
ELECTRO-MYOGRAPHIC ASPECTS OF THE STANDING WORK POSITION ⁽¹⁾

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The work that I wish to present to you in this paper was carried out, first by with the aim of studying the dentist's standing work posture.

As the work progressed, we became aware that all the peculiarities of this special posture were to be found in any other profession provided the latter was exercised in the standing position, with a frontal field of work.

For this reason, we did not limit our research to the dentist's specimen-position,

but we made our subjects work at variable heights.

Using 17 youthful subjects, we took an orthogram in 5 progressive positions: bending forward and working at different heights, the highest being located at a height 95 cm from the floor, the lowest one 75 cm; the other positions were in between.

On the orthograms, the inclination of the various vertebral segments was determined by linking the spinous processes of the vertebrae L₅, D₁₂, C₇ and the tragus. The retro- and anteversions of the pelvis were measured with an inclinometer attached to the posterior face of the sacrum.

In each position, we took an electro-myogram of the rectus abdominis, the abdo-

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minal obliquus, the gluteus maximus, the leg biceps, the soleus muscles and the latissimi dorsi (lumbar).

In the standing position of work, the centre of gravity was displaced forward because of the anterior inclination of the body and the elevation of the arms; the line of gravity approached the anterior limit of the base of support, which gave rise to a reaction from the body's posterior musculature in order to maintain the balance.

It should be noted first of all that, in this working position, all the dorsal muscle groups are not solicited in the same way.

With regard to the latissimi dorsi, several authors have verified a greater activity in the servical part, as well as in the trapezium.

This cranial muscular overload is probably caused by the fact that the inclination forward above all involves the cervical column. Indeed, when the orthograms of the ordinary standing position are compared with those of the 5 progressive work positions, it is always noticed that the inclination of the various vertebral segments increases from bottom to top.

In the position of least inclination, we have found, on an average, that the dorsal segment inclines 35 % more than the lumbar segment, whereas the percentage for the cranial segment rises to 179; for the lowest position, the inclination reaches 20 % for the dorsal segment and 84 % for the cervical segment. I believe that these results can give us an explanation for the fact that the backaches afflicting workers in standing postures are located so frequently in the cervical region; we should then demand that pause gymnastics for standing workers, should be especially directed to the upper part of the dorsal muscles.

A very important observation is that the pelvis is hardly involved in forward inclination of the trunk; the angle of the pelvis anteverision in the working posture never exceeds by more than one-sixth that of the forward inclination of the lumbar segment, which results in the passive approximation of the sternum and the symphysis.

One often blames the sitting working posture for giving rise to the relaxation of

the abdominal muscles, which may bring about in the long run an atony syndrome with intestinal ptosis and digestive troubles, a lumbar hyperlordosis with pains in that region, circulatory troubles, etc., It is undeniably a case of a true professional illness.

This relaxation of the abdominal muscles is caused by the fact that, in the sitting position, the pelvis is in retroversion and the lumbar column is slightly inclined forward.

Since in our standing posture the deviation of the lumbar column is very much more pronounced and that the anteverision of the pelvis is insignificant, we then find the same symptoms again, but less pronounced.

One cannot confuse the forward inclination in the working posture with the forward flexion in gymnastics; in this active movement, the axis of rotation is not located in the lumbar column, but in the coxofemoral joint; the sacrum and the entire spinal column are inclined as a whole with an intense activity of the abdominal muscles and of the psoas.

It is obvious that prophylactic abdominal exercises should not be restricted only to the sedentary occupations, in the strict sense of the term, but that they are also necessary in the case of professions exercised in the standing posture.

With regard to the lower limbs, the electromyogram of the gluteus maximus, shows hardly any electrical activity, which proves that this group of muscles is not solicited for immobilizing the pelvis; among the extensors of the pelvis we have only observed electrical activity in the biceps, which seemed to us as solely responsible for inhibiting the pelvis anteverision in total body inclination.

When one compares the electrical activity of the leg muscles in the normal standing posture and in the working position, one observes above all a notable increase in the activity of the soleus muscle, the contraction of which, intermittent in the normal posture, becomes continuous.

The continuous isometric contraction of the soleus, the muscular mass of which is

located between the surface venous system and the deeper system, constitutes an obstacle to venous circulation of the lower limbs, as it makes drainage by the «venae perforantes» impossible.

The obstruction is added to the hydrostatic factors to increase intra-venous pressure.

It is not surprising that the subjective troubles of fatigue and pain in the legs and even real pathological oedemas, thrombophlebitis and varicose ulcers are to be found so often in occupations exercised in the standing posture, inclined forward, though one may not entirely overlook the existence of a certain individual pre-disposition.

When pause gymnastics requires exercise that may influence the venous pressure in the lower limbs, by acting as muscle pump, the favourable effects of walking should not be forgotten.

Indeed, by the electro-myographic examination of walking one sees that the soleus muscle contracts and relaxes twice at every step, the first time at the start of the support period, the second at the end of that same period.

Intra-venous pressure, which is in the order of 90 cm of water in the normal standing position, may fall by approximately 60 cm of water when marching at a rate of 40 paces a minute, and even more when this speed is increased.

Before ending this report, I should like to draw your attention to the fact that the standing posture, with forward inclination and even rotation, with forward inclination and even rotation, though a tiring one, influences general metabolism only a little.

As a matter of fact, supplementary tests have shown that oxygen consumption, in the working position, never exceeds double of the metabolism in a lying-down position of rest.

The overloading of the cardio-vascular system is thus insignificant.

This last observation, as well as the absence of abdominal muscular activity, should make us consider every occupation exercised in the standing position with anterior inclination, as a sedentary posture.

As a result, all prophylactic measures considered necessary for truly sedentary occupations, are thus just as valuable for those occupations carried out in the working posture that has just been described to you.