Differences between upper and lower lumbar spine kinematics in cricket fast bowling

PETER ALWAY[1]*, PAUL FELTON[1], NICHOLAS PEIRCE[2], KATHERINE BROOKE-WAVELL[1], MARK KING[1]

[1]Loughborough University and [2]England and Wales Cricket Board

*Corresponding Author: P.Alway@lboro.ac.uk

@sportsmedpete

Excessive lumbar spine motion during fast bowling has been suggested to contribute towards lumbar stress fracture, among the most serious injuries suffered by fast bowlers (Ranson et al., 2008, *Journal of Sports Sciences,* 26, 267-276). Facet joints between adjacent vertebrae permit movement of the spine. Despite this, many motion analysis studies have measured lumbar spine kinematics as a singular segment (L1 - L5). The purpose of this study is to compare upper (L1 - L3) and lower (L3 - L5) lumbar spine kinematics during fast bowling. With institutional ethical approval, 20 male (mean ± SD: age: 19.32 ± 2.33 years; height: 1.88 ± 0.06 m; body mass: 83.00 ± 6.50 kg; maximum ball velocity: 35.02 ± 1.74 m/s) elite fast bowlers completed three overs of maximal effort bowling captured by an 18 camera VICON MX system (300 Hz). Retro-reflective markers were attached to participants to create upper and lower lumbar spine segments, adapted from Seay et al. (2008, *Journal of Sports Sciences,* 26, 1519-1529). The greatest ball velocity trial from each participant was analysed to produce joint angles in sagittal, frontal and transverse planes at back foot contact (BFC), front foot contact (FFC), ball release (BR) and the maximal value. Kinematics between lumbar spine segments were compared using the non-parametric Wilcoxon signed-rank test. Significant differences between lumbar spine segments were found in all planes of motion with moderate to large effect sizes ($P < 0.05$, $r > 0.50$). In sagittal plane movements, the lower lumbar segment demonstrated greater flexion at BFC (mean difference ± SD) (12 ± 10°), BR (6 ± 6°), and at maximum (5 ± 8°), but showed decreased maximum extension (7 ± 9°). In frontal plane movements the lower lumbar segment displayed greater maximum contralateral side-flexion (8 ± 10°) and at FFC (13 ± 9°) but demonstrated reduced maximum ipsilateral side-flexion (4 ± 7°). In transverse plane movements, ipsilateral rotation was greater in the upper lumbar segment at FFC (6 ± 6°), BR (3 ± 6°) and at maximum (7 ± 6°). The results suggest

that the upper lumbar spine contributes greater extension, ipsilateral side-flexion and rotational movement to total lumbar spine movement, while the lower lumbar spine contributes greater flexion and contralateral side-flexion to total lumbar spine movement, which may affect the aetiology of lumbar stress fractures. Future research should compare upper and lower lumbar spine kinematics between stress fracture and non-injured fast bowlers.