INTER AND INTRA-SPIN BOWLER TECHNIQUE VARIATION BETWEEN STOCK AND ARM-BALLS

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Summary

The aim of this study was to identify the mechanical differences between stock and arm-ball deliveries in elite female finger-spinners. Eighteen finger-spinners bowled arm-ball deliveries with, on average, significantly lower spin rates, faster ball velocities, a more backspin-oriented spin axes, more anterior release points, more pronated forearms, smaller peak forearm rotation velocities, and more extended wrist angles than stock deliveries. Intra-bowler analyses revealed not all bowlers used the same adjustments, suggesting other mechanisms could be employed to produce an arm-ball.

Introduction

Bowlers in cricket are typically required to deceive opposition batters to reduce runs conceded and to get batters out [3]. One method adopted by spin bowlers is to vary the type of delivery bowled to reduce predictability. Finger-spinners are known to primarily vary pace of delivery rather than spin rate; an arm-ball being a delivery with faster translational velocity, than their more sidespin-oriented stock delivery, where the intent is to rush the batter. Understanding of how technique differs to achieve different ball characteristics is currently limited to coaches' experiences, studies solely describing the different ball characteristics [1] and those that have explored alternative deliveries in male elites (doosra; [2]). The aim of this study was to identify the mechanical differences between a stock and arm-ball delivery in elite female finger-spinners.

Methods

Eighteen female elite finger-spinners (mean ± SD. age: 21.9 ± 3.8 yrs; height: 1.69 ± 0.05 m; mass: 68.0 ± 9.1 kg) bowled a minimum of nine stock and nine arm-balls on an indoor artificial cricket pitch. Whole-body and ball kinematics were recorded using marker motion capture at 500 Hz. Five of each delivery type were labelled and analysed per bowler, reconstruction quality dependent (Total: 90 stock, 86 arm-balls), before being averaged. Segmental velocities, joint angles and angular velocities were calculated between upper arm horizontal (UAH) and ball release (BR) or between back foot contact (BFC) to BR (e.g. 2D trunk rotation about vertical axis). Normality of data were assessed using a Shapiro-Wilks test before a paired t-test (or Wilcoxon) was run between delivery types. A Statistical Parametric Mapping (SPM) t-test was used to analyse continuous kinematic data at both the inter and intra-bowler level.

Results and discussion

On average, in the arm-ball spin rates were less (1079 ± 132 vs 1331 ± 165 rpm), ball velocities were faster (21.8 ± 1.3 vs 19.6 ± 1.0 m/s), spin axis was more backspin-oriented, and the ball was released further in front of the bowler (0.45 ± 0.07 vs 0.38 ± 0.07 m) when compared with the stock delivery ($P < 0.001$). Technique-wise, larger trunk forward rotation (115 ± 15 vs 109 ± 19°) and slower peak forearm pronation velocities (758 ± 379 vs 915 ± 387°/s) were observed when bowling an arm-ball ($P < 0.017$).

Group level SPM analysis revealed more pronated forearms and extended wrists between UAH and BR when bowling an arm-ball (Figure 1). Larger peak forearm rotation velocities observed in stock deliveries might suggest this is more important for spin rate production [3,4] and that larger pronation velocities are easier to attain when beginning with a more supinated orientation. A more extended wrist in contrast might be adopted due to more emphasis on ball velocity and less on applying sidespin to the ball.

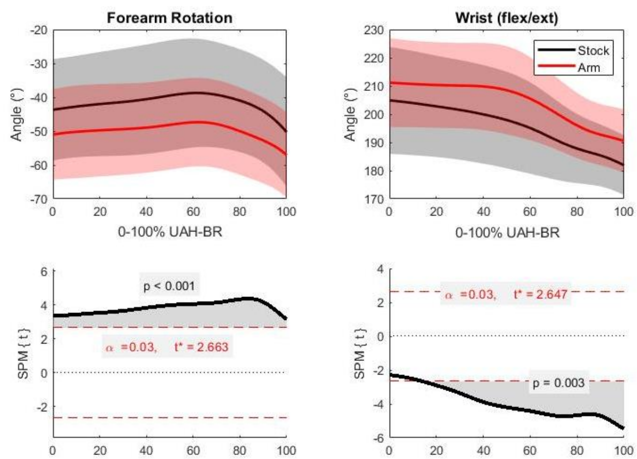

Figure 1: Group SPM analysis of forearm pronation/ supination and wrist flexion/extension angles between UAH and BR.

Within-bowler SPM analysis revealed five of the bowlers did not possess significantly different forearm and wrist orientations, implying an alternative mechanism for bowling an arm-ball may exist.

Conclusions

On average, technique adjustments at the trunk, forearm and wrist are made to produce an arm-ball. However, alternative mechanisms might exist.

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References

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