Ergonomic adaptation of workplaces for people with disabilities

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1. Introduction

Ergonomics applied to integration or reintegration of disabled people into sheltered and ordinary employment implies the selection and/or the accommodation of workplaces suitable to worker features. In order to do this, it is necessary to analyze work demands and worker capacities, to compare both and to propose adaptive measures intended to overcome mismatches between them. On the other hand, the job risk to which the worker is exposed must be taken into account because, in many occasions, it may represent even a wider problem than that caused by the mismatching between demands and capacities.

In this context, the Instituto de Biomecánica de Valencia (IBV) has developed **ErgoDis/IBV** method, a software tool intended for the adaptation of workplaces to people with physical, sensorial and/or mental limitations.

This tool has been validated by means of its application, up to date, to more than 400 workers with physical, sensorial and/or mental disabilities. Some examples of this application are shown in this paper. Besides, more than 300 related professionals have been trained in the using ErgoDis/IBV.

2. Methodology

Three different steps can be distinguished when applying this method. First, work and worker information is gathered by means of standardized forms (some of them optional, depending on the case under analysis). This requires direct observation of workers performing their jobs and also interviews to workers, supervisors and other people involved in the process; besides, a video recording of the work tasks is preferred in order to determine risks related to physical workload. Afterwards, data are processed and, finally, a decision is made depending on results.

2.1. Work and worker analysis

To analyze the work a set of forms have been prepared. First, some general items about the company and the workplace are included. Then, work tasks are described, indicating work equipment and time taken for each task, and whether it is essential or not to the job. Next, the demands form includes the analysis of physical, sensorial, communication and mental task requirements (see Fig. 1), where each item is evaluated according to a three-level demand scale (none, medium, essential).

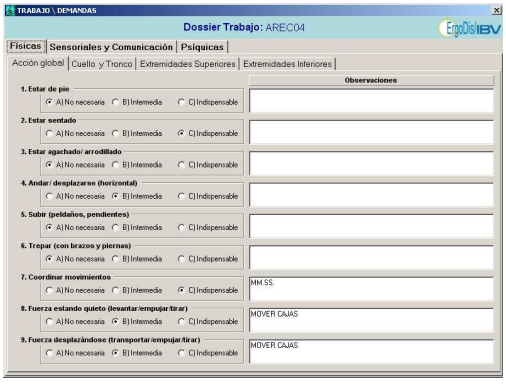

Fig. 1: ErgoDis/IBV - Some items of the physical demands form

The workplace form includes some environmental and psycho-social working conditions, also assessed on a three-level scale (none, occasional, frequent), and the relevant dimensions of the workplace. Next, architectural barriers and general accessibility conditions are described, not only within the workplace, but also in other areas to be used by the worker. Finally, the risks forms includes data which will enable the software to estimate, in a later step, risk levels arising from physical and environmental workload. Physical workload risk is based on work postures (position of upper and lower limbs, neck and trunk), muscle activity (static postures and/or repetitive movements) and handled load or applied force in each posture (see Fig. 2). As for environmental workload risk, lighting, noise and thermal environment are the considered aspects.

To carry out worker analysis, some general items of the individual are collected, such as socio-cultural and labour data. Next, the type of disability and any technical aids normally used by the worker are also included. The capacities form is aimed at analyzing physical, sensorial, communication and mental individual's abilities by means of items identical to those on the demands form; these items are evaluated on a three-level capacity scale (normal, limited, unable).

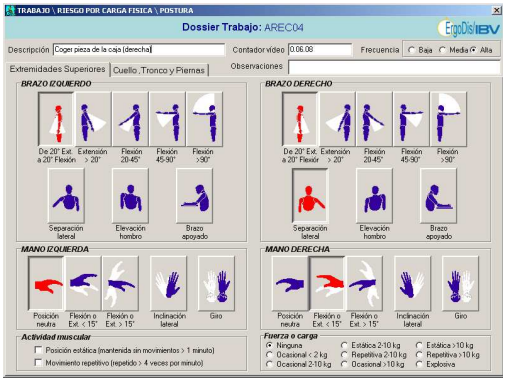

Fig. 2: ErgoDis/IBV - Some items of the physical workload risk form

The tolerance to workplace form is to assess the subject's ability to cope with environmental and psycho-social working conditions and workplace dimensions (again using similar items to those in the workplace form), and is assessed on a three-level tolerance scale (normal, limited, intolerance). Finally, a test is included where the worker may express his/her opinion about postures, movements, forces and other working conditions, as well as suggestions to solve possible problems (see Fig. 3).

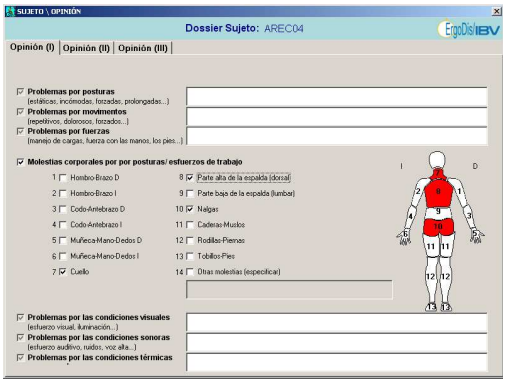

Fig. 3: ErgoDis/IBV - Some items of the worker opinion

2.2. Data processing and results

Once information is compiled, the software tool will carry out the data processing.

To assess suitability of a disabled worker for a specific job, certain items from both profiles are compared; the worker's opinion is also used to confirm or discard a possible mismatching between them. Thus, physical, sensorial and communication, and mental work demands are compared to respective worker capacities.

In a similar way, workplace conditions items are compared to the respective subject's tolerance to workplace (see Fig. 4).

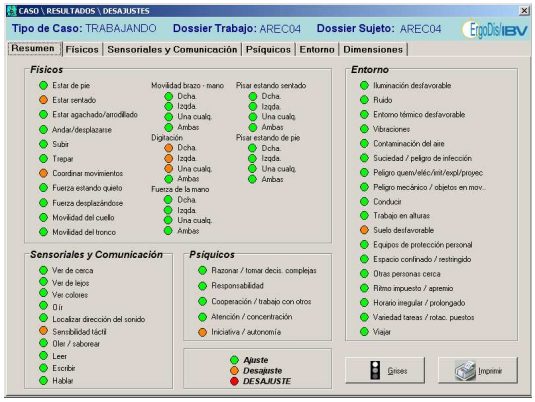

Fig. 4: ErgoDis/IBV - Summary of mismatches' screen

On the other hand, the software tool will estimate ergonomic risk levels arising from physical and environmental workload in order to identify which aspects of the workplace and/or the tasks need to be modified. For both types of workload, physical and environmental, ErgoDis/IBV method considers five risk levels, being level 5 the one requiring priority of ergonomic intervention.

Finally, a decision is to be made about the suitability of a disabled worker for a specific job considering the situation as a whole. Ideal situation occurs when there is demand-capacity matching in all analyzed items (that is, the subject is able to do all that is required) and/or when no risk is detected. However, it is very likely that some mismatching and/or risk is to be present. The number and nature of the problems detected will determine the decision to be taken, in terms of trying adaptive measures or looking for another job.

2.3. Data-Base of adaptive measures

A data-base with suggestions about adaptive measures to overcome detected problems is included in ErgoDis/IBV (see Fig. 5). It has been designed to enable searching of solutions sorted by different criteria:

- type of worker disability, for example, motor impairments (balance, extremities, head and trunk), allergies, visual, hearing, speech and/or mental impairments, etc.;
- general ergonomic guidelines applicable to any worker, with and without disabilities;
- type of adaptation, for example, environmental solutions, architectural changes, mobility aids, communication aids, organizational measures, etc.

Fig. 5: ErgoDis/IBV - Results' screen of the data-base of adaptive measures

Each specific recommendation includes its concept (accompanied by an image if appropriate), the corresponding ISO code of classification if it is a technical aid and, in any case, its source. Sources of information for this data-base are mainly the experience of the IBV in the adaptation of workplaces and the specialized literature reviewed.