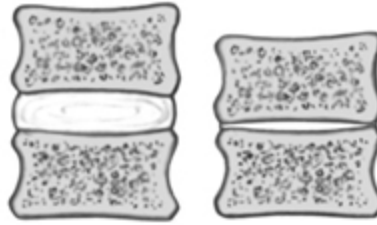


Disk Replacement

Low back pain is a significant cause of disability in the U.S. and worldwide. It is estimated that 70% to 80% of people will experience low back pain at some point in their lives.

Artificial disk replacement has emerged as an effective treatment option for low back pain. Similar to hip or knee joint replacements, disk replacement substitutes a mechanical device for an intervertebral disk in the spine. This technology has been available in Europe for over a decade. Artificial disk replacement initially gained FDA approval for use in the U.S. in October of 2004.

Cause



Left: A normal lumbar spine segment showing the disk. **Right:** Degenerative lumbar spine segments showing the disk height collapse.
Reproduced with permission from Neck and Spine, in Pfeiffer GB, Jimenez RL, Sarwark JF, Yurko-Griffin L (ed): The 2003 Body Almanac. Rosemont, IL. American Academy of Orthopaedic Surgeons, 2003.

There are a number of theories about the cause of low back pain. The principal causes are associated with the degeneration of an intervertebral disk. Disks are structures located in between each of the vertebrae that act as the spine's "shock absorbers." They provide the spine with both strength and flexibility.

As individuals age, the intervertebral disks degenerate and lose their mechanical properties. As the disks collapse, the spinal canal narrows and superficial nerves, which supply sensation to the disks, may become irritated. This can cause back pain. This syndrome of painful disk collapse is often referred to as "degenerative disk disease."

Who Is a Candidate for Disk Replacement?

To determine who is a good candidate for disk replacement, the surgeon may require a few tests. These may include magnetic resonance imaging (MRI), diskography, computed tomography (CT or CAT scan), and X-rays. These tests will also determine the source of the pain.

Good candidates for disk replacement have the following:

- Back pain thought to be caused mostly from one or two intervertebral disks in the lumbar spine
- No significant facet joint disease or bony compression on nerves
- Not excessively overweight
- No prior major surgery in the lumbar spine
- No deformity (scoliosis)

Treatment

Nonsurgical Treatment

The standard treatment of degenerative disk disease has been nonsurgical. Treatment includes trials of medications, exercise and physical therapy, activity modification, and injection therapy.

Surgical Treatment: Spinal Fusion

Spinal fusion is often recommended to patients who do not respond to a prolonged nonsurgical treatment program.

Goals. Spinal fusion is a "welding" process by which two or more of the vertebrae that make up the spinal column are fused together with bone grafts and internal devices, such as metal rods, to heal into a single solid bone.

Spinal fusion eliminates motion between vertebral segments. This may be desirable when motion is the cause of significant pain.

New Techniques. Fusion of vertebrae in the lower back (lumbar) region of the spine has been performed for decades. A variety of approaches and techniques have evolved.

Recent developments focus on limiting injury to associated muscles by inserting minimally invasive devices and using proteins to achieve successful bone healing without taking the patient's own bone as graft material.

Considerations. Spinal fusion for lower back pain has several drawbacks. For example, spinal flexibility in the fused area may be limited because fusion eliminates motion at the lumbar disk space in question.

A fusion requires bone to heal within or around the disk space. In some cases, non-healing of the bone may occur.

Also, the source of graft bone from the patient's own pelvis may lead to chronic pain at the donor site.

Surgical Treatment: Artificial Disk Replacement or Arthroplasty

Alternatives to fusion may include such options as artificial disk replacement or arthroplasty.

Goals. Artificial disks allow motion to continue after the degenerated disk is removed. The artificial disk may restore the height between the vertebral bodies.



Total artificial disk replacements are mechanical devices that simulate spinal function.
CHARITÉ artificial disk. Reproduced with permission from DePuy Spine, Inc. © 2007 DePuy Spine, Inc. All rights reserved.

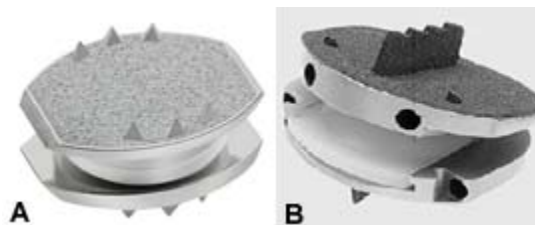
The artificial disks may widen the passageway (neural foramina) through which the nerve roots exit the spinal canal. They can relieve pressure on facet joints and help to maintain the natural curvature of the lumbar spine.

Technique. The disk replacement device may comprise the nucleus (center) of the disk while leaving the annulus (outer ring) in place, although this technology is still in an investigative stage.

Alternatively, total artificial disk replacements substitute the annulus and nucleus with a mechanical device that will simulate spinal function.

There are a number of different disk designs. Each is unique in its own way but all maintain a similar goal: to reproduce the size and function of a normal intervertebral disk. Some of the disks are made of metal, while others are a combination metal and plastic, similar to joint replacements in the knee and hip. Materials used include medical grade plastic (polyethylene) and medical grade cobalt chromium or titanium alloy.

The surgical implantation procedure of these devices may take 3 to 6 hours. The procedure is performed through an incision in the abdomen.



Examples of total artificial disk replacements.

A. CHARITÉ artificial disk. Reproduced with permission from DePuy Spine, Inc. © 2007 DePuy Spine, Inc. All rights reserved. B. ProDisc-L prostheses. Reproduced with permission from Synthes, West Chester, PA.

Considerations. The main risks of the procedure are that the large veins and arteries of the legs need to be dissected away from the front of the spine and protected while the disk is removed.

Rehabilitation

Most patients are encouraged to stand and walk by the first day after surgery. Because bone healing is not required following an artificial disk implantation, the typical patient is encouraged to move through the mid-section. Early motion in the trunk area may translate into quicker rehabilitation and recovery.

The typical hospital stay is 2 to 4 days, depending upon pain control and return to function. Basic exercises during the first several weeks after surgery include routine walking and stretching while avoiding hyperextension activities.

Patients can expect improvement of lower back pain and disability in weeks to months following surgery. The results from numerous studies, including FDA-regulated trials, reveal that disk replacement improves, but does not completely eliminate pain. It is critical that prior to surgery the patient and the treating surgeon develop realistic expectations of pain relief.

Research on the Horizon

The future of artificial disk replacement technology will likely include significant advancements in the design of implants, tools for diagnosis of the source of pain, and other approaches to regenerating the disk to normal function.

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