

THE BICYCLE AND SIDE VOLLEY KICKS IN SOCCER: A SYSTEMATICAL REVIEWRafael Toshio Bagatin¹**ABSTRACT**

As an important indicator of success kick is the most studied action in soccer. In scientific researches there are related different types of kicks, two of it, are bicycle and volley kick. In soccer the biomechanical analysis are used to define the efficiency of performance of specific kicks. The present study aimed to examine the current methods employed to analyze, from a kinematical perspective, the bicycle and volley kick in soccer as well as to elicit the main findings of recent studies. The present study was realized according to the recommendations stated in the Preferred Reporting Items for Systematic Reviews and Meta-analysis Statement, PRISMA. The articles searches were made in 5 scientific databases: PubMed, Scopus, B-on, Web of Science and Sport Discus. Afterwards, two articles citing the included papers were identified through a search in Google Scholar. Six relevant papers published in the period 2000-2017 were selected based upon inclusion and eligibility criteria. Six relevant papers published in the period 2005-2016 were selected based upon inclusion and eligibility criteria. Among the studies analyzed, all examined soccer kicks via electronical motion capture upper to 100 Hz which tracked reflective markers on the subjects' body and on the soccer ball. In this review, the volley kick, or side volley kick or side-facing bicycle was the most technic analyzed. To be successful, soccer players must adapt their body movement according to varied ball heights and velocities. Side volley appears the most effective kick compared with bicycle kick.

Key words: Football. Kinematics. Bicycle kick. Volley kick. Biomechanics.

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RESUMO

A bicicleta e o volley later kicks no futebol: uma revisão sistemática

Como importante indicador de sucesso, a ação mais estudada no futebol é o chute de sucesso. Em pesquisas científicas, existem diferentes tipos de chutes relacionados, dois deles são bicicleta e chute de vôlei. No futebol, as análises biomecânicas são usadas para definir a eficiência do desempenho de chutes específicos. O presente estudo teve como objetivo analisar os métodos atuais empregados para analisar, a partir de uma perspectiva cinemática, o chute de bicicleta e vôlei no futebol, bem como elucidar os principais achados de estudos recentes. O presente estudo foi realizado de acordo com as recomendações estabelecidas nos Itens de Relatórios Preferenciais para Revisões Sistemáticas e Declaração de Meta-análise, PRISMA. As buscas dos artigos foram feitas em 5 bases de dados científicas: PubMed, Scopus, B-on, Web of Science e Sport Discus. Posteriormente, dois artigos citando os artigos incluídos foram identificados através de uma pesquisa no Google Scholar. Seis artigos relevantes publicados no período de 2000-2017 foram selecionados com base em critérios de inclusão e elegibilidade. Dentre os estudos analisados, todos examinaram chutes de futebol via captura de movimento eletrônico superior a 100 Hz, que rastreou marcadores reflexivos no corpo dos sujeitos e na bola de futebol. Nesta revisão, o chute de vôlei, ou chute lateral de vôlei ou bicicleta lateral foi o mais analisado. Para ser bem sucedido, os jogadores de futebol devem adaptar seu movimento corporal de acordo com as alturas e velocidades variadas da bola. O vôlei lateral parece o chute mais efetivo comparado ao chute de bicicleta.

Palavras-chave: Futebol. Cinemática. Chute de bicicleta. Chute de vôlei. Biomecânica.

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INTRODUCTION

Soccer had a complex game structure and is classified as a Collective Sport Game, it is developed in an opposing situation, players must coordinate their actions toward to recover, retain and advance the ball with the aim creating situations to kick the ball and score a goal (Gréhaigne and Guillon, 1992).

As an important indicator of success (Moura and collaborators, 2014), kick is the most studied action in soccer (Lees and collaborators, 2010).

In scientific researches there are related different types of kicks, two of it, are bicycle and volley kick, in both, players hit the ball before it falls to the ground. The first one, was created in 1942 by Leonidas da Silva, a Brazilian soccer player and consists in a technical skill which players kick the ball from backwards to the goal, hitting the ball before it fall to the ground, resembles a back somersault (Toledo, 1996).

Volley Kick are generally used to surprise the opponent, are unexpectedly fast,

strong and accurate technic which means a huge advantage in today's conditions of soccer game (Mrdakovic, 2014).

In search of to understand and determine the efficiency of technical movements the biomechanical analysis is used in a large number of sports. In soccer the above analyses are used to define the efficiency of performance of specific kicks (Mrdakovic, 2014).

The present study aimed to examine the current methods employed to analyze, from a kinematical perspective, the bicycle and volley kick in soccer as well as to elicit the main findings of recent studies.

MATERIALS AND METHODS

The present study was realized according to the recommendations stated in the Preferred Reporting Items for Systematic Reviews and Meta-analysis Statement (PRISMA) (Liberati and collaborators, 2009). The process of search and selection of papers is presented in Figure 1.

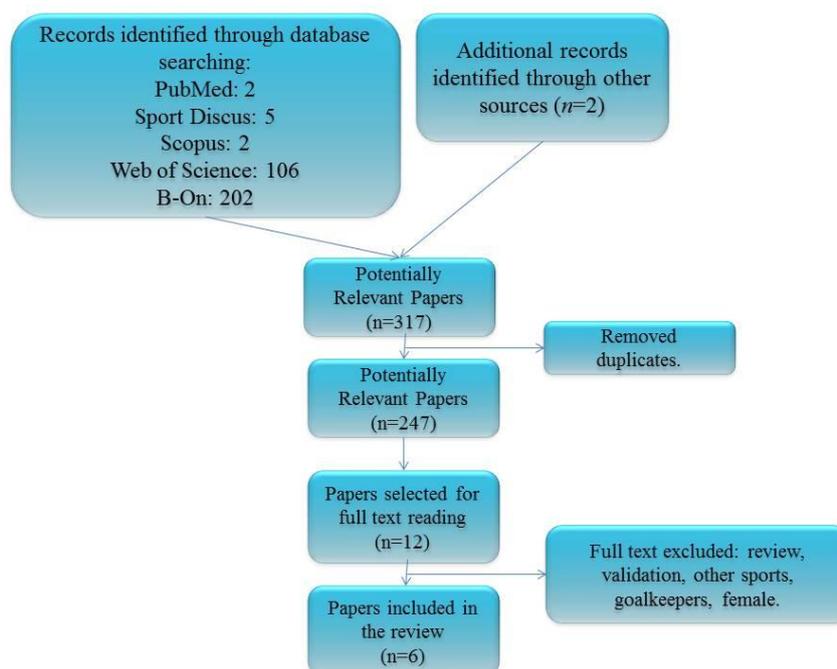


Figure 1 - Flow diagram of the study selection process.

Criteria Eligibility

Cross-sectional and longitudinal observation studies that were published in English were selected. The participants of the selected studies were male participating in soccer at any competitive level. All of the

criteria for inclusion of the studies were the following: 1) in journals offering free and complete manuscripts; 2) published between 2000 and 2017; 3) involving human beings and an experimental design and 4) in English. The following filters were applied to refine the search: "Title", "academic researches", "free

full text” and “humans” within all electronic databases.

Selection Strategy

The articles searches were made in 5 scientific databases: PubMed, Scopus, B-on, Web of Science and Sport Discus. The literature searches were limited to the period comprised in 2000 until January 2017. A pilot search was performed tentatively with a wide range of keywords. The following key words were used: biomechanics, soccer OR football, bicycle kick, volley kick and kinematics. Additionally, a second research was made with the key words, scissors kick, overhead kick(s) and side cutting volley. Afterwards, two articles citing the included papers were identified through a search in Google Scholar. All the papers titles and abstracts were examined in order to identify those potentially relevant.

Data Extraction

The participant characteristics (age, sex and nationality), total sample size, positional role in soccer team and preferred foot were extracted from the included studies.

The search for papers was conducted between December 2016 and January 2017.

RESULTS

Six relevant papers published in the period 2005-2016 were selected based upon inclusion and eligibility criteria (Figure 1). The papers included in this review are described in Table 1, encompassing year, authors, type of soccer kick, aim and the main findings. With closer inspection, it was found two of the studies reported data on the same sample: 30 male professional soccer players aged 19 to 23 playing for Serbia's national team (cadet) (Kostić, Ilić and Mrdaković, 2013; Mrdaković and collaborators 2014).

From the sample perspective, 2 studies were made with professional soccer players, in this perspective the papers (Kostić, Ilić, Mrdaković, 2013; Mrdaković and collaborators, 2014) are counted as one study, the second study was made with 2 experienced players (Shan and collaborators, 2015).

College, Amateur and Universities were analyzed respectively by (Chiu and collaborators, 2005; Shan, 2008; Sugi, 2016).

Table 1 - Studies retrieved from the literature search strategy.

Year	Autor	Soccer kick	Sample	Aim	Findings
2005	Chiu and collaborators	Side volley	5 amateur right leg male soccer players (age = 20.5, SD = 0.5yrs)	1) Examine side-volley kick at three ball-height	1) The high velocity of the ball appeared at kicking the lower ball-height, and it also expended less swing time than kicking higher ball-height
2008	Shan	Side volley and bicycle	5 male college (26 yrs., with over 10 yrs. of experience)	1) Provide a 3D kinematical characteristic of the side volley and bicycle kick using a 15-segmental full body model 2) Exploring possible parameters for quantitative evaluations of the kick quality	1) Through the 3D kinematics the authors defined 3 phases for each kick 2) Upper body movement contributes notably to soccer kicks
2013	Kostic and collaborators	Side volley	30 Serbian professional soccer players	1) Determine, from the aspect of the speed exchange rate and accuracy, the pattern of the optimizing the movement on the criterion of the side kick volley efficiency in professional soccer players	1) Soccer players had to adapt the least to the balls coming from different velocities
2014	Mrdkovic and collaborators	Side volley	30 Serbian professional soccer players	1) Establish the coordinated pattern of a side volley in top soccer players and 2) Define the biomechanical variables that modulate when the conditions in which this technical element is performed change	1) Based on kinematic analysis, the authors defined 3 characteristic phases of side volley 2) Changes in velocity and height of the incoming ball affected the body movement pattern
2015	Shan and collaborators	Side-facing bicycle (side volley)	2 experienced soccer players	1) Identify elements that govern entrainment of the technique by examining jumping, kicking and falling phases	1) Define the movements in 3 phases. Additionally, the authors found the side-facing bicycle (side volley) was the most effective style
2016	Sugi and collaborators	Side volley	15 experienced male university soccer players (age = 21.5, SD = 9, experience = 14;7 yrs., SD = 1.4 yrs.)	1) Illustrate 3D joint angular kinematics and 2) To demonstrate how players, change their volley kicking motion to different ball heights	1) The researches defined the volley kick in 4 phases 2) Soccer players adjust their volley kicking motion according to varied ball heights



Figure 2 - Side volley kick example (Mrdakovic and collaborators, 2014).

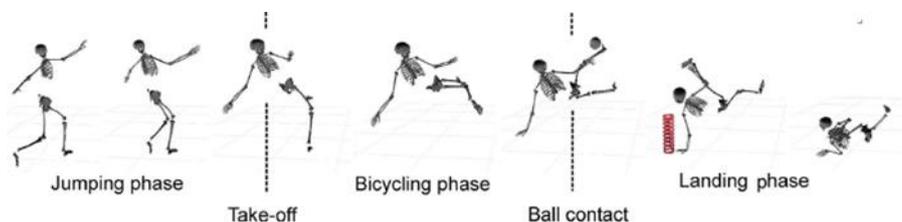


Figure 3 - Side volley kick with flight phase (Shan, 2015).

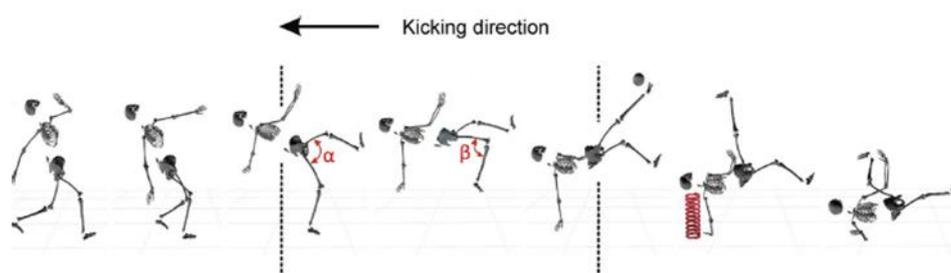


Figure 4 - Bicycle kick example (Shan, 2015).

DISCUSSION

The aim of this study was to examine the current methods employed to analyze, from a kinematical perspective, the bicycle and volley kick in soccer as well as to elicit the main findings of recent studies.

Among the studies analyzed, all examined soccer kicks via electronic motion capture upper to 100 Hz which tracked reflective markers on the subjects' body and on the soccer ball. All the captured data were used to create 3D movements and served as inputs to upper a 10-segment model in order to calculate range of motion joint and other parameters. The soccer body movements' example is presented in Figure 2, 3 and 4.

In this review, the volley kick, or side volley kick or side-facing bicycle was the most

technic analyzed (Chiu and collaborators, 2005; Kostic, Dusko and Mrdakovic, 2013; Mrdakovic and collaborators, 2014; Shan, 2008; Shan and collaborators, 2015; Sugi, 2016). A comparison between side volley and bicycle were made in two occasions and both defined the kicks in 3 phases (Shan, 2008; Shan and collaborators, 2015).

Respectively, the first comparison between both technics found the upper body movement is definitely important to be successful in both technics and timing is the most crucial element for the kicks. The second cited comparison found side volley was the most effective style, resulting a kick-foot velocity of 20.8 m/s (Shan, 2008; Shan and collaborators, 2015). Both kicks represent a complex full body, coordination movement and

the kinematical knowledges can be used for coaches to improving the skill (Shan, 2008).

Different ball heights during side volley were analyzed and concluded that changes in velocity and height of the incoming ball affected body movement pattern (Mrdakovic and collaborators, 2014), high velocity of the ball appeared at kicking the lower ball-height (Chiu and collaborators, 2005).

CONCLUSION

To be successful, soccer players must adapt their body movement according to varied ball heights and velocities, bicycle and side volley kicks can be used to surprise the opponent to score a goal, as well as an important skill to use in other situations. In terms of effectivity, side volley appears the best option when players kick the ball at a lower ball-height, expending less swing time than kicking higher balls.

Players must use upper body movement and had to percept best time to make both techniques.

REFERENCES

- 1-Chiu, Y. H.; Wong, T. L.; Wang, J. C.; Lin, C. H. The analysis of angular Momentum of Side-Volley soccer shots performed at three ball-height. In ISBS-Conference Proceedings Archive. Vol. 1. Núm. 1. 2008.
- 2-Gréhaigne, J.F.; Guillon, R. L'utilisation des jeux d'opposition a l'école. *Revue de l'Education Physique*. Vol. 32. Núm. 2. p. 51-67. 1992.
- 3-Kostić, S.; Ilić, D.; Mrdaković, V. Invariance of motor patterns in side volley kick in football. *Godišnjak Fakulteta sporta i fizičkog vaspitanja*. Vol. 19. p. 48-65. 2013.
- 4-Lees, A.; Asai, T.; Andersen, T.B.; Nunome, H.; Sterzing, T. The biomechanics of kicking in soccer: a review. *Journal of Sports Sciences*. Vol. 28. Núm. 8. p.805-817. 2010.
- 5-Liberati, A.; Altman, D.G.; Tetzlaff, J.; Mulrow, C.; Götzsche, P.C.; Ioannidis, J.P.; Clarke, M.; Devereaux, P.J.; Kleijnen, J.; Moher, D. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *Annals of Internal Medicine*. Vol. 151. Núm. 4. p. 65-94. 2009.
- 6-Moura, F.A.; Martins, L.E.; Cunha, S.A. (2014). Analysis of football game-related statistics using multivariate techniques. *Journal of Sports Sciences*. Vol. 32. Núm. 20. p.1881-7. 2014.
- 7-Mrdakovic, V.; Kostic, S.; Jankovic, N.; Matic, M.; Kukic, F.; Ubovic, M.; Ilic, D. Kinematic Analysis of a Side Volley in Soccer. *Physical Culture*. Vol. 68. Núm. 2 p. 124-137. 2014.
- 8-Shan, G. Kinematical Characteristics of Bicycle Kick and Side Volley in Soccer. In *ISBS-Conference Proceedings Archive*. Vol. 1. Núm. 1. 2008.
- 9-Shan, G.; Visentin, P.; Zhang, X.; Hao, W.; Yu, D. Bicycle kick in soccer: is the virtuosity systematically entrainable?. *Science bulletin*. Vol. 60. Núm. 8. p. 819-821. 2015.
- 10-Sugi, S.; Nunome, H.; Tamura, Y.; Iga, T. Kinematics of low, middle, and high volley kicking in soccer. In *ISBS-Conference Proceedings Archive*. Vol. 34. Núm. 1. 2016.
- 11-Toledo, L. H. Torcidas organizadas de futebol. Autores Associados/Anpocs. Campinas-SP. Brazil. Coleção educação física e esportes. 1996.

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