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Commentary

KINEMATICS OF BOWLING: A COMPARATIVE STUDY BETWEEN BEGINNER AND ADVANCED BOWLERS

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ABSTRACT

Purpose: The study aims to describe and compare the kinematics between beginner and advanced bowlers, and male and female bowlers. ***Methodology:*** Ten subjects, 5 beginner and 5 advanced bowlers participated, using snowball sampling method. Reflective markers were placed on the following anatomic landmarks: shoulder, elbow, hip, knee, and the ankle. Participants were made to execute a game while being recorded through a video camera. Observational analysis was used to describe the kinematics for each game. Codes, in 30-degree ranges, were used to determine the range of movement of every joint. An inter-rater and intra-rater reliability test was done for assessment of range of movement. Mode function was employed to measure frequency and standard deviation was used to measure dispersion of frequency. Chi square test was applied to measure significant differences of data. ***Results:*** There was a high inter-rater and intra-rater reliability. Advanced bowlers utilized the 5-step approach while the beginner bowlers used the 4-step approach when throwing. There was less variability in the joint angles seen in the performance of advanced bowlers unlike in the beginner bowlers. ***Conclusion:*** Differences were noted between beginner and advanced bowlers in terms of their kinematics in throwing. An understanding of the results in kinematics will determine focus of training in beginner bowlers.

Key words: *bowling, advanced and beginner bowlers, kinematics, 4 and 5 step-approach*

COMMENTARY

Kinematics, a subdivision of biomechanics, describes the appearance of motion, including the pattern and speed of movement sequencing by the body segments[1]. The study of the biomechanics of

human movement has tremendously contributed to performance improvements in selected sports[1,2]. Sports scientists use movement analysis primarily as a tool to enhance techniques, correct movement errors, and to aid in the rehabilitation of injuries secondary to sports[2].

Visual observation has been the most commonly used approach for analyzing the mechanics of human movement. But the accuracy of visual observation as a single measure decreases as the speed of the movement of interest increases[1]. To address this problem, the use of a video camera has been advocated. Video recording allows the athlete and the analyst to view the movement repeatedly for critical analysis[1]. Most video camera units at present enable slow-motion viewing and single frame advance that facilitate isolation of the critical aspects of the movement.

The study utilized videotape analyses in its attempt to describe the 4 and 5 step-approach used by beginner and advanced bowlers. Surface markers were placed on different anatomic landmarks on both sides of the body that included the shoulder, elbow, hip, knee, and the ankle. In order to minimize errors for the analysis of the movement, attempts were made by the authors to standardize the testing environment, such as the positioning of the cameras used and the high intra- and inter-rater reliability in evaluating the range of movement. During playback of the bowlers' performance, raters evaluated the range of movement for the different joints using codes, wherein each code had a range of 30 degrees. A large range was utilized per code since the authors believed that using smaller ranges would lead to less reliable observations by the raters. Kinematics of bowling technique were tabulated and compared between advanced and beginner bowlers.

The movement analysis conducted by the authors, with its attempts to standardize the protocol and the testing environment, may have been improved further by addressing other details. Dependence on observations from only one camera positioned on one side of the subject may have inaccurately described the positions of the joints located on the side of the subject away from the camera's view. A multi-dimensional view of the movements would have assisted the researchers in coming up with more detailed, accurate descriptions of the movements involved.

The study could have benefited from the use of more than one video clip for analysis per bowler. Subjects may perform differently when they know they are being studied. For a skilled athlete, movement kinematics may deviate minimally across performances[1], thus one may choose to analyze just a single performance. Beginners, however, may have greater variations in the kinematics of their techniques, thus a larger number of observations should be made[1]. This would help account for any variability in the range of movement.

There was no mention of the amount of clothing worn by the bowlers during the conduct of the study. Typically, subjects should wear minimal attire so that movements of the different body segments will not be obscured[1].

At present, there are available computer software programs that may digitally analyze human movement for more accurate measurements[2,3]. The software calculates the kinematic quantities of interest. Three-dimensional analyses are currently used to view the movements of the joints since most sports activities occur in a multi-planar fashion. Video cameras are still utilized and surface skin markers are properly adhered to the different joints. Recent advances in technology have also led to the development of a marker-less motion capture for biomechanical applications in order to address the problems with the use of skin markers[3]. These technological advances, when available, may assist researchers in future undertakings concerning biomechanical analysis of movement.

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