

Ergonomics

This guidance forms part of a series on the developments in information technology and picture archiving communication system (PACS) in radiology. This is a fast-moving field and developments are occurring rapidly. Consequently, this guidance will be updated regularly and readers should check regularly that they are using the most up-to-date guidance available.

1. Ergonomics may be defined as the design of workplace, taking into account the needs of the individual. This should include an analysis of the tasks to be performed and the manner in which they will be undertaken.
2. The picture archiving communication system (PACS) environment brings new challenges. Much effort goes into specification of the technical aspects of PACS, but this should not be at the expense of appropriate effort in ergonomic design. The health of the user is of vital importance. Ergonomics are also important for achieving diagnostic accuracy.
3. The arrangement of seating, desk and monitor, together with ancillary equipment such as dictation and task lighting, should be carefully considered.
4. The environment needs to be carefully designed with regard to lighting, heating, air quality and sound.
5. Seating should be comfortable with adjustable seat back, seat height and arm rests. While there is no ideal posture, it is recognised that poor posture and working position can contribute to musculoskeletal disorders.¹ A range of upper limb muscular skeletal disorders are recognised.
6. The monitor should be at arm's length and in a position which encourages good posture in order to avoid musculoskeletal strain in the cervical and trapezius musculature. Detailed advice is available from the Health and Safety Executive.²
7. Computer usage, even with ideal design features, can provide substantial musculoskeletal risk unless the operator takes regular breaks.
8. Keyboard placement and mouse placement should be planned to minimise adverse static postures. As a general principle, working with the wrist in a neutral position, the elbow close to 90° and at the side of the body is likely to minimise adverse static postures. Muscles are designed for movement and fatigue quickly with prolonged static posture. Repetitive movements and prolonged static posture lead to an increased risk of musculoskeletal disorders. Generally, PACS use does not require much keyboard input so wrist support rests are not essential. Laser mice are easier to use than mechanical mice and do not 'stick'. Some people prefer a tracker ball mouse.
9. Desktop space should be adequate to allow for placement of three monitors, at arm's length from the user, plus enough extra space to accommodate textbooks and notepaper. Departments that are installing PACS for the first time may also need desktop space for temporary light box(es). One and a half metres should be viewed as a minimum width requirement.
10. Lighting is a crucial factor. There is no formal guidance in the UK for lighting for PACS reporting areas. The Chartered Institution of Building Services Engineers (www.cibse.org/) has issued guidance through the Society of Light and Lighting with *Lighting Guide 7*.³ This has been written for offices with visual display units. PACS environments are more stringent because the ambient lighting levels need to be lower. Continuously dimmable inset ceiling lighting, preferably adjustable above each diagnostic workstation (rather than for the whole room), is preferable to dimmable fluorescent strip lighting, which has a tendency to flicker and cannot be dimmed as low.⁴
11. The basic principle for lighting is that ambient lighting should be equivalent to the monitor luminance. This reduces the effective contrast reduction from ambient lighting and maximises the inherent contrast arising from the screen. The office design should take account of external and reflected light sources which may fall across the monitor screen and reduce effective contrast. This should include using low reflectivity paint or other wall surfaces (that is, non-white) to reduce light reflected from one reporting booth into another. Specific figures for the level of ambient lighting are not quoted as monitor luminance levels vary and in general are increasing with improving technology.⁴
12. The ambient lighting levels for PACS are below those recommended for reading. If written request cards are being used then task lighting is required. This must be carefully arranged so as not to throw light across the monitor of the user or of adjacent users.⁴
13. Early PACS with cathode-ray tube (CRT) technology produced large amounts of heat. Modern PACS with flatscreen technology produce less heat. Air conditioning and adequate air handling/turnover is important to maintain a satisfactory working environment.⁴
14. Noise is an important factor in radiology reporting rooms. Design features should include sound reducing materials between workstations. The overall design of the room should take account of reflected sound. Minimising extraneous sound improves work efficiency and accuracy of speech recognition dictation

systems. Noise emitted from cooling fans from computer equipment needs to be considered. Telephones should ideally be installed in multiuser reporting rooms.

15. Security for the computer equipment needs to be considered in the overall design. This is particularly important if mobile ward PACS carts or laptop workstations are being considered.

Summary

As radiologists and others spend an increasing time at workstations, the work place environment becomes increasingly important. It is a much neglected aspect of work in an imaging department and although some of the recommendations may seem aspirational, it is important that when designing and upgrading departments, a suitable working environment is taken into account.

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References

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4. The Royal College of Radiologists. *Picture archiving and communication systems (PACS) and guidelines on diagnostic display devices*. London: The Royal College of Radiologists, 2008. http://www.rcr.ac.uk/docs/radiology/pdf/IT_guidance_PACSApr08.pdf (last accessed 11/05/12)

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