



## Relationship of selected kinematic variables on front volley kick performance among goalkeepers in soccer

Harendra Singh

Assistant Professor, Department of Sports Science, Rajiv Gandhi University, Arunachal Pradesh, India

---

### Abstract

High quality kicking technique is the most important aspect of the soccer player. The good kicking technique will increase quality of the games. The study will focus on the kinematic analysis of the university level soccer goalkeepers as well as identifying to their kicking action and technique using the front volley kick. The purpose of the study was to relationship of kinematic variables of front volley kick among goalkeepers of soccer with the age group of 18 to 25 years from L.N.I.P.E, NERC, Guwahati, Assam. 5 male soccer goalkeepers studying at L.N.I.P.E, Guwahati. Purposive sampling was used to select the sample. The selected subjects were right footed and different height. Since the subjects had been undergoing training for a considerable period, therefore it was considered that subjects possess reasonable level of technique of front volley kick. Each participant performed three front volley kicks with maximum strength that were video recorded with camera (Canon PowerShot G7 X Mark III) positioned 7 m away from the place of the kick at the height of 0.85m. Data were collected by analyzing the video recordings of each kick. Data processing was performed using the Kinovea software. The SPSS 20 software was used. From that, the data for angular velocity, angular acceleration, angle of ankle knee and hip, and Centre of gravity involved in kicking activity can be identified. The collected score of each selected angular and linear kinematic variable and the performance of shooting distance was analyzed by Pearson's product moment correlation to find out the relationship with the performance separately. The significance of the relationship was tested at 0.05. Based on the findings, the angular velocity, angular acceleration, angle of hip, knee and ankle, and Centre of gravity was identified as insignificant for the front volley kick.

**Keywords:** biomechanics, linear, angular, kinematics, angular velocity, angular acceleration, kicking technique, front volley kick, sagittal plane

---

### Introduction

Sport and Exercise Biomechanics is a title that encompasses the area of science concerned with the analysis of mechanics of human movement. In other words, it is the science of explaining how and why the human body moves in the way that it does. In sport and exercise that definition is often extended to also consider the interaction between the performer and his or her equipment and environment. Biomechanics is traditionally divided into the areas of kinetics (concerning the analysis of the forces acting on the body) and kinematics (concerning the analysis of the movements of the body)

The game of soccer is one of the most popular team sports worldwide. Soccer kick is the main offensive action during the game and the team with more kicks on target has better chances to score and win a game. For this reason, improvement of soccer front volley kick technique is one of the most important aims of training programs in young goalkeepers. Success of a front volley kick depends on various factors including the distance of the kick from the goal, the type of kick used, the air resistance and the technique of the main kick which is best described using biomechanical analysis. However, it becomes apparent that more research studies into biomechanics of soccer kick have been published within the last decade. Therefore, new aspects of soccer kicking performance are being identified, including more details regarding the three-dimensional kinematics of the movement, joint moments that drive the movement, mechanisms of soccer performance as well as various factors which affect soccer kick biomechanics such as age, gender, limb dominance and fatigue.

The most widely studied skill in football is kicking (Lees and Nolan, 1998) [3], with the majority of studies reporting on the two-dimensional (2D) and three-dimensional (3D) kinematics of the low or maximum velocity instep kick. There are many types of kick used in a game of football, including the lofted instep kick, the aim of which is to propel the ball high and over long distances. Few studies have analysed the 3D kinematics of a lofted instep kick. An understanding of the biomechanics of kicking can assist the coaching process. Coaching experience, combined with knowledge of a mechanical model of the desired performance, is regarded as necessary for a coach to correct performance. More studies on the lofted instep kick are needed to provide detailed information on the kinematics of the skill and ensure that existing coaching literature is correct.

The purpose of this study is to expand the horizon of knowledge by introducing new facts and ideas by determining the association between selected biomechanical (Linear and angular) characteristics and kicking

performance among goalkeepers. As a result, the researcher investigated the hypothesis that there will be significant relationship among kinematic variables and performance of front volley kick by goalkeeper in soccer. (Two tail hypothesis).

### Methodology Selection of subjects

For the present study, total five [N=5] national level male soccer goalkeepers of L.N.I.P.E. using purposive sampling were selected as the subjects. The selected subjects were of least deviation in profile such as playing level, playing experience and their fitness profile and all the subjects selected for the study were completely free from any kind of injuries. Since the subjects had been undergoing training for a considerable period, therefore it was considered that subjects possess reasonable level of technique of front volley kick. 17-25 years of age group were selected as subjects for the study.

### Experimental filming protocol

Cinematography technique with Video recording was employed for the selected kinematics analysis of front volley kick by goalkeepers. The camera opted in this study was a Canon PowerShot G7 X Mark III with a 30 frame per second frame rate. The height of camera was set at 0.85 meter from ground level and horizontal distance of camera was 7 meters. The 2 meters reference line was drawn for calibration., the video camera was situated perpendicularly in the Centre of the subjects' line to the sagittal plane. The subjects were asked to repeat the skill three times, with the best trail out of three being chosen for analysis. (Maximum distance covered by the ball were considered as the best trial).

On the basis of Videography obtained the scholar developed the stick figures in which data pertaining to various kinematic variables was taken. The stick figures were developed by using joint point method with help of KINOVEA software.



Fig 1: Height of Centre of gravity at time of execution (moment contact).



Fig.-2: Angle of right hip, Angle of right knee & Angle of right ankle at time of execution (moment contact).

### Procedure of data collection

Videography recording was done in order to register the performance volley kick. The moment at which football was released from the foot of the goalkeeper were filmed and taken into consider for analysis. The videography sequence was taken under controlled conditions. After the video recording, the video was played with the help of the computer software and the final position of selected phase were obtained on the screen by snipping tool software as trial-and-error method. The digitization of the photographic sequence of selected position was done with the help of Kinovea Software for obtaining the selected angular biomechanical (Linear and Angular) shown in table 1 in results.

### Statistical Technique

To determine the relationship between selected kinematic variable and the performance of volley kick by goalkeeper in soccer, Pearson correlation coefficient was used. For testing the hypothesis, the level of significance was set at 0.05

### Results

The relationship of selected biomechanical (Linear and Angular) variables with the front volley kick performance were obtained by employing the Pearson's product moment correlation (r) technique at 95 percent confidence interval. All the assumptions of applying correlation (testing normality, dependent variable in interval or ratio and outliers in the scores) were taken into consideration while analysis of data. The outcome of the relationship of all selected variable with the shooting performance is given below:

**Table 1:** Relationship of Selected Biomechanical (Linear and Angular) Variables with the Performance of front volley kick by goalkeepers.

S. No	Variables	Coefficient of correlation "r"
1	Hip Joint (right)	.808
2	Knee Joint (right)	.684
3	Ankle Joint (right)	.644
4	Height Of Cog At Point Of Contact	.565
5	Angular Velocity	-.195
6	Angular Acceleration	.242

\*Level of significance 0.05

The findings of table 1 clearly showed the insignificant relationship of all selected angular and linear biomechanical variables with the front volley kick by the goalkeepers. In that case, the null hypothesis is failed to rejected for the selected variables.

### Discussion of Findings

In case of selected angular kinematic variables, none of the angular kinematic variables has exhibited significant in relation to kicking ability. In selected angular kinematic variables, no variables were found significant but this trend does not mean that the angles at different joints, angular velocity and angular acceleration do not play any important role in kicking ability. The entire subjects were gone through considerable period of training of football and they are professional player so there might be possibility that they are acclimatized with kicking ability. On the other hand, the selected linear kinematic variables (height of Centre of gravity) in kicking were also not found significant. However, the Centre of gravity plays an important role in kicking. As in this study the research scholar was confined to compare the Centre of gravity during the contact of kicking leg with ball, but significant difference might be obtained by the studying the path or displacement of Centre of gravity. A significant result may also be obtained by increasing the sample size or by using the sophisticated equipment's.

### Conclusion

Based on the analysis and within the limitations of the present study, the following conclusions can be drawn. The angular kinematic variables like right knee angle, right hip angle and right ankle angle, angular velocity and angular acceleration has shown insignificant relation with the performance of front volley kick by goalkeeper in soccer. The height of Centre of gravity at the time of moment contact execution has also shown insignificant relation with the performance of front volley kick by goalkeeper in soccer

### References

1. Ball "Biomechanical considerations of distance Kicking in Australian Rules football",2008:7(1):10-23. DOI:10.1080/14763140701683015.
2. Keiko Sakamoto, Ryota Sasaki, Sungchan Hong, Keita Matsukura, Takeshi Asai. "Comparison of Kicking Speed between Female and Male Soccer Players",2014:72:50-55.
3. Lees A, Nolan L. The biomechanics of soccer: a review. J Sports Sci,1998:16:211-234.
4. Lees A, Asai T, Nunome H, Sterzing T. The biomechanics of kicking in soccer. Journal of Sports Sciences,2010:28:805-817.

5. Levy Morris. "Different kicking techniques in soccer: Their effect on accuracy" University of Wyoming, ProQuest Dissertations Publishing, 1991. EP23276
6. Linthorne NP, Patel DS. Optimum projection angle for attaining maximum distance in a soccer punt kick. *J Sports Sci Med*,2011;10:203-214.
7. McCrudden M, Reilly T. A comparison of the punt and the drop-kick. In: T. Reilly, J. Clarys and A. Stibbe (Eds.), *Science and Football II* London: E & FN Spon, 1993, 362-368.
8. Shinki H, Isokawa M. Analysis of soccer volley kicking - How players change the motion to different height of balls - [in Japanese]. *Japanese Journal of Fitness & Sports Medicine*,2004;53:860.