Available online at http://www.journalijdr.com

IJDR

ISSN: 2230-9926

International Journal of Development Research
Vol. 10, Issue, 02, pp. 34018-34022, February, 2020

RESEARCH ARTICLE

OPEN ACCESS

INFLUENCED OF THE ANGLE THIGH-TRUNK ON THE MOBILITY OF THE POSTURAL CHAIN

***1DIAKHATE Djiby, 2LAWANI Mohamed Mansourou, 3SECK Djibril and 2HOUETO Gratien**

[1]Unit of Formation and Research of the Sciences of the Education, the Formation and Sport (UFR SEFS) University GASTON SHEPHERD BP 234 Saint-Louis (SENEGAL)
[2]Unit of Research in Biomechanics and Performance (URBioP) INJEPS.UAC (BENIN)
[3] National Superior Institute of the Popular Eduction and Sport. B.P. 3256 - Dakar (SENEGAL)

ARTICLE INFO

Article History:
Received 18th November, 2019
Received in revised form
21st December, 2019
Accepted 13th January, 2020
Published online 29th February, 2020

Key Words:

Articularthigh-trunk,
Gravity center.

***Corresponding author: DIAKHATE Djib**

ABSTRACT

The increase of the mobility of the basin improves the performance when the area of ischio-femoral contact is reduced at the time of the tasks executed in seated position. This research has for objective to study the function that the angle plays articularthigh-trunk (C-T) on the performance. It is about an experimental survey that has been achieved on 8 masculine topics. We used a platform by force oblong of (120 x 60) cm and an equipment made of wood placed next to the platform that allowed us to value the characteristic cinematics of the performance (speed and accelerations of the gravity center) according to the antero-posterior axes and vertical, as well as the instant of the detachment of the buttocks. The gotten results showed that some meaningful differences have been observed in the condition 45 °, to the level of the vertical acceleration of the gravity center as well as his/her/its speed, the antero-posterior acceleration of the gravity center as well as its speed, the maximum receding of the center of the pressures except for the antero-posterior speed at the time of the detachment of the buttocks. But no difference has been noted in the condition safe 0° for the length of the detachment of the buttocks. The modification of the is chio-femoral contact area associated to a modification of the articular angle between the trunk and the thighs have an influence therefore on the performance.

Citation: ***DIAKHATE Djiby, LAWANI Mohamed Mansourou, SECK Djibril and HOUETO Gratien.*** **2020.** "Influenced of the angle thigh-trunk on the mobility of the postural chain*", International Journal of Development Research*, 10, (02), 34018-34022.

INTRODUCTION

It has been shown that reducing the area of hamstring contact with the seat improves performance. Previous studies by Lino et al. (1992), on a pointing task. Lino and Bouisset (1993), Goutal *et al*. (1994), Bouisset *et al*. (2002), Le Bozec *et al*. (2004), on the Sit-to-Stand (StS) Diakhaté *et al*. (2013) and the more recent one of Diakhaté *et al*. (2014) on a task of thrust have it all shown. The increase of the mobility of the basin is observed in tasks executed as well in static position that in dynamics. The increase of the mobility of the basin improves the performance in tasks executed in seated position. The authors bound these results to a modification of the mobility of the pelvis when the area of is chio-femoral contact with the foundation is reduced. However, no of these studies didn't put in evidence the interaction that between the trunk and the thighs have, when the angle thigh-trunk (C-T) is modified, on the mobility of the basin and the rachis. It is what we are going to tempt to demonstrate in this survey.

The modification of the C-T angle would change it the mobility of the basin and the rachis. Indeed, more this angle isclosed, more the mobility of one and the other decreases, even though the surface of ischio-femoral contact has been reduced. Even though the reduction of the ischio-femoral contact surface increases the mobility of the body. Is she/it the only one to influence the articularmobility?

This survey has for main objective to analyze the role that the angle playsarticularthigh-trunk (C-T) in the mobility of the body. In other words, how the articular position of the hip influences on the performance to watch. The modification of the C-T angle on the mobility of the body has been studied therefore. The gait will consist in making vary the C-T angle during a task of suit-to-stand with surfaces of is chio-femoral contact of 100-IFC and 30-IFC.

MATERIALS AND METHODS

Subjects: For this study, we tested 8 male subjects with no musculoskeletal and sensory-motor pathology. All subjects were consenting and informed of the objectives of the study. This study was conducted in accordance with the Helsinki Declaration.

Material: For this research, we used a platform by force oblong of (120 x 60) cm and of an equipment made of wood placed next to the platform that allowed us to have an angle of 45 ° in relation to the vertical. It is a device that permits to place the seat by force by force on the platform, permitting to uncouple the vertical efforts to the level of the seat, of the outside strengths acting on the body that is measured by force by the platform, thus. The height of the seat is adjustable to the size of the topic by one addition of board made of wood. This addition is taken in account in the initialization of the sensors before every experience. The equipment made of wood permitted about to alignhis/her/itstrunk in relation to the board to have an angle of 45 ° between his/her/its trunk and his/herthighs. The seat consists in a square made of wood of 65 cm of bound side of a metallic setting supported by 3 feet. A sensor by force to tonnage of constraint working in traction / compression, measuring in a range of 10 daN in 50 KN, went up to every low extremity of the feet. To the extremity of every foot, a metallic tip assures the good adhesion of the seat on the tray so that there is not any relative movement during the execution of the levee sequences, even for the veryelevated speeds. (His/her/its site on the platform is variable according to the morphology of the topic, and remainidentical for the same trial set, because systematically true.

Protocol: The subjects were by force (that is, the C-T angle makesis 45°, either 0°) seated on the seatsensor, in tilted stance to 45° or 0°. To get the stance to 45°, the subjects had to aligntheirtrunks on a structure made of wood placed to 45° in relation to the horizontal. The arms are glued to the body and are placed on the back of the topic to avoid some oscillations during and at the end of the movement. The spacing of the feet is of 30 cm, and are placed by force to 15 cm of the side of the platform with the help of markings, one to the level of the heel the other on the platform by force. To the signal of departure, the topic had to rise to the speed that one had indicated him to the departure. The length of the acquirements was of 5 seconds, with a frequency of 250 hz. The registration of the data began some seconds before the action to rise and ended some seconds after the rising of the seat. The trial number by condition is of 10, what made to the total 40 tests by topic for the 4 conditions. The order of passage in the four conditions is made of uncertainmanner, to avoid the effect of rank. The position of the heels isidentical for all topics. Two postural conditions are considered; seated on the whole length buttock-thighs (100-IFC) and foundation out of 30% of this length (30-IFC). These two conditions of support present the samepolygon of lift, only varies the area of contact with the foundation (face 1). All topics wore the same shorts at the time of the two experiences.

RESULTS

The results permitted to put in evidence the importance of the articularmobility in the motor performance. Indeed, a modification of the is chio-femoral contact area coupled to a variation of the C-T angle entails a modification of the performance variations. We will be interested in the strengths of reactions generated by force by the platform.

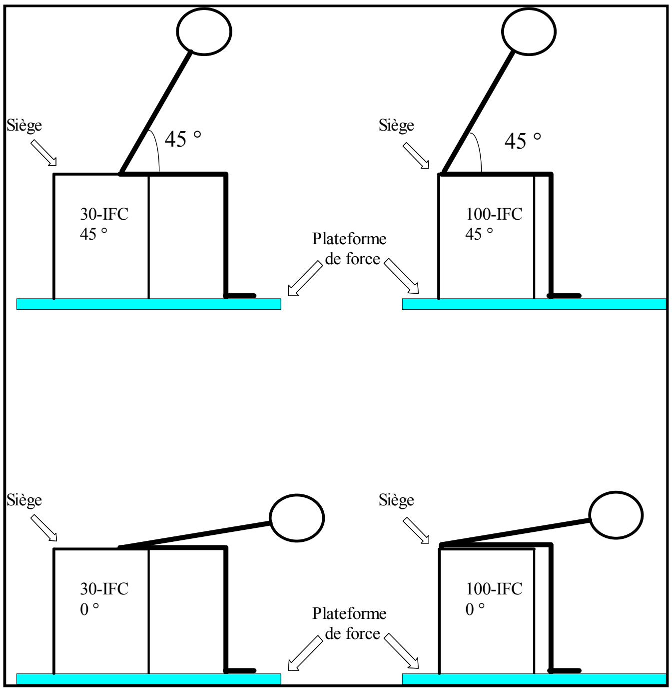

Figure 1. Conditions of foundation to 100-IFC 0 and 45°, and condition of foundation to 30-IFC 0 and 45°

Determination of the performance: We will compare the character is tick inematics of the performance (speed and accelerations of the gravity center) according to the antero-posterior axes and vertical, as well as the instant of the detachment of the buttocks. The accelerations (Az and Ax), the speeds (Vz and Vx), along the vertical and antero-posterior axes; the antero-posterior speed at the time of the detachment of the buttocks (Vxdf), the necessary length for the detachment of the buttocks (DF) as well as the receding of the center of the pressures (Xp) according to the antero-posterior axis has been raised (Figures 2, 3, 4 ,5).

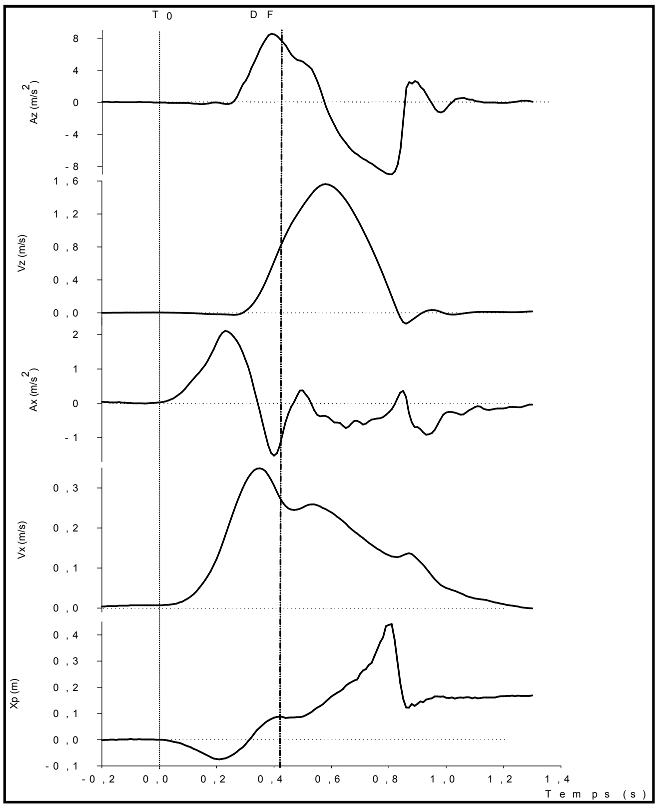

Figure 2. Drawnbiomechanics of the suit-to-stand to 0° and 100% of seating for a subject and for a test

Az, Vz, acceleration and vertical speeds of the gravity center; Ax, Vx, acceleration and antero-posterior speed of the gravity center; Xp displacement of the center of the pressures, the line stippled some indicates the beginning of the movement and the line in dash indicates the separations from buttocks (DF).

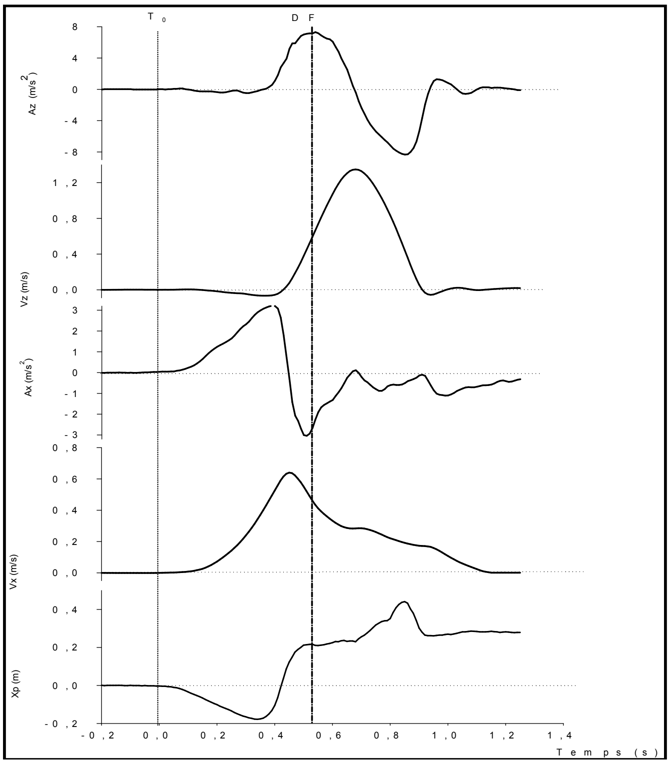

Figure 3. Drawnbiomechanics of the suit-to-stand to 45 ° and 100% of seating for a subjectand for a test

Az, Vz, acceleration and vertical speeds of the gravity center; Ax, Vx, acceleration and antero-posterior speed of the gravity center; Xp displacement of the center of the pressures, the line stippled some indicates the beginning of the movement and the line in dash indicates the separations from buttocks (DF).

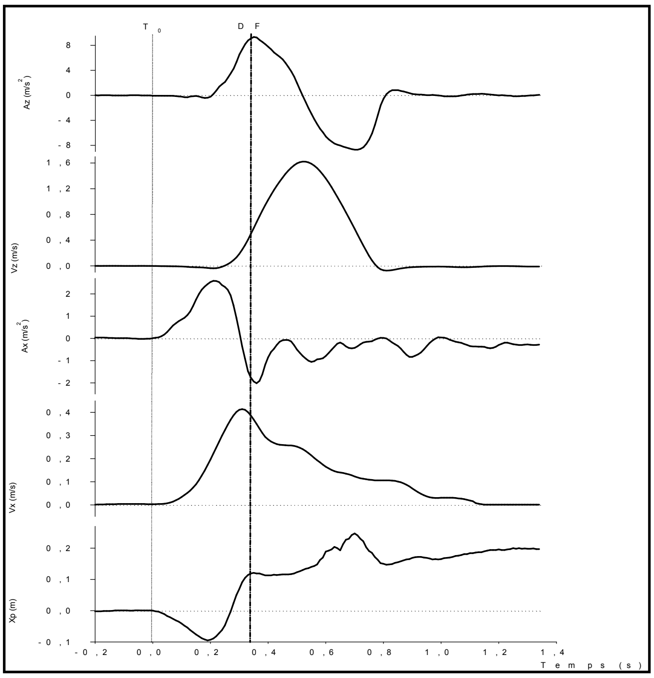

Figure 4. Drawnbiomechanics to 0 ° and 30% of foundation for a topic and for a test

Az, Vz, acceleration and vertical speeds of the gravitycenter; Ax, Vx, acceleration and antero-posterior speed of the gravity center; Xp displacement of the center of the pressures, the line stippled some indicates the beginning of the movement and the line in dash indicates the separations from buttocks (DF).

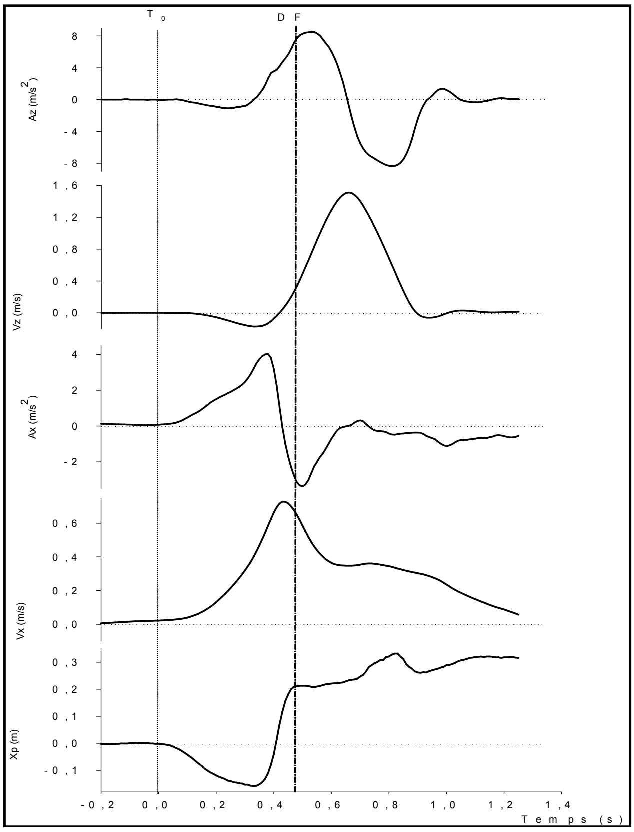

Figure 5. Drawnbiomechanics of the suit-to-stand to 45 ° and 30% of foundation for a test

Az, Vz, acceleration and vertical speeds of the gravity center; Ax, Vx, acceleration and antero-posterior speed of the gravity center; Xp displacement of the center of the pressures, the line stippled some indicates the beginning of the movement and the line in dash indicates the separations from buttocks (DF).

These figures show variations of the tracings biomechanics, that are reproducible of a subject to another and a test to the other.

The generalpaces of the curves are identical with different amplitudes according to the conditions of the tests.

The beginning of the movement symbolized by the line in dotted lines starts with a receding of the center of the pressures followed to the same instant of an increase of the antero-posterior acceleration to reach his/her/its peak before declining to reach the negative values, before coming back on the baseline.

There is a negative cup along the vertical axis at the beginning of the movement, but it is less important in the condition of inclination of the trunk at 45 ° *et al*most nonexistent in the 0 ° condition.

The acceleration antero-posterior reaches its peak before coming down again to his/her/its minimum that coincides with the maximum of the vertical acceleration.

The peaks of the vertical and antero-posterior speeds are reached to the moment or the vertical and antero-posterior accelerations change sign.

The instant of the detachment of the buttock soccurs a short time after the peak of the vertical acceleration.

All these parameter scome back to their initial values safe for the value of the center of the pressures because of the change of stance. The subject not being more seated, but standing.

Vertical and antero-posterior accelerations of the gravity center

Vertical acceleration: The maximal vertical acceleration in the condition 0° is of 5 m/s^2 to 100-IFC and 5,16 m/s2 to 30-IFC (faces 2,3 and picture 1), whereas in the condition 45 °, she/it is worth 5,31 m/s^2 and 5,71 m/s^2 respectively (faces 4, 5 and picture 2). In the first condition, the analysis of the variance shows that there is not a meaning fuldifference (F (17) = 3,02; p > 05), while in the second condition, the analysis of the variance shows a very meaning fuldifference (F (17) = 12,77; p < 001).

Antero-posterior acceleration: Following the antero-posterior axis, the acceleration is worth respectively in the condition 0° 2,32 m/s^2 and 2,49 m/s^2 to 100-IFC and 30-IFC (picture 1). The analysis of the variance shows a non meaning fuldifference with a current effect (F (17) = 2,89; p > 05). In the condition 45 °, the antero-posterior acceleration is of 2,69 m/s^2 to 100-IFC and 3,29 m/s^2 to 30-IFC (picture 2). This difference is highly meaning ful with a current effect (F (17) = 38,47; p < 0001).

Vertical and antero-posterior speed of the gravity center

Vertical speed: The maximal speed reached at the time of the StS is one of the criterias of the performance. She/it is respectively in the condition 0° of 1,03 m/s and 1,12 m/s to 100-IFC and 30-IFC for a current effect (F (17) = 2,32; p > 05) (picture 1) therefore statistically not meaningful. But in the condition 45 °, this speed is equal to 1,08 m/s to 100-IFC and 1,24 m/s to 30-IFC (picture 2) for a current effect (F (17) = 7,42; p < 005). The result shows a meaning fuldifference.

Antero-posterior Speed : Following the antero-posterior axis, the speed is of 0,44 m/s to 100-IFC and 0,32 m/s to 30-IFC in the condition 0°. The Anova doesn't show a difference meaningful with a current effect (F (17) = 1,29; p > 05) (picture 1). Whereas in the condition 45°, the analysis of the variance shows a meaningful difference with a current effect (F (17) = 9,06; p < 001) (picture 2).

Displacement of the center of the pressures: The displacement of the center of the pressures has been raised according to the antero-posterior axis. The receding of the center of the pressures is of 9 cm to 100-IFC and 11 cm to 30-IFC in the condition 0°. One notes a non meaning fuldifference according to the analysis of the variance (F (17) = 1,84; p > 05). Concerning the condition 45 °, the receding of the center of the pressures to 100-IFC is of 14 cm and to 30-IFC 23 cm with a highly meaningful ifference (F (17) = 61,122; p < 0001).

Duration required for detachment of the buttocks: The duration required for detachment of the buttocks is a lot shorter to 30-IFC that to 100-IFC in the condition 0°. She/it is respectively of 340 ms and 430 ms, a highly meaningful difference, with a current effect (F (17) = 46,87; p < 0001). As for the condition 45 °, this length is respectively of 500 ms and 370 ms for 100-IFC and 30-IFC. One notes a very meaningful statistical difference as in the condition 0°. The analysis of the variance gives its results (F (17) = 35,47; p = 0001).

Picture 1. Average and gap-type of the different parameters raised in the suit-to-stand (StS) to 0°

1.		2.	100-IFC 0°	3.	30-IFC 0°	4.	P
5.	Az_{sts}(m/s^2)	6.	5,00 (±2,27)	7.	5,16 (±2,55)	8.	Ns
9.	Vz_{sts} (m/s)	10.	1,03 (±0,38)	11.	1,12 (±0,28)	12.	Ns
13.	Ax_{sts} (m/s^2)	14.	2,32 (±0,73)	15.	2,49 (±0,88)	16.	Ns
17.	Vx_{sts} (m/s)	18.	0,44 (±0,34)	19.	0,32 (±0,06)	20.	Ns
21.	Vx_{df} (m/s)	22.	0,33 (±0,17)	23.	0,30 (±0,06)	24.	Ns
25.	Xp_{sts} (m)	26.	-0,09 (±0,03)	27.	-0,11 (±0,02)	28.	Ns
29.	DF (ms)	30.	430 (±70)	31.	340 (±70)	32.	**

Vertical peak (Azsts) of the acceleration of the center of gravity and his/her/its speed (Vzsts); antero-posterior peak of the acceleration of the center of gravity (Axsts) and his/her/its speed (Vxsts); Vxdf, antero-posterior speed at the time of the detachment of the buttocks; Xpsts, maximum receding of the center of the pressures; DF, necessary length for the detachment of the buttocks; ms: milliseconds. P: Probability; * * P < 0,01; ns: non meaningful.

Picture 2. Average and gap-type of the different parameters raised in the suit-to-stand (StS) to 45°

	100-IFC 45°	30-IFC 45°	P
Az_{sts}(m/s^2)	5,31 (±2,46)	5,71 (±2,55)	**
Vz_{sts} (m/s)	1,08 (±0,28)	1,24 (±0,23)	*
Ax_{sts} (m/s^2)	2,69 (±0,72)	3,29 (±0,82)	***
Vx_{sts} (m/s)	0,53 (±0,23)	0,64 (±0,19)	*
Vx_{df} (m/s)	0,38 (±0,11)	0,45 (±0,11)	Ns
Xp_{sts} (m)	-0,14 (±0,02)	-0,23 (±0,07)	***
DF (ms)	500 (±70)	370 (±50)	***

Vertical peak (Azsts) of the acceleration of the center of gravity and his/her/its speed (Vzsts); antero-posterior peak of the acceleration of the center of gravity (Axsts) and his/her/its speed (Vxsts); Vxdf, antero-posteriorspeed at the time of the detachment of the buttocks; Xpsts, maximum receding of the center of the pressures, DF, Duration required for detachment of the buttocks; ms: milliseconds; P: Probability; *: p < 0,05; * * P < 0,01; * * *: p < 0,001; ns: non meaningful.

DISCUSSION

The results show that the modification of the is chio-femoral contact area associated to a modification of the articular angle between the trunk and the thighs have an influence on the performance in the task of StS. Indeed, in the condition 0°, one doesn't note a meaningful difference for the different raised parameters (picture 1) (the vertical acceleration of the gravity center, the vertical speed of the gravity center, the antero-posterioracceleration of the gravity center as well as his/her/its speed, the speed at the time of the detachment of the buttocks, the maximum receding of the center of the pressures) safe for the length of the detachment of the buttocks. However in the condition 45 °, one notes meaningful differences to highly meaning fulsafe for the antero-posterior speed at the time of the detachment of the buttocks. As the subject adopts the same stance between the conditions 100-IFC and 30-IFC. The fact that there is not a meaningful difference in the condition 0° contrary to the condition 45° can explain itself by the modification of the articular angle between the trunk and the thighs. Indeed, the studies of Lino *et al*. (1992), Goutal *et al*. (1994), Bouisset *et al*. (2002), the Bozec *et al*. (2004), and the one more recent of Diakhaté *et al*. (2013), have all demonstrated that the modification of the ischio-femoral contact surface on tasks of thrust and suit-to-stand encouraged the dynamics of the body and therefore the performance that ensued some. The fact not to observe a meaningful difference in the condition 0° between 100-IFC and 30-IFC, push us to believe that this position limits the articularmobility to the level of the rachis and the joint of the hip. Indeed, the position 0° limits the mobility of the rachis *et al*so the one of the hip. Here, the subject doesn't nearly take advantage of the opening of the angle between the thighs and the trunk. In the normal suit-to-stand where the topic is in straightenedseated stance, Diakhaté *et al*. (2013), the subject displaces its trunk toward the before while adopting a certain angle before rising in the verticality. One also notes a meaningful difference of the speeds (antero-posterior and vertical) and accelerations (antero-posterior and vertical) between the two circuit court (100-IFC versus 30-IFC). In the same way, in the condition 45°, the performance is always more important to 30-IFC. The reduction of the ischio-femoral support doesn't change the polygon of lift (Diakhaté *et al*., 2013). But the speed is more important to 30-IFC and the necessary length to rise of the seatisdecreased.

In agreement with the literature (Zattara and Bouisset, 1988; Bouisset *et al*., 2002; The Bozec *et al*., 1997; The Bozec and Bouisset 2001), the results of thisurvey showed that the body is the seat of dynamicphenomena. The observed postural dynamics would been couraged by the lombo-pelvicmobility. Indeed, according to Vandervael (1956), the modification of the basin according to the foundationwouldbe favorable to an increase of the postural dynamics. To 0° the basin cannot use itsmobilitywhateveris the condition of foundation, because the possible movement in anteversion and in retroversion as previously pointed out is almost impossible because of the posture adopted. Still in agreement with the literature, a receding more important of the center of the pressures according to the axis antero-posterior has been noted in the studies of The Bozecet al. (1997) and Lino *et al*. (1992) when one passes from 100-IFC to 30-IFC. The results in the condition 45° go in the samesense, contrary to the results in the condition 0°. Indeed to 45°, the receding that was of 14 cm to 100-IFC willbe of 23 cm to 30-IFC. It is an absolutedifference of 9 cm that can explain itself by the fact that the subjects are leaned toward the before, what can contribute to increase this receding. In the condition 0°, the receding of the center of the pressures is of 9 cm to 100-IFC and 11 cm to 30-IFC, a difference that is not statistically meaningful (Picture 1). These studies show that the variation of the C-T angle reduces the articular amplitude of the joints of the backbone as well as the one of the hip. This reduction nearly entails a performance similar, between 30-IFC and 100-IFC, to 0°. Nevertheless a performance more increased are observed to 30-IFC in relation to 100-IFC in the condition 45° and a performance as big to 30-IFC in the condition of foundation straight ened (Diakhaté *et al*., 2014).

Conclusion

These results demonstrated that the articularmobility has an essential role in the motor performance. Indeed this mobility is encouraged on the one hand by the reduction of the ischio-femoral contact surface with the foundation in tasks motor cars executed in seated position, and on the other hand by the angle always formed by the thighs and the trunk in tasks motor cars done in seated position. Indeed, the variation of the is chio-femoral contact surface combined to the modification of the angle between the thighs and the trunk shows us that the motor answer in tasks executed in seated position is increased with a mobility more important of the body.

Acknowledgments

Our sincere thanks to all the subjects who voluntarily participated in this study. May they find in this publication a testimony of our great recognition.

REFERENCES

Bouisset S, Le Bozec, S, Ribreau, C. 2002. Postural dynamics in maximal isometric rampefforts. *BiolCybern.* 87: 211–219.

Diakhaté DG, DoMC, Lebozec, S. 2013. Effects of seat–thigh contact on kinematics performance in sit-to-stand and trunk flexion tasks. *J Biomech.* 46 : 879-882.

Diakhaté DG, Seck D, Lebozec S. 2014. Influence des appuisplantaires dans la pousséesymétrique sur un siègeergométrique. Cahier Sciences de la Vie et de la Santé. Histoire & Anthropologie. Numéro 30.

Goutal L, Lino F, Bouisset S 1994. Modalités de l'appuicorporel et vitesse du mouvement de pointage. Arch Int. Physiol. Bioch. Biophys 102: 5.c21.

Le Bozec S, Bouisset S. 2004. Does postural chain mobility influence muscular control in sitting ramp pushes? Exp Brain Res. 158: 427–437.

Le Bozec S, Goutal L, Bouisset S 1997. Ajustementsposturauxdynamiquesassociés au développement de forces isométriques chez des sujetsassis. C.R Académie des sciences. Paris. 320: 715-720.

Le Bozec S, Lesne J, Bouisset S. 2001. A sequence of postural muscle excitations precedes and accompanies isometric ramp efforts performed while sitting in human subjects. Neurosci. Lett. 303: 72-76.

Lino F 1995. Analysebiomécanique des effets des modifications des conditions d'appui sur l'organisationd' unetâche de pointageexécutéeen posture assise. Thèse de Doctoratd'université. Orsay, 211p.

Lino F, Bouisset S 1993. Is velocity of a pointing movement performed in a sitting posture increased by upper body instability? Abstract.XIVth ISB Congress 802-803.

Lino F, DuchêneJL, Bouisset S 1992.The effect of seat contact area on the velocity of a pointing task. In. Biomechanics (Belloti P, Capozzo A. eds) Universita La Sapienza. Rome, 232p.

Vandervael F. 1956. Analyse des mouvements du corps humain. Maloine, Paris. 168p.

Zattara M, Bouisset S 1988. Posturo-kinetic organisation during the early phase of volontary upper limb movement. *J Neurol, Neurosurg*, Psychiatry. 51: 956-965.

****