KINEMATIC DETERMINANTS AND CHARACTERISTICS OF INSTEP KICK IN SOCCER

A

SYNOPSIS

For the award of

MASTER OF PHYSICAL EDUCATION (M.P.Ed)

in

(PHYSICAL EDUCATION)

By

RAJNEESH BHATI

(11700549)

Supervised By

Dr. Bhanu Pratap (Assist. Professor)

LOVELY FACULTY OF BUSINESS AND ARTS

LOVELY PROFESSIONAL UNIVERSITY

PUNJAB

2018

INTRODUCTION

Variations of the instep kick are often used in soccer, such as when passing the ball at medium and long distances, when shooting at the goal, and when performing penalty kicks (Kellis and Katis, 2007). Coaching experience and knowledge of a mechanical model of desired performance are necessary for a coach to correct performance among players (Smith et al., 2006). The biomechanics of kicking in soccer is particularly important for guiding and monitoring the training process. Studies in the biomechanics of instep kicking have focused on numerous variables in different populations, but all seek to establish optimal variables, or variables that are most predictive of success, which is most typically defined by the resulting ball velocity (Ismail et al., 2010).[1]

The instep soccer place kick is one of the most analyzed kicking actions in soccer (Dorge et al., 2002). Considering its complexity, application in the game, multiple advantages, and the desire for the best possible technical performance, the instep kick is the subject of much research that has involved all levels of players, from youth athletes to experienced professionals (Ismail et al., 2010 Barfield et al., 2002 Shan and Westwrhoff, 2005 Reilly, 2003 Kellis et al., 2004). Biomechanical techniques are important tools for many sport disciplines, but, in soccer, they are particularly useful for defining the characteristics of skills, improving mechanical effectiveness in execution, and identifying factors that influence successful performance. Knowledge and understanding of biomechanics can enhance learning and performance of sport-specific skills (Ismail et al., 2010; Amiri-Khorasani et al., 2010). Specifically, systems

Alen Kapidžić, Tarik Huremović, and Alija Biberovic "Kinematic Analysis of the Instep Kick in Youth Soccer Players'' J Hum Kinet. Published online 2014 Sep 29 ,Pages: 81–90

for the kinematic analysis of human movement provide precise measurement of values and parameters of athletes' movements during performance of any sport technique. Understanding of the biomechanics of kicking in soccer is important for monitoring and correcting performance during the training process (Meamarbashi and Hossaini, 2010). The speed of the ball in an instep kick depends on several factors, including speed of the foot of the kicking leg before contact with the ball, body posture at the moment of kicking the ball, length of the run up to the ball and its angle (Barfield et al., 2002; Stankovic et al., 2004; Meamarbashi and Hossaini, 2010; Dorge et al., 2002).

When using their preferred leg to perform an instep kick, soccer players practice a straighter approach to the ball, place their standing foot closer to the ball, and kick the ball with greater pelvic tilt and greater knee extension of the kicking leg. Variations in the placement of the support leg impact the speed of the ball (Harrison and Mannering, 2006; Kellis et al., 2004; Orloff et al., 2008). These mechanical characteristics of the foot and the ball impact the coefficient of elasticity, which also influences the speed of the ball (Andersen et al., 2008). During a soccer game, at the moment the ball is kicked at the rival's goal, the efficiency of the kick depends on the conformation of body posture relative to the path of the oncoming ball. For a hard kick, such as a penalty kick or goal kick, two basic mechanical elements must be considered: swinging of the leg to accelerate the foot and the brief interaction of the foot with the ball. The motion of the foot takes roughly one-tenth of a second and the impact lasts for one one-hundredth of a second. For the fastest kicks, the foot must be given maximum speed in order to transfer a high momentum to the ball (Wesson, 2002). The speed of the ball also depends on muscle strength, and the muscle potential is conditioned by the angle of running to the ball (Masuda et al., 2005). The muscles accelerate the thigh, pivoting it about the hip, and accelerate the calf and the foot. As the foot approaches impact with the ball, the leg straightens and, at impact, the foot is locked firmly with the leg. If the interaction of the foot with the ball was perfectly elastic with no frictional energy losses, the speed transferred to the ball would simply follow two laws of conservation: conservation of energy and conservation of angular momentum. As noted, the process of training proper soccer technique is a difficult task (Wesson, 2002).

Due to the complexity of the instep kick, youth soccer players must pay attention to several technical elements during the training process. Biomechanical analyses of the movement are necessary to improve performance of the instep kick, to understand the results of the kick, and to develop new and more efficient movement techniques.

Very few studies of the instep kick have been conducted on youth soccer players in Bosnia and Herzegovina, so we chose this movement for our analysis. The aim of this study was to establish which kinematic variables significantly increase the speed of the ball during the instep kick. Therefore, kinematic variables were evaluated to estimate the position and speed of the kicking leg, the position of the support leg, and body posture during the instep kick. The information gained through this research will contribute to developing a more efficient movement for the instep kick in soccer. Finally, our data will encourage a faster and more efficient training process for the instep kick for youth soccer players, which will lead to an efficient application of the technique in more complex situations.

STATEMENT OF THE PROBLEM

The statement of the problem is stated as, "Kinematic Determinants and Characteristics of Instep Kick in Soccer."

OBJECTIVE OF THE STUDY

- To investigate the relationship among the kinematic variables of instep kick in Soccer.
- To find out which kinematic variables will be most contributing in the enhancement of the performance in instep kick of soccer.

DELIMITATIONS OF THE STUDY

- The study will be confined to inter university level of male footballers.
- The study will be delimited to the subject age belonging to 17 -25 years.
- The study will be further delimited to 10 footballers only.
- The study delimited the right footed player are selected.
- The study will be further delimited to stance, placement of the foot, contact with the ball and follow through.
- The study was further delimited to following variables:

Linear kinematics:

- C.G at the time of execution.

Angular kinematics:-

- ✓ Angle at ankle joint (kicking foot).
- ✓ Angle at knee joint (kicking foot).
- ✓ Angle at hip joint (kicking foot).
- ✓ Angle at shoulder joint.
- ✓ Angle at elbow joint.

Key positions:-

- **S-**Stance
- **POF**- Placement of the foot.
- **CWB**-Contact with the ball.
- **FT**- Follow through.

Key phases:-

POF-Placement of foot. (Non-kicking foot)

POC-Period of contact. (Kicking foot)

POE-Period of execution. (Kicking foot)

Limitations:-

1) The knowledge of previous experience in training will not take into consideration.
2) The diet, healthy habit, style of daily living will be consideration as one of the limitation of the study.

Hypothesis:-

From the consultations with experts about the problem and referring to the literature and researchers own understanding the kinematic model will be good model. It is hypothesized that the selected kinematic variables will be significant contributor of instep kick performance in soccer.

DEFINITION AND EXPLAINATION OF TERMS

BIOMECHANICS

Biomechanics is the science concerned with the internal and external forces acting on the human body and the effects produced by these forces.

(James G.Hay)

Sports Biomechanics is the user of the scientific method and mechanics to study the effect of various forces on the sports performer.

(Taylor and Pranch)

Biomechanics is the application of mechanical principles to living organisms.

KINEMATICS

Kinematics is the branch of biomechanics in which we study about the movement with reference to the amount of time taken to carry out the activity.

Linear Kinematics

Linear kinematics as such deals with the linear motion without taking into account the cause of the motion.

Angular kinematics

Angular kinematics deals with the rotation or the angular motion however; it does not study the cause of angular motion.

CENTRE OF MASS

The point at which all the body's mass seems to be concentrated. It is the balance point of the body. It is the point around which the sum of the torque of the segmental weight is equal to zero. It is the point of the application of gravity's force on a mass; the centre of the gravity.

Centre of gravity is the point around which the mass and weight of the body are balanced in all direction.

SIGNIFICANCE OF STUDY

. The study was significant in the following ways-

- The result of the study may help trainees and coaches to train players.
- This study will help the athletes, coaches and exercise scientists were in great need of an additional investigation of this problem.
- The result of the study may be used as a screening tool in assessing the quality of instep kick on the basis of kinematic variables.
- This study may help the physical education teacher and coaches to develop training program for the instep kick to achieve excellence.
- The finding of this study may give certain guidelines based on kinematic parameter for the proper knowledge of instep kick in soccer.
- It may be helpful for giving conditioning program and selecting scientific training methods according to level of instep kick.
- It was finally the hope of the investigator that, this study will stimulate many other researchers to attempt to bring further light to this particular problem.

Reviews of Related Literature

Alen Kapidžić et. al. (2014) conducted the study on kinematic variables significantly contributed to the efficiency of the instep kick motion in soccer. The study sample comprised 13 boys (age: 13 ± 0.5 yrs; body mass: 41.50 ± 8.40 kg; body height: 151.46 ± 5.93 cm) from the FC Sloboda school of soccer. Each participant performed three kicks with maximum strength that were video recorded with two synchronized cameras (Casio Ex-F1) positioned 12 m away from the place of the kick. Data were collected by analysing the video recordings of each kick. Data processing was performed using the APAS motion analysis system (Ariel Dynamics Inc., San Diego, CA). On the basis of the forward selection method of multiple regression analysis, we determined the correlations between the prediction variables and the selected criteria (speed of the ball; $p = 0.01$). On the basis of the regression coefficients, it was concluded that two variables significantly contributed to the speed of the ball: speed of the foot of the kicking leg at the time of contact with the ball ($p = 0.01$) and the distance between the angle support leg and centre of the ball ("foot posterior displacement") ($p = 0.01$). In order to achieve the best possible technical performance and, therefore, a higher speed of the ball, soccer players must pay attention to two important elements during training. First, it is necessary to position the support leg as close to the ball as possible and, second, maximize the force used in the initial phases of the kick to achieve a high speed of the kicking foot.[2]

Kellis et. al. (2007) Good kicking technique is an important aspect of a soccer player. Therefore, understanding the biomechanics of soccer kicking is particularly important for guiding and monitoring the training process. The purpose of this review was to examine latest research findings on biomechanics of soccer kick performance and identify weaknesses of present research which deserve further attention in the future. Being a multiarticular movement, soccer kick is characterised by a proximal-to-distal motion of the lower limb segments of the kicking leg. Angular velocity is maximized first by the thigh, then by the shank and finally by the foot. This is accomplished by segmental and joint movements in multiple planes. During backswing, the thigh decelerates mainly due to a motion-dependent moment from the shank and, to a lesser extent, by activation of hip muscles. In turn, forward acceleration of the shank is accomplished through knee extensor moment as well as a motion-dependent moment from the thigh. The final speed, path and spin of the ball largely depend on the quality of foot-ball[3]

[2]Alen Kapidžić1, Tarik Huremović1, Alija Biberovic1, Kinematic Analysis of the Instep Kick in Youth Soccer Players Published Online: 2014-10-10,Pages: 81–90

[3] Eleftherios Kellis* and Athanasios Katis* Biomechanical Characteristics and Determinants of Instep Soccer Kick J Sports Sci Med. ,Published online 2007 Jun 1,Pages 154–165|

Katis et. al. (2015) Soccer kicking training should be adjusted to the characteristics of the athletes. Therefore, examination of differences in kicking kinematics of females and pubertal players relative to males is worthwhile. The purpose of the study was to compare kicking kinematics and segmental sequence parameters between male, female, and pubertal players. Ten adult male, ten adult female, and ten male pubertal players participated in the study. Participants performed five consecutive kicking trials of a stationary ball, as powerful as they could. Analysis of variance showed significantly higher ball velocity, higher joint linear velocities for the knee and the hip, and higher angular velocities of the knee and the ankle for males compared to female and pubertal players ($p < 0.05$). Similarly, the peak joint velocity was achieved significantly closer to ball impact in males compared to other groups ($p < 0.05$). Males also showed a more plantar flexed ankle immediately before ball impact ($p < 0.05$). Females and pubertal players may benefit from skill training aiming to increase ankle plantar flexion and hip flexion prior to ball impact, and to adjust thigh and shank motion, such that the shank–foot segment travels through a higher range of motion and with a greater velocity[4].

Sinclair et. al. (**2014**) Achieving a high ball velocity is important during soccer shooting, as it gives the goalkeeper less time to react, thus improving a player's chance of scoring. This study aimed to identify important technical aspects of kicking linked to the generation of ball velocity using regression analyses. Maximal instep kicks were obtained from 22 academy-level soccer players using a 10-camera motion capture system sampling at 500 Hz. Three-dimensional kinematics of the lower extremity segments were obtained. Regression analysis was used to identify the kinematic parameters associated with the development of ball velocity. A single biomechanical parameter; knee extension velocity of the kicking limb at ball contact Adjusted $R^2 = 0.39$, $p \leq 0.01$ was obtained as a significant predictor of ball-velocity. This study suggests that sagittal plane knee extension velocity is the strongest contributor to ball velocity and potentially overall kicking performance. It is conceivable therefore that players may benefit from exposure to coaching and strength techniques geared towards the improvement of knee extension angular velocity as highlighted in this study.[5]

[4] Athanasios Katis, Eleftherios Kellis & Adrian Lees Age and gender differences in kinematics of powerful instep kicks in soccer Sports Biomechanics, Volume 14, 2015 - Issue 3 Published Online: 25 Jul 2015 Pages. 287-299|

[5] Jonathan Sinclair, David Fewtrell|, Paul John Taylor, Lindsay Bottoms, Stephen Atkins & Sarah Jane Hobbs(2014) Three-dimensional kinematic correlates of ball velocity during maximal instep soccer kicking in males, European Journal of Sport Science, Volume 14, 2014 - Issue 8- Published online: 23 Apr 2014 P 799-805.|

Manolopoulos et. al. (2004) The purpose of this study was to examine effects of lower limb strength training on physical conditioning and kinematic characteristics of instep kicking in 16 young amateur soccer players who participated in initial and final laboratory tests. In addition to their standard preseason soccer program, 8 players comprised the experimental group, who performed an 8-wk. strength-training program. Maximal and relative isometric force of the lower limbs were significantly improved. Moreover, toe and ankle linear velocity during ball contact, ball velocity, as well as ankle, knee and hip angular velocities of the kicking leg were significantly increased. It is concluded that conditioning and kinematic indices of the kicking performance could be improved after strength training of the lower limbs[6].

Naito et.al.(2010) Although previous studies have shown that motion-dependent interactions between adjacent segments play an important role in producing knee extension during the soccer instep kick, detailed knowledge about the mechanisms underlying those interactions is lacking. The present study aimed to develop a 3-D dynamical model for the multijoint kinetic chain of the instep kick in order to quantify the contributions of the causal dynamical factors to the production of maximum angular velocity during knee extension. Nine collegiate soccer players volunteered to participate in the experiment and performed instep kicking movements while 3-D positional data and the ground reaction force were measured. A dynamical model was developed in the form of a linked system containing 8 segments and 18 joint rotations, and the knee extension/flexion motion was decomposed into causal factors related to muscular moment, gyroscopic moment, centrifugal force, Coriolis force, gravity, proximal endpoint linear acceleration, and external force-dependent terms. The rapid knee extension during instep kicking was found to result almost entirely from kicking leg centrifugal force, trunk rotation muscular moment, kicking leg Coriolis force, and trunk rotation gyroscopic-dependent components. Based on the finding that rapid knee extension during instep kicking stems from multiple dynamical factors, it is suggested that the multijoint kinetic chain analysis used in the present study is more useful for achieving a detailed understanding of the cause of rapid kicking leg movement than the previously used 2-D, two-segment kinetic chain model. The present results also indicated that the centrifugal effect due to the kicking hip flexion angular velocity contributed substantially to the generation of a rapid knee extension, suggesting that the

[6] Evagelos Manolopoulos, Christos Papadopoulos, Konstantinos Salonikidis, Ermioni Katartzi, Steve Poluha,Strength training effects on physical conditioning and instep kick kinematics in young amateur soccer during preseason. Volume: 99 issue: 2 Issue published: October 1, 2004 , page(s): 701-710

adjustment between the kicking hip flexion angular velocity and the leg configuration (knee flexion angle) is more important for effective instep kicking than other joint kinematics.[7]

Khorasani et.al. (2010) The purpose of this study was to investigate the stability of kinematics responses related to stretch shortening cycle (SSC) during 10 consecutive soccer instep kicks. The kicking motions of dominant legs were captured from five experienced adult male soccer players (body height: 184.60 ± 4.49 cm; body mass: 80 ± 4.24 kg; age: 25.60 ± 1.14 years) using a three-dimensional infra-red high speed camera at 200 Hz. Some important kinematic parameters include eccentric angular velocity (AVe), concentric angular velocity (AVC), duration of eccentric (Te), and duration of concentric (Tc) at forward and impact phases selected to analyses. The AVe result of the sixth kick, relative to the first kick, was significantly lower when compared to the other kicks (with $p \leq 0.001$). The AVc result of the fifth kick, relative to the first kick, was significantly lower when compared to the other kicks (with $p \leq 0.001$). The Te result of the fourth kick, relative to the first kick, was significantly lower when compared to the other kicks (with $p \leq 0.011$). The Tc result of the fifth kick, relative to the first kick, was significantly lower when compared to the other kicks ($p \leq 0.029$). We concluded that 5 consecutive kicks are adequate to achieve high kinematic responses related to SSC[8]

Khorasani et. al. (2011) acute effect of static and dynamic stretching on hip dynamic range of motion during instep kicking in professional soccer players. J Strength Cond Res 25(6): 1647-1652, 2011—The purpose of this study was to examine the effects of static and dynamic stretching within a pre-exercise warm-up on hip dynamic range of motion (DROM) during instep kicking in professional soccer players. The kicking motions of dominant legs were captured from 18 professional adult male soccer players (height: 180.38 ± 7.34 cm; mass: 69.77 ± 9.73 kg; age: 19.22 ± 1.83 years) using 4 3-dimensional digital video cameras at 50 Hz. Hip DROM at backward, forward, and follow-through phases (instep kick phases) after different warm-up protocols consisting of static, dynamic, and no-stretching on 3 non-consecutive test days were captured for analysis. During the backswing phase, there was no difference in DROM after the dynamic stretching compared with the static stretching relative

[7] Kozo Naito, Yosuke Fukui, Takeo Maruyama, Multijoint kinetic chain analysis of knee extension during the soccer instep kick, Human Movement Science publisher: Elsevier Volume 29, Issue 2, April 2010, Pages 259-276.

[8] Mohammadtaghi Amiri-Khorasani 1, Noor Azuan Abu Osman2, Ashril Yusof, Kinematics Analysis: Number of Trials Necessary to Achieve Performance Stability during Soccer Instep Kicking, Journal of Human Kinetics vol. 23, on January 2010. Published Online: 2010-05-24

to the no-stretching method. There was a significant difference in DROM after the dynamic stretching compared with the static stretching relative to the no-stretching method during (a) the forward phase with $p < 0.03$, (b) the follow-through phase with $p < 0.01$, and (c) all phases with $p < 0.01$. We concluded that professional soccer players can perform a higher DROM of the hip joint during the instep kick after dynamic stretching incorporated in warm-ups, hence increasing the chances of scoring and injury prevention during soccer games.[9]

Inoue et.al (2014) we aimed to illustrate support leg dynamics during instep kicking to evaluate the role of the support leg action in performance. Twelve male soccer players performed maximal instep kicks. Their motions and ground reaction forces were recorded by a motion capture system and a force platform. Moments and angular velocities of the support leg and pelvis were computed using inverse dynamics. In most joints of the support leg, the moments were not associated with or counteracting the joint motions except for the knee joint. It can be interpreted that the initial knee flexion motion counteracting the extension joint moment has a role to attenuate the shock of landing and the following knee extension motion associated with the extension joint moment indirectly contributes to accelerate the swing of kicking leg. Also, appreciable horizontal rotation of the pelvis coincided with increase of the interaction moment due to the hip joint reaction force on the support leg side. It can be assumed that the interaction moment was the main factor causing the pelvis counter-clockwise rotation within the horizontal plane from the overhead view that precedes a proximal-to-distal sequence of segmental action of the swing leg.[10]

Sinclair et.al. (2014) the current investigation aimed to determine whether there are differences in ball velocity and 3D kinematics when performing maximal kicks with the dominant and non-dominant limbs. Seventeen male academy soccer players performed maximal speed place kicks with their dominant and the non-dominant limbs. The 3D kinematics of the lower extremities were obtained using a 10-camera motion capture system

---

[9] Amiri-Khorasani, Mohammadtaghi[1]; Abu Osman, Noor A[2]; Yusof, Ashril[I]" Acute Effect of Static and Dynamic Stretching on Hip Dynamic Range of Motion During Instep Kicking in Professional Soccer Players'', The Journal of Strength & Conditioning Research: - Volume 25 June 2011 - Issue 6 - p 1647-1652.

[10] Koichiro Inoue,Hiroyuki Nunome,Thorsten Sterzing,Hironari Shinkai & Yasuo Ikegami "Dynamics of the support leg in soccer instep kicking' 'Journal of Sports Sciences, Volume 32 , Issue 11, Published online: 28 Feb 2014,Pages 1023-1032

operating at 500 Hz. Hip, knee and ankle joint kinematics were quantified in the sagittal, coronal and transverse planes and then contrasted using paired *t*-tests. Significantly higher ball velocities were obtained with the dominant limb. Foot linear velocity and knee extension velocity at ball contact were also found to be significantly greater in the dominant limb. That reduced ball velocities were observed between kicking limbs highlights the potential performance detriments that may occur when kicking with the non-dominant limb; thus, it is recommended that additional bilateral training be undertaken in order to attenuate this and improve overall kicking performance.[11]

Atkins et.al (2014) Place kicking for maximal resultant ball velocity occurs many times during a rugby union game. In modern rugby union >50% of points scored come from place kicking either in the form of a conversion or a penalty. However, despite this the biomechanical mechanisms that determine kicking performance are currently unknown. This study aimed to identify aspects of in-step rugby kicking pertinent to the generation of ball velocity. Twenty male participants performed maximal velocity place kicks as lower extremity kinematics were obtained using an optoelectric motion capture system operating at 500 Hz. Multiple regression modelling was employed to identify the kinematic parameters linked to the development of ball velocity. The results show that a single kinematic measure, knee extension velocity of the kicking limb R^2=0.48, $p \leq 0.01$ was obtained as a significant predictor of ball-velocity. It is conceivable based on this observation, that rugby union kickers may profit from exposure to coaching and strength programmes aimed towards the alteration of kicking kinematics highlighted in the current study.[12]

Katis et.al. (2013) Goal scoring represents the ultimate purpose of soccer and this is achieved when players perform accurate kicks. The purpose of the present study was to compare accurate and inaccurate soccer kicks aiming to top and bottom targets. Twenty-one soccer players

---

[11] J. Sinclair,D. Fewtrell,P. J. Taylor,S. Atkins,L. Bottoms &S. J. Hobbs 'Three-dimensional kinematic differences between the preferred and non-preferred limbs during maximal instep soccer kicking''Journal of Sports Sciences **,** Volume 32, , Published online: 21 Oct 2014, Pages 1914-1923

[12] P. J TaylorSchool of Psychology, University of Central Lancashire,S. Atkins,J. Bullen,A Smith &S. J Hobbs''The influence of lower extremity kinematics on ball release velocity during in-step place kicking in rugby union" International Journal of Performance Analysis in Sport ,Volume 14, 2014 - Issue 1, Published online: 03 Apr 2017, Pages 64-72

performed consecutive kicks against top and bottom targets (0.5 m^2) placed in the centre of the goal. The kicking trials were categorized as accurate or inaccurate. The activation of tibialis anterior (TA), rectus femoris (RF), biceps femoris (BF) and gastrocnemius muscle (GAS) of the swinging leg and the ground reaction forces (GRFs) of the support leg were analysed. The GRFs did not differ between kicking conditions ($P > 0.05$). There was significantly higher TA and BF and lower GAS EMG activity during accurate kicks to the top target ($P < 0.05$) compared with inaccurate kicks. Furthermore, there was a significantly lower TA and RF activation during accurate kicks against the bottom target ($P < 0.05$) compared with inaccurate kicks. Enhancing muscle activation of the TA and BF and reducing GAS activation may assist players to kick accurately against top targets. In contrast, players who display higher TA and RF activation may be less accurate against a bottom target. It was concluded that muscle activation of the kicking leg represents a significant mechanism which largely contributes to soccer kick accuracy.[13]

Khorasani et.al. (2011) A.Biomechanical responses of thigh and lower leg during 10 consecutive soccer instep kicks. J Strength Cond Res 25(4): 1177-1181, 2011-This study investigated the number of trials necessary to obtain optimal biomechanical responses in 10 consecutive soccer instep kicks. The kicking motions of dominant legs were captured from 5 experienced and skilled adult male soccer players (height: 184.60 ± 4.49 cm; mass: 80 ± 4.24 kg; and age: 25.60 ± 1.14 years) using a 3D infrared high-speed camera at 200 Hz. Some of the important kinematics and kinetics parameters are maximum thigh angular velocity, maximum lower leg angular velocity, maximum of thigh moment, maximum lower leg moment at forward and impact phases, and finally maximum ball velocity after impact selected to be analysed. There was a significant decrease of ball velocity between the first and the fifth kick and the subsequent kicks. Similarly, the lower leg angular velocity showed a significant decrease after the fifth kick and thereafter. Compared with the first kick, the thigh angular velocity has been shown to decrease after the sixth kick and thereafter, and the thigh moment result of the sixth kick was significantly lower when compared with the first kick. Moreover, the lower leg moment result of the fourth kick

[13] AthanasiosKatis[a]EmmanouilGiannadakis[a]TheodorosKannas[a]IoannisAmiridis[a]EleftheriosKellis[a]AdrianLees[b] ‘Mechanisms that influence accuracy of the soccer kick’’Journal of Electromyography and Kinesiology, Volume 23, Issue 1, February 2013, Pages 125-131

was significantly lower in comparison with the first kick. In conclusion, it seems that 5 consecutive kicks are adequate to achieve high kinematics and kinetics responses and selecting more than 5 kicks does not result in any high biomechanical responses for analysis.[14]

Alison M. Alcock et.al. (2012) The three-dimensional kinematics of international female footballers performing a simulated direct free kick (curve kick) were compared with those of an instep kick. Reflective markers attached to the participants were tracked by 17 Vicon cameras sampling at 250 Hz. Foot velocity at ball impact did not differ between the two types of kick, but the way in which foot velocity was generated did differ, with instep kicks using a faster approach velocity and greater linear velocities of the hip and knee, and curve kicks using a greater knee angular velocity at impact. In both types of kick, peak knee angular velocity and peak ankle linear velocity occurred at ball impact, providing biomechanical support to the common coaching recommendation of kicking through the ball. To achieve a curved ball trajectory, players should take a wide approach angle, point the support foot to the right of the intended target (for right-footed players), swing the kicking limb across the face of the goal, and impact the ball with the foot moving upwards and in an abducted position. This information will be useful to coaches and players in identifying the fundamental coaching points necessary to achieve a curved trajectory of the ball compared with the more commonly described instep kick kinematics.[15]

John K. De Witt & Richard N. Hinrichs (2012),The purpose of this study was to determine whether joint velocities and segmental angular velocities are significantly correlated with ball velocity during an instep soccer kick. We developed a deterministic model that related ball velocity to kicking leg and pelvis motion from the initiation of downswing until impact. Three-dimensional videography was used to collect data from 16 experienced male soccer players (age = 24.8 ± 5.5 years; height = 1.80 ± 0.07 m; mass = 76.73 ± 8.31 kg) while kicking a stationary soccer ball into a goal 12 m away with their right foot with maximal effort. We found that impact velocities of the foot center of mass (CM), the impact velocity of the foot CM

[14]Amiri-Khorasani, Mohammadtaghi; Abu Osman, Noor A; Yusof, Ashril "Biomechanical Responses of Thigh and Lower Leg during 10 Consecutive Soccer Instep Kicks"The Journal of Strength & Conditioning Research: Volume 25 April 2011 - Issue 4 - p 1177-1181

[15]Alison M. Alcock ,Wendy Gilleard,Adam B. Hunter, john baker & Nicholas Brown 'Curve and instep kick kinematics in elite female footballers''journal of sports sciences, Volume 30, 2012 - Issue 4, , Published online: 03 Jan 2012, Pages 387-394

relative to the knee, peak velocity of the knee relative to the hip, and the peak angular thigh velocity were significantly correlated with ball velocity. These data suggest that linear and angular velocities at and prior to impact are critical to developing high ball velocity. Since events prior to impact are critical for kick success, coordination and summation of speeds throughout the kicking motion are important factors. Segmental coordination that occurs during a maximal effort kick is critical for completing a successful kick.[16]

Abbas Meamarbashi1 & S. Reza Attarzadeh Hossaini (2010),The kinematic and kinetic parameters of dominant and non-dominant legs examined with a new technology on 15 male, university soccer players in the field. A sensor module with special configuration of accelerometers placement, connected to a data logger, which attached to the shank and thigh, was applied to execute four instep kicks in the field. The angular velocity, linear velocity, angular acceleration and Z-axis linear acceleration ($p<0.005$) of the shank in dominant and non-dominant leg before impact were: 1970 ± 210, 1648 ± 300 °/s; 14.9 ± 3.0, 12.4 ± 2.6 m/s; 586.4 ± 121.9, 498.2 ± 160.4 rad/s^2; 5.7 ± 1.7 and 4.0 ± 0.9 gravity, respectively. The leg swing time, force (X) ($p<0.001$), torque, angular momentum, angular power and angular impulse ($p<0.05$) of the shank, for dominant and non-dominant leg, before impact were: 271 ± 48 vs. 263 ± 62 msec; 172.4 ± 46.6 vs. 68.7 ± 47.1 N; 133.2 ± 29.8 vs. 111.8 ± 34.9 N.m.; 5.3 ± 1.1 vs. 4.1 ± 1.0 kg.m^2/s; 2443 ± 666 vs. 1660 ± 790.1 W; 4.0 ± 0.9 vs. 3.3 ± 1.2 N.s., respectively. Even though there was lower shank angular velocity of the dominant leg compared with reported professional players, similar shape and gradient of the kicking pattern were found in the curves.[17]

Joanna C. Scurr et.al. (2010) Six competitive soccer players were recruited to examine EMG activation in three quadriceps muscles during a kicking accuracy task. Participants performed three maximum instep place kicks of a stationary ball, 11 m perpendicular from the centre of the goal line towards targets (0.75 m^2) in the four corners of the goal. Surface EMG of the

---

[16] John K. De Witt & Richard N. Hinrichs 'Mechanical factors associated with the development of high ball velocity during an instep soccer kick''journal sports biomechanics, Volume 11,2012-Issue 3 Published online: 16 Apr 2012, Pages 382-390 |

[17] Abbas Meamarbashi1 & S. Reza Attarzadeh Hossaini 2 'Application of Novel Inertial Technique to Compare the Kinematics and Kinetics of the Legs in the Soccer Instep Kick' 'Journal of Human Kinetics volume 23, Published Online**:** 2010-05-24 pages 3-12 |

vastus lateralis, vastus medialis, and rectus femoris of the kicking leg was normalized and averaged across all participants to compare between muscles, targets, and the phase of the kick. Although no significant difference were observed between muscles or kick phases, kicks to the right targets produced significantly greater muscle activity than those towards the left targets ($P < 0.01$). In addition, kicks towards the top right target demonstrated significantly greater muscle activity than towards the top and bottom left ($P < 0.01$). Under accurate soccer shooting conditions, kicks aimed to the top right corner of the goal demonstrated a higher level of quadriceps muscle activation than those towards the other corners.[18]

Nuno Cordeiro et.al. (2015),The instep soccer kick is a pre-programmed ballistic movement with a typical agonist–antagonist coordination pattern. The coordination pattern of the kick can provide insight into deficient neuromuscular control. The purpose of this study was to investigate knee kinematics and hamstrings/quadriceps coordination pattern during the knee ballistic extension phase of the instep kick in soccer players after anterior cruciate ligament reconstruction (ACL reconstruction).Seventeen players from the Portuguese Soccer League participated in this study. Eight ACL-reconstructed athletes (experimental group) and 9 healthy individuals (control group) performed three instep kicks. Knee kinematics (flexion and extension angles at football contact and maximum velocity instants) were calculated during the kicks. Rectus femoris (RF), vastus laterals, vastus medialis, biceps femoralis, and semitendinosus muscle activations were quantified during the knee extension phase. The ACL-reconstructed group had significantly lower knee extension angle (-1.2 ± 1.6, $p < 0.021$) and increased variability (1.1 ± 1.2, $p < 0.012$) when compared with the control group. Within the EMG variables, the RF had a significantly greater activity in the ACL-reconstructed group than in the control group (79.9 ± 27.7 % MVC vs. 49.2 ± 20.8 % MVC, respectively, $p < 0.034$). No other statistically significant differences were found. The findings of this study demonstrate that changes in ACL-reconstructed individuals were observed on knee extension angle and RF muscle activation while performing an instep kick. These findings are in accordance with the knee stability recovery process after ACL reconstruction. No differences were observed in the ballistic control movement pattern

[18] Joanna C. Scurr ,Victoria Abbott &Nick Ball ‘Quadriceps EMG muscle activation during accurate soccer instep kicking’’Journal of sports sciences, Volume 29-Issue 3, Published online: 16 Dec 2010, Pages 247-251 |

between normal and ACL-reconstructed subjects. Performing open kinetic chain exercises using ballistic movements can be beneficial when recovering from ACL reconstruction. The exercises should focus on achieving multi-joint coordination and full knee extension (range of motion).[19]

Adam M. Fullenkamp et.al. (2015), To date, biomechanical analyses of soccer kicking have focused predominantly on lower-extremity motions, with little emphasis on the trunk and upper body. The purpose of this study was to evaluate differences in trunk axial kinematics between novice (n = 10) and skilled (n = 10) participants, as well as to establish the relationship of trunk axial motion and sagittal plane thigh rotation to post strike ball velocity. Three-dimensional body segmental motion data were captured using high-resolution motion analysis (120 Hz) while each participant completed 5 maximal instep soccer-style kicks. The results demonstrate that skilled participants use 53% greater axial trunk range of motion compared with novice participants ($P < .01$), as well as 62% greater peak trunk rotation velocity ($P < .01$). The results also show a moderate, positive correlation of peak trunk rotation velocity with poststrike ball velocity ($r = .57$; $P < .01$), and peak hip flexion velocity with post-strike ball velocity ($r = .63$; $P < .01$). The current study highlights the potential for trunk rotation-specific training to improve maximum instep kick velocity in developing soccer athletes.[20]

Ali Shamsi Majelan et.al. (2011), Kicking accuracy and ball speed are the most important indicators of a successful soccer instep kick. The purpose of this study was to examine the effects of target position and approach angle on ball speed and kicking accuracy of powerful soccer instep kicks. Ten skilled adult soccer players (age: 25.9 ± 5.5 years; height: 1.79 ± 0.06 m; mass: 72.6 ± 7.5 kg) kicked a total of twenty-four powerful instep kicks using a standard size 5 ball, at two 0.6 x 0.6 m right and left targets from their self-selected approach angle, 30º and 45º (direction of the kick was 0º). Kicking accuracy and ball speed were analysed by two high-speed cameras at 300 fps. The mean values for ball velocity of the three approach angles were higher for left target than right target ($p < 0.05$), there was no significant difference between two positions of target in kicking accuracy. For each target separately, results revealed

[19] Nuno Cordeiro,Nelson Cortes,Orlando Fernandes,Ana Diniz,Pedro Pezarat-Correia,'Dynamic knee stability and ballistic knee movement after ACL reconstruction: an application on instep soccer kick''Journal Knee Surgery, Sports Traumatology, Arthroscopy, Volume 23-Issue 4,Published online on April 2015,pages 1100–1106.

[20] Adam M. Fullenkamp, Brian M. Campbell, C. Matthew Laurent, and Amanda Paige Lane 'The Contribution of Trunk Axial Kinematics to Post strike Ball Velocity during Maximal Instep Soccer Kicking'' Journal of Applied Biomechanics, Volume 31- Issue 5, Published on October 2015, Pages: 370-376 |

that there was no significant difference between approach angles in kicking accuracy and ball speed. Our results suggest that, for right-footed players, the instep kicks toward left goal corner target is more speed than right target. Key Words: instep kick; approach angles; soccer player; position of target.[21]

Duško Bjelica et.al. (2011),This research was aimed at gaining relevant knowledge about important differences with respect to compare accuracy of instep kicking by non-preferred leg depending on the different intensity (optimal and maximal) in a resting state, and in a state of fatigue. The sample included 20 respondents whose characteristics were: age (yrs.) 16.7±0.47, height (cm) 178.91±4.26, and body weight (kg) 71.52±5.13. The sample of variables contained four measures that defined accuracy of instep kicking by preferred leg in various occasions: with optimal and maximal intensities and in a resting state and a state of fatigue respectively. The results of the measuring were analysed by means of a statistical procedure labelled a significance test of two arithmetic means conducted on independent samples or popularly known a t-test. Based on the results it was affirmed that significant differences occur in the case of almost all the variables as it was expected and it was concluded that various intensities affect, while various states don't affect the accuracy of instep kicking by non-preferred leg at a significance level of p=.05.[22]

Yumeng li et.al. (2016) In order to generate a high ball speed in soccer, the inter-segmental coordination of the kicking leg is critical. The purpose of this study was to quantify the coordination between the thigh and shank movement in the sagittal plane during instep kicks. Eleven female soccer players were video recorded using a high-speed (80 Hz) video camera during penalty kicks. Hip, knee and ankle joint centres of the right leg were digitized, and the movement was analysed using Dartfish TeamPro (6.0). The thigh and shank segment angles were generated, and the coordination was quantified using the cross-correlation and the vector coding method. Four coordination patterns were defined based on coupling angles: in-phase,

[21] Ali Shamsi Majelan1 , Farhad Rahmani-Nia2 , Ali Asghar Norasteh2 , Arsalan Damirchi2, 'the effects of approach angle and target position on instep kicking accuracy and ball speed with skilled soccer players''journals sports SPA, Volume 8-Issue 2, Published on 17 November 2011, Pages 35-39|

[22] Duško Bjelica1, Georgi Georgiev2 and Stevo Popović1, "comparison of instep kicking by non-preferred leg among various states and intensities in young football players" Journal Acta Kinesiologica, Volume 5 Published 2011, Pages: 79-82.|

anti-phase, thigh-phase and shank-phase. The time spent in each coordination pattern was analysed. The cross-correlation coefficient was positive for all the participants, indicating that the two segments rotated with similar patterns. Based on the vector coding method, we observed dominant coordination patterns of shank-phase and in-phase during the backswing and forward swing phase, respectively. We hope the outcomes of our study could provide a better understanding of soccer kicking coordination and benefit training young soccer players. Future studies may use the methodology and outcomes in the present study to investigate the coordination of different levels of players to better understand the process of skill acquisition.[23]

Mohd Firdaus Mahamad Alia et.al. (2012), this paper presents the 3D biomechanics analysis on a soccer player during performing instep kick. This study was conducted to investigate the significant correlation within variables, such as: approach angle, distance of supporting leg from the ball and ball internal pressure with respect to knee angular velocity of the ball on the kicking leg. Six subjects from different categories were selected to take part in this study. Subjects selected are using dominant right leg and free from any injury. Subjects were asked to perform one step instep kick according to the setting for the variables with different parameter. Data analysis was performed using 3 Dimensional "Qualisys Track Manager". Statistical analysis was conducted by using Microsoft Excel 2007 software. Taguchi statistical analysis method was used to determine the composition of Orthogonal and larger noise to signal ratio (S/N). It was found the results of ANOVA analysis of P-values for all three parameters were lower than 0.05. It means that the approach angle, distance of supporting leg from the ball and the ball internal pressure have significant correlation with knee angular velocity.[24]

Hosni Hasan et.al. (2016) this study investigated effects of wearing compression garments and textured insoles on modes of movement organisation emerging during performance of lower limb interceptive actions in association football. Participants were six skilled (age = 15.67 ± 0.74 years) and six less-skilled (age = 15.17 ± 1.1 years) football players. All participants performed 20 instep kicks with maximum velocity in four randomly organised insoles and socks conditions, (a) Smooth Socks with Smooth Insoles (SSSI); (b) Smooth Socks

[23] yumeng li,[1,] marion alexander,[2,] Cheryl glazebrook,[2,] and Jeff[3,"] Quantifying Inter-Segmental Coordination during the Instep Soccer Kicks'' International Journal of Exercise Science, Volume -9 , Published online 2016 Nov 1,Pages :646–656.|

[24] Mohd Firdaus Mahamad Alia*, Baba Md. Derosa, Ahmad Rasdan Ismailb, 'Biomechanics Analysis for Dominant Leg during Instep Kicking'' Jurnal Teknologi,Volume-52,Published : 30 October 2012,Pages: 37–40 |

with Textured Insoles (SSTI); (c) Compression Socks with Smooth Insoles (CSSI); and (d), Compression Socks with Textured Insoles (CSTI). Results showed that, when wearing textured and compression materials (CSSI condition), less-skilled participants displayed significantly greater hip extension and flexion towards the ball contact phase, indicating larger ranges of motion in the kicking limb than in other conditions. Less-skilled participants also demonstrated greater variability in knee–ankle intralimb (angle–angle plots) coordination modes in the CSTI condition. Findings suggested that use of textured and compression materials increased attunement to somatosensory information from lower limb movement, to regulate performance of dynamic interceptive actions like kicking, especially in less-skilled individuals.[25]

Mohammad Ali Naseri Rouhani et.al. (2017) the aim of this study was to investigate the effect of non- stability surface of support leg on the instep kicking kinematics in soccer players. Materials and Methods**:** 30 male soccer players participated in this study. After the measurement of static and dynamic balance tests by the Biodex System, 20 players were selected who were at a desired level of the balance. Data were recorded using the three-dimensional motion analysis system with 6 optoelectronic cameras (200 HZ). The kinematic parameters in three critical moments of kicking (Forward swing of hip, Contact to ball, Follow through) were compared by using repeated measures of variance and independent t- test (0/05). Results**:** The results showed that the values of maximum angular velocity and displacement of hip and velocity of ball at the kicking over stability surface was significantly higher from the kicking over non- stability surface. Conclusion: These results indicate that the kicking over non- stability surface causes the lower of kinematic parameters in the more of the kicking skill phases and the movement prime velocity of ball.[26]

Pan Li (2014) Using biomechanical test system to reveal the kinematics parameters of instep shot in different heights in soccer players. Twelve healthy male college students voluntarily participated in this study. After digitizing the recording collected by camera, this study reached

[25] Hosni Hasan,Keith Davids,Jia Yi Chow & Graham Kerr, 'Changes in organisation of instep kicking as a function of wearing compression and textured materials**''** Journal – European Journal of Sports Science ,Volume 17-Issue 3, Published online: 14 Oct 2016, Pages 294-302 |

[26] Mohammad Ali Naseri Rouhani Mr, Mohammad Taghi Amiri Khorasani Dr, Mohammad Reza Amir Seifaldini Dr, 'The effect of non-stability surface of support leg on the instep kicking kinematics in soccer players'' Scientific Journals Management System, Volume 14, Issue 11, Published: 2017/06/11,Pages 27-38.|

the following conclusion that (1) in instep front shot the lower the contact height with ball during kicking, the faster the ball velocity. Therefore, the author put forward and (2) the player can control the ball velocity, ball trajectory, and the time of technique by controlling the vertical distance between support leg and ball.[27]

Izovska et.al. (2016) the purpose of this study was to identify the relationship between the speed of instep kick and its accuracy in experienced soccer players. The monitored group consisted of U19 category soccer teams (n = 20, age = 18.4 ± 0.4 years, body height = 182.7 ± 5.8 cm, body weight = 77.0 ± 6.3 kg). The ball velocity was recorded using a Stalker ATS radar gun and accuracy of kicking was assessed using 2D kinematic analysis. The average speed of the best instep kick trial was 108.8 ± 7.5 km.h^sup -1^. The players achieved high stability of instep kick velocity, when the difference in percentage between the best and worst kick was 6.1 ± 4.6 %. The average distance between the ball and centre of the target was 62.6 ± 28.3 cm in the best trials. However, concerning kick accuracy, we recorded high variability of accuracy when the average difference between the best and worst trial was 56.8 ± 19.6 %.In case of the fastest kicks, we found a negative trend in the relationship between speed and accuracy r = -0.17 ($p>0.05$). On the contrary, in trials with lowest speed there was a positive relationship between the variables r = 0.34 ($p>0.05$). Results showed high stability of kicking speed regarding dominant leg. On the contrary, the parameter of kick accuracy revealed high variability. The research showed that the most accurate kicks were found at speeds between 90-102 km.h^sup -1^, which is approximately 80-90 % of maximal kicking speed.[28]

Ali onur cerrah, deniz şimşek et.al. (2015) the aim of the study was to evaluate kinematic and muscular activation differences amongst different age groups of soccer players. Thirty male youth soccer players were divided into 3 groups according to their age (age 12-13; age 14-15; age 16-17). There were significant differences in ball velocities and isokinetic strength values amongst groups. Angular and linear velocities of hip, knee, ankle and toe were also significantly different ($p<0.05$) amongst groups in different phases. Furthermore, there were significant differences amongst groups regarding EMG activity of m. rectus femoris (RF), m. vastus medialis (VM), m. biceps femoris (BF) ($p<0.05$). From these results, it was suggested

[27] Pan Li "Kinematics Analysis of Instep Shot in Different Heights "Journal -Advanced Materials Research, Volume- 978, Published Online 2014-06-30, Pages: 106-109

[28] Izovska, Jana Maly, Tomas Zahalka & Frantisek "Relationship between speed and accuracy of instep soccer kick" Journal of Physical Education and Sport; Pitesti, Volume-16, Issue. 2, Published on Jun 2016 Pages 459-464.

that that the ball velocity of in-step kicking increased with age that reflects the development of both muscular strength and coordination of kicking leg.[29]

Mohammadtaghi Amiri-Khorasani (2017) The purpose of this study was to examine the effects of static and dynamic stretching within a pre-exercise warm-up on angular displacement identified as dynamic range of motion (DROM) of hip, knee, and ankle joints during instep kicking in less and more experienced soccer players. The kicking motions of dominant legs were captured from fifteen professional adult male soccer players using 6 infrared cameras at 200 Hz. Lower extremity joints DROM at instep kicking phases after different warm-ups protocols consisting of static, dynamic stretching, and no stretching, captured to analysing. Less experienced players showed significant differences in DROM after the dynamic stretching compared with the static stretching relative to the no stretching method in hip and knee joints. More experienced players showed significant difference in DROM after the dynamic stretching compared with the static stretching relative to the no stretching method in hip, knee, and ankle joints. There was no significant difference in DROM between less and more experienced after the dynamic stretching and also after with the static stretching relative to the no stretching method. We concluded that dynamic stretching during warm-ups, as compared to static stretching, is probably most effective as preparation for the DROM required in soccer.[30]

Mohammadtaghi Amiri-Khorasani & Noor Osman Ashril Yu (2010) The purpose of this study was to examine the effects of static and dynamic stretching within a pre-exercise warm-up on vastus medialis muscle activity during instep kicking and ball velocity in soccer players. The kicking motions of dominant legs were captured from using six synchronized high-speed infra-red cameras at 200 Hz and Electromyography at 100 Hz. There was significant difference in vastus medialis activity after dynamic stretching relative to no stretching condition (0.12 ± 0.06 mV) versus static stretching relative to no stretching condition (-0.21 ± 0.10 mV) with $p < 0.001$). In addition, there was also a significant difference in ball velocity after dynamic

[29] Ali onur cerrah,deniz şimşek, Abdullah ruhi soylu, hayri ertan & hiroyuki nunome, "developmental differences of kinematic and muscular activation patterns in instep soccer kick" 33rd international conference on biomechanics in sports, published on - July 3, 2015, pages-828-831.|

[30] Mohammadtaghi Amiri-Khorasani "Kinematics Analysis: The Acute Effect of Different Stretching Methods on Dynamic Range of Motion of Lower Extremity Joints during Soccer Instep Kicking" International Journal of Performance Analysis in Sport ,Volume 13, 2013 - Issue 1, Published online: 03 Apr 2017, Pages 190-199.|

stretching relative to no stretching condition (4.53 ± 2.10 m/s) versus static stretching relative to no stretching condition (-1.48 ± 2.43 m/s) with $p < 0.003$. We concluded that dynamic stretching during the warm-up, as compared to static stretching, is probably more effective as preparation for optimal muscle activity and finally have high ball velocity which is required in soccer.[31]

Simon Augustus et.al. (2016) this investigation assessed whether a Technique Refinement Intervention designed to produce pronounced vertical hip displacement during the kicking stride could improve maximal instep kick performance. Nine skilled players (age 23.7 ± 3.8 years, height 1.82 ± 0.06 m, body mass 78.5 ± 6.1 kg, experience 14.7 ± 3.8 years; mean ± SD) performed 10 kicking trials prior to (NORM) and following the intervention (INT). Ground reaction force (1000 Hz) and three-dimensional motion analysis (250 Hz) data were used to calculate lower limb kinetic and kinematic variables. Paired *t*-tests and statistical parametric mapping examined differences between the two kicking techniques across the entire kicking motion. Peak ball velocities (26.3 ± 2.1 m · s^{-1} vs 25.1 ± 1.5 m · s^{-1}) and vertical displacements of the kicking leg hip joint centre (0.041 ± 0.012 m vs 0.028 ± 0.011 m) were significantly larger ($P < 0.025$) when performed following INT. Further, various significant changes in support and kicking leg dynamics contributed to a significantly faster kicking knee extension angular velocity through ball contact following INT (70–100% of total kicking motion, $P < 0.003$). Maximal instep kick performance was enhanced following INT, and the mechanisms presented are indicative of greater passive power flow to the kicking limb during the kicking stride.[32]

Víctor Torreblanca-Martinez et.al. (2017), the purpose was to study the effects of muscle fatigue induced by countermovement jumps (CMJ) on instep kick foot velocity in young male soccer players. Fifteen under-18 soccer players from a professional club performed maximal velocity instep kicks before and after a fatigue protocol that consisted of continuous CMJ. Foot velocity at impact without fatigue, foot velocity at impact with fatigue, CMJ height without

[31] Mohammadtaghi Amiri-Khorasani & Noor Osman Ashril Yus, "Electromyography Assessments of the Vastus Medialis Muscle during Soccer Instep Kicking between Dynamic and Static Stretching" Journal of Human Kinetics, Volume 24 (2010), Published Online: 2010-06-21, Pages: 7-99 |

[32] Simon Augustus,Peter Mundy & Neal Smith Support leg action can contribute to maximal instep soccer kick performance: an intervention study" Journal of Sports Sciences Volume 35, 2017 - Issue 1 Published online: 08 Mar 2016, Pages 89-98 |

fatigue, maximum jump height in fatigue test, and CMJ height change in fatigue test on a dynamometric platform were measured. There was a significant difference between jump height with and without fatigue (P = .00; ES = 0.8), but there were no significant differences between kicking with fatigue and without fatigue (P = .580, ES = 0.10). In conclusion, although the protocol was intense enough to generate fatigue in the muscles involved in CMJ, there were no significant differences in kicking velocity under fatigue conditions with respect to kicking without fatigue in the soccer players studied.[33]

[33] Víctor Torreblanca-Martinez, Fernando M. Otero- Saborido ,José A. & Gonzalez-Jurado "Effects of Muscle Fatigue Induced by Countermovement Jumps on Efficacy Parameters of Instep Ball Kicking in Soccer" Journal of Applied Biomechanics, Volume 33 Issue 2, Published : April 2017, Pages: 105-111

METHODOLOGY

PROCEDURE

In this chapter the selection of subjects, selection of variables, the criterion measures, collection of data, filming protocol, analysis of film and statistical technique employed for analysis will be described.

SELECTION OF SUBJECTS

Ten male footballers of all India inter-university level of 17-25 years age group will be selected as subjects for the study. It is assumed that they possess good level of technique. The purpose of the research will be explained to the subject and subjects will be motivated put in their best, during each attempt.

COLLECTION OF DATA

The performance of the subjects during the Instep kick, filming protocol and analysis are described as under:

MEASUREMENT OF THE PERFORMANCE OF THE SUBJECTS

The performance of the each subject will be measured by using the standard procedures of FIFA, the horizontal distance covered by the ball will be considered as his performance or score and the horizontal distance will be measured in meters. Three trials will be given to each subject and the all attempt will be considered.

FILMING PROTOCOL AND ANALYSIS

The data will be collected with the help of Sony Camera. The camera use for analysis will be D58 Alpha, at the time of moment of Placement of foot, Period of contact and Period of

execution, will be filled at Lovely Professional University, Punjab. The analysis sequence will be taken under controlled condition. The subject will perform the technique 3 times.

STATISTICAL TECHNIQUE

To find out the relationship between selected kinematic variables of instep kick, Regression analysis will be used. For testing the hypothesis the level of significance will be set at 0.05.

SAMPLING PLAN- For the collection of data the 10 subjects will be selected purposely among the footballers.

DESIGN OF STUDY- Total observation and collection of the data will be done in one day and three observations of each subject will recorded i.e. in morning session only.