Opinion II

BALANCED SEATING

An Effective Way of Reducing Back Problems

In the industrialized world more than half the population is thought to be suffering from some form of back ailment. With the computer age, the numbers seem to be rapidly increasing. Apparently there is a general agreement that straining of the back is a primary factor in provoking backaches. But nothing will give as long lasting strain to the back as the fact that most of us spend a good deal of our lives in a sitting position with flexed backs. Already from the age of 6-7, children will spend several hours every day hunched over their desks in positions extremely harmful to the back.

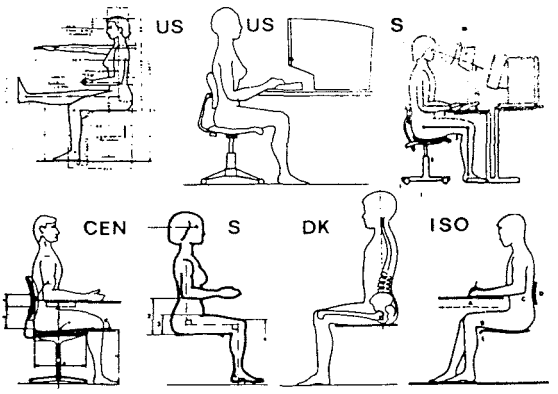

Fig. 1 Sketches concerning the basis of International Standardization (ISO & CEN), training designers (U.S.) and training of people to sit "correctly" (DK).

Fig. 1 Croquis concernant la standardisation internationale (ISO & CEN), la formation des concepteurs (U.S.) et la manière générale de s'asseoir "correctement" (DK).

Experts from all over the world have formerly been of the opinion that the right-angled or erect position is the only correct sitting position. This is illustrated by a selection of drawings from various countries in Fig.1. They clearly demonstrate persons sitting with a 90º flexion in the hip joint combined with a preserved lordosis (concavity) in the lumbar region. All are sitting with horizontal axis of vision. Lumbar support has been considered the means to achieve a good posture. The sketches constitute the basis of International Standardization (ISO & and CEN), training of designers (U.S.) and training of people to sit "correctly" (DK). The sketches

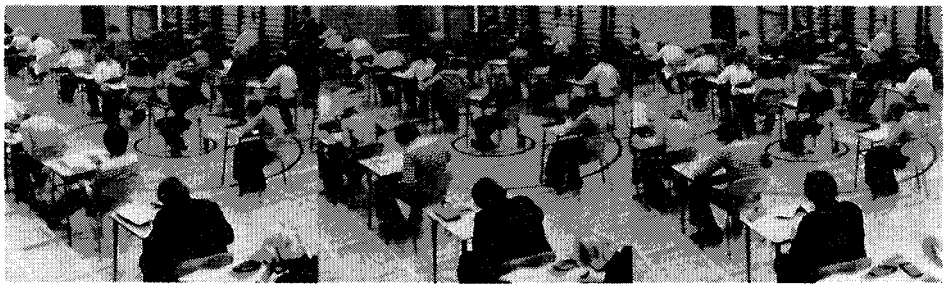

Fig. 2 Pupils after 90 hours of "sitting lessons" in Scandinavia - postures most harmful to the back.

Fig. 2 Des écoliers après 90 heures d'entraînement à une position assise correcte - tous continuent à adopter une mauvaise position.

look very nice, but unfortunately nobody is able to sit in this erect posture while working. You need so much muscular power to maintain this posture that you will be exhausted after 1-2 minutes and then you will continue to slump as usual. During the last fifty years, all furniture in schools, offices and factories, have been constructed to conform to the illusion of the "correct" right-angled posture. The right-angled posture is only based on traditions from the Victorian age and there is absolutely no scientific basis for it.

In order to prevent backaches some schools in Scandinavia have tried very hard to teach their pupils to sit more "correctly" in the right-angled posture with preserved lordosis on ISO furniture. In a municipal school authority (Gentofte) the pupils have had 90 lessons during five years in the "correct" sitting position.

The poor results of these efforts can be seen on Fig. 2. The photos are taken with a time-lapse camera with a 24 minute intervals during a four hourly examination. All the pupils are sitting with postures most harmful to the back. The lumbar support has evidently no effect while reading and writing.

Anatomical studies by Schoberth & Keegan have explained why it is impossible to sit "right-angled". Through x-ray examinations, they were able to prove that it is only possible to bend 60º in the hip joint in a seated working position. The remaining 30º flexion comes from the lumbar region. The drawing shows the upright resting position with horizontal axis of vision. To be able to read, the pupils have to bend a further 20-40º in the lumbar region to get their eyes in the optimal visual distance, which is 30-40 cm for this age group. Besides, they have to bend their neck to a similar degree.

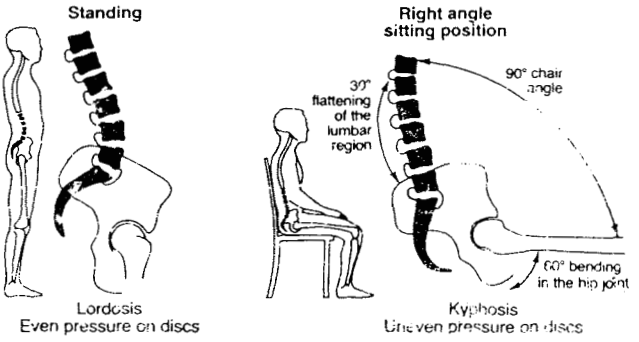

Fig. 3 Standing position and right angle sitting position.

Fig. 3 Position debout et position assise avec angle de 90º.

This means that you will normally sit with an extreme flexion or cyphosis in the lower back. This will strain the back to a very high degree and it explains why more than 50% of this age group (shown in Fig. 2) have back problems. The easiest way of attaining a better posture is by opening up the angle between the thighs and the body. When the thighs are sloping enough (about 30º), it is not necessary to bend in the lumbar region. You can sit upright and the spine can maintain its natural S-shape. This sitting posture is a healthier position and it allows the spine to carry the body weight in a more comfortable way. This is "Balanced Seating". It will allow you to move more freely and you may breathe with the abdomen.

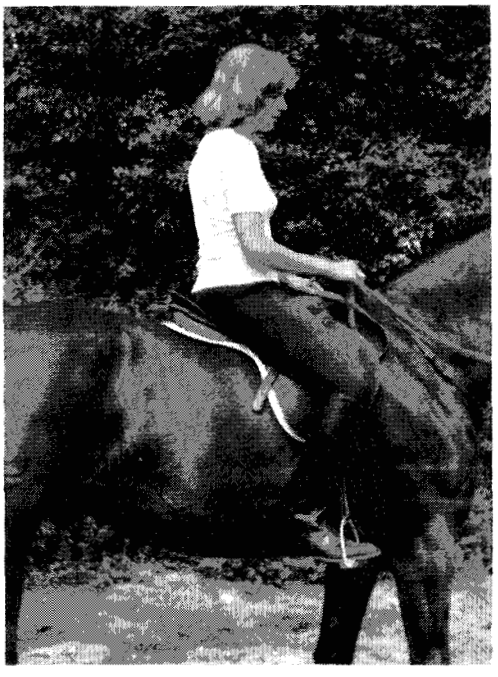

Fig. 4 When riding a horse the lumbar curve is maintained.

Fig. 4 La position du cavalier lui permet de maintenir la courbe lombaire.

When riding a horse, one sits upright but can maintain the lumbar curve because the thighs are sloping downward below horizontal. The rider maintains "Balanced Seating" by innumerable small muscular adaptations, so the body continually moves around a vertical axis. Children like to tilt forward on the front legs of their chairs to relieve back pressure and tension. By tilting forward they obtain a sloping axis of the thighs and will automatically sit with a straighter back. An even more comfortable seated position is obtained if the seat rotates around a transverse axis, so that it will follow your movements forward and backward. These types of tilting chairs are now becoming generally accepted in offices in many countries. Especially the users who have back and neck problems will benefit from the forward sloping seat.

To obtain sufficient slope of the seat, higher furniture is a great advantage. Some years ago I tested a large group of persons, and asked them what height of furniture they preferred. All wanted 15-20cm higher furniture, provided the seat and the desk top were sloping against one another. In the preferred position, they were all sitting with a much straighter back than on standard furniture.

To further evaluate what effect the furniture height and the forward tilting seat had on the flexion of the back, I conducted an experiment to document the results. I recorded the changes in flexion of the various parts of the body, and marked the following anatomical points: the knee-joint, hip-joint, 4th lumbar disc and the shoulder-joint. The participant was seated at a fixed height for the seat and work surface but the feet were placed incrementally at three different positions to simulate different work heights. To start, the person was positioned at the ISO standard furniture with the seat sloping 5º backwards (Fig. 5A), then the seat and the work surface were tilted and the position of the feet lowered to simulate an increase in the seat and work surface heights (Fig. 5B and 5C). Fifty photographs of each of the three positions were taken by time-lapse camera during a period of 10 days to record the changes in the flexion.

The average flexion of the lumbar spine is showed on the photos. In the highest position (seat height 63cm and desk height 92cm) the flexion was reduced by 32º. The flexion of the neck and hip-joint was also much reduced. In this position the body was sitting in a perfect posture for "Balanced Seating". There is no need for lumbar support and the posture is almost the same as that of a rider on horseback. The person concerned definitely preferred the highest furniture.

A few years ago I succeeded in constructing a simplified and inexpensive type of school furniture, which has proved to be very effective in reducing back problems and in improving the posture of students. The new furniture has already been accepted to such an extent that several municipal school authorities in Denmark and Sweden have decided gradually to exchange all the old ISO furniture. A major part of the production of new school furniture in the two countries is now based on this new type of furniture.

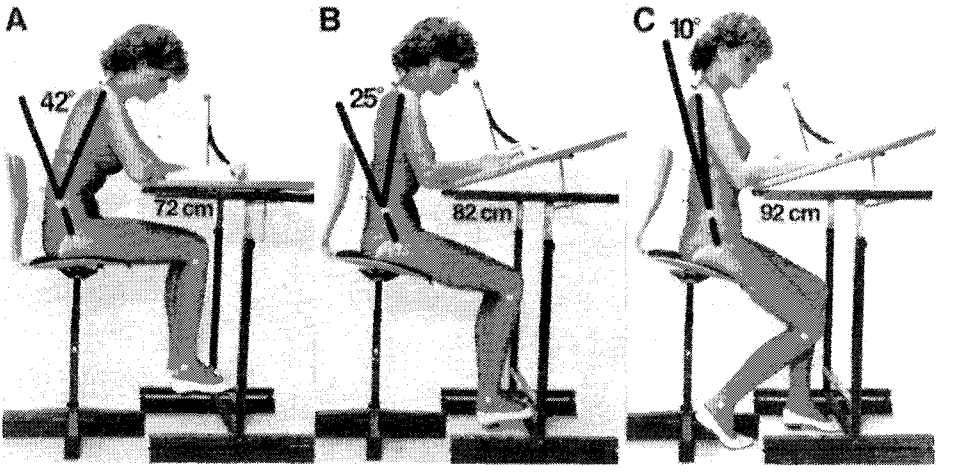

Fig. 5 Progressively nearing the "perfect position" (C).

Fig. 5 *Recherche de la "position parfaite" (C).*

Prevention of back problems must start already at school age. The ISO standard furniture and the "right angled" sitting posture will result in quite unacceptable working postures in spite of the most intensive training (Fig. 2). By means of much higher furniture with seats and desktops sloping towards one another, it is possible to improve the posture considerably and to reduce the strain and pain of the back. The same principles can of course also be used with advantage in offices and factories to reduce back pain. The ISO standard furniture is entirely based on morals, discipline and aesthetics of the Victorian age. In future the majority of the employees in the information society will spend most of their working day in a seated position with highly repetitive work. This will strain the backs and necks to a very high degree. If the pupils have damaged their backs before they finish their school education, some of them will not be able to perform this kind of work for more than a few years. In future it might be an idea to let the users themselves decide what kind of furniture they want to use. After all, they often have to sit with the pain for many hours every day. The present day of standardization of furniture in schools, offices and factories is quite unacceptable, as it means a great risk to the health of the users.

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