

I. Division of the trunk (including shoulders and neck) into three segments (Figs. 7, 10)

Practical observation of persons with postural disorders showed that it was useful to divide the trunk into three segments, from caudal to cranial:

- a) lumbar spine with pelvis
- b) thoracic spine with rib cage
- c) cervical spine with shoulder girdle (and head)

In a healthy person, these three segments can be represented by rectangles.

- a) The caudal rectangle is formed by the pelvis, lumbar spine, hypogastric region including umbilicus, up to the lower ribs.
- b) The next rectangle is formed by the chest and epigastric region. The lower border is the waist (12th rib) and the upper border the axilla (about the 3rd rib).
- c) The third rectangle is bordered caudally by the upper border of the middle segment. The upper or cranial border is in the region of the acromion. The cervical lordosis lies outside of this upper segment. However, as the cervical spine belongs functionally to this third segment, it can be imagined as running cranially to the beginning of the occiput.

The three segments are stacked vertically on top of each other. The body is balanced.

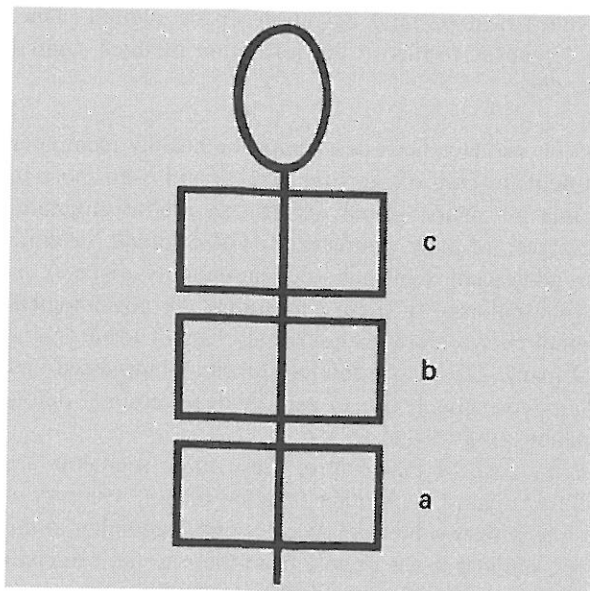


Fig. 7: Frontal view.

Viewed laterally, however, they are trapezoidal as a result of the physiological curves of the spine.

The caudal segment (trapezium a) has its lower border in an imaginary line passing through the two anterior superior iliac crest, extending dorsally to L5. With the pelvis in an erect position, this line runs horizontally. The upper border passes through the lower ribs and ends at T12.

The middle segment (trapezium b) includes the chest and epigastric region. The lower border is the upper border of trapezium a). The upper border runs along an imaginary line at the level of the armpits, the level of the cranial sternum between the clavicles and over one third of the shoulder blades dorsally up to T6. The upper segment (trapezium c) is bordered caudally by the cranial line of the middle segment. The upper border is formed by the shoulder level. Since the cervical spine is part of it functionally, one imagines trapezium c) elongated cranially to the occiput and mandible. This part is therefore called the shoulder-neck segment. These three segments are balanced over the centre of gravity.

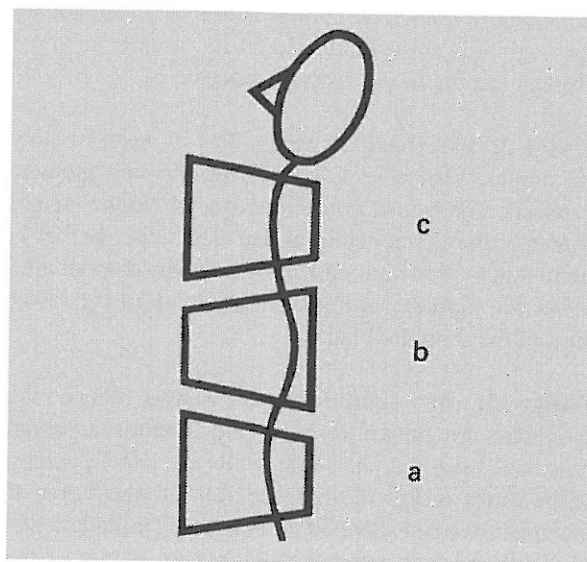


Fig. 8: Lateral view.

II. Symmetrical postural deviation in the sagittal plane

Symmetrical postural deviation in the sagittal plane, or kyphosis, results in the formation of three sagittal 'wedges'.

So far we have been describing the healthy locomotor system. In case of postural defects and even more in minor or major spinal deformities, these structural changes are more pronounced. For example, juvenile or adolescent kyphosis (Scheuermann's disease) or kyphoscoliosis. In these conditions, the physiological spinal curves show pathological changes in the sagittal plane. The spinal column appears compressed and shortened, giving rise to pathological vertebral deformations (Figs. 9 and 15-19)

In the case of malposture, these three segments are shifted against each other (sagittal plane), resulting in a line with two breaks (lateral view); beginning at the feet, running to the pelvis, from there to the back and continuing up to the head (Figs. 9, 14,15).

Due to the shifts of the three segments caused by the collapse of posture, the three segments appear as 'wedges' on top of one another – the short side of the trapezium becoming shorter and the long side of the trapezium increasing in height – and these really do have the appearance of wedges (Fig. 13). The more pronounced the deformity, the more extreme the wedging and the collapse of the back.

Lateral view (Figs. 15–17)

Wedge 1: The lumbopelvic wedge has its vertex in the lumbar lordosis. The wide side (abdominal wall) is formed by stretched abdominal muscles and the anterior iliac crest, sloping in the ventrocaudal direction forming the caudal border. The cranial border is an imaginary line beginning at the lumbar lordosis, passing the lower ribs and leading to the xyphoid process.

Wedge 2: The chest-rib wedge has its vertex below the nipple. The wide side is formed by the thoracic kyphosis. The caudal border corresponds to the cranial border of the lumbopelvic wedge. The upper border is an imaginary line running from the narrow anterior area below the nipple, passing the armpits up to the lower third of the shoulder blade.

Wedge 3: the shoulder-neck wedge: Since the shoulders are drawn forward, the anterior acromial processes form the wide side, while the exact position of the vertex is difficult to define. It lies in the region of the upper two ribs covered by the shoulder blades. The caudal border corresponds to the cranial border of the chest-rib wedge. The cranial border is formed by the

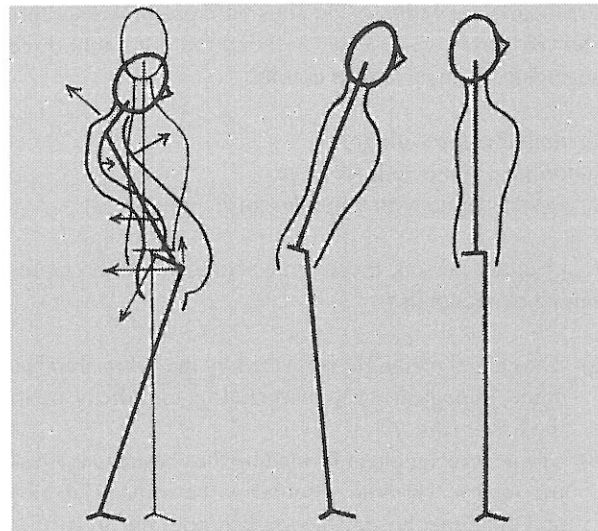


Fig. 9: Pathological body shape: wrong - overcorrection - correct

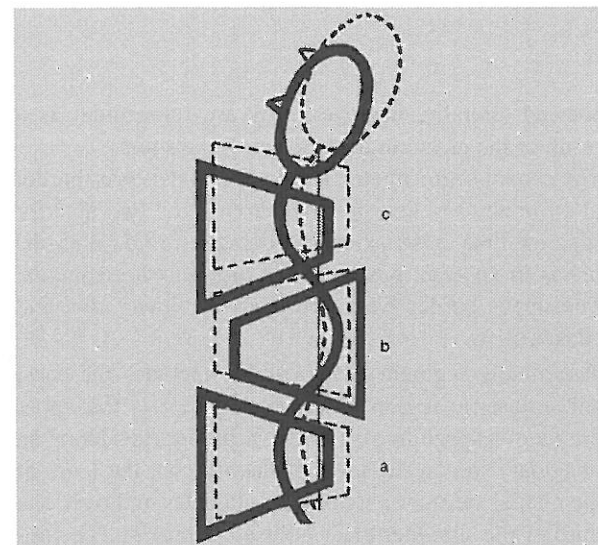


Fig. 10: Lateral view: pathological and normal shape.

- c: neck-shoulder wedge
- b: thorax-rib wedge
- a: lumbar-pelvic wedge

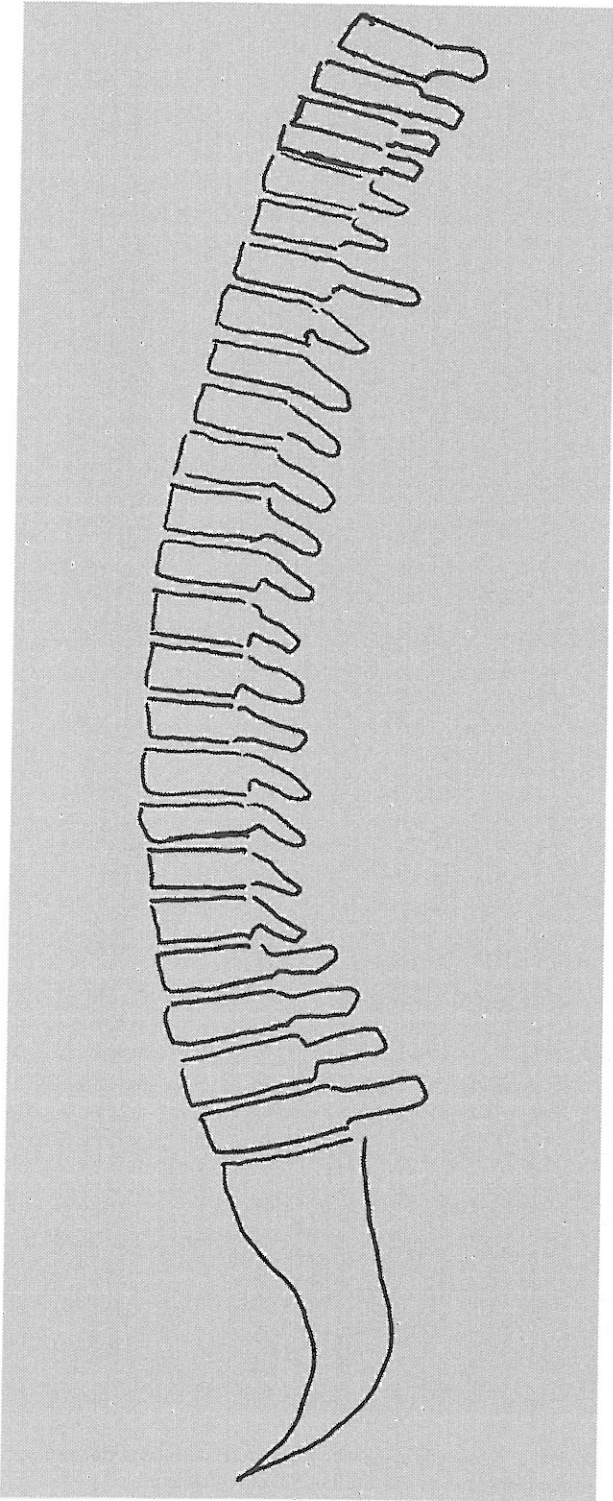


Fig. 11: Lateral view of a hollow back (thoracic lordosis). In hollow back, the physiological oscillations of the vertebrae are reversed. See page 188 and Figs. 533 and 583.

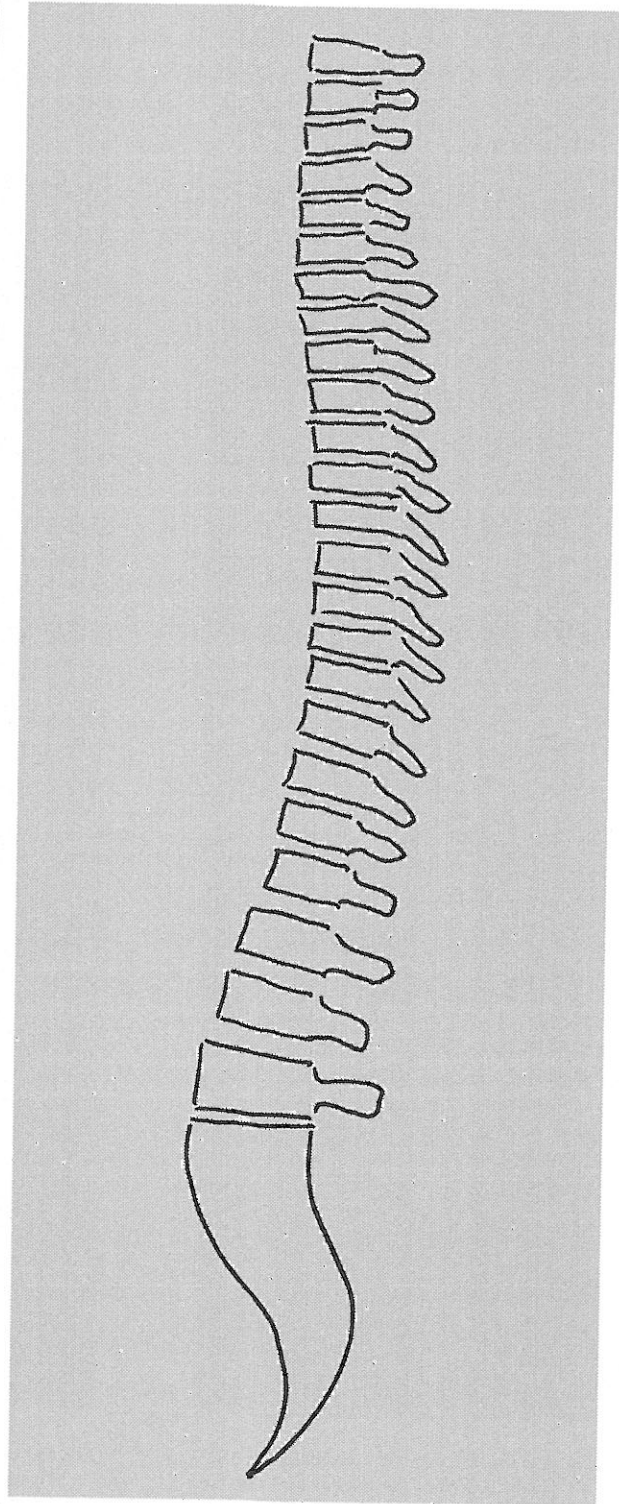


Fig. 12: Lateral view of flatback. In flatback, the physiological oscillations of the vertebrae are reduced. See page 173.

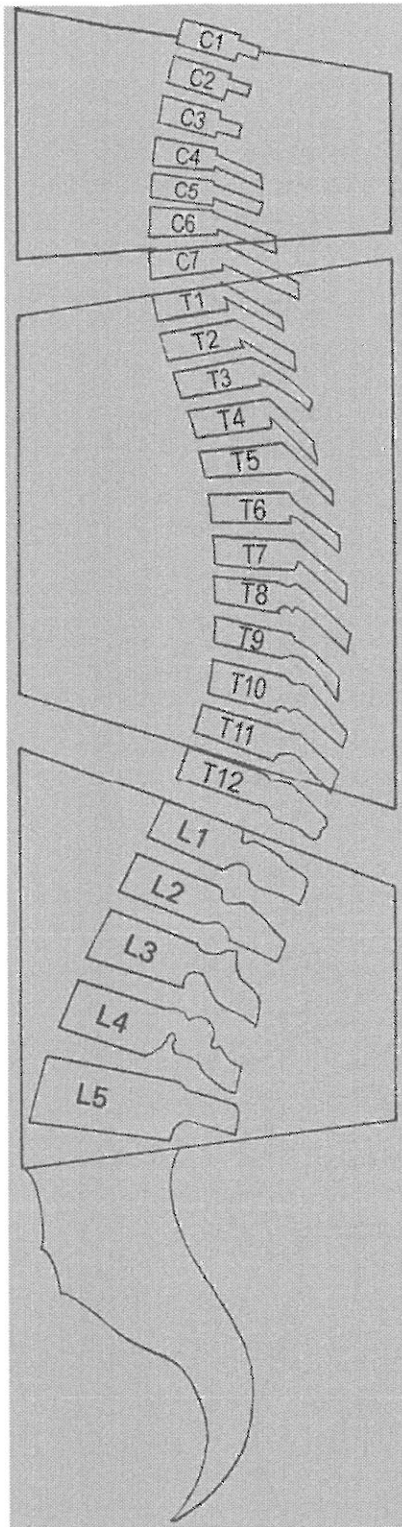


Fig. 13: Lateral view of a normal spine. Kapandji describes the lumbar lordosis of a dynamic type to be about 90°; the spine shown in Fig. 14 belongs to a static type, which is more often found in children (spine without a scoliotic component).

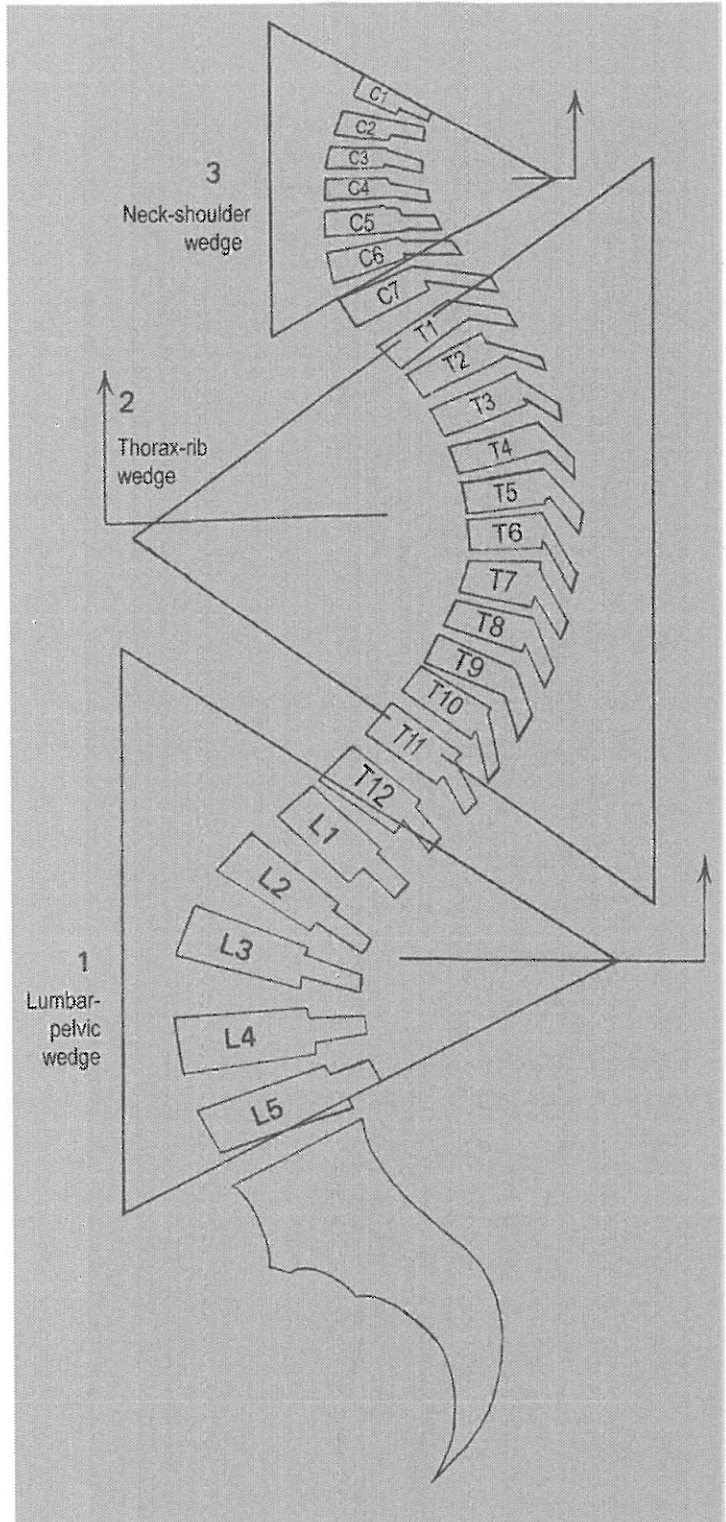


Fig. 14: Lateral view of a kyphotic spine with the postural defect described above. The right angles marked show the directions of the correction. See Figs. 9 and 472.

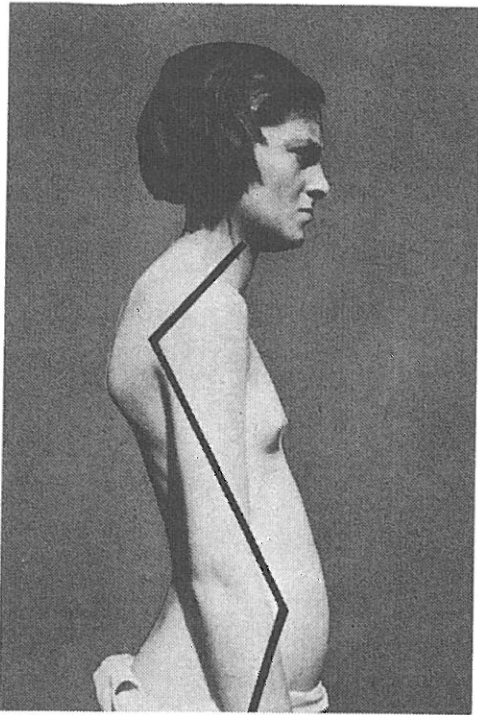


Fig. 15: Double 'broken' axis showing postural collapse.

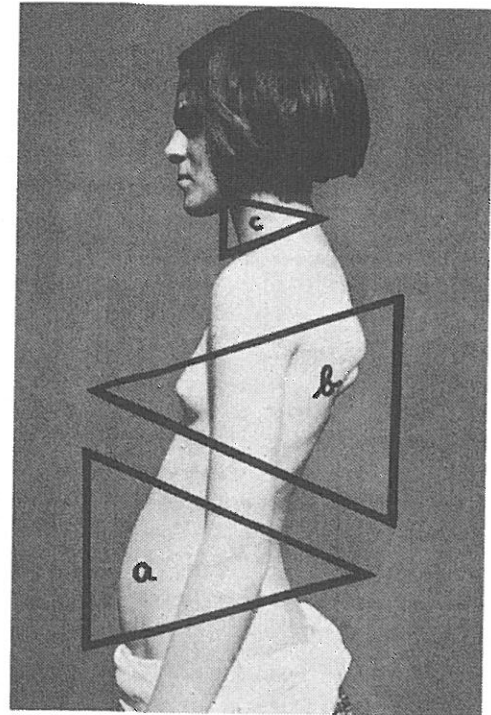


Fig. 16: The resulting 'wedges'.

shoulder level. Since the cervical spine forms a functional part of this wedge, the vertex is in the cervical lordosis and the wide side is formed by the hyperextended anterior neck portion. These two wedges may also overlap and in some cases can be seen as one large wedge theoretically.

The above applies to symmetrical postural disorders in the sagittal plane.

In the scoliotic body, the trunk also shows wedge-like deformities in the sagittal plane.

This is only true for the lateral view of the 'rib hump side'. This is because of the torsion of the trunk segments against each other.

For idiopathic scoliosis at least, it has been assumed that the lumbar spine has decreased lordosis while the thoracic spine tends to present a lordotic postural deformity (Dickson, Tomaschewski: see the sections on flatback).

Of course, there are structural changes of this type that cannot be corrected actively, such as cases with a partly fixed deformity (Meister, Heine). In the presence of deformity, different parts of the body segments adapt their appearance to the spine, and functional three-curve scoliosis can exist even in the presence of only minor lumbar and cervical countercurvatures. Treatment is adapted to the individual situation.

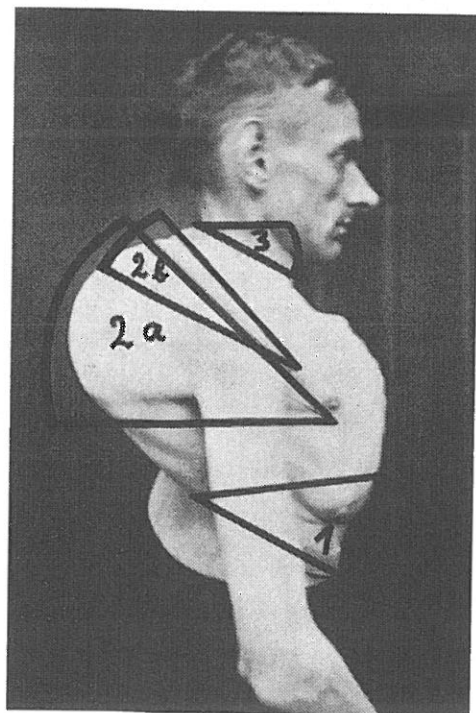


Fig. 17: Lateral view.

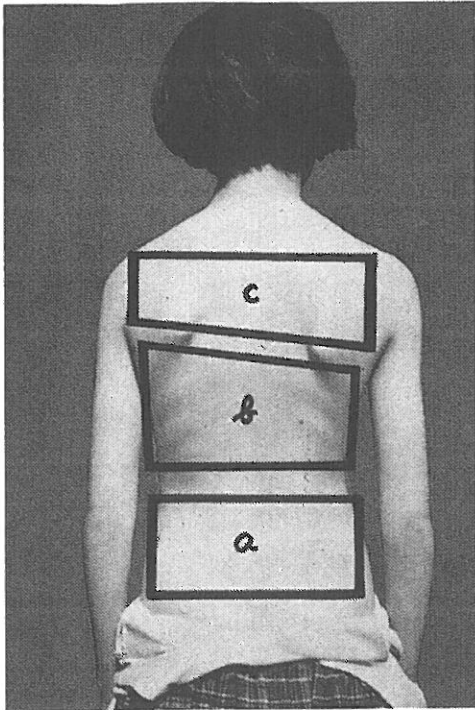


Fig. 18: 11-year-old girl with malposture and incipient left convex scoliosis.

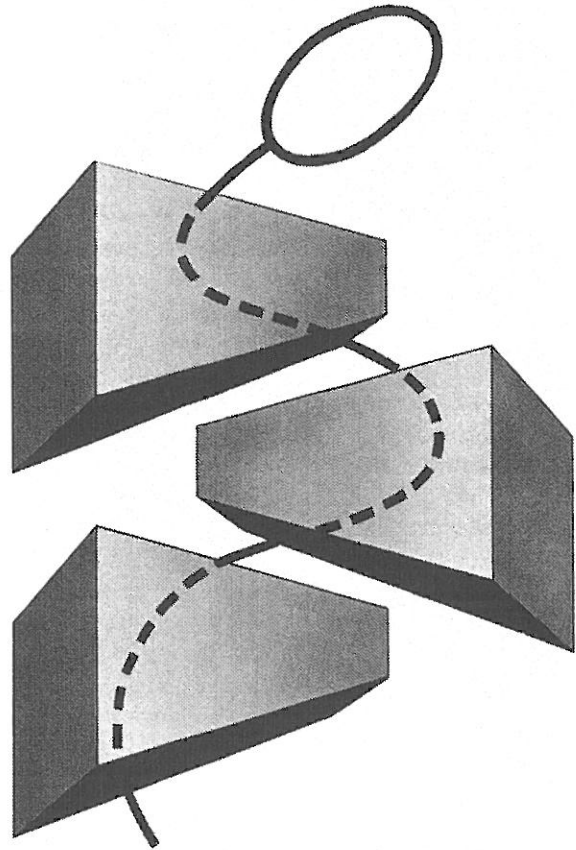


Fig. 20

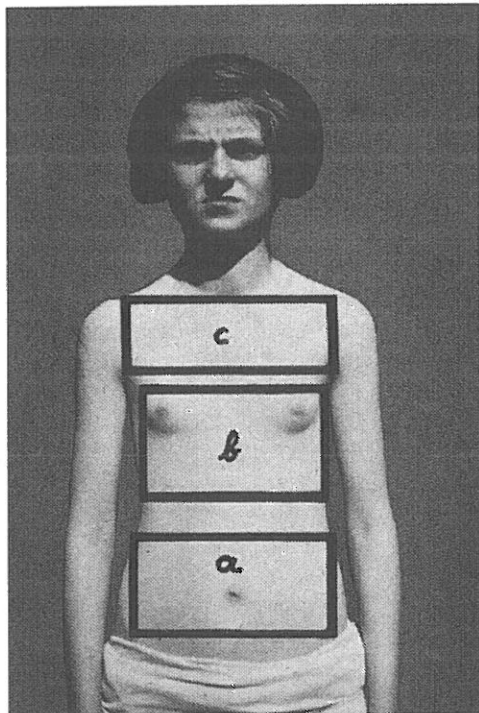


Fig. 19: The three blocks are still almost rectangularly superposed.

The 2nd, chest-rib wedge can be subdivided into two parts in cases of major scoliosis and kyphoscoliosis (Fig. 17). The vertex of wedge 2a is below the nipple and the wide side is bordered by the posterior rib hump; the vertex of wedge 2b is located in the region of the subaxillary rib portions. The corresponding wide side is formed by the kyphotic curve which begins at the shoulder. It shows the most cranially located thoracic hump. These two wedges can merge into one another.

Wedge 4, the wedge of the anterior rib hump, is on the dorsal concave side (Fig. 21). The vertex lies in the posterior concavity and the wide side is formed by the anteriorly-orientated ribs of the dorsal concavity. The caudal border is an imaginary line which begins at the concave posterior ribs and leads along the lowest ribs towards the umbilicus. The cranial border runs from the posterior concavity to a point below the nipple. This creates the scoliotic balance of the body and brings all body segments that deviate anteriorly or posteriorly above the centre of gravity. They balance each other out.

In the following, the terms 'concave' and 'convex' side always refer to the thoracic spinal curvature.

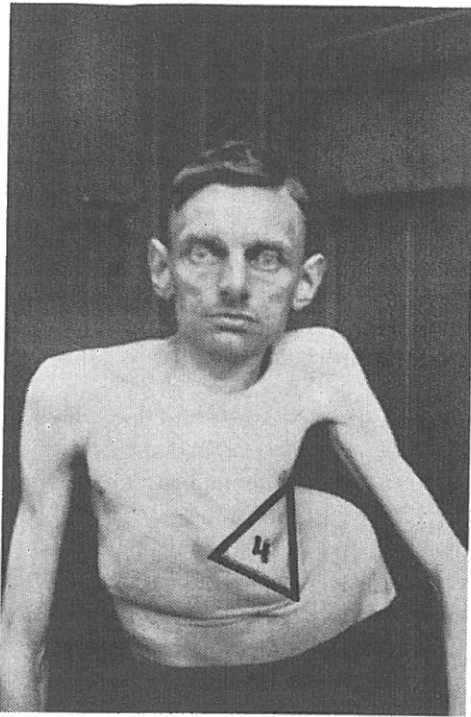


Fig. 21: Frontal view.

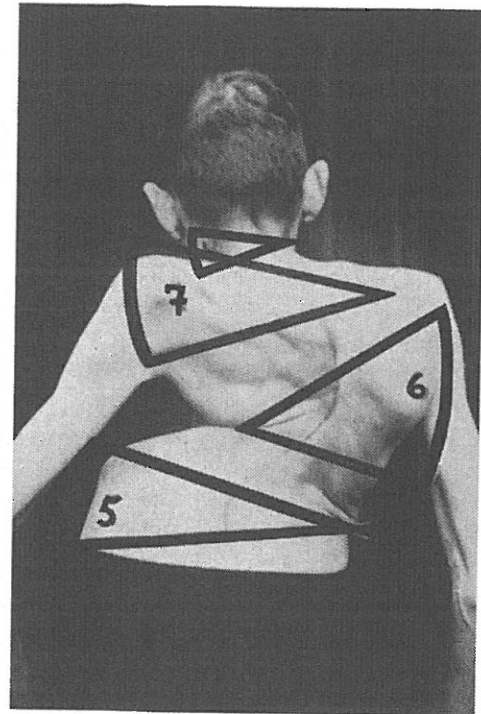


Fig. 22: Posterior view.

III. Postural deviation in the frontal plane

In scoliosis and kyphoscoliosis, the deviation in the frontal plane leads via a trapezoid to the formation of three lateral wedges (Figs. 20–23). While scoliosis is characterized more by lateral form deviations, in kyphoscoliosis, the sagittal and frontal deviations are present together. Looking at a scoliotic body from the back, we can see that the three trunk segments (pelvic girdle, rib cage, shoulder girdle) are not aligned as rectangles as they are in a healthy body. They have shifted against each other. These lateral deviations and the changed pressure and traction first twist the originally rectangular segments into trapezoids and then wedge-like segments (Fig. 23).

Dorsal view:

Wedge 5: lateral lumbar-pelvic wedge (Figs. 20, 22 and 23)

The vertex of the wedge is below the lateral rib hump (11th and 12th rib). The wide side is formed by the prominent lumbar convex-sided hip and, very often, also by the upper lumbar hump. Its caudal border is formed by the iliac crest sloping downwards on the side of the dorsal concavity due to the lateral shift. The cranial border can be seen as a line extending from the vertex of

the wedge leading to the ilia of the dorsal concave side, i.e., the highest point of the lumbar hump of this side.

Wedge 6: lateral chest-rib wedge (Figs. 22 and 23)

The vertex of the wedge is at the lowest point of the dorsal concave side. The wide side is formed by the lateral rib hump. The caudal border is also the cranial border of the 5th wedge, while the cranial border leads from the vertex of the wedge obliquely across the upper thoracic vertebrae to the middle of the shoulder blade on the convex side.

Wedge 7: lateral shoulder-neck wedge (Figs. 22 and 23)

- a) Most often the vertex is located above the thoracic hump (covered by the shoulder blade). The wide side is formed by the shoulder on the side of the dorsal concavity. Its caudal border runs parallel with the cranial border of wedge 6. The cranial border is formed by the shoulder levels on both sides.
- b) Functionally, the cervical spine forms part of this. The vertex is therefore in the shortened cervical muscles of the dorsal convex side and the wide side