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Task analysis and ergonomic evaluation in camshaft production operations

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Abstract

Here we report results of a study conducted at an industrial facility located in the central region of Mexico. It is devoted to the manufacturing of camshafts. We completed an ergonomic assessment on the working circumstances of a production line where workers interact with CNC lathes. Operating this machinery entails the performance of both physical and cognitive effort, circumstances that correspond to a process of Advanced Manufacturing Technology (AMT). The study consisted of a visual inspection of the work areas, video recording both of the site and of the workers in action, analysis of the recordings, and assessment with the REBA method. The tasks performed by the workers consist of a) handling (loading and unloading to/from the lathe) the camshaft components, b) visual inspection and test of compliance to the required parameters, c) adjusting the machinery as required, d) setting the finished pieces in containers. The recorded material allowed identifying 35 separate operations which were then analysed with the REBA Method. The results were as follows: 3 operations classified as a Very High Risk Level, 14 classified as High Risk level, 14 classified as Medium Risk Level and 4 operations classified as Low Risk Level. The body regions most at risk for WRMSD were the trunk, neck, arm and wrist. A series of changes in the workstation layout and in work procedures have been proposed, in order to ameliorate the ergonomic risk found.

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1. Introduction

This paper is the continuance to a line of enquiry whose main focus is on the presence of ergonomic risks and related damage to the musculoskeletal system. Our research interest revolves around productive processes in the automotive industry, a sector that in Mexico has grown at an impressive pace over the last two decades. And this is particularly true for the state of Guanajuato, where part of our study group is based.

We have looked into the presence of undesired effects on the well-being of workers who operate machinery in a variety of situations classified as Advanced Manufacturing Technology (AMT), where they face demands both on the physical and cognitive side.

This paper explores the situation in a site where camshafts are produced for the newest assembly line to be started by Mazda at its plant located in Guanajuato. The study here reported was requested as a means to devise measures seeking the reduction of ergonomic risks to the workers in the facility about to be set up at the time.

2. Methodology

The study was conducted with the sole aim of identifying those factors which might pose a substantial ergonomic risk to the workers. These were previously informed about the presence of the research team, and the purpose of what was about to happen.

As a first stage, the researchers visited the site and observed the workers in action, taking note of any evident issue about the layout in the workplaces and procedures. This allowed singling out those circumstances deserving a deeper consideration. Video recording was made for each of these cases, and the material was analysed applying the REBA Method [1].

3. Results

REBA produces an estimate of the ergonomic risk, by assigning a numerical value to the combination of risk factors existing in the work situation being assessed. That value is associated to a level of action, which in turn points to the kind of action the situation demands. This information is shown in table 1.

Table 1. Information on risk level as provided by REBA Method.

Final numerical value	Risk level	Action level	Action required
1	Negligible	0	None
2-3	Low	1	Some action may be necessary
4-7	Medium	2	Action is necessary
8-10	High	3	Action is necessary asap
11-15	Very high	4	Action is necessary immediately

A total of 35 production operations were assessed in the way described. The results are summarized in table 2.

Table 2. Production operations classified in accordance to REBA Method.

Risk level	Very high	High	Medium	Low
Number of operations	3	14	14	4

Some of the paradigmatic findings appear in table 3.

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