

Appendix 1

Kyphosis and lordosis

Hyper- and hypokyphosis

Kyphosis is an outward curvature of the spine, rounding away from the center of the body. This curvature is visible only in the sagittal plane. When upright, a typical spine has slight kyphosis in the thoracic and sacral regions. When the amount of kyphosis is atypical, the term kyphosis is assigned either the prefix “hyper,” meaning above typical, or “hypo,” meaning below typical.

- Hyperkyphosis indicates excessive rounding of the spine, typically in the thoracic region.
- Hypokyphosis indicates a loss of kyphosis and the presentation of an abnormally straight or flat spine.

Hyperkyphosis is classified based on its cause. Classifications include:

- **Postural kyphosis**, which is not a spine condition, but rather a posture that causes the appearance of hyperkyphosis. It is caused by a person slouching or not sitting or standing up straight. This is the most common cause of “non-structural” hyperkyphosis, the term used for hyperkyphosis that is not associated with a structural abnormality of the spine.
- **Scheuermann’s kyphosis**, which is a spine condition where at least three consecutive vertebrae grow in a wedge shape instead of a rectangular shape (Figure A1.1). This is also referred to as juvenile osteochondrosis of the spine.
- **Congenital kyphosis**, which is a spine condition where the vertebrae of a fetus does not form properly during pregnancy, which may lead to hyperkyphosis. Examples include atypical shapes or incomplete vertebrae and fused vertebrae (Figure A2.2).

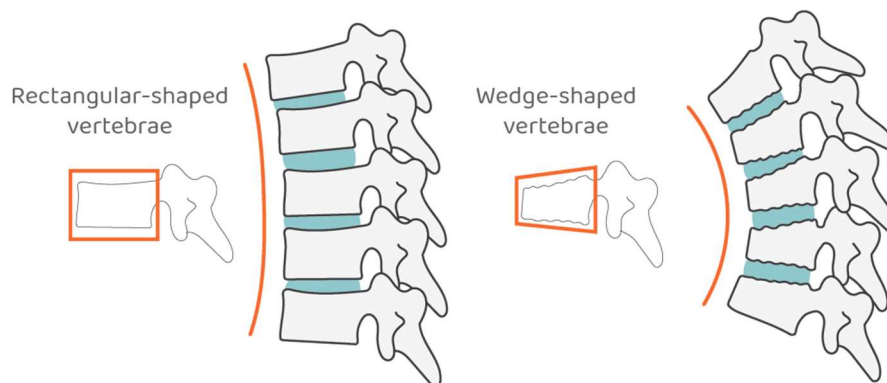


Figure A1.1 Typical spine(left) compared to Scheuermann’s kyphosis (right).

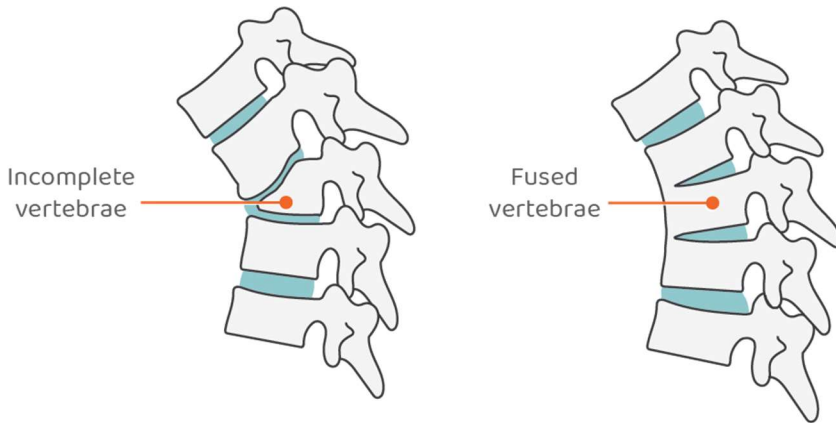


Figure A1.2 Congenital kyphosis.

Hypokyphosis means there is a loss of kyphosis or flattening of the spine. Hypokyphosis is often associated with idiopathic scoliosis. It is believed that one of the main causes of idiopathic scoliosis is asymmetric growth of the spine; the front of the spine grows faster than the back of the spine. When this asymmetric growth occurs, it commonly results also in hypokyphosis.

Hyper- and hypolordosis

Lordosis is an inward curvature of the spine, arching toward the center of the body. This curvature is visible only in the sagittal plane. When upright, a typical spine has lordosis in the cervical and lumbar regions. In the same manner as kyphosis, when the amount of lordosis is atypical, the prefixes “hyper” or “hypo” are used.

- Hyperlordosis indicates excessive arching of the spine, typically in the lumbar region, but this can also develop in the cervical region (Figure A1.3). Having excessive arching in the lumbar region is sometimes described as a “swayback.”
- Hypolordosis indicates an abnormally straight or flat spine, typically in the lumbar region.

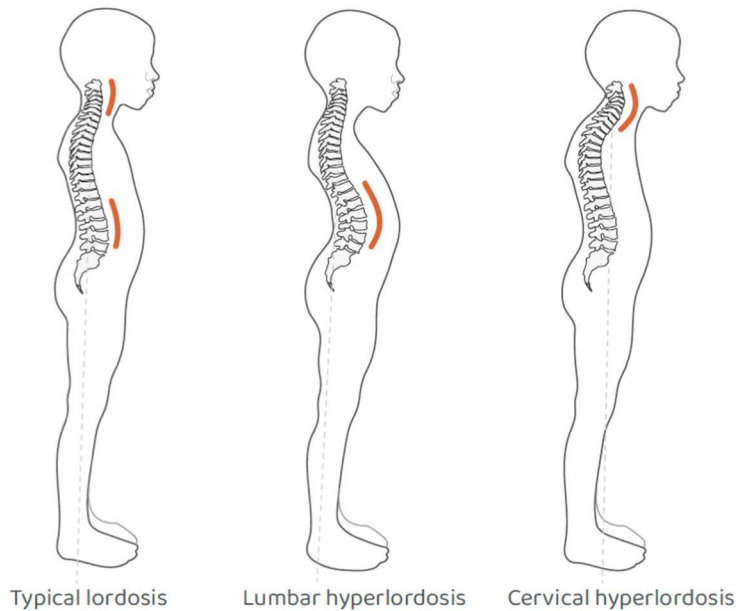


Figure A1.3 Typical spinal lordosis (left) compared to hyperlordosis in the lumbar (middle) and cervical (right) regions.

Hyperlordosis has many possible causes. Two common causes are:

- **Weak abdominal muscles:** The muscles that surround the stomach and lower back are essential for spine support. When these muscles are weak, individuals may be more prone to hyperlordosis. This is normal in younger children until they develop core strength.
- **Trauma:** Injuries to the spine can weaken it and lead to hyperlordosis.

Hypolordosis is mainly caused by **congenital vertebral abnormalities**—that is, individuals may be born with vertebrae that did not develop properly. This can prevent the front of the spine from growing at the same rate as the back of the spine, which can lead to hypolordosis as the spine begins to arch.

Appendix 2

“Other” scoliosis

In addition to the four types of scoliosis (idiopathic, congenital, neuromuscular, and syndromic) addressed in Table 1.4.1, there are “other” conditions associated with scoliosis that do not fit into the four established types. They include:

- Autism spectrum disorder
- Neural axis abnormalities

Neural axis abnormalities are atypical structures within the central nervous system (brain and spinal cord) that can impact the growth of the spine. They include:

- Syrinx
- Chiari malformation type I
- Tethered cord syndrome

See Table A2.1.

Table A2.1 “Other” conditions associated with scoliosis

Condition		Definition
Autism spectrum disorder		A neurologic and developmental disorder that affects processing of sensory information, behavior, learning, communication, and social interaction
Neural axis abnormalities	Syrinx (syringomyelia)	A fluid-filled cyst that forms in the spinal cord
	Chiari malformation type I (CM-I)	A condition in which brain tissue extends into the spinal canal through the opening in the base of the skull
	Tethered cord syndrome	A neurologic condition where tissue is attached to the spinal cord that “tethers” it and inhibits the movement of the spinal cord within the spine