Risk factors of occupational MSDs and potential solutions: past, present and future

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The ETUI-REHS Health and Safety Department and the European Trade Union Confederation jointly organised a conference on musculoskeletal disorders (MSDs) in October 2007. The presentation by Jørgen Winkel, of University of Gothenburg, provoked a good deal of audience reaction, in that the Swedish ergonomist effectively demolished a number of received opinions about MSDs. The text below, co-authored with a Norwegian colleague, expands on his ideas. He is critical of certain "good practices" that lead to what he describes as the "ergonomic pitfall" and proposes new strategies for tackling the epidemic.

Despite decades of ergonomics research, work-related musculoskeletal disorders, the single most expensive category of occupational health problems, remain a major problem for afflicted individuals, companies and societies. More than one in three European workers suffers from work-related MSD: it is widespread in all sectors and is the commonest occupational disease suffered by European workers. On top of this, European and national surveys report a general deterioration! We look at three main issues contributing to this problem: assessment of MSD, assessment of risk factors and the "ergonomic pitfall". Finally, we present some evidence-based procedures to improve the impact of measures taken against occupational MSD.

Why this problem?

Assessment of MSDs

MSDs are generally assessed by pain symptoms expressed by the worker. In most cases it is not possible to demonstrate any pathological changes in the tissues. Thus, the doctor/physiotherapist must mainly rely on statements made by the worker.

Occupational MSD may be caused by mechanical (physical) exposure at work. In addition, psychosocial factors at work may in themselves cause pain or modify the perceived pain level caused by the mechanical exposure. However, it is often difficult to assess whether such work-related factors have actually caused the pain. MSD may be due to an underlying disease not related to work, exposure occurring during leisure time, or advanced age which in itself increases the risk of experiencing pain in the musculoskeletal system.

Our knowledge of the mechanisms explaining how mechanical and psychosocial exposures cause pain is highly insufficient. Thus, in most cases it is still not possible to accurately assess the significance of work when the individual worker perceives MSD. There seems, however, to be general agreement between researchers that work plays a significant role, although we disagree about its quantitative role. This is due to differences in researchers' interpretations of the scientific empirical basis, causing different sections of society to emphasise different aspects of the empirical basis according to their political agenda.

Assessment of risk factors

On the web one can find a comprehensive amount of information on "good practices" to reduce risk factors leading to occupational MSD[1]. "Good practice" is based on evidence from ergonomic research as well as "common sense". But reducing the mechanical exposure at work towards inactivity also seems to be a risk factor, particularly if the worker is inactive during leisure time as well. High mechanical exposure, e.g. during physical training, may in fact reduce the risk of developing MSD. This positive effect is believed to be partly due to the short exposure duration (a few hours per week), in contrast to occupational exposure that may last up to about 40 hours per week.

In short, it is not easy to assess risk exposure at the workplace. Research confirms that some exposures at work should be avoided, such as poor posture, heavy manual handling of materials or patients, repetitive work and mental stress. However, research also indicates that this is not sufficient to reduce or eliminate the risk of developing occupational MSD, as is illustrated by the case described below.

The "ergonomic pitfall"

In Sweden most dentists have for many years been employed by the National Dental Service. During the 1960s their ergonomics was improved considerably. Their standing, twisted and forward flexed postures were changed into a comfortable seated position (Figure 1). The patient was put into a lying posture with the mouth slightly above the dentist's elbow height. All tools were put in ergonomically appropriate positions. A decade later, in 1977, the Swedish Confederation of Professional Associations (SACO) issued a questionnaire regarding

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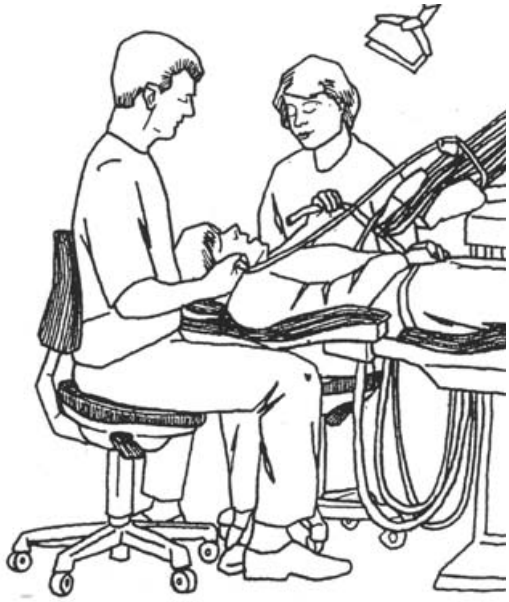
[1] See in particular the publications of the European Agency for Safety and Health at Work: http://osha.europa.eu/publications/reports/101.

Figure 1

Common type of workstation for dentists in Sweden until the 1960s

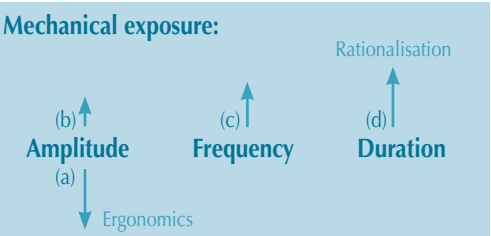


Ergonomically improved workstation for dentists since the late 1960s

professional groups' work environments. It found that dentists still, to a large extent, suffered from musculoskeletal complaints, much more so than any of the other groups investigated.

In order to understand this finding, it should be emphasised that the amount of mechanical exposure depends not only on the exposure level (amplitude) but also the exposure frequency and duration, i.e. the time aspect of exposure (see Figure 2). The ergonomist improved the work station and tool design, thus reducing the load level on muscles and joints. However, this intervention coincided with, and was actually a part of, a rationalisation increasing productive time at the lowest cost. The rationalisation was obtained by changing work organisation, which in turn influenced time aspects of exposure.

Figure 2



The risk of mechanical exposure ("physical work load") with regard to MSD depends on the exposure amplitude (e.g. manual handling or posture) as well as its frequency and duration. Ergonomists usually focus on workstation and tool design which may reduce the exposure amplitude (a). Rationalisation (e.g. Taylorism) may increase all three exposure factors (b-d), thus reducing or even eliminating any ergonomic effects.

Dentists earn a high salary and should therefore not perform tasks which can be performed equally well by occupational groups with a cheaper education and lower salary. Work teams were established including a receptionist, dental hygienist and sterilization assistance, and the nurse was assigned redefined tasks. In this system one main expert task was left to the dentist: hand performance in the mouth of the patient in an ergonomically 'correct' posture for most of his/her working hours. The long duration of constrained sitting without physical variation but with highly repetitive hand movements entailed an increased risk of developing MSD. Pacing the work by means of piece-rates and focusing economic rewards increased the psychogenic muscle tension in the shoulder and neck, which has been shown to increase the load level in the shoulder-neck region.

Thus, the risk factors were influenced by two different stakeholders with different objectives: the ergonomist aiming for improved musculoskeletal health and the rationalisation experts aiming for improved efficiency. In this case it provoked conflict. This kind of negative interaction between ergonomics and rationalisation has given rise to the expression "ergonomic pitfall". The main reason for the problem seems to be the focus of ergonomic intervention at the individual level, excluding work organisation and other issues.

Based on numerous field observations as well as scientific reports, it is our interpretation that the "ergonomic pitfall", i.e. the interaction between ergonomics and rationalisation measures, has made a major contribution to the frequent lack of success in reducing occupational MSD following the introduction of "good practice".

Interaction between rationalisation and ergonomics – more examples

The rationalisation of dentistry in Sweden illustrates that stakeholders other than the ergonomic consultant need to be involved to obtain work systems that

meet human needs (Figure 3). Risk factors having to be considered and monitored (if possible) are found not only in the vicinity of the worker, but also far away both physically and in time. Decisions made at management level regarding rationalisation strategy may have dramatic consequences for the worker in terms of risk factors for developing MSD. This will now be illustrated by some examples.

It appears from the above that ergonomists need to understand and influence rationalisations of work systems in order to make them "sustainable", i.e. competitive and meeting human needs, including musculoskeletal health.

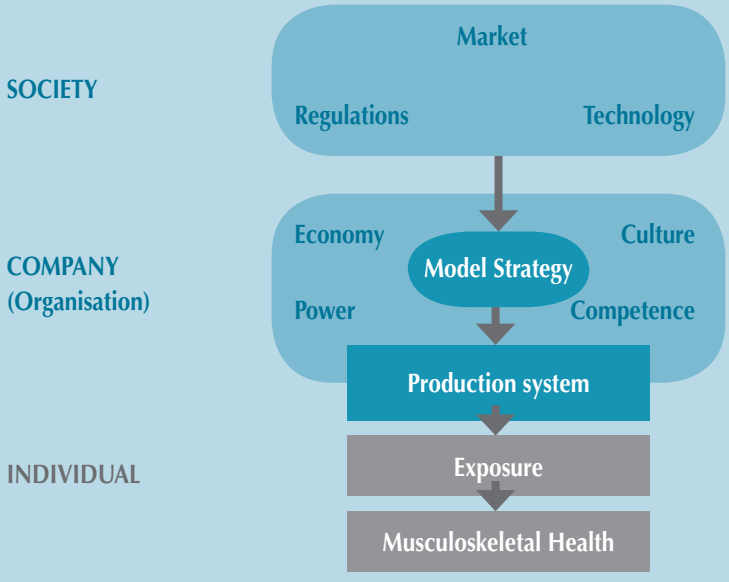
The rationalisation of dentistry as described above illustrates one type of rationalisation, often called Taylorism. During the past decade new types of "work intensification" in working life have appeared due to rationalisation. During the late 1990s a Swedish company producing printed circuits planned a comprehensive rationalisation. This resulted in a 63% reduction in the number of manual assembly workstations, thus reducing the amount of monotonous and repetitive work. Postures were not changed but the manual work became more repetitive and risky. Furthermore, this work was now in-sourced and performed by workers from a manpower company. Other parts of the assembly work were outsourced to a farmer in Denmark working at home under poor ergonomic conditions. The remaining jobs offered variation and low risk and were allocated to operatives employed by the company.

This case illustrates a trend in many big manufacturing companies, whereby risk factors are reduced or eliminated for permanent staff by exporting the risk factors. Is this an acceptable way of "solving" ergonomic problems at company level? How should society handle this type of "ergonomic intervention"?

A second case illustrates another key ergonomic aspect of modern rationalisation. The rationalisation concept of "lean production" has been introduced into all parts of working life. The aim is to minimise the working time spent on tasks that do not add value to a physical or service product. "Value" is taken to mean characteristics of the product that the customer is prepared to pay for. Examples of non-value-adding time are waiting time/micro-pauses, unnecessary transport and movements, and social communication. Our studies suggest that non-value-adding time generally involves opportunities for recovery and we call this the "porosity" of the working day (see Figure 4, next page). When minimising the non-value-adding time for the worker, "porosity" is reduced, resulting in a so-called "work intensification", often without any change in the common risk factors such as posture, manual handling of materials, etc.

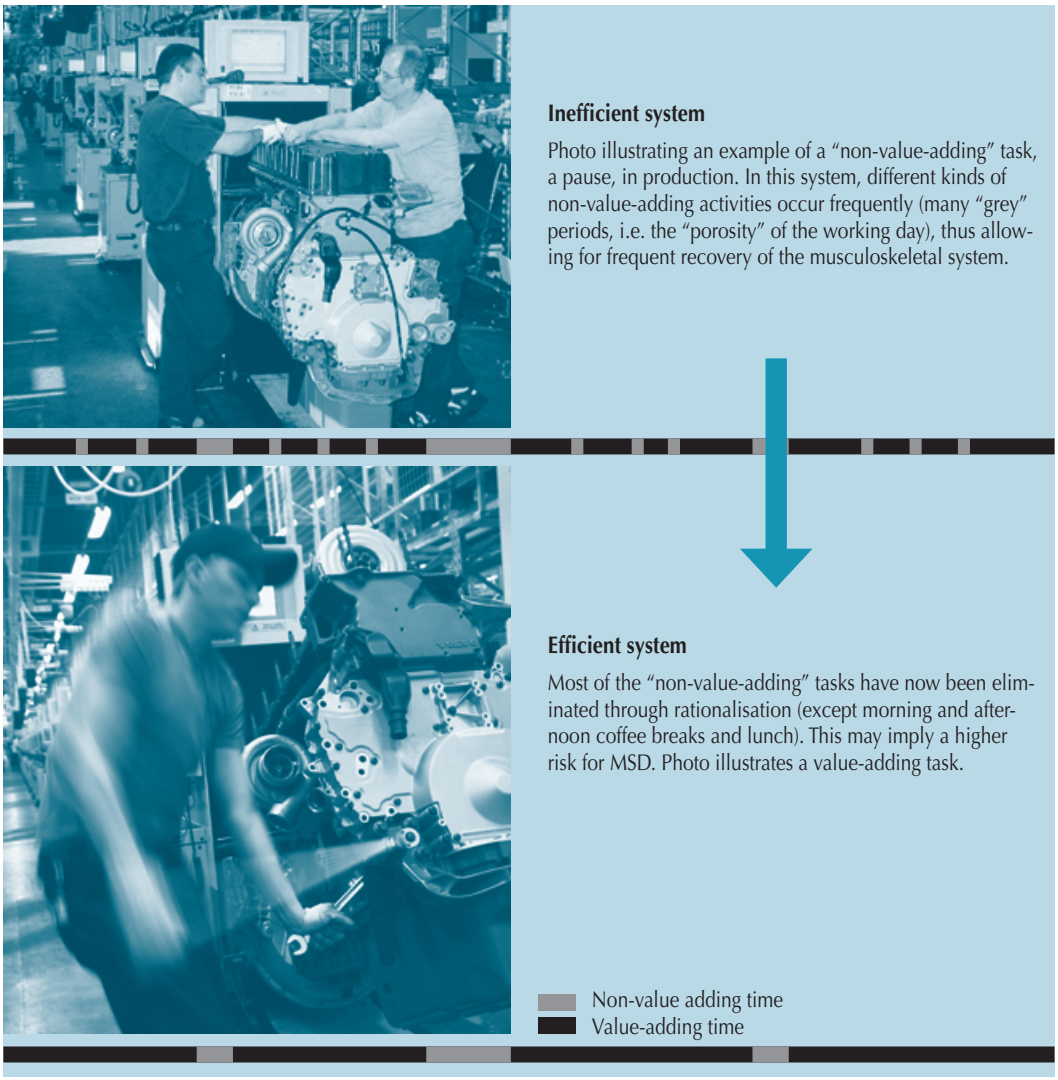
Studies from industrialised countries involving different trades have shown that when organisations aim for large cost reductions, downsizing is the first step. The same amount of work then has to be performed by fewer employees. This is usually accomplished together with reorganisation aimed at minimising value-added time. Research indicates that this kind of "work intensification" may increase certified sick leave due to musculoskeletal disorders by up to about 6 times.

Figure 3



Simple systems model illustrating how social context, strategic and design decisions at company level shape the production system and thus can influence risk factors as well as musculoskeletal health (adapted from Winkel and Westgaard 1992; Winkel and Mathiassen 1994; Westgaard and Winkel 1997, 2002; Mathiassen and Winkel, 2000).

Figure 4



New data from the Fourth European Working Conditions Survey (2007) provides a unique insight into, among other things, "work intensification" in the EU countries since 1990. Workers' perception of intensity of work has increased considerably during this period in the 15 "old" EU countries[2]. This development needs to be considered in future strategies for solving occupational MSD within the EU.

Future sustainable solutions

The above overview demonstrates the fact that risk factors are strongly related to how time is allocated between tasks, and that this depends to a large extent on the type of rationalisation and how these changes are implemented. Thus, "good practice" regarding smart solutions to ergonomic problems is not in itself sufficient to achieve sustainable work systems. The production context changes continuously, which makes today's ergonomic solutions inadequate tomorrow. The "dentists" case illustrating the "ergonomic pitfall" is a good example of this. The main challenge for the future is to increase our knowledge of "good practice" regarding intervention processes. These need to take into account that work systems should not only be ergonomic but also competitive, i.e. "sustainable".

We already have some evidence-based knowledge regarding "good" intervention processes. Some key examples are (see also Winkel and Neumann, 2005):

- intervention processes should be based on participatory approaches involving all groups affected;
- the intervention process should run continuously, adapting work systems to an ever-changing context;
- the handling of risk factors should be integrated into the process of production system development. Health and safety departments are generally trained to focus on the risk factor level. This compartmentalised organisational structure has been described as the "side-car" approach to health and safety and is criticised as being "too little too late";
- by integrating the handling of risk factors into production system development it may be possible to act pro-actively, i.e. anticipate problems and thus develop systems minimising the risk factors. Engineering initiatives in "virtual manufacturing" may provide such new opportunities in the future;

[2] See Riso, S., Working conditions in Europe. A big picture view, *HESA Newsletter*, No 33, November 2007, p. 30-33.

■ a person with a good reputation inside the company may facilitate the intervention process through reflection and strategic navigation, a so-called "political reflective navigator", thus reducing conflict between short-term efficiency demands and long-term sustainability. ■

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