

An introduction to
**ADOLESCENT
SCOLIOSIS**



*Dear reader,
Medacta International is pleased to provide you with these basic guidelines to help you and your family gain the best possible understanding of this pathology.*

Please treat this booklet as a guide only. If you require additional information, please consult your doctor.

Always follow your surgeon's instructions, even when they differ from those outlined in this booklet.



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This brochure has been produced to help you to feel comfortable and safe about your operation. It addresses questions you may have about the surgery and post-operative recovery.





INTRODUCTION

The Spine, also known as the backbone or vertebral column, consists of 33 interlocking bones positioned on top of each other. It is made up of 24 separate bones interspaced with the “intervertebral discs”, with the sacrum (5 fused bones) and the coccyx (4 fused bones) at the base.

The spine is a complex combination of interconnected bones, tendons, muscles, ligaments and nerves, any of which can become injured, misaligned or damaged leading to dysfunction.

The spine provides the main structural support of the body allowing mobility, the ability to walk upright, and it gives protection to the neurological elements (spinal cord and nerve roots) underlying and surrounding the bony structures.

Dysfunction specifically affecting the neurological elements (spinal cord or nerve roots) can result in sensitivity changes, muscle weakness or pain in the regions of the body supplied by the nerves. This can have far-reaching effects on a person’s activity levels and general well-being.

Surgery may not be the only course of action as there are also a number of non-surgical treatments available. Discuss your options with your doctor to determine the best course of action for you.



1. ANATOMY OF THE SPINE

The spine is one of the most important structures in the human body. It supports much of the body weight, provides points of attachment for muscles and ligaments, and protects the spinal cord, which carries information from the brain to the rest of the body.

A healthy spine is strong yet flexible, allowing for a wide range of movements. It appears straight if viewed from behind and curved from the side. To understand scoliosis, you must first understand what a healthy spine looks like.

The spine is made up of vertebrae and is divided into five distinct regions:

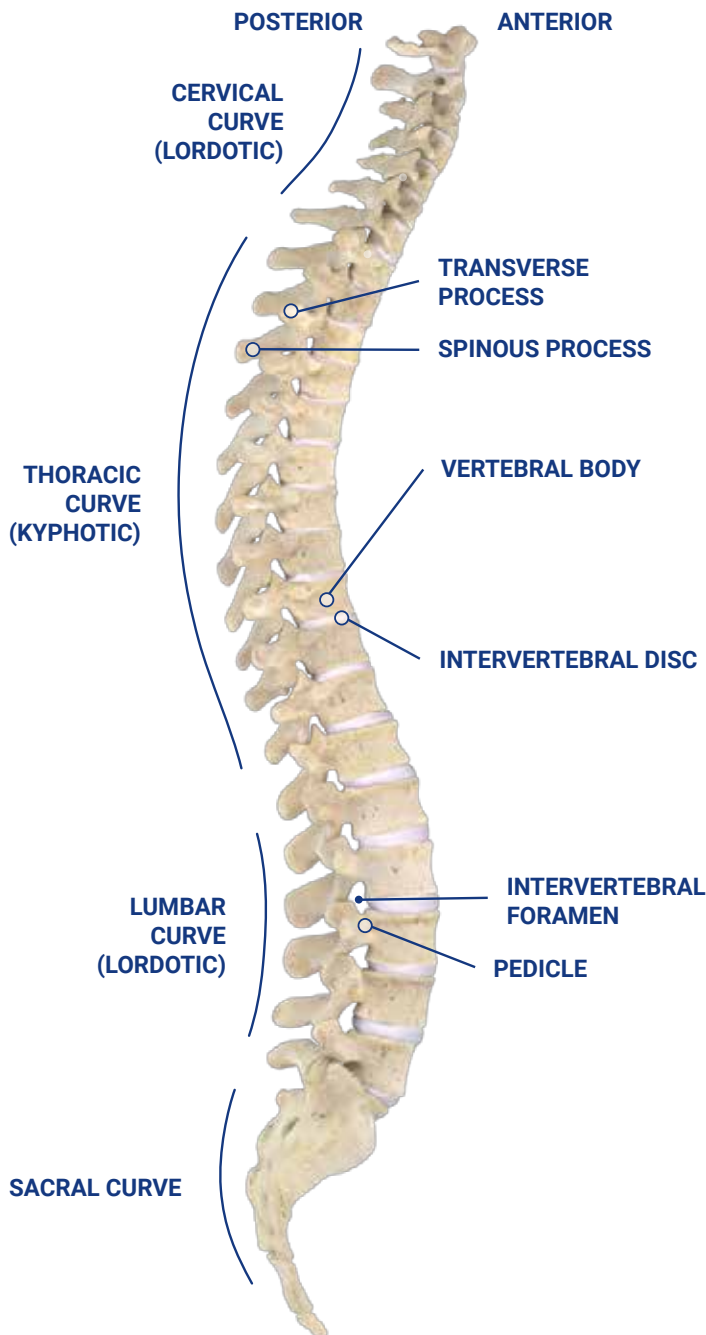
- The **cervical spine** is your neck. It is composed of 7 vertebrae (C1-C7) and gives you the most motion.
- The **thoracic spine** is your mid-back. It is very stiff and composed of 12 vertebrae (T1-T12) larger than the cervical vertebrae and smaller than the lumbar vertebrae.
- The **lumbar spine** is your lower back. It contains 5 of the vertebrae, is the largest and strongest, and carries most of the body weight. It allows motion, especially bending and rotation.
- The **sacrum** consists of 5 fused vertebrae, it connects with the pelvis.
- The **coccyx** is made of 4 fused bones.

The vertebrae are separated by intervertebral discs, which act as shock absorbers to protect the vertebrae and allow spinal rotation and bending. Each disc consists of two parts:

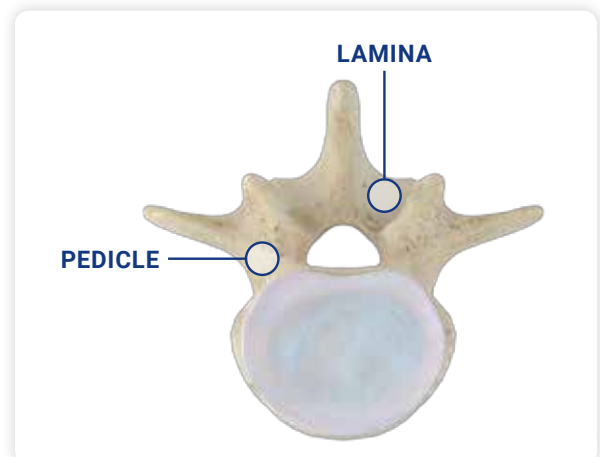
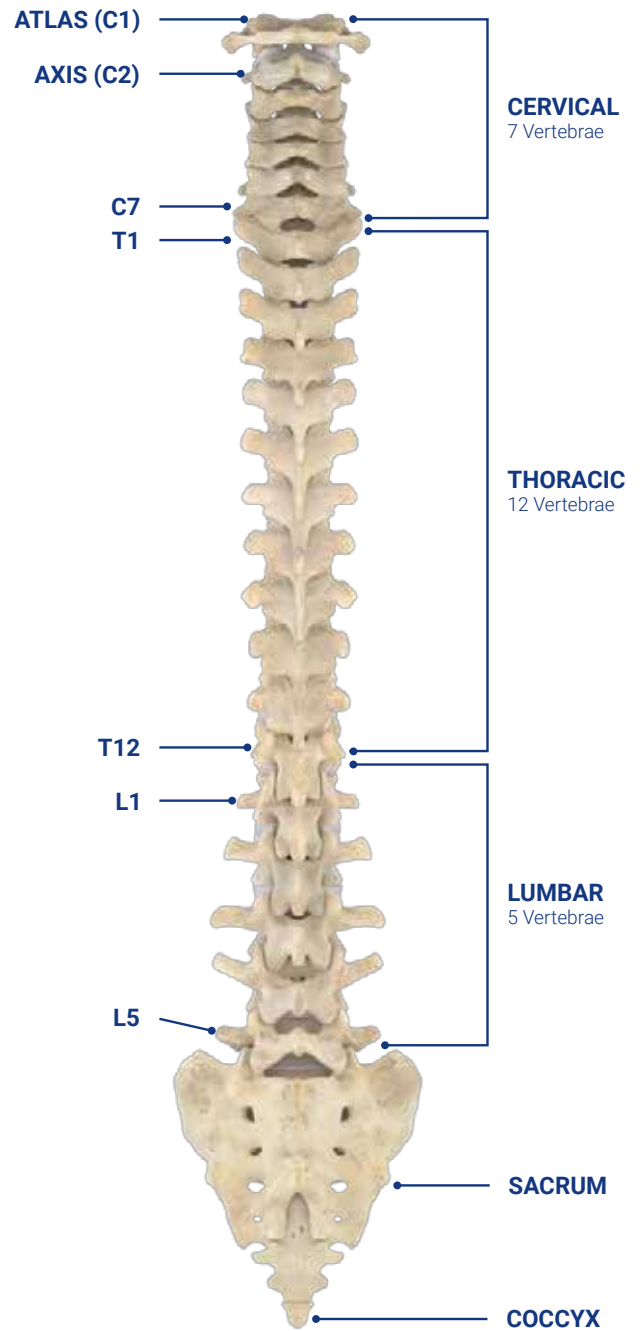
- Annulus fibrosus, a tough outer fibrous ring
- Nucleus pulposus, a soft gelatinous centre



LATERAL VIEW (SIDE)



POSTERIOR VIEW (BACK)



2. WHAT IS SCOLIOSIS

Everyone's spine has natural curves. Scoliosis is an abnormal rotation in addition to a lateral curvature in the normally straight vertical line of the spine. Patients with scoliosis could have curves that look more like a "C" (one curve) or an "S" (two curves).

NORMAL CONDITION



C-SHAPED CURVE



S-SHAPED CURVE



2.1 What are the causes of adolescent scoliosis?

Scoliosis affects less than 1 percent of the world population^[1], **mostly children** between the ages of 10-16 years. The most common form of scoliosis is called **Idiopathic Scoliosis**. “Idiopathic” means that the cause is unknown. The condition can be hereditary, so a child with a family history of scoliosis may be susceptible. Females are more disposed to the development of severe spinal curvatures than boys are.

Less common forms of adolescent scoliosis^[2] are:

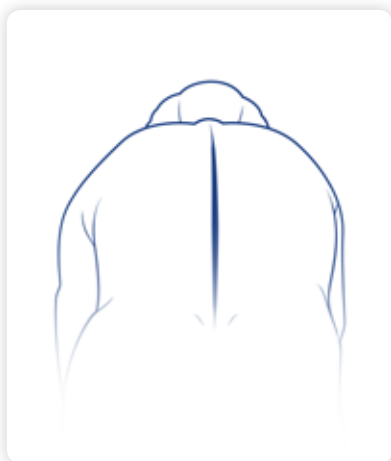
- **Congenital Scoliosis:** A fairly rare spine abnormality detected at birth
- **Neuromuscular Scoliosis:** a curvature of the spine caused by abnormalities in the muscles and nerves that support the spine. Examples include patients with cerebral palsy, spina bifida, and muscular dystrophy.

2.2 What are the symptoms of adolescent scoliosis?

Scoliosis in adolescents usually does not cause any pain, therefore symptoms can often go undetected. Contact your pediatrician if your child develops any of the following symptoms:

- Uneven shoulders and/or waist
- Constant leaning to one side
- Uneven leg length
- Prominent shoulder blade or shoulder blades
- Elevated hips

NORMAL SPINE



DEFORMITY FROM SCOLIOSIS



3. TREATMENT OPTIONS

In 90 percent of cases, scoliotic curves are mild and do not require active treatment^[3].

Non-operative treatment is preferred, including periodic observation, pain relievers and physical therapy. The most important factors to determine the treatment are:

- Severity and the location of the curve
- Age, gender and physical maturity
- Associated symptoms

It is very important to monitor curves in an adolescent patient, to prevent the progression of the pathology. In an adolescent with moderate curves, **bracing** could be an appropriate treatment option to prevent an increase in spinal deformity. Your doctor will show you the type that best meets your needs and will instruct you on how to put it on and take it off.

3.1 Surgical treatment

Surgical treatment is indicated for patients in whom the conservative approach has failed. It may be based on the following criteria:

- Scoliotic curve greater than 50°^[3]
- Muscle fatigue caused by spinal imbalance
- Unbearable back pain
- Curve progression
- Leg pain and neurologic deficit
- Difficulty breathing

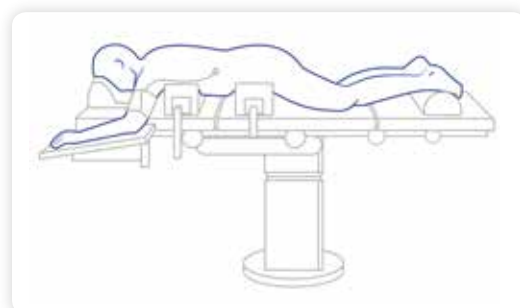
The goal of surgical treatment is to correct the curve and to prevent the curve from progressing by fusing the spine at the optimum degree of safety for the correction of the deformity. This is generally achieved by placing metal implants into the spine that are then connected to rods, which correct the spine curvature and hold it in the corrected position until the spine elements have fused together.



3.2 What happens during the surgery?

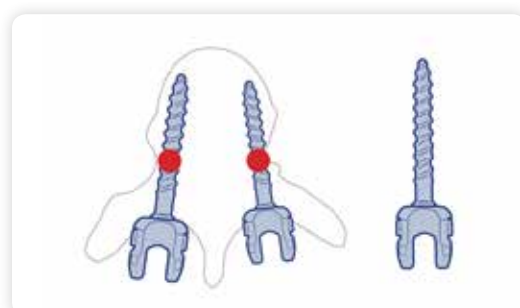
APPROACH

The patient is positioned on the operating table in a comfortable prone position. A midline incision is made and the soft tissue is gently moved laterally to expose the bony structures that need to be treated.



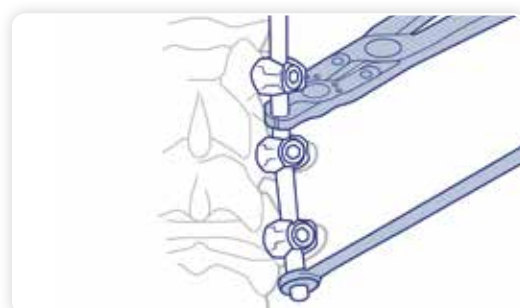
IMPLANT

The pedicle screws are implanted into the vertebrae. The appropriate rods are selected and contoured in order to match the patient's deformity. The rods are securely locked over the screws. Hooks may also be used in conjunction with screws for enhanced stability, and are placed around the pedicle or around the part of the bone called the lamina.



CORRECTION

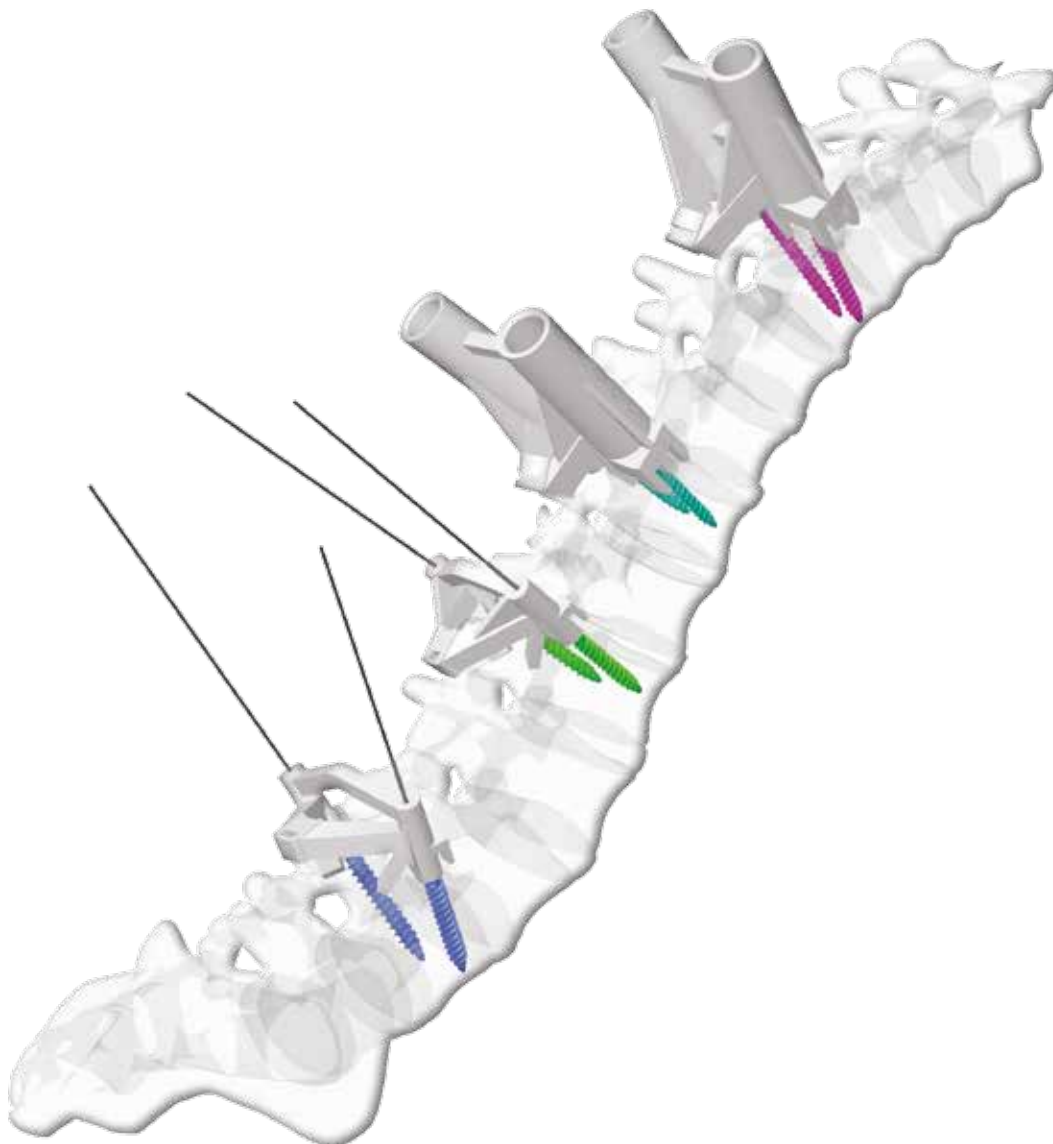
Using dedicated instruments the surgeon corrects the deformity and restores the physiological spine curvature.



3.3 Why would my doctor choose a MySpine surgery

MySpine is a patient-matched, 3D printed technology tailored to the patient's anatomy and simplifying the placement of pedicle screws. MySpine is a validated technology supported by scientific data.^[4,5,6,7,8,9] The main patient benefits of MySpine are:

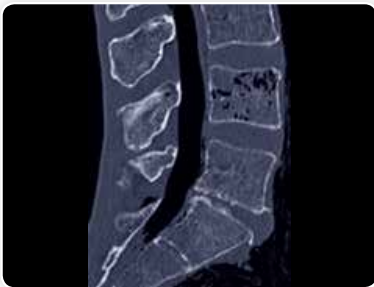
- **Accuracy** of pedicle screw position^[5]
- **Patient-matched technology** allowing for surgical technique customisation
- **Low dose** radiation protocol benefits the patients in comparison to C-Arm or O-Arm navigational technologies: up to **30 times less** irradiation!^[4]
- Potential **reduction** in the post-operative morbidity and **shortening** of the length of hospital stay^[7]



3.4 The MySpine advantage

MySpine is a surgical instrument designed to accurately fit your vertebrae.

How does it work?



OBTAIN AN IMAGE OF YOUR SPINE

The surgeon will ask you to have a CT scan of your vertebral column. Medacta have developed a specific “Low Dose CT Protocol” to ensure the safe acquisition of your image. In fact, you will receive a very similar amount of irradiation to one single spine x-ray!



REPLICATION OF YOUR SPINE

Using images of your spine, Medacta will create a plastic 3D model for each of the vertebra to be treated, in order to allow the physician to select the best implant position and size for you.



CREATION OF MYSPINE

Using the model of your vertebrae and dedicated planning software, your surgeon designs your personal surgical instruments.



PREPARATION OF SURGERY

Prior to the surgery, your surgeon will receive the MySpine instruments and the plastic replica of your vertebrae. The bone model and the screw placement guides will be analysed to accurately prepare for your spine operation.



THE DAY OF SURGERY

The MySpine guides will help to accurately position the pedicle screws according to the pre-operative plan.

...ENJOY YOUR SPINE!!!

4. PREPARATION

Depending on your condition, your recovery will be tailored to meet your needs. Your physician will determine the appropriate length of your hospital stay. Your recovery will continue at home or in a rehabilitation centre.

It is important for you to make a commitment to follow your doctor's instructions so you can get the most benefit from your surgery. Plan for assistance in your home after surgery. Consider your need for assistance in meal preparation, cleaning and other home activities.

4.1 What to do before surgery

Ten days before surgery

According to your conditions, you might be asked to discontinue certain medications. This should be discussed with your surgeon as certain drugs can cause interactions with others in preparation for surgery.

The night before surgery

Unless otherwise directed by your doctor DO NOT eat or drink anything after midnight. This includes no water, gum, candies and do not smoke. Brush your teeth. Be sure to have a bowel movement prior to the surgery, using a suppository or laxative if necessary.

The morning of surgery

Wash your body. Do not apply lotions or powders to your surgical area or legs. Only take the medication directed by your doctor and take it with the smallest amount of water needed to swallow the medication (only a sip).



4.2 Prepare your home

Reduce your risk of a fall

- Remove any scatter rugs.
- Tack down any loose carpeting so walking will be safer.
- Look around the room for other hazards and remove them.
- Wear shoes with non-skid soles (not house slippers).
- Make sure you have a supportive, comfortable chair in your home.

4.3 What to bring to the hospital

- A list of the medication that you are taking, amount you take and how frequently you take it (do not bring all of your medication)
- DO BRING migraine medication if you are prone to migraines
- DO BRING inhalers if you use them
- Glasses, hearing aides, dentures, toiletries and slippers
- Orthoses
- Insurance information and an emergency telephone number
- Wear comfortable clothes to the hospital - you will wear these home



5. IN THE HOSPITAL

The following staff members may be involved in your care:

Neurosurgeon or orthopaedic surgeon

- Performs surgery and directs your care
- Visits you on rounds in the hospital
- Evaluates you at follow-up appointments at the office

Nursing staff

- Coordinates and provides patient care in the hospital
- Shares information about your condition to the healthcare team
- Helps you plan for the move to your home or extended care facility
- Is available to answer your questions during your hospital stay

Physical therapist

- Evaluates your physical capabilities
- Instructs and assists you with a rehabilitation programme
- Provides instructions for home activity
- Identifies possible home needs

Responsibility of patient and family

- Ask questions about anything you do not understand
- Let the staff know about any problems
- Come with an up-to-date and correct list of your home medication
- Carefully follow the directions given by the medical team both before and after discharge from the hospital
- Plan for help at home after surgery



6. AFTER THE SURGERY

Recovery

You will wake up after your procedure in the post-operative recovery room. This is the area of the hospital where your condition is monitored and your vital signs are observed. Generally, a patient will only remain in the post-operative recovery room for a few hours. From there, according to your conditions, you will be transferred to your hospital room on the ward.

Some pain around the incision site is normal, but discuss how you are feeling with your medical team.

Release from Hospital

The hospital discharge depends on the extent of your operation and how your recovery is progressing. Your doctor will decide on the best post-operative course of action for you.

Rehabilitation

During your recovery phase in the hospital you may be asked to carefully sit, stand or walk under supervision. You may also be required to use a brace to assist your spine with the fusion process. Once you have been released from the hospital, it is important to adhere to the instructions given by your medical team. You may need to limit certain activities or undergo some prescribed physical therapy. Your doctor will discuss any required medication you require and give you instructions on wound care, activities and exercise.

Don't forget

- A healthy diet and regular exercise are important.
- Schedule regular check-ups.
- Contact your surgeon if you have any concerns about your spine.



7. FREQUENTLY ASKED QUESTIONS

Can spinal deformities be prevented?

Currently, there is very little that can be done to prevent spinal deformities.

Does scoliosis run in families?

Yes. Idiopathic Adolescent Scoliosis has a genetic component and up to one third of patients have a family history of spinal deformity. At present, researchers are unsure which gene causes scoliosis.

What causes scoliosis?

It depends on the type of deformity. If a specific cause is unknown, it is deemed "Idiopathic" (for example in Adolescent Idiopathic Scoliosis). Some forms of scoliosis however have a known source:

- Congenital scoliosis (abnormally formed vertebrae at birth)
- Neuromuscular scoliosis (nerves and muscles unable to maintain anatomical alignment eg. Cerebral Palsy, Muscular Dystrophy)
- Genetic conditions (such as Osteogenesis Imperfecta, Down's Syndrome)
- Anatomical changes due to age, trauma or disease

What does not cause scoliosis?

Lifestyle factors and habits are not responsible for creating a spinal deformity. Carrying heavy school bags, sporting activity, poor posture or minor leg length differences do not cause scoliosis.

What options do I have?

There are a number of solutions, surgical and non-surgical, to treat your disease. Ask your doctor what is the most suitable treatment based on your age, activity level and expectations.

Are there any risks for this kind of operation?

Any surgical procedure comes with risks. Serious complications are rare and your surgical team will do everything possible to avoid issues arising. However, the most serious potential risks include

- Paraplegia (Very rare – 1 in 1,000 to 1 in 10,000 chance)
- Excessive blood loss
- Continued progression of the curve after surgery
- Failure of the spine to fuse
- Infection

Please consult your doctor for a complete list of indications, warnings, precautions, adverse effects, clinical results, and other important medical information that pertains to scoliosis surgery.

Is the procedure covered by insurance?

It is always best to check and confirm with your insurance plan provider in advance.

Is it possible to have an MRI scan after the implantation of metal devices in my body?

It depends on several factors including physical characteristics of the devices, body area where the implants are located and type of MRI equipment. However, it is likely that the imaging may be disturbed to some extent by the metallic implants.

Do the spine implants activate the metal detectors at airports?

Sometimes this can happen but it depends on the sensitivity level of the detectors at the airport control points. All of Medacta's spine implants are identified by a card called an "Implant Passport" which should be provided by your surgeon after the operation. Always carry it with you and present it if necessary!





PHARMACOTHERAPY

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PHYSIOTHERAPY

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[1] <http://www.aans.org/> [2] <https://my.clevelandclinic.org/> [3] <http://www.srs.org/> [4] Lamartina et al. Adolescent idiopathic scoliosis surgery with patient-specific screw placement-guide Eur Spine J. 2014 Dec;23(12). MySPINE CASE / REDUCED DOSE RADIATION [5] TLamartina et al. Pedicle screw placement accuracy in thoracic and lumbar spinal surgery with a patient-matched targeting guide: a cadaveric study. Eur Spine J. 2015 Nov;24(7). MySPINE ACCURACY VS FREE HAND [6] Putzier et al. A New Navigational Tool for Pedicle Screw Placement in Patients with Severe scoliosis: A Pilot Study to Prove Feasibility, Accuracy, and Identify Operative Challenges. J Spinal Disord Tech. 2014 MySPINE PILOT STUDY [7] Landi et al. Spinal Neuronavigation and 3D-Printed Tubular Guide for Pedicle Screw Placement: A Really New Tool to Improve Safety and Accuracy of the Surgical Technique? J Spine 2015, 4:5 MySPINE ACCURACY VS GUIDED TECHNIQUE [8] Landi et al. 3D Printed Tubular Guides for Pedicle Screw Placement: The Answer for the Need of a Greater Accuracy in Spinal Stabilization. Orthop Muscular Syst 2015, 4:3 MySPINE ACCURACY / EASE OF USE [9] Accuracy of patient-specific template-guided vs. free-hand fluoroscopically controlled pedicle screw placement in the thoracic and lumbar spine: a randomized cadaveric study. Eur Spine J. 2016

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Contraindications, Complications, Warnings and Precautions

All spinal procedures come with a small risk of complications. Please speak with your doctor about the potential risks of your surgery as well as the common post-operative side-effects such as pain and discomfort.

Redefining Better in

Orthopaedics and Neurosurgery



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Scoliosis Patient Information
ref: 99.my46.16SP
rev. 00