Anatomy – fundamental concepts

Basic functional units of the movement system (bones, muscles, nerves, ligaments)

Bones
Bones are the basic construct of the body. The purpose of bones is to allow movements, to give stability to the body and protection, e.g. the ribcage protecting heart and lungs. Their growth occurs in response to stress they're exposed to. E.g. the bones of the leg align and grow in such a way that they absorb and deal with stress that is put on them during walking, because a child walks from an early age on.

Muscles
Muscles are tissue that allows us to move. They generate force. There are different types of muscles with various tasks. They quickly (meaning within days and weeks) adapt to stimulation, meaning that if you tell a muscle to perform often and hard, the muscles will adapt (within the physiological limits) to that demand.

Nerves
Nerves supply different parts of the body with information. They tell muscles to move, inform the brain if there is a dangerous situation somewhere in the body, they coordinate some aspects of the body.

Ligaments
Ligaments are rope-like structures that stabilize bony connections (i.e. joints) and limit ranges of motions in different joints (e.g. the crucaite ligaments in the knee).

Functional anatomy – Introduction to shoulder joint

In this section, the functional characteristics of the shoulder joint are explained.
The shoulder joint is one of the most complex joints in the human body. Shoulder joint actually doesn’t refer to one joint, but a complex of four joints. Of all the junctions in our body it allows the greatest movement ranges in a three-dimensional plane. The movement that is most obvious is the one of the glenohumeral joint, the joint between humerus and shoulder blade. It is responsible for about 70% abduction in the streamlined position. The glenohumeral joint is prone to instability, because of the gain of mobility it provides. Ligaments and muscles keep the humerus in place. If there is a deficiency of muscle control or ligamentous laxity, the humerus might not move properly in its socket. The other 30% of abduction movement are provided by the

Overview of bones and joints of the shoulder joint
**scapulothoracic joint**, the junction between *shoulder blade and rib cage*. It is a large bone that is gliding on the ribcage. Muscles hold it in place. If the active stabilization through muscles is not properly occurring, it hangs on the **acromio-clavicular joint**. This is the anterior junction of clavicle ("Schlüsselbein") and shoulder blade. You can spot this joint by following the line of your clavicle outwards and palpating the cavity you get to. This joint is also involved in abduction, as well as rotatory movements. In brief, if the scapula moves to allow shoulder abduction, the acromioclavicular-joint is moving as well. The other end of the clavicle is the **sterno-clavicular joint**, which is moving as well during abduction.

**Bottom line:**
- The shoulder is a very complex joint
- Overhead motion in the shoulder is not only due to movement in the glenohumeral joint, but also involves and requires correct motion of shoulder blade

*Classical picture of shoulder joint, non-functional*
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**Movement possibilities of the shoulder complex**
Movements possible in the shoulder complex

**Zero Position:** The arm is hanging at the side of the body with the palm facing the body.

**Flexion:** Functionally this is performed when lifting something up in front of you with straight arms.

**Extension:** Bringing the arm backwards.

**Abduction:** Sideway movement of the arm away from the body

**Adduction:** Sideway movement of the arm towards the body

**External rotation:** From zero position, The palm of the hand is turning outwards by first facing forwards

**Internal rotation:** From zero position, The palm of the hand is turning outwards by first facing backwards

Movement possibilities of the shoulder blade

The scapula allows various movements. Below the movement possibilities are described. Because of the connection to the shoulder complex, the movement of the scapula affects the shoulder joint, too. Therefore, it is thought that improved awareness and control of the shoulder blade improves shoulder functioning and reduces rate of injury.

**Elevation** The shoulder blade slides upwards on the torso such as in the shrugging of the shoulders.

**Depression** From an elevated position, the scapula slides downwards, towards the butt on the torso.

**Protraction** the scapula (shoulder blade) slides forward, away from the spine.

**Retraction** the shoulder blade slides towards the spine, the same as during the pinching of the shoulder blades together.