

## WORK TIME AND REST PERCENTAGE DURING PICK-AND-PLACE TASK

Reuben Escorpizo and Anne Moore

School of Kinesiology and Health Science, York University, Toronto, ON

E-mail: [reuben@yorku.ca](mailto:reuben@yorku.ca), Web: [www.yorku.ca/kahs](http://www.yorku.ca/kahs)

### INTRODUCTION

In the context of machine-paced tasks, it is of interest to know how production rate affects the physical demands imposed on the worker. The time available to perform a cycle (CT) is a critical factor in determining both the resulting speed the work is performed at, and the rest time available to the worker. Pick and place tasks are a common machine paced task. They have been studied from the perspective of loads<sup>1, 2</sup>, but the relationship between time based measures is unclear. The objective of this study was to measure the effects of shortening cycle time on work time (WT) and the overall available rest (%rest) during a cyclical pick-and-place task.

### METHODS

Six right-handed participants (3m, 3f) with a mean age of 28 yrs (SD=6.9), and mean height of 176.3 cm (SD=14.2) were recruited. The participants performed a cyclical task transferring a 0.7 kg object 0.5 m from one bin to another based on an auditory metronome. Measurements of muscle activation (EMG), hand grip force, wrist posture and error rate were made. WT was defined as the time the hand was in contact with the object (force>0), and task rest was defined as  $(CT-WT)/CT * 100$ . Surface RMS EMG was collected from flexor digitorum superficialis (FDS) and extensor carpi radialis (ECR) using a commercial system (ME3000P8, MEGA, Finland). It was analyzed using a gaps analysis<sup>3</sup> which provides a measure of the actual rest taken by the muscles. A (4 x 2) repeated measures design was used, with two independent variables: CT (1, 2, 5, and 10s) and grip type (power, chuck).

### RESULTS AND DISCUSSION

WT significantly decreases as a function of CT and grip type (Figure 1) as does %Rest (Figure 2). The chuck grip task had a significantly longer WT and associated shorter rest time at all CTs. These indicate that as the cycle time is reduced, the task is sped up; however, more time is taken out of the rest portion of a task. The relationships between the cycle time and both work time and %Rest are non-linear. Although at a one second CT, the nominal rest in the activity was at least 10% of the time, the electromyographic data found that by 2-second CT the muscle activity already occupied 100% of the time (Figure 2). To achieve even 10% muscle recovery, a CT of >3s is required. This data coupled with the EMG will allow us to model optimal CT.

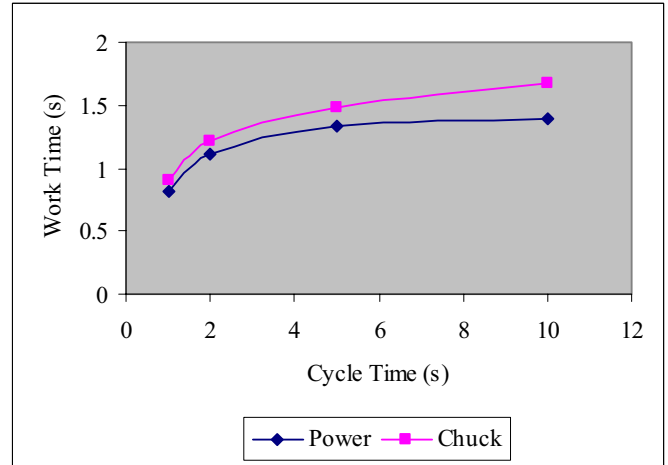


Figure 1: WT decreases as CT decreases (CT p<0.01, grip p<0.001)

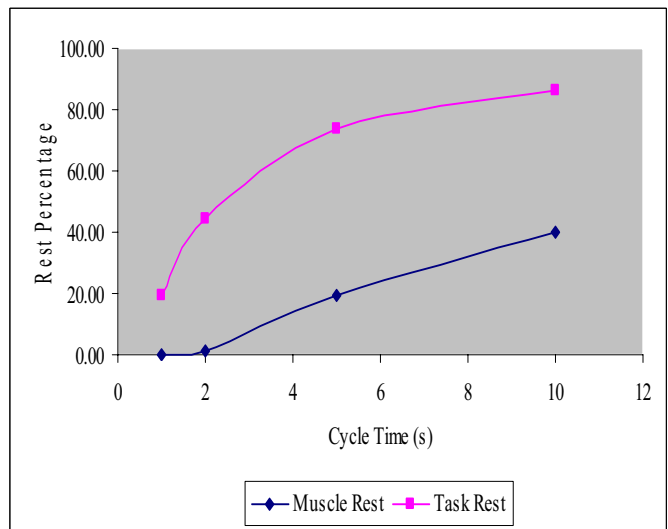


Figure 2: Calculated rest percentage based on grip force (task) and gaps (ECR muscle) during power grip

### REFERENCES

1. Krawczyk S, et al. *Proceedings of the International Scientific Conference on Prevention of Work-related Musculoskeletal Disorders*, Stockholm, Sweden, 1992.
2. Chadwick EKJ, Nicol AC. *J Biomech* **33**, 591-600, 2000.
3. Veiersted et al. *Int Arch Occup Environ Health* **62**, 31-41, 1990.

### ACKNOWLEDGEMENTS

This work was supported by NSERC (Canada) 238240-01.