

The Science of Work

Despite thoughts to the contrary ergonomics does not solely concern itself with chairs or office environments - a misconception that has resulted due to the continued misuse of the adjective 'ergonomic', writes Duncan Abbott.



Avoid bending and twisting hands specifically at the wrist. PHOTO: DUNCAN ABBOTT

Ergonomics is the science of work: of the people who do it and the way it is done; the tools and equipment they use, the places they work in, and the psychosocial aspects of the working situation.¹

What do ergonomists do? They work with organisations to resolve problems that occur when humans interact in the work environment with machines to perform work activities. Their knowledge is gained from studying biomechanics, physiology, psychology, engineering and sociology to a minimum MSc level.

Having studied a number of disciplines in depth the ergonomist can use appropriate subject knowledge to formulate guidelines to produce safe efficient human-machine interactions in all areas where work is performed.

It would be prudent to consult an ergonomist when considering any workplace intervention where the redesign of a task or environment is being considered. In the majority of cases the financial benefits of an

ergonomic intervention will far outweigh its cost².

Direct costs include compensation for workers, legal fees and medical payments, while indirect costs include lost productivity and the cost of hiring replacement workers.

RSI: an ergonomic perspective

One of the goals of ergonomics is to design or modify people's work and other activities to be within their capabilities and limitations. Poor harmonisation can lead to disorders of the musculoskeletal system known as repetitive strain injury (RSI) or work related upper limb disorder (WRULD).

Both terms are to all intents and purposes synonymous. They are used to refer to a diverse set of conditions affecting various anatomical sites in the hand, arm, shoulder, and neck, which occur in people doing a wide variety of

types of work involving intensive use of the hands.

Occupational groups most notably affected include: industrial assembly line workers, checkout till workers, musicians and keyboard users. A study in 1993 found that 29.4% of industrial workers exposed to high force and repetition suffered some form of RSI disorder compared to 4.9% of data entry operators³.

'If you repeat wrist and hand movement everyday then it is likely an anatomical structure in the upper arm will start to wear out'

At high risk of developing an RSI condition are those people whose occupations combine force and repetition of the same motion in the fingers and hand for long periods of time. These individuals include those in the meat and fish



More natural posture with minimal bending and twisting at wrist joint.

PHOTO: DUNCAN ABBOTT

packing industry as well as those using vibrating tools, like jackhammers or chain saws. Meat packers have complained of pain and loss of function in their hands since the 1860's. Even today, the incidence of carpal tunnel syndrome in the meat, poultry, and fish packing industries can be as high as 15% of workers.

Overuse injuries to the hand, wrist, and forearm, which are endemic in manual workers on industrial assembly lines are the product of a number of risk factors. The most prominent is lack of task diversity. If you repeat the same wrist and hand movement everyday then it is likely that an anatomical structure in the upper limb will start to wear out or at the very least there will be an increased risk of musculoskeletal injury.

The magnitude of forces a person has to exert in the task in question is also relevant. It is generally recognised that jobs that carry the highest levels of risk are ones in which gripping actions are combined with turning actions and/or are made with a deviated wrist.

The particular type of gripping action that the task entails is also a factor. Pinch grips and claw like grips (i.e. precision grips) both entail a higher internal biomechanical loading for a given

externally applied force and thus a higher level of risk than full grasping actions (i.e. power grips). The overspreading of the hand has also been found to be a risk factor.

Workers on assembly lines are also prone to over use injuries to the muscles and soft tissues of the neck and shoulder region. These are most commonly caused by working for lengthy periods with the arms in a raised position, and/or from making frequent or repeated reaching actions (particularly overhead reaching or reaching behind the body).

Ergonomic risk factors that have been found to result in overuse injuries to the forearm, wrist and hand in process workers (eg poultry workers, biscuit packers, meat cutters) include:

- ✓ Lack of task diversity
- ✓ Time pressure
- ✓ Forceful exertion
- ✓ Frequent or repeated gripping actions, particularly if these are combined with turning actions and/or are made with a deviated wrist
- ✓ Pinch grips, claw grips, overspreading
- ✓ Vibration, impact, blunt trauma
- ✓ Unaccustomed work.

Proper use of machines and hand tools

Tool selection is of critical importance for user safety, comfort and health. However even the best tool on the market will not transform a poorly designed workstation into a safe and comfortable one. If the workplace design does not meet the workers' physical needs, it can create risk factors for discomfort, aches and pains, fatigue, and eventually, RSI conditions or other musculoskeletal disorders.

Whereas a well-designed workplace, that frequently offers the opportunity to choose from and alternate between a variety of well-balanced working positions, allows work to be carried out safely and injury-free.

Avoid overreaching, stretching and twisting

If operating vibrating tools, try and reduce the amount of time using them and if not ensure you use 'damping devices' such as self-absorbing grips on tools and that the tools are maintained in a good state of repair.

Working for long periods with the hand and arm in a poor posture can lead to specific complaints of the wrist, elbow and shoulder. A continuously bent wrist can lead to local nerves becoming inflamed and trapped, resulting in wrist pain and a tingling sensation in the fingers. Tennis elbow, which is a local inflammation of a tendon attachment due to a combination of a bent elbow and bent wrist, can also result.

Neck and shoulder complaints occur in prolonged work with unsupported, raised arms. These problems arise especially from handling tools. In addition to posture, application of forces and repetitive movement adds to the development and aggravation of the RSI condition. Correct hand and arm postures can be promoted by using the right tools.

Selecting the right tool

- ✓ Select the best model available that is suited to the task and posture with the intention being that the joints are kept as far as possible in the neutral position.
- ✓ Use curved tools where the grip is on the tool to help prevent bending the wrist
- ✓ If you use a handheld tool, make sure the weight is no more than 2kg, and wherever possible use some sort of tool support or counterweight
- ✓ The shape and location of handgrips on equipment must take into consideration the size and placement of the hands and arms. If force is to be applied it is recommended that the grip must be a diameter of 3cm and a length of 10cm (both approximately).

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- ✓ Service and clean tools regularly, for example, blunt blades require greater force to be applied. Well maintained electric tools will reduce wear, noise and vibration

Posture

- ✓ Avoid working with hands behind the body
- ✓ Avoid work above shoulder level: if necessary use a step ladder or step stool
- ✓ Insist on a risk assessment to find the best posture for the task. If the task is found to be risky, it should be redesigned or better still automated
- ✓ Ensure sitting postures are alternated -use proper chairs or sit/stand stools to provide support during hand tool tasks, working on assembly lines or undertaking precision work
- ✓ Whether to carry, push or pull must be considered as these activities can contribute to increasing forces being exerted on the upper limbs. Invariably it is better to push than pull. Handgrips on trolleys must take into consideration placement of the upper limbs.

To summarise the main risk factors are:

- ✓ Repetitive actions
- ✓ Forceful movements
- ✓ Static loading of muscles
- ✓ Awkward posture
- ✓ Gripping and twisting
- ✓ Poor work organisation
- ✓ Stress
- ✓ Cold
- ✓ Vibration

Final words

The Health and Safety Executive has put in place much legislation to make work a safer activity. It is every employee's right to work in a safe environment and Regulation 3 of the Management of Health and Safety at Work Regulations (1992) states that every employer shall

make a suitable and sufficient assessment of the risks to the health and safety of their employees to which they are exposed whilst they are at work. The regulation requires that employers should undertake a systematic general examination of their work activity and that they should record the significant findings of that risk assessment.

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- 1 Pheasant, S. *Bodyspace - Anthropometry, Ergonomics and the Design of Work*. (P4) ISBN 0-7484-0326-4
- 2 Abbott, D. *Show us the Money*, Safety and Health Practitioner, May 2003
- 3 Armstrong, T. et al (1993). A conceptual model for work related neck and upper limb musculoskeletal disorders, *Scandinavian Journal of Work Environment and Health*, 19, 73-64

Resources

- Upper limb disorders in the workplace HSG60 (second edition) HSE Books 2002 ISBN 0 7176 1978 8
- HSE's website www.hse.gov.uk/msd

NEWS

UK

Website challenge

The Royal Society for the Prevention of Accidents (RoSPA) has challenged organisations to put their health and safety policies, performance and targets on their websites.

Going Public on Performance was launched on May 22nd and examines the websites of Britain's top 350 companies. Only 129 included health and safety information, with 123 reporting on policies and principles, 77 on performance data and 64 on their health and safety targets.

Dr Nguyen, RoSPA Occupational Safety Project

Manager, says "The internet is widely used by groups important to businesses such as shareholders, employees, regulators, insurers, investors and the media. It can also help with Corporate Social Responsibility reporting.

'Ignoring the internet as a source of providing health and safety information about an organisation can make it look as though there is something to hide. Those who do not use it are missing out on an opportunity to show that they take health and safety seriously'.

For details of the report go to www.gopop.org.uk

UK

Sick notes and company doctors

Proposals set out in new GP contracts are looking at ways of cutting the bureaucracy faced by family doctors.

If the General Medical Services contract is accepted, a group will be set up to examine the workload of GPs. One option is to remove the paperwork processed by doctors for sick notes, repeat prescriptions, housing reports and disability benefit.

A report found that removing this paperwork would make an average of 360 more appointments a year available to patients with medical-related illnesses.

Simon Fradd, joint deputy chairman of the British Medical Association's GPs' committees said: 'An occupational health system would benefit everyone.'

He told the Daily Telegraph: 'The current system fails everyone. The aim is to get a patient better and back to work. An occupational health service is in the best place to see both sides - the patient's condition and how the job might contribute to the problem.'

If adopted, a company's doctor or nurse may sign people off sick. Smaller firms with no occupational health scheme would be able to buy medical services.