Field Evaluation of a Continuous Passive Lumbar Motion System

M. Viswanathan, M.J. Jorgensen, N.K. Kittusamy, and F. Biggs

Department of Industrial and Manufacturing Engineering, College of Engineering

1. Introduction

Low back pain (LBP) is one of the major and leading occupational problems in the United States, and is also a major cause of industrial disability in the population under the age of 45 years [1]. In the United States the total cost due to LBP is about \$90 billion (Bureau of Labor Statistics 1982). Heavy equipment operators such as truck drivers, bulldozer operators and crane operators experience a high incidence of musculoskeletal disorders (MSDs). According to Bureau of Labor Statistics the incidence rate for mobile equipment and vehicle drivers was quite high, 12.1 per 100 workers per year in the year 2002 [2]. Operators of heavy equipment are generally called as operating engineers (OEs), and currently there are about 540,000 OEs in United States, who are exposed to WBV and out of these 90% are involved in performing excavating and paving work and the remaining are crane operators [3]. All these OEs are exposed to Whole Body Vibration (WBV) [3].

2. Epidemiology, Methods, Results and Discussion

Sitting has the potential to harm the spine due to higher intradiscal pressure and compressive stress on the annulus [4]. The combination of prolonged sitting and exposure to WBV was reported to result in more and longer work-related absenteeism due to intervertebral disc disorders and low back problems [4]. Magnusson et al. (1996) conducted a study on three groups of workers, of which two were exposed to vibration (truck and bus drivers) and the third group acted as a control group (sedentary workers). From the whole sample of their study, approximately 50% complained of LBP, and drivers had significantly higher LBP complaints than the sedentary workers. Among the groups, the bus drivers had more days off from work than the sedentary workers and the truck drivers. Long term exposure to vibration was the strongest predictor of LBP with an odds ratio of 2.0. One of the main challenges was to develop some kind of intervention in order to reduce the static seating posture of the OEs. So the University of Vermont came out with an additional seat support called as BackCycler, which has a lumbar support bladder that is cyclically inflated and deflated by a pump and valve system. Few lab experiments have been conducted to evaluate the BackCycler but none of them performed a field study to evaluate the effectiveness of the BackCycler. Therefore our main research objective was to evaluate the effectiveness of the BackCycler in mobile construction equipment.

In order to evaluate the effectiveness of the BackCycler, it was installed in several pieces of mobile equipment out in a real working environment and the data was collected for 8 days. In order to evaluate the intervention, two group of OEs were signed where one group acted as the control group and the other group acted as an intervention group and both these group used similar kind of equipment and they were working at two different sites. Two surveys were administered; one was the body part discomfort survey which was filled by both the group at three different sessions of a day and the BackCycler preference survey which was completed by the intervention group only. Mean low back score of every session was calculated for all 8 days of the intervention group and similarly it was done for the control group too. As well as mean low back discomfort index was calculated for both groups as specified by Buttle (1994).

From the body part discomfort survey of the intervention group we can witness the decreasing trend from day 1 to day 8 as shown in figure 1. As well as when comparing the magnitude of the morning and evening scores for the intervention group mixed results were obtained, where as in the control group (figure 2) the evening data was always higher than the morning data, indicating that with out the additional seat support the low back discomfort increased at the end of the day. Figure 3 & 4 shows the mean low back discomfort index for the both the groups, where for the intervention group there was a 2.4% decrease from morning to evening data and for the control group there was 66.67% increase from morning to evening data. BackCycler preference survey data showed that 64% of OEs felt that it provided enough support and 54% OEs felt that it reduced stiffness and fatigue, which also showed that the OEs felt very comfortable using the BackCycler as well as they felt that it reduced the overall low back discomfort at the end of the day. Therefore from the results it is evident that the BackCycler was effective in reducing the stiffness and fatigue and reduction is mainly due to the cyclic motion of the BackCycler, due to this cyclic motion

there was continuous change in the lumbar muscle lengths and as well as theoretically it is shown that there will be better transfer of nutrients to the intervertebral disc.

3. Conclusion

Therefore from the results of the body part discomfort survey and the BackCycler preference survey we can conclude that the BackCycler can effectively reduce the onset of low back pain.

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5. References

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Figure 1: Mean low back score for Intervention group

Figure 2: Mean low back score for control group

Figure 3: Mean discomfort index for intervention group between morning and evening across all days

Figure 4: Mean discomfort index for control group between morning and evening across all days