Remedial Physical Education

The most common impairments of locomotor system and posture

a distant lecture

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Impairment of locomotor system could be divided in several ways

- **hereditary** (people are born with it) vs. **acquired** (appers during lifespan)
- **orthopedic** (the problem is rather in bones, joints, ligaments, muscles..) vs. **neurological** (the problem is in the movement management – i.e. in nervous system)
- **functional** (we usually do not find any clear reason and exact problem) vs. **structural** (it is morphological, usually visible on X-ray etc.)
- **according to localization** (spinal vs. soft tissues vs. upper vs. lower extremities) – according to where the problem is mostly manifested (where is a pain or decrease of functioning)
- **according to reason from the pathological point of view**: **degenerative** vs. **rheumatoid** vs. **inflammation** vs. **post-injury**
- **according to age: typical for children** (problems which usually manifest in childhood) vs. **typical for adults** (problems which are connected rather with degeneration etc.)

Poor posture

Posture is very individual, it is a program based on reflex mechanisms.

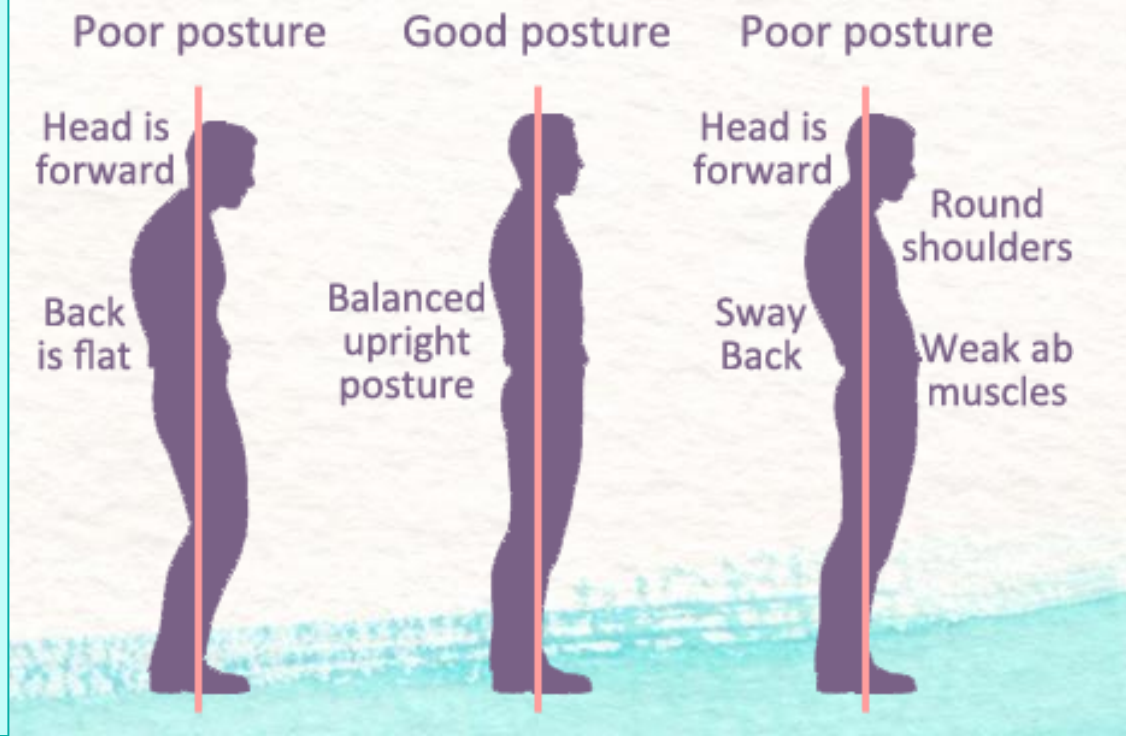
Poor posture can lead to excessive strain on our postural muscles, i.e. they are more prone to injury and back pain

Contributing factors of poor posture:
stress, obesity, pregnancy, weak postural muscles, abnormally tight muscles, high-heeled shoes, decreased flexibility, poor work environment, incorrect working posture, unhealthy sitting and standing habits

Poor posture usually involves some of the following problems: lumbar hyperlordosis, thoracic hyperkyphosis, flat back, scoliosis, flat feet, crossed syndromes …

Posture is based on the position of our:
- pelvis (center of gravity)
- head (management of movement direction)
- legs (locomotion)

A good posture means a harmonic balance between all segments with the least muscle work to keep our stability



Hyperlordosis in lumbar spine

- an excessive spine curvature in the lower back
- abdomen and buttocks appear more prominent
- It is often a result of poor posture/lack of exercise:

usually shortened m.quadratus lumborum, erector spinae muscles, hip flexors /m. iliopsoas, rectus fem., tensor f.l., adductors/, knee flexors /m.biceps femoris, m. semitendinosus, semimemranosus/, weak abdominal muscles /m.rectus abdominis, obliquus int., ext., transversus/ and gluteal muscles

- can cause muscle tightening and stiffness in the lower back, can damage the spine and soft tissues in the lumbar region, may cause low back pain

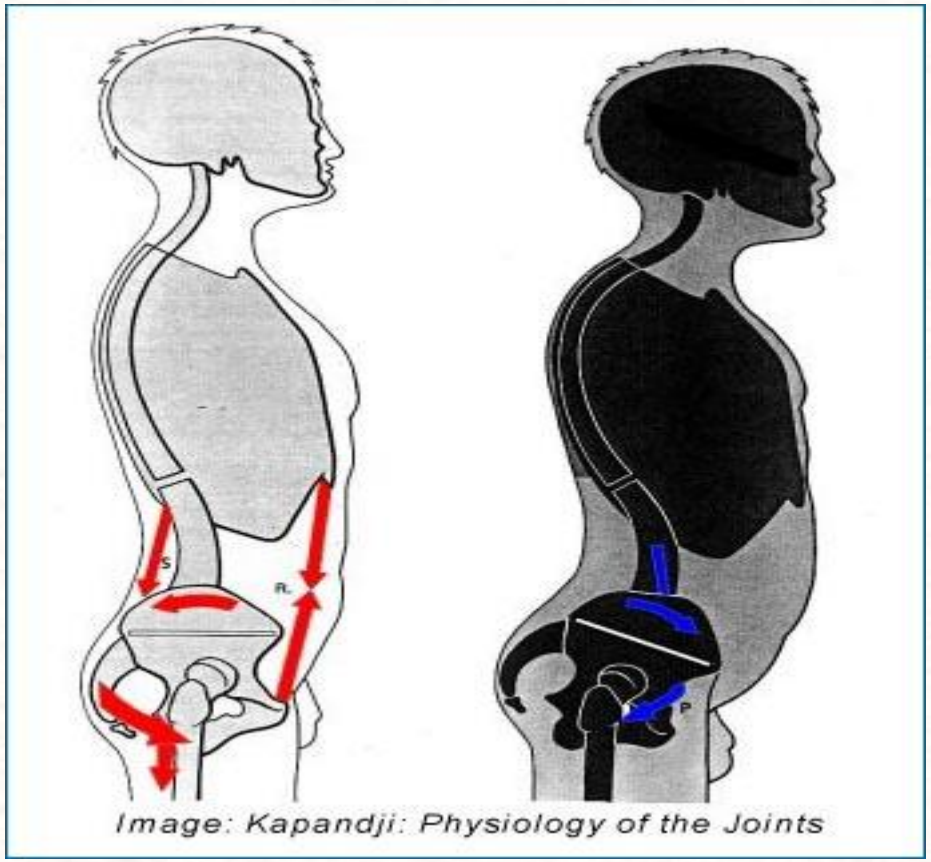


Image: Kapandji: Physiology of the Joints

<u>1. task for you:</u> What kind of exercise can be used to decrease lumbar hyperlordosis. Please draw or make picture and describe at least 3 exercises.

Compensation of lumbar hyperlordosis

Recommendation

- to stretch muscles in lumbar region
- to strengthen abdominal muscles
- to stretch muscles in back side of thigh
- to release tension and normalize mobility in the hip region
- to learn appropriate pelvis position
- rolls, „cradle“ exercise, crawling, climbing over etc.
- good basic exercise position!

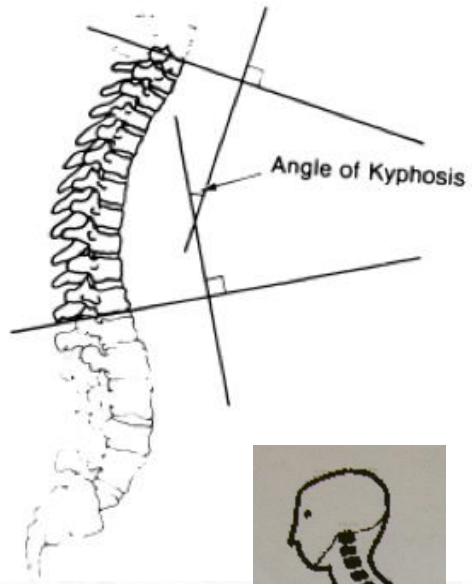
What are inappropriate, non-recommended exercises?

- trunk extension, longterm standing, jumping, hopping, heavy loads lifting, diving

Hyperkyphosis in thoracic spine

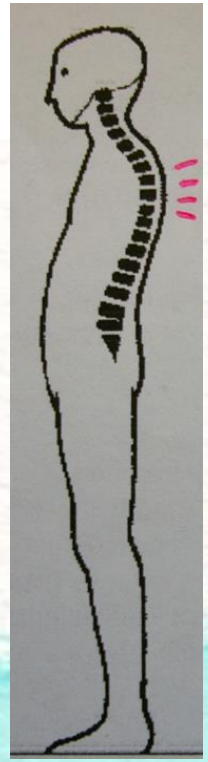
= thoracic hyperkyphosis (hunchback) - an excessive antero-posterior curvature of the thoracic spine of greater than 40°

= more common in women than in men



Possible reasons:

- Scheuermann's Disease - juvenile form of hyperkyphosis, defect of the vertebral body growth plate at the cortical level, results in weakening the vertebral body and causing wedging, it stops at the end of growth, when the growth cartilage is no longer active.
- Postural Kyphosis - most frequent form, a result of poor posture and weakened muscles and ligaments of the spine with no vertebrae deformities visible (weak: rhomboids, lower trapesius, shortened pectoralis).
- Congenital Kyphosis - bone defect detected at birth, kyphosis angle will increase if not treated in time.
- Age-related Hyperkyphosis - angle increases with age, resulting in age-related hyperkyphosis, one of the typical results of osteoporosis
- Neurological Hyperkyphosis - can be a result of the paralysis of abdominal muscles
- Ankylosing spondylarthritis



Compensation of thoracic hyperkyphosis

Recommendation

- to stretch pectoral and shoulder muscles
- to strengthen muscles stabilizing shoulder blades

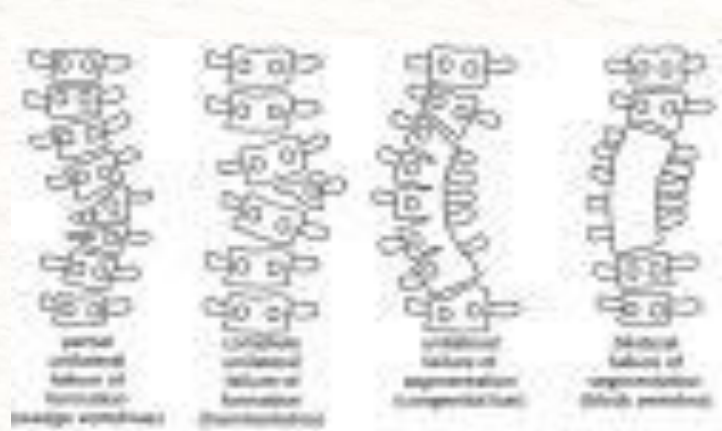
- to release tension and normalize mobility in the trunk and neck region
- to learn appropriate head position
- rolls, „cradle“ exercise, crawling, climbing over etc.

- good basic exercise position!

What are inappropriate, non-recommended exercises?

- trunk flexion, „rolls“, static load and static activities, longterm standing, jumping, hopping, heavy loads lifting, cycling

Scoliosis



condition in which a person‘s spine has a sideways curve

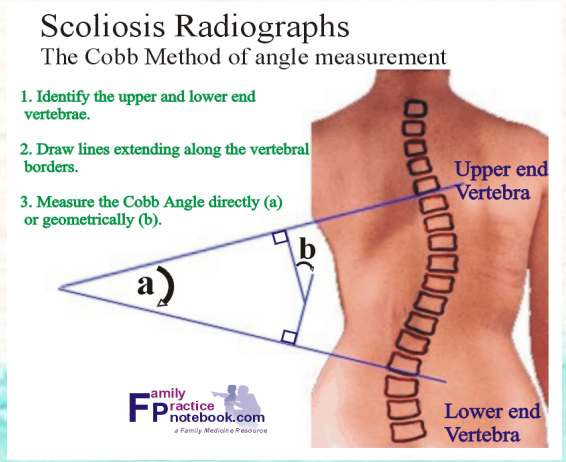
usually "S"- or "C"-shaped over three dimensions

occurs in about 3% of people

- uneven musculature on one side of the spine, rib prominence or a prominent shoulder blade, caused by rotation of the rib cage in thoracic scoliosis

mild scoliosis does not typically cause problems, while severe cases can interfere with breathing

causes: mostly unknown, but involves a combination of genetic and environmental factors, e.g. uneven leg length, carrying bag on one shoulder, asymmetrical sport aktivity, injury

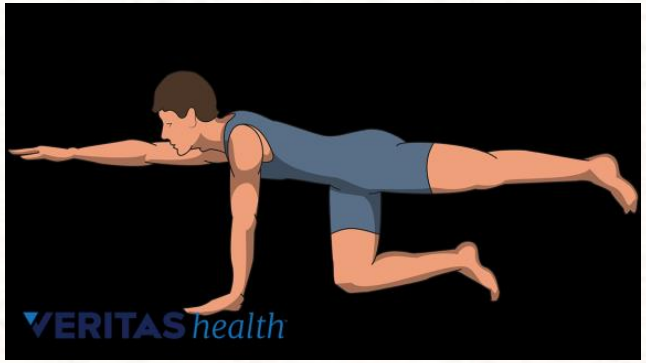


classified as either structural (curve is fixed) or functional (underlying spine is normal)

Compensation of scoliotic posture

Recommendation

- to increase/ensure spine mobility in all directions using symmetrical exercises (cat/cow exercises etc.)
- to stretch tight muscles and strengthen weak muscles (abdominal, back muscles)
- to increase chest mobility
- breathing exercises
- hanging
- arm-leg raise

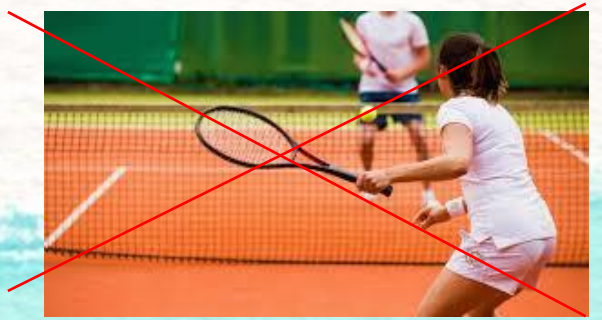


https://www.spine-health.com/blog/scoliosis-exercises

Get inspiration at: https://www.youtube.com/watch?v=k9wph_-iKys

https://www.youtube.com/watch?v=wmk5Mvz4pe8

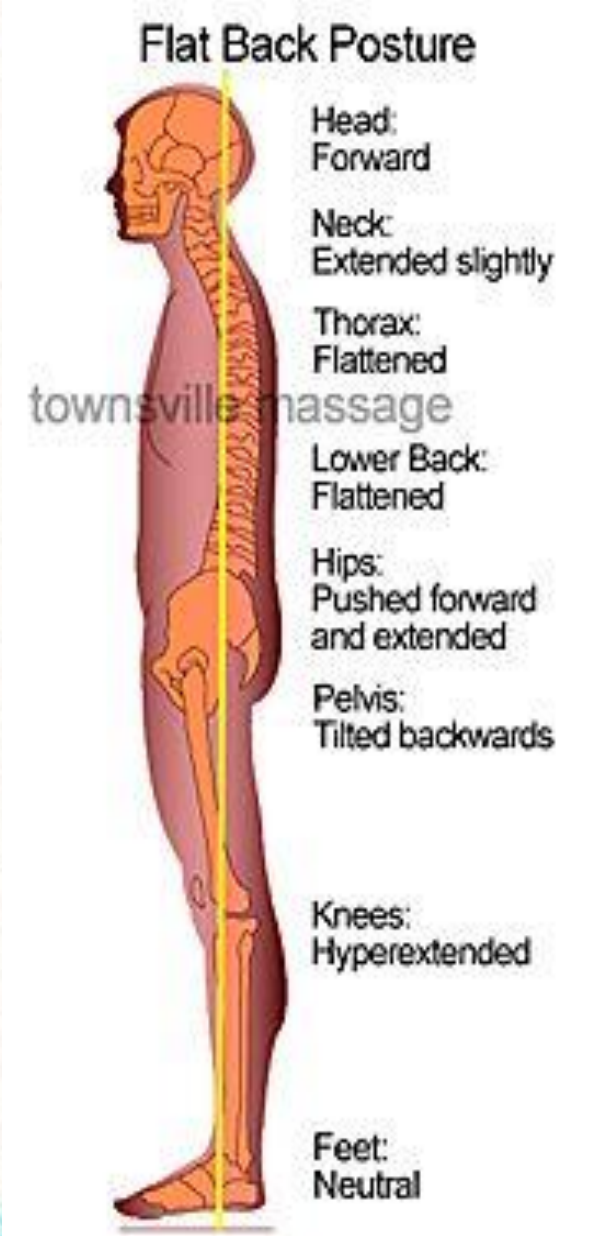
What are inappropriate, non-recommended exercises?



- asymmetrical sport activities, static load and static activities, longterm standing, jumping, hopping, heavy loads

Flat back

- occurs when there is a loss either of lordosis or kyphosis or both, making the spine straight
- persons with flatback syndrome appear stooped forward, pelvis is tilted more backwards, shoulder blades usually stand away, position of arms can be changed
- may also have: a sensation of falling forward, chronic pain in the back muscles, difficulty with certain daily activities, fatigue, stooping at the end of the day
- causes and risk factors: muscle imbalance, sometimes after scoliosis has been corrected, also can result from trunk muscles weakness, arthritis of the spine, compression fractures



Compensation of flat back

Recommendation

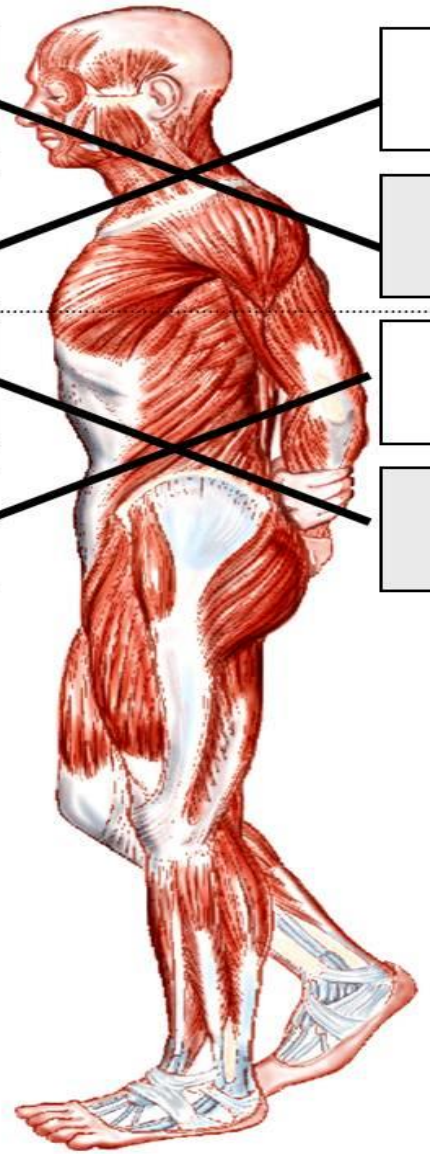
- to work with muscle imbalance – stretch tight/shortened muscles, strengthen weak muscles
- to increase thoracic spine and shoulder girdle mobility
- to improve breathing sterotype
- to improve coordination
- to improve pelvis position

What are inappropriate, non-recommended exercises?

- flat trunk flexion, staying in „hanging“ exercise, longterm standing, jumping, hopping, heavy loads

Janda´s crossed syndromes as examples of muscle imbalance

Upper Crossed Syndrome	Inhibited Deep cervical flexors	Facilitated Upper Trap / Levator Scapula	Upper Crossed Syndrome
	Facilitated SCM / Pectoralis	Inhibited Lower Trap / Serratus Ant.	
Lower Crossed Syndrome	Inhibited Abdominals	Facilitated Thoraco-lumbar extensors	Lower Crossed Syndrome
	Facilitated Rectus Femoris / Iliopsoas	Inhibited Gluteus Min / Med/ Max	



Upper crossed syndrome

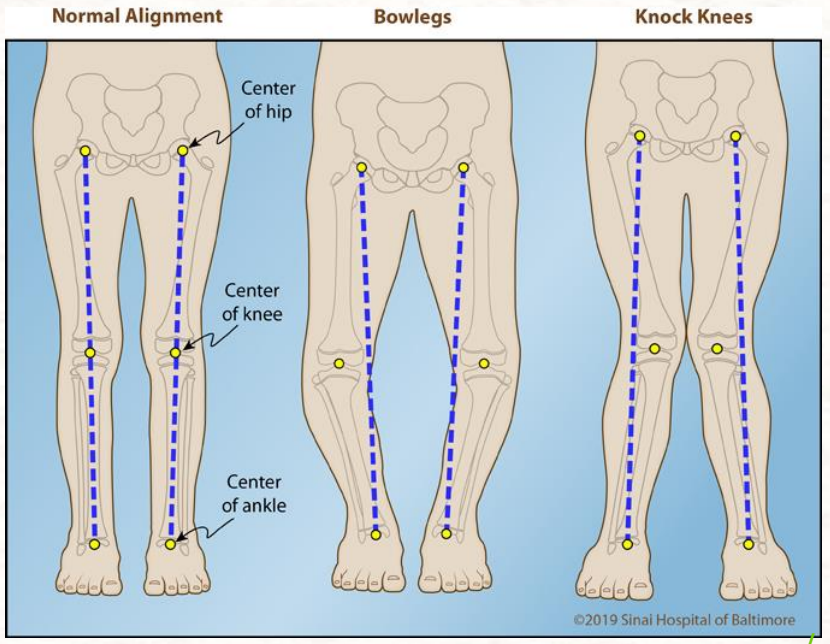
- forward head posture, which occurs when people use electronic devices, read, and drive ☺
- Symptoms include neck and back stiffness or aches.

<u>2. task for you:</u> Please search websites and find some good exercise which helps to compensate upper crossed syndrome. Send me the link as a part of your homeworks.

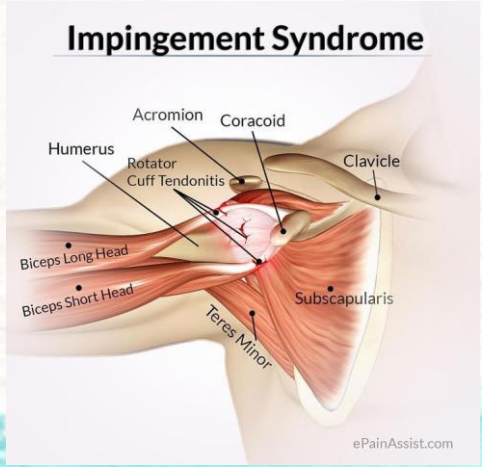
Figure 1 : Janda's Muscle Imbalance Syndromes

Most common impairments in lower and upper extremities

- flat feet
- inborn hip joint luxation
- knees of X or O shape (knock knees, bow legs)
- cerebral palsy
- foot deformities
- hand deformities
- over-use syndroms (carpal channel syndrom, impingement syndrom, tennis elbow, golfers elbow etc.)
- post-injury and post-surgery problems



http://www.limblength.org/conditions/knock-knees/



https://www.pinterest.co.uk/pin/726838827346813321/

Flat foot (fallen arches)

- a very low arch or no arch, meaning that one or both of their feet may be flat on the ground
- feet may roll to the inner side when they are standing and walking
- 20–30% of the general population have an arch that simply never develops in one or both feet
- pain, uneven distribution of body weight, shoes wearing down unevenly or more quickly than usual, can lead to further injuries
- relationship between the structure of the arch of the foot and the biomechanics of the lower leg

Importance of foot
Foot is mediating contact of our body with the terrain. It damps mechanical forces coming from locomotion. Through feet, we perceive the terrain. It is basis for our stand…

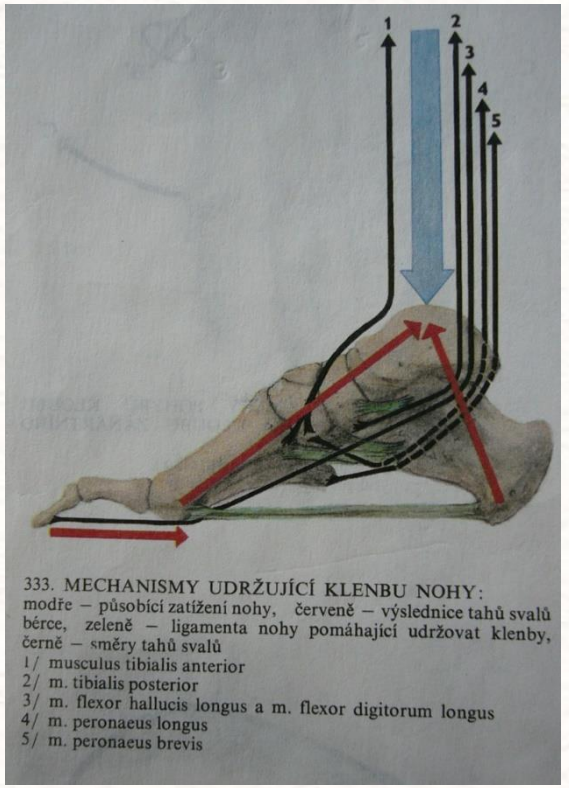
Flat foot

Foot arch

- formed by the tarsal and metatarsal bones, strengthened by ligaments and tendons, allow the **foot** to support the weight of the body in the erect posture with the least weight

- categorized as **longitudinal** (A) and **transverse** (B) **arches**.

The most common postural contributing factor of flat foot is low function of peroneal muscles which hold the concave foot shape. The most overloaded muscles are m. tibialis anterior and posterior, which maintain foot position



333. MECHANISMY UDRŽUJÍCÍ KLENBU NOHY:
modře – působící zatížení nohy, červeně – výslednice tahů svalů bérce, zeleně – ligamenta nohy pomáhající udržovat klenby, černě – směry tahů svalů
1/ musculus tibialis anterior
2/ m. tibialis posterior
3/ m. flexor hallucis longus a m. flexor digitorum longus
4/ m. peronaeus longus
5/ m. peronaeus brevis

Risk factors:

- obesity, pregnancy
- high heel shoes
- age
- injury
- arthritis
- diabetes

Prevention and compensation of flat foot

Recommendation

- Respecting normal psychomotor development in children (no pushing forward to be „standing“ or walking if the baby-toddler is not prepared yet)
- barefoot walking in nature, on uneven terrain
- appropriate shoes (width, size, heel)
- weight reduction
- physical therapy, massages
- physical activity - exercise
- sensorymotor training

<u>3. task for you:</u> What kind of exercise can be used to improve function of foot? Please draw or make picture /video and describe at least 8 exercises preventing or compensating flat feet in children.

You may find some inspiration here: https://www.youtube.com/watch?v=kStuJAu0a20 , https://www.youtube.com/watch?v=dQ6VDw-v2Xw , https://www.youtube.com/watch?v=futtkEXjk44

Muscles involved in most common postural distortions / impairments

It is important to know what muscles are involved in most common imbalances.

Also, we should know how these imbalances influence joint function and what possible injuries could be related to this.

Look at the table on the right and search for relations between muscle imbalance, biomechanics of related joints and possible pathology or injury risk.

Pronation distortion syndrome: A postural distortion syndrome characterized by foot pronation *(flat feet)* and adducted and internally rotated knees *(knock knees)*.

Pronation Distortion Syndrome			
Short Muscles	*Lengthened Muscles*	*Altered Joint Mechanics*	*Possible Injuries*
Gastrocnemius	Anterior tibialis	**Increased:**	Plantar fasciitis
Soleus	Posterior tibialis	Knee adduction	Posterior tibialis
Peroneals	Gluteus maximus	Knee internal rotation	Tendonitis (shin splints)
Adductors	Gluteus medius	Foot pronation	Patellar tendonitis
Tension fasciae latae (TFL)		Foot external rotation	Low back pain
Hip flexor complex		**Decreased:**	
Biceps femoris (short head)		Ankle dorsiflexion	
		Ankle inversion	

Lower crossed syndrome: A postural distortion syndrome characterized by an anterior tilt to the pelvis *(arched lower back)*.

Lower Crossed Syndrome			
Short Muscles	*Lengthened Muscles*	*Altered Joint Mechanics*	*Possible Injuries*
Gastrocnemius	Anterior tibialis	**Increased:**	Hamstring complex strain
Soleus	Posterior tibialis	Lumbar extension	Anterior knee pain
Hip flexor complex	Gluteus maximus	**Decreased:**	Low back pain
Adductors	Gluteus medius	Hip extension	
Latissimus dorsi	Transversus abdominis		
Erector spinae			

Upper crossed syndrome: A postural distortion syndrome characterized by a forward head and rounded shoulders.

Upper Crossed Syndrome			
Short Muscles	*Lengthened Muscles*	*Altered Joint Mechanics*	*Possible Injuries*
Upper trapezius	Deep cervical flexors	**Increased:**	Headaches
Levator scapulae	Serratus anterior	Cervical extension	Biceps tendonitis
Sternocleidomastoid	Rhomboids	Scapular protraction	Rotator cuff impingement
Scalenes	Mid-trapezius	Scapular elevation	Thoracic outlet syndrome
Latissimus dorsi	Lower trapezius	**Decreased:**	
Teres major	Teres minor	Shoulder extension	
Subscapularis	Infraspinatus	Shoulder external rotation	
Pectoralis major/minor			

Tasks for students – distance study

1. Please go through the presentation including videos.
2. Please read the attached articles.
3. Please **answer the following questions:**
   1. What activities should NOT be recommended to people with flat feet?
   2. What does the flat foot cause biomechanically?
   3. Could be anterior knee pain connected with lower crossed syndrome? Why?
   4. Please search literature and find possible causes of knock knees and bow legs and try to make up a compensation program for one of them /knock or bow/, i.e. a serie of exercises which would help to compensate that impairment (a small training unit for home exercise lasting 20 min max.)
4. **Please fullfil the tasks from the presentation (slides 4, 12, 16 - red frame)**