
Exposure Assessment of Upper Limb Repetitive Movements: Work Reintegration Criteria

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1 INTRODUCTION

The return to the workplace of individuals affected by work-related musculoskeletal disorders (WMSDs) of the upper limbs, represents a critical problem in work settings which feature a multitude of tasks liable to biomechanically strain the upper limbs. Workers suffering from disorders are largely considered to be temporarily or permanently unfit for the jobs which are likely to have caused or aggravated the disorder. Some relevant criteria, procedures, and solutions for returning workers with limited fitness to tasks and jobs with lower exposure will be described. For successful reintegration we suggest an intensely participatory approach involving technical staff, medical staff, and affected workers. This should allow the affected workers to remain productive, at least to some extent, while safeguarding their health.

2 PROCEDURES AND CRITERIA

2.1 INVOLVEMENT OF TECHNICAL STAFF IN REDESIGNING JOBS

The technical staff should be trained to submit the relevant jobs to the specific risk assessment procedure, so as to more effectively redesign tasks for both “healthy” and diseased workers. The training should cover aspects such as definition of repetition injuries of the upper limbs and their relationship to work stresses; introduction to the pathogenesis of the principal upper limb disorders related to repetitive movements; methods and criteria for rating occupational risk; techniques for measuring action frequency by analyzing slow-motion films, methods of applying an upper limb strain index using the Borg scale, criteria for detecting awkward postures and evaluating recovery times, identification and measurement of additional risk factors.

The technical staff should be asked to inspect their departments and single out jobs and duties that would be immediately suitable for WMSD-affected workers, or could be adapted with minimal changes. When jobs are not entirely suitable for affected workers, job redesign recommendations should be drafted. Any jobs or tasks that would be too expensive or too slow to modify should be rejected. An ergonomic supervisor should carry out a final check on the task analysis and evaluation performed by the technical staff and a final check on the jobs they have selected.

2.2 CRITERIA FOR LOCATING SUITABLE TASKS AND JOBS FOR AFFECTED WORKERS

The recommendations for redesigning jobs for affected workers could be based on the following criteria: frequency should be less than 20 actions per minute; minimal upper limb exertion (less than 5% of the maximal voluntary contraction, or a score of 0.5 on the Borg scale); posture and movements not requiring “intense involvement” of the main joints; adequate recovery times during each shift. If tasks already include adequate recovery times, no further allowances are added.

If posture is not optimal, the recommendation is to slow down the frequency of the actions, with special attention devoted to the clinical findings of the worker involved. If the job involves occasional manual material handling, the following weights should be considered, assuming the handling is carried out with the correct posture:

- For 4–5 kg loads, lifted alone, lift no more than 2–3 times every 30 minutes.
- For the occasional 7–10 kg load, lifted by 2 workers, lift no more than once every 30 minutes.

- For the occasional 14–15 kg load, lifted by 2 workers, lift no more than once every 60 minutes.
- Avoid lifting loads of more than 15 kg.

2.3 MATCHING TASKS AND JOBS WITH DISORDERS

To facilitate communications between the technical staff and the medical staff within the factory, the results of the analysis of the various jobs and tasks should be classified. It is also useful to classify upper extremity disorders in relation to degree and severity. This makes it easier to match the affected workers with the most appropriate jobs.

The following ratings are suggested for the task: excellent with no limitations (no modifications needed, suitable for all affected workers); excellent with some limitations (no modifications needed, but not suited to all affected workers); excellent with modifications (suitable for all affected workers, even the most severe, provided that the recommended modifications are adopted); very good with modifications (suitable for workers with a moderately severe condition, provided the recommended modifications are adopted); unsuitable (job difficult to adapt, therefore not suitable for affected workers).

The following ratings are suggested for disease degree: severe (only one part of the upper limb affected severely, or several parts affected moderately); moderate (only one part of the upper limb affected moderately, or several parts affected mildly); anamnestic (only suspect symptoms detected, with no clinical or instrumental findings). It is also important to check the sequence of the upper limb involved — scapulohumeral joint (shoulder), elbow, wrist, hand/finger.

2.4 TIMETABLE FOR RETURNING WMSD-AFFECTED WORKERS TO THE WORKFORCE

The principal aim of reassigning workers with upper limbs disorders to new or redesigned jobs or tasks is to alleviate the clinical signs and symptoms associated with the disorder while maintaining the worker's productivity. To ensure the results of the various decisions could be monitored continuously, it was essential to have close cooperation between the technical staff, the plant medical staff, and above all the workers themselves. Here is a recommended schedule.

2.4.1 Medical history

Workers known to have work-related disorders should be interviewed by medical staff regarding their symptoms upon starting the redesigned job. The interview should be carried out using a clinical questionnaire in order to standardize the data collection.

2.4.2 Enhancing worker awareness

Meetings should be arranged between the medical staff and the workers involved in the study. The meetings should be designed to make the workers more aware of how best to cooperate with the medical and technical staff in verifying how successfully the jobs are redesigned and allocated. During the meetings (for groups of up to 10 workers), the following points should be discussed:

- Type and pathogenesis of the most common bio-mechanical strain disorders affecting the upper limbs; reasons for changing and shifting workers to new or redesigned tasks and jobs.
- Correct use of the modified job, particularly the correct use of recovery times; importance of maintaining a regular pace without accelerating the frequency of the actions; importance of avoiding the needless lifting of harmfully heavy loads.
- Need to pay careful attention to any disorders affecting the upper limbs, and in particular to any flare-up of existing symptoms (if symptoms worsen, the worker is invited to notify the plant physician, even between regularly scheduled follow-up appointments).
- Need to pay careful attention to the new method adopted for performing the job, and inform the supervisor whenever any unforeseen problem arises (use of excessive force, inability to keep up with required speeds, etc.).

2.4.3 Supply and use of orthopedic orthosis

During the meeting to discuss the worker's medical history, the medical staff should recommend the use of specific orthopedic orthoses whenever they are appropriate. The orthoses are recommended primarily for workers with carpal tunnel syndrome; initially they should be worn only at night.

3 HEALTH CARE MONITORING

Close monitoring is required every time jobs and tasks are redesigned; this should be carried out almost continuously, so that any technical and organizational modifications can be made promptly. A special health care program is used to validate the decisions made about the various diseases that are present; this aims to monitor (at close intervals) the clinical condition of the workers in their newly designed jobs, as well as their degree of acceptance of the jobs.

A simple questionnaire should be used to obtain information regarding changes in relevant symptoms (classified as symptoms completely disappeared, symptoms improved, situation unchanged, symptoms worse, appearance of new symptoms or disorders); use of the

orthopedic appliance, in terms of compliance and degree of tolerance; assessment of acceptability of new job or task, with details concerning any inadequacies deriving from awkward joint segment positions, excessive muscle force, etc.

Moreover, the questionnaire should provide a diagnostic link, perhaps for requesting further clinical or instrumental tests; and a useful operational link for the production engineers. Based on the results of the Study, the physicians are able to provide the engineering staff with practical information, which may be summarized as follows: the worker need no longer be classed as "affected" (remission of disease); the worker may continue to perform his/her duties in the current job, even if not redesigned for affected workers (anamnesic case); the worker must remain in his/her current workstation redesigned for affected workers (clinical case); the worker must be transferred to a redesigned workstation (new case or worsening of anamnesic case); the workstation to which the worker has been assigned must be redesigned for diseases other than those related to repetitive movements. Checkups should be scheduled as follows:

- 2 weeks after changing jobs
- 3 months after changing jobs
- 6 months after changing jobs
- 12 months after changing jobs
- every 12 months thereafter

The checkup at 2 weeks is to give a rough assessment of whether or not the situation is satisfactory and to reinforce the instructions given to the worker.

4 RESULTS OF THE HEALTH CARE MONITORING PROGRAM

Cross-tabulation is used to analyze the preliminary results of the monitoring program on workers affected by upper

limb disorders who were transferred to a redesigned job or task one year earlier. The tables show disease, degree of severity, sex, location, bilateral location, multiple joints, relative complaints (improvement or worsening), appearance of new disorders, department and job redesign. To elucidate the most plausible phenomenon, it is usually advisable to evaluate the worst percentiles and the better percentiles.

Table 1 shows the trend for disorders affecting wrists analyzed in two different departments: the job in one department (assembly line) had been redesigned earlier than in the other department (electrical engines) due to technical problems. A large proportion of the workers in the second department were still performing jobs that were only partially redesigned. The table clearly illustrates the difference between the wrist symptoms in the two departments: the results are highly positive in the first area. Even without a thorough statistical analysis, there is no question the redesign has had positive effects. Special attention should be paid to carpal tunnel syndrome and the use of orthopedic orthoses; workers who wear an orthosis frequently report an improvement.

5 CONCLUSIONS

- It seems essential to reduce the amount of exposure to repetitive tasks of the upper limbs among workers with WMSDs.
- Reducing exposure to risk factors associated with repetitive tasks of the upper limbs would seem to be a sufficiently adequate measure. In fact, it produces a distinct improvement in symptoms.
- The decision to allow workers to perform tasks with a frequency of less than 20 actions per minute, in the absence of any other risk factors, proved to be a good starting hypothesis which deserved to be further verified and, eventually, validated. This approach moreover preserves the

TABLE 1
Condition of Workers with Specific Wrist Disorders 6 Months and 1 Year after Starting Re-Designed Job, in Two Different Workstations

Wrist Symptoms	Right Wrist				Left Wrist			
	Assembly Bay Workshop		Electrical Engines		Assembly Bay Workshop		Electrical Engines	
	No.	%	No.	%	No.	%	No.	%
Disappeared	10	33.3	2	11.1	5	20	3	18.7
Improved	8	26.6	4	22.2	8	32	4	25
Unchanged	10	33.3	7	38.9	9	36	5	31.2
Worsened	0	0	5	27.5	1	4	3	18.7
Onset of new symptoms	2	6.6	0	0	2	8	1	6.2
Total Positive Cases	30	100	18	100	25	100	16	100

WMSD-affected worker's residual productivity Expressed as an OCRA exposure index (Occhipinti 1998), this decision would imply that workers with upper limb disorders are on the whole better suited to jobs and/or workstations with a strain index score less than or equal to 0.7.

- For the program to be successful, it is vital to ensure active participation and excellent communications between all those involved (technical staff, plant medical staff, workers).

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