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Kinematic Comparison of Different Technique of Putting the Shot at the Moment of Release

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Abstract

The purpose of the study was to conduct a kinematic comparison of different techniques of putting the shot at the moment of Release. Eight male shot putters of L.N.U.P.E. between the age group of 20 to 26 years, who had been participating regularly, were selected as subjects. 2 D Kinovea Video Anlysis software was used for kinematical analysis of different techniques of putting the shot. Casio Exilim Ex F1H a standard camera which frequency was 300 frame/second and which was placed at 4.67 meter distance perpendicular to the subject in horizontal plane at height of 1.50 meter. To find out kinematical comparison between those shot putters who uses different stances t-test was used. For testing the hypothesis the level of significance was set at .05.Results show that the calculated t value is 1.237 and .260 in relation to linear kinematical variables at moment of releases i.e. Height of c.g. of subject and height of c.g. of shot respectively. It also show that calculated t value for angular kinematic variables such as ankle (right & left),knee(right&left),hip(right&left),shoulder(right&left),elbow(right&left)andwristjoint(right&left)is(.454&2.83*),(1.39&.351),(2.23&1.51),(.290&.419),(.550&.794)and(.365&.833). 1)Insignificant difference was found between those shot putters who uses different technique of putting the shot in relation to height of c.g. of subject and height of c.g. of shot put.2)Insignificant difference was also found in relation to ankle (right), knee (right & left) and hip joint (right), shoulder (right & left), elbow (right & left) and wrist joint (right & left).3)Significant difference was found between those shot putters who use different technique of putting the shot in relation to ankle joint (left).

Key words: Horizontal Plane, Kinematic, Shot Put, Techniques

1. INTRODUCTION

The standard throwing events in track and field are the shot put, discus throw, the javelin throw and the hammer throw. In each of these events, the athlete's objective is to obtain as large a displacement of the implement as possible as, without infringing the rules governing the recording of a legal throw. The principal rules with which the athlete is concerned are those prescribing the manner in which the implement is to be thrown, the sector in which it must land, the manner in which it is to land (javelin throw) and the forward limits of the area from which the throw must be made (James.G.Hay 1985)[6]. The shot is put (pushed) and not thrown. The prime objective is distance and assuming the angle of projection is correct the distance is dependent upon the velocity at which the shot is moving at release, One's ability to develop velocity of the shot is dependent upon power, which is combination of strength and speed. The shot-putter, then, is essentially concerned with increasing power and perfecting the specific skill of shot-putting (R. Clayne Jensen & W. Gordon Schultz(1977)[7]. In the shot-put, the shot is released at height of seven feet or more above the surface to which it falls. Since the angle of projection of 45^{o} in order to attain the greatest distance, is prediction on the fact that the implement projected will not fall below the level from which it was projected (John W. Bunn 1978)[5]. It is close that all the facts of shot technique have not year been explored. This is unfortunate, as otherwise use may reach a point of stagnancy, as the case might well have been where it is not for an innovation such as introduction by Perry O'Brien. Before O'Brien we were probably more concerned with "style" as the new stance introduced by O'Brien paired the way towards a more scientific approach to shot putting. Today technique is equally the key to better performance, although we cannot escape the facts that "style" will always be an integral aspect in ultimate performance. This is due to the differences in the physical and anatomical structure of the human body, which differs from athlete to athlete (Hannes Booysen1971)[1].

2. Objective of the Study

The objective of the study was to conduct a kinematic comparison of different techniques of putting the shot at moment of release.

3. Material and Methods

Eight male shot putters of L.N.U.P.E. between the age group of 20 to 26 years, who had been participating regularly were selected as subjects, the subjects had been undergoing training for a considerable period. Therefore it was considered that they possess good level of technique. Casio Exilim Ex F1H a standard camera for videography was employed for conducting the kinematical analysis of putting the shot. The frequency of the camera was 300frames/second. Kinovea Video analysis software was used for the analysis of kinematical variables at the moment of final stance . The subjects were photographed in Saggital plane in controlled conditions. The distance of the camera from the subject was 4.67 meters and was fixed 1.50 meter height. An object of known dimension was also filmed prior to the filming the subject for reference purpose. The scholar developed stick figures utilizing joint point method. The angles at various joints were measured by Kinovea video analysis software. The centre of gravity of each subject at moment of release was located by using segmental method. Each athlete was given three trials. The performance was measured from the inner edge of throwing circle to the point where the shot touched the ground, by using a steel tape. The performance was recorded in meter.

The following variables were selected for the purpose of the study:-

- Ankle Joint (Right, Left) Knee Joint (Right, Left)
- Hip Joint (Right, Left) Shoulder Joint (Right, Left)
- Elbow joint(Right, Left) Wrist Joint (Right, Left)
- Height of C.G. of subject at moment of release.
- Height of C.G. of shot at moment of release.

Two techniques was considered

1) Final Stance (Less than 80 cm.)
2) Final Stance (More than 80 cm.)

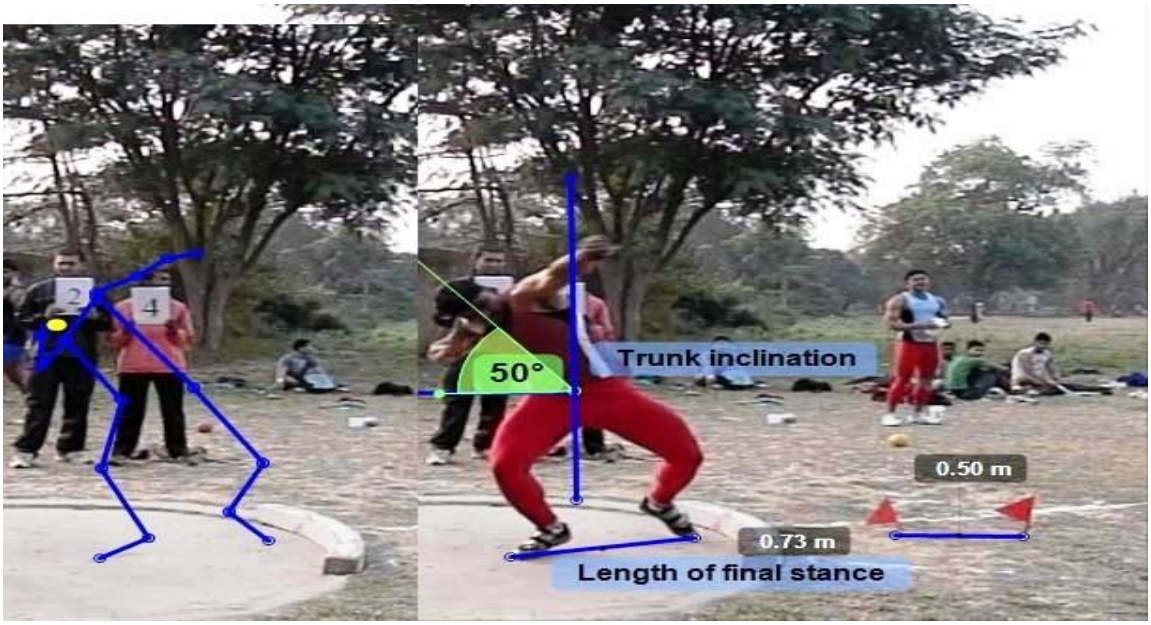


Fig. 1 – Length of Final Stance

4. Results, Discussion and Conclusions

The statistical analysis of data was conducted on the kinematical variables (linear and angular) of eight male shot putters of Lakshmibal National University of Physical Education, Gwalior while executing put from final stances of different cm. The "t" test was used to carry out the kinematical comparison from different final stances on the performance of shot putters. In order to test the hypothesis the level of significance was set at 0.05. The results are given in table 1, 2, and 3.

TABLE – 1

COMPARISON OF MEANS OF HEIGHT OF CENTRE OF GRAVITY AT THE MOMENT RELEASE

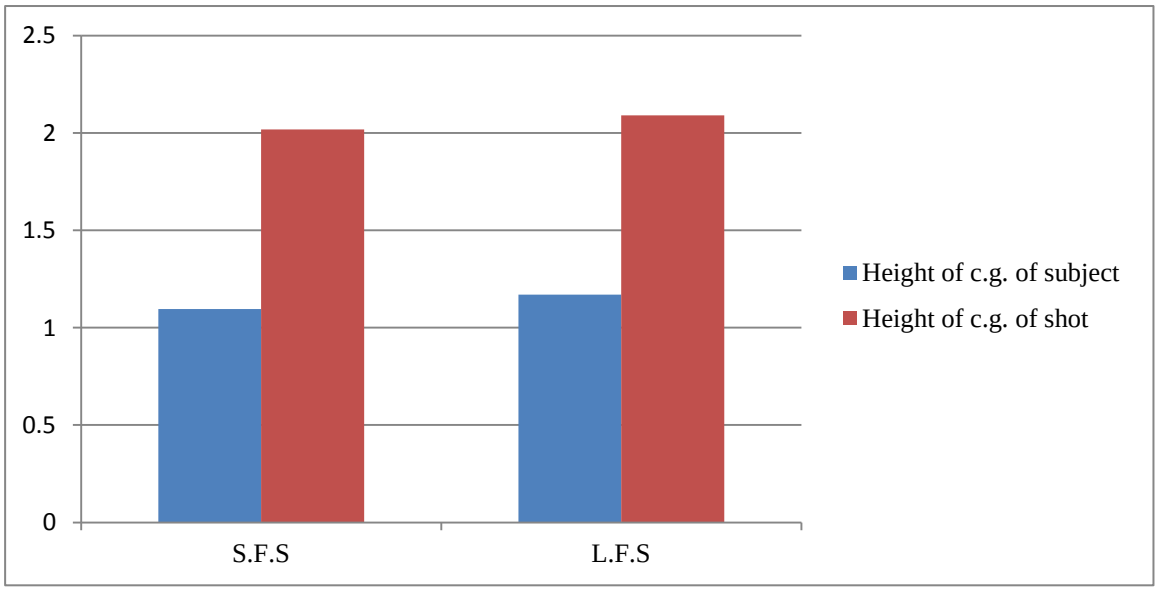
variables	group	No. of subject	Mean(M)	S.D	d/f	T-ratio
Height of c.g. of subject	S.F.S	4	1.095	.062	6	1.237
	L.F.S	4	1.17	.103		
Height of c.g. of shot	S.F.S	4	2.017	.165	6	.260
	L.F.S	4	2.09	.166		

Required value of 't' for 6 degree of freedom at .05 level is 2.44

Table- 1 shows that these were no significant difference between the means of height of centre of gravity of the subjects in putting the shot at moment release from various final stances. The obtained value of t – ratio of 1.237, was less than the required value at the selected level of significance. There was also insignificant difference found between the means of height of centre of gravity of the shot at the moment of release. The obtained't' ratio of 0.260 was less than the required value at the selected level of significance. It is also shown on the figure-2.

Figure-2

COMPARISON OF MEANS OF HEIGHT OF CENTRE OF GRAVITY AT THE MOMENT RELEASE



TABLE–2
COMPARISON OF MEANS OF ANGULAR KINEMATIC VARIABLES OF THE SUBJECTS AT THE MOMENT OF RELEASE

Variables (Angles in Degree)	Group	Subject	Means	S.D.	d/f	t-ratio
Ankle Joint(Right)	S.F.S. L.F.S.	4	104.25 108.25	12.56 11.02	6	.454
Knee Joint(Right)	S.F.S. L.F.S.	4	121.50 153.80	5.25 58.86	6	1.39
Hip Joint (Right)	S.F.S. L.F.S.	4	143.00 161.00	81.25 83.50	6	2.23
Shoulder Joint (Right)	S.F.S. L.F.S.	4	151.50 147.50	20.44 18.48	6	.290
Elbow Joint (Right)	S.F.S. L.F.S.	4	166.25 166.25	31.50 31.25	6	.550
Wrist Joint (Right)	S.F.S. L.F.S.	4	153.25 158.25	16.64 4.16	6	.365
Ankle Joint (Left)	S.F.S. L.F.S.	4	112.75 131.25	16.64 4.16	6	2.83*
Knee Joint (Left)	S.F.S. L.F.S.	4	164.50 166.50	21.92 19.41	6	.351

Hip Joint (Left)	S.F.S. L.F.S.	4	149.50 161.75	6.8 8.7	6	1.51
Shoulder Joint (Left)	S.F.S. L.F.S.	4	114.0 117.0	13.17 14.44	6	.419
Elbow Joint (Left)	S.F.S. L.F.S.	4	93.0 78.0	26.93 62.88	6	.794
Wrist Joint (Left)	S.F.S. L.F.S.	4	150.0 155.0	18.67 4.203	6	.833

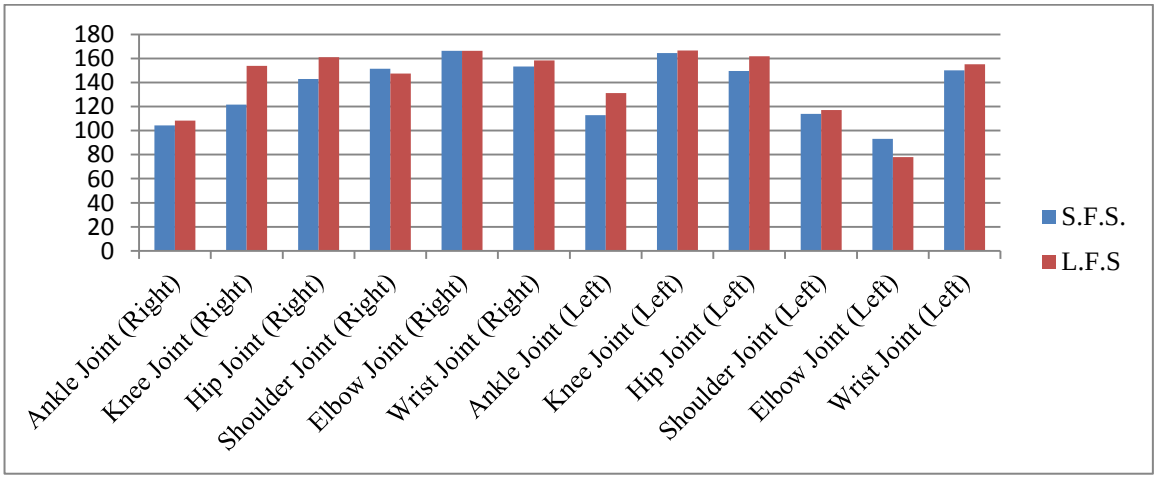
S.F.S.-short final stance, L.F.S.-Long final stance, Required value of 't' for 6 degree of freedom at .05 level is 2.44

Table-2 shows that there was no significant difference among the angles of right ankle joint, knee joint, shoulder joint, elbow joint, wrist joint and left knee joint, hip joint, shoulder joint, wrist joint at the moment of release from various stances. As it was shown that calculated value of't' ratio which was lesser than the tabulated value at selected level of significance.

Table-2 also shows that there was no significant difference between the means of angle of ankle joint (left) at the moment of release from various stances. It was shown that calculated value of't' ratio which was greater than tabulated value at selected level of significance. It is also shown at the figure-3.

Figure-3

COMPARISON OF MEANS OF ANGULAR KINEMATIC VARIABLES OF THE SUBJECTS AT THE MOMENT OF RELEASE



5. Discussion of Findings

The result of the study show that there was significant difference was found in relation to ankle joint (left) this might be due to the shot putters who uses final stance more than 80 cm. get more range to full extension of body (from toe to right arm) but in case of less than 80 cm due to narrow stance shot putters do not extend fully lower extremity and delay landing of left leg. An alternative reasoning is that the ankle joint is the weakest joint in the lower extremity and as a result, complete contact between the foot and the ground may be a more effective technique when athletes are attempting to apply maximum force to the ground (Zatsiorsky et al., 1981)[14].Insignificant difference was found in relation to right ankle joint, knee joint, shoulder joint, elbow joint, wrist joint and left knee joint, hip joint, shoulder joint, wrist joint at the moment of release this might be due to in both technique full extension of body and arm, clearly visible extension of both legs and unwinding of torso. Scientific Research Project Biomechanical Analyses at the IAAF World Championships (Daegu 2011) conducted study on "Biomechanical Analysis of Men's Shot put – Qualification (Group A & Group B)" and similar result was found in both technique linear as well as rotational in relation to release angle, release height, forearm angle, and upper arm angle. Present study is supported by the study conducted by (Daegu 2011) [2].

Conclusions:

1) Insignificant difference was found between those shot putters who use different technique of putting the shot in relation to height of c.g. of subject and height of c.g. of shot put.

2) Insignificant difference was also found in relation to ankle (right), knee (right & left) and hip joint (right), shoulder (right & left), elbow (right & left) and wrist joint (right & left).

3) Significant difference was found between those shot putters who use different technique of putting the shot in relation to ankle joint (left).

4) On the basis of result it was concluded that there was not greater differences between less than 80 cm. stance and more than 80 cm. stance in relation to kinematic variables because both techniques were similar nature.

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