A TEMPORAL ANALYSIS OF OVER-ARM AND SIDE-ARM THROWS IN CRICKET PLAYERS

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Wintec, Hamilton, New Zealand 2015

Introduction

Throwing is an essential element of cricket used for reducing runs and dismissing opposing batsmen (Freeston & Rooney, 2014), despite this few studies have aimed to investigate the temporal aspects of throwing by identifying the duration of each phase within the throwing movement (Boroujerdi, Rahimi & Noori, 2009; Freeston, Ferdinands & Rooney, 2007). Throwing phases for an over-arm throw are displayed in figure 1, which include "wind up", "stride", "arm cocking", "arm acceleration", "arm deceleration" and "follow through" (Sachlikidis & Salter, 2007).

There is also a lack of research based upon different throwing techniques specifically for cricket. Freeston, Ferdinands and Rooney (2007) suggested over-arm throws to be the most common throwing technique compared to side and under-arm techniques, with little theoretical support. The only reliable piece of research comparing over-arm and side-arm throws specifically for cricket was conducted by Hussain and Bari (2002) which suggested that over-arm throws generated both greater endpoint velocity and accuracy.

The aim of the current study was to identify temporal, endpoint velocity and accuracy differences between over-arm and side-arm throwing techniques.

Based on the previous research of Hussain and Bari (2002), it was hypothesised that over-arm throws would produce a greater accuracy, shorter duration of the acceleration phase, resulting in a greater endpoint velocity.

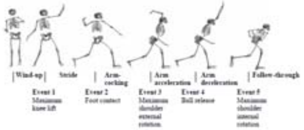

Figure 1: Events and phases used to analyse the throw (Sachlikidis & Salter, 2007)

Methodology

Participants: Ten male, inexperienced amateur cricket players volunteered to participate in the current study (mean ± SD: age: 21.4 ± 2.2 years; height: 1.80 ± 0.04 m; weight: 83.4 ± 8.5 kg).

Procedures: Each participant was instructed to perform 10 throws (5 over-arm and 5 side-arm throws) utilising a counter-balanced study design to reduce the risk of fatigue on results. Each participant was instructed to throw the ball as "hard" and as "accurately" as possible towards a target set at 20.14 m, representing the distance of a cricket pitch, as used by (Freeston et al., 2007). The target consisted of 9 cricket stumps (71 cm x 0.35 cm) lined up in a row, with each stump equalling a different score value (0-5 points).

Data Analysis: The 2D analysis was conducted using a high speed camera (Casio EX-ZR200), placed 7 m perpendicular to the line of the movement. All camera footage was analysed using SiliconCoach Live to retrieve temporal data of the movement phases.

A radar gun (Stalker ATS II) was positioned behind the cricket stumps (target) in line with the direction of the movement collecting the peak velocity of each throw.

Statistical Analysis: Descriptive statistics (means and standard deviations) were calculated for all variables. Comparative statistics were conducted in a customised MSExcel spreadsheet to calculate if any meaningful differences existed between over-arm and side-arm throws. Statistical significance which was set to a *P*-value < 0.05, percentage change scores and effect size statistic were calculated. Effect sizes can be interpreted as: Trivial (0.0 – 0.2); Small (0.2 – 0.6); moderate (1.2 – 2.0); large (1.2 – 2.0) and very large (2.0 – 4.0). The smallest worthwhile effect size difference was set to 0.2 to ensure small results may be observed (Puddle & Maulder, 2013).

Table 1: Over-arm and Side-arm throwing technique differences; including velocity, accuracy and temporal variables.

	Over-arm Throw			Side-arm Throw			*P*-value	Percentage Change	Effect size
	mean	±	SD	mean	±	SD		%	
Endpoint Velocity (Km/h)	90.2	±	2.42	88.64	±	2.81	0.070	1.8	0.51
Accuracy Per Throw (Points)	0.6	±	0.4	0.5	±	0.7	0.774	-	0.09
Overall Accuracy Score (Points)	3.1	±	2.0	2.7	±	3.6	0.774	-	0.07
Preparation Phase Duration (sec)	0.56	±	0.18	0.50	±	0.12	0.180	10.9	0.39
Acceleration Phase Duration (sec)	0.23	±	0.04	0.25	±	0.05	0.213	-4.5	-0.21

Findings

No significant differences were observed between the two throwing techniques, with throwing velocity demonstrating the closest outcome to being significantly different (*P*-value of 0.070). Throwing velocity also demonstrated the highest effect size of 0.51, meaning that the difference was small, but clearly showed that over-arm throwing technique resulted with a faster endpoint velocity. This finding corresponded with acceleration duration, with over-arm throws producing a 4.5% faster acceleration phase than side-arm throws. Inversely, the initial temporal variable, the preparation phase, revealed that over-arm throws produced a 10.9% slower wind up, despite producing greater average endpoint velocity. Overall accuracy scores and accuracy scores per throw each resulted in trivial effect size differences, both resulting in over-arm throws producing greater results.

Practical Implications

The findings of the current study indicate over-arm throws compared to side-arm throws produce greater endpoint velocity and greater accuracy scores per throw in a cricket context.

Throwing is a pivotal aspect of many different sports, such as baseball, water polo, javelin, handball and American football thus our findings should be considered by coaches and athletes when deciding what type of throw to utilise.

It is recommended that future research in this particular field acquire a greater sample size of participants with a greater level of experience to increase validity and reduce the risk of error.

Discussion

It was hypothesised that over-arm throws would generate shorter acceleration phase time, thus resulting in a greater endpoint velocity, and leading to greater accuracy, based on the findings of Hussain and Bari (2002). These hypotheses were supported by the findings of the current study. Hussain and Bari (2002) suggested that there was not a distinct body segment that determined the differences in endpoint velocity, but rather the "integration of body segments". This integration of body segments refers to sequencing of the movement also known as proximal to distal throw sequencing, has been described as the most important aspect of successfully performing over-arm throws (Cook & Strike, 2000). This aspect of sequencing also suggested potential reasoning as to why there were differences observed in accuracy per throw scores and overall accuracy scores.

Cook and Strike (2000) explains that this acceleration phase generates a stretch of the antagonist muscles within the shoulder, and in turn stores elastic energy. This storage of elastic energy, results in an enhancement of the concentric muscle contractions, the acceleration phase, as a result of the stretch reflex (Newton et al., 1997), known as the stretch shortening cycle (SSC). Consequently, one of the potential causes of over-arm throws generating a greater endpoint velocity could be attributed to a larger development of elastic energy during the cocking phase of over-arm throws, within the shoulder and upper extremity muscles.

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