Introduction to the Skeletal System

Humans are vertebrates, animals having a vertebral column or backbone. They rely on a sturdy internal frame that is centered on a prominent spine. The human skeletal system consists of bones, cartilage, ligaments and tendons and accounts for about 20 percent of the body weight.

The living bones in our bodies use oxygen and give off waste products in metabolism. They contain active tissues that consume nutrients, require a blood supply and change shape or remodel in response to variations in mechanical stress.

Bones provide a rigid framework, known as the skeleton, that support and protect the soft organs of the body.

The skeleton supports the body against the pull of gravity. The large bones of the lower limbs support the trunk when standing.

The skeleton also protects the soft body parts. The fused bones of the cranium surround the brain to make it less vulnerable to injury. Vertebrae surround and protect the spinal cord and bones of the rib cage help protect the heart and lungs of the thorax.

Bones work together with muscles as simple mechanical lever systems to produce body movement.

Bones contain more calcium than any other organ. The intercellular matrix of bone contains large amounts of calcium salts, the most important being calcium phosphate.

When blood calcium levels decrease below normal, calcium is released from the bones so that there will be an adequate supply for metabolic needs. When blood calcium levels are increased, the excess calcium is stored in the bone matrix. The dynamic process of releasing and storing calcium goes on almost continuously.

Hematopoiesis, the formation of blood cells, mostly takes place in the red marrow of the bones.

In infants, red marrow is found in the bone cavities. With age, it is largely replaced by yellow marrow for fat storage. In adults, red marrow is limited to the spongy bone in the skull, ribs, sternum, clavicles, vertebrae and pelvis. Red marrow functions in the formation of red blood cells, white blood cells and blood platelets.

Structure of Bone Tissue

There are two types of bone tissue: compact and spongy. The names imply that the two types differ in density, or how tightly the tissue is packed together. There are three types of cells that contribute to bone homeostasis. Osteoblasts are bone-forming cell, osteoclasts resorb or break down bone, and osteocytes are mature bone cells. An equilibrium between osteoblasts and osteoclasts maintains bone tissue.

Compact Bone

Compact bone consists of closely packed osteons or haversian systems. The osteon consists of a central canal called the osteonic (haversian) canal, which is surrounded by concentric rings (lamellae) of matrix. Between the rings of matrix, the bone cells (osteocytes) are located in spaces called lacunae. Small channels (canaliculi) radiate from the lacunae to the osteonic (haversian) canal to provide passageways through the hard matrix. In compact bone, the haversian systems are packed tightly together to form what appears to be a solid mass. The osteonic canals contain blood vessels that are parallel to the long axis of the bone. These blood vessels interconnect, by way of perforating canals, with vessels on the surface of the bone.
**Spongy (Cancellous) Bone**

Spongy (cancellous) bone is lighter and less dense than compact bone. Spongy bone consists of plates (trabeculae) and bars of bone adjacent to small, irregular cavities that contain red bone marrow. The canaliculi connect to the adjacent cavities, instead of a central haversian canal, to receive their blood supply. It may appear that the trabeculae are arranged in a haphazard manner, but they are organized to provide maximum strength similar to braces that are used to support a building. The trabeculae of spongy bone follow the lines of stress and can realign if the direction of stress changes.

**Bone Development & Growth**

The terms osteogenesis and ossification are often used synonymously to indicate the process of bone formation. Parts of the skeleton form during the first few weeks after conception. By the end of the eighth week after conception, the skeletal pattern is formed in cartilage and connective tissue membranes and ossification begins.

Bone development continues throughout adulthood. Even after adult stature is attained, bone development continues for repair of fractures and for remodeling to meet changing lifestyles. Osteoblasts, osteocytes and osteoclasts are the three cell types involved in the development, growth and remodeling of bones. Osteoblasts are bone-forming cells, osteocytes are mature bone cells and osteoclasts break down and reabsorb bone.

There are two types of ossification: intramembranous and endochondral.

**Intramembranous**

Intramembranous ossification involves the replacement of sheet-like connective tissue membranes with bony tissue. Bones formed in this manner are called intramembranous bones. They include certain flat bones of the skull and some of the irregular bones. The future bones are first formed as connective tissue membranes. Osteoblasts migrate to the membranes and deposit bony matrix around themselves. When the osteoblasts are surrounded by matrix they are called osteocytes.

**Endochondral Ossification**

Endochondral ossification involves the replacement of hyaline cartilage with bony tissue. Most of the bones of the skeleton are formed in this manner. These bones are called endochondral bones. In this process, the future bones are first formed as hyaline cartilage models. During the third month after conception, the perichondrium that surrounds the hyaline cartilage “models” becomes infiltrated with blood vessels and osteoblasts and changes into a periosteum. The osteoblasts form a collar of compact bone around the diaphysis. At the same time, the cartilage in the center of the diaphysis begins to disintegrate. Osteoblasts penetrate the disintegrating cartilage and replace it with spongy bone. This forms a primary ossification center. Ossification continues from this center toward the ends of the bones. After spongy bone is formed in the diaphysis, osteoclasts break down the newly formed bone to open up the medullary cavity.

The cartilage in the epiphyses continues to grow so the developing bone increases in length. Later, usually after birth, secondary ossification centers form in the epiphyses. Ossification in the epiphyses is similar to that in the diaphysis except that the spongy bone is retained instead of being broken down to form a medullary cavity. When secondary ossification is complete, the hyaline cartilage is totally replaced by bone except in two areas. A region of hyaline cartilage remains over the surface of the epiphysis as the articular cartilage and another area of cartilage remains between the epiphysis and diaphysis. This is the epiphyseal plate or growth region.

**Bone Growth**

Bones grow in length at the epiphyseal plate by a process that is similar to endochondral ossification. The cartilage in the region of the epiphyseal plate next to the epiphysis continues to grow by mitosis. The chondrocytes, in the region next to the diaphysis, age and degenerate. Osteoblasts move in and ossify the matrix to form bone. This process continues throughout childhood and the adolescent years until the cartilage growth slows and finally stops. When cartilage growth ceases, usually in the early twenties, the epiphyseal plate completely ossifies.
so that only a thin epiphyseal line remains and the bones can no longer grow in length. Bone growth is under the influence of growth hormone from the anterior pituitary gland and sex hormones from the ovaries and testes.

Bone growth is under the influence of growth hormone from the anterior pituitary gland and sex hormones from the ovaries and testes. Even though bones stop growing in length in early adulthood, they can continue to increase in thickness or diameter throughout life in response to stress from increased muscle activity or to weight. The increase in diameter is called appositional growth. Osteoblasts in the periosteum form compact bone around the external bone surface. At the same time, osteoclasts in the endosteum break down bone on the internal bone surface, around the medullary cavity. These two processes together increase the diameter of the bone and, at the same time, keep the bone from becoming excessively heavy and bulky.

**Classification of Bones**

**Long Bones**

The bones of the body come in a variety of sizes and shapes. The four principal types of bones are long, short, flat and irregular. Bones that are longer than they are wide are called long bones. They consist of a long shaft with two bulky ends or extremities. They are primarily compact bone but may have a large amount of spongy bone at the ends or extremities. Long bones include bones of the thigh, leg, arm, and forearm.

**Short Bones**

Short bones are roughly cube shaped with vertical and horizontal dimensions approximately equal. They consist primarily of spongy bone, which is covered by a thin layer of compact bone. Short bones include the bones of the wrist and ankle.

**Flat Bones**

Flat bones are thin, flattened, and usually curved. Most of the bones of the cranium are flat bones.

**Irregular Bones**

Bones that are not in any of the above three categories are classified as irregular bones. They are primarily spongy bone that is covered with a thin layer of compact bone. The vertebrae and some of the bones in the skull are irregular bones.

All bones have surface markings and characteristics that make a specific bone unique. There are holes, depressions, smooth facets, lines, projections and other markings. These usually represent passageways for vessels and nerves, points of articulation with other bones or points of attachment for tendons and ligaments.

**Divisions of the Skeleton**

The adult human skeleton usually consists of 206 named bones. These bones can be grouped in two divisions: axial skeleton and appendicular skeleton. The 80 bones of the axial skeleton form the vertical axis of the body. They include the bones of the head, vertebral column, ribs and breastbone or sternum. The appendicular skeleton consists of 126 bones and includes the
free appendages and their attachments to the axial skeleton. The free appendages are the upper and lower extremities, or limbs, and their attachments which are called girdles. The named bones of the body are listed below by category.

**Axial Skeleton (80 bones)**

**Skull (28)**

**Cranial Bones**
- Parietal (2)
- Temporal (2)
- Frontal (1)
- Occipital (1)
- Ethmoid (1)
- Sphenoid (1)

**Facial Bones**
- Maxilla (2)
- Zygomatic (2)
- Mandible (1)
- Nasal (2)
- Platine (2)
- Inferior nasal concha (2)
- Lacrimal (2)
- Vomer (1)

**Auditory Ossicles**
- Malleus (2)
- Incus (2)
- Stapes (2)

**Hyoid (1)**
**Vertebral Column**
- Cervical vertebrae (7)
- Thoracic vertebrae (12)
- Lumbar vertebrae (5)
- Sacrum (1)
- Coccyx (1)

**Thoracic Cage**
- Sternum (1)
- Ribs (24)

**Appendicular Skeleton (126 bones)**

**Pectoral Girdles**
- Clavicle (2)
- Scapula (2)

**Upper Extremity**
- Humerus (2)
- Radius (2)
- Ulna (2)
- Carpals (16)
- Metacarpals (10)
- Phalanges (28)

**Pelvic Girdle**
- Coxal, innominate, or hip bones (2)

**Lower Extremity**
- Femur
- Patella
- Tibia
- Fibula
- Tarsals
- Metatarsals
- Phalanges
Lower Extremity

- Femur (2)
- Tibia (2)
- Fibula (2)
- Patella (2)
- Tarsals (14)
- Metatarsals (10)
- Phalanges (28)

Articulations

An articulation, or joint, is where two bones come together. In terms of the amount of movement they allow, there are three types of joints: immovable, slightly movable and freely movable.

Synarthroses

Synarthroses are immovable joints. The singular form is synarthrosis. In these joints, the bones come in very close contact and are separated only by a thin layer of fibrous connective tissue. The sutures in the skull are examples of immovable joints.

Amphiarthroses

Slightly movable joints are called amphiarthroses. The singular form is amphiarthrosis. In this type of joint, the bones are connected by hyaline cartilage or fibrocartilage. The ribs connected to the sternum by costal cartilages are slightly movable joints connected by hyaline cartilage. The symphysis pubis is a slightly movable joint in which there is a fibrocartilage pad between the two bones. The joints between the vertebrae and the intervertebral disks are also of this type.

Diarthroses

Most joints in the adult body are diarthroses, or freely movable joints. The singular form is diarthrosis. In this type of joint, the ends of the opposing bones are covered with hyaline cartilage, the articular cartilage, and they are separated by a space called the joint cavity. The components of the joints are enclosed in a dense fibrous joint capsule. The outer layer of the capsule consists of the ligaments that hold the bones together. The inner layer is the synovial membrane that secretes synovial fluid into the joint cavity for lubrication. Because all of these joints have a synovial membrane, they are sometimes called synovial joints.

 Movements

<table>
<thead>
<tr>
<th>Movement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion</td>
<td>Narrowing joint angle in sagittal plane (bending elbow)</td>
</tr>
<tr>
<td>Extension</td>
<td>Increasing joint angle in sagittal plane (straightening elbows)</td>
</tr>
<tr>
<td>Hyperextension</td>
<td>Increasing angle more than in natural position, eg bending backwards</td>
</tr>
<tr>
<td>Abduction</td>
<td>Lifting a body part away from body midline (in frontal plane)</td>
</tr>
<tr>
<td>Adduction</td>
<td>Returning a body part to body midline (in frontal plane)</td>
</tr>
<tr>
<td>Rotation</td>
<td>Turning a body part on axis (horizontal plane) (not rotation all the way round - see circumduction).</td>
</tr>
<tr>
<td>Lateral flexion</td>
<td>Bending body sideways (frontal plane)</td>
</tr>
<tr>
<td>Lateral extension</td>
<td>Returning body to anatomical position</td>
</tr>
<tr>
<td>Elevation</td>
<td>Lifting a body part (shoulder shrugs)</td>
</tr>
<tr>
<td>Depression</td>
<td>Lowering a body part (dropping the jaw)</td>
</tr>
<tr>
<td>Protraction</td>
<td>Moving a body part outwards</td>
</tr>
<tr>
<td>Retraction</td>
<td>Bringing a body part back</td>
</tr>
<tr>
<td>Horizontal Flexion</td>
<td>Moving arm forwards in horizontal plane</td>
</tr>
<tr>
<td>Horizontal Extension</td>
<td>Returning arm to the abducted position</td>
</tr>
<tr>
<td>Dorsal Flexion</td>
<td>Bending ankle so that the toes are raised</td>
</tr>
<tr>
<td>Plantar Flexion</td>
<td>Hyperextending ankle joint so toes point downwards</td>
</tr>
<tr>
<td>Circumduction</td>
<td>Range of movements that create a complete circle (as opposed to a rotation of less than 360 degrees.)</td>
</tr>
</tbody>
</table>
Review: Introduction to the Skeletal System

Here is what we have learned from Introduction to the Skeletal System:

- The human skeleton is well-adapted for the functions it must perform. Functions of bones include support, protection, movement, mineral storage, and formation of blood cells.
- There are two types of bone tissue: compact and spongy. Compact bone consists of closely packed osteons, or haversian system. Spongy bone consists of plates of bone, called trabeculae, around irregular spaces that contain red bone marrow.
- Osteogenesis is the process of bone formation. Three types of cells, osteoblasts, osteocytes, and osteoclasts, are involved in bone formation and remodeling.
- In intramembranous ossification, connective tissue membranes are replaced by bone. This process occurs in the flat bones of the skull. In endochondral ossification, bone tissue replaces hyaline cartilage models. Most bones are formed in this manner.
- Bones grow in length at the epiphyseal plate between the diaphysis and the epiphysis. When the epiphyseal plate completely ossifies, bones no longer increase in length.
- Bones may be classified as long, short, flat, or irregular. The diaphysis of a long bone is the central shaft. There is an epiphysis at each end of the diaphysis.
- The adult human skeleton usually consists of 206 named bones and these bones can be grouped in two divisions: axial skeleton and appendicular skeleton.
- The bones of the skeleton are grouped in two divisions: axial skeleton and appendicular skeleton.
- There are three types of joints in terms of the amount of movement they allow: synarthroses (immovable), amphiarthroses (slightly movable), and diarthroses (freely movable).

Disorders and Diseases of the Skeletal System

Arthritis

Arthritis is inflammation of one or more joints. The main symptoms of arthritis are joint pain and stiffness, which typically worsen with age. The two most common types of arthritis are osteoarthritis and rheumatoid arthritis.

The most common signs and symptoms of arthritis involve the joints. Depending on the type of arthritis someone has, signs and symptoms may include:

- Pain
- Stiffness
- Swelling
- Redness
- Decreased range of motion

Severe arthritis, particularly if it affects hands or arms, can make it difficult for you to take care of daily tasks. Arthritis of weight-bearing joints can keep a person from walking comfortably or sitting up straight. In some cases, joints may become twisted and deformed.

Rheumatoid arthritis

Rheumatoid arthritis is a chronic inflammatory disorder that most typically affects the small joints in hands and feet. Unlike the wear-and-tear damage of osteoarthritis, rheumatoid arthritis affects the lining of joints, causing a painful swelling that can eventually result in bone erosion and joint deformity.

An autoimmune disorder, rheumatoid arthritis occurs when immune system mistakenly attacks its own body's tissues. In addition to causing joint problems, rheumatoid arthritis can also affect the whole body with fevers and fatigue.

Signs and symptoms of rheumatoid arthritis may include:

- Joint pain
- Joint swelling
- Joints that are tender to the touch
Red and puffy hands
Firm bumps of tissue under the skin on your arms (rheumatoid nodules)
Fatigue
Morning stiffness that may last for hours
Fever
Weight loss

Early rheumatoid arthritis tends to affect your smaller joints first — the joints in your wrists, hands, ankles and feet. As the disease progresses, your shoulders, elbows, knees, hips, jaw and neck also can become involved. In most cases, symptoms occur symmetrically — in the same joints on both sides of your body.

**Osteoporosis**

Osteoporosis, which means "porous bones," causes bones to become weak and brittle — so brittle that a fall or even mild stresses like bending over or coughing can cause a fracture. In many cases, bones weaken when person has low levels of calcium and other minerals in your bones.

In the early stages of bone loss, you usually have no pain or other symptoms. But once bones have been weakened by osteoporosis, person may have osteoporosis signs and symptoms that include:

- Back pain, which can be severe, as a result of a fractured or collapsed vertebra
- Loss of height over time
- A stooped posture
- Fracture of the vertebra, wrist, hip or other bone

Fractures are the most frequent and serious complication of osteoporosis. They often occur in spine or hip — bones that directly support body weight. Hip fractures often result from a fall. Although most people do relatively well with modern surgical treatment, hip fractures can result in disability and even death from postoperative complications, especially in older adults. Wrist fractures from falls also are common.

**Bursitis**

Bursitis is a painful condition that affects the small fluid-filled pads — called bursae — that act as cushions among bones and the tendons and muscles near joints. Bursitis occurs when a bursa becomes inflamed.

The most common locations for bursitis are in the shoulders, elbows or hips. But you can also have bursitis by your knee, heel and the base of your big toe. Bursitis often occurs in joints that perform frequent repetitive motion.

When someone has bursitis, the affected joint may:

- Feel achy or stiff
- Hurt more during movement or when pressed on
- Look swollen and red

The most common causes of bursitis are repetitive motions or positions that irritate the bursae around a joint. Examples include:

- Throwing a baseball or lifting something over head repeatedly
- Leaning on elbows for long periods of time
- Extensive kneeling, for tasks such as laying carpet or scrubbing floors
- Prolonged sitting, particularly on hard surfaces

Some bursae at the knee and elbow lie just below the skin, so they are at higher risk of puncture injuries that can become infected and cause septic bursitis.

Sprains and strains are common injuries that share similar signs and symptoms, but involve different parts of your body.

**Sprains and strains**

A sprain is a stretching or tearing of ligaments — the tough bands of fibrous tissue that connect one bone to another in joints. The most common location for a sprain is in ankle.

A strain is a stretching or tearing of muscle or tendon, a fibrous cord of tissue that connects muscles to bones. Strains often occur in the lower back and in the hamstring muscle in the back of the thigh.
Initial treatment for both sprains and strains includes rest, ice, compression and elevation. Mild sprains and strains can be successfully treated at home. Severe sprains and strains sometimes require surgery to repair torn ligaments, muscles or tendons.

Signs and symptoms will vary, depending on the severity of the injury.

**Sprains**

- Pain
- Swelling
- Bruising
- Limited ability to move the affected joint
- At the time of injury, you may hear or feel a "pop" in your joint

**Strains**

- Pain
- Swelling
- Muscle spasms
- Limited ability to move the affected muscle

Factors contributing to sprains and strains include:

- **Poor conditioning.** Lack of conditioning can leave your muscles weak and more likely to sustain injury.
- **Fatigue.** Tired muscles are less likely to provide good support for your joints. When you're tired, you're also more likely to succumb to forces that could stress a joint or overextend a muscle.
- **Improper warm-up.** Properly warming up before vigorous physical activity loosens your muscles and increases joint range of motion, making the muscles less tight and less prone to trauma and tears.

**Osteomyelitis**

Osteomyelitis is the medical term for an infection in a bone. Infections can reach a bone by traveling through the bloodstream or spreading from nearby tissue. Osteomyelitis can also begin in the bone itself if an injury exposes the bone to germs.

In children, osteomyelitis most commonly affects the long bones of the legs and upper arm, while adults are more likely to develop osteomyelitis in the bones that make up the spine (vertebrae). People who have diabetes may develop osteomyelitis in their feet if they have foot ulcers.

Signs and symptoms of osteomyelitis include:

- Fever or chills
- Irritability or lethargy in young children
- Pain in the area of the infection
- Swelling, warmth and redness over the area of the infection

Sometimes osteomyelitis causes no signs and symptoms or has signs and symptoms that are difficult to distinguish from other problems.

Osteomyelitis complications may include:

- **Bone death (osteonecrosis).** An infection in bone can impede blood circulation within the bone, leading to bone death. Bone can heal after surgery to remove small sections of dead bone. If a large section of bone has died, however, one may need to have that limb amputated to prevent spread of the infection.
- **Septic arthritis.** In some cases, infection within bones can spread into a nearby joint.
- **Impaired growth.** In children, the most common location for osteomyelitis is in the softer areas, called growth plates, at either end of the long bones of the arms and legs. Normal growth may be interrupted in infected bones.
- **Skin cancer.** If osteomyelitis has resulted in an open sore that is draining pus, the surrounding skin is at higher risk of developing squamous cell cancer.

**Rickets**

Rickets is the softening and weakening of bones in children, usually because of an extreme and prolonged vitamin D deficiency.

Vitamin D promotes the absorption of calcium and phosphorus from the gastrointestinal tract. A deficiency of vitamin D makes it difficult to maintain proper calcium and phosphorus levels in bones, which can cause rickets.
If a vitamin D or calcium deficiency causes rickets, adding vitamin D or calcium to the diet generally corrects any resulting bone problems for your child. Rickets due to a genetic condition may require additional medications or other treatment. Some skeletal deformities caused by rickets may need corrective surgery.

Signs and symptoms of rickets may include:
- Delayed growth
- Pain in the spine, pelvis and legs
- Muscle weakness

Because rickets softens the growth plates at the ends of a child's bones, it can cause skeletal deformities such as:
- Bowed legs
- Abnormally curved spine
- Thickened wrists and ankles
- Breastbone projection

If left untreated, rickets may lead to:
- Failure to grow
- Skeletal deformities
- Bone fractures
- Dental defects
- Breathing problems and pneumonia
- Seizures

**Spina bifida**

Spina bifida is part of a group of birth defects called neural tube defects. The neural tube is the embryonic structure that eventually develops into the baby's brain and spinal cord and the tissues that enclose them.

Normally, the neural tube forms early in the pregnancy and closes by the 28th day after conception. In babies with spina bifida, a portion of the neural tube fails to develop or close properly, causing defects in the spinal cord and in the bones of the backbone.

Spina bifida occurs in various forms of severity. When treatment for spina bifida is necessary, it's done through surgery, although such treatment doesn't always completely resolve the problem.

Spina bifida occurs in three forms, each varying in severity:

- **Spina bifida occulta.** This mildest form results in a small separation or gap in one or more of the bones (vertebrae) of the spine. Because the spinal nerves usually aren't involved, most children with this form of spina bifida have no signs or symptoms and experience no neurological problems.

  An abnormal tuft of hair, a collection of fat, a small dimple or a birthmark on the newborn's skin above the spinal defect may be the only visible indication of the condition. Many people who have spina bifida occulta don't even know it, unless the condition is discovered during an X-ray or other imaging test done for unrelated reasons.

- **Meningocele.** In this rare form, the protective membranes around the spinal cord (meninges) push out through the opening in the vertebrae. Because the spinal cord develops normally, these membranes can be removed by surgery with little or no damage to nerve pathways.

- **Myelomeningocele.** Also known as open spina bifida, myelomeningocele is the most severe form — and the form people usually mean when they use the term "spina bifida."

  In myelomeningocele, the baby's spinal canal remains open along several vertebrae in the lower or middle back. Because of this opening, both the membranes and the spinal cord protrude at birth, forming a sac on the baby's back. In some cases, skin covers the sac. Usually, however, tissues and nerves are exposed, making the baby prone to life-threatening infections.

  Neurological impairment — often including loss of movement (paralysis) — is common. So are bowel and bladder problems, seizures and other medical complications.
**Scoliosis**

Scoliosis is a sideways curvature of the spine that occurs most often during the growth spurt just before puberty. While scoliosis can be caused by conditions such as cerebral palsy and muscular dystrophy, the cause of most scoliosis is unknown.

Signs and symptoms of scoliosis may include:
- Uneven shoulders
- One shoulder blade that appears more prominent than the other
- Uneven waist
- One hip higher than the other

If a scoliosis curve gets worse, the spine will also rotate or twist, in addition to curving side to side. This causes the ribs on one side of the body to stick out farther than on the other side. Severe scoliosis can cause back pain and difficulty breathing.

**Kyphosis**

Kyphosis is a forward rounding of your upper back. Some rounding is normal, but the term "kyphosis" usually refers to an exaggerated rounding, more than 50 degrees. This deformity is also called round back or hunchback.

With kyphosis, your spine may look normal, or you may develop a hump. Kyphosis can occur as a result of developmental problems; degenerative diseases, such as arthritis of the spine; osteoporosis with compression fractures of the vertebrae; or trauma to the spine. It can affect all ages.

Kyphosis symptoms may include:
- Slouching posture or hunchback
- Mild back pain
- Spinal stiffness or tenderness
- Fatigue

In mild cases, kyphosis may produce no noticeable signs or symptoms.

Kyphosis may cause the following complications:
- **Body image problems.** Adolescents, especially, may develop a poor body image from having a rounded back or from wearing a brace to correct the condition.
- **Deformity.** The hump on the back may become prominent over time.
- **Back pain.** In some cases, the misalignment of the spine can lead to pain, which can become severe and disabling.
- **Breathing difficulties.** In severe cases, the curve may cause the rib cage to press against your lungs, inhibiting your ability to breathe.
- **Neurological signs and symptoms.** Although rare, these may include leg weakness or paralysis, a result of pressure on the spinal nerves.

**Lordosis**

Lordosis is an increased curving of the spine. Too much lordotic curving is called swayback (lordosis). Lordosis tends to make the buttocks appear more prominent. People with significant lordosis will have a significant space beneath
their lower back when lying on their back on a hard surface.

If the lordotic curve is flexible (when the child bends forward the curve reverses itself), it is generally not a concern. If the curve does not move, medical evaluation and treatment are needed.