

## Spinal Deformity: Adult Degenerative Scoliosis

### Overview

Spinal deformity is an abnormal curvature of the vertebral column. Adult scoliosis and kyphosis can be caused by age-related wear and tear on the joints and discs or as a complication from previous spine surgery. Pain results from stressed joints and pinched nerves. Moderate deformity may lead to balance problems and changes to one's posture. Treatment can include medications, physical therapy, injections, or surgery.

### Anatomy of the spine

The spine is a column of 24 moveable bones called vertebrae that are connected to one another by ligaments. The bones are separated by discs, which act as shock absorbers and give the spine flexibility. Each vertebra has a three-joint complex with a large disc in the front and two facet (pronounced fah-CETTE) joints in the back. This strong, tripod design keeps the bones connected and aligned, one on top of the other, while allowing our spine to bend and twist.

When viewed from the front the spine is perfectly straight, but from the side it has three curves (Fig. 1). This curvature enables us to stand upright, absorbs the shock of footsteps, and positions our head naturally over the pelvis and hip. At the neck, or cervical level, the normal spine arches slightly inward toward the jaw in a curvature called lordosis. The spine arches out slightly at the chest level (kyphosis), and it curves inward again (lordosis) at lumbar level, or lower back.

### What is spinal deformity?

Spinal alignment and curvature can be altered in many ways. They can occur as a result of a birth defect, a child's growth, aging, injury, or previous spine surgery. The most common type of spinal deformity in adults is degenerative scoliosis.

### Scoliosis

Scoliosis is an abnormal side-to-side curvature of the spine. Idiopathic (of unknown cause) scoliosis develops in children and can persist into adulthood. Degenerative scoliosis develops in adults when their facet joints and discs begin to deteriorate (Fig. 2). The facet joints give the spine flexibility, enabling us to twist, stretch, or curl up on the couch. When these joints deteriorate, the spine bones can tilt, rotate, and begin to shift to one side.

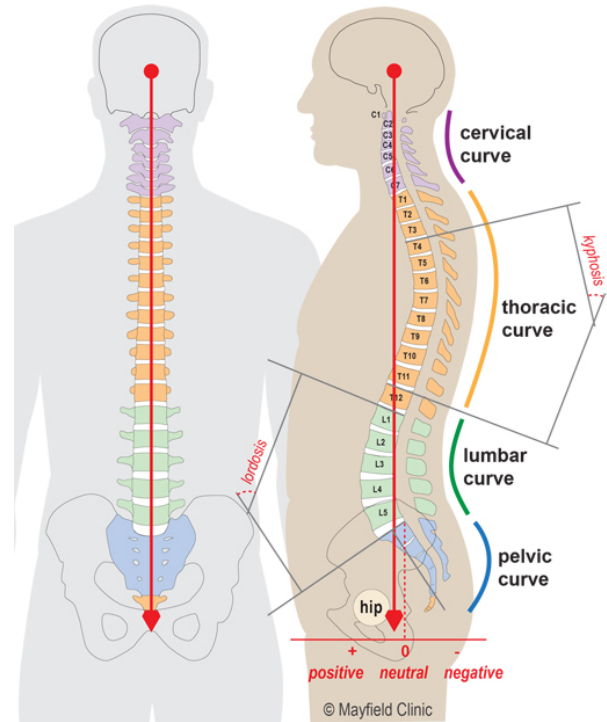


Figure 1. Front and side views of the body show normal alignment of the spine bones and the natural curves.

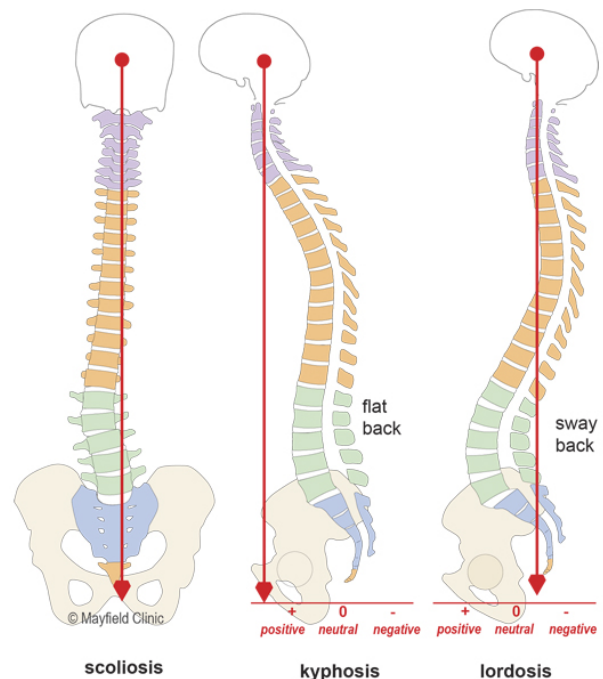


Figure 2. Types of spinal deformities: a side-to-side curve is called scoliosis; a forward curve (kyphosis) shifts the center of balance in front of the hip; a concave lower back (lordosis) thrusts the hips forward.

## Kyphosis

Kyphosis is an abnormal forward rounding (more than 50 degrees of curvature) of the spine. In the upper (thoracic) back, kyphosis is commonly due to osteoporotic compression fractures. It can also occur in the lower (lumbar) spine. It limits function and results in a common complaint among older people: "I can't stand up straight." Another common scenario is a patient who has previously had one or more spine surgeries. These patients can develop what is called "flat back syndrome," which means they have lost some of the natural lordosis (inward curvature) of their lower spine. A patient who has had a previous lumbar fusion may develop a junctional kyphosis. In this situation, the spine has weakened right above the fusion, causing the patient's posture to bend forward.

## Lordosis

Also called swayback, lordosis is a condition in which the spine curves significantly inward at the lower back, giving a backward leaning appearance.

## What are the symptoms?

Scoliosis is not a single disease. It falls along a spectrum, from mild to moderate to severe. Symptoms include pain or stiffness in the mid-to-lower back, and numbness or weakness in the legs or feet. Not all adults with degenerative scoliosis experience pain. When pain does occur, a pinched nerve is typically the cause, not the curvature.

In more severe cases, scoliosis can cause shooting pain down the leg (sciatica), an inability to stand up straight, and an inability to walk more than a short distance. Symptoms of severe, progressive scoliosis are similar to those of stenosis, but with visible spinal imbalance. This imbalance can result in strain on the hips and knees, the inability to walk a straight line, and falls.

Patients with kyphosis have lost their ability to stand up straight. Hunched over while standing, they may become quickly fatigued and have difficulty talking to others or maintaining eye contact. They also may have difficulty lying flat.

## What are the causes?

As you get older, your bones undergo degenerative changes that are part of the natural aging process. When joints deteriorate, arthritis can develop and the spinal column can shift sideways. Other conditions that might cause degeneration include:

- **Arthritis** from degenerative discs and facet joint syndrome, resulting in the loss of normal vertebral alignment (Fig. 3).
- **Osteoporosis** (loss of bone mass) and vertebral compression fractures.
- **Previous spine surgery** (adjacent level disease). The passage of time after a spine surgery is a leading cause of spinal deformity.

The aging of joints, combined with a fracture at a level above a previous fusion, can also cause a significant deformity. Simply removing material from the spine can cause a problem down the road. It may reduce or eliminate pain in the near term, but symptoms can return later because of instability of the spine. Think of the game, *Jenga*. When you remove a block from the tower, other blocks can be affected. Like the *Jenga* tower, what goes on globally in the spinal balance and pathology is important.

## Who is affected?

Mild to moderate spinal deformity is common in older adults, but it can also affect adults in their 50s and younger. An estimated 60% of people over age 60 may have mild degenerative scoliosis.

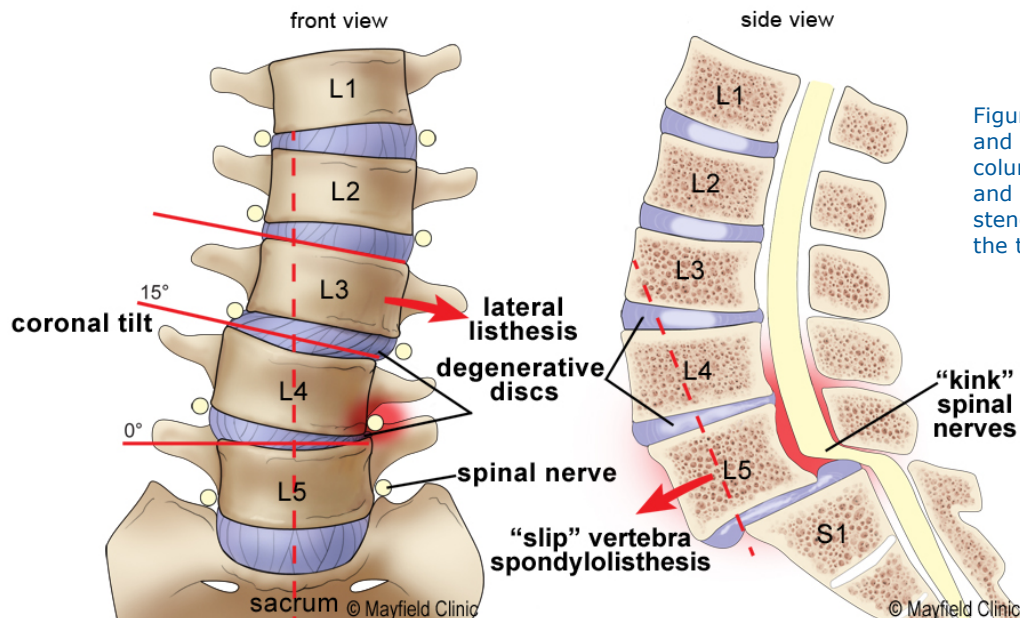


Figure 3. Degenerative discs and facet joints can cause the column of bones to tilt, rotate, and slip (listhesis). Foraminal stenosis occurs on the inside of the tilt and pinches the nerve.

## How is a diagnosis made?

Diagnostic tests include a physician examination, x-rays, CT scan, MRI, or myelogram.

**X-rays** create images of the bones in your spine and show whether any of them are too close together or whether you have arthritic changes, bone spurs, fractures, or slippage of the vertebrae. Special long-cassette x-rays are taken in standing, flexion, and extension to measure angles and monitor curve progression (Fig. 4).

**Computed Tomography (CT) scan** uses an x-ray beam and a computer to make 2-dimensional images of your spine. It may or may not be performed with a contrast dye injected into your bloodstream. It is useful for viewing bony changes.

**Magnetic Resonance Imaging (MRI)** gives a detailed view of the soft tissues of your spine. Unlike an x-ray, nerves and discs are clearly visible. It may or may not be performed with a contrast dye injected into your bloodstream. MRI is useful in evaluating soft-tissue damage to the ligaments, discs, and spinal cord.

**Myelogram** is a special X-ray where contrast dye is injected into the spinal canal. A fluoroscope then records the images formed by the dye. Myelograms can show a nerve being pinched by a disc, bony overgrowth or stenosis. The dye shows the spinal canal and cord. A CT scan follows the test.

## What treatments are available?

Treatment for mild to moderate spine deformity in adults is determined by the severity of the symptoms, not the size of the curve. It begins with a trial period of pain management, physical therapy, and nonsurgical options. If pain is caused by inflammation of the facet joints, treatment involves facet joint therapy. If the curvature is mild, the deformity is not treated. If the curvature is severe, complex spinal surgery may be recommended. Barring serious "red flags," such as a neurologic impairment, conservative care is used for 3 to 6 months before surgery is considered.

**Self care:** Using correct posture and keeping your spine in alignment are the most important things you can do for your back. You may need to make adjustments to your daily standing, sitting, and sleeping habits. You may also need to learn proper ways to lift and bend. If you smoke or are overweight, you may be able to reduce your symptoms by quitting smoking and/or achieving a healthy weight appropriate for your body frame.

**Bone density:** A bone-density scan can determine the strength of your bones. If osteoporosis is detected, your risk of a fracture to your spine is increased because your bones have weakened and become more brittle. Your doctor may prescribe a medication that slows bone loss.

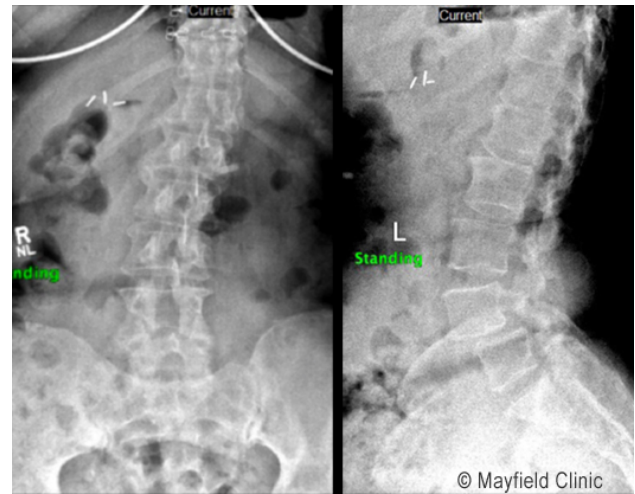


Figure 4. Standing scoliosis X-rays of the spine show misalignment of the bones.

**Physical therapy:** Exercise and strengthening exercises are key elements to your treatment and should become part of your life-long fitness. Physical therapists can instruct you on proper lifting and walking techniques, and they will work with you to strengthen your back, leg, and stomach muscles. They will also encourage you to stretch and increase the flexibility of your spine and legs. Check with your doctor before you begin any new exercise program and be sure to see a physical therapist who specializes in spine rehabilitation.

**Medication:** Over-the-counter and prescription medications can help you cope with back pain.

- **Nonsteroidal anti-inflammatory drugs (NSAIDs)**, such as aspirin, naproxen (Aleve, Naprosyn), and ibuprofen (Motrin, Nuprin, Advil) are used to reduce inflammation and relieve pain.
- **Analgesics**, such as acetaminophen (Tylenol), can relieve pain but do not have the anti-inflammatory effects of NSAIDs. Long-term use of analgesics and NSAIDs may cause stomach ulcers as well as kidney and liver problems.
- **Steroids** reduce the swelling and inflammation of the nerves. They are taken orally (as a Medrol dose pack) in a tapering dosage over a 5-day period. They have the advantage of providing pain relief within a 24-hour period.
- **Epidural steroid injection (ESI)** involves an injection of corticosteroid into the space around the spinal nerves to reduce swelling. Many patients have some relief after an ESI, although the results tend to be temporary.
- **Facet injection** involves an injection of corticosteroid and an analgesic-numbing agent into the painful facet joint.

**Bracing:** Wearing a brace is often used for childhood scoliosis, but it will not straighten the adult spine. A brace may help reduce pain in the short-term, but it also will allow the muscles to get weaker, eventually leading to more back pain.

**Chiropractic care:** Chiropractors apply pressure to an area to align bones and return joints to a more normal motion. Patients with spinal deformity might benefit from tissue massage for a muscle spasm, traction for a pinched nerve, or ultrasound for tight muscles. Dry needling or acupuncture might also prove helpful. But most patients with spinal deformity are *not* candidates for a high-velocity spinal adjustment (a back crack). Such adjustments (by x-ray criteria) do not result in a measurable change of spinal alignment. If you have a major deformity, consult a neurosurgeon to determine if chiropractic is safe.

**Surgery:** Surgical options vary depending on the severity of the symptoms, the number of levels affected, and the type of deformity. A combination of different fusion and instrumentation techniques are used to treat the patient's specific condition.

- **Decompression:** If the scoliosis is mild and is causing a pinched nerve at one level, then only that level is treated with a laminectomy.
- **Fusion:** A patient suffering from stenosis and scoliosis may require a spinal fusion to restore disc height when a vertebra has collapsed on a nerve. Fusion restores proper alignment and joins two vertebrae with a bone graft (Fig. 5), which is held together with rods, screws or cages. Over several months the bone graft will join the vertebrae above and below to form one solid piece of bone.
- **Minimally invasive fusion:** A lateral lumbar interbody fusion (LLIF) surgery is an option for some patients with scoliosis (Fig. 6). The surgeon operates through a tube incision at the waist and avoids cutting the back muscles.
- **Spinal reconstruction:** Complex deformities and kyphosis often require the cutting of bone (osteotomy) and stabilization with long rods and screws in staged operations (Fig. 7.).

**Sources & links**

If you have more questions, please contact Mayfield Brain & Spine at 800-325-7787 or 513-221-1100.

**Links**

www.srs.org  
www.spine-health.com

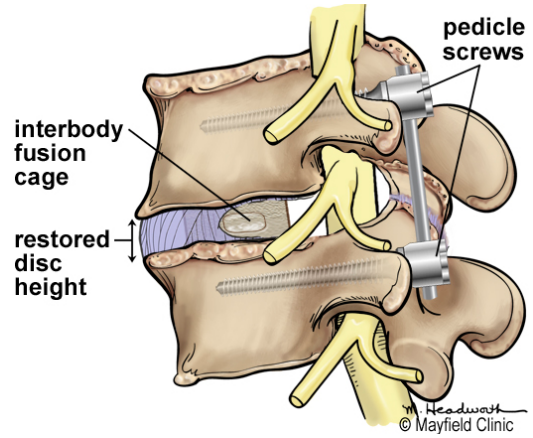


Figure 5. A transforaminal lumbar interbody fusion (TLIF) replaces the disc with a bone graft and immobilizes the bones with pedicle screws and rods.

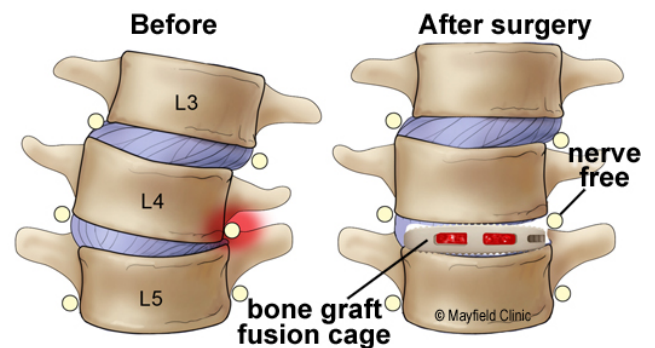


Figure 6. A lateral fusion (LLIF) for moderate scoliosis restores the normal tilt and height of the disc space.

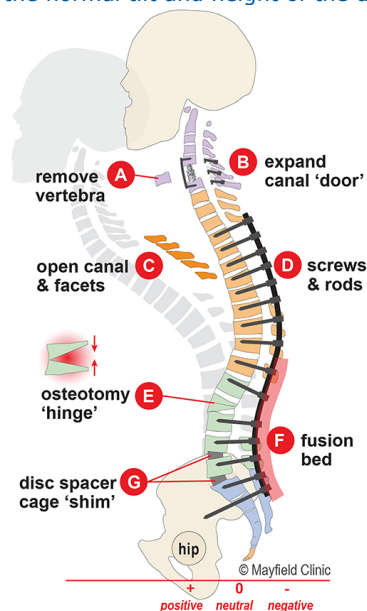


Figure 7. Complex spine surgery is customized for each patient's unique problem. It can involve: A. Corpectomy, B. Laminectomy, C. Decompression, D. Screws and rods, E. Osteotomy (hinge), F. Fusion, G. Disc spacers.



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