Work-related musculoskeletal disorders (MSDs): an introduction

Summary

Awkward postures, repetitive work or handling heavy loads are amongst the risk factors that may damage the bones, joints, muscles, tendons, ligaments, nerves and blood vessels, leading to fatigue, pain and musculoskeletal disorders (MSDs). Work-related MSDs are mostly cumulative, resulting from repeated exposure to loads at work over a period of time. Upper limbs (the hand, wrist, elbow and shoulder), the neck and lower back are particularly vulnerable to MSDs.

MSDs are episodic - the pain often subsides or disappears, only to recur later. Many MSDs are transient, with symptoms disappearing with rest or change of activity. But some MSDs may become persistent or irreversible. Some MSDs are specific, with clear clinical features, while others are non-specific, without evidence of a clear specific disorder.
MSDs are the most common work-related disorders, and they are increasing. Blue collar employees experience many more MSDs than white collar employees, especially service and shop and market sales workers, labourers in mining, construction, manufacturing and transport, and plant and machine operators and assemblers. Male workers are more likely to suffer from MSDs than female workers, and complaints increase with age.

Factors contributing to MSDs include use of force, repetitive work, work in awkward postures, vibration, work in cold environments, and prolonged sitting or standing. They are also affected by levels of stress, autonomy and support from colleagues, individuals' prior medical history, physical capacity and age, and social factors such as leisure activities. These factors may act uniquely or in combination.

Employers are required to assess the risks that their workers face, including the risk of developing MSDs, and act on them.

Introduction

The aim of this article is to inform workers, employers and occupational safety and health (OSH) professionals about musculoskeletal disorders. The following questions will be answered: What are musculoskeletal disorders? How often do they occur? What are the risk factors? And do legislation and standards exist to prevent these disorders?

This is a general, introductory article that is complemented by more in-depth information on specific disorders and workers in specific sectors:

- Work-related neck and upper limb disorders (WRULDs)
- Manual handling of loads
- European legal requirements relating to MSDs
- MSDs and the pace of work
- MSDs in construction
- WRULDs in construction
- MSDs in agriculture
- MSDs in the service and retail sector
- MSDs in hotels, restaurants and catering [available soon]
- MSDs in education
- MSDs in young workers [available soon]
- MSDs and ageing [available soon]

What are MSDs?

Walking, sitting, running, playing sport, dancing and working are all activities that we perform using our musculoskeletal system. The musculoskeletal system is a complex entity, composed of **bones, joints, muscles, tendons, ligaments, bursa, nerves and blood vessels**. All our postures and movements are dependent on the functioning of the musculoskeletal system. Being physically active is beneficial for our musculoskeletal system, but an overload of physically strenuous tasks may pose a threat to it. Awkward postures, repetitive work or handling heavy materials may damage the system, leading to musculoskeletal fatigue, pain or disorders. MSDs are caused when the physical capacity of the muscles, joints, ligaments etc. is **not in balance** with the external forces that act upon the body.

External forces may cause acute trauma during an accident, resulting in fractures, lacerations and contusions. However, work-related MSDs are mostly cumulative disorders. They result from repeated exposure to high or low intensity loads over a certain period of time (several months or years, in many cases). Because individuals often repeat actions or spend long periods of time carrying out work activities in awkward postures, or with intense mental stress throughout the work day, many MSDs are associated with work.

MSDs are disorders that affect the musculoskelatal system, resulting from a repetitive exposure to loading. Upper limbs (the hand, wrist, elbow and shoulder), the neck and lower back are particularly vulnerable to MSDs. Lower limbs and the upper back may also be affected.

MSDs: Common

MSDs are the most common work-related disorders, affecting workers both in physically strenuous work (e.g. mining) and in low-intensity static work

(e.g. computer work). The costs of treating MSDs, together with the costs of absenteeism, have been estimated at between 0.5% and 2% of Gross National Product in the Nordic countries,[i] for neck and upper limb disorders alone.

MSDs: Episodic

Many people will suffer from an MSD once in their life, and many will experience symptoms more than once. MSDs may be characterised as **episodic diseases** because the pain often subsides and disappears for a while and recurs a few months or years later[ii]. A large number of MSDs are **transient**, in that the pain (or other symptoms) disappears with rest or when an activity is changed. However, dependent on the tissue involved and on the forces that act upon the body, some MSDs may become **persistent** or **irreversible**.

MSDs: Specific and non-specific

Most physicians and researchers classify MSDs either as specific or non-specific disorders. Some MSDs are **specific,** in that they have clear clinical features; they include lumbosacral radiculair syndrome in the low back, carpal tunnel syndrome in the wrist, and patellar tendonitis in the low extremities. Some MSDs are **non-specific, in that** pain is present without evidence of a clear specific disorder. One in every three patients who present in primary health care experience pain in the absence of a clear specific disorder. Of course, this does not mean that these symptoms are trivial or non-existent[iii].

How frequently do MSDs occur?

MSDs represent the most important work-related health problem in Europe. This section gives some statistical data on the occurrence and impact of MSDs in Europe. Two definitions are used:
1) The number of **new, occupational MSD cases** in the EU - certified cases recognised by national insurance systems,[iv] and
2) The number of **work-related MSD complaints**, suffered during the past 12 months, caused or made worse by work. This is a broad concept that

[i] European Agency for Safety and Health at Work. Work-related neck and upper limb musculoskeletal disorders, 1999. National Research Council. Musculoskeletal disorders and the workplace, 2001
[ii] Waddell G. A new clinical model for the treatment of low back pain. Spine 1987;22:128-56.
[iii] National Research Council. Musculoskeletal disorders and the workplace, 2001
[iv] Reported in Eurostat. Number and incidence rate (per 100,000 workers) of occupational diseases by economic activity, disease (ICD-10) and sex - EODS obligatory list, 2001, 2002, 2003 data (Data includes m00-m99 diseases, g560 Carpal tunnel sdr, and I730 Raynaud´s syndrome).

covers much more than the occupational MSD cases. It includes complaints based on the assessment of work-related health.[v]

In 2003, for every 100,000 workers, there were 32 new MSD cases. This means that MSDs account for 50% of all new cases of occupational disorders in the EU (2003 data), and 50% of all work-related health problems in Europe (1999 data). Moreover, the number of MSD cases is increasing over time. In 2001, around 19 workers in every 100,000 suffered from a new MSD. This number had almost doubled by 2003 (32 per 100,000 workers).

MSDs by sector

Mining and quarrying, manufacturing and construction are the sectors with the highest relative number of MSD cases: 960 new cases per 100,000 workers, which is 30 times the average number of 32 per 100,000. However, in terms of work-related MSD complaints, the health and social work, transport, communication and construction sectors have the highest rate of symptoms (1.2 to 1.6 times higher than the average in the total population).

Sectors with the highest relative number of new MSD cases (per 100,000 workers)		**Sectors with the highest number of work-related MSD complaints** (per 100,000 workers)	
Mining and quarrying	960	Health and social work	4283
Manufacturing	81	Transport and communication	3160
Construction	50	Construction	3158
Total population	32	Total population	2645

MSDs by occupation

Of all European workers, blue collar employees experience almost 20 times as many MSDs as white collar employees (legislators, professionals and clerks). Compared to service workers and shop and market sales workers (for example salespersons and demonstrators), the number of MSDs among blue collar workers is 4 times higher.

Of the blue collar workers, craft and trade workers, plant and machine operators and assemblers, and workers in elementary occupationsvi have the

[v] Calculated from relative Eurostat prevalence figures

[vi] Occupations are classified by ISCO-88 (the International Standard Classification of Occupations) into 10 major groups. Group 9, Elementary occupations, covers workers whose occupations require only the limited knowledge and experience necessary to perform mostly simple and routine tasks, involving the use of hand-held tools, considerable physical effort in some cases, and, with few exceptions, only limited personal initiative or judgement. Tasks include: digging and shovelling;

highest risk of MSDs: they accounted for 84% of all new certified cases reported in 2003 in EU countries. Among craft and trade workers, the number of MSDs is 101/100,000 workers, among workers in elementary occupations it is 71/100,000 workers, and among plant and machine operators and assemblers it is 65/100,000 workers (2 to 3 times the average in the total population).

The relative number of work-related MSD complaints is highest among service workers and shop and market sales workers (3,700/100,000 workers) and also among workers in elementary occupations (labourers in mining, construction, manufacturing and transport) and plant and machine operators and assemblers - 1.2 to 1.4 times the average.

Occupations with the highest number of new MSD cases (per 100,000 workers)		**Occupations with the highest number of work-related MSD complaints** (per 100,000 workers)	
Craft and trade workers	101	Service workers and shop and sales workers	3,700
Workers in elementary occupations	71	Workers in elementary occupations	3,500
Plant and machine operators and assemblers	65	Plant and machine operators and assemblers	3,300
Total population	32	Total population	2,645

MSDs by sex and age

The risk of male workers suffering from an MSD is 1.3 times higher than the risk to female workers: 35/100,000 compared to 27/100,000. In terms of (self-reported) work-related MSD complaints, the risk is only slightly higher among male workers (1.07 times higher).

The number of work-related MSD complaints increases with age. At the age of 55-64 years the number of self-reported symptoms is 1.7 times higher than at the age of 25-34 years.

Sickness absence and permanent disability due to MSDs

MSDs are the wo rk-related health problem with the highest impact on sickness absenteeism in Europe; 39% of total sickness absence of 2 or more weeks is due to work-related MSD symptoms (in comparison, 19% of total sickness absence is due to stress, depression and anxiety). MSDs are also the work-related health problem with the highest impact on permanent

loading and unloading; raking and pitching hay; watering and weeding; picking fruit and other crops; feeding, watering and grooming animals.

incapacity; 61% of permanent incapacity is due to MSDs (compared to 10% due to stress, depression and anxiety and 10% due to cardiovascular disorders)[vii].

Almost 24% of workers who have suffered from a work-related MSD complaint in the past 12 months have a sick leave period of between 1 and 13 days. 11 % have a sick leave period of between 2 weeks and 1 month, and a little more than 20% have a sick leave period of more than 1 month.

What factors may contribute to MSDs?

Four different groups of factors may potentially contribute to MSDs:

- Physical or biomechanical work-related factors
- Organisational or psychosocial work-related factors
- Individual or personal factors
- Factors relating to social content.

Physical factors

Physical factors include the work procedures, equipment and environment that lead to biomechanical stress in the muscles, tendons, spinal discs and nerves. Force, repetition, awkward postures or long-term static postures, vibration and work in low temperatures are considered the principal physical work-related risk factors in relation to MSDs:

- Applying manual **force** with the intention of moving objects, persons or animals loads the muscles and tendons of the arms
- **Repetitive** work using the same muscles and tendons for a considerable part of the working day may be responsible for fatigue and injuries.
- In **awkward postures** (with the hands above shoulder height or with the wrists noticeably bent) the joints are more susceptible to injuries and the muscles have less capacity for exerting force.
- Excessive work with hand-powered tools like hammer drills and other percussive breakers like concrete crushers, hand-held portable grinders, jig saws and chainsaws, may expose the hands to **vibration** and contribute to potential disruption to the blood circulation in the fingers and to the nerves of the hand and arm.
- **Cold environments** compromise muscle efficiency and may cause vascular and neurological damage. Workers with cold hands may exert more force then necessary, affecting muscles, soft tissues and

[vii] Paoli, P. and Merllié, D., Third European survey on working conditions 2000, Luxembourg: European Foundation for the Improvement of Living and Working Conditions, Office for Official Publications of the European Communities, 2001, ISBN 92-897-0130-7.

joints. This can lead to a more rapid onset of fatigue and to the development of disorders.

- Hairdressers, dentists, computer operators and musicians are examples of workers who have long-term **static postures**: the shoulder muscles are tensed, without movement, in order to maintain the arms raised, while the hands work without the opportunity to rest. This type of repeated static posture can give rise to injuries, particularly when repeated for months or years.
- **Prolonged standing** may result in fatigue and discomfort in the legs. It can lead to the development of musculoskeletal disorders (e.g. painful feet and other foot problems) and varicose veins. **Prolonged sitting** requires the muscles to hold the trunk, neck and shoulders in a fixed position. This squeezes the blood vessels in the muscles, reducing the blood supply. An insufficient blood supply accelerates fatigue and makes the muscles prone to injury.
- **Manual handling** refers to the transfer, pushing, pulling and carrying of loads by one or more employees. When heavy manual handling is repetitive, and combined with awkward work postures (eg with the trunk bent forward, or bent and twisted at the same time) there may be a high risk of MSDs in the lumbar region. However, some loads may be considered favourable; they contribute to the dynamic s of movement and to the efficiency of blood circulation (particularly when the load is suitable for the duration of the activity and the recovery time allowed).
- **Repetitive, forceful** work with the joints in **an awkward position** is one of the most important combinations of risk factors. It can be seen for example in grocery checking, meat, poultry and fish preparation, manual assembly line work, helping patients to move, serving food and drink, cleaning, paint-spraying, using hand-held machines and using hand tools.

Organisational and psychosocial factors

Daily exposure to physical risk factors and insufficient rest or recovery time are among the principal organisational factors that can lead to MSDs. Providing knowledge, skills and information on working methods and techniques, and on working movements, postures and loads, can reduce the risk of MSDs.

Mental strain can cause muscular tension, and increase existing physical strain. Work conditions that may increase mental strain include:

- Psychologically demanding activities, in which the workers are exposed to high levels of work stress, work pressure and mental demands, as a consequence for example of tight deadlines and low levels of autonomy

- Activities in which there is little support from colleagues, supervisors and managers.

Individual factors

Individuals differ in their susceptibility to MSDs. Factors such as prior medical history, physical capacity and age are very important. Obesity, pregnancy, rheumatoid arthritis, acute trauma and endocrinological disorders are other examples of individual non-occupational factors that may affect the occurrence of MSDs.

Factors relating to social context

Social context provides some important non-work risk factors relating to MSDs. Some types of sport, leisure activities and housekeeping work at home can all increase susceptibility to MSDs.
The relation between work activities and a particular musculoskeletal disorder is multi-factorial. This means that when different physical factors are present, coexisting with organisational factors (and also individual and social factors), a work situation may arise in which there is a high risk of developing MSDs.

Do legislation and standards exist to prevent these disorders?

Employers in Europe are required to comply with laws and regulations in their Member States relating to working conditions and the workplace. To a large extent, these laws and regulations are based on European Directives. Some Directives are very important for the prevention of MSDs:

- 90/269/EEC on the minimum health and safety requirements for the **manual handling of loads,** where there is a risk particularly of back injury to workers
- 90/270/EEC on the minimum safety and health requirements for work with **display screen equipment**
- 2002/44/EC on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (**vibration**)
- Council Directive 89/391/EEC on the introduction of measures to **encourage improvements** in the safety and health of workers at work.

These Directives set out the obligations of employers to put in place preventive organisational measures, to provide mechanical aids, to perform risk assessments, and to assess the demands of a specific task. Employers

must also give workers the information and training they need to work in a healthy manner.

With regard to the manual handling of loads, specific attention must be paid to risks relating to characteristics of the load (eg whether it is too large, unstable or difficult to grasp), the physical effort required (eg whether it is too strenuous, or can only be achieved through a twisting movement of the trunk), characteristics of the working environment (eg uneven or slippery floors or unsuitable temperature) and the requirements of the activity (e.g. over-frequent physical effort or insufficient recovery periods).

With regard to work with display screen equipment, workstations must comply with minimum requirements (eg with space in front of the keyboard, a work desk with a sufficiently large surface, adjustable seat and available footrest, satisfactory lighting). Also, work on a display screen should be periodically interrupted by breaks or changes of activity. Finally, attention should be paid to the operator-computer interface (eg providing suitable software).

Existing standards (for example ISO and CEN standards) give detailed technical information concerning the organisation of work places and equipment, in order to prevent MSDs.

See the Agency's website for more information on European legislation relating to the protection of workers: http://osha.europa.eu/legislation