Juvenile and Adolescent Idiopathic Scoliosis FAQs
What is scoliosis?

Scoliosis is a form of twisting of the spine. The term scoliosis is from the Ancient Greek term for ‘bending’. The medical term scoliosis is used to describe sideways bending, although the deformity is usually twisting of the spine in three dimensions. The term kyphosis refers to forwards bending of the spine, giving a hunched appearance.

Are there different types of scoliosis?

Yes. The most common types occur in teenage and old age, but different types can occur in babies and young children, and other types at any age.

Here are the most common types, listed according to age:

Babies and young children:

- Congenital scoliosis – the child is born with an abnormal spine, and usually the scoliosis gets worse as the child grows.

Children and teens:

- Juvenile and Adolescent idiopathic scoliosis – this means ‘scoliosis occurring in children and teenagers of unknown cause’. It’s the most common cause in young people, and the subject of these Juvenile & Adolescent Idiopathic Scoliosis FAQs.
- Neuromuscular – there is a disease affecting the strength of the muscles, so they cannot support the spine eg muscular dystrophy.
- Syndromic scoliosis – scoliosis associated with specific diseases, e.g. Neurofibromatosis and Kabuki syndrome.

Young adults:

- Sciatic scoliosis – a slipped disc causes pain and associated twisting of the spine.

Elderly people:

- Degenerative scoliosis – the discs, and sometimes also the bones, collapse due to wear and osteoporosis, and the spine becomes twisted. This is the subject of the Degenerative Scoliosis FAQs.
Any age:
• Infection;
• Tumour;
• Leg Length Difference;
• Other causes.

**How is scoliosis diagnosed?**

Initially, simply by looking to see if the spine is straight.

Normally, the spine is almost perfectly straight, and we can see this when we look at a persons back. The trunk (or torso) is symmetrical and the shoulders are level in a normal person. If a scoliosis is present, the back will be curved.

If the curve is small the deformity may be mild and subtle and escapes detection, especially when clothed.

When the curve is moderate there may be some prominence of the rib cage on one side, called a rib hump in the chest region or a waist hump in the low back region.

If the curve is severe, there will be obvious deformity.

The rib or waist hump is usually more obvious if the patient bends forwards, and this can be measured with a scoliometer – a device similar to a spirit level.

An X-ray will demonstrate the problem. It should be a special X-ray of the whole spine, taken with the patient standing.

*Figure 1a Right thoracic scoliosis showing right rib hump, asymmetry of the shoulders and shifting of the trunk resulting in a left ‘axillary gap’ between the arm and the body.*

*Figure 1b Forward bending test showed prominent right rib hump resulting from the rotational deformity*
**Are there different types of Juvenile & Adolescent Idiopathic Scoliosis?**

The scoliosis can affect the whole spine from the neck down to the pelvis. One of the ways we describe scoliosis is based on the location and direction of the deformity. The location and direction helps to predict the prognosis.

**What causes Juvenile & Adolescent Idiopathic Scoliosis?**

We are not entirely sure, despite a vast amount of research!

We think it is a genetic condition with complex inheritance. The evidence for this includes that it affects identical twins with over 90% concordance although the severity and curve location may not be the same\(^1\,^2\).

**Tell me more about the genetics?**

Genome Wide Association Studies (GWAS) have identified many linkage chromosomes (6p, 6q, 8q, 9q, 10q, 16q, 17p, 18q, 19p, Xq) that harbour idiopathic scoliosis susceptibility [3]. More genes have also been associated with scoliosis such as the LBX1AS1, BCL-2, PAX/EPHA4, ASAP1 indicating multiple causes of idiopathic scoliosis [4, 5]. It seems this condition is genetically based due to mutation of gene units called Single Nucleotide Polymorphisms (SNPs) affecting the development of the spine. There is some tendency for these to occur in families.

**How likely is my child to be affected with Juvenile or Adolescent Idiopathic Scoliosis?**

Our large study of school screening in Hong Kong shows scoliosis affects about 3% of teenagers [6].

Of those who have scoliosis, about 10% would require brace treatment and 1% would end up requiring operation.

Scoliosis mainly affects girls. Mild scoliosis is about three times more common in girls than boys, and moderate to severe scoliosis is about eight times more common in girls than boys.
How do I know if my child has scoliosis?

Mild scoliosis escapes detection particularly when the child is wearing clothes. Parents may detect the abnormality when they have the opportunity to look at their child’s back, for example during summer when the child goes swimming.

The best way to know is to have an objective assessment by a medical professional or to participate in a school screening programme, which usually start at the age of 10. School screening may be especially valuable in Asia, where many teenagers dress quite conservatively, and scoliosis may not be noticed.

School screening is safe, simple, and not especially embarrassing. The child’s back can be observed through a special Moiré topography system, which highlights any asymmetry, and/or using a scoliometer as the child bends forward. It does not involve X-rays, though children are recommended to have X-rays if the screening test is positive.

How is scoliosis measured?

When scoliosis become significant, it will be visible on examination. The most objective method of assessment is to take an X-ray of the whole spine.

The scoliosis is described by its direction, the levels involved, the apex of the curve, and the size of the curve, which is known as the Cobb angle. For example the common location would be a right thoracic curve from T5 to T11 with apex located at T8,9 and Cobb angle of 25°.

Fig 2: Measuring Apical Trunk Rotation with a scoliometer

Idiopathic and other forms of ‘structural’ scoliosis have a special feature where the affected part of spine will twist toward the direction of deviation posteriorly and is called axial rotation. This will cause prominence of the rib cage, described as a ‘rib hump’. The severity of the rib hump corresponds to the degree of curvature of the scoliosis and is measured in the apical trunk rotation (ATR).
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When does scoliosis become important?

Scoliosis becomes important when the Cobb angle gets to above 20° in a growing child. This is because with further growth the scoliosis is likely to progress. A study showed that with a curve greater than 20° in an immature child the risk of progression is 68%, while the risk of progression is only 22% if the child is more mature.

How do we estimate remaining growth, and thus the likelihood of scoliosis progression?

A number of factors are considered: age; skeletal maturity (based on X-rays); rate of growth; and, for girls, time since menarche (first menstrual period).

X-rays of the hand to look for the maturity of the growth plates in the hand and wrist, giving bone age, is a reliable method, but the conventional system describing the changes of these growth centres with age is complicated, requiring the use of reference charts. Our recent study using the thumb growth centres simplifies the assessment.

Risser’s sign is a method of assessment of the skeletal maturity of a person by looking at the maturity of the pelvic bone, which, conveniently, can usually be seen in the X-rays of the spine taken to assess the scoliosis. The sequence of ossification follows a set pattern and this can be used to estimate the individual’s maturity and remaining growth potential. The Risser staging runs from I (immature) to V (fully skeletally mature).

Is scoliosis serious?

A very mild scoliosis does not matter at all, and the individual may not even be aware they have it.

A mild scoliosis may only be a minor cosmetic problem. They are not usually painful.

Unfortunately, severe scoliosis causes both cosmetic and functional problems.

Long-term studies show that with severe scoliosis, with a Cobb angle greater than 90°, leads to premature death from cardiopulmonary diseases.

Natural history studies of moderate (40-70°) to severe (>70°) progressive scoliosis showed there was an increased death rate from age 40-80 years of age. This was particularly
significant for the scoliosis of early onset.

**When does scoliosis require treatment?**

Treatment of scoliosis depends on the size of the curve and the age and maturity of the patient.

Brace treatment would be recommended for curves above 25° in a person with significant growth remaining. The brace would be worn 23 hours a day until the patient reached skeletal maturity, usually around 16 years of age.

Thereafter the risk of progression depends on the size of the curve. Larger curves, over 50°, are likely to continue to progress beyond skeletal maturity, whereas lesser curves usually do not.

For a curve that has progressed to more than 50°, operation is recommended.

![Figure 3a & b, Girl with scoliosis treated with brace.](image)

**What are the different kinds of operative treatment?**

The current operative treatment of progressive scoliosis is to perform spinal fusion, straightening the spine, fusing (joining) the bones together and making the patient taller.

The exact technique depends on the type of scoliosis.

The most common type, thoracic scoliosis, is usually treated via a posterior approach – ie from behind. Current techniques involve placing multiple pedicle screws into each vertebral bone to achieve the best possible correction. Using modern navigation systems, surgeons can perform precise corrections, ensuring the spine is straightened accurately.
techniques improves the speed and accuracy of the procedures.

![X-rays showing thoracic scoliosis corrected by posterior spinal fusion with rods and pedicle screws. The screws were accurately placed into the spine using computer navigation.](image)

Spinal Fusion can also be done with anterior spinal fusion. This is mainly used for scoliosis that occurs in the mid or lower spine region, called thoracolumbar or lumbar scoliosis. This is very effective in correcting the three dimensional deformity of the spine and usually gives a near-perfect correction.

![Thoraco-Lumbar scoliosis corrected by anterior spinal fusion with vertebral body screws and dual rod system.](image)

**Fig 5A, B, C & D:** Thoraco-Lumbar scoliosis corrected by anterior spinal fusion with vertebral body screws and dual rod system.
What are the complications of operative treatment?

Operations on Idiopathic scolioisis are very safe, with total risk of significant complications around 2%. In a large survey of its members, the Scoliosis Research Society reported the risk of nerve injury at 0.75% 12.

What is the outcome of treatment of scoliosis?

The outcome of operative treatment has been comprehensively studied. In one study the quality of life of patients who had been treated by operation or brace was the same as normal controls 13. The improvement in lung function of patients treated by operation or brace was maintained up to 25 years after treatment 14.

Our recent study of 76 patients undergoing posterior spinal fusion surgery showed excellent results for quality of life 15.

Reference:


7. Lonstein, J.E. and J.M. Carlson, The prediction of curve progression in untreated


Spine
• Juvenile and Adolescent Idiopathic Scoliosis FAQs
• Adult Scoliosis FAQ
• ‘Slipped Disc’ FAQs
• Diagnosis of Low Back Pain FAQs
• Lumbar Disc Replacement FAQs
• Lumbar Spinal Stenosis FAQs
• Sacroiliac Joint Pain FAQs
• Treatment of Cervical Disc Hernia or Degeneration

Hand, Wrist and Elbow
• Carpal Tunnel Syndrome FAQ’s
• Common Hand Disorder

Shoulder
• Clavicle Fracture FAQs
• Is It Really Frozen Shoulder?

Hip
• Acetabular Dysplasia FAQs
• Choosing among different types of hip replacement FAQs
• Femoro-Acetabular Impingement (FAI) FAQs
• Hamstring Tendon Tears FAQs

Knee
• ACL FAQs
• Articular Cartilage Injuries in the Knee FAQs
• Biological Knee Replacement (BKR) FAQs
• Meniscal Regeneration by Meniscal Scaffold Implant Actifit Polyurethane Scaffold
• Meniscus FAQs: Tears, Repairs & Transplants
• OA Knee FAQs
• Patellofemoral Pain

Foot and Ankle
• Achilles Tendinopathy FAQs
• Ankle Sprain FAQs
• Bunion FAQs
• Chronic Pain after Ankle Injury
• Hallux Rigidus FAQs
• Minimally Invasive Surgery in the Foot & Ankle

Children
• Scoliosis: A Common Condition Which is Frequently Misunderstood

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