TWO-DIMENSIONAL QUANTITATIVE ANALYSIS OF SHOT PUT THROW AMONG INTER UNIVERSITY ATHLETES

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ABSTRACT

The purpose of this study was to track trajectory of shot and to measure projectile variables of shot put throw for two-dimensional quantitative analysis. One shot put athlete was analyzed in this study. Recordings was made with one camera (Sony DSC-HX100v) fixed at shot put sector during inter university competition. The frequency of video recording was 50Hz and the resolution was 1440 x 1080 pixels. Using systematic video recording procedure the result given form the values such as angle of release, height of release, initial velocity, final velocity and peak height reached by shot was measured. The results of the study showed that the shot put throw depended on optimal peak height, angle of release, height of release and initial velocity.

Key Words: Quantitative analysis, shot put throw and two-dimensional.

INTRODUCTION:

Quantitative biomechanical analysts are mainly interested in improving performance and reducing injury risk. We can identify two fundamentally different approaches to experimental movement analysis in sport – qualitative analysis and quantitative analysis. The latter requires detailed measurement and evaluation of the measured data. Quantitative video analysis may be two-dimensional or three-dimensional. The former approach is much simpler, but it assumes that the movement being analysed is confined to a single, pre-defined plane. Any measurements taken of movements outside this plane will be subject to perspective error, thus reducing their accuracy. Even activities that appear to be two-dimensional, such as a walking gait, are likely to involve movements in more than one plane; a two-dimensional analysis would not enable these to be quantified accurately.

The quantitative experimental approach often takes one of two forms, usually referred to as the cross-sectional and longitudinal approaches. A cross-sectional study, for example, might evaluate a sports movement by comparing the techniques of different sports performers recorded at a particular competition. This can lead to a better overall understanding of the biomechanics of the skill studied and can help diagnose faults in technique. An alternative cross-sectional approach, which is less frequently used, is to compare several trials of the same individual. This is done to identify the performance variables that correlate with success for that athlete. In a longitudinal study, the same person, or group, is analyzed over a longer time to improve their performance. This probably involves providing feedback and modifying their movement patterns. Both the cross-sectional and the longitudinal approaches are relevant to the sports biomechanist, although conclusions drawn from a cross-sectional study of several athletes cannot be generalised to a single athlete, or vice versa.

Quantitative analysts often want to quantify such graphs, in contrast to the qualitative analyst, whose focus will be on their shape. Quantitative analysts may also identify values of some variables at important instants in the movement to allow inter- or intra-performer comparisons. These values, often called performance parameters or variables. They are discrete measures that, although they can be very important for that performer, discard the richness of movement information contained in time-series graphs or coordination diagrams. Computer visualisation of the movement will also be possible. Biomechanical quantitative analysis is not very difficult but technical tools of quantitative analysis are very expensive. Related to physical education and sports and experts did not know the procedure of track trajectory of shot and to measure projectile variables of shot put throw for biomechanical quantitative analysis and this is an important to know everyone related to physical education and sports. There are some softwares for biomechanical analysis like Quintic, Maxtraq, Motion analysis, simi. Researcher was used Tracker video analysis software in the present study.

METHODS:

The purpose of this study was to track trajectory of shot and to measure projectile variables of shot put throw for two-dimensional quantitative analysis. One shot put athlete was participated in the present study. Recordings was made with one cameras (Sony DSC-HX100v) fixed at shot put sector during inter university competition. There were five shot put throwing trial taken during competition. The frequency of video recording was 50Hz and the resolution was1440 x 1080 pixels. The sector of the shot put throw was coordinated with 1meter reference scaling stick (See Figure 1) for establishing the kinematic parameters of the technique. The physics Tracker software package was used to acquire data on angle of release, peak height, initial velocity, final velocity of shot put throw.

Data Collection Procedures

When conducting a quantitative video analysis, certain procedures must be followed carefully, at both the video recording and digitising stages. The following guidelines are designed to minimise the systematic and random errors present in two-dimensional co-ordinates, resulting from the video recording stage. This will increase the accuracy of any parameters subsequently obtained from these co-ordinates. The guidelines are based on those previously reported in Bartlett, 1997b, and in earlier texts (Miller and Nelson, 1973; Smith, 1975).

Equipment Set-Up

Mount the camera on a stable tripod and avoid panning

The standard approach in a two-dimensional analysis is for the camera to remain stationary as the performer moves through the field of view. This enables the movement of the performer to be determined easily relative to an external frame of reference. Two-dimensional filming techniques involving panning or tracking cameras have been used when the performance occurs over a long path (Gervais *et al.*, 1989; Chow, 1993). (See Figure 1)

Maximise the camera-to-subject distance

The camera must be positioned as far as is practically possible from the performer. This will reduce the perspective error that results from movement outside the plane of performance. (See Figure 1)

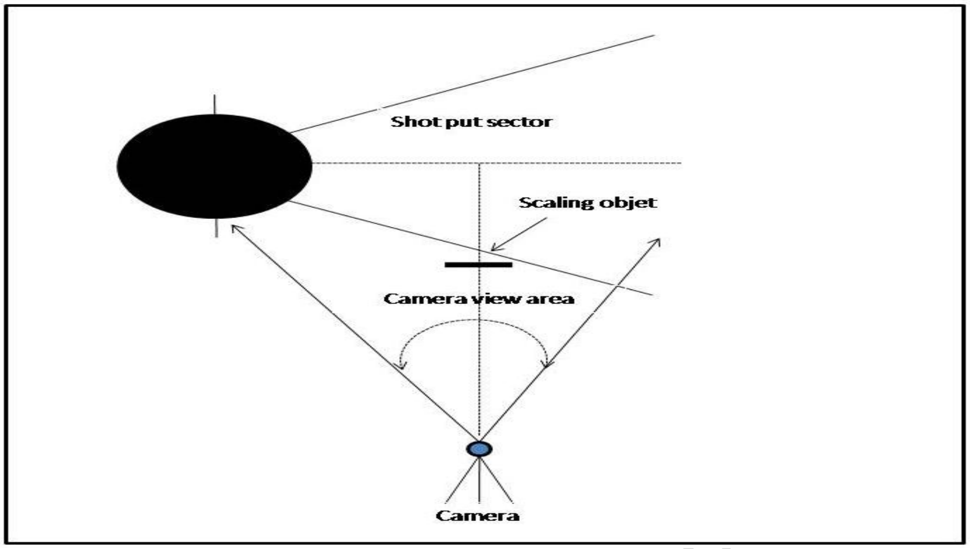

Figure 1: Camera setup for two-dimensional quantitative analysis

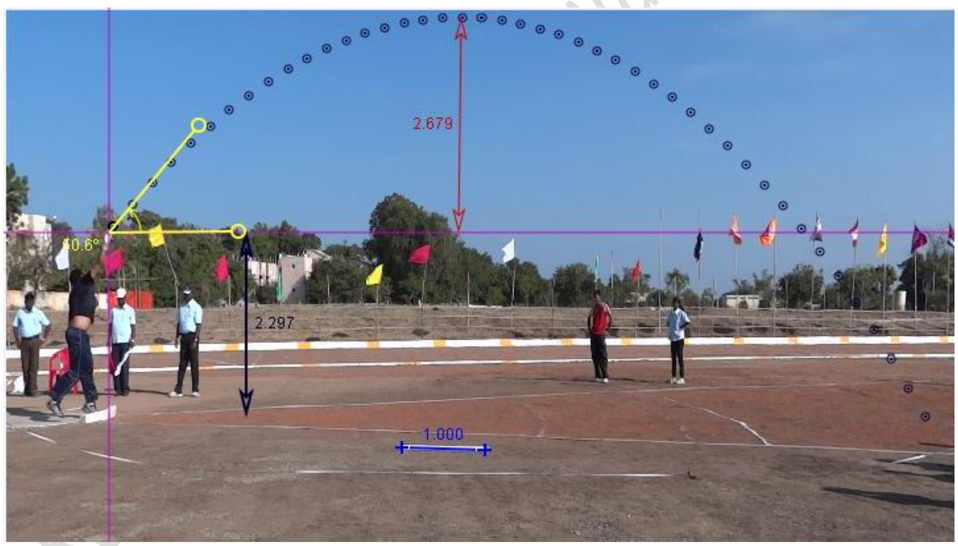

Figure 2: An athlete during shot put throw and quantitative analysis

Maximise the image size

To increase the accuracy during digitising, the image of the performer must be as large as possible. Image size is inversely proportional to the field of view of the camera. The camera should therefore only be zoomed out sufficiently for the field of view to encompass the performance path, plus a small margin for error.

Focus the camera manually

Most video cameras have an automatic focus system that can be manually overridden. In most situations, the camera should be set in manual focus mode. For a well-focused image, zoom in fully on an object in the plane of motion, manually focus, and zoom out to the required field of view.

Record a scaling object

An object whose dimensions are accurately known must be recorded in the plane of motion. This is to enable image co-ordinates to be transformed to object-space (real world) co-ordinates following the digitising stage. Recording of the scaling object must be done only after the camera set-up is complete. (See Figure 1)

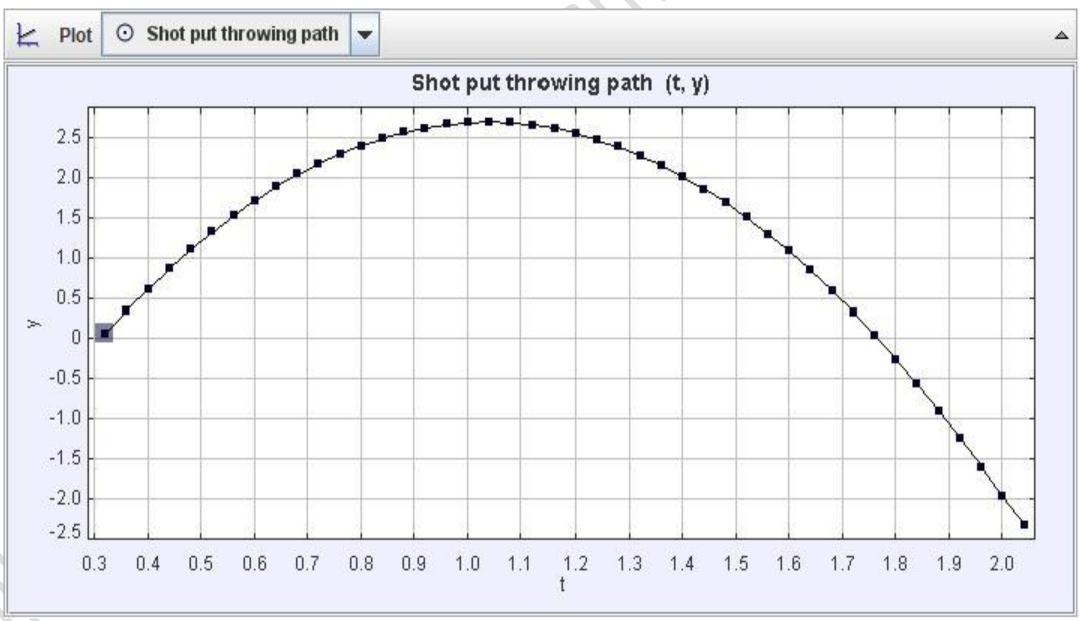

Figure 3: Trajectory of shot on y axis

Figure 4: Initial and final velocity of shot put throw

RESULTS:

The purpose of this study was to track trajectory of shot and to measure projectile variables of shot put throw for two-dimensional quantitative analysis. Table 1 Shows that the average angle of release 49.12° and standard deviation .341, average height of release 2.12m and standard deviation .024, average peak height 2.09m and standard deviation .681, average Initial Velocity 9.08m/s and standard deviation .046, average Final Velocity 10.57m/s and standard deviation .072.

The shape of the projectile trajectory is determined by the projection angle. The optimum angle of release for a projectile being released at ground level is 45 ° if the relative height of projection increases, the angle of release should decrease. Conversely, if the relative height of projection decreases, the angle of release should increase.

Tables and figures

	Angle of Release (Degree)	Height of Release (Meter)	Peak Height (Meter)	Initial Velocity (m/s)	Final Velocity (m/s)
Mean	49.12	2.12	2.09	9.08	10.57
Std. Deviation	.341	.024	.681	.046	.072

Table 1: Mean and standard deviation of shot put throw

DISCUSSION AND IMPLEMENTATION:

The purpose of this study was to track trajectory of shot and to measure projectile variables of shot put throw for two-dimensional quantitative analysis. One shot put athlete was analyzed using systematic video recording and the result given form the values such as angle of release, height of release, initial velocity, final velocity and peak height reached by shot was calculated. Table 1 show that the angle of release is greater than 45°. Because of greater angle the peak height also high in parabolic shape. The height at which the Shot is released affects the optimum angle of release. The greater the height, the lower the angle should be in order to increase the distance thrown. The height of release can mainly be determined by the natural stature of the athlete, and may bear taller athletes with a slight advantage over their competitors. Therefore, shot put thrower often has to determine their own optimum angle of release to suit their height. However, if an object is projected from a height and it lands below this height then the final velocity will be greater than the initial velocity and in the opposite direction. (See Table 1 and Figure 4) The three main variables are initial velocity, angle of release and height of release that increase shot put throw. One of these variables alone is not enough to ensure a good shot put throw.

CONCLUSION:

Angle of release, height of release, initial velocity and final velocity was explained using tracker video analysis software. Understanding how projectile motion works is very beneficial in determining how to best propel an object. Being able to measure the different variables helps the athlete to develop better technique for them personally. Low initial velocity is a result of a loss of momentum during this phase and so the technique needs to be altered hence improving the initial velocity. Although the aim of this was to track trajectory of shot and to measure projectile variables of shot put throw for two-dimensional quantitative analysis. The results could be applied by video analysis of other sports to calculate specific variables.

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