Ergonomics and musculoskeletal disorders: overview

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Abstract Musculoskeletal disorders continue to be a major source of disability and lost work time. Understanding their causes, and especially those that are work-related, remains the key to primary prevention. This set of in-depth reviews considers the problem from a number of systems needs and viewpoints. Assessing the exposure of workers to known risk factors is essential and appropriate methods are reviewed. Similarly, a consideration of psychosocial factors thought to contribute indirectly to the problem has also been explored. Contemporary ergonomics stresses the importance of a participatory approach to prevention and solution finding, and evidence in support of this is presented. The final review considers the application of ergonomics knowledge to understanding musculoskeletal disorders amongst those using computer technology.

Key words Ergonomics; musculoskeletal disorders.

Introduction

There has been an increasing effort in recent years to investigate the causes of musculoskeletal disorders (MSDs) and to take action to prevent them. This has led to increasing recognition from workers, employers and government agencies that a strong relationship exists between factors within the working environment and the development of MSDs, and that these conditions result in significant sickness absence and reduced productivity [1].

Action to prevent these disorders within the UK has been based upon the current European Union directive framework. Key directives, introduced in 1992, such as those relating to the management of health and safety at work, manual handling and the use of display screen equipment have played an appreciable role in increasing public awareness and in introducing measures for prevention across a wide range of industrial sectors.

The papers that follow in this in-depth review consider the problems from a number of perspectives, including problems specific to computer users, the wider social and psychological factors associated with these disorders, methods for assessing risks in the workplace and contemporary approaches for establishing effective ergonomics interventions.

The size of the problem

It is now generally acknowledged within the UK that MSDs affect large numbers of people across most industries and occupations, have the potential to lead to long and serious disability, and impose heavy costs on employers and on society.

The UK Health and Safety Commission have made prevention of MSDs a priority programme as part of their 'Securing Health Together' agenda. This strategy aims to: (a) reduce ill-health in employees and public caused or made worse by work, (b) to help people who have been ill to return to work, (c) to improve work opportunities for those excluded from work on health-related grounds and (d) to use the work environment to help people maintain or improve their health. Further, there is a vision, as part of a 10-year plan, that 'No individuals should be made ill by work'.

These important goals were based on an extensive consultation process that brought together a wide range of key stakeholders, including government departments, professional groups and industry. In delivering this agenda, targets have been set to reduce working days lost from work-related ill-health by 30% by 2010, and to reduce the incidence rate of cases of work-related ill-health by 20% by 2010.

Added priority has been given to reducing MSDs by setting interim targets to achieve at least half of these improvements (for each target) by 2004. This means that to achieve the 2004 targets, the number of new cases must be reduced by 29 000 and the number of working days lost by 1.8 million.
How many people are affected?
The UK Health and Safety Executive (HSE) have estimated that 5.7 million working days (full-day equivalent) were lost in 2001/02 mainly as a result of back pain that was caused or made worse by work. On average, each person suffering took an estimated 18.9 days off in that 12-month period. Additionally, they estimate that 4.1 million working days (full-day equivalent) were lost in 2001/02 through MSDs that mainly affected the upper limbs or neck that were caused or made worse by work. On average, each person suffering took an estimated 17.8 days off in that 12-month period.

The economic costs to individuals, industries and society are also excessive. The HSE estimate the cost to the economy to be £5.7 billion per year.

Are effective prevention measures available?
MSDs affect all industries and workplaces, and there is general recognition that a systems ergonomics approach based on a participatory model that engages key stakeholders is important. This is demonstrated by the key elements identified for ergonomic intervention that include: commitment from senior management, worker involvement, risk assessment, control measures and instruction and training. A recent publication by the HSE [2] provides a good basis for developing a preventative strategy at a local level.

An extensive range of guidance materials are available from government agencies and these have been supplemented by advice for specific industries

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**Figure 1.** A model of systems in ergonomics [5].
System failure, ergonomics and MSDs

A number of leading organizations within the UK recognize that a high prevalence of MSDs is a symptom of ‘system failure’ that should be addressed to improve overall quality and productivity. Thus, programmes for the prevention of MSDs are incorporated within a wider ergonomics approach to the continuous improvement of work systems, organizational design, use of technology and the work environment. This requirement is best described as an ergonomics approach.

In August 2000, the International Ergonomics Association (IEA) Council adopted an official definition of the discipline of ergonomics. This states that ‘ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.’

Those engaged in ergonomics and human engineering have long since recognized that the preferred route for preventing problems and enhancing performance in systems is through a design or redesign process. This may require a consideration of a range of issues. These include:

- the system goals,
- the task allocation,
- the equipment design,
- interactions between sets of equipment and groups of people,
- the work organization,
- and the job design.

Whilst methods [4] exist for the analysis of each of these components of the system, the complexity of such an approach is, at first sight, daunting. A recent model, shown in Figure 1, attempts to draw together the components of systems that need to be considered if we are to take the systems design or systems engineering approach [5].

This model enables the various levels of the system to be conceptualized for the purpose of understanding, interpreting, evaluating, information collection, and design purposes. Such an approach and understanding is required for successful systems analysis and design [6].

Earlier models of the causation of MSDs characterized worker activity as movements and exerted forces that lead to the generation of internal forces within the body [7]. These models recognized the role of psychological and social factors but the importance of these factors has been explored more thoroughly recently [8].

The working situation derives from the organization of work (work organization factors) and the perceptions or beliefs held by workers regarding the way the work is organized (psychosocial work factors). This has led to models and scientific evidence indicating that work organization and psychosocial work factors are associated with the development of work-related MSDs [9–12]. These psychosocial work factors may also influence the biomechanical load and/or the reactions to workplace stress [13,14]. Finally, individual psychological factors, perhaps pertaining to coping strategies are emerging as additional factors requiring further research [15].

In this set of in-depth reviews, the importance of taking consideration of factors at every level of the system is evident.

Conclusions

The science of ergonomics and its application to MSDs associated with the modern workplace provide both an important perspective and a preventative approach. The breadth and impact of ergonomics extends well beyond what is often presented in the lay literature.

This set of review papers provides insight into how ergonomics has enhanced our understanding of the nature of the disorders, their work-relatedness and their potential prevention. Greater adherence to the ergonomics process in design and assessment of work systems would seem the most likely strategy for securing long-term primary prevention of these disorders within the UK and elsewhere.

References


