KINEMATIC ANALYSIS OF LOWER EXTREMITY ON DIFFERENT RUNNING SPEED

Wu-chen Lin, Tzu-Lin Wong, Jin-Cherng Wang*, and Rong-Jung Shih
National Taipei Teachers College, Taipei, Taiwan
***National Chia-yi University, Chia-yi, Taiwan**

A kinematic analysis of selected variables of human lower extremity was completed during different running speed (3.5±0.3 and 4.9±0.2 m/s)on treadmill.Ten male elite running players served as subjects.It got two dimensions photograph analysis along sagittal plane with video data collected at 60Hz.The purpose of the study was to analyze the kinematic parameters including the range of motion,the joint angle,angular velocity and angular acceleration of lower extremity joint related to the cycle time during horizontal running. According to the experimental result of a research ,we could get the below conclusion:angle of lower-extremityed joints in different running speed reaches significant difference . Angle of lower-extremityed joints is getting more with the increasing of velocity.Then maximum angle, angular velocity and angular acceleration of knee joints stretched are getting more with the increasing of velocity. Maximum stretched angle in joint extension phase of take-off significnce.

KEY WORDS: lower extremity, kinematics, range of motion, stride, step.

INTRODUCTION: Because Lower extremity a joints is still human body the structure the most for complicated joints, In stretch-shortening cycle of periodic exercise model .It acts extremely important part.By legs a joints stretches and bent result.Impel body to yield fast move a phenomenon.Run action still lower extremity joints fast stretches-shortening bent of performance.Recent years, A lot of scholars the professional difference of every kind method. Study to run period within lower extremity joints variety situation of the kinetics variables. lower extremity joints actions while running at different velocities(Sinning, 1970).Super-speed camera record to knee joints is runing hours of kinetics variety situation,for example action scope,angle,speed wait?Winter, 1979??Can at action technique aspect adds the leading and improves upon to meet the principle of the mechanics,Cooperate the terms of the inborn.Believe score necessarily can further.Base on question leads to me in regard to human body lower extremity joints can accompany with different to runnidg while have the difference.Therefore, the purpose of this study was to investigate the effects of varying degrees of different running speed on lower extremity kinematics:To understand variety of the lower extremity action scope in different speed when youre running.Compares Knee joints to angular velocity in understand different running speed.Understand different to run speed Knee joints angular acceleration compares.

METHODS: A written language major is studying whole to experiment the method and the steps. Divide into following several part to come explanation :Ten elite male running players participated voluntarily in this study.Their mean age, height and weight were 26.8±2.4 years, 1.72±0.03 M and 74.5±7.0 Kg, respectively.One camera was operated at 60Hz and was used to record the participators when they performing the flat serve. The camera was set up to record the movement of whole body is sagittal plane. Nine landmarks were placed on head, shoulder,elbow,wrist,hip,knee,ankle,heel,and tiptoe.To gain the Kinematics parameter fo human lower extremity by handle filter.The range of data is from the average of free strides.
The experimental result treat with APAS System software.The film after digital,Direct Linear Translation,to wait treat after to gain raw data.The experimental result acquire the lower extremity hip joints?knee joints?ankle joints wait angular displacement (?),angular velocity (?),angular acceleration(?).And income parameter of number analysis interoptation method will give to proceed the standardization of the analysis.Finally,the parameters up to reach the obviously level by T-test , the level is 0.05. ?.05. The period of support is referred to as the stance phase,and nonsupport is known as the swing phase.The stance phase begins when the foot contacts the ground (footstrike), and ends when the foot leaves the ground (toe-off).Conversely, the swing phase extends from toe-off to footstrike. Gait cycles are usually

defined relative to these events. For example, one complete cycle, such as from left foot toe-off to left foot toe-off,is defined as a stride (Enoka, 2002).

RESULTS AND DISCUSSION:

Table 1 Different speed of the lower extremity joints the range of motion difference.

	Lower Extremity		
	3.5 m/s (n = 10)	4.9 m/s (n = 10)	t-values
Hip joints (rad)	0.440 0.38	0.544 0.43	- 4.452 *
Knee joints (rad)	1.065 0.51	1.222 0.54	- 4.725 *
Ankle joints (rad)	0.611 0.822	0.778 0.19	- 3.861 *

* $p < .05$

On the basis of the experimental result (Table 1,Figure 1): when the when action scope of the different running speed lower extrematics hip joints is 0.44(rad) and 0.54 (rad). The parameter of lower extrematics hip joints is getting more according to the increase of velocity.According to figure can must know. In take-off extension phase maximum stretches angle no significnce. However,There is between different running speed is a significnce in maximum swing flection. with the increase of the speed thigh to enlarge the step.

On the basis of the experimental result (Table 1,Figure 1): when the when action scope of the different running speed lower extrematics hip joints is 0.44?rad? and 0.54 ?rad?.The parameter of lower extrematics hip joints is getting more according to the increase of velocity.According to figure can must know. In take-off extension phase maximum stretches angle no significnce. However,There is between different running speed is a significnce in maximum swing flection. with the increase of the speed thigh to enlarge the step.

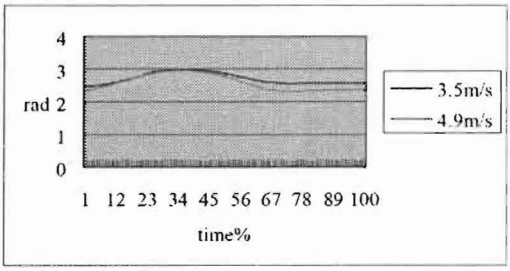

Figure 1: Different angular displacement of hip joints on running speed.

When speed is 3.5m/s, 1.06 rad and 4.9, 1.22 rad(Table 1, Figure 2). According to (Grillner, 1979) Study knee joints lower extremity accompany the situation of the speed variety.The parameter of knee joint range of motion is getting more according to the increase of velocity. While knee joints maximum angle goes out midswing after in a twinkling. 2.866 rad. Maximum stretches angle appears opportune moment and (Cavanagh, 1990) Research result fits together each other.

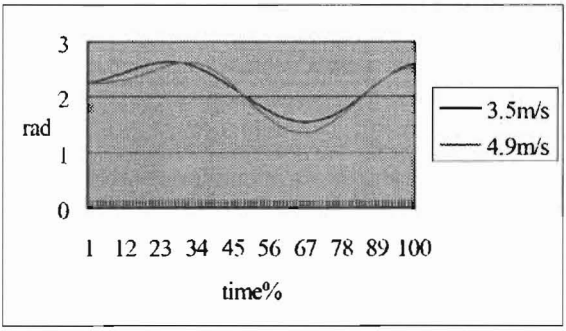

Figure 2: Different angular displacement of knee joints on running speed.

When speed is 3.5m/s, 0.611 rad and 4.9m/s, 0.788 rad(Table 1,Figure 3).The parameter of ankle joint range of motion is getting more according to the increase of velocity.

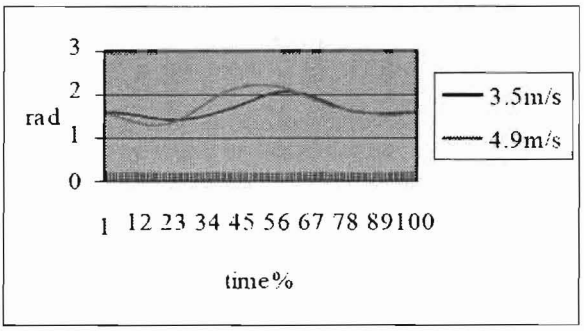

Figure 3: Different angular displacement of ankle joints on running speed.

Table 2 Average angular velocity of stride in different running speed compare.

	Angular velocity rad/s	
	Maximum stretched angle	**Minimum stretched angle**
3.5 m/s	6.901 ± 1.043	6.680 ± 1.251
4.9 m/s	8.431 ± 0.748	7.729 ± 0.694

Table 3 Average angular acceleration of stride in different running speed compare.

	Angular acceleration rad/s/s	
	Maximum stretched angle	**Minimum stretched angle**
3.5 m/s	92.29	- 92.56
4.9 m/s	108.76	- 123.2

(Table 2,3 and Figure 4) The parameter of Angular velocity and angular acceleration is getting more according to the increase of velocity. (Hoshikawa, T., Matsui , H. , & Miyashita, M. 1973).Then maximum knee joints angular velocity and angular acceleration goes out appear in take-off(midswing). Cause take-off time does to make an effort maximum.

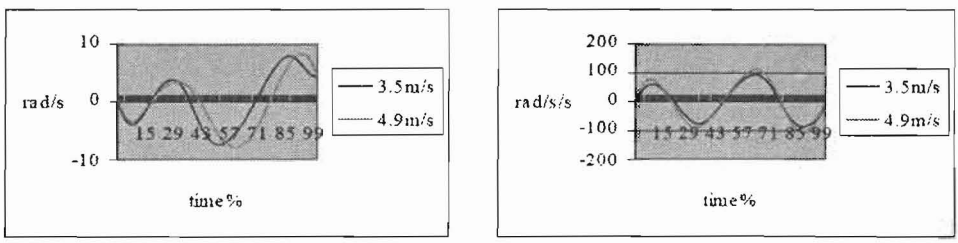

Figure 4: Different angular velocity and acceleration of knee joints on running speed.

CONCLUSION: Angle of lower-extremityed joints in different running speed reaches significant difference . Angle of lower-extremityed joints is getting more with the increasing of velocity. Then maximum angle, angular velocity and angular acceleration of knee joints stretched are getting more with the increasing of velocity. Maximum stretched angle in joint extension phase of take-off significance.

REFERENCES:

Cavanagh, P .R. , Pollock, M.L. , & Landa, J .(1977). A biomechanical comparison of elite and good distance runners. Annals of the New York Academy of Science, 301, 328-345.

Cavanagh, P .R. (Editor) (1990) . Biomechanics of Distance Running . Human Kinetics Books. PP.71-78.

Enoka, R.M. (2002). Neuromechanics of Human Movement (Third Edition).Human kinetics.

Grillner,S., Helbertsma,J.,Nilsson,J., & Thorstenson,A.(1979). The adaptation to speed in human locomoton. Brain Research, 165, 177-182.