A DEVICE FOR MEASURING THE VELOCITY-TIME HISTORY OF ATHLETES

Peter M. McGinnis
Department of Exercise Science and Sport Studies, SUNY College at Cortland, Cortland, New York, USA

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INTRODUCTION: Measurements of the velocity-time histories of sprinters and jumpers are valuable to coaches of these events, but the devices which have been developed to make such measurements are too expensive for most athletics programs. The purpose of this study was to develop and validate the use of a relatively inexpensive device for measuring the velocity-time history of straight away sprinters, long jumpers, triple jumpers, and pole vaulters.

THEORY OF OPERATION AND DESCRIPTION: The basic design of the system is as follows. A lightweight belt with a magnet attached to it is worn around the athlete's waist. Another magnet attached to a lightweight, inextensible line is magnetically attached to the magnet on the athlete. The line extends around a pulley and is wound up by a bait casting fishing reel. Tension in the line is provided by a weight and an elastic cord. A photogate is open or closed by the spokes of the pulley. The timing of the opening and closing of the photogate is recorded by a datalogger which is wired to a handheld computer or graphics calculator. Knowing the diameter of the pulley and the number of spokes in it, the distance the line moves can be computed. The timing data can then be used to compute velocity. The handheld computer or graphics calculator stores and display the velocity-time history. The actual device includes a Texas Instruments TI-86 Calculator and CBL data logger, a Vernier Photogate and SuperPulley, Spectra fishing line, a Daiwa baitcaster fishing reel, a lightweight photo tripod, and various small pieces of hardware. The total cost of the system was less than $500. This is much less than the laser or radar based velocity measuring devices.

METHOD: Two experiments will be done to validate the system. The first experiment will utilize the device to measure the velocity of a freely falling object. A weight will be attached to the line and dropped from a height greater than 3 m. Velocity data for 10 drop trials will be collected. The average slopes of the resulting velocity-time curves will be computed and compared to the accepted value for the acceleration due to gravity. The second experiment will involve actual sprints. The line will be attached to a subject and a visual target will be attached to this end of the line as well. The subject will then sprint 50 m. Ten sprint trials will be completed using one or more subjects. A stationary videocamera operated at 60 Hz and set up with its optical axis perpendicular to the plane of motion will record the sprints during the interval between 27 and 33 m. This videorecords will be digitized to determine the coordinates of the target on the line during each sprint. Velocity data will be derived from the digitized coordinate data and compared to the velocity data recorded by the device for this interval of the sprint.

RESULTS AND DISCUSSION: Preliminary results indicate that the device accurately measured a linearly increasing velocity as a weight was dropped. The drag force imposed on the weight resulted in an acceleration error of 5%. A larger drop weight will be used in the actual testing to reduce the influence of the drag force. Initial tests of the device when measuring sprint velocities produced velocity time curves typical for sprinters as measured by laser devices (Dickwach, Hildebrand & Perlt, 1994) or radar (Headly, 2003).

REFERENCES:

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