A Comparison of Two Grip Force Evaluation Systems.
A Pilot study.

S. Gigourtakis 1, A. Baxevani 1, A. Pitikaki 1, G. Koumantakis 2, G. Manolarakis 3, M. Matthaikis 4, C. Koutsojannis 5

1 Physiotherapy Private Practice, Heraklion, Crete, Greece; 2 Physiotherapy Department, General Military Hospital of Athens, Athens, Greece; 3 Orthopaedic & Ortho-Trauma Surgeon Private Practice, Heraklion, Crete, Greece; 4 Orthopaedic Surgeon Private Practice, Heraklion, Crete, Greece; 5 University of Patras, Computer Engineering and Informatics Department, Patras, Greece

OBJECTIVE
The purpose of the study was to establish the concurrent validity and test-retest reliability of the Grip Force Measurement System (GFMS), as a specialized system of the grip force of the palm and its individual fingers.

METHODS
Grip strength testing was performed on 12 injured participants by the same examiner. All participants suffered from hand trauma, that affected the total capability of hand grip.

The protocol of grip strength assessment included:
Three trials were completed for the right and left hand on the Biometrics E-LINK EP 9, using a repeated measures design, with random side selection. The maximal voluntary grip force perpendicular to the surface of the handle was estimated immediately afterwards, using a glove with 349 sensors (Tekscan, USA-Grip Force Measurement System), while holding the digital biometrics dynamometer at the same time. Six more trials (three for each hand) were tested using GFMS, during holding a cylindrical handle. Individual digit and palm forces were studied. Each subject was properly positioned and the same verbal orders were given.

Six participants repeated the testing later, for test-retest reliability of the Grip Force Measurement System.

RESULTS
The study presents initial evidence on the test-retest reliability of the Grip Force Measurement System. In addition, a repeated measures analysis of variance (ANOVA) with one within participants factor of systems (Biometrics versus Grip), was conducted to determine whether differences in strength scores existed between systems. Differences were considered significant at the 0.05 level of significance.

On average, there was no significant difference for either of the hand (R/L) sequential force measurements with the GFMS and under simultaneous GFMS and Tekscan glove force measurements, with the coefficient of variation (CV%) ranging between 1.1-6.9% for the R and between 0.5-8.1% for the L hand.

CONCLUSIONS
• The human hand grip force is commonly assessed using hydraulic or tensometric hand dynamometers, but the Grip Force Measurement System allowed identification and analysis of the force of the palm and its individual fingers. The total hand grip force was measured by 349 resistive sensors located in a glove. Fourteen sensing areas were placed on the phalanges of the hand, and the remaining ones on the palm.
• The results indicate that the Grip Force Measurement System is reliable and comparable to the Biometrics E-LINK EP 9, when used for measuring grip strength.
• However, due to small sample, future studies into the reliability and validity of the Grip Force Measurement System should be conducted.
• These are the preliminary results of a project in progress.