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A checklist extension of VIDAR – a participative video-based method for ergonomic evaluation

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Abstract

There is a need for easy-to-use methods for assessments of exposure. VIDAR was presented at IEA 2003; an employee is first video-recorded when performing his/her daily work. He/she is then asked to identify physically and psychologically demanding situations. In this project, we have followed a request from practitioners and extended the method with a checklist, the Quick Exposure Check (QEC). When the employee has identified a physically demanding situation he/she is now, as before, asked about body region of discomfort, the level of pain or discomfort, the task description, occurrences per time unit. The additional questions concern: Handled weight, handled weight with one hand, duration, and visual requirements. The film is run through and several situations may be identified. The ergonomist later edit the situations, the QEC observer checklist is implemented to input; degree of static/dynamic work, and work postures for the back, shoulder-arm, wrist-hand and neck. It is easy to make a printout, and the reports are suitable as a basis for discussions in improvement groups. The first tests of the extended method indicate that the new options add value to the analysis with only a small increase of time consumption.

Keywords: Participatory ergonomics, Ergonomic checklist, Exposure assessment, Video, Self-confrontation

1. Introduction

Numerous methods for exposure assessments have been proposed, not only for research but often to be used by practitioners. However, there are still very few methods that are frequently used by practitioners. There seem to be a risk for researcher-made methods to be too complicated or too time-consuming to be attractive for the occupational health service. On the other hand, too coarse and simple methods may not give relevant information. There are today complex associations between exposure and disorders, and the methods should not be too focused on specific parameters. It is also hard to define separate limits for different kinds of exposure.

In a review report [1], Westgaard and Winkel concluded that the changes that have the best chance of success are those with high commitment of different stakeholders (managers, workers, engineers, ergonomists), which utilise multiple interventions to reduce identified risk factors, and those that focus on workers at risk, using measures that actively involve the worker. They conclude that the way to success may be described by one overall strategy: to identify and deal with risk factors relevant for the individual at risk. Accordingly, the active support and involvement of the

individual at risk and other stakeholders in the organisation should be ensured. Thus, a participative intervention tool should be the aim when designing a practical method.

At IEA 2003 a laptop and digital camcorder version of VIDAR, a participative video-based method for ergonomic assessments, was presented [2]. The first version of the method was presented at IEA '97. A significant disadvantage of the old version was the need for large, heavy and expensive hardware. VIDAR is now being used with a (laptop) PC, which is connected via a fire-wire connection (IEEE 1394) to a digital camcorder (DV). It was designed mainly for ergonomists working for occupational health services to be used in participative workplace interventions. The new version was designed in a participatory way, i.e. together with user representatives. There are now practitioners who use VIDAR in ergonomics interventions. Also occupational therapists have started to use the method for design of individually adjusted work places. When using the method an employee is first video-recorded when performing his/her daily work. He/she then does an assessment of physically and psychologically demanding situations. The analyses can also be made by a group of employees by connecting the laptop to a large screen projector. A report of saved situations, including pictures, may be printed directly after the analysis. The reports are suitable as a basis for discussions in improvement groups. As VIDAR is a participative method, we also try to be participative in its further development. In contacts with practitioners we have been asked to add more input options. This project is an attempt to satisfy that request by adding a checklist module to the program. Such an option should increase the power in comparing the effect of interventions. It would also improve usage in research projects where more detailed exposure estimates often are requested.

Several ergonomic checklists have been constructed, but few are frequently used by practitioners. The Quick Exposure Check (QEC) [3,4] is a checklist that was developed in collaboration with health and safety professionals, and with a clear aim of being easy and quick to use. QEC facilitates assessment of four main body regions to be assessed in tasks involving manual handling of loads and other postural strains. It supports combined analyses of a range of exposure factors connected with risk for musculoskeletal disorders.

The purpose of this project was to combine VIDAR and QEC in a computer program, and to let a practitioner test the usability (the easiness, time-consumption, and result presentation) of the extended assessment program.

2. Combining VIDAR and QEC

Microsoft's .Net Visual Basic was used to implement the new program version. Functions from Microsoft's framework Direct-X was used to enable communication between the computer and a DV (via IEEE 1394).

VIDAR version 3.2 was used as a base and the checklist was added as an option that could be checked or not.

The modified version of QEC [4] was implemented as the tool increased input. The QEC has four worker questions and a set of observer questions. In the paper version, these fit on a single page. It has a logical way of calculating scores for each of four body regions, and a guide of how to interpret the scores.

3. The extended VIDAR version

In the first look of the extended version, the new module is hidden as a checkbox under Settings. Fig. 1 shows the QEC checkbox, and the different modes in the left column. The program may be used with a DV-camera connected (via a FireWire cable) to the laptop or with an mpeg- or avi-file. The employee sees him/herself work on the computer screen. When the employee has identified a physically demanding situation he/she is now, as before, asked about body region of discomfort, the level of pain or discomfort, the name of the work task, occurrences per time unit, and an optional comment. Then, the new questions are asked. The film is run through and several situations may be identified. Based on standard VIDAR, the QEC checkmark adds:

- Four new user questions in the area that appears when you have clicked on the button for a physical demanding situation, in the play mode (Fig. 1). They concern: Handled weight, handled weight with one hand, duration, visual requirements, mental stress level. Each question has 2-4 answer alternatives. These are the worker questions of the QEC paper version.

- Four questions that are not to be answer for each situation, but for the work shift as a whole (Fig. 1). The answers to these questions may be written and changed at any time during the analysis.

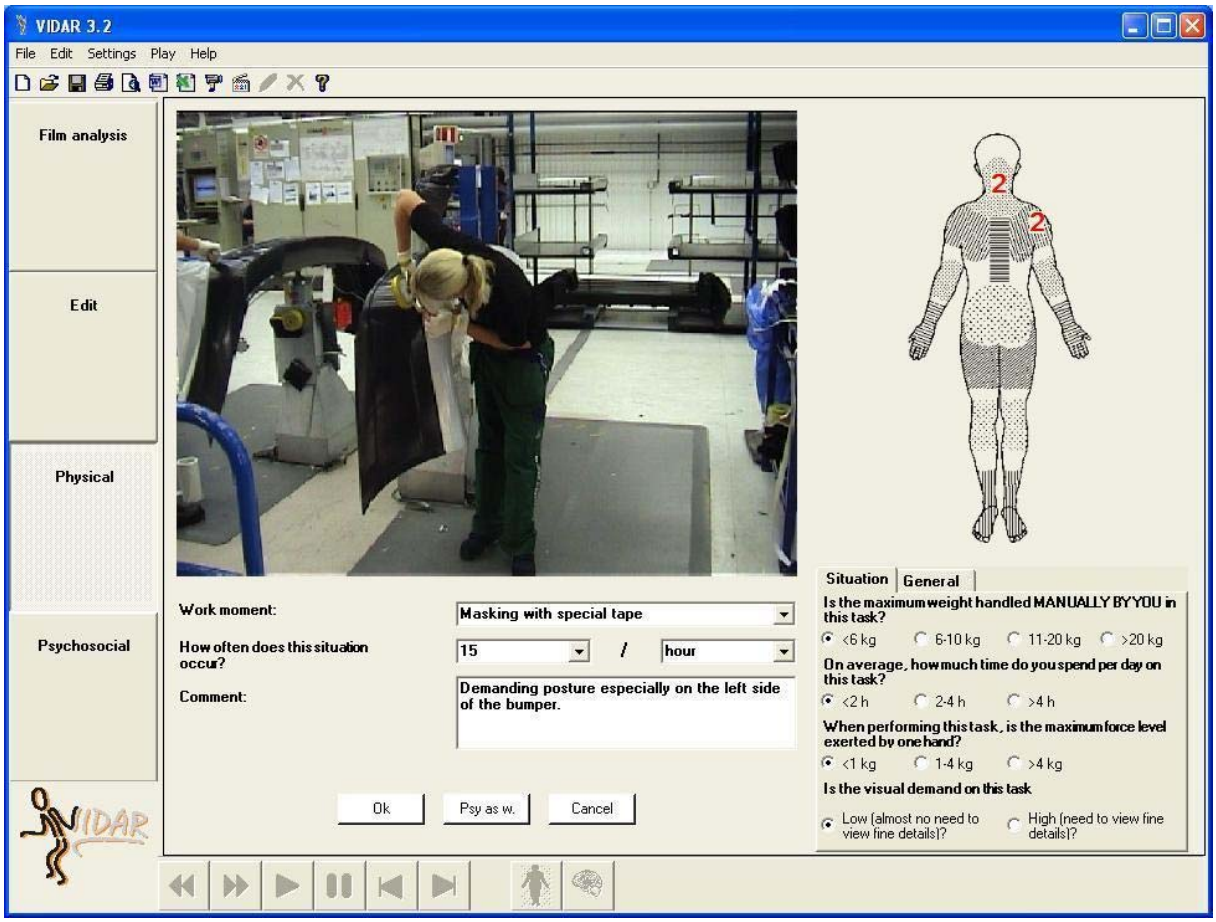

Fig. 1. The worker input area that is shown when a physically demanding situation is identified by the worker. The questions in the lower right corner are the QEC questions that are asked for each situation, the general questions, the back card, concerns the full work shift.

- The QEC observer questions. In the edit mode (which the ergonomists may go to in his/her office) there is a QEC-button that opens the questions (Fig. 2). The checklist includes, as QEC, degree of static/dynamic work and work postures for the back, shoulder-arm, wrist-hand and neck. The observer is not forced to visit all cards in the card index. In those not visited, the lowest exposure alternative, which is set as default, is kept as the answer. The questions are labelled as in the paper version, but here in a card index.

When the editing phase is finished, it is easy to make a paper printout with 1 situation per page (without QEC the VIDAR report holds two situations per page). The report includes, for each situation, the name of the work moment, a picture, body regions (and level on the Borg CR-10 scale) where the worker feels pain or discomfort, the QEC-score together with its for the body regions. The answers that are above the lowest answering alternative, for each question, are also shown. In the QEC reference guide exposure scores have been categorised into 4 exposure categories: Low, Moderate, High or Very High. The score's corresponding categories is also spelled out.

The print out of standard VIDAR has shown to be useful as a basis for participative discussions for solutions and improvements, with QEC it ought to improve documentations of improvements. The report may also be exported to Word. This should be useful when the user, needs to write an own report with a set of examples of situations.

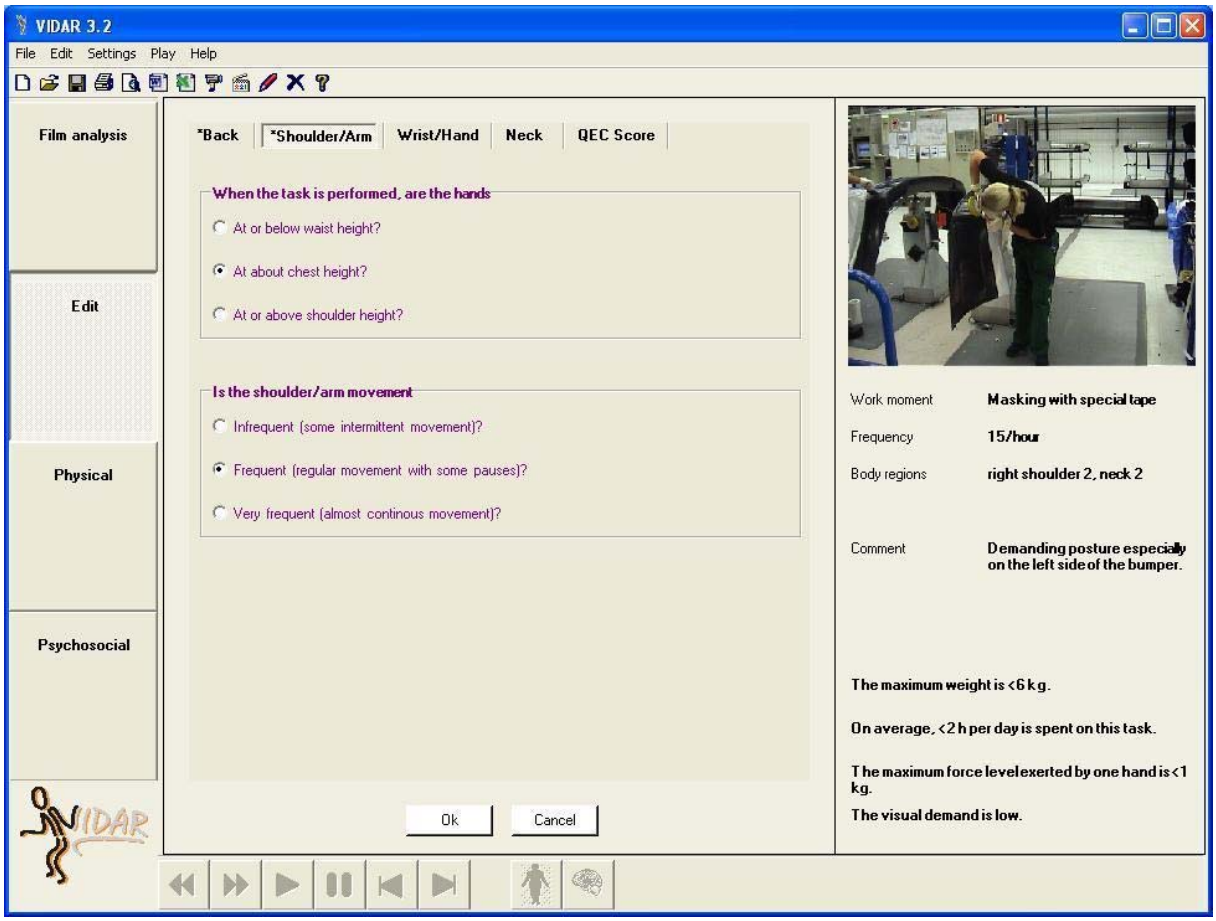

Fig. 2. The Shoulder/Arm card, an example of QEC observer questions that are shown to the ergonomist during the edit mode. The other body regions are seen as cards. An asterisk means the that card has been visited. The questions are default checked in the lowest exposure alternative, and the font-colour is black. When a question has been checked, the font-colour is changed to purple. The data from the worker's assessment is shown to the right. The computed scores may be seen on the QEC Score card.

4. Result from two case studies

To evaluate the usability of the QEC-module, it was used by an ergonomist in two studies; One industrial job and one phone reception. The later was included to get an impression of the amount of time and the amount extra work the QEC module entailed.

4.1. Masking of bumpers

The first case study was an industrial work where the workers tape-mask bumpers, position the bumper on dock, hang it on a line before the paint station, take painted bumper and details from the line, and control and adjust quality deficiencies. In this studies the standard VIDAR analyses was made previously to the QEC module completion, therefore it lacks the worker input. Eight workers were video recorded during at least two work-cycles. VIDAR analyses were carried out individually, i.e. the worker sees him/herself in his/her ordinary work, and tells the ergonomist when there is a demanding situation. Both physically and psychosocially demanding situations are saved. In this project we focus on the physically demanding situations. Seven persons had years of experience at this station, while one had worked there for 2 months. The work cycle length varied between 3 and 5 minutes.

All together, from all subjects, the filmed was stopped at 32 physically demanding situations. The overall most frequently marked body region was the right shoulder (marked by the workers in 19 of 32 situations). From these, the ergonomist identified 8 different, unique situations (several workers saved "the same" situation). By using the QEC module, the

ergonomist obtained QEC scores from these eight situations: four of them showed scores in the Low category for all four regions, while four showed scored Low for three regions and Moderate for the shoulder/arm region.

4.2 Phone switchboard

The other case study with QEC was carried out to obtain a judgement from the ergonomist of the usefulness of the module. The ergonomist was an experienced VIDAR user. Seven employees were filmed during their work in the switchboard of a regional hospital, and analysed with VIDAR-QEC. In total 14 stops were made for physically demanding situations, which were saved. Subjects saved the same situations and the ergonomist found 8 different situations. As expected, since QEC usually is thought of in more manually active work, the score were for all situations in the Low category for all body regions. However, in two of the situations the score for shoulder/arm was in the top of the Low interval. These two situations showed static work situations, and may indicate that means may be needed to include more variation in the work.

4.3. Time-consumption

In both case studies, the QEC module was used with very little extra effort; tens extra seconds per situation with the employee (only done in the switchboard study) and about 2-3 minutes extra time per situation for the observer, in the edit mode. The ergonomist was pleased with the report, and quickly learned how to use the module.

5. Discussion

This paper shows an attempt of making a tool for practitioners, in a participatory way. Researchers are patient in use their instruments and they are willing to work in months with analyses to obtain the analysis result; practitioners are not. Instruments that researchers have made with the aim of being practically useful are usually to a very low extent put into practical use. Two possible exceptions seem to be VIDAR and QEC. To add a "more objective" module to the subjectively based method VIDAR, has been planned for a long time. When it was asked for by the practitioner, the natural choice of checklist was QEC. An other alternative was to base the observers' questions on the Swedish ergonomics regulations. In the future there might be such a module too.

There are differences in the principles of VIDAR and QEC. VIDAR needs computer and DV-camera, while QEC needs only pen and paper. Still VIDAR is being used and is spread (an installation CD at low cost) to about 100 practitioners. Another difference is that QEC analyse workstations or work shifts, while VIDAR saves worker marked demanding situations, which may be multiple per workstation. In the paper version QEC, the ergonomist has to check questions for all body regions; in VIDAR, the ergonomist are reminded by all regions in the card index, but does not have to check them all. This is to save time and keep a low perceived effort for the ergonomist. An alternative, forcing, way would be to show all "cards"after each other, and you would have to check all questions and click OK to save each page. The ergonomist who used VIDAR-QEC in this pilot applications was satisfied with the chosen solution, but it need to be more tested in practice and it may be changed in the future.

In participative ergonomics, pictures are a successful tool to promote workers' activity and contributions. With the QEC module the possibilities of documenting improvements are enlarged, this should increase the attractiveness also for management.

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