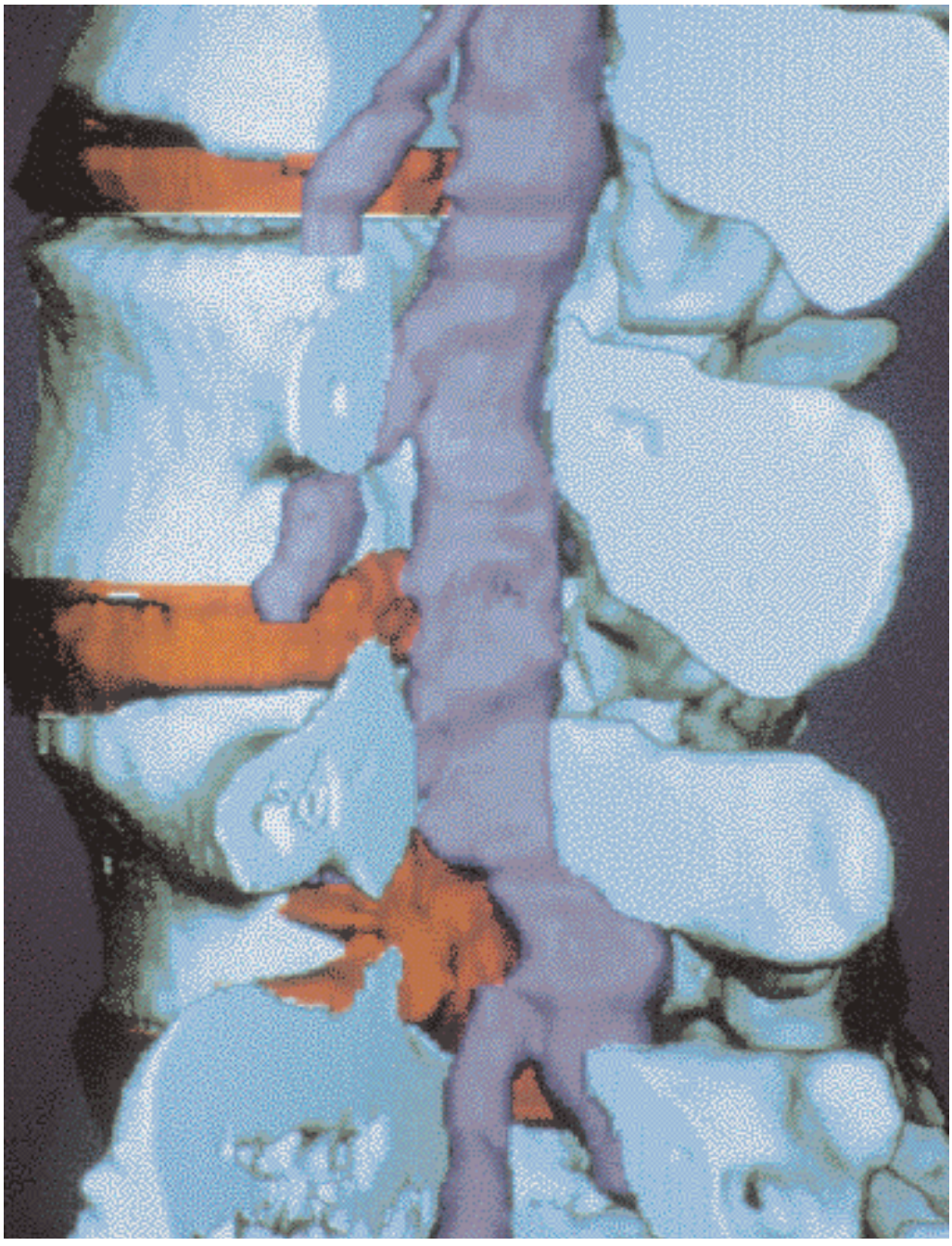
Corrupt discs

Using biomechanics – the study of forces on the human body – it has been established that one of the leading causes of spinal instability, and thus of low back pain, is degeneration of intervertebral discs. While these, like most other parts of the body, will deteriorate with age studies to date have been less than clear about the link between age and the incidence of lower back pain in manual handling tasks. Duncan Abbott examines the evidence and suggests some strategies for minimising the risk of work-related low back disorders.



Just as no universal weight limit is suitable for everyone, there will always be individuals whose backs are described as being in a 'vulnerable state'. The conditions that may predispose these individuals as being at risk will become more common as age increases.

Two terms used to describe the phenomenon of low back pain are: any back pain between the ribs and top of the leg, from any cause; and work-related back pain. The latter is any pain originating in the context of work and considered clinically to have been caused – at least in part – or exacerbated by the claimant's job. It is often impossible to distinguish 'back pain caused by work' from pain of uncertain origin that makes the patient's work impossible to carry out.[1]

As with many other factors at work, attempting to examine age and incidence of lower back pain as a result of manual handling is difficult. Age is straightforward to determine but degeneration of the body, which occurs at a different rate for different people, and reduction in strength of the trunk muscles that resist internal pressures when lifting, is not so easy. Furthermore, skill tends to increase with age, and more skilled individuals might handle objects in a more appropriate manner than younger and less experienced colleagues.

There is some evidence that age dependence is a more significant factor in chronic back pain cases, and incidental for low back episodes.[2] Over their working lives, older patients are exposed to repeated microtrauma to the spine, which may leave them more vulnerable to occupational injury. Further, the load-bearing capacity of the spine decreases with age and there has been some speculation that older workers' spines are less able to counteract mechanical loads required by

occupational demands. After the age of 60, and coincident with retirement from gainful employment, there is a decreasing prevalence of back symptoms.

Epidemiological studies (studies that seek to find associations between exposure and disease, or cause and effect) have shown that mechanical factors can increase low back pain, which is often caused by an associated increase in disc degeneration. Back pain is equally common in men and women, occurs at all ages, and is particularly prevalent among people whose work involves certain types of activity, or risk factors. Back pain can have its source in any of the spinal structures (discs, facets, ligaments, vertebrae, and muscles) but one of the leading causes is spinal 'instability' resulting from disc degeneration.[3] The main function of the intervertebral disc, a gel-like substance located between two vertebrae, is to resist compression. Any degeneration of the lumbar discs therefore reduces the stability of the lumbar spine. A high biomechanical demand on such an unstable lumbar spine leads to a high demand on the ligament and muscular structures.

The age factor

The degenerative process is believed to be a cause of low back pain and sciatica through disc bulging, which causes nerve root impingement and irritation. The process by which disc degeneration occurs is slow and a cumulative effect of many factors. Men start to show signs of degeneration in their 20s, women in their 30s. At the age of 50, 97 per cent of the lumbar discs in both males and females have degenerated. Those that degenerate most with age are in the lower lumbar region – between the third lumbar vertebra and the sacrum.[4]

By means of a critical review of international literature, a study by Italian researchers examined the influence of the 'age factor' on work-related musculoskeletal disorders of the lower back.[5] Their research found evidence of the influence of age in determining a progressive increase in the occurrence of degeneration. Much of the literature agrees that the prevalence of low back disorders (LBDs) increases as people enter their working years. However, it would be incorrect to conclude that LBDs are a health problem only for older workers, since prevalence rates are also found in younger age groups. In a 1997 European study the prevalence of LBDs in the under-25 age group was found to be 25 per cent, and at 55 years and older, 35 per cent. A 1998 study found that by the age of 20, more than 50 per cent of young people will have experienced at least one low back pain episode. Yet another piece of research cites 12 studies that reported a positive association between LBDs and increasing age and a further 15 studies in which no association is mentioned.

Cumulative injury

A multi-dimensional approach by the Orthopedic Bioengineering Laboratory[6] has yielded a new and different understanding about the nature of disc injury. Orthopaedic surgeons have long understood that back pain is associated with dehydration of the intervertebral disc. In a healthy spine, the centre of the disc is composed of a hydrated gel-like substance, surrounded by a tough, flexible ring. When disc tissue degenerates – often because it has been subject to excessive force or 'loading' – it can lose its gel-like texture, along with its ability to maintain proper distribution of mechanical stress and strains. Disc regions may be subjected to loads for which they are not well suited and the tissue may alter as a result. This may pressure spinal nerves and cause pain.

Contrary to the prevailing notion that back injuries are discrete, sudden events the Bioengineering team's findings suggest that these injuries are cumulative in nature. Disc degeneration is very common and in most patients asymptomatic (symptoms not displayed) until a specific event triggers pain: thus, the impression among patients – and most of the medical community – that an action "threw the back out". The Bioengineering team's research indicates that while a final event may have triggered the pain, the underlying abnormality was, in all likelihood, already present – probably for some time.

An explanation for the lack of an observed relationship between an increased risk for musculoskeletal disorders (MSDs) and aging is that some studies may be 'survivor biased'. If workers who have health problems leave their jobs, or change jobs to one with less exposure, the remaining population includes only those workers whose health has not been adversely affected by their job. The effect of survivor bias is to underestimate the true risk of developing MSDs in the older workers.

The importance of ergonomic programmes

The loss of muscular strength in older workers may also increase the risk of developing musculoskeletal injuries as a result of tasks involving workloads that approach the individual's maximum capacity.[7] According to the World Health Organisation it is generally agreed that task demands and work environments should be matched to the capabilities of the older worker in order to prevent occupational ill health and maintain safe working conditions. Thus the importance of implementing an ergonomic programme.

Using increasing scientific knowledge, guidelines and standards have been developed and continue to be improved and refined. In the case of risks from manual handling of loads employers are already provided with important information on how to protect workers: The Manual Handling Directive (Council Directive 90/269/EEC) is particularly aimed at preventing risks of back injuries during manual handling of heavy loads. It provides minimum health and safety requirements and an approach for risk assessment and prevention.

Older workers' spines may be less able to counteract mechanical loads required by occupational demands

However, further development of guidelines and standardised criteria are necessary to increase the awareness of all possible problems associated with work-related low back disorders. Occhipinti *et al*'s findings[5] suggest that specific measures should be adopted for workers aged over 45 who are exposed to manual material handling. They suggest using reference values for the recommended weight that are lower than those adopted for younger workers (aged 18-45 years) and implementing specific programmes of active health surveillance.

Conclusion

If mechanical factors do play a role in the degenerative process, it would be beneficial to reduce the effects of loads on the spine by reducing the magnitude of loads on the disc, thus limiting the extent of chronic exposures. There is evidence of the effectiveness of the ergonomic approach for locating risk factors and devising prevention measures. This approach focuses on the identification and evaluation of risk factors in the task, equipment, work environment and work organisation. Strategies to prevent low back disorders include both workplace and health care-based interventions. It is increasingly being recognised that an integrated approach including both types of intervention is needed to tackle the problem effectively.

But certain occupations are more prone to disc problems – for example,

labourers, farmers, baggage handlers, and nurses (see article opposite). So, the widespread occurrence of lower back pain calls for an ergonomic programme that will avoid or reduce overloading and wear and tear on the intervertebral discs. More refined research methods in laboratory conditions are being used and further developed to increase knowledge – the multi-dimensional approach by the Orthopedic Bioengineering Laboratory, for example.

According to one study,[8] materials handling is moving from an environment where the load has traditionally been the risk factor to a situation where variability in repetition and awkward motions performed under time pressures are more significant risk factors. The economy is now primarily service-based, so work activities can now take place at home or at non-modifiable locations. This has changed the nature of the risk of lower back disorders and so requires more comprehensive and systematic assessment of that risk. Manual handling risk models should be expanded so that they are comprehensive and consider the complex multi-dimensional nature of lower back disorder risk instead of the one-dimensional risk assessments that are currently in use.

A common approach is needed to all musculoskeletal problems in the workplace. In this context it is helpful to view the risks in terms of combined 'overload' on the musculoskeletal system. Employers should pay attention to the risk factors detailed in the Manual Handling Regulations (1992) when making an assessment. Also, selecting measures for the prevention of low back and other work-related musculoskeletal disorders should form part of every employers' overall prevention plan for dealing with health and safety risks.

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6 The Berkeley Orthopedic Biomechanics Laboratory, in the Department of Mechanical Engineering at UC Berkeley, was established in 1993. Calling on the expertise of scientists across an array of disciplines – medicine, engineering, molecular biology, computer science and more – the Laboratory is rapidly advancing understanding of injury to the spine, what emerging treatments hold most promise, and which preventive measures will be most successful in avoiding degenerative spinal disease.

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About the author

Duncan Abbott is an ergonomist and works with a wide range of companies, including banks, government agencies, Local Authorities, manufacturers and retail companies. He has extensive experience of assessing employees with disabling conditions for their return to work.