

*Questions
& Answers
about . . .*

Scoliosis in Children and Adolescents

*National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS)
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You can also find this booklet on the NIAMS Web site
at www.niams.nih.gov/hi/topics/scoliosis/scochild.htm.

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This booklet defines scoliosis and provides information about how it is diagnosed and treated in children and adolescents. You may be interested in contacting one or more of the organizations referenced at the end of the booklet for more information.

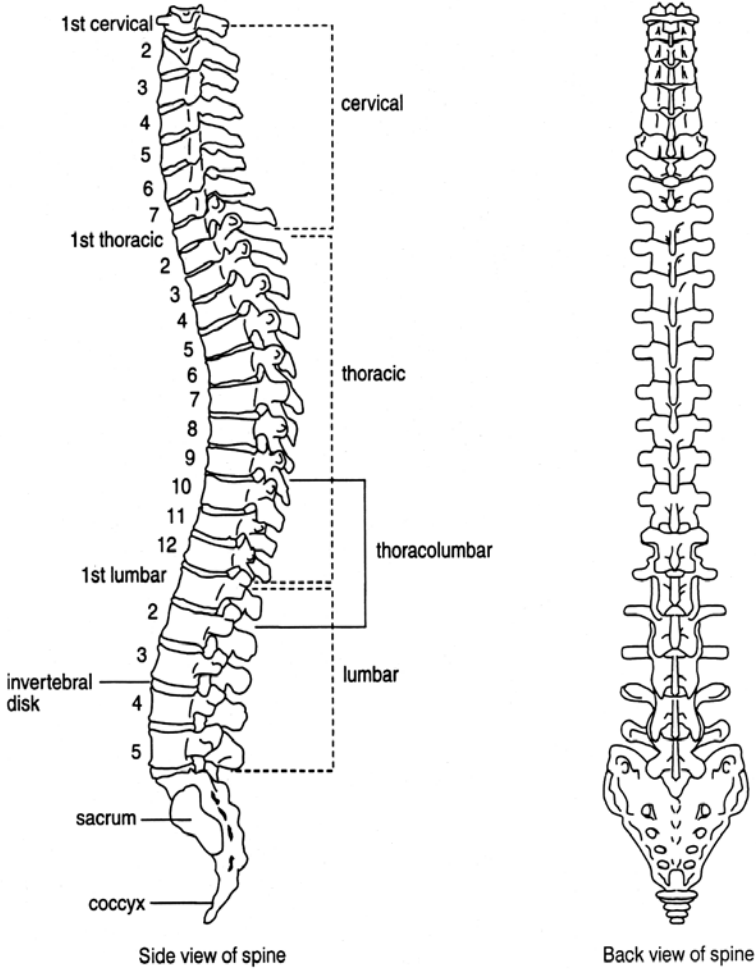
What Is Scoliosis?

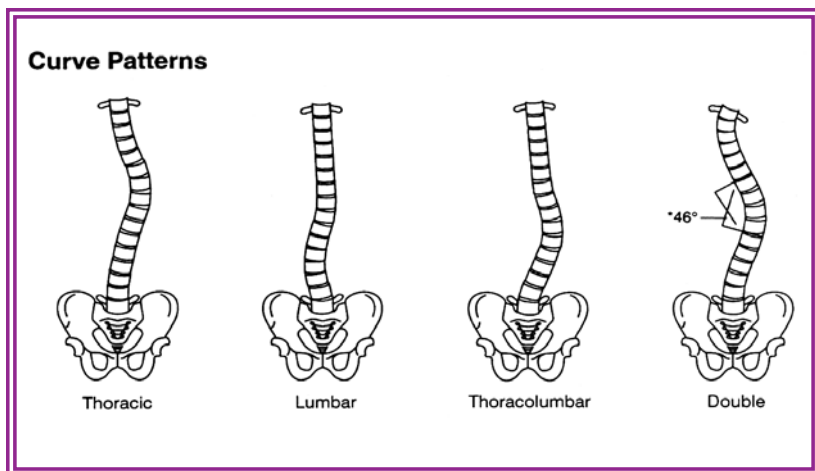
Scoliosis is a musculoskeletal disorder in which there is a sideways curvature of the spine, or backbone. The bones that make up the spine are called vertebrae. Some people who have scoliosis require treatment. Other people, who have milder curves, may only need to visit their doctor for periodic observation. The section starting on page 7, “Does Scoliosis Have To Be Treated? What Are the Treatments?” describes how doctors decide whether or not to treat scoliosis.

Who Gets Scoliosis?

People of all ages can have scoliosis, but this booklet focuses on children and adolescents. Of every 1,000 children, 3 to 5 develop spinal curves that are considered large enough to need treatment. Adolescent idiopathic scoliosis (scoliosis of unknown cause) is the most common type and occurs after the age of 10. Girls are more likely than boys to have this type of scoliosis. Since scoliosis can run in families, a child who has a parent, brother, or sister with idiopathic scoliosis should be checked regularly for scoliosis by the family physician.

Normal Spine





Idiopathic scoliosis can also occur in children younger than 10 years of age, but is very rare. **Early onset** or **infantile idiopathic scoliosis** occurs in children less than 3 years old. It is more common in Europe than in the United States. **Juvenile idiopathic scoliosis** occurs in children between the ages of 3 and 10.

What Causes Scoliosis?

In 80 to 85 percent of people, the cause of scoliosis is unknown; this is called idiopathic scoliosis. Before concluding that a person has idiopathic scoliosis, the doctor looks for other possible causes, such as injury or infection. Causes of curves are classified as either nonstructural or structural.

- **Nonstructural (functional) scoliosis**—A structurally normal spine that appears curved. This is a temporary, changing curve. It is caused by an underlying

condition such as a difference in leg length, muscle spasms, or inflammatory conditions such as appendicitis. Doctors treat this type of scoliosis by correcting the underlying problem.

- **Structural scoliosis**—A fixed curve that doctors treat case by case. Sometimes structural scoliosis is one part of a syndrome or disease, such as Marfan’s syndrome, an inherited connective tissue disorder. In other cases, it occurs by itself. Structural scoliosis can be caused by neuromuscular diseases (such as cerebral palsy, poliomyelitis, or muscular dystrophy), birth defects (such as hemivertebra, in which one side of a vertebra fails to form normally before birth), injury, certain infections, tumors (such as those caused by neurofibromatosis, a birth defect sometimes associated with benign tumors on the spinal column), metabolic diseases, connective tissue disorders, rheumatic diseases, or unknown factors (idiopathic scoliosis).

How Does the Doctor Diagnose Scoliosis?

The doctor takes the following steps to evaluate a patient for scoliosis:

- **Medical history**—The doctor talks to the patient and the patient’s parent or parents and reviews the patient’s records to look for medical problems that

might be causing the spine to curve, for example, birth defects, trauma, or other disorders that can be associated with scoliosis.

- **Physical examination**—The doctor looks at the patient’s back, chest, pelvis, legs, feet, and skin. The doctor checks if the patient’s shoulders are level, whether the head is centered, and whether opposite sides of the body look level. The doctor also examines the back muscles while the patient is bending forward to see if one side of the rib cage is higher than the other. If there is a significant asymmetry (difference between opposite sides of the body), the doctor will refer the patient to an orthopaedic spine specialist (a doctor who has experience treating people with scoliosis). Certain changes in the skin, such as so-called café au lait (coffee-with-milk-colored) spots, can suggest that the scoliosis is caused by a birth defect.
- **X-ray evaluation**—Patients with significant spinal curves, unusual back pain, or signs of involvement of the central nervous system (brain and spinal cord) such as bowel and bladder control problems need to have an x ray. The x ray should be done with the patient standing with his or her back to the x-ray machine. The view is of the entire spine on one long (36-inch) film. Occasionally, doctors ask for more tests to see if there are other problems.

- **Curve measurement**—The doctor measures the curve on the x-ray image. He or she finds the vertebrae at the beginning and end of the curve and measures the angle of the curve (see “Curve Patterns” diagram, page 3). Curves that are greater than 20 degrees require treatment, as described on page 7.

Doctors group curves of the spine by their location, shape, pattern, and cause. They use this information to decide how best to treat the scoliosis.

- **Location**—To identify a curve’s location, doctors find the apex of the curve (the vertebra within the curve that is the most off-center); the location of the apex is the “location” of the curve. A thoracic curve has its apex in the thoracic area (the part of the spine to which the ribs attach). A lumbar curve has its apex in the lower back. A thoracolumbar curve has its apex where the thoracic and lumbar vertebrae join (see “Normal Spine” diagram, page 2).
- **Shape**—The curve usually is S- or C-shaped.
- **Pattern**—Curves frequently follow patterns that have been studied in previous patients (see “Curve Patterns” diagram). The larger the curve is, the more likely it will progress (depending on the amount of growth remaining).

Does Scoliosis Have To Be Treated? What Are the Treatments?

Many children who are sent to the doctor by a school scoliosis screening program have very mild spinal curves that do not need treatment. When a child does need treatment, the doctor may send him or her to an orthopaedic spine specialist.

The doctor will suggest the best treatment for each patient based on the patient's age, how much more he or she is likely to grow, the degree and pattern of the curve, and the type of scoliosis. The doctor may recommend observation, bracing, or surgery.

- **Observation**—Doctors follow patients without treatment and re-examine them every 4 to 6 months when the patient is still growing (is skeletally immature) and has an idiopathic curve of less than 25 degrees.
- **Bracing**—Doctors advise patients to wear a brace to stop a curve from getting any worse when the patient:
 - is still growing and has an idiopathic curve that is more than 25 to 30 degrees;
 - has at least 2 years of growth remaining, has an idiopathic curve that is between 20 and 29 degrees, and, if a girl, has not had her first menstrual period; or

— is still growing and has an idiopathic curve between 20 and 29 degrees that is getting worse.

As a child nears the end of growth, the indications for bracing will depend on how the curve affects the child's appearance, whether the curve is getting worse, and the size of the curve.

- **Surgery**—Doctors advise patients to have surgery to correct a curve or stop it from worsening when the patient is still growing, has a curve that is more than 45 degrees, and has a curve that is getting worse.

Are There Other Ways To Treat Scoliosis?

Some people have tried other ways to treat scoliosis, including manipulation by a chiropractor, electrical stimulation, dietary supplements, and corrective exercises. So far, studies of the following treatments have not been shown to prevent curve progression, or worsening:

- **Chiropractic manipulation**
- **Electrical stimulation**
- **Nutritional supplementation**
- **Exercise**—Studies have shown that exercise alone will not stop progressive curves. However, patients may wish to exercise for the effects on their general health and well-being.

Which Brace Is Best?

The decision about which brace to wear depends on the type of curve and whether the patient will follow the doctor's directions about how many hours a day to wear the brace.

There are two main types of braces. Braces can be custom-made or can be made from a prefabricated mold. All must be selected for the specific curve problem and fitted to each patient. To have their intended effect (to keep a curve from getting worse), braces must be worn every day for the full number of hours prescribed by the doctor until the child stops growing.

- **Milwaukee brace**—Patients can wear this brace to correct any curve in the spine. This brace has a neck ring.
- **Thoracolumbosacral orthosis (TLSO)**—Patients can wear this brace to correct curves whose apex is at or below the eighth thoracic vertebra (see “Normal Spine” diagram). The TLSO is an underarm brace, which means that it fits under the arm and around the rib cage, lower back, and hips.

If the Doctor Recommends Surgery, Which Procedure Is Best?

Many surgical techniques can be used to correct the curves of scoliosis. The main surgical procedure is correction, stabilization, and fusion of the curve. Fusion is the joining of two or more vertebrae. Surgeons can choose different ways to straighten the spine and also different implants to keep the spine stable after surgery. (Implants are devices that remain in the patient after surgery to keep the spine aligned.) The decision about the type of implant will depend on the cost; the size of the implant, which depends on the size of the patient; the shape of the implant; its safety; and the experience of the surgeon. Each patient should discuss his or her options with at least two experienced surgeons.

Patients and parents who are thinking about surgery may want to ask the following questions:

- What are the benefits from surgery for scoliosis?
- What are the risks from surgery for scoliosis?
- What techniques will be used for the surgery?
- What devices will be used to keep the spine stable after surgery?
- Where will the incisions be made?
- How straight will the patient's spine be after surgery?

- How long will the hospital stay be?
- How long will it take to recover from surgery?
- Is there chronic back pain after surgery for scoliosis?
- Will the patient's growth be limited?
- How flexible will the spine remain?
- Can the curve worsen or progress after surgery?
- Will additional surgery be likely?
- Will the patient be able to do all the things he or she wants to do following surgery?

Can People With Scoliosis Exercise?

Although exercise programs have *not* been shown to affect the natural history of scoliosis, exercise is encouraged in patients with scoliosis to minimize any potential decrease in functional ability over time. It is very important for all people, including those with scoliosis, to exercise and remain physically fit. Girls have a higher risk than boys of developing osteoporosis (a disorder that results in weak bones that can break easily) later in life. The risk of osteoporosis is reduced in women who exercise regularly all their lives; and weight-bearing exercise, such as walking, running, soccer, and gymnastics, increases bone density and helps prevent

osteoporosis. For both boys and girls, exercising and participating in sports also improves their general sense of well-being.

What Are Researchers Trying To Find Out About Scoliosis?

Researchers are looking for the cause of idiopathic scoliosis. They have studied genetics, growth, structural and biochemical alterations in the discs and muscles, and central nervous system changes. The changes in the discs and muscles seem to be a result of scoliosis and not the cause. Scientists are still hopeful that studying changes in the central nervous system in people with idiopathic scoliosis may reveal a cause of this disorder.

Researchers continue to examine how a variety of braces, surgical procedures, and surgical instruments can be used to straighten the spine or to prevent further curvature. They are also studying the long-term effects of a scoliosis fusion and the long-term effects of untreated scoliosis.

Where Can People Get More Information About Scoliosis?

- **National Scoliosis Foundation**

5 Cabot Place

Stoughton, MA 02072

Phone: 617-341-6333 or

800-NSF-MYBACK (673-6922) (free of charge)

Fax: 617-341-8333

E-mail: scoliosis@aol.com

This is a nonprofit voluntary organization that provides pamphlets, a newsletter, and other information materials on childhood and adult scoliosis. The foundation also provides support group information and lists of physicians in each state who specialize in scoliosis.

- **The Scoliosis Association, Inc.**

P.O. Box 811705

Boca Raton, FL 33481-1705

Phone: 561-991-4435 or 800-800-0669 (free of charge)

Fax: 561-994-2455

E-mail: normlipin@aol.com

www.scoliosis-assoc.org

This association publishes a quarterly newsletter and pamphlets. A single copy of their fact sheet is available free by sending a self-addressed, stamped envelope. The association also provides information about local chapters and support groups.

- **Scoliosis Research Society**
611 East Wells Street
Milwaukee, WI 53202
Phone: 414–289–9107
Fax: 414–276–3349
E-mail: goulding@aaos.org
www.srs.org

This is a professional organization for orthopaedic surgeons interested in scoliosis. It provides pamphlets about the diagnosis and treatment of scoliosis. Their free pamphlet is offered on their Web site as well as through the mail. The society also can provide referrals to physicians.

- **American Physical Therapy Association**
Scoliosis
1111 North Fairfax Street
Arlington, VA 22314–1488
E-mail: svcctr@apta.org
www.apta.org

To obtain a copy of the American Physical Therapy Association’s brochure about scoliosis, in English or Spanish, write to the above address or visit their Web site.

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