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THE LUMBOSACRAL SEGMENT AS A VULNERABLE REGION
IN VARIOUS POSTURES

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16. Abstract The Lumbosacral region in man is exposed to special static and dynamic load. In a supine position, the disc size increases because of the absence of axial load. In a standing position, with physiological posture of the spine, strain discomfort occurs which is increased even more in the sitting position due to the curvature of the lumbar region of the spine and the irregular distribution of pressure in the discs as a result of this. This special problem of sitting posture can be confirmed by examinations.			
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The human spine has two functions to perform, one static and one dynamic. For the most part, they are interconnected. With regard to the first, its function is to be loaded in the longitudinal axis by the weight of the body. The load line does not run through the center of each vertebral body, but is displaced as a result of the sagittal curvature in the shape of a double S. However, because of the shape of the individual segments, the load on the discs is nevertheless uniform. Secondly, the spine must cushion changing loads, such as are produced while walking or during a change of posture. During a change of posture the bending movements of the spine are physiological. These occur rapidly and thus improve the metabolism in the bradytrophic tissues of the movement segments. /537*

The necessity of having to perform two different functions explains the fact that the spinal column is not optimally equipped for one of the two load functions alone. The exclusively static load adversely affects the metabolism in the discs, especially during a forced change in the shape of the spinal column. The exclusively dynamic function, such as occurs during weightlessness, causes a slow change in the spongiöse structures in the vertebral bodies. /538

The weak point in this system is the transition region between the mobile lumbar area of the spine and the sacrum fixed in the pelvis. This is the site of 70 per cent. of the

*Numbers in the margin indicate pagination in the foreign text.

flexion/extension movement of the entire lumbar region of the spine, contributing to the greatest static load, since the erection of the spine in humans takes place primarily in this region (Fig. 1). A special load of the lumbosacral transition region is therefore typical for man and manifests itself in degenerative changes here with an early onset (Fig. 2). These in turn upset the harmony of the path of movement and shift the load into the adjacent regions.

The different postures of man have their problems especially in the lumbosacral region. After a long period of lying in a fixed position--for example, in a plaster cast--there develops a greater amount of fluid uptake in the discs, in spite of physiological spinal configuration, due to the lack of axial spinal load and the lack of movement. The discs increase in size and an expansion pain occurs in the posterior longitudinal ligament. In addition, the spine becomes slow to react. In the extreme case, a slipped disc may occur as a result of a sudden change in posture.

In the standing position, the physiological curves of the spine are maintained (Fig. 3a). The pressure is uniformly distributed in the lumbosacral disc. Discomfort arises due to the static load and should stimulate movement. They are the result of ligamentous strain and not the expression of an irregular distribution of pressure in the hydroelastic system. Degenerative changes develop exclusively as a result of the unavoidable load on this region caused by holding the body erect.

In the sitting position, the shape of the spine is influenced by the position of the hip joint. During severe bending at the hip the lumbar region of the spine is stretched or is even made kyphotic. Seventy per cent of this bending

occurs in the lumbosacral segment (Fig. 3b). The result is uneven disc strain with an increase in intradiscal pressure. As in the lying and standing positions, load peaks can be reduced only by a change in posture. For the unfavorable static sitting position with kyphosis of the lumbar region, there is thus the compound problem of the axial spinal load and the load due to an uneven distribution of pressure in the intervertebral disc. Nine out of 10 test subjects had a poor sitting posture with respect to the way they held the lumbar region of the spine. And yet they had the feeling of sitting comfortably. Therefore, it is not surprising that 85 per cent of a group of patients being treated for persistent lumbago stated that their discomfort occurred especially while in a sitting position.

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Static body postures are problematic for the human spine. If, in the standing position, the lumbosacral segment is strained in its normal position, then in the sitting position there is also a forced and uneven distribution of pressure in the disc due to kyphosis of the lumbar region of the spine. If the axial load on the spine due to holding the trunk erect is unavoidable, then by correcting a long-term sitting posture it must be attempted to avoid the additional bending of the lumbar region of the spine (Fig. 3c). The adaptability of man should not unnecessarily be taken advantage of, especially in the choice of static sitting postures. For the lumbosacral segment, an adverse, long-term body posture may easily be a factor which causes early troubles and late injuries as a result of degenerative changes which have not yet become manifest.

Figures Captions.

Fig. 1. Model of the lumbar region of the spine in lordosis (left) and kyphosis (right). Seventy per cent of the total

flexion/extension movement takes place in the lumbosacral segment, 20 per cent in the segment immediately above this and 10 per cent distributed over the remaining segments. This, in conjunction with the static conditions, gives rise to the special load on the lumbosacral transition segment.

Fig. 2. Thirty-seven-year-old male. Pronounced arthrosis which is especially localized on the lumbosacral transition segment with a decrease in disc size, changes in the upper plate of S1 and the bottom plate of E5 and in the small vertebral joints.

Fig. 3a.to 3c. Sketeches of the lumbosacral transition segment in standing position with lardosis of the lumbar region of the spine, in the sitting position with kyphosis of the lumbar region and in the sitting position with lordosis of the lumbar region. In the case of lordosis, physiological, i.e. uniform disc compression in the lumbosacral region, in the sitting position with kyphosis, irregular pressure distribution in the disc with ventral load peaks.