



**EXAMINATION METHODS IN REHABILITATION, 4.1.2021**


**EXAMINATION OF RESPIRATORY FUNCTIONS  
DEEP STABILIZATION SYSTEM OF SPINE**

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# Content

1. The function of the respiratory system
  2. Mechanics of respiration
  3. Deep stabilisation system of the spine
  4. Examination of the DSSS
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# Function of respiratory system:

- **Respiratory functions**
  - Respiration: ventilation, diffusion, perfusion
- **Non-respiratory functions**
  - postural and dynamic functions – the movement of the chest and of the entire musculoskeletal system
  - muscle tone (inspiration – facilitation, expiration – relaxation)
  - other autonomic functions (respiratory arrhythmia, peristalsis, defecation, micturition, ...)
  - psychological functions (emotions, relaxation)
  - defensive function (sneezing, coughing, mucus production, the function of cilia, heating, humidification)
  - taste, smell, yawn, hiccups
  - speech, audio manifestations
  - immunity

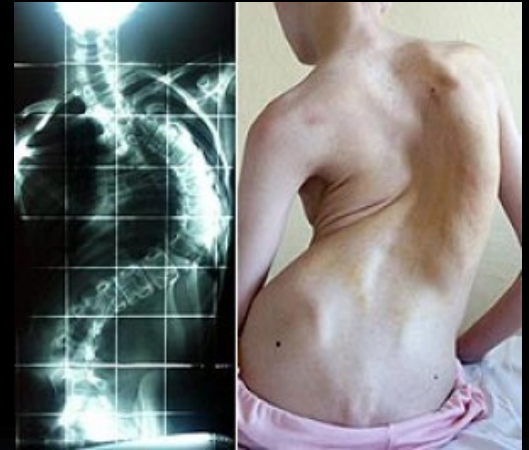
# Mechanics of respiration

participate and influence the individual character of breathing



## passive:

- shape and elasticity of the rib cage (Th vertebrae, ribs, sternum) and abdomen
- resistance of UAW and LAW
- filling of the hollow organs of the abdominal cavity
- pulmonary parenchyma



## active:

- diaphragm and other inspiratory and expiratory muscles

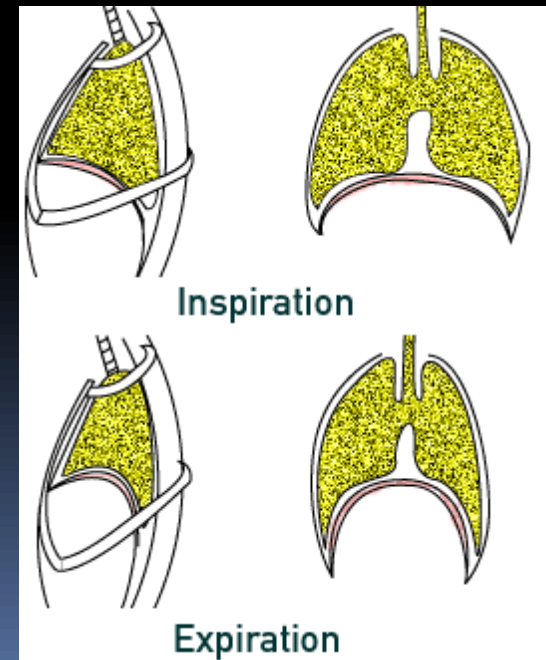
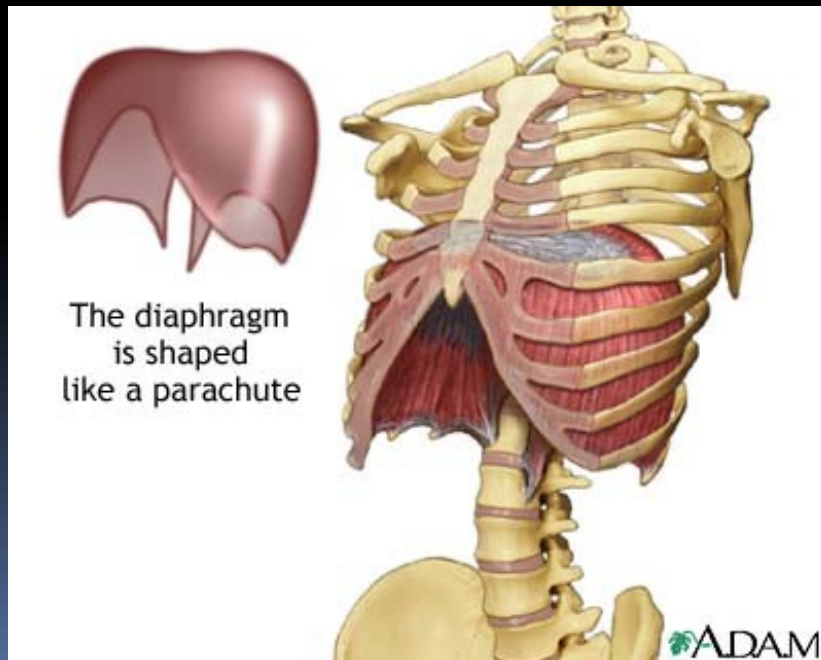
Controlled from the CNS, PNS and ANS, it can be influenced by the will partially.



# Breathing and musculoskeletal system

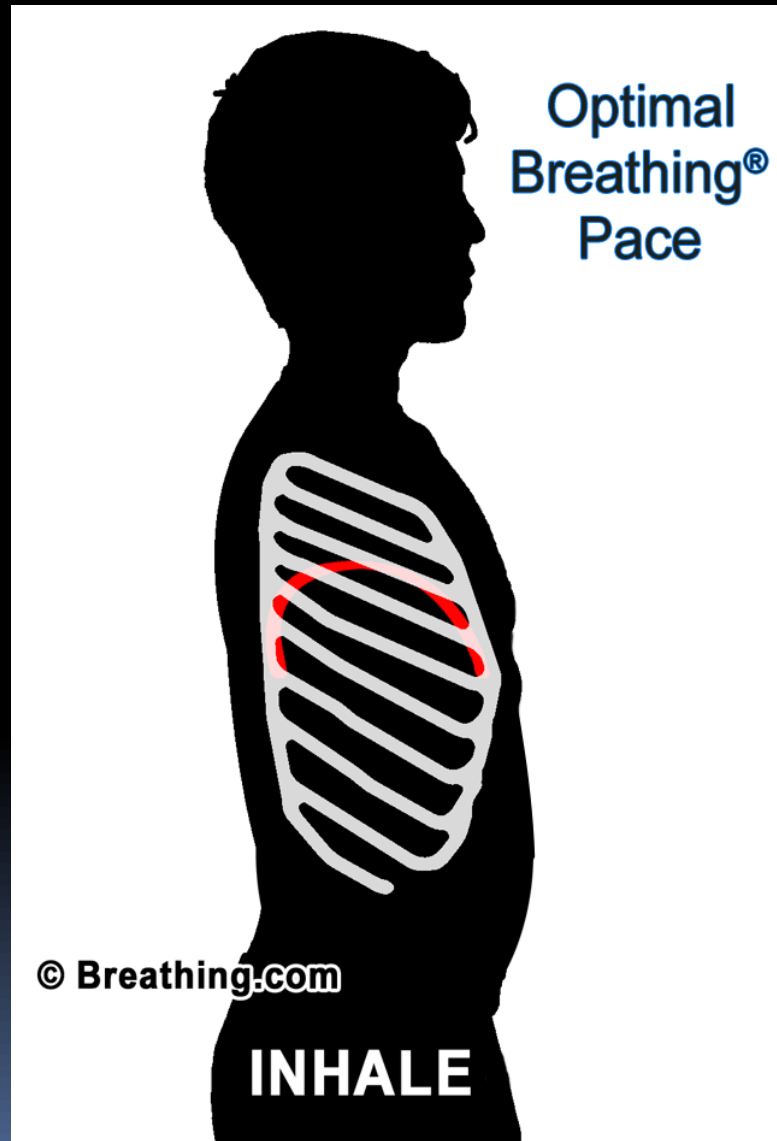
**Diaphragm** = main respiratory muscle (60 % VC):

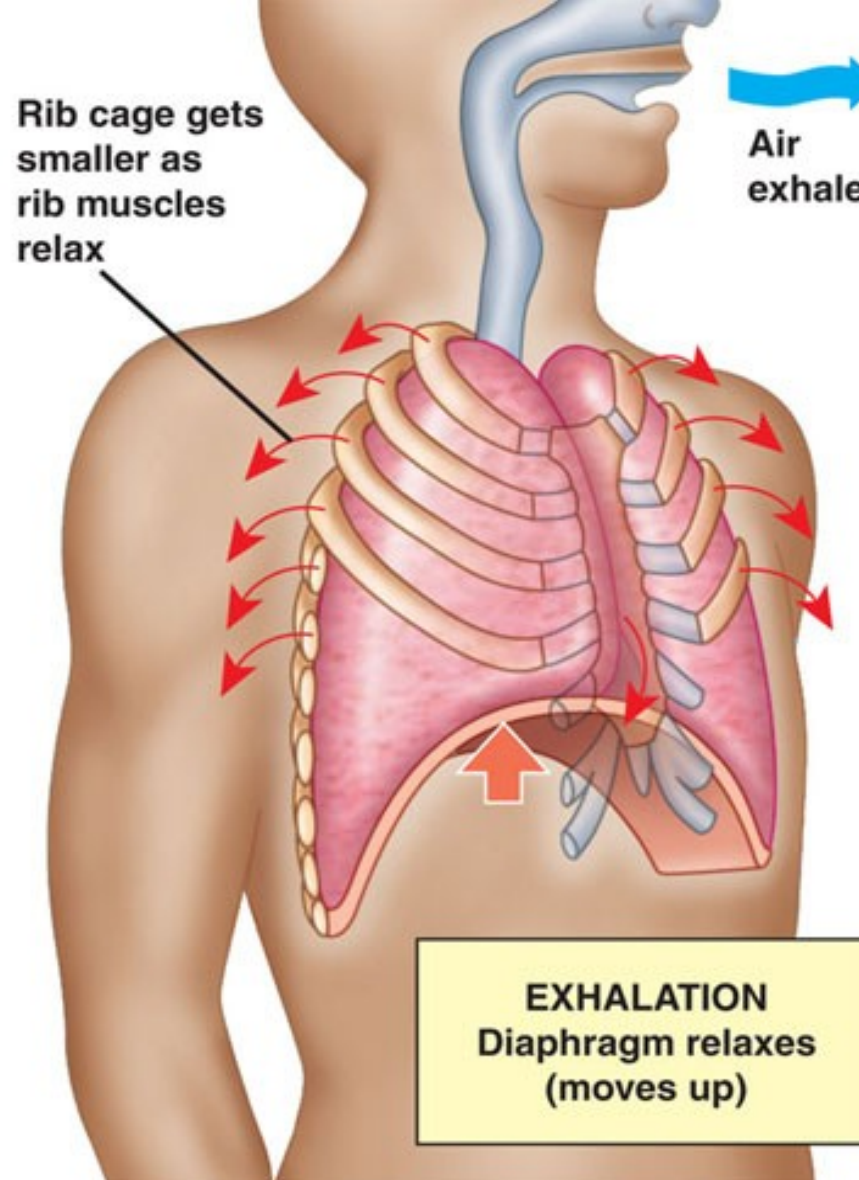
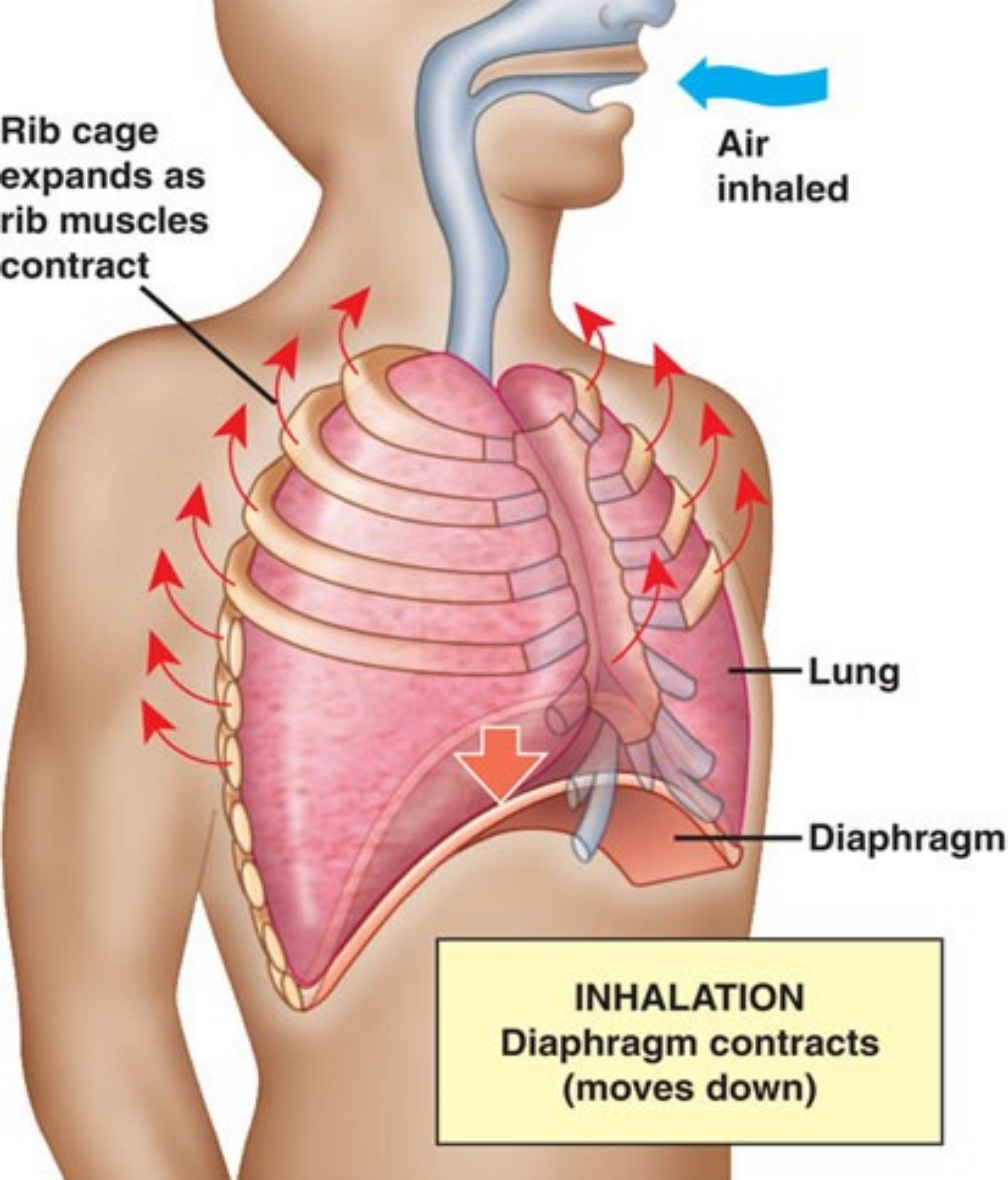
- 3 parts, related to DSS, horizontal position
- contracts during inspiration (moves caudally) – intra-abdominal p  $\uparrow$
- relaxes during exhalation (moves cranially)
- works in cocontraction with the abdominal musculature
- diaphragm expands the chest in the vertical direction



# Mechanism of breathing

<http://www.youtube.com/watch?v=hp-gCvW8PRY>

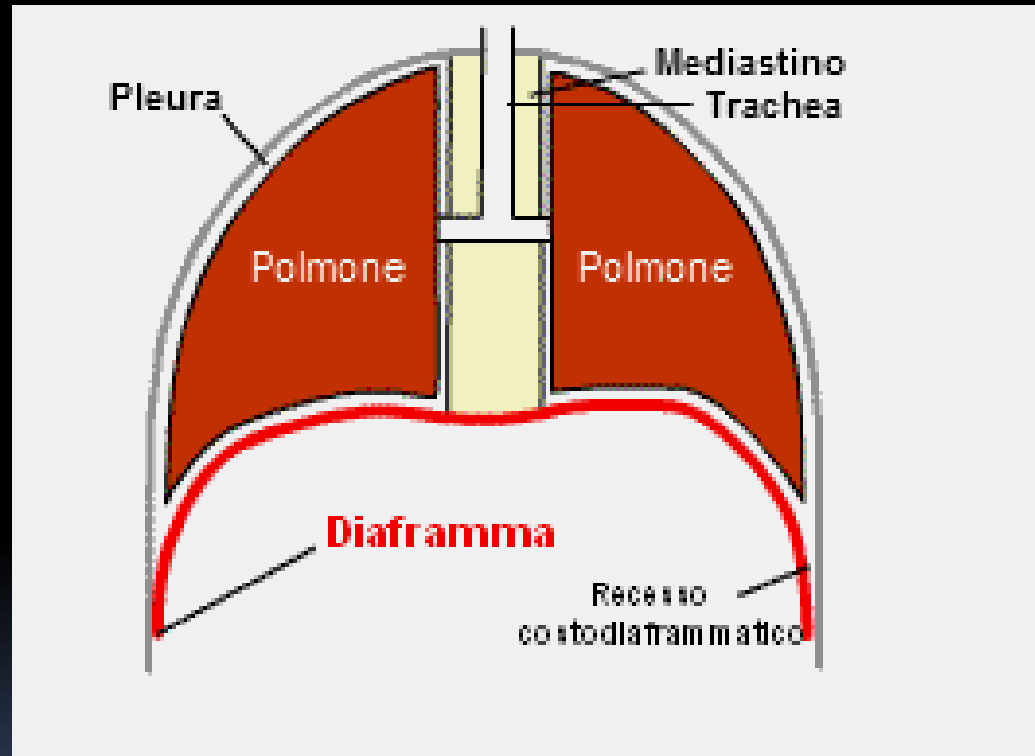




**Inspiration** – always **active action** (activity in the breathing muscles – the diaphragm, mm. intercostales ext.)

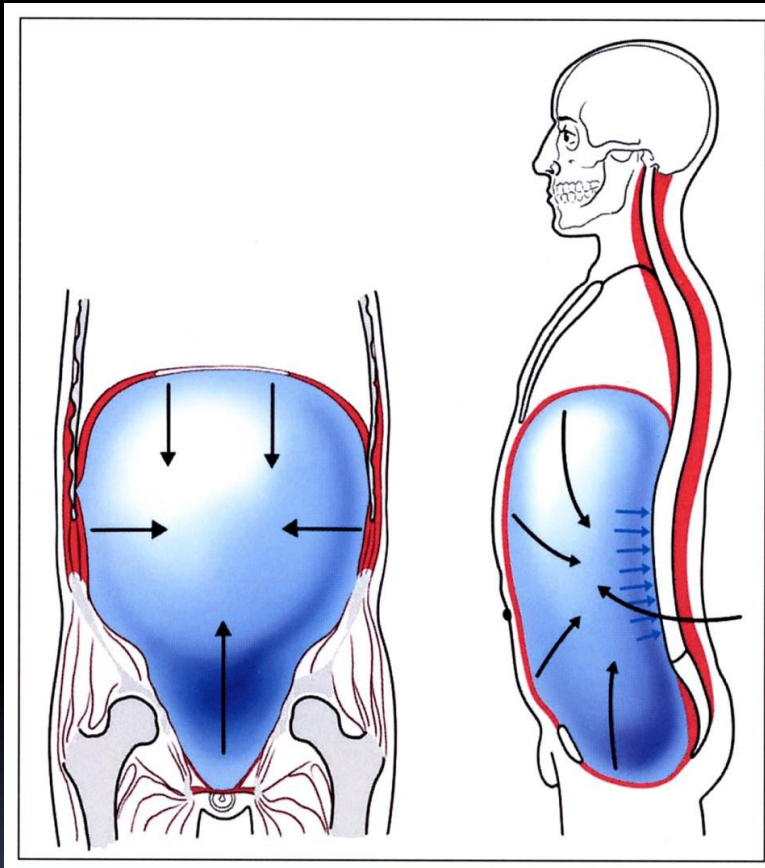
**Exhale** – mostly under resting conditions **passive action** (due to the elasticity of the soft tissues of the chest and lungs)

# Mechanism of breathing

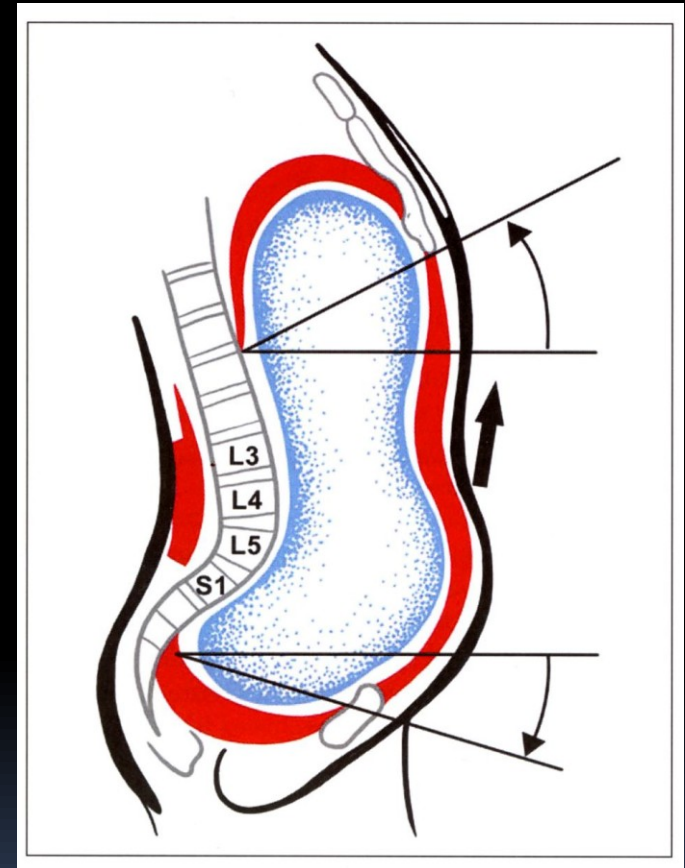




# Postural and respiratory stabilization stereotype



**Physiological situation:**  
respiratory and postural  
function balance of DSSS



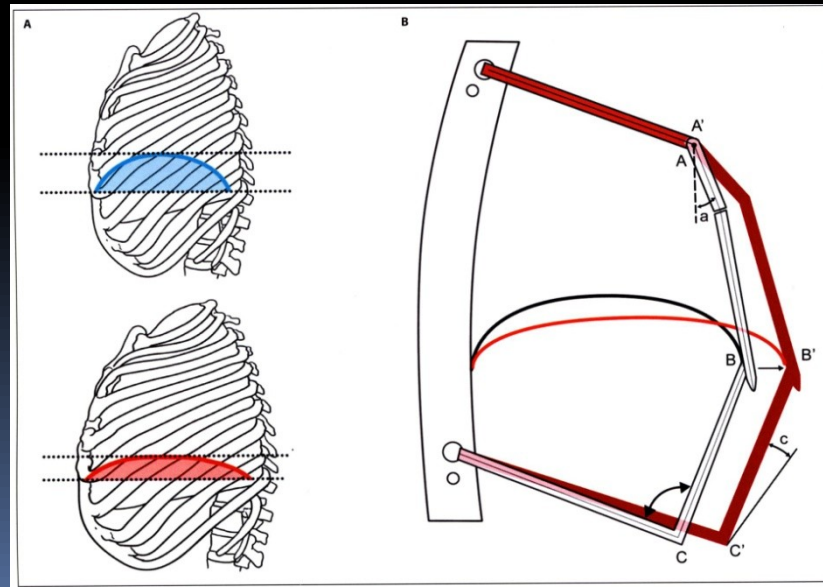
**Non-physiological situations:**  
inadequate extension of  
lower thoracic outlet

# 1. Examination of breathing stereotype

- It is possible to assess the **activation of the diaphragm** and its cooperation with the the **abdominal muscles**
- We classify respiration from kinesiology perspective on **diaphragmatic and costal breathing**
- Examination can be performed **in different positions** (lying prone/supine, sitting, in a bipedal stance)
- the **lower chest** and some of the **auxiliary muscles** are palpated, the **movement of the ribs/chest** is monitored

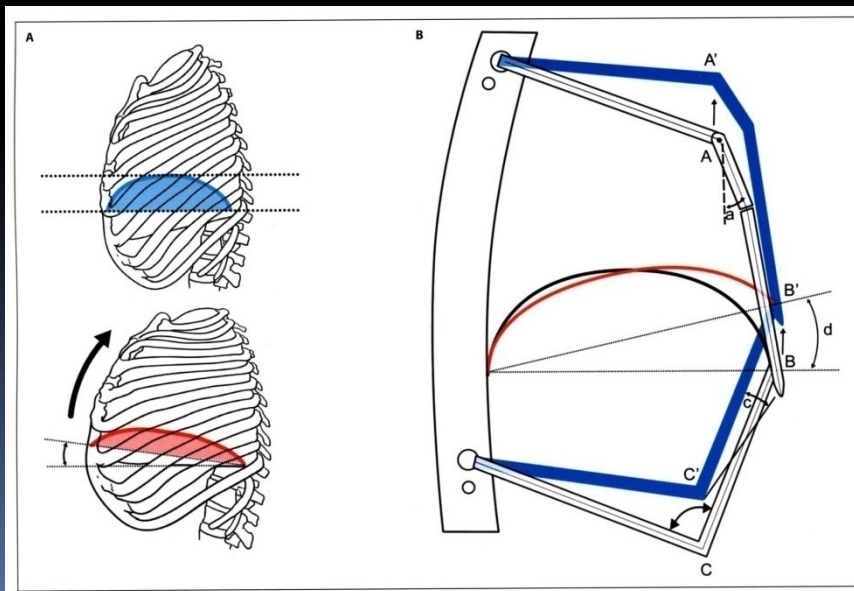
# a) Physiological diaphragmatic breathing

- when you inhale the diaphragm is activated, is flattened
- internal abdominal organs are compressed caudally
- does not extend only to abdominal cavity, but the lower aperture of the chest
- sternum moves ventrally
- at palpation intercostal spaces are widen, lower part of the chest expands laterally and ventrodorsally
- auxiliary muscles should be relaxed



## b) Costal breathing

- sternum moves craniocaudal and chest expands minimally
- intercostal spaces do not expand and also auxiliary muscles participate in the inhalation, if the patient is unable to perform diaphragmatic breathing pattern it indicates impaired interplay between the diaphragm and abdominal muscles
- common reason is that the patient can not relax the abdominal wall, especially its upper portion



Cranial movement of the chest during the insufficient stabilizing function of the diaphragm, there is no lateral extension of the lower thoracic outlet

# The contour of the chest at the insufficiency of the diaphragm



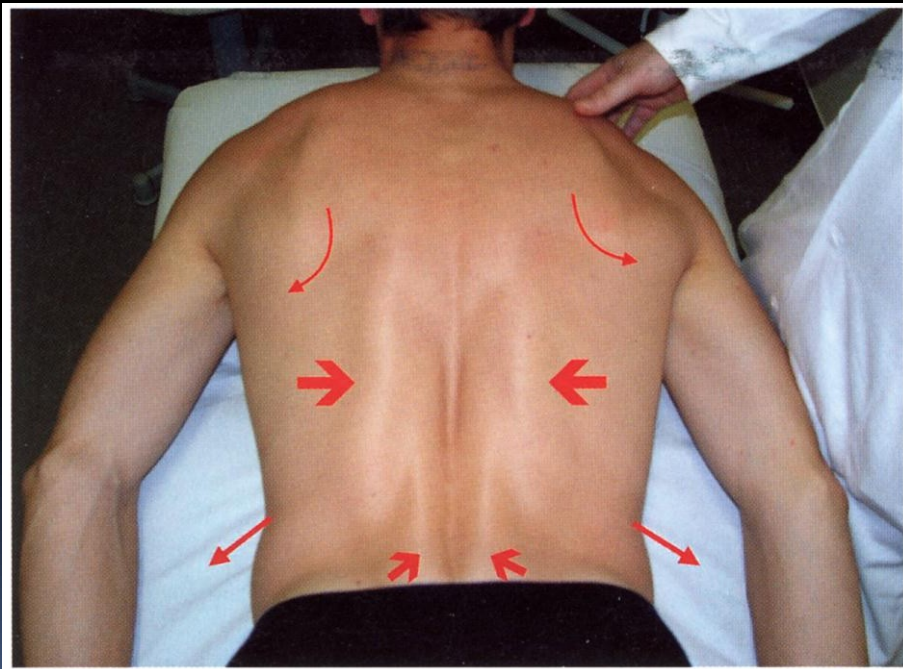
concave narrowing below the lower false ribs accompanied by increased tension of paravertebral muscles with maximum in ThL transition



flattening of the intercostal space between 5-10th rib

## 2. Test of extension

- ✓ coordination of the involvement of the back muscles and lateral abdominal muscles groups and activity in ischiocrural muscles

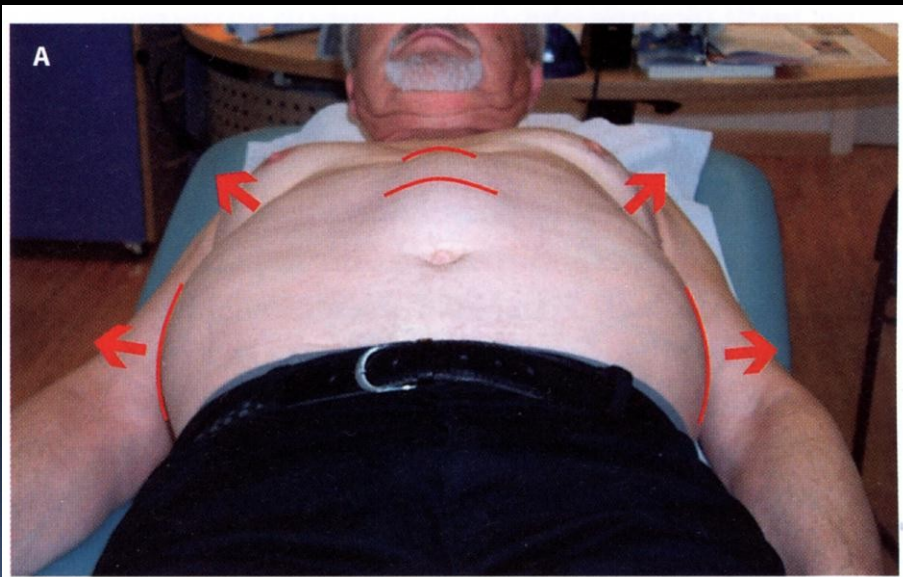


### Insufficiency of the DSS of the spine:

- significant activation of the paravertebral muscles (max. of Th/L transition)
- min. activation of the lower part of the lateral group of abdominal muscles
- upper angles of the shoulder blades in adduction and they migrate cranially
- overactivity of ischiocrural muscles

### 3. Test of trunk flexion

✓ with neck flexion the abdominal muscles are activated and chest remains caudal position. When the trunk flexion occurs the lateral abdominal muscle group is activated



#### Insufficiency of the DSS of the spine:

- during flexion of the head and trunk the chest is set cranial ie. in the inspiratory position
- arcus costalis expands
- lateral group of abdominal muscles bulges convexely
- the abdominal diastasis accentuates
- m. TRA is not engaged to flexion

## 4. Diaphragm test

- ✓ we examine the ability to activate the diaphragm in the interplay with activity of the abdominal muscles and pelvic floor
- ✓ we palpate laterally under the lower ribs and gently pushing against the lateral abdominal muscle group, we observe the position and behavior of the lower ribs



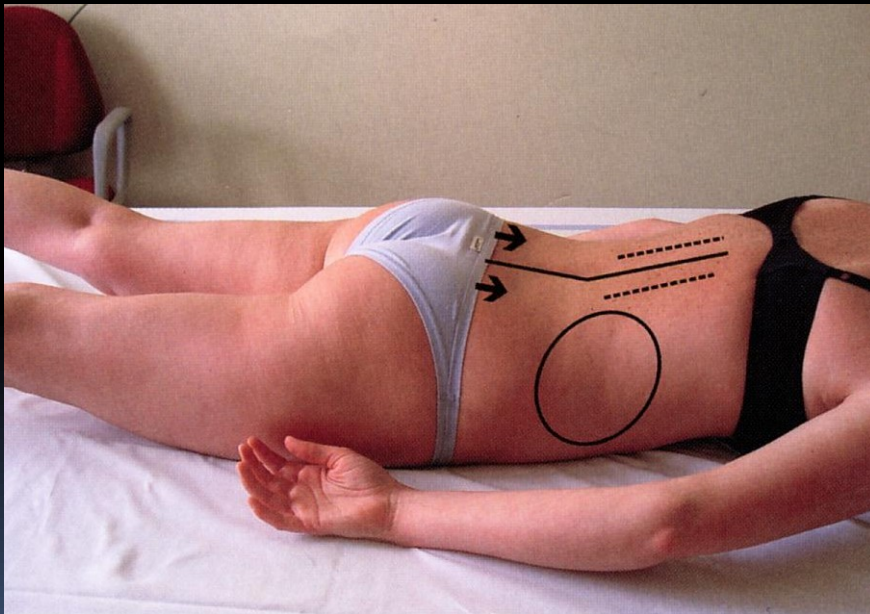
### Insufficiency of the DSS of the spine:

- minimal or no activity against our resistance
- chest does not expand
- ribs when activated migrate cranially



## 5. Test of hip extension

- ✓ we monitor coordination of involvement of back muscles and lateral abdominal muscle groups and ischiocrural muscle activity

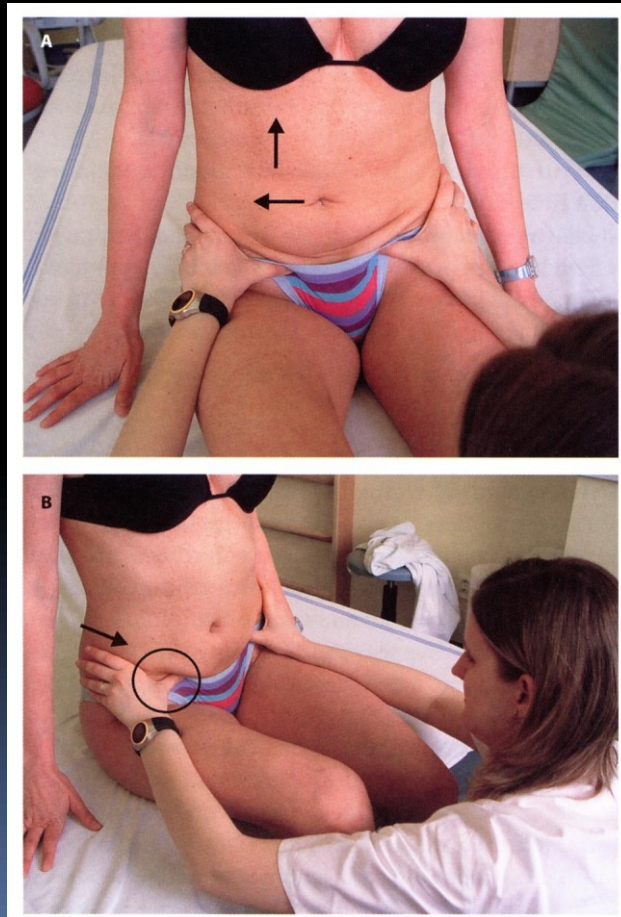


### Insufficiency of the DSS of the spine:

- pelvic anteversion
- hyperlordosis
- kyphotization of TH/L transition

## 6.a Test of hip flexion in sitting

✓ we focus on the activation of the abdominal muscles in inguinal region, on synkinesis of the spine and pelvis and abdominal muscles behavior

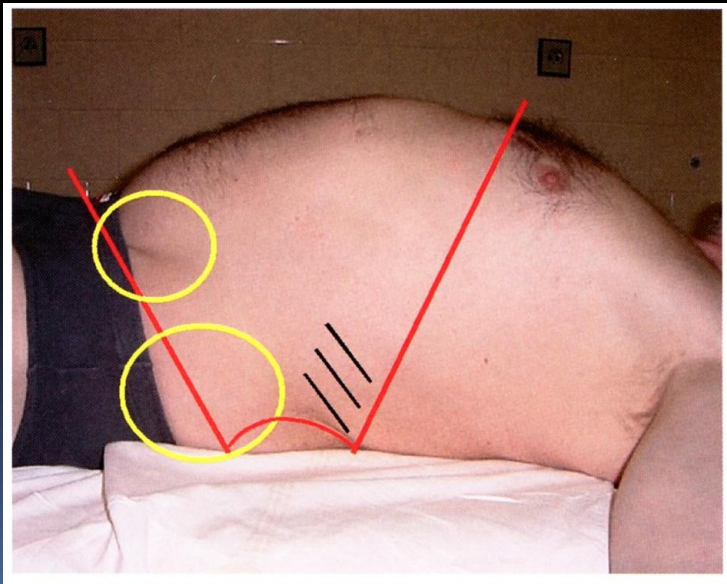


### Insufficiency of the DSS of the spine:

- only minimal activity in palpated area
- pelvic slightly flips into anteversion
- umbilicus migrates laterally

## 6.b Test of hip flexion in supine

✓ monitors the activity of the abdominal muscles and muscles that ends at the upper aperture of the thorax. During flexion of hip abdomen is activated and chest remains in caudal position. Muscles having its insertion at the thoracic outlet are not activated



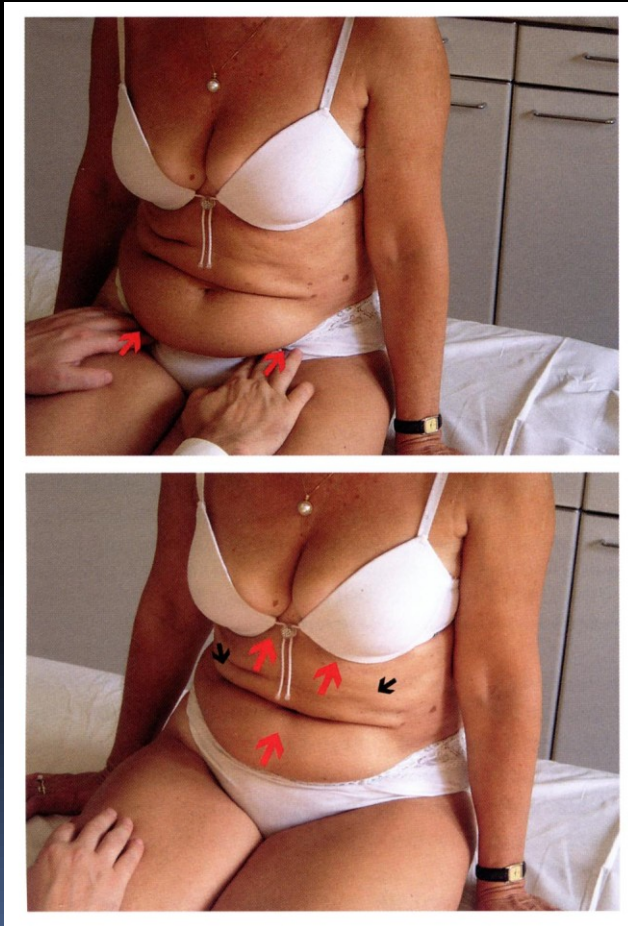
### Insufficiency of the DSS of the spine:

- umbilicus migrates cranially
- concave curvature of the abdominal wall appears above the inguinal ligament
- chest built into the inspiratory position
- the activity of paravertebral muscles significantly increases

## 7. Test of intraabdominal pressure

- ✓ we focus on involvement of the abdominal muscles and chest behavior
- ✓ patient sits on the edge of the table, UL are loose
- ✓ patient activates abdominal wall against our pressure
- ✓ with activation of the diaphragm will first bulge in the abdominal wall in region of lower abdomen, then abdominal muscles are activated

## 7. Test of intraabdominal pressure

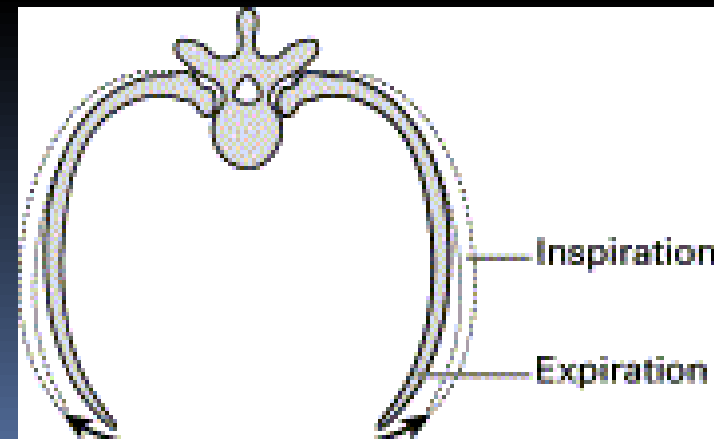


### Insufficiency of the DSS of the spine:

- the upper portion m. rectus abd. and m. obliquus abd dominates when activating against our palpation
- abdominal wall is in the upper half pulled
- umbilicus migrates cranially

# Breathing movements

1. **Lower (diaphragmatic, abdominal)** – from the diaphragm to the pelvic floor
  2. **Medium (lower thoracic)** – between the diaphragm and Th5
  3. **Upper (thoracic, clavicular, upper chest)** – Th5 to lower Cs
- **Caudal** ribs move mainly sideways
  - **Cranial** ribs horizontally
- During inspiration the chest expands:
    - **transversely**  
(upper ribs to 7.r. and sternum)
    - **anterior-posteriorly and lengthwise**  
(lower ribs and diaphragm)



# Examination of the patient by a physiotherapist in the context of RPT

## Evaluation of breathing:

- type, manner and rhythm of breathing, frequency, depth, length of inspiration and expiration ,
- breathing stereotype (examination of breathing wave – *distoproximal*, chest expansion, activation of DSS)

## Musculoskeletal examination:

- kinesiology examination of (posture, muscle imbalance)
- manual techniques (soft tissue, muscles, joints)

## Instrumentation:

- examination of ventilation – **pneumography** (breathing movements), **spirometry** (tidal volumes static + dynamic) – vital capacity, minute ventilation, expiratory flow
- stress testing – spiroergometry

# The principles in the implementation of RPT

The basis is the **correct position and posture**:

- motion axis of the body form hip, spine with chest and head
- posture has a profound affect on respiration
- correction of posture begins with change of pelvis

**Practicing the basic breathing pattern** (vertical sitting position):

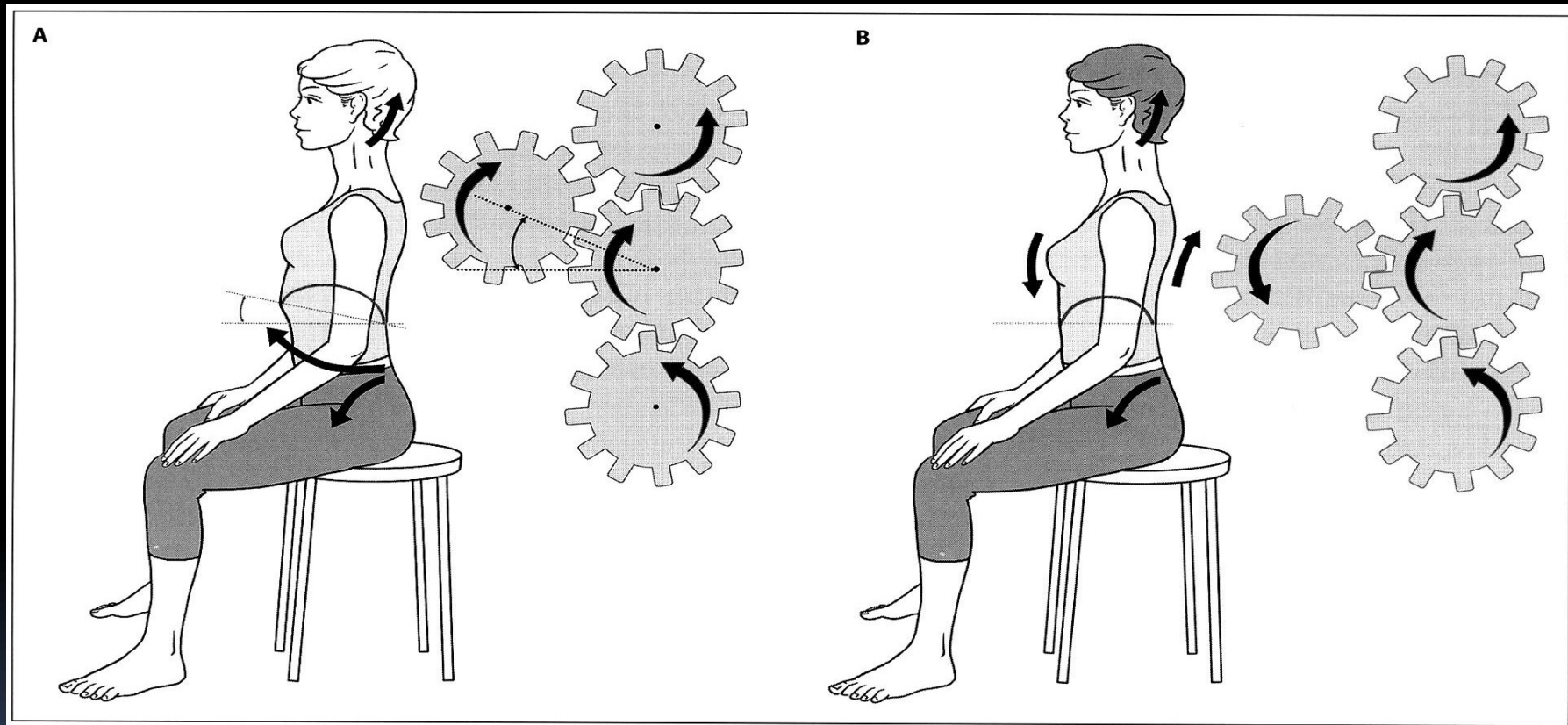
- we start with inhalation through the nose, the mouth is closed
- free exhalation with mouth slightly open, exhalation is first passive, gradually adding muscle activity to exhale and exhale continuously extending until the expiratory pause
- we intercut the corrective work of body with relaxation breaks in concessional body positions and we breath through the mouth

At the beginning of the RPT it is necessary to have **hygiene of airways**

- drainage (expectorant) techniques in combination with inhalation provide removal of phlegm



# Correct posture during RPT



- Brügger concept (recommends lifting of ribcage when straightened spine)

- Kolář (straightening of the Th spine in the max. caudal position of thorax)

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Thank you for your attention 😊



**"Breathing! Wow! What a concept."**