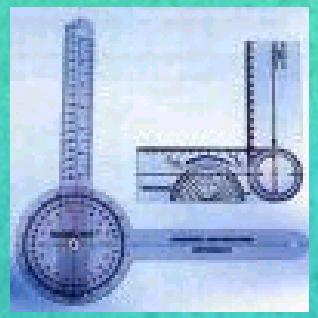
Remedial Physical Education

Evaluation of posture and movement function

Department of Adapted PE
and Sports Medicine 2020



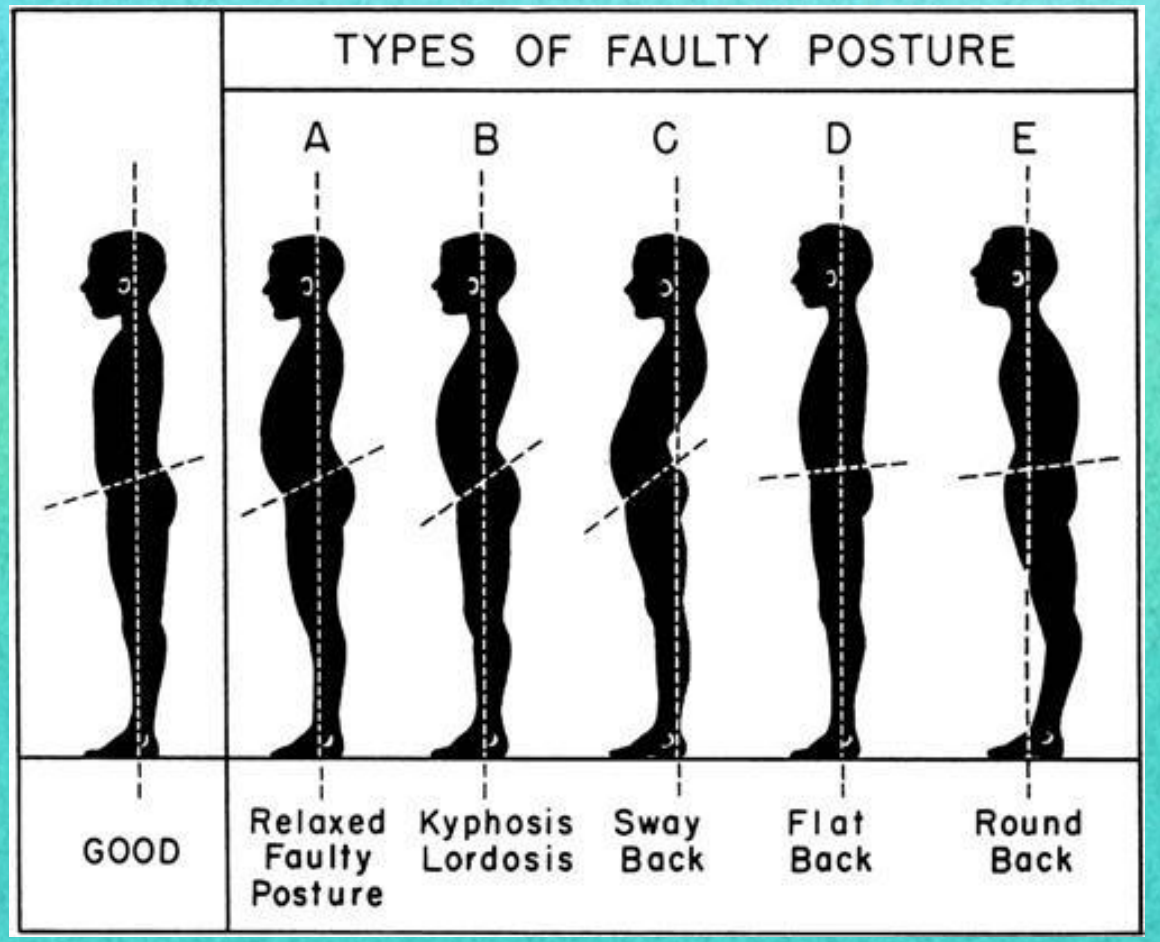


Figure retriever from: https://clinicalgate.com/assessment-of-posture/

Evaluation of locomotor system / movement function

Why is this important?

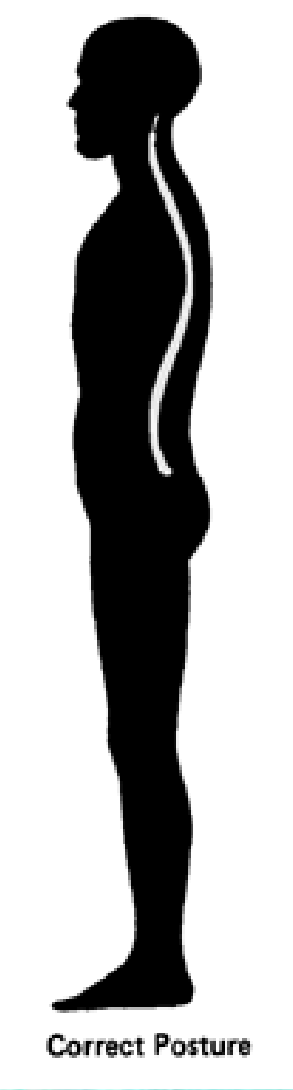
- Such data will give us a picture about the person's needs (e.g. low aerobic capacity, weak hip and knee extensors, a limited range of motion in left shoulder etc.). From this, we can make one more step to identify exercise plan. It gives us idea what to work on, what to improve and also what we should not do (i.e. what activity is „contraindicated")
- **= appropriate assessment will give us useful information about the pupil / client to set goals and the exercise plan.**

What kind of tests are useful in (Remedial) Physical Education?

- Postural assessment including feet
- Range of motion / joint mobility / hypermobility
- Muscle imbalance – esp. short muscles
- Movement stereotypes including gait
- Aerobic capacity / cardiorespiratory fitness (i.e. 6-min walking distance test or „step test", well known from exercise physiology)

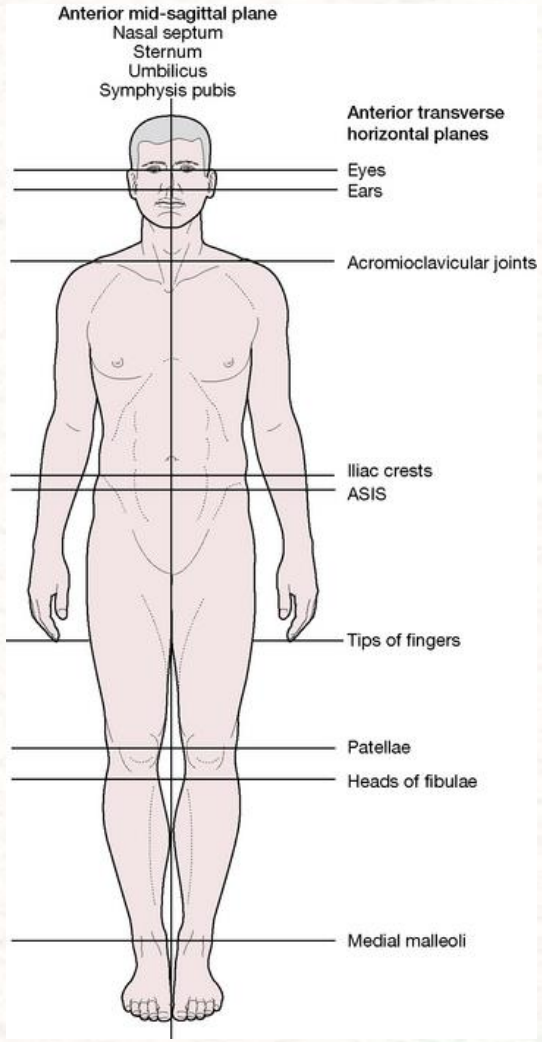
Postural assessment / analysis

- **= step-by-step procedure of looking at the structural landmarks of the body**, both in weight bearing and non-weight bearing positions
- assessment **may usefully begin as the person enters the room** or even as he is walking across the parking lot, habits of use will be more obvious when the person **is not aware he is being observed**, such as how he carries objects, how he sits etc. ☺
- the individual being examined should be as unclothed as is deemed possible and appropriate, or **dressed in form-hugging attire** (such as leotards, tights or biker's shorts), so that key features are not masked
- the person should make a 'comfortable' standing position (i.e. the habitual way he stands) – barefoot, relaxed, arms hanging comfortably at the sides, feet placed in a comfortable position



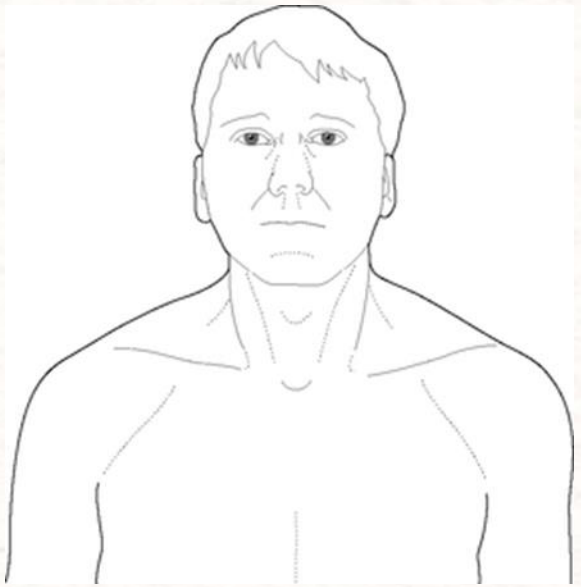
Static postural assessment / analysis

- the habitual position often displays compensation patterns, e.g. forward placement and lateral rotation of leg
- firstly we stand in front, at a distance of 10–15 feet (if space allows), it gives us an overall impression of alignment and often reveals 'global' compensations that are masked when we move closer
- head tilt, shoulder height differential, pelvic tilt and the appearance of carrying more body weight on one leg than the other are examples of what may be seen from a distance
- view from a distance may also reveal forward-leaning posture, locked knees (genu recurvatum)
- we also look at feet and their shape (see slide nr. 11)



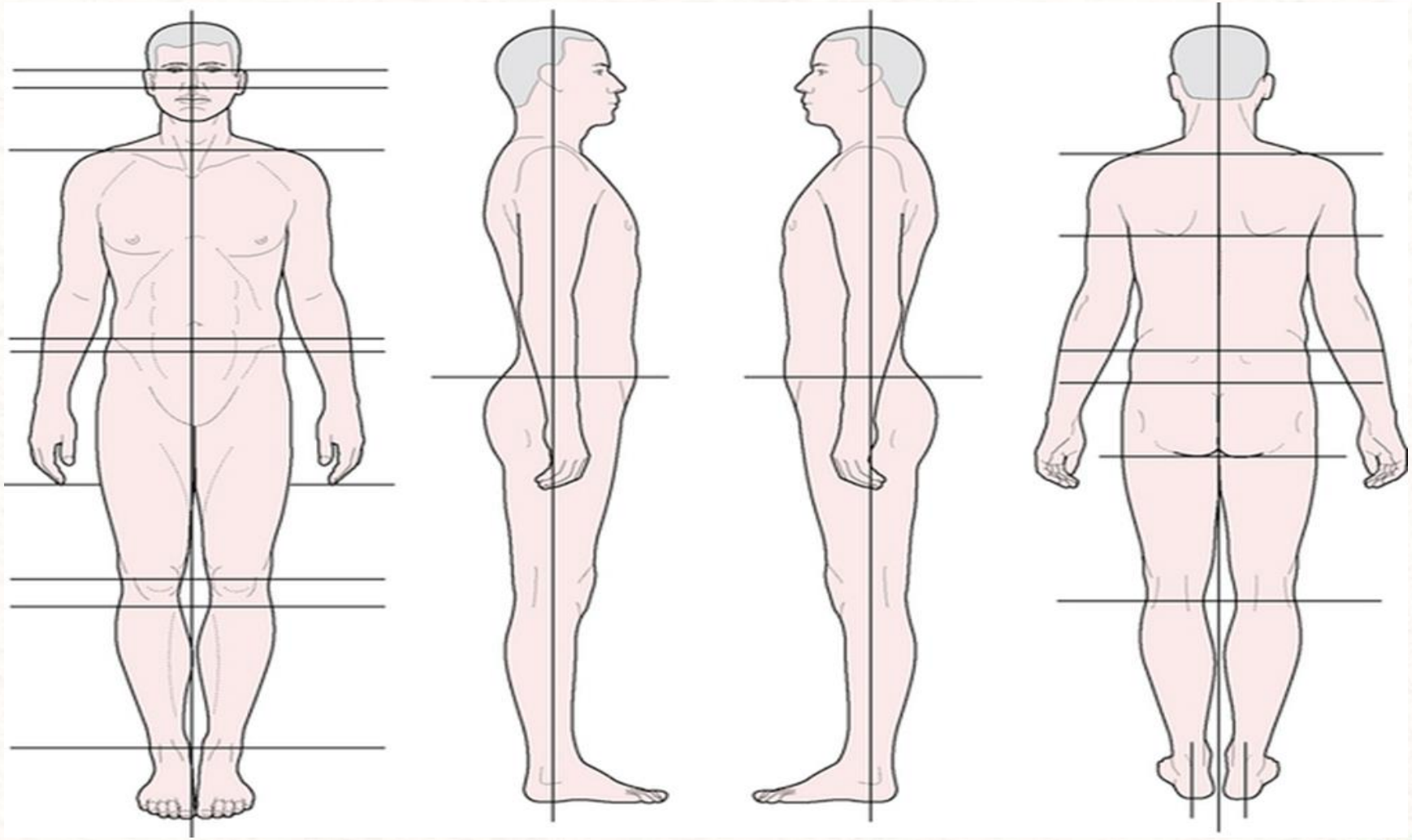
Static postural assessment / analysis

- firstly we stand in front, at a distance of 10–15 feet (if space allows), it gives us an much the body has deviated from the 'ideal' posture
- Examples:
  - *Is the muscular mass of either or both upper portion of trapezius excessive (as in 'gothic shoulders') or are they both balanced and of normal proportions?*
  - If hypertrophy of upper trapezius exists (even bilateral) this suggests the possibility of upper crossed syndrome imbalance with consequent inhibition of the lower fixators of the shoulder
  - *Do the arms hang comfortably at the sides with the shoulders placed in neutral position with no apparent medial or lateral rotation of the humerus?*
  - If not, imbalance in the rotator cuff mechanism and/or global rotators of the shoulder (e.g. pectoralis major), and/or an imbalance between flexors and extensors associated with the upper crossed syndrome may be present
- **Basically, we try to figure out how much the body has deviated from the 'ideal' posture. We look at the body from front, back and side.**



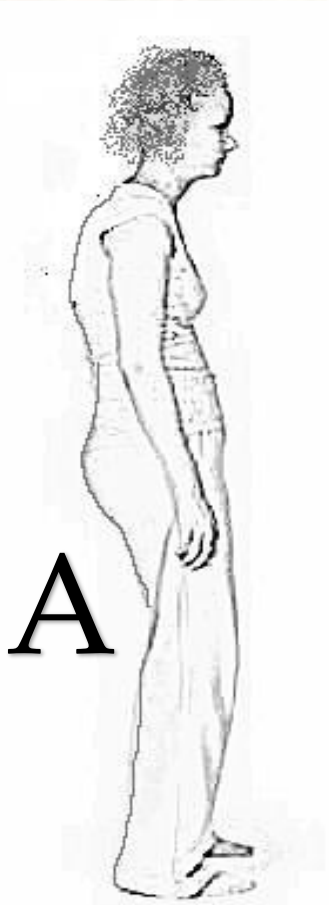
Gothic shoulders - Journal of Bodywork and Movement Therapies 1(1):24

Posture evaluation recording form as a useful tool



postural evaluation recording form (adapted from NMT Center lower extremity course manual (1994))

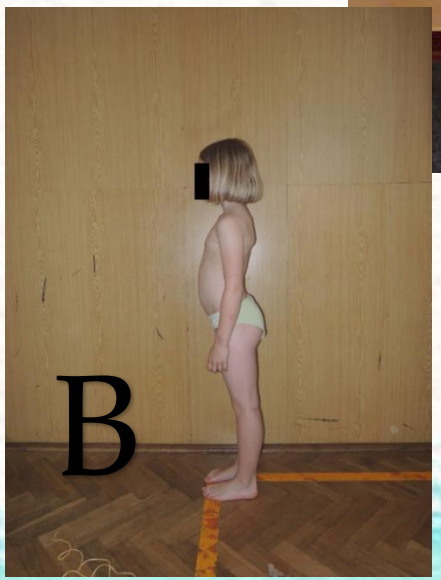
Posture evaluation – little practice



- What do we search for? We ask questions like:
  - Is the head held erect or does it tilt to one side or the other?
  - Do we see another postural distortions, such as an elevated shoulder or hip, gothic shoulders etc.?
- We mainly look for asymetry!
  - Position of head, shoulder and arms
  - Position of pelvis, knees, heels and feet
  - Spine curves (lordosis, kyphosis, scoliosis)

Task for you: Please look at these pictures.

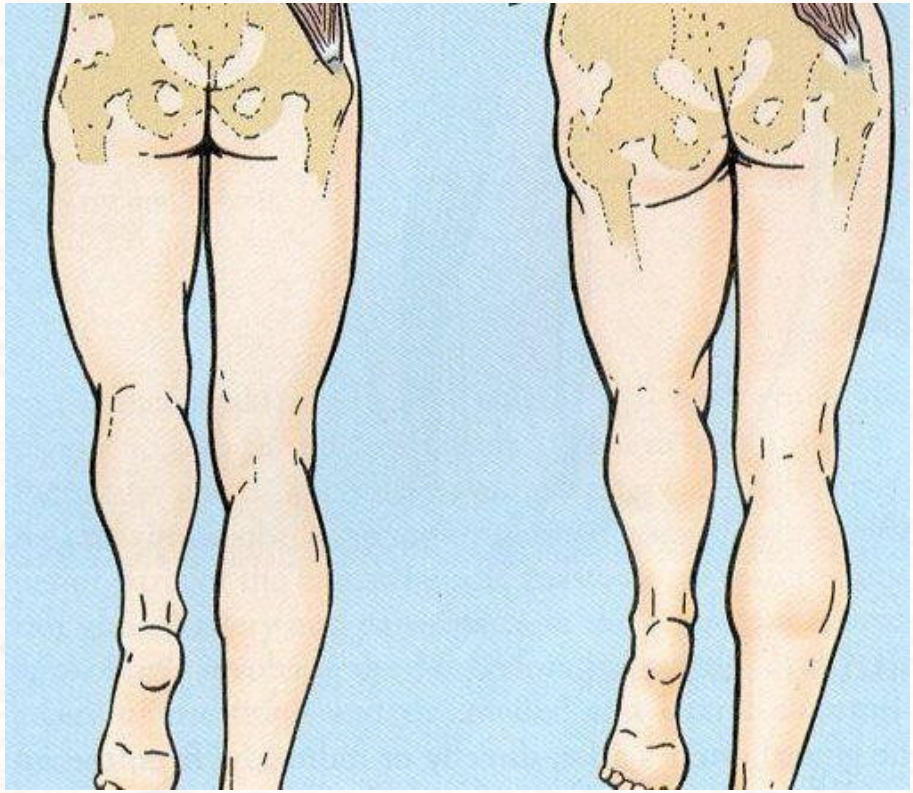
- Can you find some pathology or asymetry?
- What the pictures tell us about that posture?



Dynamic posture evaluation – standing on one leg

Trendelenburg test

- a quick examination that can reveal a hip dysfunction
- **Description**: The pupil is asked to stand on one leg for 30 seconds without leaning to one side. We observe if pelvis drops on the contralateral side during a single leg stand on the affected side (test is „positive“ if during unilateral weight bearing the pelvis drops toward the unsupported side)
- Positive test usually indicates **weakness in the hip abductor muscles**: gluteus medius and minimus, which can be associated with various hip abnormalities such as congenital hip dislocation, rheumatic arthritis
- Please see video at: https://www.physio-pedia.com/Trendelenburg_Test



Adam´s test for assessment of scoliosis

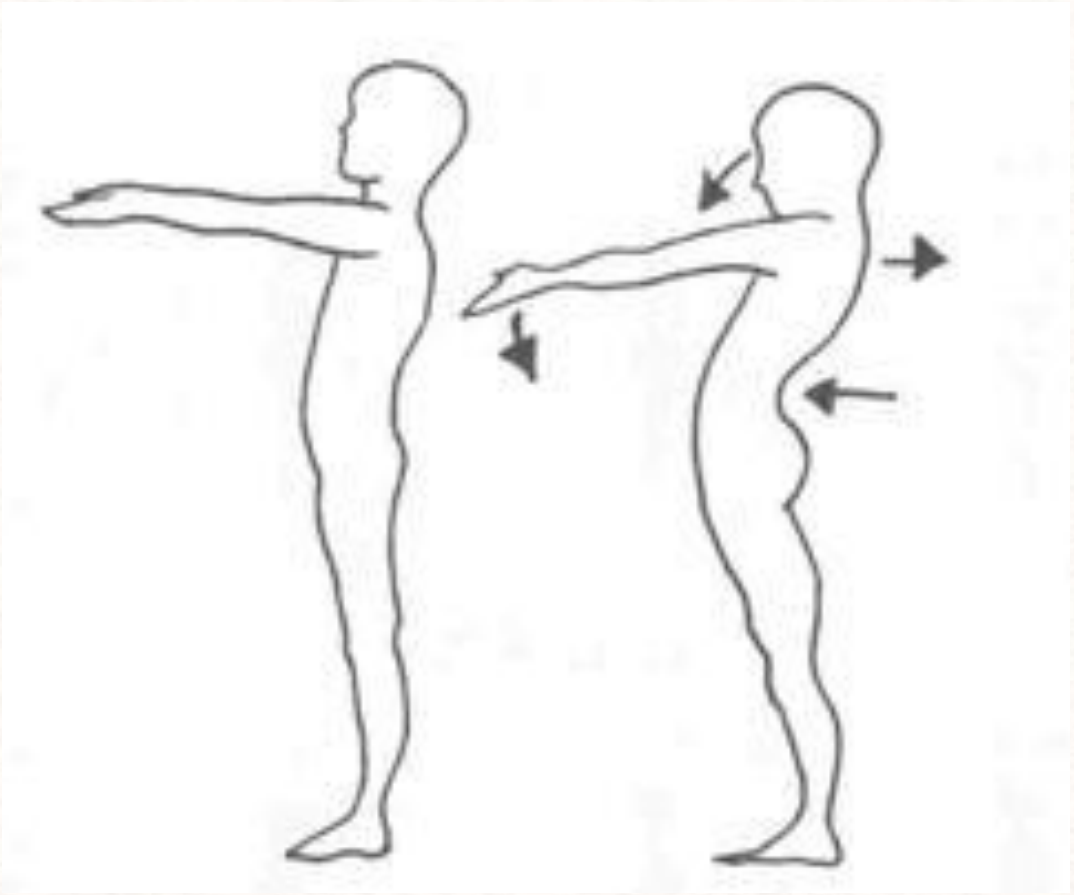
The person takes off his/her t-shirt so that the spine is visible. The person needs to bend forward, starting at the waist until the back comes in the horizontal plane, with the feet together, arms hanging and the knees in extension. The palms are hold together. The examiner stands at the back of the person and looks along the horizontal plane of the spine, searching for abnormalities of the spinal curve, like increased or decreased lordosis/ kyphosis, and an asymmetry of the trunk.

Please see the video at: https://www.physio-pedia.com/Adam's_forward_bend_test

We also look for limb length discrepancy… it might be reason for scoliosis

Matthias posture test for children

- This indicative test reveals poor posture (overall lower muscle tension). It comes from the knowledge that with postural weakening, active posture can only be taken for a limited time. It is important to tell the child at the beginning to stand upright with muscle activation.
- **The child is stretching arms forward (up to 90 degrees) and we leave him/her for 30 seconds**. We evaluate the initial and final posture, possible muscle activation and relative restlessness. If the head is tilting forward and the upper part of the chest tilts, the shoulders go forward, the tummy is poked out, it is poor posture. However, in a significantly poor posture, the child is even unable to take a stand (initial position).
- The test can be performed in children from 4 years of age.



Feet assessment

- part of posture assessment in standing position

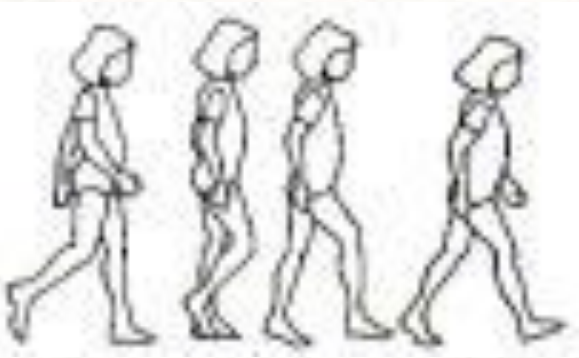
- looking at weight distribution and alignment, foot biomechanics

- **Pedograph** – foot print analysis

- **Foot Posture Index (FPI)** is an observational tool which constitutes 6 items to analyse static standing posture from 3 different angles.

- **Podoscopy** - assessment of foot load using the principle of mirror reflection, useful method to assess posture and foot load in children

Gait analysis



- Left-right symetry?
- Pelvis movement?
- Work of foot and ankle?
- Movement of arms during walking?

- assessment of walking pattern
- can be done in various ways
- an experienced physiotherapist will be able to detect gait abnormalities purely via observing your walking or running style BUT also **PE teacher should be able to reveal some bigger differences from normal /physiological/ gait**
- video gait analysis can be used to slow down walking action for both assessment and correction purposes
- force plate computer analysis can also be used, e.g. https://www.kistler.com/en/applications/sensor-technology/biomechanics-and-force-plate/gait-analysis/

- Poor walking or running gait is not only inefficient, it can also cause compensatory injuries at, above or below the injury level. For example, an injured knee that affects the gait can cause foot, hip or back pain.
- A normal walking pattern is even more important when you start to run (running increases any abnormal stress forces on joints and muscles)
- Poor habits may become long-term, which can **predispose** person to other injuries or arthritis.

Assessing mobility / flexibility

A basic **assessment** of **flexibility** includes active range of motion **assessment** to determine whether the person can move, i.e. what is his (pain free) range of motion.
Why? It might be important to know whether individual muscles or groups may need some **flexibility** training.
Also, we observe the way the person moves, and to examine differences between the right and left side.
The most accurate tests of **flexibility** are those in which a goniometer is used to measure the actual degrees of rotation of the various joints.
However, in PE we use more „orientation“ tests.

Example:

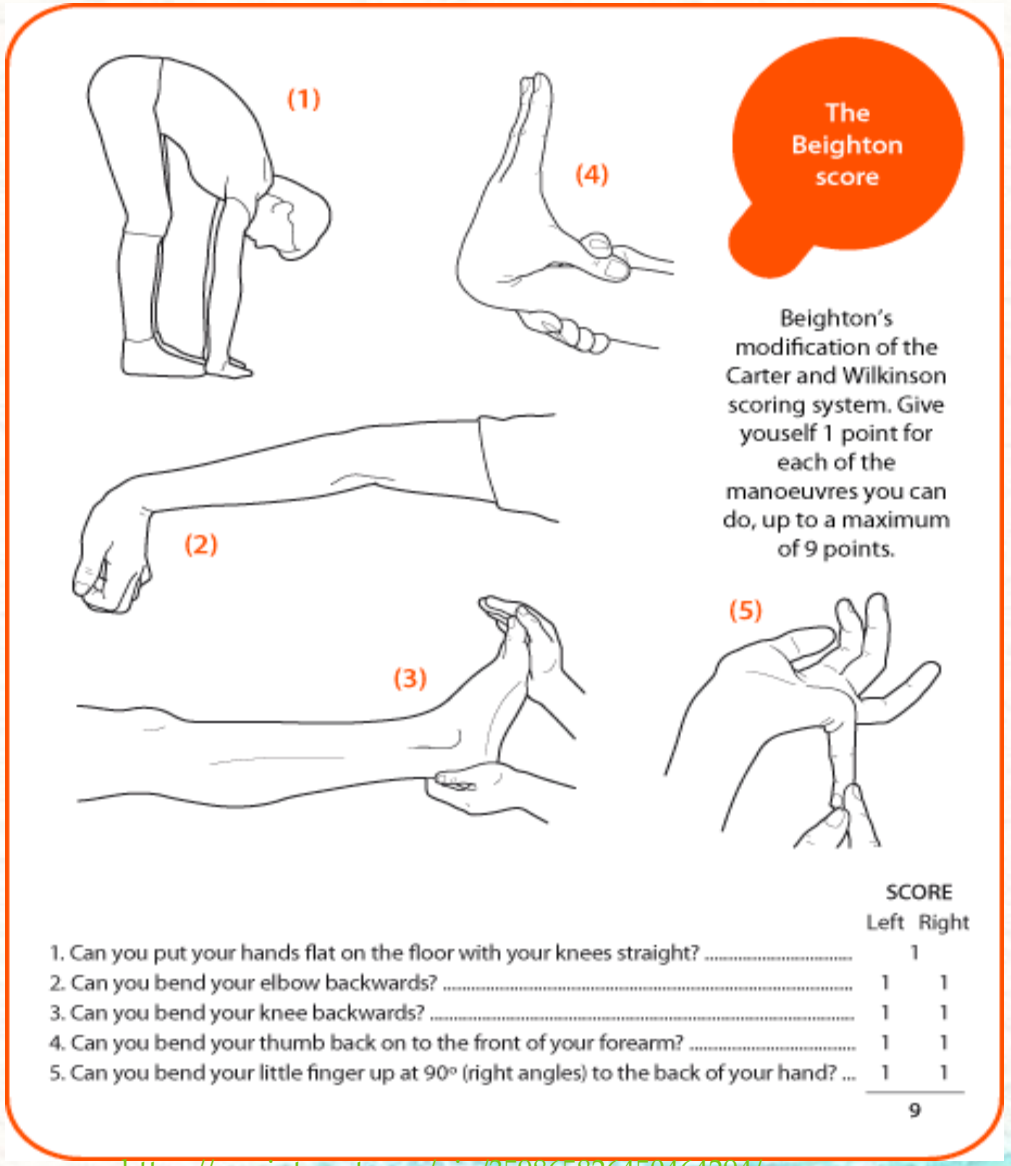
Thomayer´s test – test of single forward bending

This test assesses non-specifically mobility of the spine.

More accurate is sit and reach test, see https://www.youtube.com/watch?v=lv-_D8NnKdw or https://www.youtube.com/watch?v=Br6be7YEmKM

Assessment of hypermobility

- The Beighton score is a popular screening technique for hypermobility (pathologically increased mobility).
- It is a nine – point scale and requires the performance of 5 maneuvers, four passive bilateral and one active unilateral performance.
- It was originally introduced for epidemiological studies involving the recognition of hypermobility in populations.
- https://www.youtube.com/watch?v=ZwWts_P-Xws



https://cz.pinterest.com/pin/359865826450464294/

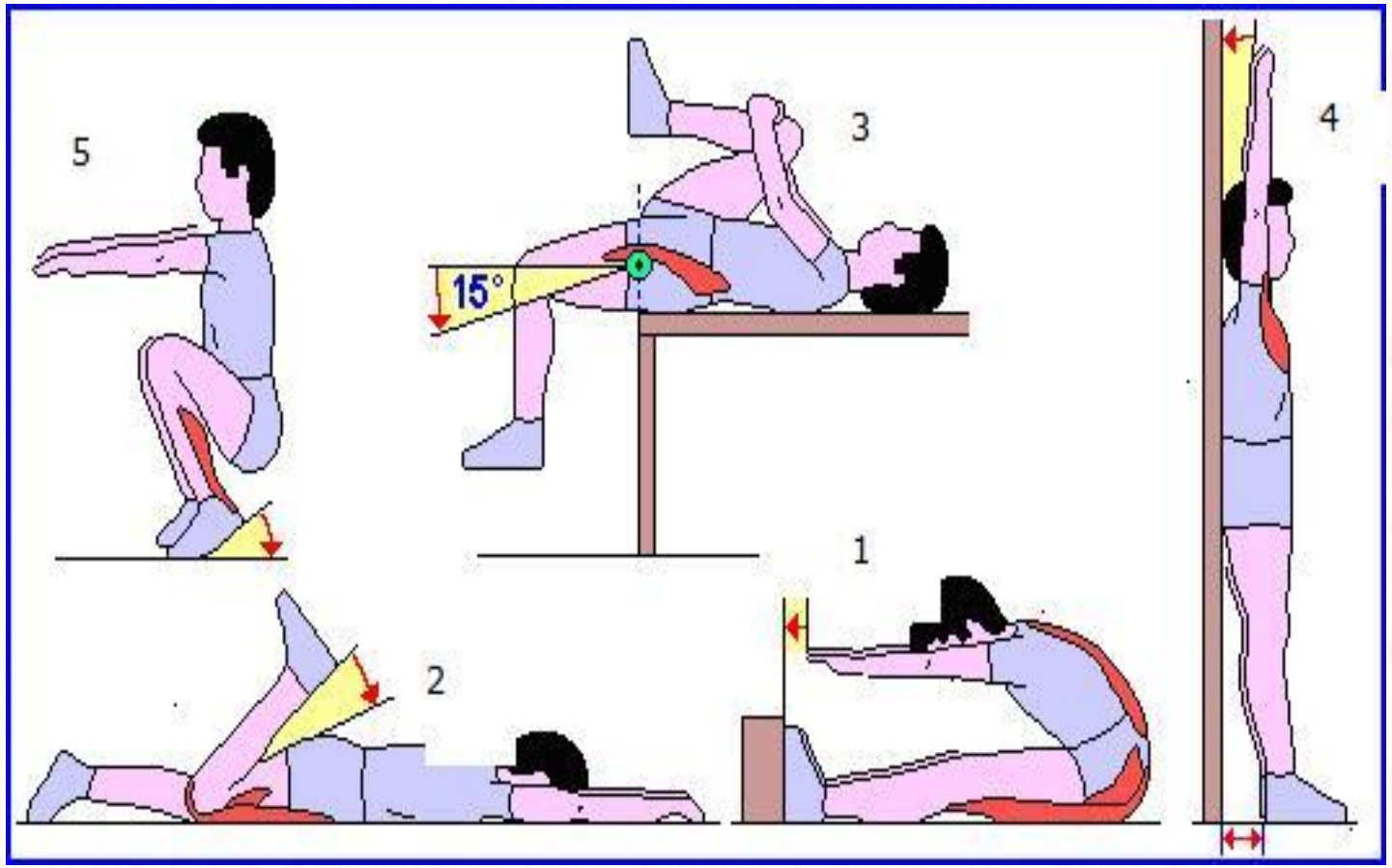
Evaluation of tight / shortened muscles

As some muscles (esp. the ones we call postural muscles) have tendency to become tight or shortened which has then consequences in the muscle imbalances,,,cross syndromes“ and poor posture, it is valuable to evaluate them

- m. trapesius
- m. pectoralis major
- m. quadratus lumborum
- knee flexors (hamstrings)
- m. iliopsoas, m. rectus fem., m. tensor fasciae latae
- hip adductors
- m. triceps surae
- paravertebral muscles

Example: testing of hip flexors, abductors and adductors + rectus femoris: https://www.youtube.com/watch?v=q4w-VSuXVQI

Typical tests for tight / short muscles



What muscle is this exercise testing?

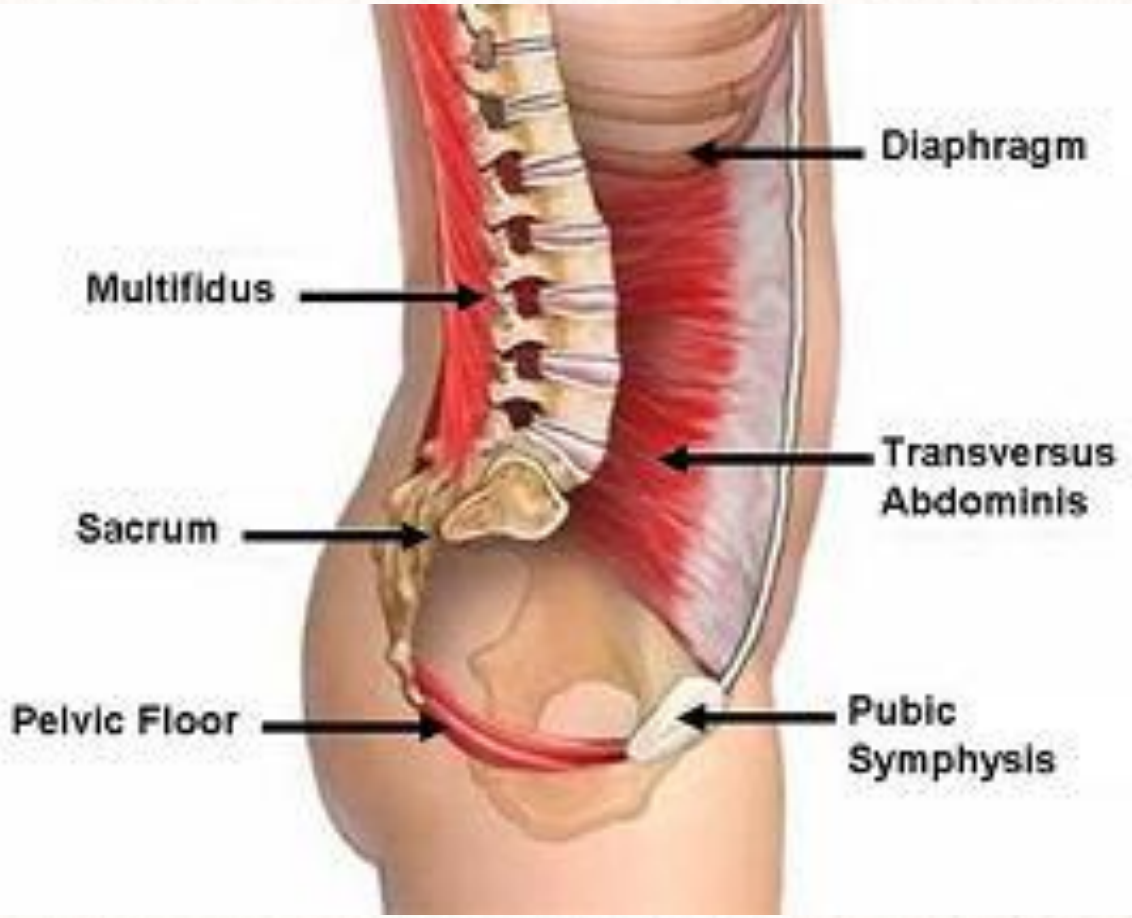
Deep stabilisation system - Deep Core Stability Muscles

- to make a flexible but stable region around L spine
- to stabilise L spine in its many positions

Its good function is important for prevention of back problems and their reoccurence.

Deep stabilising muscles involve:

- diaphragm
- diaphragm pelvis – pelvic floor
- deep abdomen muscles – transversus abdominis
- deep back muscles - multifidus



Picture retriever from: https://physioworks.com.au/FAQRetrieve.aspx?ID=31027

Evaluation of deep stabilisation system function

Tests according to Kolar's approach and dynamic neuromuscular stabilisation method, based on developmental kinesiology:

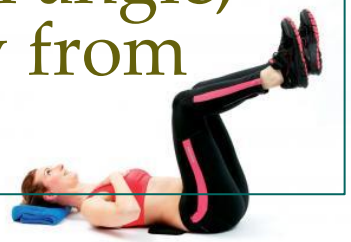
- **Diaphragm function test**
- **Intra-abdominal pressure test**
- **Trunk and neck flexion**
- **Arm lifting test**
- **Leg lifting test**
- **Hip flexion**
- **Core stabilization during movements of arms and legs simultaneously**

See more at:

- http://www.hanslindgren.com/articles/diaphragm-function-and-core-stability/

Common signs of impaired postural stabilisation (function of deep stabilising muscle system):

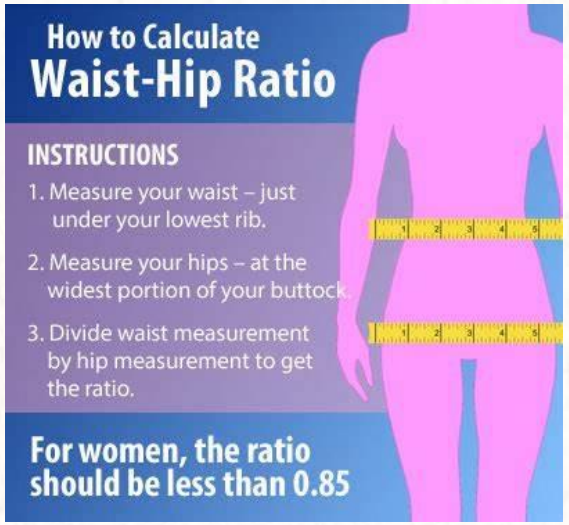
- Chest in inspiration position (elevated chest)
- Pelvis anteversion – anterior tilt
- Inability to relax paravertebral muscles
- Diastasis of abdominal muscles
- Shoulderblades: adduction and external rotation of distal angle, elevation, standing away from ribs

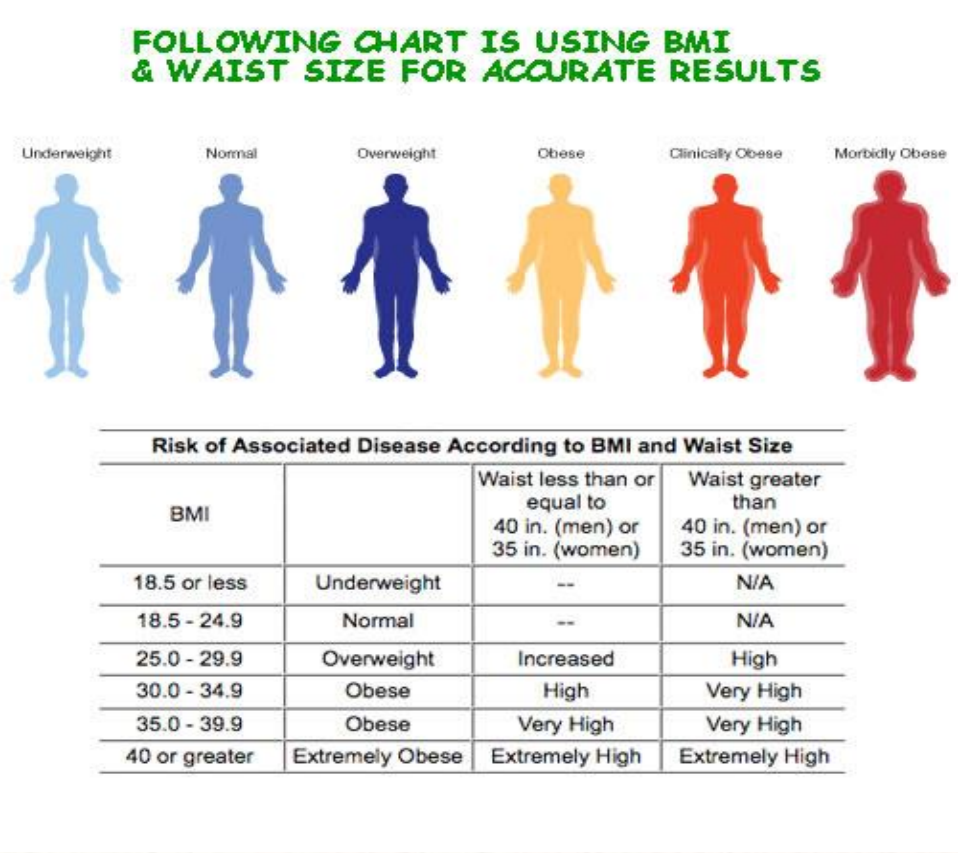


Anthropometry

What measures can be useful?

- waist circumference
- hip circumference
- waist-hip ratio
- BMI (Quetelet index)
- % of body fat (bioimpedance methods, skinfold measurements, underwater weighing, DEXA etc.)





Risk of Associated Disease According to BMI and Waist Size

BMI		Waist less than or equal to 40 in. (men) or 35 in. (women)	Waist greater than 40 in. (men) or 35 in. (women)
18.5 or less	Underweight	--	N/A
18.5 - 24.9	Normal	--	N/A
25.0 - 29.9	Overweight	Increased	High
30.0 - 34.9	Obese	High	Very High
35.0 - 39.9	Obese	Very High	Very High
40 or greater	Extremely Obese	Extremely High	Extremely High

In Remedial Physical Education, BMI and circumferences are usually sufficient. They might be useful in people who suffer from metabolic and cardiovascular disorders, and anorexia nervosa.

Evaluation of movement patterns (stereotypes)

Background: Functional movement is never isolated; requires several muscles acting as **prime movers, synergists or stabilizers**.

Movement patterns utilized by an individual are developed by their activities, habits, hand dominance, and previous injuries. A temporary lack of activity may be the impetus for deterioration of movement patterns. A lack of variety of movements, sedentary lifestyle, prolonged static postural stress, or poor body mechanics can all lead to muscular imbalances. Overuse activities frequently lead to adaptive shortening/tightening of muscles. Disuse may lead to weakening or inhibition of muscles. A common example of inhibition is the tightening of the iliopsoas, perhaps from prolonged sitting or ineffective recruitment of the gluteus maximus leading to the neurologic inhibition of its antagonist, the gluteus maximus.

6 Basic Movement Patterns which we usually test:

- Hip Extension
- Hip Abduction
- Curl-up
- Cervical Flexion
- Push-up
- Shoulder Abduction

Hip Extension:

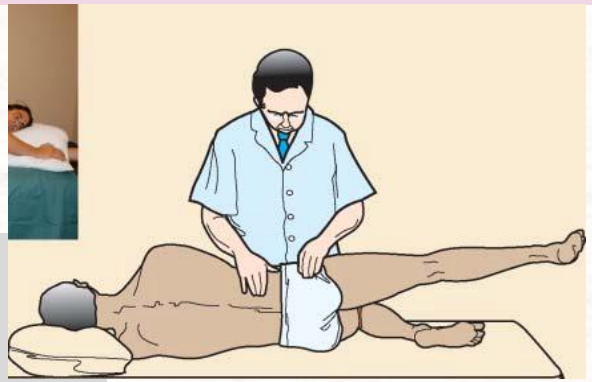
pelvic tilt with hyperlordosis are a positive test

Hip Extension Monitoring – muscle firing pattern

1. Hamstring
2. Gluteus Maximus
3. Contralateral QL
4. Ipsilateral QL
5. Contralateral E. Spinae
6. Ipsilateral E. Spinae

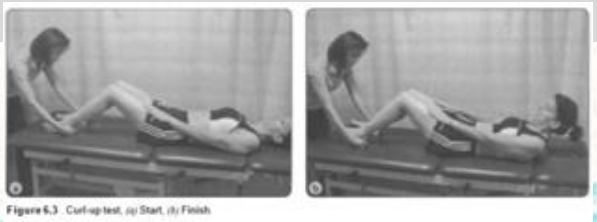
Hip Abduction (20 degrees):

- Pelvis stabilizers during gait.
- Gluteus medius, gluteus minimus and TFL are prime movers; QL and abdominal muscles are stabilizers.
- Hip flexion (not pure abduction) indicates TFL tightness.
- QL initiates hip abduction with gluteus weakness.



Trunk Curl-up:

- During trunk curl up the upper trunk should round, lower back flattens and the pelvis tilts posteriorly.
- Hip flexor motion will be associated with little to no curling of upper trunk and anterior pelvic tilt.
- Early loss of pressure under heels is another sign.



Cervical Flexion:

- Primary deep flexors are longus capitis, longus colli and rectus capitis anterior should work.
- SCM (m. sternocleidomastoideus) and anterior scalene are superficial flexors.
- Compensation by SCM and scalene will result in the chin or jaw jutting forward (OA extension) during cervical spine flexion.

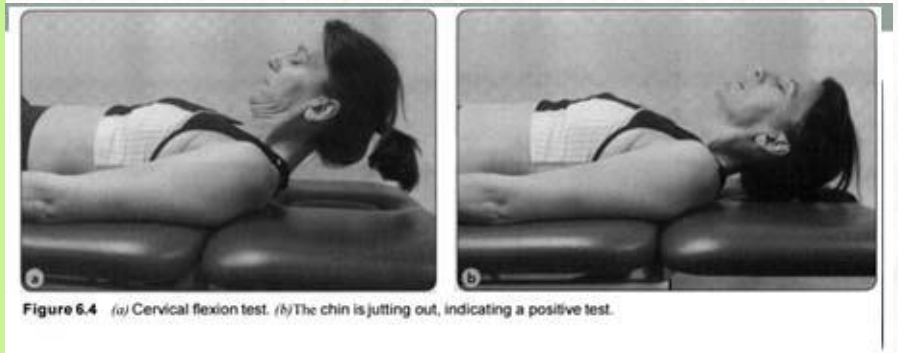


Figure 6.4 *(a)* Cervical flexion test. *(b)* The chin is jutting out, indicating a positive test.

Figure 6.4 *(a)* Cervical flexion test. *(b)* The chin is jutting out, indicating a positive test.

Figure 6.6 Shoulder abduction test, *(a)* Beginning position. *(b)* Faulty movement pattern, *(c)* Excessive right shoulder elevation before 60° of shoulder abduction. Note right cervical rotation, which indicates a dominance of the levator scapulae.

Shoulder Abduction:

- Deltoid, rotator cuff, upper trapezius and levator scapula should work.
- Elevation of shoulder girdle before 60 degrees of abduction is a positive test.
- Contralateral side-bending of trunk to initiate abduction is also positive test (showing a non ideal pattern).

Push-up:

- Force coupling between trapezius and serratus anterior necessary for scapula stabilization.
- Excessive scapular elevation, tipping, winging, adduction or abduction.

See more at https://www.youtube.com/watch?v=2LwbBmkosos

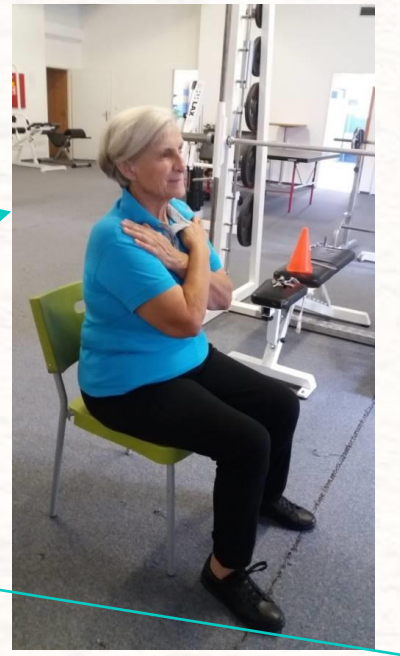
Evaluation using test batteries

A good example of such complex evaluation is the Senior Fitness Test.
It is especially usefule when you work with the elderly.

Senior Fitness Test

(Rikli and Jones 2011)

- 30-Second Chair Stand
- Chair Sit-and-Reach
- Arm curl
- 2-minute step test
- Back Scratch
- Foot Up-and-Go



Please look at this video till 13th min:
https://www.youtube.com/watch?v=IXrnsh938OI

Tasks for students – distance study

1. Please go through the presentation including videos.
2. Please **answer questions from slides 7 and 16.**
3. Please try to evaluate the posture of your friend / classmate – static posture evaluation, Matthias test, Adam´s test, Trendelenburg test, Beighton score, Thomayer test. **Describe briefly what you have found.**
4. Please read the following articles.

- Brzęk et al. BMC Musculoskeletal Disorders (2017) 18:117, DOI 10.1186/s12891-017-1462-z. It is a nice example of testing methods, as well as of relation of schoolbag usage and posture.
- Frank, Kobesova, Kolar. (2013). DYNAMIC NEUROMUSCULAR STABILIZATION & SPORTS REHABILITATION. IJSPT, 2013. It explains the stabilisation system of the spine in a nice way.