

**COMPARISON OF FORCE, VELOCITY AND POWER DURING THE LAT PULLDOWN EXERCISE PERFORMED ON A CONVENTIONAL OR AN INERTIAL CONICAL PULLEY AT DIFFERENT LOAD LEVELS**

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**INTRODUCTION**

In contrast with traditional weight stack machines or free weights to stimulate the neuromuscular system, different devices that use the inertia of rotating flywheels has been extensively researched over the last fifteen years. The basic mechanism of these devices is to load kinetic energy in the spinning of the flywheel(s) in the concentric phase and then resist the stored kinetic energy while braking the wheel(s) in the eccentric phase. Thus, an accommodating inertial resistance is obtained where the resistive force is proportional to the force generated by the subject<sup>1,2</sup>.

A device using the same principle but including a combination of freely-moving round pulleys that drive a rope while winding and unwinding on a conical pulley has been recently introduced<sup>3</sup>. However, no study has been conducted to define the force, velocity and power profile while performing at the available positions or intensity levels in both eccentric and concentric movement phases

**METHODS**

Eleven subjects with previous experience with use of both exercise devices volunteered to participate. A randomized cross-over design was utilized to compare individuals performing the same exercise (lat pulldown) with different sources of resistance (traditional pulley vs. conical inertial pulley) at 4 different intensity levels. For the traditional pulley (TP; Gevsport, Spain) these settings were equivalent to the subject's 20, 40, 60 and 80% of maximal voluntary force (MVC) while for the VP the four available levels were tested. Force, position and velocity were recorded in a synchronized manner using the MuscleLab 4000e system (Ergotest AS, Langesund, Norway).



**RESULTS**

When comparing intensity levels in the same exercise configuration, TP follows a classical power/load curve pattern with maximal concentric power attained at 40% of MVC. However, with VP the maximal concentric power is attained at intensity level 1. Both avg and max power are significant higher at VP than at TP. Velocity and force data are shown in graphs.

When comparing movement phases only while performing on the VP a significant eccentric overload was attained. Thus, while exercising at levels 2, 3 and 4 significant higher eccentric than concentric peak forces were found.

**CONCLUSIONS / PRACTICAL APPLICATIONS**

Despite the light weight of the portable inertial pulley analyzed in this study (aprox. 20 kgs), it is possible to obtain clearly higher power values than when performing on a traditional pulley. This has applications for athletes who need to travel on a consistent basis -i.e. tennis players or team sports- to locations where no weight equipment is available.

On the other hand, the feature of accomplish an eccentric overload is crucial in order to promote its associated training adaptations (i.e. muscle injury prevention, tendinosis rehabilitation, power improvements, etc...).

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