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Title	Biomechanical performance measurement using wireless inertial sensors for professional and recreational darts players
Authors	Walsh, Michael;Tyndyk, Magdalena;Barton, John;O'Flynn, Brendan;Ó Mathúna, S. Cian
Publication date	2011-12
Original Citation	Walsh, M., Tyndyk, M., Barton, J., O'Flynn, B. and O'Mathuna, C. (2011) 'Biomechanical performance measurement using wireless inertial sensors for professional and recreational darts players', British Journal of Sports Medicine, 45(15), pp. A10-A10. doi: 10.1136/bjsports-2011-090606.31
Type of publication	Article (peer-reviewed)
Link to publisher's version	http://bjsm.bmj.com/content/45/15/A10.1 - 10.1136/bjsports-2011-090606.31
Rights	Published by the BMJ Publishing Group Limited. This article has been accepted for publication in British Journal of Sports Medicine. The definitive copyedited, typeset version is available online at: http://bjsm.bmj.com/content/45/15/A10.1
Download date	2026-09-09 16:48:07
Item downloaded from	https://hdl.handle.net/10468/576

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University College Cork, Ireland
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Biomechanical performance measurement using wireless inertial sensors for professional and recreational darts players

M Walsh[1], M Tyndyk[2], J Barton[1], B O'Flynn[1], and C O'Mathuna[1]. 1 Clarity Centre for Web Technologies, Tyndall National Institute, Microsystems Centre, University College Cork. 2 Medical Engineering Design and Innovation Centre, Department of Manufacturing, Biomedical and Facilities Engineering, Cork Institute of Technology

Biomechanical performance is an important factor for developing darts players. The darts throw happens so quickly (< 200 ms) that even the trained eye of an experienced coach has difficulty in identifying the small movement differences that can determine a player's technical proficiency. Traditionally for high precision sports such as darts, biomechanical information is captured with an optical marker system, which is immobile, expensive and requires a specialized team to operate. Advances in wearable sensor technology allow measurement of kinematics using non-invasive sensors embedded in athletic clothing. Data from one professional player aged 24 y and ranked within the top 60 in the Professional Darts Corporation world rankings and two recreational players aged 28 and 25 y respectively were used in this analysis. A single custom-built Wireless Inertial Measurement Unit (WIMU) was placed on the proximal forearm of each participant. Each player performed 150 throws in a real game situation. Score and the projectile's final position on the target were recorded manually. As reported previously, players with higher skill level had the ability to regulate a number of variable parameters affecting outcome, for each discrete over arm throwing action, more effectively then the less skilled players. These parameters included the maximum acceleration of the throwing arm (std. dev. Pro. 0.1 g, Rec 0.35g), the maximum speed of the throwing arm (std. dev. Pro. 0.1 ms-1 g, Rec 0.2 ms-1), and the throw timing (std. dev. Pro. 0.15 s, Rec 0.67 s). These results concur with previous measurements taken using an optical marker system. Placing WIMU's on a darts player's arm holds potential for coaches to easily measure biomechanical factors, thus quantifying performance without the need for a complex biomechanics laboratory. Coaches can use this data to fine-tune elite athletes or to screen younger players for characteristics that are indicative of a potential for high performance.