

The effect of strengthening using different moment of inertia resistance

*I-Han Tai, En-Chung Chang and Tzyy-Yuang Shiang

Department of Athletic Performance, National Taiwan Normal University, Taiwan

*e-mail: lalay777@gmail.com

SUMMARY

In our study, training with different moment of inertia (MoI) resistance did not affect the static performance. However in dynamic performance, 6 weeks of both lower and higher MoI training can significantly enhance the ability during concentric and eccentric contraction.

INTRODUCTION

Strengthening by inertial resistance provides users demonstrating maximal effort and it also offers the adding mechanical load during the eccentric phase (eccentric overload) [1.2.3]. This type of loading potentially increases the recruitment of motor unit and inducing the training adaptations [2.3.4].

During training, MoI and training speed play important roles for the training intensity. Different MoI can modulate maximal training velocity and eccentric overload, furthermore, induce different training results. The purpose of this study was to identify the effect of strengthening using different MoI resistance and provide the guideline for inertial resistance training.

METHODS

Twenty-four healthy college students (age 20.1 ± 1.3 years old; height 171.2 ± 3.9 cm; weight 61.9 ± 7.4 kg) were recruited in this study. They were arranged to low-MoI group (12 participants; LMoI) and high-MoI group (12 participants, HMoI) based on the result of knee extension maximal voluntary contraction (MVC) from pre-test. During training, all participants were asked to warm up for 5 minutes then perform 30 repetitions maximal effort of full range of motion knee extension (quadriceps concentric contraction) and knee flexion (quadriceps eccentric contraction) for 2 sets in sitting. There were 3 minutes resting between sets. And there were 2 trainings per week for 6 weeks. A custom made MoI-adjustable resistance training device was used in this study (Figure 1).



Figure 1: Custom made MoI-adjustable resistance training device

Lower limb performance were obtained by Biodex system (Biodex Medical System Inc, Shirley, NY) including MVC of isometric knee extension, peak torque of isokinetic knee extension-flexion (concentric-eccentric) in $360^\circ/s$.

Two-way analysis of variance (mixed design) was processed by SPSS 17.0 version and significant level was set as $\alpha = .05$. Tukey's test was chosen for post-hoc analysis.

RESULTS AND DISCUSSION

There is no significant difference between groups in isometric MVC. During the isokinetic test, significant difference happened on extension and flexion peak torque in both groups between pre- and post-test (Figure 2).

Isometric contraction value showed no difference between groups, we hypothesize that the major factor was less energy stored from single joint movement compared with other study's multiple joint movement [1.2.3]. In dynamic muscle performance, both MoI trainings can significantly enhance the ability during concentric and eccentric contraction between pre- and post-test, but no significant difference between groups. It indicated that training velocity might be the major factor that affecting training results instead of the MoI.

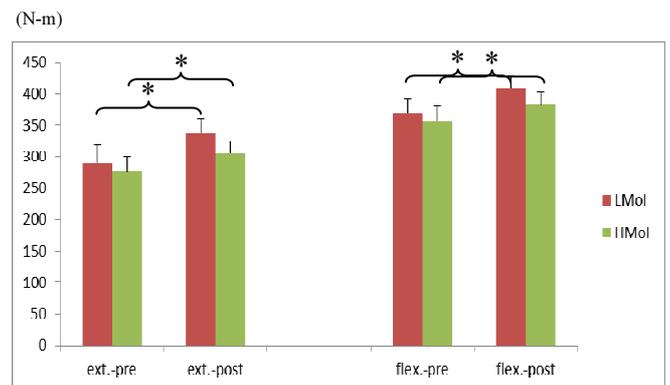


Figure 2: Pre- and post-test of peak torque in isokinetic ($360^\circ/s$) knee extension-flexion. * $p < .05$

CONCLUSIONS

Strengthening by inertial resistance can affect more in dynamic performance than in static performance. However, the proper intensity for the exercise should be identified in further studied.

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