82 - EFFECT OF THE VISION OCLUSION ON DYNAMIC BALLANCE ON UNSTABLE PLATAFORM

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INTRODUCTION

Postural control is considered as a complex task that depends on the interaction of multiple sensorial motor processes (HORAK; MACPHERSON, 1996). Informations from the visual, somatosensory (proprioceptive, cutaneous, and articular receptors), and vestibular systems detect the movement and the relative position of the body on space, in relation to gravity and environment, helping in balance maintenance (MOCHIZUKI; AMADIO, 2006).

Mccollum, Shupert, and Nashner (1996) assumed that the transition from a sensorial source to another is adjusted by a simple sensorial clue. This clue would be chosen from a list of limited options, instead of a combination of sensorial clues or under more general environmental aspects (MCCOLLUM; SHUPERT; NASHNER, 1996). Therefore, the postural control would not use all the sensorial information available, but it would prioritize only one of them. The transition between the sensorial sources, for example, corresponds to a transition from visual information dominance to a somatosensory dominance (MAUER et al., 2000). Massion and Woollacott (1996) propose that the dominance of a sensorial system over the other one is the way that the nervous system has to avoid conflicts of the sensorial information. This dominance is dynamic and depend essentially on the task, on the sensorial information available, and on postural control aim (MEYER; ODDSSON; DE LUCA, 2004).

It was suggested that in a bright room and on a stable support base, healthy subjects have a distribution of importance in the action of the sensory information with a load of 70% for the somatosensory system, 20% for the vestibular system, and only 10% for the visual system (PETERKA, 2002). However, it is not clear yet how these contributions of the sensorial systems can vary with the occlusion of the visual system associated to the instability on the base of support. If the postural control, in a condition of an unstable base of support, also has this same importance distribution for the balance regulation, the visual information occlusion will not have visible effect on dynamic balance.

Within this scope, the present study analyzed the effect of the vision occlusion on dynamic balance on an unstable platform. This paradigm with the manipulation of the visual system on dynamic balance has the potential to understand the importance of the visual sensorial information in the balance control.

METHODS

Participants

The sample was composed by fourteen participants aging from 19 to 28 years old (M=23,9 years old; SD=3,1), male (n=9) and female (n=4) individuals. Before beginning the test, the participants assigned a free consent term to participate in the study. The experimental procedures were approved by the local university`s Ethical Commit of Research (Protocol n. 22170/10, Title Page n. 368588, CAAE n. 0197.0.268.000-10).

Equipment and task

The task consisted of maintaining the balance on an unstable platform during 10 seconds. The task was performed in the condition with visual information (V) and without visual information (WV). The platform of dynamics balance used in the study (OKAZAKI, 2010) consisted of a wooden base with 40 cm wide and 40 cm length with electronic sensors on its edge (figure 1).The platform was connected to a computer, by an analog-to-digital adaptor (OKAZAKI, 2009), allowing the variables of interest to be collected through the Dynamic Balance Task software (v.1.0) (OKAZAKI, 2010).

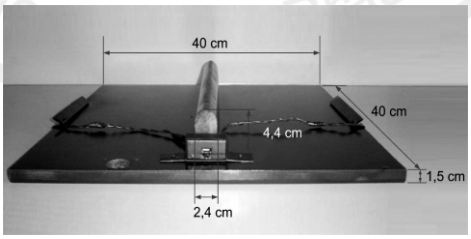

Figure 1. Illustration of the Dynamic Balance Platform used (anteroinferior view).

PROCEDURES

The participants received information about the task and performed a familiarization trial on each experimental condition. A perturbation on the mediolateral direction of the participants was used. The participants were informed to stay in an upright bipedal position, with their arms extended laterally, and with the feet apart on the width of the shoulders. Task was performed with the participants using their shoes.

Initially, participants were positioned behind the balance platform. At the signal of the experimenter, they went up on the platform and kept the left side on the ground. Afterwards, participants were instructed to try to keep the platform in balance for ten seconds without touching its lateral edges on the ground. During visual condition, participants were instructed to direct their visual focus on a fixed point on the wall at the height of their eyes. In the condition without vision, participants stood with eyes closed with a black eye patches.

It was performed three attempts in each condition, with intervals of 1 minute between the conditions, and with intervals

of 10 seconds between the attempts. The conditions were aleatorized between participants. If the participant lost balance and fell from the platform, the attempt was repeated. The analysis of the dynamic balance was performed by the dependent variables provided by the software, named as: time in balance (total time in which participants kept without touching the lateral edges of the platform on ground) and the number of imbalances (number of touch of the lateral edges of the platform on ground).

Statistical Analysis

Descriptive statistic was performed by the mean (M) and the standard deviation (SD). Data normality was confirmed by the Shapiro-Wilk test (P>0,442). For the comparative statistic, it was used the t Student test for dependent samples. Significance adopted was set at 5% (P<0,05).

RESULTS

The V condition showed greater absolute time in balance (t=7,544; gl=13; P<0,0001) with M=6,90 s (SD=0,50), in comparison to the WV condition with M=5,37 s (SD=0,56).

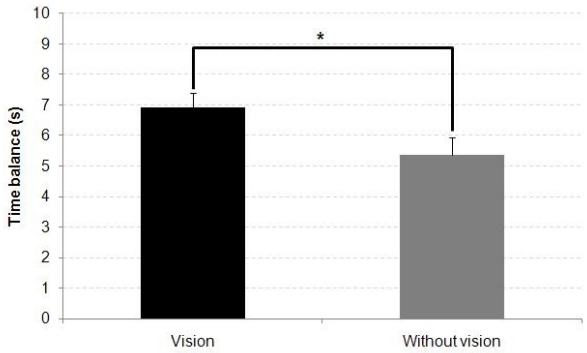

Figure 1. Mean and standard deviation of the absolute time variable in equilibrium during the conditions with and without vision. The "*" indicates the difference (P<0,05) between experimental conditions.

The V condition showed fewer imbalances (t=-4,30; gl=13; P<0,001), with M=11,05 u.m. (SD=2,11) in comparison to WV condition with M=13,00 u.m. (SD=1,86).

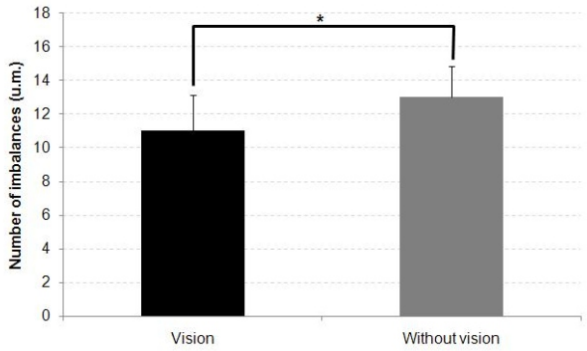

Figure 2 – Mean and standard deviation of the number of hits of the platforms lateral edges during the vision and without vision condition.

DISCUSSION

The visual occlusion decreased the time of balance and increased the imbalances of the participants. Thus, it was demonstrated that on an unstable base of support the visual system information may be an important feature to control balance. Therefore, the hypothesis that visual occlusion would not lead to a worse balance on an unstable platform was refuted. Such results also corroborate with the results found by other authors that also analyzed the visual occlusion in unstable situations on the basis of support (PERRIN et al., 1998).

Perin and colleagues (1998) verified the consequences of the suppression of the visual information in a test of postural balance on a platform with regular oscillations in the anteroposterior, with participants that used to and did not use to practice sports. The group that used to practice sports showed a postural adaptation with less dependence on visual information in comparison to the group that did not use to practice sports. Authors suggested that the postural control would involve two components, such as: a stable reference system based on the prior knowledge and other dynamic correction system that intervenes when perturbations appear. Thus, sportive practice plays an important role on the dynamic of redistributing of the importance that sensorial information has.

Duarte and Zatsiorsky (2002) performed a work with the purpose to study the human balance maintenance in different postural inclinations and with different types of visual information. These authors verified that the balance control, in both cases, suffered considerable influence of the sensorial information. Thereby, visual information allows the elaboration of an internal representation of the external world, recognizing and reporting the position and movement of each body part. Rougier (2003) demonstrated that the vision is capable to influence the center of pressure and center of mass oscillation and increased the difference between them during the absence of the visual feedback and also impaired the manner of the center of pressure corrects instability. Therefore, postural control uses information from all systems (MCCOLLUM; SHUPERT; NASHNER, 1996). The information abundance is a fact that guarantees the postural stability even during the deficiency of a system. Thus, the modular and redundant characteristics of the sensorial information (MCCOLLUM; SHUPERT; NASHNER, 1996) explain why

participants, even when they showed a decrease on balance, were able to perform the task and they did not fell.

Lee and Lishman (1977) performed an experiment exploring the moving-room paradigm, the results showed that irregular movements of the room lead to body oscillation, even when participants had been advised to ignore the conflicting information of the visual system. Thereby, authors concluded that vision works in a proprioceptive manner as an integral component of the balance control system and cannot be voluntarily turned off, except, of course, closing the eyes. This set of study corroborate with the present experiment, showing the great relevance of the visual system for the balance control. Thus, visual system does not offer only proprioceptive information about the environment, the objects, and the external events; vision also offers proprioceptive information about the relative position of the body parts and about the body position and movement as a whole in relation to environment (LEE; LISHMAN, 1977).

CONCLUSION

The present study analyzed the effect of the visual occlusion on balance on an unstable platform. The results showed that the visual occlusion caused a decline in the participants balance. This decline was explained by the fact of the vision also serves as a proprioceptive system of reference. Therefore, visual occlusion also forbids this system of reference for the body movements and position to be used to optimize balance control. Moreover, visual information is responsible for the dynamic corrections due to the perturbation that becomes more relevant when the perturbation is the instability of the support base. Thereby, the characteristics of the dominance of a sensorial information over other showed to be dynamic, task-dependent and, also, dependent of the sensorial information available.

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EFFECT OF THE VISION OCLUSION ON DYNAMIC BALLANCE ON UNSTABLE PLATAFORM

ABSTRACT

The present study analyzed the effect of the visual occlusion on balance on an unstable platform. Fourteen young adults participated on the study aging between 19 and 28 years old. The task consisted on the maintenance of the balance on an unstable platform during ten seconds. The experiment was performed under conditions with and without vision. The t Student test for dependent samples showed lower balance time (P<0,05) under the without vision condition (M=5,37 s; SD=0,56) in comparison to the vision condition (M=6,90 s; SD=0,50). It was also verified great number of imbalances (P<0,05) in the condition without vision (M=13,00; SD=1,56) in comparison to the vision condition (M=11,05 s; SD=2,11). Therefore, visual occlusion leaded to a decline on balance suggesting that vision also acts as a proprioceptive system of reference that helps the postural control. The dominant characteristic of the sensorial information is dynamic, task-dependent, and dependent of the sensorial information available.

KEY-WORDS: Postural control; sensorial information; instability.

OCCLUSION DES EFFETS VISUELS DANS PLATEFORME EQUILIBRE DYNAMIQUE DANS INSTABLE

RÉSUMÉ

La présente étude a analysé l'effet de l'occlusion visuelle sur l'équilibre sur une plate-forme instable. Quatorze jeunes adultes ont participé à l'étude du vieillissement entre 19 et 28 ans. La tâche consistait sur le maintien de l'équilibre sur une plate-forme instable pendant dix secondes. L'expérience a été réalisée dans des conditions avec et sans vision. Le test t de Student pour échantillons dépendants Montré temps inférieur swing (P<0,05) sous la condition de non-vision (M=5,37 s, SD=0,56) en

comparaison à la condition de vision (M=6,90 s, SD=0,50). Il a été vérifié aussi grand nombre de déséquilibres (P<0,05) dans la condition sans vision (M=13,00, SD=1,56) en comparaison à la condition de vision (M=11,05 s, SD=2,11). Par conséquent, visuelle au plomb à une baisse de la vision qui suggère que l'équilibre agit aussi comme un système proprioceptif de référence qui aide le contrôle posturale occlusion. La caractéristique dominante de l'information sensorielle est dynamique, les tâches dépendantes et dépendantes de l'information sensorielle disponible.

MOTS-CLÉS: contrôle postural, l'information sensorielle; instabilité.

EFECTO DE LA OCLUSIÓN VISUAL EN EL EQUILIBRIO DINÁMICO SOBRE PLATAFORMA INESTABLE

RESUMEN

El presente estudio analizó el efecto de la oclusión visual sobre el equilibrio dinámico en una plataforma inestable. Participaron del estudio 14 adultos jóvenes con edad entre 19 y 28 años. La tarea consistió en mantenerse en equilibrio sobre una plataforma inestable durante diez segundos. El experimento fue realizado en condiciones de visión y no visión. El test t de Student para muestras dependientes demostró menor tiempo en equilibrio (P<0.05) en la condición de no visión (M=5.37; DP=0.56) en comparación a la condición de visión (M=6.90, DP=0.50). También se verificó un mayor número de desequilibrios (P<0.05) en la condición de no visión (M=13,00; DP=1,56) en comparación a la condición de visión (M=11,05; DP=2,11), de este forma, la oclusión visual ocasionó un declino en el equilibrio, sugiriendo que la visión también funciona como un sistema de referencia propioceptivo que auxilia en el control postural. La característica del dominio de una información sensorial es dinámica y dependiente de la tarea y la disponibilidad de la información sensorial.

PALABRAS LLAVE: Control postural, informaciones sensoriales, inestabilidad.

EFEITO DA OCLUSÃO VISUAL NO EQUILÍBRIO DINÂMICO EM PLATAFORMA INSTÁVEL

RESUMO

O presente estudo analisou o efeito da oclusão visual sobre o equilíbrio dinâmico em uma plataforma instável. Participaram do estudo 14 adultos jovens com idade entre 19 e 28 anos. A tarefa consistiu em manter o equilíbrio em uma plataforma de equilíbrio instável durante dez segundos. O experimento foi realizado nas condições com visão e sem visão. O teste t de Student para amostras dependentes demonstrou menor tempo em equilíbrio (P<0,05) na condição sem visão (M=5,37; DP=0,56) em comparação a condição com visão (M=6,90; DP=0,50). Também foi verificado maior número de desequilíbrios (P<0,05) na condição sem visão (M=13,00; DP=1,56) em comparação a condição com visão (M= 11,05; DP= 2,11). Desta forma, a oclusão visual causou um declínio no equilíbrio sugerindo que a visão também funcione como um sistema de referência proprioceptivo que auxilia o controle postural. A característica da dominância de uma informação sensorial é dinâmica, dependente da tarefa e da disponibilidade de informação sensorial.

PALAVRAS-CHAVE: Controle postural; informações sensoriais; instabilidade.