or more symptomatic levels or levels adjacent to a

cervical spine fusion. More data is needed before the uses of cervical artificial disc replacements are expanded to other problems in the cervical spine. Cervical artificial disc replacement is not advised when there is cervical spine instability, significant facet joint damage, or infection.

What happens during the operation?

Before we describe the procedure, let's look first at the artificial disc itself.

The cervical artificial disc has several different designs. Some look like a sandwich with two endplates separated by a plastic spacer. The two endplates are made of cobalt chromium alloy, a safe material that has been used for many years in replacement joints for the hip and knee. A plastic (*polyethylene*) core fits in between the two metal endplates. The core acts as a spacer and is shaped so that the endplates pivot in a way that imitates normal motion of the two



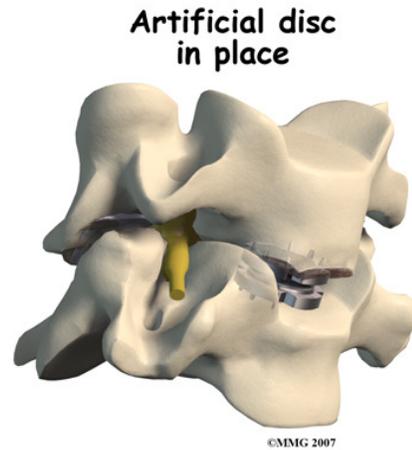
vertebrae. There are small prongs on one side of each endplate. The prongs help anchor the endplate to the surface of the vertebral body. Another artificial disc replacement design is a ball and socket articulation to allow for normal translation of motion at that segment. The implant may be made of titanium and polyurethane in a metal-on-plastic design. Some are made of stainless steel and are all metal-on-metal. Inserted between two vertebrae, the prosthesis reestablishes the height between two vertebrae. As a result of enlarging the disc space, the nearby spinal ligaments are pulled tight, which helps hold the prosthesis in place. The prosthesis is further held in place by the normal pressure through the spine.

The Operation

The surgical approach is the same as that presently used for a discectomy and fusion operation. To do this, the patient is placed on his or her back. An incision is made through the skin and the thin muscles of the front of the neck. The blood vessels, the *trachea* (windpipe), and the esophagus are moved to the side so that the surgeon can see the front of the cervical spine. The disc that is to be replaced is identified using the *fluoroscope*. The fluoroscope is an x-

ray machine that allows the doctor to actually see an x-ray image while doing the procedure.

Working from the front of the spine, the spine surgeon removes a large section from the middle of the damaged disc. Next, the bones of the spine are spread apart to make more room to see and work inside the disc space. Using a surgical microscope, any remaining disc material toward the back of the disc is removed. The surgeon will also remove any disc fragments pressing against the nerve and shave off any *osteophytes* (bone spurs).



The disc space is *distracted* (jacked up) to its normal disc height. This step helps decompress or take pressure off the nerves. At this point, x-rays or a fluoroscope, is used to insert the artificial disc device into the prepared disc space. This allows the doctor to watch where the implant goes as it is inserted. This makes the procedure much safer and much more accurate. Finally, the prosthesis is tested by moving the spine in various positions. An X-ray will be taken to double check the location and fit of the new disc.

What might go wrong?

All types of spine surgery, including artificial disc replacement, have certain risks and benefits. Weigh these as you gather advice and information. Be sure to discuss the possible risks of disc replacement with your spine surgeon. Medical complications arising from spinal surgery are rare but could include stroke, heart attack, spinal cord or spinal nerve injury, pneumonia, or possibly death. However, information from the disc replacement operations shows a low rate of complications. There have been no reports of death, significant infection, or major neurological problems.

As with all major surgical procedures, complications can occur. This document doesn't provide a complete list of the possible complications, but it does highlight some of the most common problems

Anesthesia Complications - Most surgical procedures require that some type of anesthesia be done before surgery. A very small number of patients have problems with anesthesia. These problems can be reactions to the drugs used, problems related to other medical complications, and problems due to the anesthesia. Be sure to discuss the risks and your concerns with your anesthesiologist.

Infection - Infection following spine surgery is rare but can be a very serious complication. Some infections may show up early, even before you leave the hospital. Infections on the skin's surface usually go away with antibiotics. Deeper infections that spread into the bones and soft tissues of the spine are harder to treat and may require additional surgery to treat the infected portion of the spine.

Blood Loss - Cervical disc replacement surgery carries risks associated with operating from the front of the spine. Blood vessels that travel near the front of the spine may be injured during anterior cervical surgery.

Nerve Injury - Any surgery that is done near the spinal canal can potentially cause injury to the spinal cord or spinal nerves. Injury can occur from bumping or cutting the nerve tissue with a surgical instrument, from swelling around the nerve, or from the formation of scar tissue. An injury to these structures can cause muscle weakness and a loss of sensation to the areas supplied by the nerve. The nerve to the voice box is sometimes injured during surgery on the front of the neck. When doing anterior neck surgery, surgeons prefer to go through the left side of the neck where the path of the nerve to the voice box is more predictable than on the right side. During surgery, the nerve may get stretched too far when retractors are used to hold the muscles and soft tissues apart. When this happens, patients may be hoarse for a few days or weeks after surgery. In rare cases where the nerve is actually cut, patients may end up with ongoing minor problems of hoarseness, voice fatigue, or difficulty making high tones.

Spontaneous Ankylosis (fusion) - Some things can go wrong with any implant. In the case of artificial disc replacements for the cervical spine, sometimes the spine fuses itself, a process called *spontaneous ankylosis*. Loss of neck motion is the main side effect of this problem. Bone may also form in the soft tissues around the vertebrae. For

example, cartilage turns to bone or bone-like tissue. This process is called *ossification*. Ossification may not affect the implant or your final results in terms of motion or function. Some patients are left with pain, numbness, and weakness. This can occur when there's been incomplete neurologic decompression. In other words, there is still pressure on the spinal cord or spinal nerves.

Subsidence (sinking) - *Subsidence* is another possible problem. The implant actually sinks down into the vertebral body above or below it. This results in a loss of the normal disc height. Neurologic compression with neurologic symptoms can occur.

Implant Failure (need for further surgery) - Over time, wear and tear just from the physical process of motion across a bearing surface can cause tiny bits of debris to flake off the implant. The body may react to these particles with an inflammatory response that can cause pain, implant loosening, and implant failure. So far, significant inflammatory reactions have not been reported for spinal artificial disc replacements. In rare cases, the artificial disc replacement can dislocate.

What happens after surgery?

Most people spend one or two days in the hospital. You may require an extra day or two if for some reason you're having extra pain or unexpected difficulty. Patients generally recover quickly after the artificial disc procedure. You should be able to get out of bed and walk within a few hours. Move carefully and comfortably, and avoid extending your neck (bending backward). You may need to wear a brace or soft collar for a short while after the operation to support your neck muscles. As you recover in the hospital, a physical therapist may see you one or two times each day until you go home. You'll be shown ways to move, dress, and do activities without putting extra strain on your neck. Your therapist will help you begin a walking program in the hospital. You are encouraged to continue the walking program when you return home.

When you leave the hospital, there are very few activity restrictions. You should be safe to sit, walk, and drive. However, you should avoid lifting items for at least four weeks. Your surgeon will probably release you to return to work in two to four weeks. If your job requires moving and lifting

heavy items, you may require a longer period of recovery. Your surgeon may give you the okay to do all your activities by the sixth week after surgery. If you spend large amounts of time in front of a computer or other machine, you may need to change the height and angle of your work surface and/or the computer. Finding a position that puts minimal stress on your neck is important. You should avoid spending hours in one position reading, sewing, or doing other handwork. The therapist can help you find optimal positions and advise you about ways to stretch your neck muscles.