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Longer Term Outcome of Employer Provided Ergonomics Interventions for Work Related Upper Limb Disorder Affecting the Upper Extremity: A Prospective Study

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Abstract

Introduction: The Health and Safety Act of 1974 supported by the Display Screen Equipment Regulations of 1992 places duties on employers to provide ergonomics assistance to keyboard workers with work related upper limb disorder, but no longer term evaluation has been published on the effect of such provision.

Purpose: To evaluate prospectively the longer term outcome of employer provided ergonomics interventions to keyboard workers with work related upper limb disorder.

Methods: Prospective study of rest, typing pain and typing endurance before and after ergonomics interventions. Two-tailed student T-test was used for evaluation.

Results: Patients were evaluated a mean of 5.12 years after the start of the study. Short term testing showed significant improvement for all outcomes and the pain after typing was significantly lower at the longer follow-up.

Conclusion: Employer provided ergonomics interventions have significant longer term beneficial effect on keyboard workers with work related upper limb disorder.

Keywords: Keyboard workers; Work related upper limb disorder; WRULD; Ergonomics interventions; Longer term; Outcome

Practitioner Summary

Health and Safety Regulations places duties on employers to provide ergonomics assistance to keyboard workers, but no longer has term evaluation been published. This prospective 5 years (mean) study of keyboard workers with work related upper limb disorder show that employer provided ergonomics interventions have significant longer term benefits.

Introduction

Work Related Upper Limb Disorder (WRULD) has been identified in workers in the manufacturing sector, musicians and computer users and in Europe is the most common cause of industrial injuries, reported to account for 45% alone [1-4]. Resent research suggests that the natural history of computer workers with non-specific WRULD who do not receive intervention or treatment is pessimistic, as 77% reported more disability 4 years later [5]. In Great Britain workers are protected through the Health and Safety Act of 1974 and those who work with computers are further supported by the Display Screen Equipment Regulations of 1992 which places duties on employers to provide ergonomics assistance to keyboard workers when needed [6,7]. Because of the significant socio-economic and legal consequences affecting this group of working patients, many studies have investigated the short term effect of interventions [8,9]. However, no longer term prospective evaluation has been published on the effect of interventions for keyboard workers with work related upper limb disorder. This paper therefore aims to evaluate prospectively the longer term outcome of employer provided ergonomics interventions to keyboard workers with work related upper limb disorder.

Materials and Methods

The diagnostic criteria for work related upper limb disorder was adopted from the definition as suggested by Newman et al. [3]. Twenty-nine keyboard workers with a diagnosis of hand/forearm WRULD, were offered participation in a programme that encouraged employer provided ergonomics provision and occupational therapist provided ergonomics education [9].

Patients who accepted participation in the study underwent a functional typing test which has previously been described and published [10]. The typing test was carried out at a standardized work station that was compliant with the guidelines set by the Health and Safety Executive (HSE) of the United Kingdom [6,7,11]. The participants were given ergonomics education about an optimal work station set up and recommended to seek maximal ergonomics workstation modifications through their employer according to the guidelines set by the HSE in addition to a physical part of the ergonomics education which concentrated on stretching and strengthening exercises of the affected muscles, supported by self-exercises several times a day at the work station during mini breaks [6,7,11]. The purpose of the HSE documents is to assist employers in preventing the use of computer work stations from causing risk to the welfare of the operators. It provides good practice guidance regarding nature and timing of breaks, planning of activities, eyes and eyesight, provision of training, provision of information and workstation requirements. Examples of ergonomics modifications that were implemented are: adjustment of monitor height, monitor positioning, improved leg room under desk, alternative keyboard, adjustable chair and provision of footrest.

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After a minimum of 3 months the participants were again evaluated with the standardized typing test and the before and after results were statistically compared. After a minimum of 3 years after start of the study the participants were ask to complete a Patient Rated Outcome Measure (PROM) concerning their current status regarding resting pain, typing induced pain, typing endurance, current keyboard work requirement and whether they were involved in any ongoing legal process due to their WRULD condition.

Results

29 keyboard working patients with a diagnosis of WRULD had the initial typing test, and were provided with ergonomics support from their employer and had an educational session lead by an occupational therapist about stretching exercises, good work routines and work station adjustments. 17 of the 29 returned for a short term follow up typing test 3-6 months after the ergonomics improvements had been put in place by the employer according to HSE guidelines and 17 replied to a patient rated outcome measure (PROM) at the longer term follow up at a mean of 62 months (5.16 years). The measurements at the initial, short and longer term follow-up are seen in Table 1. Statistical evaluation of the measurements showed that at the short term follow up all 3 measured parameters were significantly improved compared with the initial test results; resting pain p=0.02, typing pain p=0.0002 and typing endurance p=0.0069.

At the longer term follow up all PROM scores were still improved compared with the initial test scores but only the typing pain was improved statistically significantly (p=0.004). Statistical comparison between the shorter term test measurements and the longer term PROM scores did not show any significant difference. At the mean 5 year follow-up all respondents indicated that they were working at the same intensity level as at the start of the investigation.

Discussion

The Health and Safety Act etc of 1974 supported by the Display Screen Equipment Regulations of 1992 and publications by the HSE like "upper limb disorders in the workplace" give recommendations and places indirect duties on employers to provide ergonomics assistance to key board workers when needed [6,7,11]. Therefore, despite the published literature being divided on the benefit of ergonomics provision, failure by a UK employer to comply with the HSE recommendation on ergonomics assistance can lead to prosecutions in a British court [12-14].

It is therefore important, both for medical but also for judicial reasons, to further investigate if provision of ergonomics assistance is likely to be of benefit to keyboard workers either when provided prophylactively or after a worker has developed problems in order to minimize or cure work related upper limb disorders. This paper reports on the short and longer term effect of ergonomics intervention provided by employers for keyboard workers after they have developed problems. The findings in this study are based on keyboard workers with musculoskeletal symptoms of their hands and forearms that were so severe that they sought medical advice, however, the severity of the resting pain score was less than VAS 5 in the included patients. There is no control group in this study as all participants were provided with ergonomics intervention according to the HSE guidelines as failure to do so would have exposed the employer to the risk of legal complaints for failing to comply with the HSE guidelines. In order to compensate for the lack of a control group all participants had to have had their symptoms for at least 3 months to ensure that the complaints were of a persistent nature as previous studies have showed that a "no-intervention" approach was likely to cause progressive detoriation in the condition over the longer term [5]. The purpose of the investigation was therefore to record if provision of employer provided ergonomics support according to the HSE guidelines made a statistical difference in the short and longer term and thereby would support the HSE recommendations for ergonomics assistance for workers with WRULD.

The measurements in Table 1 show that prior to the interventions 21 (72%) of the 29 workers suffered from resting pain at a mean VAS level of 1.59 (± 1.3) but at the short term follow-up 3 months after the interventions had been put in place only 6 (35%) of the 17 tested workers suffered from resting pain at a mean VAS level of 0.7 (± 1.1). That would suggest that the ergonomics interventions made

Patient.		Score before interventions		Score at final Follow-up			Follow-up
Nr:	Rest pain	Typing pain	Endurance	Rest pain	Typing pain	Endurance	Length
1	3	4	30	1.6	5	5	71
2	3	5	30	0	0	30	40
3	2	4	30	0.5	1.7	30	47
4	1	2	30	0.3	0.4	30	72
5	2	2	30	0	0	30	66
6	0	5	30	2.3	4.6	30	78
7	1	5	12	0	2	30	84
8	2	5	7	3.1	4	30	96
9	1	4	30	1.5	5	19	72
10	0	1	30	1.7	2.5	30	66
11	3	5	30	2.7	1.7	30	46
12	3	5	5	3.2	4.7	30	48
13	1	4	30	1	2.3	30	69
14	1	4	30	0	0	30	36
15	2	3	30	0	0.6	30	40
16	0	5	20	1.5	5	8	39
17	3	5	17	2	4	30	90
MEAN	1.6	4	24.8	1.3	2.6	26.6	62.4
SD	1.1	1.2	8.7	1.1	1.9	7.8	18.6
Pain measure on VAS 0-10, endurance measured in minutes, follow length measured in months							

Table 1: Pain and endurance before and after interventions.

a significant improvement (p=0.02), though 1 (6%) of the 17 workers got worse in that period which suggests that provision of ergonomics assistance does not guaranty improvement. However, these results should be seen in the light of reported detoriation in 77% of workers if no ergonomics intervention is provided [5].

If we look at the short term effect of the ergonomics intervention on the pain after typing we found that prior to intervention none of the 29 could type for 30 minutes without pain but three months after provision of ergonomics support 3 (18%) of the 17 workers had no pain and 12 (70%) of the 17 workers had less pain after the 30 minutes of typing the typing test and could type statistically longer. However, 1 (6%) of the 17 workers had more pain, which reminds us that ergonomics provision is not a guarantee against further deterioration in this patient group.

These results suggest that in the short term, ergonomics interventions and education about self rehabilitation do have a statistically beneficial effect both on the individual worker but also on the group as a whole regarding the level of pain after typing. However it also suggests that ergonomics intervention provided by the employer is unlikely to lead to a normalization of the pain for keyboard workers who have developed WRULD. In conclusion, according to the results in the present study, ergonomics provision can in the short term provide good effect on pain levels in workers with develop WRULD and would support the HSE guidelines to employers with keyboard workers.

In order to investigate the longer term effect of employer provided ergonomics intervention we asked those patients who had had a typing test more than 3 years ago, before their employer provided ergonomics intervention, to conduct a new typing test in their own work environment. The mean follow up time of those who responded to the request was more than 5 years and the reply rate was 58% (17 of 29). The mean resting pain was less in 10 (59%) of the 17 workers but in 6 (35%) of 17 workers they had more pain than before interventions but as a group the difference was not significant between the results now and 5 years earlier. The pain after typing when assessed a mean of 5 years after the ergonomics interventions were started suggested that the mean pain was reduced significantly (p=0.004), though 3 (18%) of the 17 workers had more pain than before the ergonomics interventions were provided. These results suggest that employer ergonomics provision can have longer term benefits for a large part of the work force but will not guarantee a protection against pain progression in a smaller part of the work force, supporting the recommendation by the HSE [7].

In conclusion, the present results suggest that ergonomics interventions provided by employers can have a significantly positive effect in the short term for the majority of key board workers but they do not provide benefit for all recipients and some keyboard workers who have developed WRULD may continue to decorate despite provisions by the employer according to the HSE guidelines. According to the results in the present study ergonomics provision can provide good longer term effect and would support the HSE guidelines to employers with keyboard workers who develop WRULD.

The results suggest that an interventional approach that combines employer provided ergonomics intervention and empowerment of the working WRULD sufferer through education of ergonomics adjustments and physical self-rehabilitation can have a long term beneficial effect on the otherwise previously perceived pessimistic prediction of the natural deterioration of this condition in this group of workers.

The short term results after interventions showed a greater reduction in the resting pain than what was found in longer term. The reason for the difference in resting pain reduction between the early post-treatment resting pain level and 5 years later could be that the effect of the knowledge about the ergonomics options and the self-rehabilitation programme declined over time and that the participants might benefit from a refresher course.

The selection of the participants from a tertiary treatment centre suggests that the patients were of the more severe spectrum of the WRULD, however, for the purpose of this study participants were excluded if they had a resting pain level of VAS 5 or above at the pre-treatment typing test. It is therefore accepted that the participants in this study were suffering from mild to moderately severe WRULD and that extrapolation cannot be made to patients with more severe conditions as high pain ratings have been suggested to predict treatment failure [15]. The conclusions would have been enhanced if an untreated control group had been available. However, it is unrealistic to believe that patients referred to a tertiary treatment centre would accept not to receive any treatment for a painful condition for five years and such a control group would also be in breach of the HSE guidelines forcing a possible complaint on the employer. The author is therefore of the opinion that it is reasonable to conclude that keyboard workers with moderately severe WRULD can derive significant longer term benefit from a combination of education and provision of ergonomics workstation modifications supported by a physical rehabilitation programme but are unlikely to become cured by these measures. However, when introduced at an early stage before the condition has become too severe, the described interventions are likely in the longer term to prevent a high incidence of deterioration of pain in keyboard workers who have developed WRULD.

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