3D KINEMATIC AND KINETIC ANALYSIS OF JAVELIN THROWING PERFORMANCE

Didier Gonzalez, David Amarantini, Gilles Dietrich*,
Jean-Paul Micallef, and Daniel Favier**
Aerodynamics and Biomechanics of Motion Laboratory, Marseille, France
***Kihopsys, Aix en Provence and University of the Mediterranean, Marseille, France**
****INSERM and Propara Center, Montpellier, France**

INTRODUCTION: Major studies on javelin throwing have focused more recently on kinematics studies, in two, and later, in three dimensions (3D), especially to analyse high performances (Bartlett & Best, 1988). However, there is a lack of literature reporting on kinetics data in javelin throwing event (Bartonietz, 2000). The main objective of this study is to develop a 3D kinematics and kinetics analysis of the final release phase of the javelin throw to explain javelin throwing performance.

METHODS: In collaboration with the French Track and Field Federation, two national javelin throwers participated in this experiment. Two synchronized digital video cameras (50 frames/s) coupling with two force plates (200 Hz) were used to collect kinematics and kinetics data during javelin throwing, respectively. Data synchronization, reconstruction (DLT method), smoothing (2nd order Butterworth filter), processing and analysis (by an inverse dynamics approach) were performed using motion analysis and modelling software (BiomecaLab).

RESULTS AND DISCUSSION: Ground reaction forces variations (force plate 1, Fx1, Fz1, and force plate 2, Fx2, Fz2) in Figure 1, and anteroposterior joint forces variations (for the ankles) in Figure 2, are shown for one javelin thrower during the final double-support phase (RFS: right foot support ; LFS: left foot support ; REL: release).

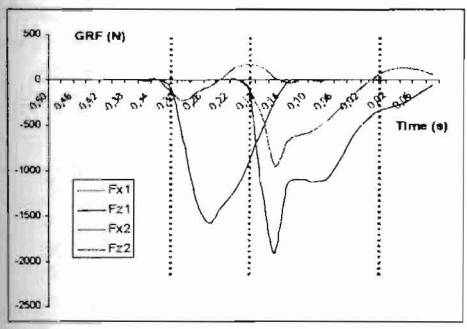

Figure 1: Ground reaction forces (GRF).

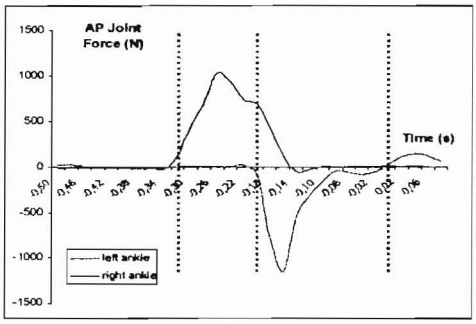

Figure 2: Anteroposterior joint forces.

CONCLUSION: The aim of such a work in progress is to evaluate (1) the relationships between GRF (Figure 1) and javelin throwing performance, and (2) the contribution of GRF to local joint forces and torques (Figure 2) during the final double-support phase of javelin throwing movement. First results obtained are consistent with using such a method, and will allow to determine actions produced by lower limbs and how it affects the force produced by the throwing upper limb during the final release phase of this movement.

REFERENCES:

Bartlett, R.M. & Best, R.J. (1988). The biomechanics of javelin throwing: A review. Journal of Sports Sciences, 6, 1-38.

Bartonietz, K. (2000). Javelin throwing: An approach to performance development. In V.M Zatsiorsky (Ed.), Biomechanics in Sport, Performance Enhancement and Injury Prevention (pp. 401-434). Oxford: Blackwell Science.