

Computer Connected Force Platform Performance Assessment and Training Tool for Rock Climbing

F. Bourassa-Moreau¹, B. Bourassa-Moreau², E. Bourassa-Moreau³

¹Department of mechanical engineering, Technical University Munich, Germany

²Department of physics and biomedical engineering, Centre hospitalier de l'université de Montréal (CHUM), Canada

³Department of Orthopedic Surgery, University of Montréal, Canada

Summary – Use of a force platform software during a hangboard finger training as a performance assessment and training tool for rock climbing.

INTRODUCTION

Traditional training on hanging board is widely used for rock climbing. However, it does not allow precise measurement of training intensity variation. Pressure sensor allows this level of precision and variability [1,2] but are not widely available. Therefore, we developed a software intended to use a widely available force platform (FP) as specific performance assessment and training tool (PATT) for rock climbing.

METHOD

General principle: Effort calculation is based on the partial weight measured on the FP subtracted to the measured total body weight (BW). (1)

$$BW - \text{Measured Weight} = \text{Suspended Weight (1)}$$

Protocol:

- The user stands on the FP (Wii balance board ©) and get his weight measured.
- A hangboard disposed directly over the FP is used for suspension exercises.
- The foot of the user remains on the FP throughout the suspension exercises.
- Percentage of BW and absolute weight lifted are calculated by the PATT.
- Direct visual feedback is provided to the user on the computer interface.
- The FP error is about one kilogram [3].

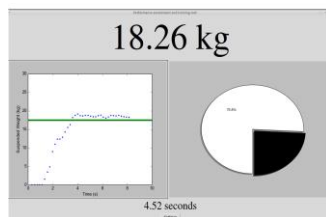


Figure 1 [Left] Climber suspended on the hangboard over the Wii FP placed on the ground. [Right] The interface of the software allows the user immediate visual feedback of his absolute (left) and relative (right) effort.

RESULTS

Established bluetooth connection with the FP receives the reaction with the floor

data. The *Nintendo Wii Balance Board* ©, the *Snake Byte Bitness Board* © and the *Big Ben Balance Board* © are all compatible with the PATT software. Figure 2 shows raw data from a 45 minutes endurance training. It consisted in two repetitions of 15 minutes exercise separated by a 10 minutes break. The exercise was one handed hold pull at 50% of maximal strength, alternating left and right hand each 10 seconds. Maximal strength was calculated as maximal BW lifted in a trial of one handed pull-up.

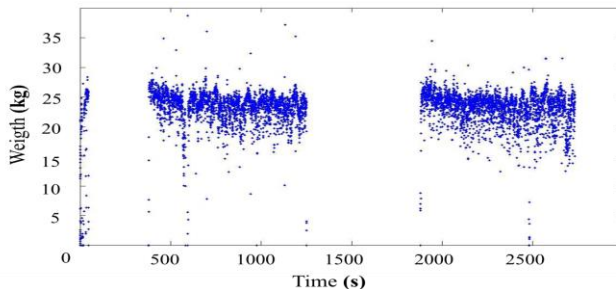


Figure 2 Suspended weight over time during a 45 minutes aerobic finger endurance training

DISCUSSION

Training with the feet on the balance using the PATT improves the control and precision of training intensity. This provides a safe and stimulating environment for performance enhancement specific to rock climbing.

A drawback of this system is that the forces in the plane of the balance are not measured by the PATT. However this bias is systematic toward underestimation of measured effort. The difference between real effort and calculated effort is most likely minimal with the disposition of the FP under the hangboard.

This PATT has the advantage of being widely available. This tool allows personalized rock climbing training for users of all level. It further offers endless possibilities of connectivity with smartphones and computers. In the future, users may share their training data with researchers, coaches or friends.

REFERENCES

- [1] AM Amca, L Vigouroux, S Aritan, E Barton, "Effect of hold depth and grip technique on maximal finger forces in rock climbing," *Journal of Sports Sciences*; 30, 7; 669-677, 2012.
- [2] MJ Morenas, VL Del Campo, M Leyton Román, JM Gómez-Valadés Horillo, JS Gómez Navarrete, "Description of the finger mechanical load of climbers of different levels during different hand grips in sportclimbing," *Journal of Sports Sciences*; 31, 15; 1713-21, 2013
- [3] J H. Bartlett, J. Bingham, and L. Ting, "Accuracy of force and center of pressure measures of the Wii Balance Board" *Gait & Posture*., vol. 39, pp. 224-228, 2014.