

“A workstation needs to be at a height that suits the stature of the operator, sitting or standing”

TAKE

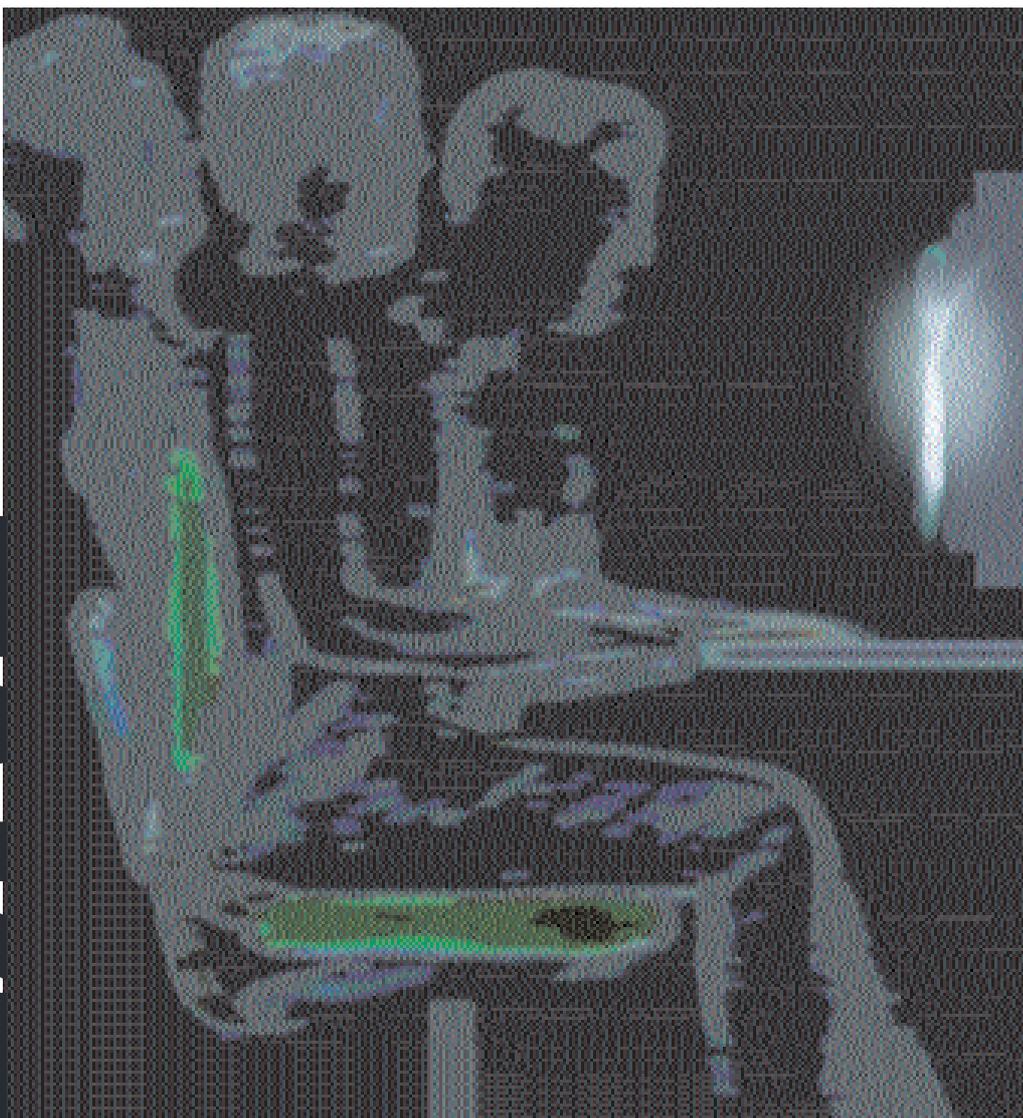


Image: Enricosmog

A SEAT

Just because heavy industry has given way in recent times to a more service-based economy doesn't mean that all of the health issues traditionally associated with the former have disappeared. Back problems, for instance, used to be primarily rooted in heavy lifting and incorrect manual handling but it is now accepted that sitting for long periods of time causes most difficulty. Our bodies, particularly our spines, are simply not designed for sitting on chairs for hours on end but if that's what the job requires, the most important thing to get right is the chair itself, as **Duncan Abbott** explains.

When specifying office furniture it makes sense to follow ergonomic guidelines to avoid purchasing unsuitable equipment. A useful international standard is ISO 9241-5 'Workstation and Postural Requirements'. This details ergonomic guidelines for users of workstations and provides advice on how to achieve a good fit between worker and task by breaking down the items and the requirements necessary for this to be achieved. Workstation recommendations are, to some extent, based on anthropometric data (the measurement of dimensions of the human body) but behavioural patterns of people and specific requirements must also be considered.

Owing to human variability and the fact that bodies come in all shapes and

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sizes, product design has, by making products adjustable, tended to cover 90 per cent of the user population. To achieve this ‘fit’ designers consult anthropometric tables that contain body measurements for men and women aged 16 to 25 in the working population. To accommodate the 90 per cent of users, designers use two rules of thumb. Firstly, to ensure reach is achievable they take the measurement for the fifth percentile woman for each of the dimensions required. Secondly, to ensure that height is achievable for the tallest man, the 95th percentile man is used. The fifth percentile means that 5 per cent of the population is below this measurement, while the 95th percentile means that 5 per cent of the population is above it. Thus, a designer can ensure that 90 per cent of the population will be able to use the product. To accommodate users outside the 5th and 95th percentile ranges, i.e. 10 per cent of the user population, it will be necessary to purchase components not within the design range.

A workstation needs to be at a height that suits the stature of the operator, sitting or standing. Task and furniture should encourage change in posture by the user. Work organisation, job content and furniture design should encourage movement. Workstations must be capable of supporting several tasks – screen viewing, keyboard input, writing, reading and phone work. For input device use, the height of the support surface should allow comfortable and efficient posture of the upper arms, forearms and hands. Prolonged static sitting posture should be minimised and adjustment easily achieved by individual users. Ideally, the work surface should be height-adjustable and tiltable, if the task demands it.

The art of sitting

The chair – an integral part of the workstation in terms of user comfort – should be selected on the basis of adjustability and fit. If these criteria are not considered, and the chair is selected because it is cheap, for example,

various problems can arise and are discussed below.

If seat height increases beyond the back of the knee (popliteal) height of the user, pressure will be felt on the underside of the thighs. This can reduce circulation to the lower limbs, leading to pins and needles, swollen feet, and considerable discomfort. Conversely, as height decreases the user will flex the spine more owing to the need to increase the angle between thigh and trunk. Seat height is also important in setting the hand position and is critical in determining lines of sight to ensure that visual elements of the task can be accommodated without putting undue load on the neck, shoulder and upper back. Users with a lower stature will require the chair height to be adjustable to put themselves at the correct working height, but a footrest may also be

necessary to reduce discomfort if the legs are not properly supported.

If chair depth is too long for the distance between the user’s buttock and the back of the knee they can experience discomfort due to curvature of the mid-back and from having no back support. The back of the knees is covered in sensitive skin, which provides little padding over the tendons. Contact between this tender area and the seat should therefore be avoided. Seat depth can be modified by adjusting the backrest in relation to the seat, or by moving the seat pan in relation to the backrest. If seat depth is fixed, priority should be given to proper back support, as this is more important than supporting the whole length of the thighs.

Type of task and the layout of the workstation determine the height of the

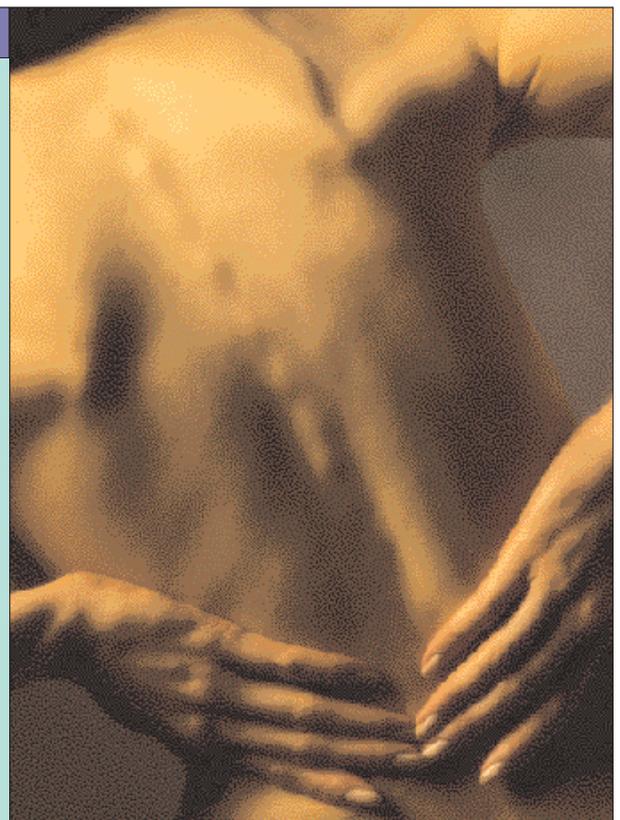
Over to you

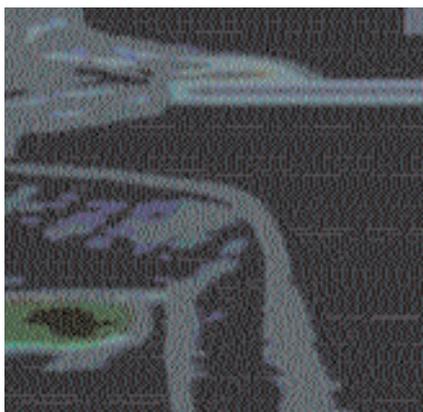
While a supportive chair and ergonomically designed workstation can do much to help avoid musculoskeletal problems the behaviour of the individual user is equally important in ensuring that these problems are minimised.

If your employer has provided you with an ergonomic chair make sure you use it correctly by adjusting the settings to suit your body and the tasks you carry out while seated. If your back is not supported properly, your muscles become tired, causing you to slouch in order to give those muscles a rest. This, in turn, affects the natural curve of your spine, which can result in slipped or bulging discs.

Keeping the muscles in the back, shoulders and abdomen strong and flexible not only prevents them from getting tired so quickly but also helps them relax. It is a good idea, therefore, to do a series of stretching exercises for a few minutes every day, to improve flexibility. Sit-ups, half-press-ups, back relaxers, neck stretches and head rolls are just some of the exercises that can be easily accomplished by most people.

Taking regular breaks – in which you either get up from your chair and walk around, or execute a series of simple stretches in your seat – is also recommended.





“Health and safety managers should follow and apply the principles of the guidance in ISO 9241-5 for evaluating workstation furniture and determining user fit”

backrest. A short backrest height will suit users who need to keep their shoulder area free, whose legs are constrained in a narrow knee-hole, or who need to twist their upper back to perform a task. A low-level backrest should commence at a height that clears the buttocks and has a maximum prominence in mid-lumbar support to aid natural lower-back curvature (lordosis) but which prevents curvature of the mid-back (kyphosis). The backrest should end just below the level of the shoulder blades so as not to inhibit upper body movement.

In jobs involving prolonged periods of sitting – for example, computer operations – a higher backrest has many advantages. Freedom of the shoulder blade depends on the job being performed. In many instances the upper body leans forward when arms are being used and the shoulder blades are not in contact with the backrest. A high-level backrest should give full head and neck support. To use the lumbar support to its full advantage it is necessary to provide clearance for the buttocks, so in some kinds of chair it may be prudent to leave a gap between the seat and the bottom edge of the backrest.

Armrests should not restrict a user's preferred working posture and should be adjustable or detachable. Their height should not prevent the chair from being slid under the work surface, nor should it restrict access to the work area. An important note is that armrest height interacts with the width of the seat. A small user may have to raise an upper arm to reach the armrest, or lean over to one side, whereas a large user may be restricted in movement if the seat is too narrow between armrests and so be

unable to change posture easily.

ISO 9241-5 finds that the seat design should allow frequent posture adjustments by the user and lists four major aspects of seat design that contribute to this:

- seat angle;
- movement of the seat pan and back support;
- castors; and
- swivel.

Seat angle allows users to vary their posture forward and backward and ensures good blood flow. Seats can have a fixed or adjustable seat angle and the seat pan can incorporate forward and rearward tilt. A positive seat angle helps the user maintain good contact with the backrest and counteracts the tendency to slide out of the seat. An excessive tilt reduces the hip-to-trunk angle and makes standing up or sitting down more difficult. For most purposes an angle of 5-10° is all that is required.

Some users prefer sitting with their chair in a reclining position when reading documents or on the telephone, and sitting slightly forward when writing or computing. Most users rarely change their chair settings, either because they do not know how, or they have found that a particular setting works for them when undertaking all tasks. This is fine, providing the user has been trained in the operation of their chair, which ensures compliance with both the Display Screen Equipment Regulations 1992 and the Work Equipment Regulations 1992.

Castors are recommended to enable users to easily and safely move for short distances to reach equipment and support their changing task requirements. However, they must not roll unintentionally and their resistance must suit the type of floor.

The distance between the seat and the underside of the work surface dictates the degree of movement and is crucial to enable a change in posture for the lower legs. It can have an important influence on the height at which hands will be expected to work. Knee-hole depth is the minimum dimension defined by the distance between the back of the buttocks and the front of knees. If freedom of movement is to be provided an allowance beyond this is required to allow for leg movement and stretching. Knee-hole width is also important. If possible, keep the underside of the work surface clear to allow the user freedom of movement.

Workstation tips

In positioning keyboards and input devices support for hands, wrists and forearms should aim to reduce static loading of the upper limbs. Such support should also reduce the work of neck and shoulder muscles and the need for bending, extension or deviation

of the wrist. This can be accomplished by making sure there is about 10cm of free space in front of the input device.

The distribution of wiring and cables (mains, data, telephone, etc.) needs careful consideration in relation to the user's needs. In particular, wires should be fastened and carried in horizontal or vertical ducting to the required point. Sufficient cable length for likely rearrangement of office layout should be supplied and excess capacity in ducting for new cables allowed for. The workstation should also be accessible for cleaning and maintenance. If height-adjustable furniture is used ensure that cables are long enough to reach the maximum height.

Summary

Health and safety managers should follow and apply the principles of the guidance provided in ISO 9241-5 for evaluating workstation furniture and determining whether or not it conforms to the body sizes of the working population. The performance and comfort of visual display terminal (VDT) users should be enhanced. The more intensive the VDT usage, the more important it is to adhere to these principles.

However, the application of ergonomic principles to specific user and workspace combinations may result in dimensional conflicts, and multiple product solutions may be required to accommodate the entire population. Task variability, not just human variability, must be considered. For example, owing to task or space constraint some users will require low backrests while other users require high ones.

To determine whether an individual user has been accommodated the Ultimate Test of Fit is the final criterion on which to judge the success. The two most important aspects of fit for users of work chairs are seat depth and backrest height, both of which can be achieved for 90 per cent of the population via adjustability.

Further reading

- British Standards Institution: Ergonomics Guideline for Visual Display Terminal Furniture used in office work spaces, BIFMA G1-2002 and ISO-9241-5

About the author

Duncan Abbott is an ergonomist and works with a wide range of companies, including banks, government agencies, Local Authorities, manufacturers and retail companies. He has extensive experience of assessing employees with disabling conditions for their return to work.