

THE INITIAL CONDITIONS AT RELEASE IN HAMMER THROW OF WORLD CLASS TOP ATHLETES

Atsushi Okamoto, Shinji Sakurai*, and Yasuo Ikegami**

Faculty of Human Wellness, Tokai Gakuen University, Nagoya, Japan

*School of Health and Sports Sciences, Chukyo University, Toyota, Japan

**Research Center of Health, Physical Fitness, and Sports, Nagoya University, Nagoya, Japan

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INTRODUCTION: In hammer throw, the influence of the air resistance is negligibly smaller in comparison with javelin and discus throw. Therefore, the throwing distance of a projectile object is practically determined by the initial conditions at release such as initial velocity, the angle of projection and the release height. The purpose of this study was to investigate the influence of initial conditions at release on the throwing distance of hammer throw.

METHOD: The throwing motions of the hammer throw were recorded in the final event of 3rd IAAF World Championships in Athletics Tokyo and in 12th Asian Games Hiroshima with two synchronized high-speed cine and video cameras. The initial conditions of hammer head were calculated by using DLT technique (Abdel-Azis & Karara, 1971).

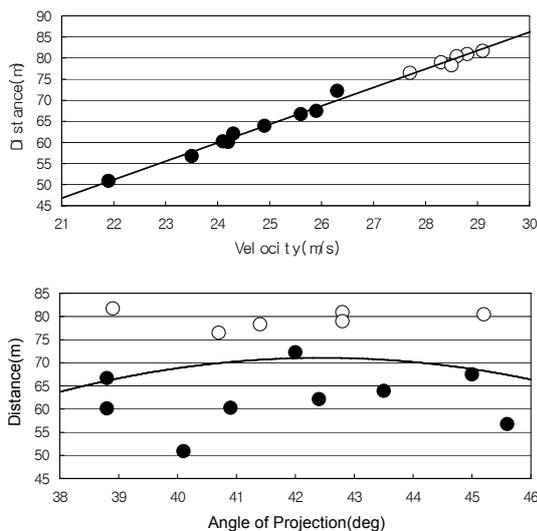


Figure 1 Relationships between initial conditions at release and distance of hammer throw (○:top 6 athletes of 3rd IAAF World Championships in Athletics Tokyo, ●:all finalists of 12th Asian Games Hiroshima)

RESULTS & DISCUSSION: Relationships between initial conditions at release and the throwing distance were shown in Figure 1. Only a significant correlation was obtained between the initial velocity and the distance. The correlation coefficient was 0.996 ($P < 0.001$, $Y = 4.373X - 45.036$). The angle of projection strongly depends on the inclination of the orbital plane of hammer head just before the release and the release height which depends on the timing of the release of hammer head. In other words, athletes cannot choose the angle of projection and release height independently. That would be the reason why the distance of hammer throw was almost determined by the initial velocity in the world class top athletes.

In conclusion, in this study the most important initial condition at release in hammer throw was identified by the analysis of world class top athletes. From the results of the biomechanical analysis, it became clear that the initial velocity of hammer head was the most dominant factor which affected the performance.

REFERENCES:

Abdel-Azis, Y.I. & Karara, H.M. (1971). Direct linear transformation from comparator coordinates into object space coordinates in close range photogrammetry. Proceedings of the ASP/UI Symposium on Close-Range Photogrammetry. Falls Church, VA: American Society of Photogrammetry, 1-18.