90 - SPACIAL-TEMPORAL VARIABLES OF THE DOMINANT AND NON-DOMINANT INFERIOR MEMBER DURING THE KICK

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Introduction

Some researches have focused the acquisition of quantitative data related to soccer[3,7,13]. Many of them focus the kinematic variables of the kicking movement, which is the manner of shooting, in which the foot is used to give speed to the ball. It is known that the kick with the back of the foot is one of the bases used in the soccer, and it is very important because of the potency and good precision gained in its execution. The attack member is the part that conducts the ball and determines kick result. This part of the body is studied due to its importance for a good practice and to its function of offering balance and help in the ball trajectory.

The human body is characterized for the presence of anatomic even and integrally symmetric parts. This anatomic symmetry is doubled for a functional asymmetry in the sense that some activities just influence one part. Many individuals cannot or are not used to do activities that require both sides of the body in the same way. For instance, the soccer, a sport that requires a lot the inferior members of the body, activities that intend to develop the right and left side as both had the same ability, many times are not considered. The truth is that dexterous individuals always intend to make movements with the right side, and left-handed individuals, with the left side. This is because they are used to or they have a better coordination of the movements with the respective dominant side. The bilateral movements involve the use of both sides of the body in a simultaneous and parallel manner. The unilateral movements involve the use of one of the sides of the body or of a member in that side, as kicking the ball with one leg. The lateral balance is the comprehension of the notion of the difference between right and left; it is the skill of controlling both sides of the body, together or separated, and it is the special concepts motor base. The lateral balance is the apprehension of a right-left idea, knowledge that must be automated as earlier as possible. For the same author it is necessary to reinforce the lateral process, establishing a sequence of exercises that show the less efficient and skillful side to reinforce it, since having a preference for one side of the body is a natural tendency of the child, congenital and from a neurological nature.

This study intended to describe the kicking kinematic variables executed by a dexterous and a left-handed child kicking with the back of the foot with its dominance and non-dominance members. This study is justified for the assistance to Physical education professionals in terms of soccer for children, regardless if they are dexterous or left-hander.

Methodological procedures

This study was conducted in two ten-years-old male individuals, soccer players, of the *pre-mirim* category from a school in Santa Maria-RS, one dexterous and the other left-handed. Initially two students with, at least, a year of practicing and with two or more constantly times of training a week were chosen on purpose.

In the first contact with the subjects it was explained the objective of the study, as well as the procedures for the data collection. The player was instructed to use the ordinary clothing and the shoes used during the trainings. Before the data collection, a warm-up activity was done, in which the subjects practiced kicks for adaptation, according to the procedures that would be applied during the shooting. The individuals were instructed to try getting right a target, with dimensions of one meter square, as well as in a study made by Lees & Nolan[11] that was half-height positioned in the goal center. The kick should be executed from the penalty area, located 11 m from the goal, the same that was made in study by Cunha, Ximenes and Magalhães Jr.[6] Three attempts of each individual, that got right the target with each member (three with the dominant member and three with the non-dominant member), were analyzed. Before the kick, it was done a run (from the large area approximately), because according to Opavsky *apud* Barbieri[1], the kicks that have an approach run present higher speeds in all the variables, including the linear speed.

For the data collection it was used a videography , through the *Peak Motus (Peak Performance Inc.)* with two video cameras with acquisition of images frequency of 180 Hz. The shootings were done in the soccer field of the Physical Education and Sport Center of the Universidade Federal de Santa Maria. The kick was analyzed since the moment the attack foot lost the contact with the ground (foot of attack leaving) until 10 squares (0,555 s) after the touch of this foot on the ball. The following events were analyzed: foot of attack leaving (spa), foot of support touch (tpa), touch on the ball (tb) e end of the movement (fm). The anatomical references used for the segments of the body definition and posterior variable calculation were: acromio of the right and left scapula, trochanter of the right and left femur, lateral condyle of the right and left tibia, lateral malleolus of the right and left tibia, and proximal phalange of the right and left hallux.

The acromio of the scapula and the trochanter of the femur defined the trunk segment; the trochanter of the femur and the lateral condyle of the tibia defined the thigh segment; the lateral condyle of the tibia and the lateral malleolus defined the leg segment. The angles of the hip and the knee were defined as anatomical angles 180° between the trunk-thigh segments and thigh-leg, respectively. The cameras were positioned laterally to the movement of the individual, in a distance of 4 meters, in a way that the anatomical points of interest were visible during the whole movement. After the shooting, it was made the images digitalization, what allowed the coordinates of the points of interest acquisition, which were the base for the calculation of the kinematic variables.

Results and discussions

The figure 1 shows the angle between the right and left hip pf the dexterous and left-handed individuals when they did the kicks with their dominant and non-dominant members.

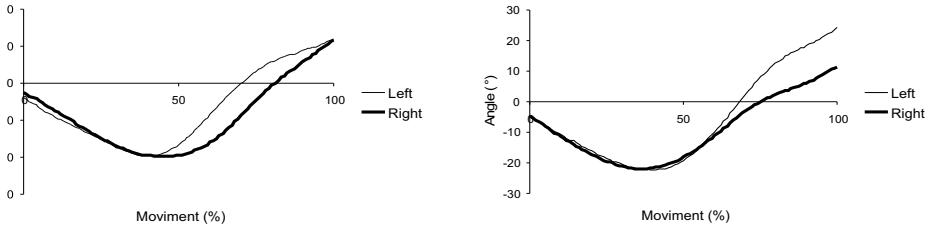


Figure 1 – Right and left hip angle of the dexterous (a) and left-handed (b) subject.

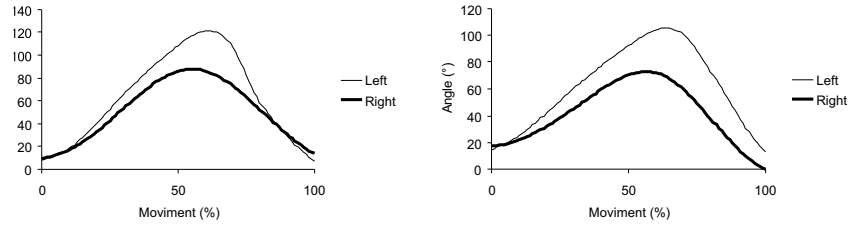
It is possible to observe that the dexterous subject present a technique that starts differing between the members

from around the half part of the movement. The left-handed subject present similar movement between the members to after the half part of the movement. However, all the curves have the same shape. The movement starts with a hip extension, after it presents a maximum hyperextension before the half part of the movement, then it deflects and keeps the movement with the continuation of the deflection. The subjects differ in the trace of their curves around the half part of the movement, and the dexterous presents with different hip movements, but in the end of the movement the curve tends to make the values equal. With the left-handed the opposite happens; his movement took more time to show differences between the angles, but they do not tend to approximate in the end of the movement. The table 1 presents the values of the average (X) and the standard deviation (S) of the hip angle in the selected events.

Table 1 Average and standard derivation of left (qe) and right (qd) hip angle during the attack foot leaving (spa), touch of support foot (tpa), touch on the ball (tb) and end of the movement (fm) (°).

		Spa		Tpa		Tb		Fm	
		qe	qd	qe	qd	qe	qd	qe	qd
Dexterous	X	-7,13	-4,99	-39,83	-42,71	14,07	6,02	23,87	43,48
	S	15,03	1,26	4,25	8,42	13,75	4,4	7,83	1,69
Left-handed	X	-4,92	-2,98	-18,55	-24,74	19,53	1,88	23,87	43,48
	S	4,51	6,48	1,09	8,46	7,17	6,14	7,83	1,69

The figure 2 presents the angle between the right and left knee of the dexterous and left-handed individuals when they did the kicks with their dominant and non-dominant members.



a b

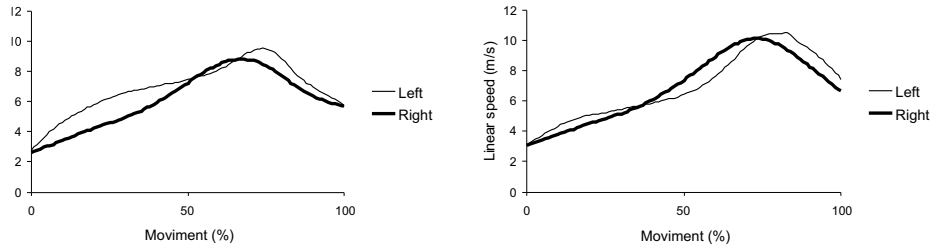
Figure 2 – Angle of the (left) and right (right) knee of the dextrous (a) and left-handed (b) subject.

It is possible to observe that the curves present a peak only. Their traces present as similar. The values of both subjects for the both members from the beginning to the half part of the movement are similar. It is observed that when the kick was did with the left member, both subjects presented higher values. From the half part of the movement, the dexterous present a faster extension of the knee, approximating the values of the left member with those from the right member. However, the left-handed do not equal the values of the left knee with those from the right knee until the end of the movement. Even with the different dominances, the subjects present a bigger similarity in the trace of the right member curves**.** The table 2 presents the average and the standard deviation of the values of the angle in the knee in the four events analyzed.

Table 2 Average and standard derivation of left (je) and right (jd) knee angle during the attack foot leaving (spa), touch of support foot (tpa), touch on the ball (tb) and end of the movement (fm) (°).

		Spa		Tpa		Tb		Fm	
		je	jd	je	jd	je	jd	je	jd
Dexterous	X	11,09	9,56	87,98	79,87	47,02	51,36	7,07	4,24
	S	2,19	6,9	2,29	1,28	15,21	1,89	5,06	6,2
Left-handed	X	14,78	16,99	96,63	60,88	45,55	33,97	0,19	-1,77
	S	2,7	3,47	3,77	14,88	6,11	6,59	1,26	3,1

The figure 3 shows the linear speed of the right and left foot top of the dexterous and left-handed individuals when they did kicks with their dominant and non-dominant members.



a b

Figura 3 – Linear speed of the left (left) and right (right) tip of food of the dextrous (a) and left handed (b) subject.

Through the figures it is possible to note that the bigger similarity happened in the curves of the right member of the both subjects. The linear speed of the foot top starts with low values that increase until the maximum peak, which happened right after the half part of the movement. From this moment on the values start reducing until the end of the movement, but they are still higher than the ones of the beginning of the movement. The same happens with the left member that is similar for both subjects. The curves are alike the ones found in studies done by Barfield, Kirkendall and Yu[3], however in their study the values start between 5 and 10 m/s and get around 25 m/s of maximum speed. This difference among the values regarding the present study can be related to the age of the investigated subjects. The table 3 presents the values of the average and the standard deviation of linear speed of the foot top in the four studied events.

Table 3 Average and standard derivation of the linear speed of the left (ppe) and right (ppd) foot top during the attack foot leaving (spa), touch of support foot (tpa), touch on the ball (tb) and end of the movement (fm) (m/s).

		Spa		Tpa		Tb		Fm	
		ppe	ppd	ppe	ppd	ppe	ppd	ppe	ppd
Dexterous	X	1,69	2,39	7,67	6,43	11,34	11,44	12,95	12,39
	S	0,57	0,2	0,51	0,16	0,26	1,28	13,18	0,54
Left-handed	X	1,86	1,95	8,29	6,36	7,95	5,3	8,37	7,51
	S	1,81	0,84	7,36	0,54	0,94	0,72	9,47	3,58

The values found in this study in the tb moment are different to the ones found by Barfield, Kirkendall and Yu3; they presented values for these same variables in individuals between 19 and 22 years old, and found 18,90 ± 1,6 m/s for the dominant member, and 17,70 ± 1,2 m/s for the non-dominant member. The same authors assessed women and the values found were lower than the ones found in men. The values were 16,20 ± 2,3 m/s in the dominant member and 14,80 ± 2,1 m/s in the non-dominant member. Barfield[2] present values of approximately 8,00 m/s in the tpa moment in consonance with all the values found in this same moment in the present study. The same authors present values of approximately 21,00 m/s in the tb, and this ones differ from the values found here.

Conclusion

It was concluded that both subjects presented similar results, either when in relation to the right and left member of each subject or in relation to the dominant and non-dominant member of each subject. Through this it was noticed that the non-dominant member presented similar characteristics to the dominant member and also that, when it is compared to other studies, these values were different from the ones found in the consulted literature.

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SPACIAL-TEMPORAL VARIABLES OF THE DOMINANT AND NON-DOMINANT INFERIOR MEMBER DURING THE KICK

Abstract

The soccer is one of the most practiced sports in the world and many studies have been focusing this modality, mainly the kick movement, which is decisive in this modality. This study had as objective to describe the kick kinematic variables executed by a right and a left-handed child doing the kick with its dominant and non-dominant members. Two male subjects, 10-years-old players of soccer, a right and a left-handed one, were analyzed. The subjects were instructed to try to get right a target, with one square meter positioned in the goal center. The kick was executed from the penalty mark. For data collection and analysis, *Peak Motus* system with two video cameras and frequency of images acquisition of 180 Hz was used. Three attempts of each member of each subject that got right the target were analyzed. The results showed that the non-dominant member presented similar characteristics to the dominant one and that when some results were compared to other studies they were different from the ones found in the consulted literature.

Keywords: soccer, kick, kinematics

VARIABLES ESPACE-TEMPOREL DU MEMBRE INFERIEUR DOMINANTE ET PAS DOMINANTE PENDANT LE COUP

Résumé

Le football c'est un des sports plus pratiqués dans le monde, alors plusieurs études ont centré cette modalité principalement le mouvement pour être determine dans cette modalité. Ce texte a eu comme objectif décrire les variables espace-temporel du coup executé par un enfant adroit et un autre enfant gaucher en réalisant les shoots avec la partie supérieur du pied avec ses members de dominance et pas dominance. Ont été analysé deux sujets du sexe masculin, joueurs au foot de terrain de football, un adroit et l'autre gaucher, tous les deux âgé 10 ans. Les garçons ont été instruit d'essayer de viser juste une cible d'un metre carré qu'était dedans le poutre. Le *shoot* a été fait dans la marque penalty. Pour analiser les donnés a été utilizé le système *Peak Motus* avec deux cámeras de video et la fréquence d' acquisition d' image de 180 Hz. Ont été analysé trois tentatifs de chaque membre des sujets qu'ont touché juste la cible. Les resultés ont montré que le membre pas dominante a présenté caracteristique pareil au membre dominante et quand comparé avec les autres études quelques résultats se présentait différents de leurs trouvé dans la littérature consulté.

Mots-clés: football, coup, cinematique

VARIABLES ESPACIO-TEMPORALES DEL MIEMBRO INFERIOR DOMINANTE Y DEL NO DOMINANTE DURANTE EL GOLPE DADO EN LA PELOTA

Resumen

El fútbol es uno de los deportes más practicados en el mundo y muchos son los estudios que tienen enfocado esta modalidad, principalmente el movimiento del golpe dado en la pelota, por ser determinante en esta modalidad. Este trabajo tuvo el objetivo de describir las variables espacio-temporales del golpe ejecutado por un niño diestro y un zurdo realizando golpes con el empeine de sus miembros de dominio y no dominio. Fueron analizados dos sujetos del sexo masculino, jugadores de fútbol de cancha, uno diestro y uno zurdo, los dos con 10 años. Los sujetos fueron instruidos a intentar marcar el gol, con un metro cuadrado posicionado en el centro del arco. El golpe fue ejecutado de la marca del penal. Para la colecta y análisis de los datos fue utilizado el sistema *Peak Holus* con dos cameras de video y frecuencia de adquisición de imagines de 180 Hz. Fueron analizados tres intentos realizados con cada miembro de los sujetos que lograron el punto de mira. Los resultados mostraron que el miembro no dominante presentó características parecidas con el miembro dominante y que cuando comparado a otros estudios algunos resultados se presentaron distintos de los encontrados en la literatura consultada.

Palabras-clave: fútbol, golpe en la pelota, cinemática

VARIÁVEIS ESPAÇO-TEMPORAIS DO MEMBRO INFERIOR DOMINANTE E NÃO DOMINANTE DURANTE O CHUTE

Resumo

O futebol é um dos esportes mais praticados no mundo e muitos estudos têm enfocado esta modalidade, principalmente o movimento do chute, por ser determinante nesta modalidade. Este trabalho teve como objetivo descrever as variáveis espaço-temporais do chute executado por uma criança destra e uma sinistra realizando chutes com o dorso do pé com seus membros de dominância e não-dominância. Foram analisados dois sujeitos do sexo masculino, jogadores de futebol de campo, um destro e um sinistro, ambos com idades de 10 anos. Os sujeitos foram instruídos a tentar acertar um alvo, com um metro quadrado posicionado no centro da goleira. O chute foi executado da marca do pênalti. Para coleta e análise dos dados foi utilizado o sistema *Peak Motus* com duas câmeras de vídeo e freqüência de aquisição de imagens de 180 Hz. Foram analisadas três tentativas de cada membro de cada sujeito que acertaram o alvo. Os resultados mostraram que o membro não dominante apresentou características similares ao membro dominante e que quando comparado a outros estudos alguns resultados apresentaram-se diferentes dos encontrados na literatura consultada.

Palavras-chave: futebol, chute, cinemática.