# The role of physiotherapy in the prevention of industrial accidents

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In 1964, New Zealand had 57,918 industrial accidents of which approximately 15,000, or over 25%, were sprains and strains, entirely due to incorrect lifting procedures (NZ Dept of Statistics, 1964). The direct cost to New Zealand was in the region of £3 million and indirectly about £9 million, and this for only a small country. In England, last year, the cost was more than £356 million, so it is obviously a world-wide problem and, perhaps, part of the price being paid for progress.

The productive time lost in any given year is equal to the permanent withdrawal of more than 8,000 people from the labour force. Many of these are skilled workers, which the country can ill afford to lose. The ever-increasing industrial tempo is being matched with an equal relentless rise in the industrial accident rate.

It is, of course, not confined to industry, although this is the real purpose of this discussion, but it is also a social problem, being the occupational hazard of any physical activity that involves the action of bending the spine. The housewife making beds, the young mother lifting her baby, the weekend gardener, as well as industrial workers, are all facing the hazards of suffering an acute and often permanently disabling back strain.

The physiotherapist today, through training in kinesiology and experience in the treatment of industrial accident cases, is in an important strategic position to prevent and modify this futile drain in manpower and money, and also to prevent and modify the suffering and pain it produces.

Lifting and carrying are among the activities that subject the body to its greatest strain. In 50% to 60% of the injuries, the cause is degenerative in nature, ie, the consequence of aging and excessive wear and tear on skeletal and muscular tissue. After all, it is not only our faces that reflect our age despite the fact that it may not be quite so apparent in our joints and muscles.

Since the levers of the human body are adapted for range, speed and precision of movement rather than for weight handling, it is not surprising that the incidence of in juries attributed to lifting is extremely high. Although injuries occur involving all joints and muscles, I am particularly concerned with the spinal column, since it participates in every movement either by direct lifting or static holding. Damage to the spine is the primary injury in some 50% of the compensable accidents of industrial handling; it is the secondary injury in a further 25% of the incapacitating strains and sprains. It is the key to the whole problem of cause and prevention in the high rate of industrial accidents. With a leverage ratio of 1 to 8 in the average man, the weight of the trunk alone at a lifting angle of 30° throws a strain of something like 350 lb on the lumbar discs (CHS Geneva, 1962). Even picking up a piece of paper from the floor involves a 90° angle in this area, and is equal to a pressure strain of 1,000 lb on the lumbar discs. It becomes very obvious, therefore, that the often heard remark, "But I didn't lift any thing very heavy," is far from fact. In lifting the weight of the trunk alone one has performed quite a feat.

The idea that lifting is a natural movement which does not need to be learned is completely fallacious. Children learn by imitation. The young apprentice learns, almost subliminally, lifting techniques which are often entirely wrong but, nevertheless, are perpetuated.

What are the essential principles in correct lifting? There are five key factors: (1) Straight or erect back; (2) chin tucked in; (3) elbows into side; (4) palmar grip; and (5) proper foot position (Guthrie, 1963).

It is generally agreed by orthopaedic surgeons and physical medicine specialists that lifting should be done not only with a straight back but preferably with an erect back. Floyd and Silver (1951) state that, with the spine in the erect or neutral position, the erector spinae muscles show minimal activity, but that, as soon as movement begins, they contract strongly. These findings indicate that, in the upright or neutral position, the body weight is transmitted through the bony vertebrate and the intervertebral discs, ie, the spine is stabilized and the muscles relaxed. This is understandable, for in the erect position the diarthrodial joints are locked. Their supporting structures, as well as the weak posterior common ligament with which the relatively loose fibres of the posterior portion of the annulus fibrosus blend, are not subject to the same degree of tension as when the back is bent. Therefore, trauma due to minor degrees of derangement of the inter vertebral discs and diarthrodial joints resulting from degenerative changes, and triggered by incorrect lifting, are much less likely to occur (Guthrie, 1963).

The position of the feet is of vital importance. They should be a comfortable distance apart with one foot slightly in front of the other. This ensures that the centre of gravity during the lift passes through a point between the feet. It provides for better balance and for protection in the case of a slip. Should the operator intend to move with the object to the right or left, the foot nearer that direction should be first turned to point that way. This prevents turning on a fixed foot after picking up an object and thus placing a rotation strain on the discs or knee joint.

Contrast this with untrained lifting procedure where a worker, tending to think only of the immediate problem, stands with his feet near each other, his legs straight and his back bent. In taking weight he is clearly off balance. The neutral axis passes through the posterior third of the vertebral and disc area. The

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compression effort is thus distributed unevenly over the anterior two-thirds of the disc area while the posterior third and back muscles are subjected to tensile stresses.

However, it is not the object of this discussion to go deeply into the pathology of disc lesions or the techniques of lifting the problem now is how can the physiotherapist change this depressing picture.

# SCHOOL EDUCATION PROGRAMME

The physiotherapist can, by obtaining the co-operation of the school physical education teacher, influence the syllabus so that at sixth-form level it includes instruction in the handling of various objects to bring out the correct principles of lifting. This is the best place to begin education of this kind and is essential if lifting correctly is to become a reflex action pattern that will following through in industry or the home. At the risk of being thought a heretic, I believe it to be much more important than teaching rugby or basketball in schools. Or need this be the alternative?

It can be argued that the school training programme is not the physiotherapist's field but surely these appalling statistics are everybody's problem. Help is needed from all authoritative sources and I have found the school staff only too willing to co-operate.

#### APPRENTICES

Correct lifting techniques relevant to the particular trade should be part of every apprentice training programme. During this critical period, many adolescents begin the minor trauma that will later lead, through lowered resistance in the discs, to early degeneration and limited function.

These are, indeed, the formative industrial years. Bad habits picked up, will remain forever. In New Zealand, all apprentice courses now include lectures on industrial safety by National Safety Council lecturers. Unfortunately, this is done only by local consent and I think the time has come when it should be written into the apprentice's terms of contract and rigidly adhered to as part of his syllabus.

#### FOREMEN'S AND WORKERS' SEMINARS

The physiotherapist can organize lectures to foremen, supervisors and groups of workers involved in lifting operations, explaining in elementary terms the anatomy and physiology of muscular and skeletal structures. Also, simple mechanics of the spine and correct lifting techniques can be taught. These methods have been in operation in industry for some time now. The response has been extremely good from both management and workers, and a consequent reduction in the accident figures of the firms represented has been shown.

# INDUSTRY

Here, the physiotherapist, in co-operation with his National Safety Council and the industry's own safety officers, can advise on correct job placement. This is a vital responsibility. As sporting contests show, short, intense contests of speed and strength are won by competitors between the ages of 15 and 25 years. On the other hand, the winners of endurance contests include persons in their forties and, where experience and routine play a special part, even their fifties and sixties (CHS Geneva, 1962). Conditions are similar in working life. In most occupations, older workers can be employed to advantage since their reduced physical performance is offset by greater experience, powers of endurance and more rational methods of work. Older workers, however, are at a decided disadvantage in occupations where straightforward strength and speed are the decisive factors.

By making himself familiar with industrial working conditions, the physiotherapist can advise the movement, if necessary, of a worker to some other job which requires similar skills with less strain in the same factory.

He can lay down ideal anatomical considerations for heavy lifting work (short stocky types are best suited for heavy lifting operations) or the weight lifting limits for specific jobs. He can analyse lifting problems producing abnormally high accident figures and advise modifications such as lifting platforms, lowering stacks of goods or minimizing static holding situations. He must seek out his National Safety Council, or its equivalent, and play a part in its work and development. If such an organization does not exist, he should stir up a local consciousness that will create such a body. There are ample precedents for this and a mountain of literature available. Everything must have a beginning.

The lifting habits of a community cannot be changed overnight, but, with determination and common sense, a practical answer can be provided to a very real problem in industry today.

To recapitulate, the industrial accident figures continue to rise, with tremendous cost and tremendous waste in money and manpower. Many accidents are the result of faulty lifting techniques. The physiotherapist's role in the prevention of industrial accidents is, therefore, to train the population in correct lifting techniques, to advise industry on job placing, analyse accident causes, and to see accident potentials.

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# Commentary

Len Ring was a leader in the field of Occupational Health Physiotherapy in New Zealand. The occupational health field has changed somewhat since he wrote this article in 1967. This was prior to introduction of no fault accident compensation legislation administered by the Accident Compensation Commission (ACC) in New Zealand in 1974. Work related injuries however (in particular those attributed to the low back), still continue to rise in both number and cost. In 2010-2011 the cost to ACC of new soft tissue injuries sustained in an industrial work place and attributed to lifting or carrying was \$30,822,093. Fifty four per cent of industrial soft tissue injury claims attributed to lifting or carrying in 2010-2011 were for the back or spine (ACC 2012). Len strongly advocated for physiotherapy involvement in injury prevention. Physiotherapists have taken up this challenge. Physiotherapy New Zealand now has an Occupational Health Special Interest Group with 310 members. Physiotherapists assist with prevention of a wide range of injuries and no longer have a role in just providing lifting and back care advice and training. Unfortunately, funding for physiotherapy services and health and safety legislation requirements has meant that physiotherapists' work in prevention is more often within industry, often in response to a problem rather than in the context of schools and apprentice training schemes as Len had proposed.

Len's injury prevention advice is based on his premise that bending the spine is a hazard and that by bending the person risks suffering an "acute and often permanently disabling back strain". He advocates a rigid erect straight back when lifting. His back injury prevention principles focus on technique though he also suggests advice about job placement and workplace design.

Many factors have now been identified that contribute to back injury and poor technique is only one of these (ACC 2006). Research into low back pain has highlighted that non-physical factors contribute to back pain and psychosocial factors are linked with progression to disability (Nicholas et al 2011). Reliance on changing technique alone has not proven to be an effective injury prevention strategy (Verbeek et al 2011). Physiotherapists now adopt a multifactorial approach to back injury prevention in line with current evidence.

In summary, Len Ring was a leader in the occupational health physiotherapy field in New Zealand. He encouraged physiotherapists to use their skills in the industrial setting. Physiotherapists now have an important role and a strong presence in work related injury prevention and rehabilitation. It is a challenge for us to further embrace potential opportunities in primary prevention.

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